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INTERACTION BETWEEN ECONOMIC AND SOCIAL VARIABLES: THE TRANSFORMATIONAL GROWTH MATRIX¹

*Edward Nell
New School For Social Research*

[Abstract which is also introductory paragraph]

The TG Matrix proposed here shows how economic and social variables interact in the process of development. It can be described as a ‘general equilibrium’ methodology that allows us to see as precisely as possible how economic and social variables affect one another at a certain moment or stage of development. Economic growth affects social variables and the environment, but the environment and social variables affect each other and also affect economic growth. And there are indirect effects: the environment impacts on health, which in turn reacts back on economic growth. Using the matrix of these interactions we can then analyze how such effects play out over a course of prolonged interaction. This also shows how and to what extent economic relations are embedded in the larger society; and it can be used to analyze – and suggest policy to influence – the changes in the way the economy and the rest of society relate to each other in the course of development. In particular, ‘development traps’ can be identified and policies to avoid them suggested.

**Globalization and Development*

Globalization, that is, opening trade and increasing capital flows, leads to economic advance, which in turn brings about social change. This chain of connections is complex. (By ‘economic advance’ we mean not only economic growth in the normal

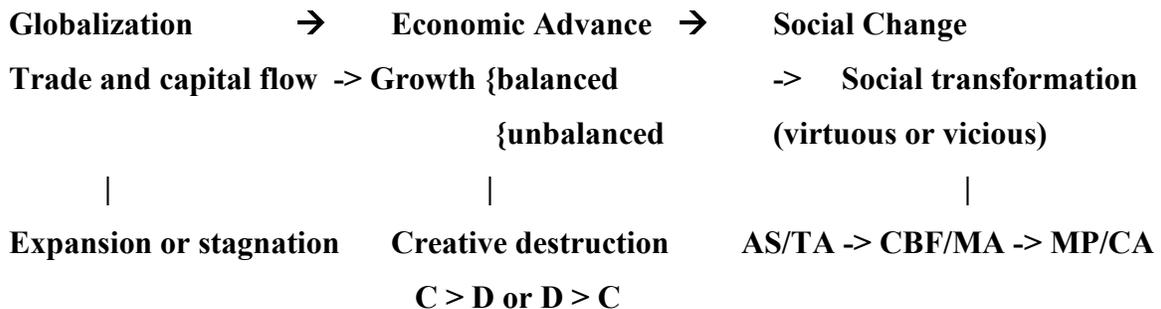
¹ This paper is partly based on material in Chapters 4 and 7 of *HUMANIZING GLOBALIZATION*, forthcoming, co-authored by Edward Nell, Federico Mayor and Karim Errouaki.

sense – increase in overall output - and improvements in productivity, but also the introduction of new and superior products.)

Globalization → Economic Advance → Social Change

The usual assumption is that at each stage the arrows imply a positive change. As we have seen, however, this is not necessarily true. On the contrary, in present conditions these changes may even be predominantly negative. Globalization might bring about a setback in economic development; advances in economic development could bring undesirable social change. But with the right policies these linkages can be made positive.

Look at this again:



(The letters on the bottom right of this chart stand for different stages of technological development. AS/TA stands for ‘artisan shops/traditional agriculture’, CBF/MA for ‘craft-based factories/mechanized agriculture’ and MP/CA for ‘mass production/corporate agriculture’. Cf Nell, 1998)

Over time, it is argued, the flow of capital, especially foreign direct investment, will lead to growth. Money is not only flowing in; it is being directed to projects which the investors consider potentially profitable. If they are correct this must result in growth. Certainly - but our point is that this growth may be balanced or unbalanced. If the latter, there may be special problems; unbalanced growth is

likely to create pressures on the slow-growing sectors, and may lead the faster-growing ones to run ahead of the market. The result may be a crisis, leading to financial collapse, and widespread business failure. On the other hand, if the imbalances are limited, they may stimulate innovation in the lagging sectors; they may be the grains of sand that bring about the growth of pearls.

Whether balanced or unbalanced, however, growth will lead to creative destruction. Under balanced growth the creation is likely to outweigh the destruction; with unbalanced growth the opposite may come about. But either way, there will be movement towards social transformation. Societies of artisan shops and traditional agriculture will move towards craft-based factories and mechanized agriculture, or skipping the intermediate stage, directly to mass production and corporate agriculture.

Looking at the matrix will make it possible to see patterns in the way the relationships interact. An advantage of our approach is that important patterns can be seen *even when we are not able to specify the relationships numerically*. Sometimes all we can say is that variables are related positively, negatively, or not at all. In such a case all we can enter are '+', '-', and '0' in the appropriate cells of the matrix. But even with this limited information, when we look at the matrix we may very well be able to see important patterns; not only can we identify significant causal linkages, we see how they interact and feed back on one another. As we shall see when we lay the matrix out, in some cases a simple visual inspection – no mathematics needed - can tell us whether the interactions will end up in a vicious or a virtuous cycle.

Types of economies

Globalization means opening trade and encouraging world investment; this may lead to expansion, as commonly assumed, but it can easily lead to stagnation – and often does. Advanced countries penetrate and capture markets in weaker countries, upsetting their balance of payments. Those countries must then adopt austerity

policies, cutting back on both investment and government social spending –ending in stagnation. The opening of trade can set in motion purely economic changes that tend to weaken or undermine it. Trade policies have to be carefully designed to avoid such traps, but to do this it will be important to understand the possible interactions.

These interactions are complex; so it will take some effort to see how they work. We also want to find out how they depend on, and affect, the way development proceeds. But the interaction between economic and social variables also depends on how the economy itself is organized. Economies here are assumed to be made up (at a minimum! keeping it simple) of sectors – industry, agriculture, services – and social classes – workers, landlords, business owners, bankers. (On this view economies are *not* made up of abstract, rational, self-seeking ‘individuals’; we see the agents in the economy as *products of socialization*, therefore having identities, skills and commitments resulting from that socialization. Moreover, *the economy has to support the institutions of socialization*.) When these sectors and classes are related in different ways, there are likely to be different patterns of development – or of stagnation and failure to develop. This will affect the way our variables interact –especially the relations between the economic and social variables.

The pattern of transactions between sectors, and between sectors and classes, in developed countries will be different from those in developing ones. In developed countries agriculture tends to employ few workers, industry tends to be large, and services even larger, but services tend to serve business more than households, are often technologically advanced and also employ many high skill workers. More than half the labor force is white collar. By contrast in developing countries, agriculture tends to be large and technologically backward, industry often employs traditional craft skills, and remains small-scale, while services may be a strange mix of advanced hotels and tourism, on the one hand, and traditional, largely household services on the other. White collar employment is low and important white collar jobs may be filled by expatriates.

A particularly difficult case is ‘Dualism’: This refers to a pattern of economic dependency in which a modern sector develops in a traditional society; the modern sector trades with the advanced world, but has little connection with the traditional economy, which tends to stagnate. In many cases the traditional crafts and crops will be undercut by imports from the advanced world, which may also (contradicting its professed support for free trade) deny access to the products, especially crops or other agricultural goods, of traditional economies. The middle class in the advanced sector may identify with the advanced world and therefore fail to support the interests of the traditional sector, so that the society divides politically as well.

Earlier we noted the stunted and irregular growth, for example, of economies that depend on exports of primary goods, oil economies, or plantation agriculture; these behave like economies with advanced sectors that trade with the West, but interact little with their own traditional sectors. Both of these tend to be prone to economic crises and unable to develop in balance. Small scale, family firms and family farms, on the other hand, might have a better shot at developing; such economies were less likely to be overwhelmed by a flood of migrants into the cities, depopulating the countryside. Countries industrializing on the basis of outmoded technologies or low productivity labor might improve their standards of living, but were poised precariously on the edge of disaster. Free trade could wipe out their manufacturing.

Roughly speaking, then, we have four cases: Two of them, Primary Exporting countries, and Dualistic economies, show weak and asymmetric integration between the sectors, and lack a strong middle class. The traditional sectors in such countries will normally be ‘capital-poor’, that is, all the farms, shops, factories, and offices, taken together, cannot offer enough positions to employ all the available labor (many potential workers, however, may not be healthy enough or sufficiently educated to be employable, creating a Catch-22.) The other two, Small-Scale Craft

and Farming, and Out-dated (or Copy-cat) Industrialization, have strong intersectoral trade and a developing middle class. They may still be capital-poor in some areas, but are on their way to becoming capital-rich, that is, to have enough office, shops, factories and farms to offer positions to the available labor force. We can refer to the former pair as ‘weakly integrated’, the latter as ‘strongly’.

Development, in each of these cases, poses special problems in social adaptation; the other parts of society have to respond to the pressures generated by economic advance. If development is to be successful in the long run, it will require protection of the environment, enhancement of the social sector, political accommodation and control over population pressures. We will explore these four points in detail, and we will see that success is much easier in strongly integrated economies, but even there it is by no means assured.

‘Development Traps’ and related problems

Free trade, unrestricted capital flows and migration of labor are seen as the basis of economic globalization and as the foundation of development. But taken together they can easily lead to a disturbing pattern of ‘jobless growth’. Free trade can combine with capital mobility to create a serious ‘development trap’, even in a strongly integrated economy. Suppose that an inflow of investment and aid from outside significantly raises agricultural productivity in a developing country. However demand for food normally rises more slowly than income in general. So the combination of rising productivity and stagnant or more slowly rising demand for food will tend to force marginal labor out of agriculture; it results in migration – and as we have seen, in various social strains. The resulting pool of unemployed labor will then hold wages down in the cities. This might seem to offer opportunities for industry to develop – and just this happened in Europe in the last century, but in today’s world, free trade will lead to imports of manufactures from the developed world, on the part of the rich and middle class. So domestic industry will have a hard time competing, and will grow only sluggishly, and so create jobs slowly. Free trade makes it difficult to generate enough manufacturing employment in the cities

to provide jobs for the labor forced out of agriculture. If industry in the towns does not grow faster (generating jobs) than productivity in agriculture (which causes job loss), the economy will fail to expand employment.

Indicators for the variables

First we summarize the variables we want to consider. These will appear in the row and column vectors. They will be composite variables, involving different elements that tend to move together, so that the variable can be represented by appropriate proxies. [See Appendix on Principal Component Analysis for a description of the statistical procedure for constructing a single variable out of a set of related variables. Note that sometimes the elements making up a variable may not move together, or may not do so over certain ranges; in such cases the variable will have to be disaggregated.] Measurement scales will have to be chosen or developed, and they will necessarily be approximations. Here are some lists of indicators.

