12 Endogenous growth in a stylised 'classical' model*

Heinz D. Kurz and Neri Salvadori

Introduction

Interpreters from Adolph Lowe (1954) to Walter Eltis (1984) have stressed that economic growth and socio-economic development in the classical authors from Adam Smith to David Ricardo and Karl Marx were considered endogenous phenomena. In their writings, the behaviour of agents, their creativity and need for achievement and distinction, and social rules and institutions defined the confines within which the process of the production, distribution and use of social wealth unfolded. The concept of exogenous growth, as it was introduced by Gustav Cassel and then made central in Robert Solow's growth model (Solow 1956), was totally extraneous to the way the classical economists thought. In their view the main problem the social sciences were confronted with consisted of the fact, in the words of Smith's teacher Adam Ferguson, that history is 'the result of human action, but not of human design'. What was needed was to come to grips, as best as one could, with the consequence of purposeful human actions, both intended and unintended.

In this chapter we consider a very small and highly stylised aspect of the endogenous character of economic growth as envisaged by the classical authors. To keep the argument within limits, we set aside problems that cannot be dealt with in a short chapter. In particular, we do not deal with the development aspect of economic growth, the technical, social, structural and institutional changes involved, the availability of an ever greater variety and quality of goods, the erosion of received patterns of consumption, of cultural styles and of social relations, and the establishment of new ones, and so forth. These themes play an important role in work of authors such as Smith and Marx. We also set aside analytical complications due to the factual intricacies of an ever more sophisticated system of the social division of labour and an ever more complex network of interdependent sectors of production.

* Reproduced with permission from George Stathakis and Gianni Vaggi (eds), *Economic Development and Social Change*, London: Routledge, 2006.

The chapter assumes essentially a one-sector economy in which 'corn' is produced by means of doses of labour-cum-capital, where capital consists only of corn and each dose of labour-cum-capital exhibits the same proportion of labour to corn. This means that labour-cum-capital can be treated as if it were a single factor of production. This bold simplification of the 'classical' approach to the problem of economic growth can only be justified if it does not misrepresent an important aspect of at least a variant of that approach. One generally engages in such simplifications only for heuristic reasons, and the heuristic perspective underlying this chapter is to prepare the ground for a comparison with prominent contributions to the so-called 'new' growth literature (see Kurz and Salvadori 1996, 1998a, 1998b, 1999, 2003).

Many of the models elaborated in the new growth literature are essentially one-sector models and know only a single capital good, just as our model does. By highlighting certain ideas found in the classical approach in the simplest form possible, we provide similes of some ideas found in modern contributions to growth theory. This allows us to raise the question, and provide elements of an answer to it, of continuity and change in growth theory from the classical to the modern authors. We believe that the stylised classical model elaborated in this chapter following a well-known literature (see Kaldor 1955–56, Samuelson 1959, Pasinetti 1960), despite some valid criticisms that can be forwarded against it, is able to capture a number of elements of at least an important thread in classical thinking.

The following analysis will be exclusively *long period.* That is, attention will focus on positions of the economic system characterised, in competitive conditions, by a uniform rate of profit throughout the system, a uniform real wage rate, and a uniform rate of rent for each quality of land.

The composition of the chapter is as follows. In the second section we outline the stylised 'classical' or rather Ricardesque theory of growth, and use Kaldor's well-known diagram to illustrate the endogeneity of the rate of growth. We deal both with the case in which the real wage is given and independent of the rate of growth of the workforce, and the case in which a higher rate of growth requires a higher real wage rate, reflecting a kind of Malthusian population dynamics. It is argued that the introduction of the latter does not affect the basic logic of the classical point of view, namely, that in normal conditions the pace at which capital accumulates regulates the pace at which the labouring population grows. In other words, labour is considered as generated within the process of capital accumulation and economic growth.

The third section deals with neoclassical models of economic growth. It is first argued that for reasons that have partly to do with its analytical structure, which takes the initial endowments of the economy of 'factors of production' as given, the marginalist approach starts naturally from a long-term rate of growth that equals some exogenously given rate of growth of the factor(s) of production. This is exemplified in terms of the contributions of Alfred Marshall, Gustav Cassel and Robert Solow.

