New Growth Theory and Development Economics

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Introduction

After a period of relative calm in the aftermath of the so-called Cambridge Cambridge controversies in the theory of capital (for an overwiew, see Kurz and Salvadori, 1995, chapter 14) which had dealt a serious blow to the long-period version of neoclassical theory in general and the Solovian growth model based on an aggregate production function in particular (Solow, 1956), growth economics has become again one of the most vibrant areas of research in economics in the last two decades. The revival was spurred by theoretical and empirical contributions. New modelling techniques imported from other areas in economics were used in order to 'endogenize' technological progress within a macroeconomic intertemporal general equilibrium framework and thus overcome a major shortcoming of Solow's model – the treatment of technological change as exogenous. This is also the reason why the new class of models are frequently dubbed 'endogenous'. The construction of new data sets for a large number of countries, in particular the Penn World Table (Summers and Heston, 1991; Heston, Summers and Aten, 2002) and Maddison (2001), has led to a revived interest in empirical studies which in turn have thrown up new problems for growth theory. The existing literature is huge and still rapidly growing. For summary accounts of the present state of the art in this area of research, see, in particular, Barro and Sala-i-Martin (2003), Jones (2002), Aghion and Howitt (1998), and Aghion and Durlauf (2005).

While neoclassical growth theory had first to overcome the straitjacket of the *exogeneity* of the long-term growth rate in Solow, in alternative approaches this was not necessary. There the growth rate has always been considered as endogenous, shaped by the behaviour of agents, the distribution of income, social institutions etc. The very stress the classical authors in the tradition of Adam Smith laid on the unintended social consequences of purposeful activities of individuals or groups of people acting within a highly complex system of an ever deeper division of social labour, characterized by scarce natural resources, technical innovations and changing social relations is incompatible with the idea of an exogenously given growth rate. This impression is already corroborated when we look at what may be called their linear growth 'models' (see Kurz and Salvadori, 1998, 1999, 2006; Salvadori, 2003). Marx's scheme of extended reproduction constitutes a two-sector, the von Neumann model an *n*-sector and the so-called 'Harrod-Domar' model a one-sector model of endogenous growth. An important difference with the new growth models is that the latter are *intensive* models, concerned with explaining the growth of income per capita, not extensive ones. However, intensive models are also encountered in these non-neoclassical traditions, be they classical, Marxist, Keynesian or evolutionary. For summary accounts of this kind of literature that is surprisingly largely ignored in Aghion and Durlauf (2005), see Dutt (1990), Foley and Michl (1999), Salvadori (2003), Nelson (2005) and Bhaduri (2007).

Since sustained growth in income per capita is arguably the most important determinant of living standards and since other measures of living standards, such as life expectancy and the Human Development Index (HDI), typically, though not always, move together with income per capita, to understand the causes of economic growth is of direct relevance to development economics.

There is also the following phenomenon that emphasizes the close connection between economic growth and development. For thousands of years incomes per capita, measured in some broad way, were not all that different throughout the world, and whenever they rose somewhat in some areas due to technological innovations this rise discharged itself first and foremost in a Malthusian way in terms of a growing population which, in turn, due to diminishing returns to land, tended to annihilate the increase in income per capita. Hence, while there were lasting increases in population in some areas of the world, there were hardly any in income per capita. It was only with the Industrial Revolution that sustained growth of GDP per capita became a normal fact of life in Europe and the Western Offshoots, with large parts of the rest of the world at first remaining stagnant. This led to what the historian Kenneth Pomeranz (2000) called the 'Great Divergence', the spreading out especially in living standards. Seen from a long-term historical perspective, the problems of economic growth and those of development are thus two sides of a single coin, with the latter being perceived as a problem only after the former had made an appearance which by all historical standards can only be called impressive.

We deal first with neoclassical growth models, followed by a brief discussion of approaches trying to come to grips with the 'fundamental' causes of growth and development, in which the role of economic, political and social institutions is emphasized. We conclude with a discussion of Keynesian and evolutionary contributions.