ECONOMIC

- **Economic Growth (EconG):** The indicators will be a number of measurable economic variables that tend to move together when the economy is working properly. These related variables, which are measures of market activity, can be grouped under four headings: Growth, Expenditure, Technology and Productivity, Money and Finance. Under Growth we can list: Gross Domestic Product/head, growth in GDP/head, GDP/head, growth in GDP/head (all expressed in terms of ‘purchasing power parity’ (PPP)). (Note that we may need to modify or correct standard GDP numbers.) Under Expenditure we have: Savings, Investment, Exports and imports, government spending and taxes. Under Technology and Productivity there are: measures of technology, efficiency of energy use productivity, growth in productivity, growth in work force, level of unemployment, and Foreign Direct Investment. Finally, under Money and Finance we find: the money

stock, its growth, the rate of inflation, consumer debt in relation to national income, foreign debt service as a percent of export of goods and services.

ENVIRONMENTAL ISSUES

- **Environment (EnvH):** The indicators of environmental quality can usefully be grouped in regard to the traditional ‘four elements’ of the ancient world: earth, air, fire and water. Earth - soil quality, waste disposal and recycling; Air - pollution from excess release of gases and particulate matter, acid rain, respiratory diseases; Fire – waste heat and energy discharge and its effects on temperature and climate; Water - rainfall, water quality and availability. Of course, we need all the measures we can get of climate change and warming.

SOCIAL ISSUES

- **Socialization of Adolescents (AdlSoc):** The indicators should show or measure the degree of success in preparing adolescents for adult life: A key measure will be the amount of contact between adolescents and non-parental adults – especially outside the classroom or other formal settings. Also - divorce rates, single parent families, young offenders among the prison population, youth crime, gangs, truancy, apprenticeship and other training programs, school drop-out rates, measures of substance abuse.
- **Education (Educ):** Here we have indicators that should move together if the educational system is educating the population properly: literacy rates, school enrollments, education spending as a percentage of government budget, of GNP, primary, secondary, and college graduation rates, research programs, specialized training programs, newspapers and books published, library book loans, net school enrollment male and female (primary, secondary, tertiary), literacy, ratio of female to male literacy. (We want to make sure we measure the accomplishments of the current effort, not the amount of capital invested – we are interested in results, not input.)

- **Health:** Again, we have a set of measures that move together when the general health of a country is improving, and which will all be low when health is poor: infant mortality, mother's condition in childbirth, life expectancy, morbidity and prevalence of disease, access to hospitals, availability of medicines, hospitals, doctors per thousand population, indicators of public health. These measures should tell us whether the level of current activity is adequate (again, we are not measuring the capital invested – that comes under Social Infrastructure.)
- **Household Standard of Living (HStdL):** Here the indicators should show, not only the *level* of the average standard of living, but also its *distribution* – the degree of inequality. The indicators should tell us how many households are capable of adequately preparing their young to work in the newly developing economy and to live in the emerging society; how many can provide a decent level of health and education for their members, how many can take on the role of active citizens? Under 5 infant mortality, shared household income ratio between highest 20% and lowest 40%, population using improved drinking water and sewage facilities. Public goods, crime rates by income distribution, radios and televisions per capita. Gini coefficients will give an overall picture; poverty rates for different poverty levels, and measures of concentration of wealth and ownership of land will portray the extremes.

POLITICAL

- **Social Infrastructure (SocInf):** The indicators should tell us whether the public sector is adequately providing the degree of support needed to make the private sector work. We need measures of transportation, communications, police and the criminal justice system, public infrastructure - roads, bridges, sewers and water supply, harbours, airports, garbage and waste management; we need to assess the system of public administration,

land management and zoning, and the military and defense spending. And finally, we need to measure the capital invested in Health and Education.

- **Effective and Democratic Government (EffGov):** Here above all we need indicators that show the extent to which those who have been damaged by economic development and social change can make their case for compensation: Representative and responsive government, civil order, size of middle class, percentage voting, effectiveness of the legal system and the courts, training of the police, the working of a free press and other institutions supporting human rights and religious freedom.

DEMOGRAPHICS

Population (PopP): The usual indicators will do - Size, growth, age distribution, median age, birth and death rates, natural reproduction rates, fertility, % under 15, % over 65, life expectancy at birth. Sex ratios, if available.

The variables can be grouped together in various ways. PopP, AdlSoc and Educ together give us people along with their skills, what they know and what they can do. EconG and EnvH tell us what is being done, what is being produced, who is working, in what ways, and with what effects on the world in which the society is set. SocInf measures what the state and the society as a whole provides as a framework to undergird and regulate social life and economic activity. Health and HStdL show how what is being produced benefits the people, in both public and private dimensions. It gives us a measure of the benefits being delivered and their distribution. And finally EffGov tells us how order is maintained and disputes resolved.

The Transformational Growth Matrix

On the basis of these descriptions we can set up a Transformational Growth Matrix, showing the interactions between Economic Growth, Environment, Adolescent

Socialization, Education, Health, Household Standard of Living, Social Infrastructure, Effective/Democratic Government, and Population Pressure. Each of these will be written as dependent on the others. That is - giving each a shorthand designation – PopP, for example, will depend on EconG, EnvH, AdlSoc, Educ, Health, StndL, SocInf, and EffGov – and possibly on itself. This dependence can, in principle, be either positive or negative, meaning that PopP would either increase or decrease when, say, StndL increases. (Its change in any actual case has to be discovered empirically).

[Economists and social scientists will want to know in what units these dependencies will be expressed, and how they can be estimated. Technical matters are addressed in the Appendix; the present discussion does not depend on numerical estimation. It is enough if we can tell whether the dependency is positive or negative – even better if we can also say whether it is strong or weak.]

We want to concentrate on the way EconG interacts with the rest; in our view this is the key to development, and where the pressures of globalization hit hardest. Accordingly we will start in the top row with EconG, showing how it depends on each of the other variables. (And in the first column the impact of EconG on the other variables will appear.) EconG may be stimulated or supported by EconG itself – or it may not. It will normally benefit from improvement in the EnvH, as well as the four social variables, AdlSoc, Educ, Health, and Household StndL. Improvements in the Political variables, SocInf and EffGov can also be expected to benefit EconG.

In the next line below we will write EnvH as depending on EconG, EnvH itself, AdlSoc, Educ, Health, StndL, SocInf, EffGov, and PopP; below that we will have AdlSoc depending on each of the others, and so on, for Educ, Health SocInf, HStndL, EffGov, and PopP, respectively. Each depends on the others, and the interdependence can be positive, negative, or zero. And, of course, the dependence

can change, either as the result of the pressures of globalization, the changes brought about by development, or by policy, or as a mix of all these.

In the bottom row of the following table we show the way PopP depends on the other variables. Higher EconG, for example, could go either way. By bringing in improved technology, it would improve medicine, and lower death rates, so increasing PopP. This is the likely short-term response. But by bringing increased economic opportunities, especially for women, it could lead to lower fertility, reducing PopP, though it may take time for this to emerge. (We will explore this further in Chapter 7.) In the same way, a better EnvH will lead to fewer deaths from respiratory disease and foul water, but a healthy environment might also lead to more chances for enjoyable leisure, reducing fertility. Good AdlSoc should lead to fewer unwanted pregnancies and smaller families, representing deliberate choices, thus lowering fertility. A higher standard of living, at least initially, increases population pressure, because it reduces deaths. But in the long run, a higher HStdL will lead to reduced fertility as women take advantage of greater opportunities with confidence that their smaller families will survive and live healthier lives. A positive relationship between these economic variables and PopP can be seen in many developing countries today, reflecting the fact that better diet and public health will increase longevity and lowers childhood mortality, while the long run effects have yet to show themselves.

The result will be the set of equations below, described further in matrix form in the Appendix, but shown here with the equations arranged in a Table. On the Left in a column we have the amounts of each of the variables; they are each set equal to the combined effects on them of the others, shown on the right. The plus or minus mark in each cell indicates whether the variable on the left is related positively or negatively to the variable at the top of each column. Strong relationships are indicated in boldface. (The particular configuration shown here reflects our stylized summary of some of the problems developing economies face now. Later we will

consider the way these variables are related in the developed countries.) All the variables are endogenous, although most will also have an exogenous component.

As a first approximation, the relationships can be taken as linear.

	<u>EconG</u>	ENV	AdlSoc	Educ	Health	<u>StdL</u>	<u>SocInf</u>	<u>EffGov</u>	PopP
EconG = f (_____	+	+	+	+	+	+	+	-)
EnvH = f (+or-	(+)	+	+	-----	?+	+	+	-)
AdlSoc = f (+or-	0	_____	+	+	+	+	+	-)
Educ = f (+	+	+	(+)	+	+	+	+	-)
Health = f (+or- +	+	+	(+)	+	+	+	+	- })
StdL = f (+?	+	+	+	+	_____	+	?	-)
SocInf = f (+or-	+	?+	?	+	?	-----	+	-)
EffGov = f (+?	+	+	+	+	+	+	(+)	-)
PopP = f (+or-?	+or -	-	-	+or - ?	+or-	+	?-	___)

[There should also be a constant term in each equation, to capture the influences not accounted for by the stated variables. This will not enter into the analysis here, but will be important in Chapter 7.]

A brief explanation is in order. This presentation simply shows whether the relationships are positive or negative. But if we were to take the analysis further, as we do in the Appendix, we would write each equation to show the current *change* in a variable to be equal to the sum of the impacts on it by the other variables. These impacts would be measured as percentages of the initial amount of the variable. The impact of one variable on another, say of EconG on Env, depends first on the nature of the interaction. This will be represented by a positive or negative coefficient. Secondly it will depend on the *size or amount* of the variable – how large or extensive is the economic change? Each term would therefore be a coefficient

multiplied by a quantity or size measure of the impacting variable. But this goes beyond our concerns here.²

Going back to the equations: If the impacts shown are all positive, and if each impact is interpreted to represent a fraction of the total change of the variable, then basing the system on suitable initial conditions, we could expect this would lead to a unique solution. That is, solving the equations would tell us how large, relative to each other, the variables must be. [See Appendix] Since such a solution will determine *relative* amounts, it is possible to use this system to examine the impact of a policy change – which is, indeed, the main point. If, for example, the degree of change in EconG were imposed from outside, the system would allow us to calculate the effects on all the other variables. [Economists will note that the case where the coefficients in a row or column sum to unity is especially useful; it gives rise to Markov chains in which successive adjustments converge to a unique solution.]