Next, it is argued that the endogenisation of the growth rate in a class of models belonging to the so-called 'new' growth theory is carried out in a manner reminiscent of classical economics. While in the Solow growth model, for example, labour is treated as a non-producible and non-accumulable factor of production whose fixed rate of growth constrains the long-term expansion of the economic system, in some new growth models this factor is replaced by 'human capital' or 'knowledge', which are taken to be producible and even accumulable (or costlessly transferable among subsequent generations of the population). Very much like the classical assumption of a given real wage rate this is equivalent to the assumption that there is a mechanism generating 'labour'. The final section contains some concluding remarks.

Endogenous growth in the 'classical' economists

Accumulation vis-à-vis diminishing returns in agriculture

We begin our discussion with a selection of some stylised analytical elements – and their interaction – that figure prominently in David Ricardo's work, and that are often considered to represent the building blocks of the classical position *tout court.* This invariably involves a bold reduction of the fascinating richness and diversity of classical analyses. It does not adequately represent Ricardo's much more analytically focused contribution to the problem under consideration. However, it captures some of the ideas that permeate much of his work, and this is one of the reasons why we embark on the following Ricardesque model.

The focus of our attention is on what Ricardo called the 'natural' course of the economy. By this he meant an economic system in which capital accumulates, the population grows, but there is no technical progress. Hence the argument is based on the (implicit) assumption that the set of (constant returns to scale) methods of production from which cost-minimising producers can choose is given and constant. Assuming the real wage rate of workers to be given and constant, the rate of profits is bound to fall. Due to extensive and intensive diminishing returns on land, 'with every increased portion of capital employed on it, there will be a decreased rate of production' (Ricardo [1817] 1951: 98).

Profits are viewed as a residual income based on the surplus product left after the used up means of production and the wage goods in the support of workers have been deducted from the social product (net of rents). The 'decreased rate of production' thus involves a decrease in profitability. On the premise that there are only negligible savings out of wages and rents, a falling rate of profits involves a falling rate of capital accumulation. Hence, as regards the dynamism of the economy, attention should focus on profitability. Assuming that the marginal propensity to accumulate out of profits, s, is given and constant, a 'classical' accumulation function can be formulated

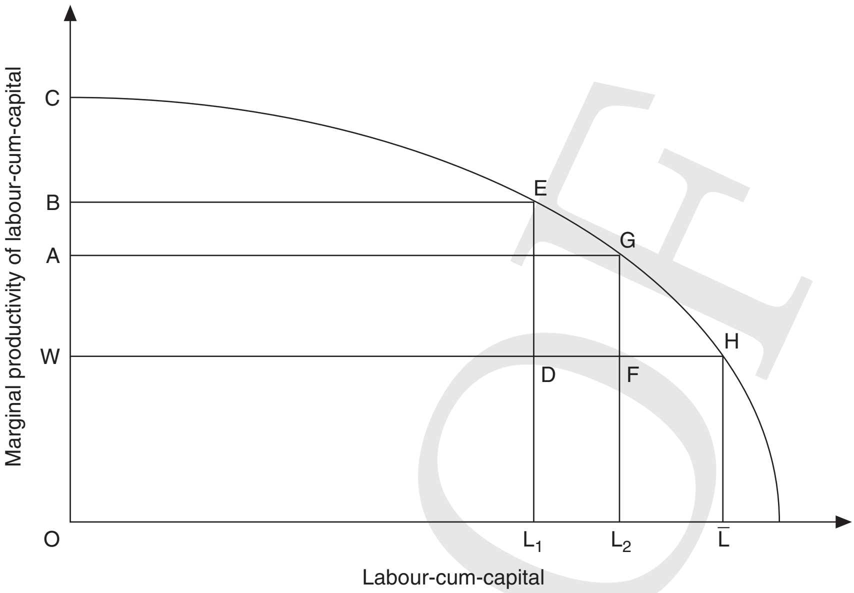

Figure 12.1 Land as an indispensable resource

$$g = \begin{cases} s(r - r_{\min}) & \text{if } r \geq r_{\min} \\ 0 & \text{if } r \geq r_{\min} \end{cases}$$

where $r_{\min} \geq 0$ is the minimum level of profitability which, if reached, will arrest accumulation (ibid: 120). Ricardo's 'natural' course will necessarily end up in a stationary state.[1]

Clearly, in Ricardo the rate of accumulation is endogenously determined. The demand for labour is governed by the pace at which capital accumulates, whereas the long-term supply of labour is regulated by some 'Malthusian Law of Population'.[2]