Neoclassical theory

At the forefront of research in contemporary growth economics are the proximate and fundamental causes of technological progress, which, together with human capital formation, is seen as the prime mover of the system and a main source of rising living standards. The main reference point of this literature is still the Solow model, and while the model at first has been rejected by major advocates of new growth theory, it recently had a comeback in an augmented form. Interestingly, it was not rejected because of a lack of solid micro foundations of its technology and production side. This is somewhat surprising because one criticism levelled at it was that its treatment of savings behaviour lacked such foundations. Yet replacing a Keynesian savings function by the assumption of an immortal representative agent maximizing his or her intertemporal utility can hardly be said to meet the criterion. The main reasons for its rejection were rather the following: (a) it takes as given the behaviour of the variable meant to depict the main driving force of growth, technological knowledge; (b) it implies that decisions of agents to save more or less have no impact on the steady-state rate of growth; (c) it has little to offer in terms of policy advice for long-run growth; and (d) it predicts the convergence of levels of income per capita on a world scale. According to the logic of the model, countries that exhibit similar structural parameters (savings rate, population growth) should in the long run have similar levels of income per capita. This is brought about by poor countries with a lower capital-to-labour ratio growing faster than rich countries. Alas, the propositions of the model as to convergence have not generally been confirmed empirically. While there are 'convergence clubs' (W. Baumol), e.g. the OECD economies, there is no universal catching up of the less developed countries. In addition to remarkable success stories (e.g. the so-called Asian Tiger economies) there are a number of disaster stories (e.g. sub-Saharan Africa). Cross-country studies indicate by and large a strong negative correlation between population growth and income per capita and a strong correlation between the latter and the share of investment (alias savings) in GDP. Another implication of Solow's model has not been corroborated by empirical studies, namely, that poor countries exhibit higher rates of return, because capital is relatively more scarce. If this were to be true, one would expect massive flows of capital from rich to poor countries, which, however, have not been observed across poor countries as a whole. The implicit assumption of Solow's model that advances in technical knowledge are both a free and a public good, cannot be sustained. There exist, and possibly persist, technological or 'idea gaps' (P. Romer) between developed and developing countries. However, a poor economy may benefit in terms of economic growth from its relative backwardness, and there is some evidence that its openness helps in this regard. Economies that follow an isolationist strategy (e.g. North Korea) are cut off from the flow of ideas and in medium terms suffer stagnation or even negative growth.

Let us now have a closer look at some of the new growth models. A central feature of them is that they abandon the conventional marginalist assumption of diminishing returns to capital accumulation. This is done by broadening the concept of capital to encompass both physical capital, human capital and 'ideas' or 'knowledge', and by invoking positive externalities with regard to the accumulation of capital. The first generation of models attempted to integrate a range of growth mechanisms in a neoclassical macroeconomic framework. The most important mechanisms concern the creation of new technical knowledge in R&D departments of firms (Romer, 1986) and the formation of human capital in education processes (Lucas, 1988). These two mechanisms swiftly got accepted as the main engines of growth. Both mechanisms rely on positive externalities which counteract any tendency of the marginal product of capital (and thus the rate of profit) to fall. Romer stipulated a 'research technology' that is concave and homogeneous of degree one,

$$\dot{k}_i = G(I_i, k_i)$$

where I_i is an amount of forgone consumption in research by firm i and k_i is the firm's current stock of knowledge. The production function of the consumption good relative to firm i is

$$Y_i = F(k_i, K, \mathbf{x}_i)$$

where K is the accumulated 'stock of knowledge' in the economy as a whole and $\mathbf{x}_i$ is the vector of all inputs different from knowledge. The function is taken to be homogeneous of degree one in k_i and $\mathbf{x}_i$ and homogeneous of a degree greater than one in k_i and K. Romer assumes that factors other than knowledge are in fixed supply. This implies that knowledge is the only capital good utilized in the production of the consumption good. Spillovers from private research and development activities increase the public stock of knowledge K. A positive externality is taken to be responsible for per capita income growth. Different from the Solow model, agents via their behaviour do have an impact on the long-term growth rate.