A few words on how to estimate the coefficients are in order. Consider the effect of EconG on Env in a particular period for a certain country (or region.) The procedure is to move step-by-step. The first step is to ascertain that there is indeed an impact; the coefficient is not zero. Next, a simple question, but not necessarily that easy to answer when the relationship is complex: is the impact positive or negative? This may require calculating the net resultant of several offsetting impacts. Third, we must judge or measure by some rule of thumb (but one applied

² It will be assumed here that there will be little or no immediate impact of a variable on itself. Such impacts do take place in economics – cf. the well-known Multiplier-Accelerator models– but this usually happens in developed economies, and is not thought to be so likely in developing ones. However, there may be self-reinforcing effects in some of these variables. For example, higher PopP probably leads at a later date to even higher PopP. EconG is also likely to be self-reinforcing. Good AdlSoc tends to be reinforcing; adolescents who have been properly socialized will develop into socially adjusted adults who want to help the next generation adjust, too. Bad socialization may perhaps be even more likely to spread its effects. EnvH could in some cases lead to self-reinforcing spirals. However it seems unlikely that SocInf or StndL will have effects of this kind, and while EffGov could conceivably, the effects are likely to be insignificant compared to other factors. In general, these effects are likely all to be positive or zero, and if positive very small, at least in the short run.

consistently) whether the impact is strong or weak? In the same vein, does it take effect rapidly or slowly? And comparisons should be made: Is the impact stronger or weaker than the impact on other related variables? Finally, can a quantitative index be developed, or a suitable proxy be found?

To carry this further we would have to consider how to adapt the methods for constructing Input-Output Tables and SAMs (Social Accounting Matrices) to our case. We do this in the Appendix, but again, our argument here does not depend on success in filling in the numbers. We can see the relationships and how they interact even without knowing the precise quantities.

Bearing these points in mind, let's illustrate how to read the relationships, taking the column 'EconG'. (The analysis is abstract, but it will help to have examples in mind, so we will cite some illustrative cases). First, EconG may have a positive effect on itself; good times beget more good times – and bad times bring on worse. Think of the boom of the 1990s; think of any panic or crash, 1929, or the Asian Crisis. (Both of these are 'positive effects' – 'positive' means that the two variables move in the same direction, whether up or down.) Next, EnvH: This can go either way. When the economy is doing well, it generates more pollution and more garbage, but on the other hand, prosperity offers a chance to adopt 'green' strategies or technologies. The Environment may end up being damaged less, although no one should count on this. Moving down, as we've seen earlier, EconG will very likely disrupt the way adolescents are socialized. On the other hand, it should improve Health, unless it generates so much rural to urban movement that it leads to crowding, and contagion. Same for Education; growth and more jobs should both encourage and provide funds for education - and the disruption of growth could at least temporarily set it back. So EconG will be related positively to both Health and Education, as for example in Ireland since the 1980s. Next, when the economy is doing well, wages and salaries will rise and the Household Standard of Living will normally increase. On the other hand, EconG could be so concentrated in a few sectors that all the benefits would go to a few, while the

destruction of older ways of living and working were widespread. The result could be a fall in the average StndL. (This has happened recently in Nigeria, and arguably took place in Brazil during the 60s and 70s. In 2004 almost the entire growth of US income went to the top 1% of the income distribution; median family income actually declined slightly!) Almost certainly higher EconG will be accompanied by a corresponding improvement in at least some parts of the Social Infrastructure, since an expansion of infrastructure is needed to support economic growth. And as we've seen, the disruption accompanying EconG creates a serious need for democratic institutions through which people can channel their demands for redress. It is likely - though certainly not guaranteed! - that this pressure will lead to democratic developments, as it has for example in India and in South Africa, and in many other countries. The plus sign in the bottom row means that PopP pressure will increase as EconG increases, since the death rate will fall as new technology is introduced and medicine improves. Alternatively, PopP could diminish over the long run as EconG increases, since when the economy is doing well over time, families will tend to have fewer children.

With nine equations and nine variables we have eighty-one relationships to consider - or seventy-two, if we ignore the question of self-reinforcing relationships. It is a great advantage of our approach that it allows us to see all these possibilities in a compact form. It can be presented neatly, as a Table, with the nine variables arranged in rows and columns. The first row shows for example, how EconG depends on the other variables, while the first column shows how the other variables depend on EconG. The second row shows how EnvH depends on the other variables, and the second column shows how the others depend on EnvH. The third row and column then show AdlSoc, the fourth Educ, the fifth, Health, and so on, finishing with PopP.

	EconG	EnvH	AdlSoc	Educ	Health	StdL	SocInf	EffGov	PopP
EconG	-----	+	+	+	+	+	+	+	-
EnvH	+ or -	-----	+	+	?+	+	+	+	-
AdlSoc	+or-	+	-----	+	+	+	+	+	-
Educ	?+	?+	+	---	+	+	+	+	-
Health	-?+	+	+	+	-----	+	+	+	-
StdL	+or-	+	+	+	+	-----	+	+	-
SocInf	+or-	+	+	?+	?	+	-----	+	-
EffGov	+?	+	+	+	+	+	+	-----	-
PopP	+,- ?	+,- ?	-	-	-or+	+	-	-	-----

Interpretation

Let's look at some of the most important relationships, using the matrix to help us to see which ones hold generally, that is, seem to hold in all four of our types of developing countries, and which vary with the economic structure. We will take each variable in turn, and read across the matrix, to see how each of the others tends to affect it.

ECONOMICS

We start by reading across the top row, showing how Economic Growth depends on the other variables. These relationships will tend to hold in all of the cases. An improved Environment will support Economic Growth; it will mean more productive agriculture and healthier households and labor force.. Better Socialization of Adolescents will mean a more skilled workforce. Both improved Education and better public and private Health measures will raise productivity and reduce sick days. A better Social Infrastructure will translate into a more secure workforce, while a higher Household Standard of Living provides larger markets and better informed consumers, and promotes better health. It also supports but does not guarantee better socialization of adolescents. A more Democratic Government helps to ensure a stable civil order and a reliable and

uncorrupt system of justice. Finally, economic Growth will be made more difficult by Population pressure,

And it works in reverse; just as improvements in these variables promote EconG, declines or reductions will hamper economic advance. If adolescents are not properly socialized, they will not fit into an urban work force, and they will not function well as citizens. This will be reflected in weaker productivity and a decline in the Household Standard of Living, as relatives will be under pressure to support them. Poor education and health will only compound these difficulties. All this will put pressure on social infrastructure, and will create tensions within democratic institutions.

THE ENVIRONMENT

The Environment will very likely come under pressure from EconG in two cases, Primary Exporting and Dualistic economies, but may not be so pressured in the other two. Faster growth tends to generate increased pollution and contributes to global warming, especially in Primary Exporting and Dualistic economies. Pollution is, famously, an ‘externality’, that is, a cost which neither buyer nor seller pay, unless forced to by regulation or law. This is unlikely in weakly integrated systems. But faster growth also provides the resources and the new technologies to clean up and preserve the environment, although this may be difficult in economies undergoing Out-dated Industrialization (think of Peru or Argentina in the 1960s and 70s, or India even today.). Prosperity also elevates the regard placed on a sustainable and healthy environment. For these reasons some have argued that starting from a low level, Economic Growth will first tend to worsen the Environment, but at higher levels further economic growth will improve the environment. This is sometimes called an “Environmental Kuznets Curve” – analogous to Kuznets’ original hypothesis that historically economic growth first worsened, then improved the distribution of income. The evidence, however, is inconclusive, both in regard to the environment and for the original claim. As for the other variables, better Education and Health probably have little effect; at best

they may contribute marginally to a better Environment. But better Social Infrastructure, a higher Standard of Living and greater Democracy will all tend to encourage improvement in the Environment. On the other hand, in general, when Population increases the Environment will tend to suffer.

SOCIAL VARIABLES

The Socialization of Adolescents will tend to be altered by EconG in all four cases. Higher EconG will lead to an outflow of families from rural areas into the cities, where they will lose the traditional support of neighborhood and kin. The older generation will lack the skills and knowledge to provide guidance to the young. In Primary Exporting and Dualistic economies EconG may not create many new opportunities; youth unemployment may become a major social issue. On the other hand in Small-Scale Craft and Industrializing economies, higher growth will provide the both tax revenues and employment opportunities in the cities, making it possible to offer education and training to the young. The effect of the other variables is straightforward, except, perhaps, in one case. Higher Population growth will put a strain on Socialization, making it more difficult, but a better Environment and improved Social Infrastructure, a higher Standard of Living and a more Democratic Government all tend to encourage better socialization of the young. Better Education will certainly improve AdlSoc, and better Health is likely to. A warning, however: in the short run improved Education could lead to a 'generation gap' between youth and parents. This is a standard theme in Bollywood movies, and is evident even in today's Ireland.

Education: Economic Growth can go either way; growth can promote education by demanding greater skills and a higher quality of labor. But it could also draw children and the unskilled into low-level long-hour jobs, keeping them out of school. Which effect it has depends on the kind of growth being promoted. In general the positive result is more likely in the strongly integrated economies, the negative in the weakly integrated ones. Better AdlSoc will make it easier; improved social infrastructure and a higher standard of living will tend to improve education. A

more Democratic Government will strengthen it. But a cleaner and better Environment, by itself, may not have much impact one way or the other on education – although people may learn a good deal by cleaning up! Health strongly and positively impacts education– better health means better learning. Note the chain of positive linkages: a better Env leads to better Health, which leads to better learning, which, in turn, is likely to promote a better Env! These are the kinds of connections to look for. A rise in Pop pressure, on the other hand, will generally create problems for education.

Health: In the well-integrated economies, EconG will provide more resources; and employers will want a healthy labor force, so Health should improve; but even in these economies, and certainly in Primary Exporting and Dualistic ones, economic expansion might create too much disruption, leading to crowding and congestion that will reduce the quality and availability of health care. AdlSoc and Education will improve it, the latter quite strongly. Better SocInf and a higher StandL will both improve health, and greater EffGov will open the way for people to demand better health measures. Pop pressure can reduce health.

The Household Standard of Living should improve with advances in EconG. However, Economic Growth can lead to such an intense concentration of income and wealth in the hands of a small group that everyone else is actually left worse off. It will also tend to be improved by increases in the other variables, but it will come under pressure from increases in Population.

POLITICAL VARIABLES

The Social Infrastructure will be put under pressure by increased EconG, but at the same time, growth will bring increased resources. In the weakly integrated economies, the former effect is likely to predominate, in the strongly integrated the latter. Population will press on the Infrastructure, but it will tend to be strengthened as a result of increases or improvements in all the other variables.

