

12. Interaction between economic and social variables: the transformational growth matrix *

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12.1. INTRODUCTION

The object here is to explore the interactions between economic growth and change, on the one hand, and changes in social, environmental, political and population variables, on the other. These interactions are likely to affect social and economic well-being, for better or worse, and very possibly quite strongly. Economic Growth could be supported and enhanced –or it could be undermined, even reversed. The economy is ‘embedded’ in society, after all; the object will be to show this in a measurable way, and to show as precisely as possible why and how this matters.

Keeping the analysis simple, but still realistic, economies here will be assumed to be made up of sectors – industry, agriculture, services – and social classes – workers, landlords, business owners, bankers.¹ There are economic interactions between sectors and social classes; analyzing these is part of the theory of growth and fluctuations. But we want to focus on a different kind of interaction, also involving both sectors and classes, but this time between economic advances and the resulting pressure or development of social variables. When sectors and classes interact along the social dimensions, we shall argue, it is likely to change the patterns of development – and it may lead to stagnation and failure to develop.^{2,3}

12.2. THE TRANSFORMATIONAL GROWTH MATRIX

To examine these questions we must set up quite a general framework, in which we can study how different kinds of economic change can interact in various ways with many aspects of the social order. But in what follows we

will keep the discussion of the purely economic side as simple as possible, allowing us to define and examine a wide range of social, political and demographic variables. We will stick to straightforward cases of economic growth resulting from capital accumulation and technological advances. At this point we will present a full spectrum of non-economic variables, though later we will simplify this, too. Even so, we will see that the interaction between the economic side of a country and the other aspects of its social order turns out to be complicated and important.

To display the variables and their interactions in the most general way, we will set them out as a matrix, in which the coefficient will indicate the relationships. (Since we are examining growth, we call this the Transformational Growth Matrix.) First we will list and describe the variables to be considered. These will appear in the row and column vectors. Usually a variable will be a composite, made up of a number of different but related elements that tend to move together, so that it can be represented by appropriate proxies.⁴ Measurement scales will have to be chosen or developed, and they will necessarily be approximations. However, we will not deal with the empirical issues here. Our aim is to present the approach, and outline the kinds of relationships that we can see between economic advances and social, political and demographic variables.

12.2.1. Indicators for the Variables

First, the variables:

Economic

- Economic Growth (EconG): GNP levels and growth, level and growth of employment, standard measures of sectoral growth; human development index, for comparison with purely economic.

Environmental issues

- Environment (EnvH): Pollution of soil, waste disposal air pollution – gases and particulate matter; acid rain; waste heat and energy discharge and the effects on climate; water quality and availability.

Social issues

- Socialization of Adolescents (AdlSoc): preparing adolescents for adult working life, contact between adolescents and non-parental adults, apprenticeship and other training programs, school drop-out rates, measures of substance abuse.
- Education (Educ): 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.

- Health: 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.
- Household Standard of Living (HStdL): not only the level of the average standard of living, but also its distribution – the degree of inequality. 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): transportation, communications, police and the criminal justice system, public infrastructure - roads, bridges, sewers and water supply, harbours, airports, garbage and waste management; public administration, land management and zoning, military and defense spending.
- Effective and Democratic Government (EffGov): 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, human rights and religious freedom.

Demographics

- Population (PopP): 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.

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.

12.2.2. The Matrix

The object here is to show how EconG interacts with the rest; we argue that this will be the key to successful development. Accordingly the top row will show how EconG depends on each of the other variables, and the first column will give the impact of EconG on the other variables. For example, 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 StdL. Improvements in the Political variables, SocInf and EffGov can also be expected to benefit EconG.

The next line below shows EnvH as depending on EconG, EnvH itself, AdlSoc, Educ, Health, StdL, SocInf, EffGov, and PopP; below that we will have AdlSoc depending on each of the others, and so on, for Educ, Health SocInf, HStdL, 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.

The bottom row of the following table shows 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. 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 Matrix is not designed to make general statements; a separate Matrix must be developed for each country, and it can be expected to change over time. Indeed, these changes will mark the development of the country. Each

case must be investigated empirically, and the investigation must be updated regularly.

Yet when we assemble the data in the right way, some surprising general patterns can be seen. The results of empirical study can be written as the set of equations below, 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 a 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.