Similarly in the model of human capital formation by Lucas (1988) in which agents are assumed to have a choice between two ways of spending their (non-leisure) time: to contribute to current production or to accumulate human capital. Lucas's conceptualization of the process by means of which human capital is built up is the following:

$$\dot{h} = \upsilon h(1 - u)$$

where υ is a positive constant. With the accumulation of human capital there is said to be associated an externality: the more human capital society as a whole has accumulated, the more productive each single member will be. This is reflected in the following macroeconomic production function

$$Y = AK^{\beta}(uhN)^{1-\beta}h^{*\gamma}$$

where the labour input consists of the number of workers, N, times the fraction of time spent working, u, times h which gives the labour input in efficiency units. Finally, there is the term h^*. This is designed to represent the externality. The single agent takes h^* as a parameter in his or her optimizing by choice of c and u. However, for society as a whole the accumulation of human capital increases output both directly and indirectly, that is, through the externality.

In both models we are confronted with a variant of a public good problem: The individual optimizing agent faces constant returns to scale, yet for society as a whole returns are taken to be increasing.

The lessons to be drawn for developing countries are straightforward: It is not so much a lack of physical capital relative to population (as in the so-called ‘Harrod-Domar’ model) or relative to the labour force (as in the Solow model) that accounts for low levels of income per capita, but a lack of human capital and technical knowledge. In order to catch-up, a less developed country is well advised to invest in its education system and infrastructure and to try to get closer to the frontier of technological knowledge by providing incentives to domestic firms to imitate and innovate and by encouraging foreign direct investments of technologically advanced firms.

Given the stress laid on knowledge and human capital in these models, it comes as a surprise that hardly any attempt was made to clarify whether and how these magnitutes can be measured. Obviously, if and only if they are *cardinally* measurable can anything be said about returns to scale, marginal and average products, growth rates etc. (see Kurz, 1997; Steedman, 2003). One aspect of the problem can be highlighted with reference to Lucas’s model, who for simplicity assumed that all workers are possessed of the same amount of human capital. Yet if this is the case, wherein could the externality consist? Similarly in Romer’s model, there is the problem of multiple counting of the same particles of knowledge in building up an aggregate measure of the social stock of knowledge. In short, while the models are suggestive, they lack conceptual clarity.

The simplest and for a while most popular new growth model was the linear or AK model according to which

$$Y = C^{\alpha}H^{\beta} = AK$$

where K represents a broad measure of aggregate capital, consisting of physical capital C and human capital H, and A is a given and constant productivity parameter. The net rate of profit is exogenously given and equals $A - \delta$, where δ is the overall rate of depreciation. In long-run competitive equilibrium the two kinds of capital receive the same rate of return. As capital accumulates, total output expands proportionally, and with a constant population income per capita grows with the same rate as total output. In this model savings (alias investment) assume centre stage. The higher the savings (alias investment) rate, the higher is the growth rate of income per capita. The lesson to be drawn from an economic policy point of view is simple: The process of development is speeded up by whichever policy leads to an increase in savings in physical and human capital.

There is a close similarity between this model and the Harrod-Domar model, because in both models diminishing returns to capital are absent by construction. The important difference is that whereas the Harrod-Domar model assumes a given and constant input proportion of labour and capital and thus allows for labour unemployment, the AK model has effectively replaced the concept of labour by that of human capital. What in the Solow model (as well as in the Harrod-Domar model) was a non-accumulable factor of production, labour, has now become an accumulable one. While Solow had subsumed land (and, more generally, scarce natural resources) under capital, the AK model can be said to have gone to the extreme by subsuming also labour under it. With only a single accumulable factor contemplated, the possibility of perpetual growth should come as no surprise (see Kurz and Salvadori, 1998). Of William Petty's famous 1662 dictum 'that Labour is the father and active principle of Wealth, as Lands are the Mother', nothing is left in this class of models: The parents of wealth is Capital.