Effective /Democratic Government should be encouraged by EconG, but things are not so simple; there can be difficulties. Well-balanced economic development, encouraging the growth of a middle class, as in the integrated economies, will certainly be supportive of democracy, (think of India or Chile today). But there are other patterns of economic development. The kind of Economic Growth that results in a high concentration of income and wealth, or that focuses on an extractive industry, oil or minerals, or a plantation crop, may not be so congenial. Indeed, famously, such an economic structure favors an authoritarian or dictatorial government. As for the other variables, EffGov will be made more difficult by Population pressure, but will normally be encouraged by improvements in all the other variables.

DEMOGRAPHICS

Population pressure depends on both births and deaths. Economic and social improvements will generally reduce deaths, thus increasing Pop initially, but in the long run such improvements will lead to a decline in family size. Reading across the first row, we see:

-that the effects of Economic Growth and an improved Environment will tend to go both ways, in the short run probably increasing Pop, but in the long run and ultimately reducing it;

-that Population pressure will tend to be reduced by improved Socialization of Adolescents (fewer out-of-wedlock births, later marriages);

-that Educ will tend to lower Pop, through knowledge of birth control and increased awareness of opportunities for women

-that improved Health will reduce deaths, which will tend in the short run to increase Pop, but as better Health decreases infant mortality and childhood deaths, fewer births will be needed to ensure surviving children and fertility will tend to fall

-that better Social Infrastructure will tend to reduce Population pressure (by providing for old age and sickness, reducing the need to have large families to assure care in old age;

-that a higher Standard of Living will increase PopP initially because it will reduce mortality and deaths during childbirth – but in the long run it will lead to lower fertility;

-that Democratic Government will probably reduce PopP– for example, by offering more opportunities for women, who will then be inclined to have fewer children.

Analysis

Just by glancing at the matrix we can see that the largest number of +or- and ? cases are to be found under Population and Economic Growth. These are the variables that matter most. Let's look at each, in the light of our four types of economy.

Consider PopP, reading along the bottom row: under present-day conditions it is likely that PopP will be increased by improved economic growth, a better environment and a higher standard of living. As a result, PopP itself (now read down the vertical column) will react back negatively not only on those variables, but also on the others. Greater PopP will make it harder to socialize adolescents, will create crowding and congestion, hindering education and economic progress, causing health problems and environmental stresses; moreover, it tends to overtax the social infrastructure, bid wages down and otherwise lower the standard of living, and so make democratic government more difficult. That is to say, *an economic advance could undermine itself*, by generating population pressures that will undo it. This is the modern version of Malthus, and the 'Iron Law of Wages', where wage gains lead to population increases which eventually pressure wages back down to subsistence levels. If there is to be development, PopP must be controlled; (think of incentives to have fewer children in China.)

On the other hand, it works in reverse, too. If Population pressure can be reduced, all the other variables, both social and economic, will be improved. So we need to develop policies to ensure that increases in the economic variables will not increase Population pressure. (But PopP control must not go too far; France and Italy are

facing an aging population that is declining in numbers. That is one reason for permitting socially troublesome immigration.)

Now look at the column under 'EconG'. This shows the effects of a rise in Economic growth, with greater investment in new technologies raising productivity, developing new sectors and bringing increased employment. These effects increase the resources available to society. This should lead to improvements in the other variables. But as we have argued earlier, economic investment does not necessarily imply general economic and social improvement. On the contrary, it will always destroy as well as create, and, especially in weakly integrated economies, it can cause terrible problems - destroying the old ways of life (as corporate farming does, for example), driving people off the land in search for work, thereby undermining the way the young are socialized. New resources are created, but in a weakly integrated economy, those who feel the destructive impact may have no access to the new resources. Moreover, as we have seen, economic decisions respond to the market; pollution costs are 'external' (costs paid by neither buyer nor seller), so unregulated industrialization normally leads to widespread environmental damage, especially air and water pollution. If the new industries are unregulated they will often have unsafe or unhealthy working conditions, creating new health hazards. We have already discussed how the migration of labor that takes place in order to supply the new industries with workers may result in haphazard housing developments, with unhealthy sewage and waste disposal, and contaminated water. These shifts of population can overburden school systems already under pressure. Economic development generally leads to at least some expansion of social infrastructure, but the expansion is not necessarily proportional, so the institutions may become overburdened. Finally, economic growth need not necessarily lead to a rise in the general standard of living; if the benefits are concentrated and the costs spread widely, most people could end up worse off.

These negative interactions are likely in a weakly integrated economy, where economic advance in one area need not be matched by corresponding and

complementary advances elsewhere. But they can also take place *even if economic growth is proceeding in a smooth and balanced manner*, that is to say, even if all the economic variables interact positively, so that the economy moves forward strongly overall. Even in such a case, as we have just seen, economic growth can have a negative impact on other aspects of the society – undermining socialization, damaging the environment, overloading the social infrastructure, increasing inequality and spreading poverty. But the environment, and the social variables are positively related, to each other and also to economics. That means that the negative impact of economic growth on the other variables will set up reactions between them, on each other, and then back on economic growth itself, resulting in a general downward spiral that could offset or undermine the initial economic improvement. A general economic advance creates resources and tax revenues that could be used to offset the destructive impact; but there is no guarantee that the resources will be used to do that.

Consider: a negative impact on AdISoc could result in inadequate socialization, which would mean a less productive labor force; this in turn would put more pressure on the infrastructure; then a damaged environment would lead to poorer health, lowering productivity, while overburdened institutions would increase economic insecurity, and so on, all combining to reduce the standard of living – in spite of a general economic advance. (Think of the high youth unemployment and free-floating anger in much of the Arab world.) As noted, all these effects then react back on the economy itself, undermining economic growth. In other words, economic advance can be brought to a standstill, even turned into decline, by the impact of the economy on society and the environment, even when the economy itself, considered in isolation, seems to be working well.

As an example, suppose that we start from a stable situation, in which economic growth has been modest, and population pressure mild, but the country is poor. A new economic development policy is instituted, so that EconG increases. This may also be accompanied by policy-induced changes in some of the coefficients;

previously EconG has had little or no impact on AdlSoc, and a mildly positive effect on Health and Education. But now it will generate large shifts in population from rural to urban with strong negative impacts on both the socialization of adolescents and the environment. It will also overburden the urban school system. However, previous development has already reduced the death rate, so there is no reduction in PopP, since the influence on fertility will only show over the long term. Suppose further that there is also no short term effect on EffGov, but that EconG has a positive impact on both SocInf and StndL.

How could we determine the overall outcome for growth? First consider the column showing how EconG affects the other variables; in each cell, we will have a coefficient indicating the change, positive or negative, in the relevant variable (written in the left column) due to the change in EconG. Next, turn to the row for EconG. Each cell indicates how EconG changes due to a change in the other variables (as indicated at the top). To find the overall impact, combine these. A rise in EconG brings a worsening of AdlSoc, and a worsening of AdlSoc reduces EconG; a rise in EconG harms the Env, but a poorer environment weakens economic growth. Add together these negative effects and compare them to the positive feedback effects on EconG of its positive impact on SocInf and StndL. The overall effect will depend on whether the negative effects outweigh the positive. It is easy to see that the negative effects could come to predominate, even if the economy is strongly integrated.

To carry out this process fully the calculation should be performed for all the variables at once. That is, the starting point is the new exogenously determined level of EconG, along with the present levels of the other variables. Then we examine the policy-induced changes in coefficients, together with the unchanged coefficients. This is the initial position, and we apply the matrix to find the new position; that is, we multiply the variables by the matrix to determine their new levels, taking into account the effects of the new level of EconG and the revised coefficients. But this is not necessarily the end of the story. We need to re- enter the results a second time,

again multiplying the new set of variables by the matrix, to find how the new levels of the variables interact and affect one another. This will give us yet a further set of levels of the variables, and we once again repeat the process, so that the result will be calculated once more – and reentered and repeated, until the results clearly converge to a new solution. [Mathematicians will note that certain assumptions are needed here; the matter is discussed in the Appendix.]

Economic growth is supposed to shower a society with riches, improving life across the board; but given the present policy climate it is particularly likely to make things worse - that is, it will tend to have a negative impact on social and environmental variables. This is especially likely in economies that are only weakly integrated. The possibility that economic growth can cause social or environmental problems is becoming more widely recognized now; there is even a ‘modified Washington Consensus’ taking this into account. But until now there has been no way to demonstrate the consequences of this with any precision; that is what our approach provides. We show exactly how an apparently successful policy of growth can be undermined by its negative impact on social and environmental variables. More generally, our approach can explore all sorts of interactions between economic and social – and other - variables.³

Clearly strong policies are needed to channel the powerful forces of economic transformation. To ensure that Economic Growth does not unhinge the socialization of adolescents or worsen the Environment, or unleash such destruction of the older ways of life that most people are left poorer than before, we must control and channel the forces of the market. Those forces cannot be allowed to

³ The international policy community is still committed to the promotion of free trade, free markets and unrestricted capital mobility. We are skeptical; we certainly support trade, markets and capital mobility – but all three need regulation and management. Policies must pay attention to the social and environmental impact of globalization and growth policies. If these factors are not considered, we can be sure that ‘creative destruction’ will be destructive; we cannot be so sure that it will end up being creative. However, the conventional approach has no systematic program for ensuring that policies will attend to the social and other impacts of growth. They cannot develop adequate policies because they have no way of systematically assessing these impacts. The TG Matrix is designed to help do just that.

overburden the Health care system or overload the social infrastructure. On the other hand, if we can develop policies that ensure that these social and environmental variables are properly related to the economic ones, we may be able to set the whole system not only moving in a positive direction, but along a self-reinforcing path. Creative destruction is important – it is the engine of transformation and has produced unimaginable riches for the advanced world – but the creativity has to outweigh the destruction, as those who bear the burden of the destruction can attest.

UNDERSTANDING THE TRUE COSTS AND HOW TO PAY FOR THEM

Providing health and education, offering welfare services, building infrastructure and protecting the environment will cost money. Heavy spending is likely to drive the government into deficit. But to repeat what we said earlier: the balance of the government budget – or the trade budget – is only an indicator. A government deficit is not necessarily a sign of trouble, provided the monetary system has been developed appropriately, and that financial markets are controlled so as to prevent excessive speculation. If controls are weak, or the monetary system poorly designed, a government deficit can cause *financial* trouble, but, to repeat, it is not necessarily a sign of *real* trouble. If the financial problems are averted by proper design of the monetary system and sound regulation of financial markets, then deficits can provide useful stimulation to the economy.