Assuming for simplicity a given and constant real wage rate, Ricardo's view of the long-run relationship between profitability and accumulation and thus growth can be illustrated as in Figure 12.1 (see Kaldor 1955–56). The curve CEGH is the marginal productivity of labour-cum-capital; it is decreasing since land is scarce. When labour-cum-capital increases, either less fertile qualities of land must be cultivated or the same qualities of land must be cultivated with processes which require less land per unit of product, but are more costly in terms of labour-cum-capital. Let the real wage rate equal OW. Then, if the amount of labour-cum-capital applied is L1, the area OCEL1 gives the product, OWDL1 gives total capital employed and BCE total rent. Profits are determined as a residual and correspond to the rectangular WBED. As a consequence, the *rate* of profits can be determined as the ratio of the areas of two rectangles that have the same bases and, therefore, it equals the ratio WB/OW.

If in the course of capital accumulation and population growth the amount of labour-cum-capital rises to the level of L_2, then $OCGL_2$ gives the product, OWFL2 the capital, ACG the rent and WAGF profits. The rate of profit has fallen to WA/OW. Obviously, if a positive profit rate implies a positive growth rate (i.e. $r_{min} = 0$), the economy will expand until labour-cum-capital has reached the level E. At that point, the profit rate is equal to zero and so is the growth rate. The system has come to a standstill; the engine of growth, profitability, has run out of steam.

In this bold simplification the required size of the work force is considered as essentially generated by the accumulation process itself. In other words, labour power is treated as a kind of producible commodity. It differs from the other commodity, corn, in that it is not produced in a capitalistic way by a special industry on a par with the corn-growing sector, but is the result of the interplay between the generative behaviour of the working population and socio-economic conditions. In the most simple conceptualisation possible, labour power is seen to be in elastic supply at a given real (that is, corn) wage rate. Increasing the amount of corn available in the support of workers involves a proportional increase of the work force.

In this view the rate of growth of labour supply adjusts to any given rate of growth of labour demand without necessitating a variation in the real wage rate.[3] Labour can thus place no limit on growth because it is 'generated' within the growth process itself. The only limit to growth can come from other non-accumulable factors of production. As Ricardo and others made clear, these factors are natural resources in general and land in particular. In other words, there is only endogenous growth in the classical economists. This growth is bound to lose momentum as the scarcity of natural resources makes itself felt in terms of extensive and intensive diminishing returns. (Technical change is of course seen to counteract these tendencies.)

The assumption of a given and constant real wage rate which is independent of the rate of growth of the demand for 'hands' can, of course, only be justified as a first step in terms of its simplicity. In fact, in some of his discussions with Thomas Robert Malthus, Ricardo appears to have adopted this assumption precisely for the sake of convenience. There is clear evidence that he did not consider it a stylised historical fact of long-term economic development. Reading his works, one gets the impression that the relationship between the expansion of the economic system as a whole and the wage and population dynamics is far from simple, and actually differs both between different countries in the same period and between different periods of the same country, depending on a variety of historical, cultural and institutional factors.

For example, Ricardo stressed that 'population may be so little stimulated by ample wages as to increase at the slowest rate – or *it may even go in a retrograde direction*' (Ricardo, *Works*, VIII: 169, emphasis added). And in his *Notes on Malthus* he insisted that 'population and necessaries are not necessarily linked together so intimately'; 'better education and improved habits' may break the population mechanism (Ricardo, *Works*, II: 115).

However, we encounter also the following view expressed in his letter to Malthus of 18 December 1814:

> A diminution of the proportion of produce, in consequence of the accumulation of capital, does not fall wholly on the owner of stock, but is shared with him by the labourers. The whole amount of wages paid will be greater, but the portion paid to each man, will in all probability, be somewhat diminished.
>
> (Ricardo, *Works*, VI: 162–3)

In what follows, we formalise the idea that higher rates of capital accumulation, which presuppose higher rates of growth of the workforce, correspond to higher levels of the real wage rate.[4] We shall see that the basic logic of the argument which we have illustrated by means of the assumption of a fixed real wage rate remains essentially untouched: in normal conditions the pace at which capital accumulates regulates the pace at which labour grows.