The matrix developed here should make it possible to see patterns. An advantage of our approach is that these 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, not only can we identify significant causal linkages, we see how they interact and feed back on one another. As we see here, simple visual inspection – no mathematics needed – can sometimes tell us whether the interactions will end up in a vicious or a virtuous cycle.

As a first approximation, the relationships can be taken as linear⁵. The justification is that the changes in the variables will be small.

Table 12.1. Signs of the coefficients

	<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. ⁶ This will be important later.]

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, it might be reasonable to expect a unique solution. That is, solving the equations would tell us how large, relative to each other, the variables must be. Since such a solution will determine relative amounts, it would be 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.⁷ [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.]

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 can all be presented neatly, as a Matrix, 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.

Table 12.2. Matrix of coefficient signs

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

Let's look at the variables and how they might relate to one another in various economic conditions, taking them in succession. Important cases include countries that depend on Primary Exports, Dualistic economies, economies trying to industrialize using out-dated technologies and second-

hand equipment, and economies still relying on traditional and craft technologies.

Economics

Reading across the top row shows how Economic Growth depends on the other variables. These relationships will tend to hold in all of the cases. An improved Environment will tend to support Economic Growth; it should lead to more productive agriculture and to a healthier 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 other cases. 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 Outdated Industrialization (think of Peru or Argentina in the 1960s and 70s, or parts of 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 altered by EconG in virtually any developing economy. 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.

12.2.3. 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.

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 (Clark, 2007). 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 economic investment does not necessarily bring 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.

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

EffGov	+	+	+	+	+	+	+	-----	-
PopP	-	-	-	-	-	-	-	-	-----

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.

Table 12.3. Matrix of ideal coefficient signs

	EconG	EnvH	AdlSoc	Educ	Health	StdL	SocInf	EffGov	PopP
EconG	-----	+	+	+	+	+	+	+	-
EnvH	+	-----	+	+	+	+	+	+	-
AdlSoc	+	+	-----	+	+	+	+	+	-
Educ	+	+	+	-----	+	+	+	+	-
Health	+	+	+	+	-----	+	+	+	-
StdL	+	+	+	+	+	-----	+	+	-
SocInf	+	+	+	+	+	+	-----	+	-

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. We will explore these relationships in a moment.

12.2.4. 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 rural-to-urban migration; 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, given suitable conditions, the remaining equations can be solved, 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. (Nell, Mayor and Errouaki, 2008) 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.

12.3. DYNAMICS – AND DEVELOPMENT TRAPS

To carry the argument further, it will be useful, first to simplify our approach, and then to explore the dynamics – the patterns of interaction – more fully.

So we will simplify by looking only at the interactions between certain parts of the matrix, holding everything else constant, rather like the ‘partial equilibrium’ analysis in economics. (Our approach will be open to some of the same criticisms as ‘partial equilibrium’, but it allows us to isolate the problems peculiar to each of the important sets of variables.) We will combine the social variables into one composite, and look at the interaction of Soc and Econ.⁸ Then we can hold the Soc relationships constant, and

examine the interaction of Econ with Env, with EffGov, and with Popl. In each case we will explore how these interactions can turn into various kinds of vicious circles and development traps, modeling the interactions in terms of simple stability dynamics.⁹ Such modeling will help us to see exactly which aspects of the interactions cause problems (subject, of course, to our simplifying assumptions.) Having identified problematic aspects and hopefully having clarified the dynamics, we might be able to suggest policies.

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 - which led to a population explosion, putting additional pressure on land and water, whereupon health deteriorated again. Cf J. Sachs.

Development traps are especially serious when the configuration of the matrix is unfavorable, but it is important to see that traps can emerge even when the overall configuration is favorable. Of course, a favorable configuration makes it much easier to devise policies to avoid the traps.

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 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!

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?

12.3.1. 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, that is, the impact of Econ will lower the level of Soc; if it supports it, the effect will be positive, so the impact of Econ will raise Soc.

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.)