The true constraint on what government can bring about at any time is what the economy can produce, and the point of development is to increase that. Each of the programs suggested here can be expected to generate additional consumer demand, since they add to employment, and so increase the aggregate wage bill – which also means higher tax collections. This additional consumer demand is the true cost of these programs. Yet meeting this demand means that the families of the newly employed will have a better standard of living, and better health. So the *cost* of the program is also a *benefit*. It is an increase in the well-being of part of the population, and that is what development is supposed to bring about. If carefully planned, it should be simple enough to supply such additional consumer demand, provided there is spare capacity in the consumer goods sector. If there is no spare capacity, then new

productive facilities will have to be built and/or productivity raised (new land brought into cultivation, better seeds or more fertilizer used, more textile factories and food processing plants built, existing ones run faster, and so on.) Again an ELR program could be used to support some of this – market gardening, for example, mobilizing traditional textiles and shoe-making, other traditional crafts, and even house-building. Sewing machines with foot-pedals will save on electricity.

The new demand will generate additional employment in the consumer goods sector, and will tend to lead to pressure for higher productivity there. In general, the programs should be both highly beneficial, and not expensive in real terms. Paying older students and the retired to tutor the underprivileged and needy, supporting nurses training, providing apprenticeship programs, all are obviously desirable and need not be that costly, in terms of the impact on the government budget. Even a great deal of infrastructure building need not put a great burden on the government. These programs should certainly lead to improvements in health and standards of living, with spillover effects on other social variables. And many of the activities in question – tutoring, apprenticeship, etc. – can be expected over time to increase the productivity of the labor force.

With these policies in place, we can expect a more self-reinforcing and constructive set of relationships between our vectors. This is what the tables below set out. Indeed, this presentation displays an extreme case, where all the relationships are favorable to development. EconG has a positive impact on all variables, except PopP, where its impact is negative, to reduce population pressure. All the other variables have a positive reaction back on EconG; PopP has a negative impact, meaning a slowdown in PopP *improves* the prospects for growth, In this case it is obvious that the dynamic will be favorable, a virtuous cycle.

It might seem that these are the relationships we would expect to find in a developed economy. But that is not quite so. Certainly in a developed economy the Economic and the Social, Environmental and other variables do support each other. But in a fully developed economy the support of the social and other relationships would tend to be independent of the current changes in the economy, certainly in the short run. That support would not vary with the

current level of EconG. The Soc Env and other variables would certainly tend to support economic development both in the short and the long run, but the positive development of those variables would be independent of any but the largest fluctuations in the economy. This of course is made possible by the fact that a developed economy has a high level of productivity, and so can support social, environmental, etc., development without regard to current variations in the economy. More on this point later.

Transformational Growth Equations

	<u>Economics</u>	<u>Environment</u>	<u>Adl Soc</u>	<u>Education</u>	<u>Health</u>	<u>Standard of Living</u>	<u>Social Infrastructure</u>	<u>Democratic Govt</u>	<u>Population</u>
EconG = f(_____	+	+	+	+	+	+	+	-)
Envent = f(+	_____	+	+	+	+	+	+	-)
Adl Soc= f(+	+	_____	+	+	+	+	+	-)
Education = f(+	+	+	_____	+	+	+	+	-)
Health = f(+	+	+	+	_____	+	+	+	-)
Stnd Living= f(+	+	+	+	+	_____	+	+	-)
SociInfra= f(+	+	+	+	+	+	_____	+	-)
Demo G. = f(+	+	+	+	+	+	+	_____	-)
Population = f(-	-	-	-	-	-	-	-	_____)

Rewriting this in the matrix format:

	EconG	EnvH	AdlSoc	Educ	Health	StndL	SocInf	EffGov	PopP
EconG	-----	+	+	+	+	+	+	+	-
EnvH	+	-----	+	+	+	+	+	+	-
AdlSoc	+	+	-----	+	+	+	+	+	-
Educ	+	+	+	_____	+	+	+	+	-
Health	+	+	+	+	-----	+	+	+	-
StndL	+	+	+	+	+	-----	+	+	-
SocInf	+	+	+	+	+	+	-----	+	-
EffGov	+	+	+	+	+	+	+	-----	-
PopP	-	-	-	-	-	-	-	-	-----

Some variables will be fast-acting, others will exert their influence only over longer stretches of time. Economic growth will act quickly, as will the Standard of Living; in both cases the changes will be felt through markets. But changes in Social Infrastructure will be felt a little more slowly, while the impact of changes in the Socialization of Adolescents, Population Pressure and Democratic Government will take a long time to develop.

The Population variable is critically important because it has a strong long-run impact on the others. An increase in PopP will worsen all the rest, and they will in turn react on each other. PopP can change rapidly, if the death rate falls or rises, but the changes are slower when the change is due to changes in fertility.

The Environment/Economic relationship need not be positive (+); indeed, in present conditions it appears to be negative – that is, higher Economic Growth leads to a worsening of the Environment. The worsening of the Environment then leads to lower performance in many of the other variables, ultimately reacting back to reduce or impair EconG.

But if policies could be developed to ensure that Economic Growth led to a better Environment, this could be crucially important. For then the better Environment would improve all the rest, and, as we have seen, it is fairly reasonable to think that the other variables will be positively related to each other (+). Then, assuming that population growth will depend negatively (-) on the others, a positive Environment/Economic relationship will tend to bring about a pattern in which the growth of each of the other factors reinforces the rest in a positive (constructive) spiral.

The configuration of pluses and minuses shown above tells us that the variables mutually affect one another in the ‘right’ direction. Economic growth improves social conditions, and these react back favorably on economic conditions. Both improve the environment and support a more representative and active politics – and this also reacts back favorably on

social and economic conditions. Better social and economic conditions, in turn, tend to reduce population pressures in the long run.

Sustainable Globalization

At this point we can derive an interesting implication of our approach, one that provides an important contribution to the current debate over globalization. Opening up new areas of trade, building new factories, outsourcing and flows of hot money – the processes of globalization, in short - all tend to generate RUM; they call for workers to develop new skills; they require additional infrastructure, they generate pollution, create needs for new public health measures, etc. In general they lead to social changes. But these social changes react back on the globally driven economic processes. As we have seen this raises the question whether this interaction is sustainable, that is, whether, given its impact on developing societies (and perhaps also on the advanced world) the process will support itself, and will be carried on, or whether it will generate counter forces that will tend to bring it to an end.

Using the matrix we can define a precise condition that shows what is necessary for development to be sustained, answering the question, when and whether the development process, driven by globalization, can be sustained. Of course, to do this the equations have to be written out with actual numbers, even if they are only estimated numbers. For this purpose we should treat PopP separately, since the issues there are on a much longer time scale. We should also separate out EffGovov. (It might also be useful to examine Env on its own, but it could be included.) Then the remaining equations can be solved (see Appendix) and we have

$$\text{economic impact on society} = \text{social impact on the economy}$$

This holds in equilibrium, and it says that when the equations are in balance, the economy's contribution to the growth of the social variables just balances the society's contribution to the growth of the economy. Each reinforces the other. This is the condition for 'sustainable development'. When there is an economic advance it will change the social variables in the same direction; but the social variables will act reciprocally back on the economic realm, also

moving it forward, and the two effects will be just the right magnitude to keep the balance between the two realms. (See Appendix for derivation and extension to more complex cases.) Economic advance leads to better education, improved public health and more expansive housing (higher StdL). But, in turn, the improved education, public health and housing have arrived at just the right level (not too much, not too little) to support that degree of economic advance.

If this condition does not hold, we do not have an equilibrium; either society will be contributing more to the economy than it receives back, or vice versa. Of course, an equilibrium balance can only be defined if it is possible to measure the impacts, so that we can write equations. But even when measurement is not possible we can see that if the elements of both rows and columns are positive, the economic impact on society and the social impact on the economy reinforce one another. They may not be in exact balance – without numbers we have no way of knowing - but we can say that they work in the same direction.

Look back at the earlier version of the matrix, where many elements in the EconG column were negative, but all the elements in the row were positive. Under those conditions the economic impact on society not only could not possibly be in balance with the social impact on the economy, the two could not possibly be mutually reinforcing. One will be likely to undermine the other, or worst of all, each will tend to undermine the other. The Econ variable will depend positively on good education, on effective public health, on a clean environment; but economic advances will put schools under strain, will create crowding and disease in the cities, while polluting the environment. These deteriorating conditions will then undermine the economic advance. Something very like this happened throughout Africa following independence.

A simplification

The point being made in what follows can be expressed in a general way: First we simplify by looking only at the interactions between certain parts of the matrix, holding everything else constant. Then we show how these interactions can turn into various kinds of vicious circles and development traps. These interactions are modeled in terms of simple stability dynamics;

this modeling then enables us to see exactly which aspects of the interactions cause the problem (subject, of course, to our simplifying assumptions.) Having identified the problematic aspects and clarified the dynamics, we can then design policies to target the real sources of the trouble.

We have defined the economic variable in terms of markets and money; an increase in Econ means growth of monetized economic activity. It does not automatically mean an increase in economic welfare – although plausibly that will often be the case. More people are producing more of the things they want and doing more of the things they want to do. But there may also be more economic coercion, too, and more negative externalities, and these will show up in the social and environmental variables. By examining how the Econ and other variables interact we can determine the extent to which an increase in Econ will lead to a rise in general welfare.

Moreover, in portraying how Econ and the Social variables interact we demonstrate that the economic aspect of society cannot in general be isolated from the rest – though in some stages it will interact more intensely than in others, as we shall see. No doubt for some specific purposes the economic aspects can be studied in and all conclusions have to take that into account.

The various models below basically partition the matrix into simplified components – Econ and Soc, Econ and EffGov, Econ and PopP. ‘Soc’, for example, will be an aggregate of the variables of the matrix, such as Educ, Health, SocInf and AdlSoc. In each case we take Econ as it appears in the matrix, and then either treat the other elements as constant, and explore the relation between Econ and another variable, e.g. EffGov or PopP, or combine several variables together into a composite variable, e.g. Soc, made up by combining the Social Variables. Then we show how these components of the matrix can interact so as to lead to development traps.

By a ‘development trap’ we mean a set of relationships in which important variables are related in such a way that any advance forward sets up offsetting movements in other

variables that undermine that advance. For example, in Africa, and in Bangladesh some years back, aid and economic growth improved health but that led to a population explosion, putting additional pressure on land and water, whereupon health deteriorated again. Cf J. Sachs. We will explore a number of different kinds of such traps. We need to understand these traps in order to avoid them. The traps will be especially serious when the configuration of the matrix is unfavorable, but we will also show that traps can emerge under certain circumstances *even when the overall configuration is favorable*. Of course, the favorable configuration makes it much easier to devise policies to avoid the traps. Understanding how such traps work will make it possible to avoid them or to create policies to get out of them.

