DEVELOPMENT ECONOMICS

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Summary

For the purposes of this essay, economic development is defined to be the process whereby a poor agrarian society is transformed into an affluent urban one, so that development necessarily involves growth. The Solow–Swan model serves as the theoretical device for organizing the main ideas and is analyzed in some detail. There follows an examination, evaluative as well as descriptive, of the historical experience of development in the past two centuries. The claim that history matters is taken up both generally and with respect to the specific hypothesis that latecomers grow more rapidly than did the earlier cohorts of pioneers at the same stages of the process. The possible role of place, in the form of climate, as an influence on the spread of development in the past and as an obstacle to development in the tropics in the present is addressed next. This leads to an assessment of the prospects for the future, in which the potential interplay between development and climate on a global scale threatens to become increasingly important.

In Orwell's *Coming Up for Air*, George Bowling, a middle-aged salesman who leads a dreary suburban life, wins a small sum of money on the horses and resolves to revisit the little town in the Thames valley where he had grown up at the turn of the century.

As a boy, his passion had been fishing. He recalls the large country house that lay in many acres of its own grounds, heavily wooded and graced by two ponds, one of which was deep, secret and full of large carp. Once or twice, he had obtained permission to fish there, but suitable tackle was beyond his boyhood means, so the carp remained unmolested. This childhood memory ever fresh, he determines to go after them.

On arriving at the gate, he finds clear signs that things have changed. The house has been converted into a lunatic asylum, and the rest of the property has been subjected to what realtors call development, after a plan drawn up by an architect, of course. Virtually all of the trees had been felled to make way for clusters of "Tudor-style" houses designed for affluent middle-class families. Some children paddle in the first pond, while others sail model yachts, or dash about in canoes. To an angler's eye, the pond looks dead. Bowling falls into conversation with one of the elders of this community, who waxes enthusiastically about its "natural" character. At length, Bowling steers the talk to the second pond, whereupon the elder's face betrays unease. He mutters that the community's arrangements for disposing of its rubbish leave something to be desired, the development being rather far from the town. They go to the spot, which is ringed by a cover of some trees. The pool had been drained, and is now half full of tin cans. Cursing all of them silently, Bowling gets into his car and drives back to the hotel, having lost a part of his childhood and all too aware of the domestic fate that awaits him on his return to suburbia.

Having introduced the topic of this essay with a cautionary parable, the first step is to define economic development precisely but also critically, in the sense that the limitations of the definition to be employed are clearly exposed. The second step is to erect a formal framework to sort out the main ideas in an orderly way. The choice here falls naturally on the Solow-Swan model of economic growth, which is laid out, analyzed, and discussed at some length. With the foundations so laid, the third step is to examine the historical experience of development, both of industrially mature economies and of what are called the less developed countries (LDCs), an experience which is inevitably richer in character than what can be captured in an abstract model.

The aim is two-fold: first, to draw hypotheses about the process of development in the former group that contain lessons for development in the present; and secondly, to establish when and in what measure economic growth took hold in LDCs. Particular attention is paid to the claim that history matters, in the sense that the character of development in any latecomer depends, *inter alia*, on what has already happened in countries that embarked on the process earlier. In the fourth step, the dimension shifts from time to place, in the form of climate and its influence on economic performance. Finally, time and place are brought together through a discussion of the LDCs' development prospects over the next half-century in a world whose climate is already being altered by the effects of economic growth in the past.

1. Defining Development

What, then, is meant by economic development? A free interpretation of Kuznets' definition of what has come to be called "Modern Economic Growth" (hereafter abbreviated to MEG) runs as follows:

Definition: economic development is the process whereby a poor and largely illiterate agrarian society, which is plagued by high morbidity and mortality, is transformed into an affluent and literate urban society, whose members can expect long and healthy lives.

Such a definition draws on the historical experience of economic growth in what are now thought of as fully developed economies, which make up the membership of the Organization for Economic Cooperation and Development (OECD). Looking forward, one would surely want to add the condition that the end state of affluence, literacy, and healthy longevity be sustainable.