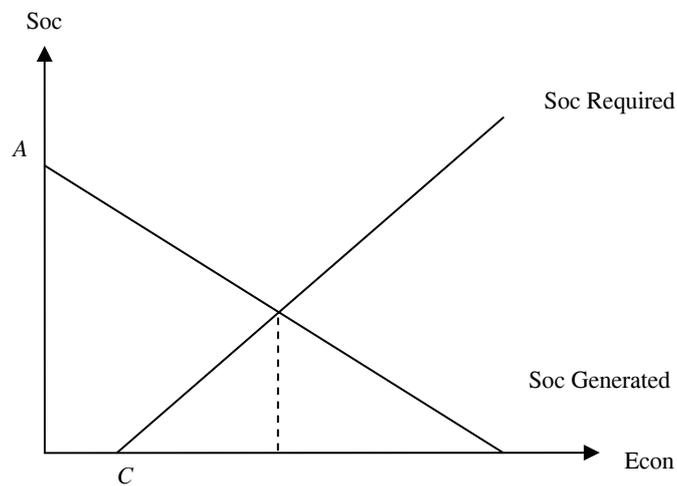


Figure 12.1. Intersection between required and generated Soc as functions of Econ

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:

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

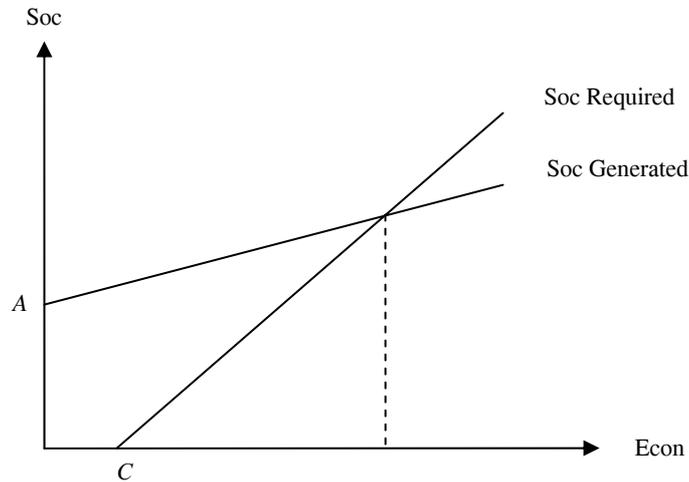


Figure 12.2. Another form of the intersection between required and generated Soc

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.

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 that both lines are positive, and that they intersect in the positive quadrant. But where are the intercepts, and which line is steeper? In Figure 12.2 the Soc generated lies above the Soc required at all levels of Econ below the intersection. Since this is so, Econ can easily be increased, so the society would be likely to move to the equilibrium. Above the equilibrium, Soc required will be greater than that generated, so Econ will tend to fall back. But suppose, as in Figure 12.3, that Soc required is high even when Econ is minimal, but rises slowly, while Soc Generated is very low at low levels of Econ, but rises rapidly.

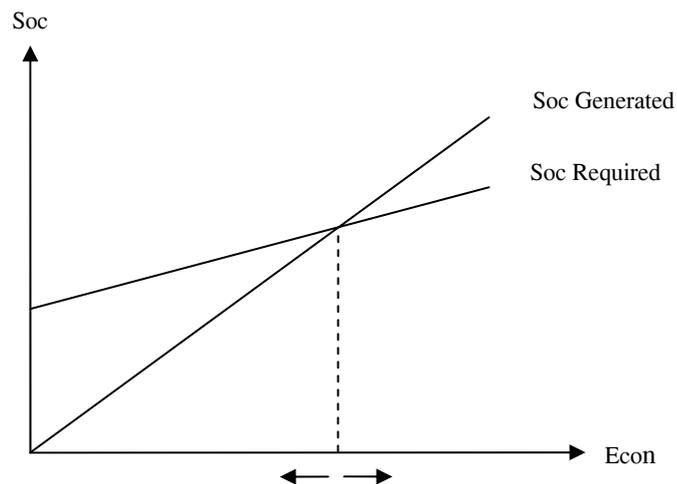


Figure 12.3. Unstable interaction between Soc and Econ

Then at all low levels of Econ, Soc required will exceed Soc generated, resulting in a development trap! But at levels of Econ above the balancing point, Soc generated will be higher than what is required, and the system can expand freely – the balancing point is a takeoff position. The system will find it difficult to reach or stay in its equilibrium, even though this equilibrium is well defined.