Dynamics – and Development Traps

In examining the dynamics here we are going beyond the matrix. The matrix is a snapshot, holding at a moment of time. But at this point we are going to examine these relationships as they interact over time. This means treating the relationships as durable, as fixed or settled, so we can trace how they work out over time as they interact. Yet in many cases they may be unsettled, and liable to shift, or they may not be ‘reversible’. In interpreting the matrix the unsettled quality of some of the relationships could be indicated for example, by entering a question mark with the coefficient. But if a relationship is not reliable, then it will be difficult to say anything definite about patterns of dynamic interaction. Nevertheless working through the possible patterns of interaction will give us an idea not only of how the variables might develop, but of how their development might affect the system as a whole.

Let’s now explore the dynamics. This is a difficult subject in economics, but it is increasingly apparent that it is *the* key to many of the most difficult problems in the field (financial instability, unemployment, inflation, business cycles, etc.) – and in our case here, it is the key to understanding how globalization impacts on development. But at this point we leave the arena of ordinary discussion; we have to draw on some mathematics. We are looking at how incentives lead agents in the different sectors to interact, and these interactions are channeled by the structure of the system in ways that can lead to outcomes nobody expects – and sometimes nobody wants!

Interaction between Econ and Soc

We will start with Econ and Soc, where the latter is a composite made up of Educ, Health, AdlSoc and SocInf. The main question is, will the incentives created by the interaction of Econ and Soc tend to lead the society to the position where the two mutually support one another? Or will the incentives drive the system away from that point, something nobody wants! Or perhaps the interaction will just leave things stagnant?

A simple two equation example

The coefficients of the matrix represent the slope of an implied linear function connecting the two variables; thus the coefficient showing the impact of EconG on Health is the slope of a linear function showing how Health varies as EconG increases or decreases. The coefficient showing the effect of Health on EconG is similarly the slope of the function showing how EconG can be expected to vary as Health gets better or worse. Our first example will examine the interaction of the variables governed by these linear functions.

To simplify, let's leave out the environment and democratic politics, and take the social variables as a group, represented by a simple index, Soc. Then we can illustrate the general principles with a simple case in which there are just two equations and two unknowns:

$$\text{Econ} = S(\text{Soc}) \text{ and}$$

$$\text{Soc} = E(\text{Econ}),$$

where $S()$ and $E()$ are the two functions. The first says that various levels of Soc support or, in a stronger interpretation, generate or help to generate corresponding levels of Econ, where higher levels of Soc lead to higher levels of Econ. The second says that various levels of Econ generate corresponding levels of Soc. But in this case, Econ could either *damage* or *support* Soc. If it damages it, then the effect will be negative, if it supports it, the effect will be positive.

Let's first consider the linear case with one equation negative, one positive. We can write our equations:

$$\text{Soc} = A - B(\text{Econ}), \text{ and}$$

$\text{Econ} = C + D(\text{Soc})$ B and D are the coefficients drawn from the matrix, saying how Econ affects Soc, and how Soc affects Econ. Note that besides the coefficients, we must

consider constant terms (which are not part of the matrix); these terms describe what Soc or Econ would be in the absence of effects from the other. (The equations have intercepts, as well as slopes.) The first equation says that increases in Econ will bring reductions in Soc. The second says that increases (declines) in Soc will bring increases (declines) in Econ. If there are two equations, one with a positive and one with a negative slope, there has to be an intersection. Of course it might be negative! But it exists. One relation is positive,- upward sloping – and one negative, downward sloping; so there is an intersection somewhere. If it is in positive space, it can be considered an ‘equilibrium’, that is, the social and the economic will be mutually supportive. There could equally well be an intersection where one or both of the variables was negative; in this case the relationship would be destructive rather than supportive. (In ordinary language this says that these variables affect one another, in ways described by the equations, and that there is a point where the impact of Econ on Soc just balances the opposite impact of Soc on Econ.)

[diagram]

Solving for the level of Econ, we substitute the first equation in the second and rearrange:

$$\text{Econ} = [C + DA] / \{1 + DB\}$$

Now we can see that if the negative relationship were to turn positive, the intersection would be at a much higher level of both Econ and Soc. In that case:

$$\text{Econ} = [C + DA] / \{1 - DB\}, \text{ which is clearly greater.}$$

[diagram]

This is illustrated on the diagram. But it should be intuitively obvious also. If Econ has a weaker negative effect on Soc, the line will be flatter; if it has no effect the line will be horizontal. But as the downward sloping line swings up, the intersection will be further out, i.e. at a higher level of Econ. Note that it is possible for the Soc generated by Econ to *always* lie above the Soc needed line (in the positive quadrant); in such a case it would never be a constraint on economic advance – but this is not likely]. This would be the case if $DB = 1$; if $DB > 1$, this would also be true, but there would be an intersection in negative space.

Moving toward or away from equilibrium

Next suppose the society is not in that equilibrium – let’s say that the level of Econ is a little less than the intersection or equilibrium level. Can we expect social or market forces to drive the system back to the balancing level? Will there be appropriate incentives?

Let’s recall what the equilibrium means. It is the level at which the Soc generated by Econ would be just equal to the Soc required to support Econ. This is an important relationship, in regard to being able to maintain a program of economic expansion, whether market driven or planned. If the level of Soc generated or supported by a particular level of Econ is equal to or greater than the level required to support that Econ, then that economic activity can continue or move ahead. But if the Soc generated is *less* than the level needed to support that rate of Econ advance, the Econ will have to be cut back. But we started from the assumption that the level of Econ was just a little lower than the mutually supporting level. If Econ is cut back then the system is moving away from equilibrium – the relationships are working perversely. This can be seen most easily looking at a diagram. There are two lines, one representing Soc generated by Econ, the other Soc needed by Econ, with Econ on the horizontal axis, Soc on the vertical. We assume they intersect in the positive quadrant. The issue is, which line is steeper: at a level of Econ just below the intersection, is the Soc generated by Econ greater or less than the Soc required to support Econ? If it is greater, then Econ can easily be increased, so the society would be likely to move to the equilibrium. But if it is less, then it will be hard if not impossible to increase Econ, and the society will find it difficult to reach its equilibrium, even though the equilibrium is well defined.

[for example,

Vicious or Virtuous circles, Undermining or Supporting

Now we can set out a simple example of what we have been saying all along. When Econ has the wrong kind of impact on Soc, the effects will react back and undermine Econ. This is a vicious circle. To see exactly how the ‘undermining’ (or, alternatively, the supportive process) works, as we have been discussing it, we need to express the impacts of the variables in a ‘period’ analysis. That is, we divide up time according to how the effects of the variables on each other work out. Mathematically, that means we set it out in Difference equations.

These are equations in which the variables are ‘dated’; that is, the values of the variables are the values that they hold in certain specific time periods.

Here we assume that Econ will play itself out in period 0; but its impact will be felt on Soc in the *next* period, period 1. However, the effects of Soc on Econ will all take place in period 1.

So we have:

$$\text{Soc}_1 = E(\text{Econ}_0) \text{ and}$$

$$\text{Econ}_1 = S(\text{Soc}_1)$$

The first says that impact of Econ on Soc takes time; the impact of Econ now will be felt in the following period’s Soc. (Econ growth will shift population from the countryside to the cities, and next period the schools will be crowded and health facilities overrun. Think of Mexico City, or Cairo, or Sao Paulo.) The second equation says that the support of Soc for Econ is needed currently – Soc now affects Econ now. (Today’s health facilities keep today’s workers healthy; today’s roads and bridges move today’s goods and services.) Then substituting, we have

$$\text{Econ}_1 = S(E(\text{Econ}_0)),$$

which will tell us how the system will evolve over time.

Let’s go back to our example, this time writing it as a first-order linear difference system:

$$\text{Econ}_1 = C + DA - DB(\text{Econ}_0).$$

If $DB(\text{Econ}_0) < C + DA$ then $\text{Econ}_1 > 1$; but if $DB(\text{Econ}_0) > C + DA$, then $\text{Econ}_1 < 1$. As this suggests, and as the diagram shows, the system alternates around the equilibrium; it will converge, however, only if the Soc line is steeper than the Econ line. (R.G.D. Allen, 1968, pp. 81-3)

[diagram]

If the relationship is positive, this becomes

$$\text{Econ}_1 = C + DA + DB(\text{Econ}_0),$$

which clearly increases indefinitely.

[explain implications ...]

A non-linear case

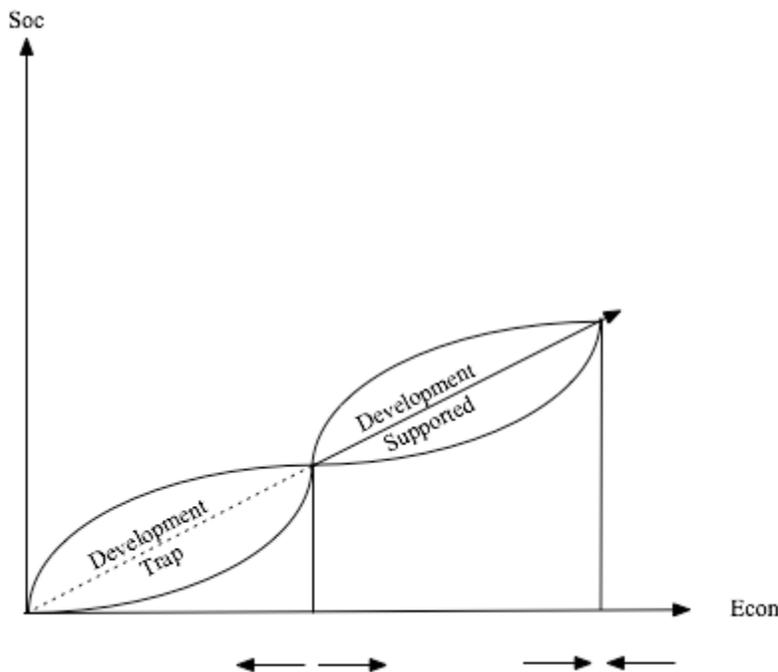
The matrix gives us fixed coefficients, implying that the underlying relationships are linear. But we do not have to stay with that assumption, if there are good reasons to think the variables are related in a more complicated way. The important thing is to consider plausible relationships, while keeping the analysis simple enough that we can visualize the dynamics.