It goes without saying that this definition, even when extended to cover all future generations through the imposition of sustainability, is incomplete from a moral perspective; for although literacy and good health are surely essential elements in any sensible concept of a good and fulfilling life, the definition does not necessarily imply that the inhabitants of rich countries are happier and more fulfilled than those of poor ones. Seers pursued this theme by emphasizing the importance of freedom from want, insecurity, and oppression. While it is certainly true that want, insecurity and oppression are found in abundance in much of what is called the "Third World," one could claim that a sizeable minority of the citizens of rich countries are likewise afflicted, in as much as wants and a sense of security and belonging are socially determined. Sen has gone even further, arguing that definitions of living standards that are based on national income, as conventionally measured at least, confuse opulence with well-being. One should be concerned, he argues, not with the gratification of desires, but rather with expanding individuals' capabilities to undertake a rich range of activities. These points command wide assent. It is also the case, however, that in the absence of a fairly productive economic system, it will not be possible to free most people from want, insecurity and certain forms of oppression; nor will there be the means to expand their capabilities in the cause of ensuring that they will have more fulfilling lives. Thus, while the definition given above should not be viewed as all-encompassing, it does describe what is a necessary and large part of the process of achieving development.

Granted this rather restrictive definition of development for the purposes of this essay, the question naturally arises: Is this process ahistorical? That is to say, does it apply uniformly to all societies, regardless of their individual histories, the dates on which they embark on the process of transformation, and the number of societies that have gone before them? More poetically, is there an "iron law" of history that dictates that all must tread the same path? Those who are persuaded that such a conception of the process springs from a scholarly orthodox and politically conservative view of the world may find the following quotation from Marx unsettling: "The industrially more developed country presents to the less developed country a picture of the latter's future." [*Das Kapital* (1st. ed.), preface.]

The thesis that all countries are treading the same path is a recurrent theme in a good deal of contemporary writing and will be taken up in different ways in sections 2 and 3.

2. The Solow–Swan Model

Many of the central ideas and elements that will appear in the succeeding sections can

be usefully and formally ordered and drawn together using the framework of the Solow–Swan model. In its standard form, all countries have access to a common technology, and are therefore able, in principle, to tread the same path. Differences in paths arise solely due to differences in thriftiness (savings rates) and rates of population growth, which are assumed to be exogenously given. In this form, the model has been extensively tested using cross-section data on both countries and regions within countries, and it provides the basis for investigations into the contributions of the factors influencing economic growth in a given economy over a long span of time. It should be added, however, that some theorists shy away from the literal interpretation of reality that such applications of the model imply.

2.1. The Assumptions

Beginning with the technology, at time t a single output is produced by means of a bundle of contemporaneous inputs, whose services in production are written as the vector $\mathbf{X}(t)$. The relationship between output, $Y(t)$, and inputs is assumed to be representable by means of a production function $F(.)$:

$$Y(t) = F[\mathbf{X}(t)] \qquad (1)$$

where $F(.)$ is assumed to have the following properties:

Assumption 1. $F(.)$ is strictly increasing in all inputs; it exhibits constant returns to scale (CRS); and it is twice continuously differentiable.

The assumption of CRS, coupled with Euler's Theorem, implies that

$$F[\lambda\mathbf{X}(t)] = \sum_i \lambda X_i(t) \cdot F_i[\lambda\mathbf{X}(t)]$$

where λ is any positive scalar and F_i denotes the derivative of $F(.)$ w.r.t. its i^{th} argument. CRS and Euler's Theorem also yield, in turn,

$$F[\lambda\mathbf{X}(t)] = \lambda F[\mathbf{X}(t)] = \sum_i \lambda X_i(t) \cdot F_i[\mathbf{X}(t)]$$

Combining the two results, we have

$$F_i[\mathbf{X}(t)] = F_i[\lambda\mathbf{X}(t)] \quad \forall\lambda > 0$$

that is, $F_i[\mathbf{X}(t)]$ is homogeneous of degree zero in $\mathbf{X}(t)$: in the terminology of economics, the marginal product of each and every input depends only on the relative proportions in which inputs are used. Thus, pure changes in scale leave the marginal rate of technical substitution (MRTS) unchanged, which is essential if the economy is to exhibit steady-state growth. When the MRTS is so scale-invariant, the isoquant map is said to be *homothetic*.

In addition to Assumption 1, an additional restriction is often imposed on $F(.)$, namely, that it satisfy the so-called lower and upper Inada conditions:

Assumption 2. $\lim_{X_i \to 0} F_i = \infty$, $\lim_{X_i \to \infty} F_i = 0 \ \forall i$

It is straightforward to show that Assumption 2 implies that all inputs are essential in production: if, for any i, $X_i = 0$, then $F(\mathbf{X}) = 0$.