The class of 'horizontal innovation models' (for a critical account, see Park, 2006) was started by Romer (1990) who combines (a) the endogenous production of new 'industrial designs' as in Romer (1986) with (b) the formalization of the role of human capital in economic growth as in Lucas (1988) and (c) a product-diversity specification of physical capital which he derives from the model of monopolistic competition with regard to consumption goods of Dixit and Stiglitz (1977). Romer's argument relies on three premisses: 1. Technological progress is the prime mover of economic development. 2. Such progress is in large part the result of deliberate actions of agents responding to market signals. 3. Technical instructions of how to use raw materials and other inputs are fundamentally different from other goods. While the development of an 'industrial design' or of some other economically useful knowledge incurs costs, once this knowledge is available it can be used time and again without generating significant further costs. Hence the cost under consideration is a kind of fixed cost. Differently from human capital, industrial designs are said not to need to be embodied, and differently from ordinary goods they are nonrival and also only partially excludable. 'Growth is driven fundamentally by the accumulation of a partially excludable, nonrival input.' (Romer, 1990, p. S74) Knowledge per capita can be accumulated without limit, and because of its incomplete excludability there will be spillovers which drive the process of growth. The presence of nonrival inputs of necessity involves nonconvexities. Concavities in techniques are disruptive of the received concept of equilibrium and imply a more 'open-ended' vision of economic development and growth. As Romer's paper shows, it takes some considerable effort to tame the model and subdue it again to the equilibrium method.

Economic development is typically bound up with an expanding variety of intermediate products. Romer tries to capture this fact in terms of the following formalization. The final product is taken to be produced according to the production function

$$Y(H_Y, L, x) = H_Y^{\alpha} L^{\beta} \sum_{i=1}^{\infty} x_i^{1-\alpha-\beta}$$

where H_Y denotes the amount of human capital employed in the final output sector, L the number of workers, and $\sum_{i=1}^{\infty} x_i^{1-\alpha-\beta}$ the employment of intermediate products. Since at a given moment in time there is only a finite number Z of them, $x_i = 0$ for all $i > Z$. Final output is thus seen as an additive separable function of the various intermediate products. It is an ever growing number of (patented) designs, Z, that propels economic expansion and makes income per capita grow. On the one hand an increasing Z increases the productivity of labour and human capital in the production of final output. On the other hand the nonexcludability of knowledge in research involves a direct positive relation between the total stock of designs and knowledge, Z, and the productivity of human capital employed in research. The research technology Romer postulates has the rate of increase of Z as a linear function of Z (and of human capital employed in the research sector). This implies that 'unbounded growth is more like an assumption than a result of the model.' (Romer, 1990, p. S84)

Romer's model has a number of disquieting features. We have already pointed out that knowledge and human capital must boldly be assumed to be cardinally measurable. The postulated heterogeneity of intermediate products is more apparent than real. Since they all exhibit the same input proportions in production, they cannot be distinguished and all represent unspecifically given amounts of forgone consumption. Once introduced, an intermediate product will be used forever: it neither depreciates nor becomes economically obsolete. New economic knowledge is never the enemy of existing knowledge. If, say, final output happens to be wheat, then wheat in ancient Egypt was produced by means of digging sticks only, whereas today it is taken to be produced by means of digging sticks and ploughs and oxen and tractors and combine harvesters etc., all employed simultaneously. This is certainly an extreme conceptualization of a growing capital input diversity which is squarely contradicted by an even casual observation of facts. New capital goods frequently replace old ones in a similar way as new particles of knowledge supersede their ancestors.