We should be careful, however, when interpreting these functions – they are being used to examine dynamics, and we are assuming that they are reliable, grounded in contracts, obligations or social mores. Yet they may not be well grounded, or the grounds may be changing; it is entirely possible that some of the relationships we are considering may shift unexpectedly with social and cultural changes. We have argued that treating them as mathematical functions will be useful; it will show us the various possible patterns of interaction over time. But it should be remembered that, at times, this will be a stretch. In particular, it would be unwise to assume that these relationships are always ‘reversible’. That is, if the system moved along one of the functions from A to B, it could reverse itself and return from B to A. Assuming reversibility is tantamount to holding that time does not matter, an issue hotly debated by economists. But if time matters, when reversing, things may end up at a point different from A. Nevertheless, let’s look further.

A plausible non-linear case: the relationships might both be ones that increased slowly at first, then rapidly, then slowly again. That is, the dependent variable rises slowly, but at an accelerating rate, then rises rapidly, but decelerates, until it is increasing only slowly again, and then flattens out. (Further increase of the independent variable will have no effect on the dependent.) These are known as ‘sigmoid curves’. Suppose this described the effect of Econ on Soc – as Econ increased, moving along the horizontal axis in the diagram, the Soc which each level of Econ could support, would first increase slowly, then rise rapidly, and finally slow down again. But the effect of Soc on Econ would also show the same form. As Soc increased, moving along the vertical axis, the Econ it could support would first rise slowly, then more rapidly, and then slowly again. [This is hard to spell out intuitively, but can easily be visualized; the diagram plots the curves with Soc on the vertical axis and Econ on the horizontal. See the diagram here and for more discussion, the Appendix.] The two curves

start from the origin and intersect twice – the second intersection marking the point beyond which increases in the independent variables have no further effects on the dependent ones. Below the first intersection, reading from the horizontal axis, the curve showing Econ supported/generated by Soc lies above the curve showing the Soc supported/generated by Econ. After that point, it is just the other way around. The curve showing Econ supported by Soc lies below the curve showing Soc supported by Econ.

Let's interpret this. A level of Econ is only viable – can only be maintained – if the level of Soc that it supports is as large or larger than the level of Soc that it needs (i.e. the level that is needed to support it). As Econ increases from a very low level, the Soc that it generates or supports will be low at first, and then rise rapidly, while low levels of Soc, will only support low levels of Econ. This means we have a 'development trap' here: at low levels of Econ, the Soc generated or supported will be *less than the Soc required to support those levels of Econ*. Since the system starts out poor, it is caught; by itself it can never get going, even though if it did, it would reach a point where it would begin a pattern of self-sustaining upward movement towards a high-level position of mutual support.]



Another version of the non-linear relationship

This time let's include Env along with Soc, and assume they move together. Both are negatively impacted by Econ growth. But in the absence of pressure from Econ, SocEnv will grow on its own. When Econ growth speeds up, rural-to-urban migration increases, putting pressure on education and health, and overstressing social infrastructure. In addition, pollution increases and environmental damage rises. Hence SocEnv will stop growing or even decline. But a stagnant or depleted SocEnv will then, after a time lag, react back on economic growth, slowing it down. But slower economic growth, in turn will reduce rural-to-urban migration. But with slower growth and lower migration, the social system will be able to absorb the earlier migrants and clean up the environmental damage; SocEnv will resume its growth. Health and education will improve, while the environment recovers. At this point growth can resume, and the cycle will start all over again. This, of course, is analogous to the famous 'prey-predator' model. Growth is the 'predator', it feeds on its 'prey', society and environment; but if it devours them too much, it cannot continue, and must slow down. Once it does so, however, society and environment can recover, and when they do, growth can resume. (Lotka-Volterra, Goodwin⁴)

Four possible patterns of interaction between Econ and Soc have been examined: simple linear ones, lagged linear interactions, sigmoid non-linear relationships, and a prey-predator model. Many other possibilities could have been explored, but these are more than just plausible. They show how the interaction can either undermine or augment economic development. The development of the economy cannot be considered in isolation.

Interaction between Population and Economic Growth

The discussion so far has dealt with short or intermediate term relationships. Let's now consider some possible longer term interactions – between economics and population pressures. These are, of course, much more hypothetical; many external factors can change and introduce unexpected influences. The relationships themselves may change because of new technologies, or new socio-political conditions. Nevertheless, it may still be illuminating to 'hold these matters constant in our minds', and consider the relationships. They are after

⁴ Another version of this story could be developed following the 'non-linear accelerator' model of Goodwin (suggested by Matias Vernengo).

all, the relationships underlying the pros and cons of the debate over Malthus. Remember, Malthus argued that reform and policy-induced poverty reduction would not work; higher wages and higher living standards would simply lead to increases in population, driving living standards down again. Population increased geometrically, but food supplies and higher living standards could only increase arithmetically; the former would inevitably overwhelm the latter. But in fact economic activity, and so living standards, also grow geometrically, and the patterns of interaction are more complex, and result in quite a different picture.

At a minimum we have two relationships, enough to illustrate the issues. There are two variables, economic growth and population growth; one relationship shows the effects of Pop on Econ, the other shows the effects of Econ on Pop.

The two relationships are:

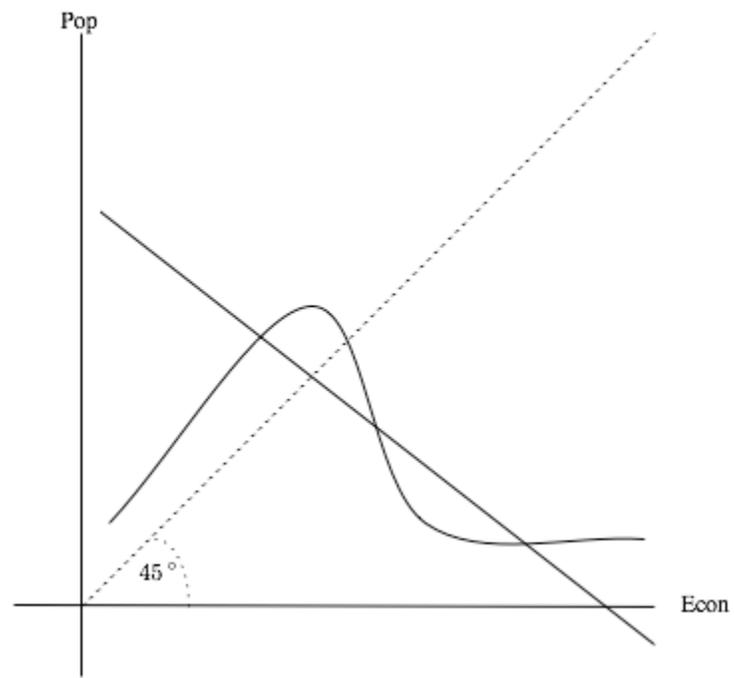
--Econ depends inversely on Pop; as Pop declines, Econ rises. Reduced pressure on natural resources allows for more investment; reduced pressure on family resources allows for more investment in children, producing more highly educated and healthier workers. On a diagram with Pop on the vertical axis and Econ on the horizontal, this curve slopes down from left to right.

--Pop depends on Econ, first rising with higher Econ (better diet, better health), then peaking and falling (smaller families), finally flattening out at a low or zero level. That is, as Econ rises from a low level, it makes better health and diet possible, so Pop grows faster, but as Econ goes higher still, women become educated and reduce their fertility, so Pop slows down and growth declines to a low level. On the same diagram, this curve rises from near the origin to a peak, then falls, and flattens out.

As is evident in the diagram, there could easily be three intersections of these curves. At least one would be unstable, according to the usual analysis of economists. If the first curve started very high and did not fall steeply, while the second rose only a little before starting to fall, there could be no intersection at all.

This has implications for the Malthusian debates. Contrary to Malthus it is clear that *both* Pop and Econ grow geometrically. But it is also apparent that there is no reason to expect them to grow at the same rate. Instead the question is, will they support each other? At intersection points, Pop supports Econ to the same extent that Econ supports Pop – they are mutually consistent. This raises the question, are there forces that pull them together, so that they will tend over time to grow in a supportive balance? This does not mean that they must grow at the same rate; in fact, there may be a number of equilibrium points, and some may be ‘unstable’, (by economists’ definitions – which may not always be appropriate!) The equilibrium positions will generally *not* lie on the 45 degree line (the line along which Pop growth = Econ growth). Malthus feared that Pop would normally grow faster than Econ. In general this will not be true, nor need they grow at the same rate; on the contrary, in advanced countries, normally, $Econ > Pop$, which implies that average income per capita will be rising.

[insert diagram]



Interaction between Government and the Economy

We can set Soc and Pop aside, and turn to a study of the interaction between EconG and EffGov, between economic advance and increases or decreases in the degree of effectiveness of government. (There are, of course, many other kinds of interaction between government and the economy.) Admittedly, measuring the degree of government effectiveness will be difficult, and there will be some unavoidable arbitrariness. But measures have been proposed and we can draw on them, bearing in mind that the relationships under examination cannot be considered exact.

Note that we do not insist that effective government is necessarily democratic. China, for example, has been amazingly successful, though it is notoriously not democratic. Neither is Singapore, another success story. Two issues are paramount: providing voice to those who are injured, so they can demand to be compensated, and allowing pressures to develop that will lead to renewal, to the renovation of institutions, clearing out calcified administrative structures and restoring flexibility.

Let's consider an interesting problem that could arise even though there might be positive relations between EconG and EffGov.

On the one hand, under appropriate circumstances a rise in EconG can be expected to generate an increase in the effectiveness of government, EffGov. Economic growth will tend to bring an increase in the middle class, and also give rise to a prosperous upper level of the working class. Both will push for greater representation, and will try to advance their causes politically. Both will push to educate their children, and both will demand better public services. EconG and EffGov are positively related, in that an increase in EconG tends to *generate* a rise in EffGov.

On the other hand, an improvement in the effectiveness of government (and very often in the degree of democracy) will (usually) tend to encourage an increase in EconG. Better administration, more adequate provision of public goods and infrastructure, more reliable

law and order, all will contribute to furthering EconG. So here, too, EffGov and EconG are positively related, but in this case, an increase in EconG depends on a corresponding increase in EffGov.

We have two positive relationships between EconG and EffGov; it might seem that no difficulties could arise. Not so. Consider a low level of EconG; if the degree of EffGov *generated* exceeds that *required* the level is sustainable. Suppose it rises, and it is still the case that the degree of EffGov generated is greater than required, but not by as much. Then move to quite a high level; here the degree generated is less than required; in between there will a point at which they just balance. We can see all this on a simple diagram.