Turning to economic organization, the economy is assumed to be comprised of households, which own its endowments, and of firms, which undertake production, hiring households' endowments to do so. The behavioral rules are:

Assumption 3. Households offer their endowments to firms perfectly inelastically; firms maximize profits; and perfect competition rules everywhere.

The next step is to define the list of endowments. In the standard model, there are two, namely, capital and labor, where capital is to be interpreted as the aggregate of all produced means of production. This interpretation calls for a remark about the treatment of natural resources, especially land. One can accommodate land into the story by assuming that it is homogeneous in quality and available in perfectly elastic supply, if necessary by clearing and improvement at constant costs; for in this case, no Ricardian problems of diminishing returns to capital and labor alone can arise. It is clear, however, that this assumption keeps everything tidy by denying land any role in the proceedings, an essential difficulty that is taken up below.

At time t, households are endowed, in aggregate, with $K(t)$ and $L(t)$ units of capital and labor, respectively. Without loss of generality, the units of measure may be chosen such that a unit of each factor yields a unit stream of productive services in each period. Assumption 3 then permits eq. (1) to be written with the economy's aggregate endowments as the arguments of $F(.)$:

$$Y(t) = F[K(t), L(t)] \qquad (2)$$

Since Assumption 2 implies that both inputs are necessary in production, $F(0, L) = F(K, 0) = 0$.

A very strong assumption about the nature of capital is now introduced:

Assumption 4. Capital is made of the same stuff as output, it is perfectly malleable, and it can be consumed.

This assumption rules out the horrendous (index number) problems that arise if capital goods and consumption goods are different and capital itself is not homogeneous.

In order to complete the description of the structure, the processes whereby the endowments grow must be specified. To start with, let demographic behavior have nothing to do with economic conditions:

Assumption 5. $L(t)$ grows at the exogenous rate n.

This implies that capital is the only produced input in the system. The capital stock is augmented by savings out of current output, and it is diminished by wear and tear in the

passage of time. Solow assumes that household's preferences are such as to yield a very simple savings rule:

Assumption 6. A fixed fraction, *s*, of income is saved and invested.

Where depreciation is concerned, it is usual and convenient to assume that there is 'radioactive decay' of the capital stock:

Assumption 7. A fixed fraction, δ, of the capital stock wears out in each period.

It is convenient to work with the per capita form of the system, all variables being normalized by the size of the labor force (which is taken to be equal to the population). By virtue of CRS, the intensive, or per capita, form of (2) may be written as:

$$y \equiv Y/L = L \cdot F(K/L, 1)/L \equiv f(k) \qquad (3)$$

where $k \equiv K/L$ denotes the capital stock per worker, and the dependence of all variables on t may be suppressed without ambiguity. If both inputs are imperfectly substitutable for one another everywhere, then CRS implies that $f(k)$ must be a strictly concave function. Assumption 2 also implies that $f(0) = 0$ and that $f'(0)$ is unboundedly large.

By Assumption 6, savings per head, which are denoted by the function $s(y)$, are

$$s(y) = sf(k) \qquad (4)$$

Assumption 3 ensures that, in equilibrium, factors will be paid the values of their respective marginal products when both are fully employed. By definition, the marginal product of capital is $F_K(K, L) = F_K(k, 1) \equiv f'(k)$. Since capital is made of the same stuff as output, f' has the dimension $[\text{time}]^{-1}$, that is, $f'(k)$ is the rate of profit per period that will rule at full employment:

$$r = f'(k) \qquad (5)$$

The total profit per worker is rk; so that CRS and Assumption 3 together imply that the wage rate is given by

$$w = y - rk = f(k) - f'(k) \cdot k \qquad (6)$$

Hence, the relative factor-price ratio, or wage-rental ratio, is

$$\omega \equiv w/r = [f(k) - f'(k) \cdot k]/f'(k) \qquad (7)$$

Observe that r, w and ω depend only on the technology and k.

Summing up thus far, in the standard model, the economy is described by the technology, $f(k)$, and the parameters measuring natural increase, n, thriftiness, s, and depreciation, δ.

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Biographical Sketch

Clive Bell was educated at St. John's College, Cambridge, where he read Engineering and Economics. He obtained his Ph. D. at the University of Sussex, where he was a Fellow of the Institute of Development Studies before taking up a position in the Research Department of the World Bank in 1974. He was appointed professor of economics at Vanderbilt University in 1986, and at Heidelberg University in 1995. His research interests include the fields of rural economic organization, growth and inequality, taxation, and social cost-benefit analysis, interests which are anchored to extensive, though increasingly dated, field experience in India and Malaysia.