This latter fact is taken into account in so-called Schumpeterian growth models with quality-improving innovations championed by Aghion and Howitt (1998). These models revolve around Schumpeter's concept of 'creative destruction'. Accordingly, new technical devices are hardly ever a general good. While innovators may benefit, those that have invested their capital in previous vintages of technical knowledge suffer from them. The double-edged character of innovations raises the problem of the socially optimal rate of technological advancement.

Some broader issues regarding the fundamental causes of growth

Schumpeter, when talking about innovations, the main force of economic development, referred to 'new combinations'. The idea that new knowledge of whichever sort consists of the (re)combination of given pieces of knowledge can be traced far back in natural philosophy. It was referred to by Adam Smith who in a famous passage in *The Wealth of Nations* discussed the combination of existing ideas in order to create new ones in the context of the emergence of a new profession in an ever deeper division of labour, that is,

> philosophers or men of speculation, whose trade it is, not to do anything, but to observe every thing; and who, upon that account, are often capable of *combining together the powers of the most distant and dissimilar objects*. In the progress of society, philosophy or speculation becomes, like every other employment, the principal or sole trade and occupation of a particular class of citizens. (Smith, *WN*, I.i.9; emphasis added)

Weitzman (1998) in an attempt 'to get inside the black box of innovation' and build up an explicit model of knowledge production gave the combinatoric metaphor a more precise form. New ideas, he mainained against Romer and others, are not some exogenously determined function of 'research effort' in 'the spirit of a humdrum conventional relationship between inputs and outputs.' Rather, 'when research effort is applied, new ideas arise out of existing ideas in some kind of cumulative interactive process' (p. 332). What happens may be compared to the activities in an agricultural research station in which pairs of existing 'idea-cultivars' are combined to bring about new 'hybrid ideas' (where the word 'cultivar' is an acronym for *culti*vated *var*iety). With I as the number of idea-cultivars, the corresponding number of different binary combinations that can be got from I is $C_2(I)$, which is given by

$$C_2(I) = \frac{I!}{(I-2)!2!}$$

For example, with $I = 5$, we have $C_2(5) = 10$; and with $I = 6$, we have $C_2(6) = 15$, etc.

The important message of Weitzman's otherwise rather mechanistic argument is that the growth in the number of ideas that results from combining reconfigured existing ideas is remarkable and exceeds well exponential growth. Would the entire potential of recombinatory possibilities always be exploited, then the growth of the number of knowledge particles would over time increase almost without limit. Yet the capacity to process new ideas depends on the resources devoted to the task and the productivity of these resources. According to Weitzman it is sensible to assume that the ultimate constraint on economic expansion is linear. This implies that steady-state growth rates are linearly proportional to aggregate savings – not unlike the situation in the Harrod-Domar model.

Reaching beyond the confines of economics, narrowly defined, there have been studies focusing on what are frequently called the 'fundamental' causes of growth. The emphasis is on the role of economic and political institutions; see, for example, Alesina and Rodrik (1994). These studies typically proceed by superimposing upon one of the endogenous growth models some mechanism designed to capture the interaction of social, political and economic institutions and the role of income inequality. Factors such as property rights and their enforcement, ‘social capability’ (M. Abramovitz), the quality of governance, corruption etc. are investigated with respect to their impact on the growth and development performance of countries. Economic institutions decide the incentives of economic agents and the constraints they face. Because different groups of society benefit from different economic institutions, there is typically a conflict over the alternatives. Political power which depends on political institutions and the distribution of resources decides the outcome of the conflict. Political power may, however, be eroded by socio-economic developments. Thus a picture emerges showing the complex dynamics of the interaction of economic, institutional, political and social forces.