[diagram]

Very roughly, what it means is that at levels of EconG below the point of intersection, the degree of EffGov generated exceeds that required – so the way is open for EconG to increase further. But at levels above the intersection, the EffGov required exceeds that generated, so EconG can't be sustained, and will have to decline.

[real world examples?]

Now suppose that the slopes of the lines are reversed, and that at levels of EconG below the intersection the required EffGov exceeds the generated EffGov. EconG will not be sustainable; it will have to fall to zero. (For instance, key sectors of the developing country may be easily monopolized, leading to stagnation; democratic politics would be needed to break up the trusts.) By contrast, however, at levels of EconG above the intersection, generated EffGov exceeds required – at such high levels of economic advance social dislocation will be high, but so will opportunities; money will flow into politics, and class and sectoral conflicts will be intense. When the level of EffGov generated exceeds the level required economic expansion can move up indefinitely, no matter how high.

[diagram]

Cost Disease for Educ and Health

This is a different kind of dynamic problem, one that doesn't involve adjustment. Instead it concerns the way the relative sizes and costs of different sectors will change over time. As development proceeds *over the long run* the costs of Educ and Health and some government services will appear to rise relative to other costs. It may begin to seem that these services are becoming more and more difficult for the economy to afford. This is an illusion (Baumol and Bowen, Baumol and Gomory...) In reality, however, they are easier for the society to afford; what makes them seem relatively more expensive is that productivity in *other sectors* has been growing more rapidly, compared to the services in question. Slower than average productivity growth in a given sector or industry implies a rise in the costs of that sector relative to those in others. Productivity in certain services such as Education and Health cannot increase rapidly – some jobs just cannot be performed faster - but those who work in these sectors must be highly trained so their wages and salaries must keep pace.

Consider an example: an opera company is putting on *Cosi Fan Tutte*, the orchestra plays and the singers sing; they are good and do it well. Nearby there is an assembly plant in which skilled workers put together refrigerators from imported components. It takes two hours for a batch of refrigerators to be assembled from start to finish; that is also the time required to sing the opera. Let's suppose that the number of workers and the number of singers and musicians are the same, and that they are paid the same; then the cost of an opera performance and a batch of refrigerators are also the same. Now the time and motion engineers reorganize the work at the assembly plant, and with suitable incentives, it speeds up, and a refrigerator can be assembled in one hour. But it still takes two hours to sing the opera; it won't work trying to speed up the singing. So now the refrigerators cost only half as much; that is, *the cost of the opera has doubled, relative to refrigerators.*

Services in Education and Health (and some other areas) require people to spend time with other people; nursing, medical care, and teaching all take time and require person to person communication. Like opera singing, these services can't easily be speeded up or be done by machine. (Of course productivity can be improved in other ways, for example, with better

equipment – but such improvements are likely to be expensive, and may improve the product or the service, rather than reduce the cost.) Care providers, teachers and research workers are highly skilled, and must be paid accordingly; moreover as average pay rises, pay in these skilled services must keep pace – even though productivity is growing more slowly than average. It will therefore seem that costs are rising out of control; they are not. They appear to be rising, in fact, because other sectors of the economy are becoming more productive.

Surveying the implications

Now let's review what we have accomplished; remember, in Chapter 4 we set up the Transformational Growth Matrix, showing the way the variables impact on each other; now here, we have developed the dynamic implications, showing how those impacts play out.

--First, we have broken down the barrier between economic and social/environmental analysis. Our approach shows exactly how economic variables interact with social and environmental ones. Contrary to what some mainstream economists believe, not only can economics *not* be isolated from the rest of society, but we can show *exactly* how it impacts on the other aspects of society and how society reacts back on it. These relationships can be modeled precisely, and we can see that there are many possible positions of 'mutual support' (equilibrium, economists would say), both stable and unstable.

--Second, this also lets us show how and to what extent the economy can become independent of the rest of society as development proceeds. The separation of the economy from society is not inherent or necessary; it emerges as a result of development and will normally remain partial and incomplete.

--Third, we've provided a method not only for examining this theoretically, but one which can be applied practically. It's flexible and can be used with ordinal or cardinal measures, even without numbers at all, an important feature, since the statistics in developing areas are often poor to non-existent.

--Fourth, we've derived the condition for a balanced mutually supportive relationship, one where the effect of Econ on Soc is just balanced by the reciprocal effect of Soc on Econ.

--Fifth, we've shown how the matrix can be partitioned, and the coefficients used to define simple functional relationships. This makes it possible to explore whether market or, more broadly, general material incentives would tend to push the system towards the balanced position just defined – and we've seen that in very plausible cases this won't happen. Even worse, 'development traps' can be identified, where the incentives work perversely, preventing development from moving forward, or setting vicious cycles in motion, undermining economic advances.

--Finally, we've shown that active policies will be needed, and can be defined, to avoid traps and to establish the relationships that will be mutually supportive, and we've outlined what those policies should be.

This suggests that the mainstream view that the economy can be investigated separately from society is seriously in error. The economy rests on social foundations, and the society rests on the economy. They are interdependent, and that interdependence can be modeled with a great deal of precision; that is the central message of our condition for sustainable globalization.

Methods and approaches like that of the Copenhagen Consensus, resting on partial equilibrium analysis, are also wrong. In general, it is not possible to isolate certain variables, and deal with them separately; sometimes this can be done, but only if we have first clearly defined the pattern of interdependence, so that we know exactly what we are ignoring. The same problem can be seen in the somewhat opportunistic approach of the well-meaning and important campaigners against world poverty - for example, Jeffrey Sachs and Bono. Their work produces results, but because the problems are attacked separately, often in response to the availability of funds, problematic interactions can emerge. The eradication of childhood diseases could result in a dramatic increase in the numbers of school-age children, crowding the schools, overburdening teachers. Efforts to improve the schools then might result in a

shortage of building materials and construction workers. Efforts to expand public construction could then unbalance government budgets, leading to austerity measures, which would set back the whole development process. Many similar scenarios can be devised; the point of the TG matrix is to help us foresee, and forestall, such problems.

We might ask why well-trained and able investigators would make such mistakes. The answer may lie in the concept of ‘the economy’. In the advanced world we are accustomed to ‘the economy’ operating, to some extent, on its own. Indeed, this is considered desirable in many ways. ‘The economy’ is supposed to be generally independent of the rest of society; it produces the goods and services that support the rest of society, but only insofar as these needs are manifested through the market; and it is not itself directly or immediately dependent on the rest of society. Indirectly, and in the long run, yes, of course the economy depends on and interacts with the social system. But not in the short run, and not immediately or directly. So when ‘the economy’ is well-developed, as in the advanced countries, the matrix will exhibit this independence; for the short run case, many of the cells representing the interaction between EconG and the social variables will show zeroes. But this will never be the case for a developing economy.

Stages of Socio-Economic Development

This suggests a more general point, and the Transformational Growth Matrix can be used to help us to see what is at issue: it is, in fact, a question of defining ‘economic development’. Typically in traditional societies, there will be a balance between Econ, Env and Soc for small changes in established economic practices. But substantial and innovative economic advance will create turmoil and have a negative impact on the social variables. Successfully developing economies will exhibit a positive relationship, a virtuous cycle. Then economic development can be said to reach a high or ‘advanced’ level when social and environmental activities can be supported on an independent basis, ‘funded’, so to speak, so that they do not depend on the success or failure of current economic activities. That is when ‘the economy’ emerges, as an aspect of the society somewhat independent of the rest.

We can rewrite the matrix again, now showing that in a fully developed economy many short-run connections can be severed, so that the different areas are independent of one another. This will be represented by '0's. In an advanced economy a rise in EconG means an increase in growth and in productivity. So in such an economy we can expect the acceleration principle to work; EconG will therefore have a positive effect on itself. An improved Env will surely support EconG, but better AdlSoc is unlikely to have much immediate impact. Improved Educ, Health, a higher HStndl and better SocInf may all have an encouraging effect. Better political institutions are unlikely to have much effect in the short run, but they might.

Now look at the effects of higher EconG on the other variables, bearing in mind that we are thinking of the short to medium term, the next year or so. Of course, higher EconG can be expected to show up as higher HStndl. But otherwise it will not have any great impact on any of the other variables. The sectors that these variables represent are already supported and developing according to plan, independently of whether or not the economy is running strongly, that is to say, independently of the business cycle. If they are supported by taxes the expenditures they require will be sustained by deficit spending during downturns; to the extent they are private, funding will carry them through difficult times.

An important implication of this table is that once a country is developed, further progress is likely to come chiefly through the political arena. Effective and responsive government, EffGov, will have a positive effect on all the social variables. A more sensitive, better functioning government, especially one responsive to the public, will be able to offer improved services to the economy, to monitor the environment more carefully, to provide programs to counsel adolescents, to promote education and health, improve the distribution of income and social services, thereby raising the household standard of living,. And it will most likely work to improve social infrastructure, and finally it is likely to react back on itself, and move towards improved and more democratic practices. All of these will be furthered or supported by strong and effective approach to demand management – which could be developed around a public service employment program of the kind we have suggested.

	EconG	EnvH	AdlSoc	Educ	Health	HStdL	SocInf	EffGov	PopP
EconG	+	+	0	+	+	+	+	+	0
EnvH	0	-----	0	0	0	0	+	+	-
AdlSoc	0	0	-----	0	0	0	0	+	0
Educ	0	0	+	---	0	0	0	+	0
Health	0	+	0	+	-----	0	0	+	0
HStdL	+	+	0	+	+	-----	+	+	0
SocInf	0	0	0	0	0	0	-----	+	-
EffGov	0	0	0	+	0	0	0	+?	0
PopP	0	0	0	0	0	0	0	0	-----

Earlier we noted that different economic adjustment ‘mechanisms’ allowed us to usefully distinguish stages of economic development. When technology is relatively primitive, output and employment will tend to be inflexible; fluctuations in demand will therefore be reflected in fluctuations in prices. These price changes will, in turn, help to bring supply and demand back into balance. But when the system has moved into mass production output and employment will be quite flexible, and supply will quickly adapt to variations in demand. In the case of relatively early, craft technology it is likely that the impact of economic advance on the social variables will often be negative; economic advance will put a strain on education, health, infrastructure, the environment. But when technology is more advanced, the systems supplying education, health, infrastructure, etc., are more likely to have some flexibility built into them, so they won’t succumb to strain, on the one hand, and economic advance is more likely to generate an increase in public revenues, allowing the public sector to expand and experience both economies of scale and network economies.