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’, which means that 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, the system alternates around the equilibrium; it will converge, however, only if the Soc line is steeper than the Econ line (Allen, 1968, pp. 81–3). On the other hand, if the relationship is positive, this becomes

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

which clearly increases indefinitely. This would be self-sustaining growth.

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 may be hard to grasp intuitively, but can easily be visualized; the diagram plots the curves with Soc on the vertical axis and Econ on the horizontal. 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.]

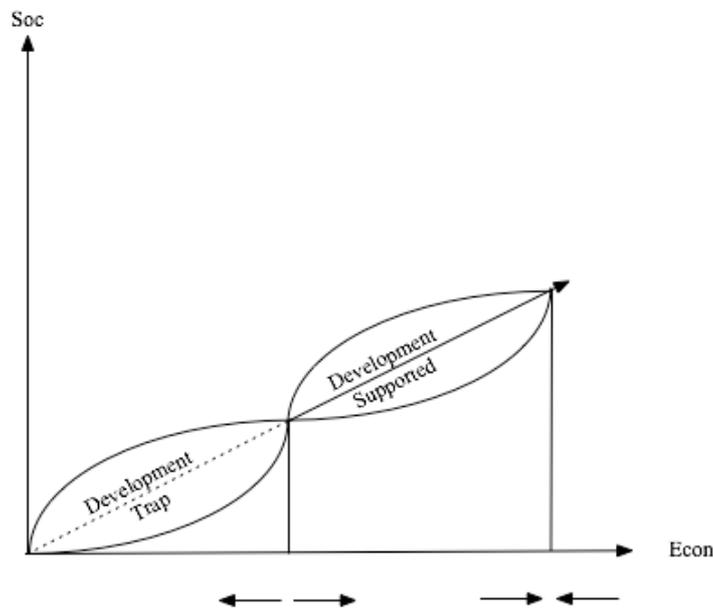


Figure 12.4. *Development trap and development support*

Another version of the non-linear relationship

This time let’s consider not the levels of Econ and Soc, but their rates of growth; let’s also include Env along with Soc, and assume they move together.¹⁰ 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 (for the Lotka–Volterra approach, cf. Goodwin, 1966¹¹).

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.

12.3.2. Interaction Between Government and the Economy

We can set Soc aside, continue to hold our other variables constant, and turn to a study of the interaction between EconG and EffGov, that is, 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.

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.¹²

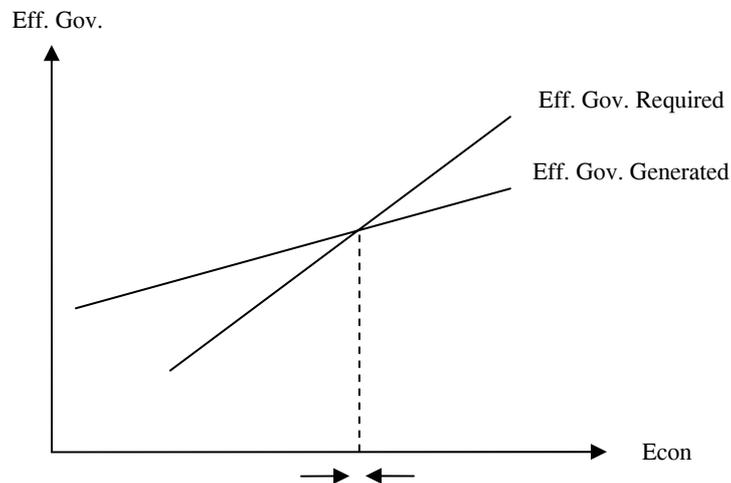


Figure 12.5. *Effective Government and Econ*

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.

As noted Government policy will be called upon to direct and orient economic development; but government action will surely require support from Soc. But government action that favors economic development will very likely bring improvements in Soc. That is, EffGov will tend to generate Soc, while also requiring higher Soc. So EffGov and Soc will vary together; so it might seem that would be no problems. However, for reasons we have already seen in the case of Econ and Soc, this is not so.