From the point of view of development economics of particular relevance are studies of self-reinforcing mechanisms that perpetuate poverty; see, for example, Azariadis (1996). These mechanisms typically involve an adverse impact on the formation of human and physical capital and the adoption of best practice technology. They can be traced back to market, institutional and political failures. There is strong empirical evidence that weak law and contract enforcement, an insufficient protection of property rights, confiscatory taxation and a corrupt bureaucracy act as disincentives to enterprise and capital accumulation and entail unproductive rent-seeking behaviour. Despotism is considered incompatible with sustainable economic development, while democracy and good political institutions can be expected to foster it. Then there are studies that investigate the role of largely exogenous factors on growth, such as the geography of a country (natural resources, climate, topography), its ‘culture’ and ethnic diversity. Here, at the latest, the received division of labour amongst the (social) sciences is somewhat overcome and economics, sociology, political science and history are brought together in order to come to grips with inherently intricate problems.

Such multi-disciplinary approaches are indeed badly needed as also the following example shows. However, the example testifies to some economists’ insistence on what they consider ‘rigorous’ explanations, that is, the explanation of some grand historical fact in terms of an utterly simple model in which some utility maximizing agents faced with changing budget constraints shape centuries or, as in the present case, even millennia. What is dubbed ‘unified growth theory’ purports to ‘capture the complexity of the process of growth and development over the entire course of human history.’ (see Aghion and Durlauf, 2005, ch. 4, p. 174) The approach focuses attention on the take-off from what is called an epoch of stable Malthusian stagnation to a Post-Malthusian Regime of persistent growth in income per capita which occurred in Europe and the Western Offshoots at the beginning of the 19th century. The main reasoning is simple and goes something like this. Any rise in income per capita above subsistence levels due to small technological improvements in the Malthusian Period was swiftly followed by an expansion of population that made income per capita fall again to around its former level. (One wonders how, for example, the Roman Empire could ever get off the ground and where the surplus product it needed in order to do so came from.) It was only the acceleration in technological progress during the Post-Malthusian Regime that broke the vicious circle. The increase in income per capita was no longer fully channelled into an increase in population, but stimulated the accumulation of human capital in the form of literacy rates, schooling, and health. Then, during the second phase of the Industrial Revolution, industrial development was based more and more on increased skills of workers. The human capital formation in turn brought about a demographic transition and paved the way to an era of sustained economic growth. The latter is characterized by a significant increase in the average growth rate of ouput per capita and a decline in population growth. This broad development is then explained in terms of a model where utility maximizing fertility behaviour implies that households at low levels of income find it preferable to allocate a large part of their time to raise children and only at higher levels of income change their allocation of time from child rearing to human capital formation and consumption.

Karl Marx in the preface to the first edition of volume I of *Capital* stressed: ‘One nation can and should learn from others[, but] ... it can neither clear by bold leaps, nor remove by legal enactments, the obstacles offered by the successive phases of its normal development. But it can shorten and lessen the birth-bangs.’ (Marx, 1954, p. 20) The conclusion drawn from unified growth theory is similar and adds a new meaning to Marx’s reference to birth-bangs: a state of sustained economic growth can only be reached after the forces shaping fertility behaviour have brought about the transition to the Post-Malthusian Regime. The advocates of the ‘unified’ approach appear to be optimistic that sooner rather than later all economies will have gone through the transition phase to the regime of sustained economic growth worldwide. After an epoch of ‘Great Divergence’ some economists see even an epoch of ‘Great Convergence’ ahead of mankind in which the problem of development will vanish.

The idea of unbounded growth of income per capita on a world scale implies that we can escape the limits to growth imposed by environmental constraints. This is a highly controversial claim (see Aghion and Durlauf, 2005, ch. 28). Industrial pollution, global warming and climatic change, soil erosion, the reduction of biodiversity etc. point towards problems that cannot adequately be dealt with in terms of the usual macroeconomic growth models. Measuring living standards vis-à-vis fundamental changes in the quality of the environment and life becomes a tantalizing task and ought to prevent social scientists from getting complacent about their achievements as to explaining the world.

Alongside an avalanche of theoretical contributions there has been a no less impressive avalanche of empirical ones. The first round of papers was motivated by the observation that there need not be a convergence of per capita income levels worldwide, as predicted by the Solow model. The new growth models were expected to do a better job. Yet Mankiw, Romer and Weil (1992) contested this and insisted that the empricial performance of the conventional Solow approach was superior to the 'endogenous' growth models. While on the surface this may well be so, Felipe and McCombie (2005) have shown that there is no reason to become complacent, for the 'good fit' of the Solow model is simply a reflection of the fact that an accounting identity has been tested. For summary accounts of the empirical findings, see, for example, Temple (1999) and Bosworth and Collins (2003).

Non-neoclassical contributions

Aghion and Durlauf (2005) give the impression that the revival of growth economics was restricted to the neoclassical camp whose characteristic feature is that the problems at hand are redefined in such a way that they can be subjected to constrained optimization. This neglects contributions coming from other traditions. Here is not the place to provide a comprehensive account of classical, Marxian, Keynesian and evolutionary approaches to the problem of growth and development; see, therefore, Foley and Michl (1999), Salvadori (2003), Nelson (2005), Salvadori and Panico (2006).

Neoclassical models, old and new, typically assume full employment of labour and full capacity utilization and thus follow Solow's example who in his 1956 contribution explicitly set aside problems of effective demand and assumed what he called a 'tight rope view of economic growth'. This does not mean that there are no such problems, as Solow was to stress time and again and also most recently (see Aghion and Durlauf, 2005, p. 5). Despite his warnings, neoclassical growth theorists continue to be concerned almost exclusively with the evolution of potential output and ignore all effective demand failures. Interestingly, the subject index of the handbook just referred to has no entry on capacity or capital utilization. Ignoring the demand side, that is, assuming Say's law, is justified in terms of the overwhelming importance of long-run growth compared with short-run fluctuations. However, there appears to be a misunderstanding involved here, as the following example can clarify. Assume two identical economies except for the fact that one, due to a better stabilization policy, manages to realize on average, over a succession of booms and slumps, a higher average rate of capacity utilization than the other economy. With Y as actual and Y^* as potential output, s as the savings rate, v as the actual and v^* as the optimal output-to-capital ratio and $u = Y/Y^*$ as the average degree of utilization of productive capacity, we have

$$g_i = \frac{S}{Y}\frac{Y}{K} = \frac{s}{v} = \frac{S}{Y}\frac{Y^*}{K}\frac{Y}{Y^*} = \frac{s}{v^*}u_i \qquad (i = 1, 2)$$

Assume now that $s = 0.2$ and $v^* = 2$, but $u_1 = 0.8$ and $u_2 = 0.7$. Then the first economy would grow at eight per cent per year, whereas the second would grow at only seven per cent. This may seem a trifling matter, and in the short run it surely is, but according to the compound (instantaneous) interest formula after about 70 years the first economy would be larger than the second one by the amount of their (common) size at the beginning of our consideration. Hence effective demand matters. Experience also suggests that there is no reason to presume that actual savings can be expected to move sufficiently close around full employment and full capacity savings. Persistently high rates of unemployment in many countries, both developed and less developed ones, strongly indicate that the problems of growth and development cannot adequately be dealt with in terms of the full employment assumption.

A recurrent tenet of Keynesian models is that different components of effective demand affect the rate of growth differently. It was already Roy Harrod who stressed that government policies have to be used both to stabilise the economy and to achieve higher growth. This theme was taken up by Nicholas Kaldor who discussed the interaction between public debt and interest rates. A monetary policy causing widely fluctuating short-run interest rates is said to raise the long-term rate to levels which may curb accumulation unless the rate of profit is raised too. This, Kaldor maintained, can be accomplished by stimulating effective demand via tax cuts and by fiscal policy.