Look at the diagram, replacing ‘EffGov’ with ‘Soc’: the two lines – Econ generates Soc, Econ requires Soc - are drawn so they intersect in the positive quadrant. If the ‘requires’ line is flatter, then at levels of Econ below the intersection the system is in a trap; at these levels of Econ more Soc is required than is generated, and the position is unsustainable. (The economy needs more education, more health care, better infrastructure than it is getting. Absent these, the level of economic activity cannot be sustained.) Above the intersection, however, the situation is the opposite; more Soc is generated than is needed to support the economy. This could just lead to cab drivers with PhDs. But, more optimistically, if matched with surpluses in other variables, it could be the start of a takeoff into self-sustained growth.

12.3.3. 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 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.

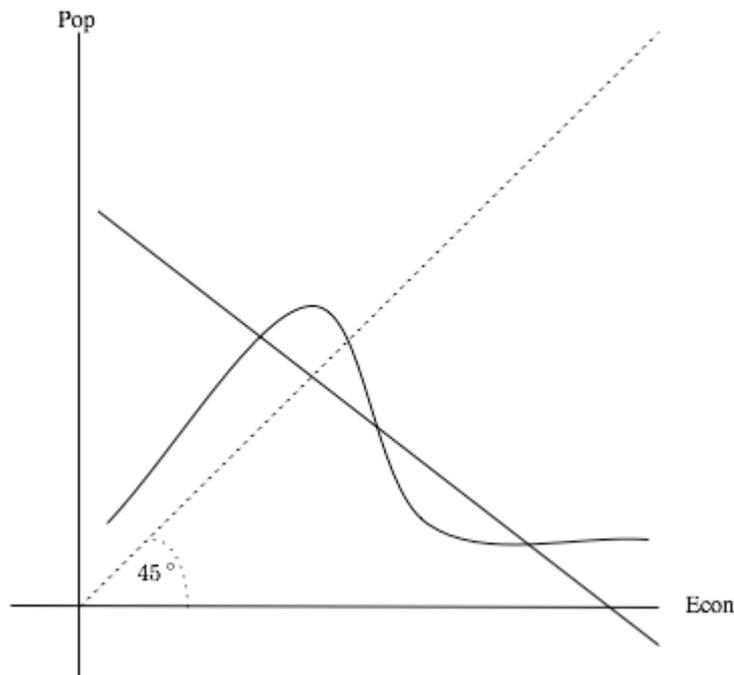


Figure 12.6. Population growth and Econ

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, as many economists have argued. In reality, 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 *Così 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.

12.3.4. Economic Growth and the Growth of Government

Growth of the economy brings with it a rise in urbanization, as we have seen¹³. The number of transactions between people normally depends on the density of the population in a given area – given the transport and communications system. Urban population density is obviously higher than rural, and urban transportation and communications are normally much superior. So a rise in urbanization typically leads not only to an increase in transactions, but to a more than proportional increase. Again, typically, this tends to reduce transaction costs, and also leads to economics of scale and scope. The presence of such economies, and also of externalities resulting from concentration, is well-known to promote agglomeration, which in turn

will tend to generate increases in productivity (Acs, 2006). The externalities and spillover effects are particularly strong in regard to ‘human capital’, skilled workers and especially the professional classes. (Simon and Nardinelli, 1996) So an increase in urbanization could be expected to lead back to a rise in productivity, which could, in turn, have a positive effect on growth.

These are common observations, and figure frequently as assumptions in discussions of the reasons for migration to urban areas, and for locating industry in urban areas.

However, urbanization will not continue indefinitely; a shift from low or irregular growth to strong and regular growth will lead to a rise in urbanization, setting off a rate of migration from the countryside that will continue for a long time. But the migration will slow down and come to a halt when the gains from additional migration are offset at the margin by the rising costs of congestion. At this point industry will seek to locate its expansion elsewhere – perhaps back in the countryside, perhaps in a new area of agglomeration, or possibly overseas – and migrants will find it sufficiently difficult to find accommodation, jobs, health care, etc, that they will look for ways to survive in the informal and illegal economy.

As urbanization increases, transactions increase more than proportionally. If we think of this in terms of a network, the in-movement of migrants increases the number of nodes per unit of space (the same can be said for the formation of new businesses). This can be thought of as an arithmetical increase in the nodes in a given area of living space. But, as a first approximation, the network consists of the direct relations between the nodes, and this increases per unit space in a much faster rising series:

Number per unit space: 1 2 3 4 5 6 7 8 9 ...