The relationship between the rate of growth of effective demand and the rate of profits in the simplest framework possible is expressed by the so-called Cambridge equation

$$r = s_c g$$

where s_c is the propensity to save of capitalists. This relationship, or some variant of it, holds in a large number of cases. In more recent times, taking up suggestions especially by Michal Kalecki and Joseph Steindl, there have been attempts to analyse more carefully investment behaviour. The presence of an 'investment function' in addition to and independently of the savings function is indeed a characteristic feature of Keynesian models. This has led to a class of investment-led growth models, in which growth is typically seen to depend on two main, but interrelated factors: profitability and effective demand. As regards the second factor there is wide agreement and strong empirical evidence that investment responds positively (negatively) to rising (falling) levels of capacity utilization. Profitability in turn is governed by the innovative potential that can be exploited at a given moment of time and by income distribution. Put in a nutshell, the type of investment function typically employed looks as follows

$$\gamma = \gamma(r, r^e, i, u)$$

where γ is the share of investment, r the current rate of profit as an indicator of the possibilities of internal financing, r^e the expected rate of profit, i the long-term rate of interest, and u the degree of capacity utilization. The characteristic features of these models are essentially three. First, income distribution and growth are simultaneously determined. Secondly, the 'paradox of thrift' is not limited to the short run: an increase in the overall propensity to save, other things being equal, reduce both the rate of growth and the rate of profit. This is exactly the opposite of what neoclassical models typically predict. Finally, the rate of growth depends negatively on the real wage rate provided the system is in what is called a profit-led growth regime. However, this need not be the case. There exist constellations of the parameters which give the model an 'underconsumptionist' flavour with the growth rate rising together with the real wage rate over a certain range. For a summary account of this class of models, see Commendatore et al. (2003).

Recent economic history shows that the Keynesian approach can be used to interpret reasonably well, e.g., the economic development of the United States which over many years up until now followed a policy of massive budget deficits. The remarkable growth performance of China can also be explained with reference to the leading role of investment and, via the multiplier, of effective demand, whereas an explanation presupposing the full employment of labour is bound to lead astray with respect to an economic system in transition from a dominantly agricultural to an industrial economy, with hundreds of millions of workers from rural areas in search of jobs in cities.

There is also evidence that sluggish economies have less potential to adopt and develop new technology. This brings us to contributions in which technical progress is endogenous. There are several meachnisms discussed in the literature how the growth of output affects the growth of labour productivity, especially in the manufacturing sector, from Adam Smith's concept of the division of labour to Verdoorn's and Kaldor's law. The virtuous circle contemplated in this kind of literature sees profitability positively related to the growth of labour productivity, which is seen to be positively related to the growth in output. High rates of profit in turn will feed high rates of investment growth and thus high rates of output growth.

Another class of contributions comes from evolutionary economics. This is a rapidly growing field and its main concern, following in the footsteps of Joseph A. Schumpeter, is to analyse why and how the economic system incessantly changes from within. The focus of attention is more on development than growth, or rather it is insisted that the economic process generates rapid qualitative change that cannot be captured in terms of the usual highly aggregate growth models. The origins of the evolutionary approach can be traced back to the classical economists, especially Adam Smith. The approach was taken up in parts by Alfred Marshall and then Schumpeter. The modern discussion was largely shaped by Nelson and Winter (1982). The evolutionary approach centres on a dynamic analysis in which random elements change the population of firms or the technology they use via a selection mechanism on existing variety. Discovery, learning and imitation assume centre stage in the argument which is about population dynamics and the economic effects it entails. For obvious reasons, evolutionary economics rejects such neoclassical concepts as the 'representative agent' or the 'aggregate production function'. Neoclassical growth theory is said to suffer from a detachment between formal and 'appreciative' theory (Nelson, 2005), where the latter is close to empirical studies of the actual behaviour of firms. Important contributions to evolutionary growth economics came from, among others, Giovanni Dosi, Stanley Metcalfe, and Gerald Silverberg. For a summary account see Santangelo (2003).

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