Relations per unit space: 0 1 3 6 10 15 21 28 36 ...

The expenses of government arguably will depend not on the number of people, but on the relationships and activities that arise between them; it is to encourage and support these connections and activities that government build infrastructure (roads, sewers, light and power, water, etc.), provide police and courts, undertake regulation, and support education and public health. (Of course not all the possible direct relations will become actual; also, besides the direct relations, there can be higher order relationships.) So, as a very simple first approximation, government expenditure will tend to be proportional, not to the number of people, but to the connections between them. It will therefore rise with urbanization, but will rise faster than the urban population; however, it will then slow down and stop rising when urbanization slows down and stops.

So as population shifts from rural and lightly populated areas to urban intensely populated areas, the number of transactions and activities in the urban areas increases at a faster rate than the population intensity; government expenditures will then rise with the transactions activity.

These models show not only the variety and complexity of possible interactions between the variables of the Transformational Growth Matrix, but they demonstrate that the problems of the economy cannot be separated from those of the society, its politics and its environment. (See also Keuning, 1996, 1997) Economics as a subject cannot be isolated, except temporarily for the purposes of argument, from the other social sciences.

'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.

12.3.5. Advanced Socio-Economic Development

This suggests a way 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 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 (partially) 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 HStdL 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 HStdL. 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.

Table 12.4. The case of advanced development

	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	-----

This table suggests 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, operating as an ‘automatic stabilizer’ as suggested elsewhere.¹⁴

12.4. Concluding Remarks

Now let’s review what we have accomplished; initially we set up the Transformational Growth Matrix to show the way the variables impact on each other; now we have indicated the dynamic implications, sketching how those impacts play out – filling in the initial sketches.

1. First, we have broken down the barrier between economic and social/environmental analysis. Our approach shows 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 in principle, we can show just 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.
2. 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.
3. 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; this could be important in practice, since the statistics in developing areas are often poor to non-existent.
4. Fourth, we’ve derived the condition for a balanced mutually supportive relationship, one where, for example, the effect of Econ on Soc is just balanced by the reciprocal effect of Soc on Econ.
5. 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.

6. 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. We have already suggested what those policies should be, and we'll consider them further in a moment.

Our argument 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.

NOTES

- * This paper is partly based on *Humanizing Globalization*, forthcoming, co-authored by Edward Nell, Federico Mayor and Karim Errouaki.
1. 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. The interactions between sectors and classes are central in distribution theory and in the analysis of business cycles, but in our discussion here we will focus chiefly on the interaction between the economy – taken as a whole – and the other parts of the society. (For interactions between sectors, classes and banks, cf. Nell, 2004.)
 2. 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.
 3. An important special case is 'Dualism', 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 may fail to support the interests of the traditional sector, so that the society divides politically as well.
 4. Principal Component Analysis can be used 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.

5. Each equation could be written 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, would depend first on whether the interaction was positive or negative. Secondly it would 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. This approach is developed elsewhere (Nell, Mayor and Errouaki, 2008).
6. 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 StdL 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.
7. Estimating the coefficients will not be easy. (Preliminary estimates have been made for El Salvador and the Philippines, cf. Ozawa, 2008.) 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, not as easy as it looks: 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 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?
8. 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 see the extent to which an increase in Econ will lead to a rise in general welfare.
9. The matrix is a snapshot, holding at a moment of time. But we are now proposing to examine these relationships as they interact over time, which means assuming they are durable, fixed or settled enough so we can trace how they work out. 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. When a relationship is not reliable, we need to know how unreliable it is, and in what ways. If this cannot be determined, then it may be difficult to say anything definite about patterns of interaction. Nevertheless working through the possible patterns 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.
10. If we plot the growth of Soc on the vertical axis, and that of Econ on the horizontal, the 45 degree line will mark the balancing point. Along this line the overall ratio of Econ to Soc will equal the ratio of new Econ to new Soc.

11. Another version of this story could be developed following the 'non-linear accelerator' model of Goodwin (suggested in correspondence by Matias Vernengo, University of Utah).
12. Examples might be found in ambitious African development programs following independence, which often failed at least in part because of inadequate administration and oversight.
13. The shift in population has two sources; one is migration, the other relative rates of population growth.
14. Cf. Nell and Forstater, 2002; Wray, 1998; also Nell, Mayor and Errouaki, forthcoming. Such programs are sometimes called 'Employer of Last Resort' (ELR) systems. They offer public service jobs at a basic wage to anyone who wants to work. The work will be in environmental cleanup, educational or healthcare support, poverty relief and the like. This provides unskilled or semi-skilled labor for a wide range of public sector projects, and it provides income for many low-end households. In a boom, labor will be attracted out of the ELR into higher paying work in the private sector; in a slump, labor will flow back into it. This will act as a buffer stock, tending to stabilize wages and it will provide countercyclical support for aggregate demand.

REFERENCES

- Acs, Z. (ed.) (2006), *The Growth of Cities*, Cheltenham, UK: Edward Elgar.
- Allen, R.G.D. (1968), *Macro-Economic Theory: A Mathematical Treatment*, London: Macmillan; New York: St. Martin's Press.
- Argyrous, G. M. Forstater and G. Mongiovi (2004), *Growth, Distribution and Effective Demand: Alternatives to Economic Orthodoxy*, Armonk, NY: M.E. Sharpe
- Bhagwati, J. (2004), *In Defense of Globalization*, New York and Oxford: Oxford University Press.
- Chang, H.-J. (2008), *Bad Samaritans: The Myth of Free Trade and the Secret of Capitalism*, New York: Bloomsbury Press.
- Clark, G. (2007), *A Farewell to Alms*, Princeton, NJ: Princeton University Press
- Delamonica, E. and S. Mehrotra (2007), *Eliminating Human Poverty*. London: Zed Books for UNICEF.
- Easterly, W. (2006), *The White Man's Burden: Why the West's Efforts to Aid the Rest have done so Much Ill and so Little Good*, London and New York: Penguin Book.
- Goodwin, R.M. (1966), 'A Growth Cycle' in C.H. Feinstein (ed.), *Socialism, Capitalism and Economic Growth*, Cambridge: Cambridge University Press
- Keuning, S. (1996), *Accounting for Economic Development and Social Change*, Amsterdam: IOS Press.
- Keuning, S. (1997), 'Sesame: An Integrated Economic and Social Accounting System', *International Statistical Review*, **65**(1), 111–21.
- Meier, G.M. (2005), *Biography of a Subject: An Evolution of Development Economics*, Oxford and New York: Oxford University Press.
- Meier, G. and J. Rauch (2005), *Leading Issues in Economic Development*, New York and Oxford. Oxford University Press.
- Nayyar, D. (2007), 'Macroeconomics in Developing Countries', *BNL Quarterly Review*, **60**(242), 249–69.

- Nell, E.J. (1998), *The General Theory of Transformational Growth*, Cambridge: Cambridge University Press.
- Nell, E.J. (2004), 'Monetizing the Classical Equations: A Theory of Circulation', *Cambridge Journal of Economics*, **28**(2), 173–205.
- Nell, E.J. and M. Forstater (2002), *Reinventing Functional Finance*, Cheltenham, UK: Edward Elgar.
- Nell, E.J., K. Errouaki and F. Mayor (forthcoming), *Humanizing Globalization*.
- Ozawa, S. (2008), 'Preliminary Estimates of the TG Matrix: El Salvador and the Phillipines', New School For Social Research.
- Sen, A.K. (1999), *Development as Freedom*, New York: Anchor Books.
- Simon, C.J. and C. Nardinelli (1996), 'The Talk of the Town: Human Capital, Information, and the Growth of English Cities, 1861 to 1961', in Z.J. Acs, *The Growth of Cities*, Cheltenham, UK: Edward Elgar.
- Stiglitz, J. (2007, 2006). *Making Globalization Work*. (With a new Afterword), New York: W.W. Norton.
- Stiglitz, J., J. Ocampo, S. Spiegel, R. French-Davis and D. Nayyar (2006), *Stability with Growth: Macroeconomics, Liberalization and Development*, Oxford: Oxford University Press
- Wray, R. (1998), *Understanding Modern Money*, Cheltenham, UK: Edward Elgar.