Assume that higher growth rates of the labouring population require higher levels of the corn wage paid to workers. Higher wages, the usual argument goes, give workers and their families access to more abundant and better nutrition and medical services. This reduces infant mortality and increases the average length of life of workers. Let $\bar{w}$ be the wage rate that must be paid in order to keep the labouring population stationary, and let $w = \bar{w}(1+g)$ be the wage rate to be paid in order for the labouring population to grow at the rate g. Further, let the marginal productivity of labour-cum-capital (the CEGH curve of Figure 12.1) be the function $f(L)$. Then the rate of profits r turns out to be

$$r = \frac{f(L) - \bar{w}(1+g)}{\bar{w}(1+g)}.$$

Hence, on the simplifying assumption that $r_{\min} = 0$,

$$g = s\frac{f(L) - \bar{w}(1+g)}{\bar{w}(1+g)},$$

from which we obtain a second degree equation in g:

$$\bar{w}g^2 + (1+s)\bar{w}\,g - s\left[f(L) - \bar{w}\right] = 0,$$

which, for $f(L) > \bar{w}$, has a positive and a negative solution. The negative solution is insignificant from an economic point of view because it is less than

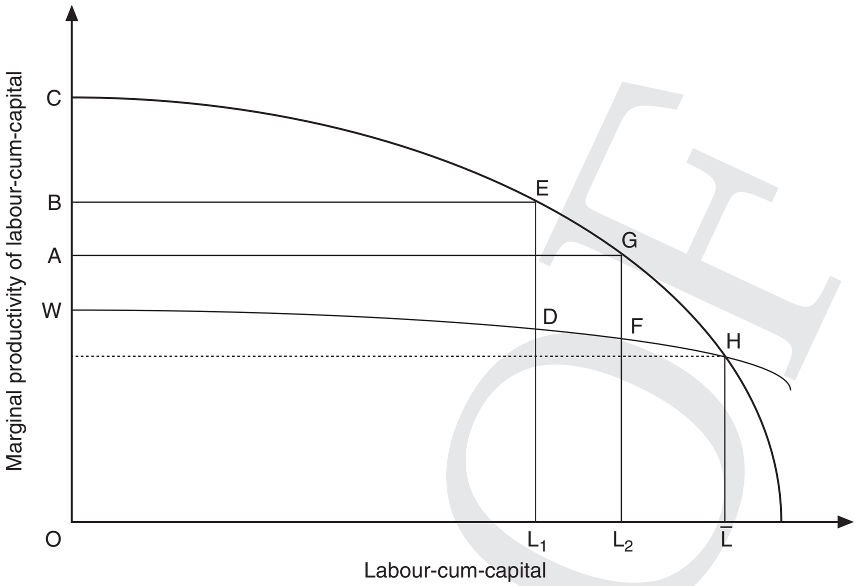

Figure 12.2 The wage rate as a function of the growth rate

−1 and would thus be associated with a negative real wage rate. The positive solution is

$$g = \frac{\sqrt{(1-s)^2\,\overline{w}^2 + 4sf(L)\overline{w}} - (1+s)\overline{w}}{2\overline{w}}.$$

The result of this simple exercise is that the WDFH curve (see Figure 12.2), which in Figure 12.1 was a horizontal straight line, becomes a decreasing curve:

$$\overline{w}(1+g) = \frac{\sqrt{(1-s)^2\,\overline{w}^2 + 4sf(L)\overline{w}} + (1+s)\overline{w}}{2}.$$

Note that if $f(L) > \overline{w}$, then $f(L) > \overline{w}(1+g) > \overline{w}$, whereas if $f(L) = \overline{w}$, then $f(L) = \overline{w}(1+g) = \overline{w}$. To conclude, the resulting modifications of Figure 12.1 do not change the substance of the 'classical' point of view expounded above.[5]

Production with land as a free good

We may now briefly turn to the hypothetical case in which the economy can grow without ever experiencing the constraint of scarce land(s). This amounts to setting land aside in Ricardo's doctrine, which might strike the reader as something like Hamlet without the prince. However, Ricardo himself contemplated this case. In his letter to Malthus already referred to, he wrote:

> Accumulation of capital has a tendency to lower profits. Why? Because every accumulation is attended with increased difficulty in obtaining food, unless it is accompanied with improvements in agriculture, in which case it has no tendency to diminish profits. If there were no increased difficulty, profits would never fall, because there are no other limits to the profitable production of manufactures but the rise of wages. *If with every accumulation of capital we could tack a piece of fresh fertile land to our Island, profits would never fall.*
>
> (Ricardo, *Works*, VI: 162, emphasis added)

Similarly, in his letter to Malthus of 17 October 1815 he stated that

> [P]rofits do not *necessarily* fall with the increase of the quantity of capital because the demand for capital is infinite and is governed by the same law as population itself. They are both checked by the rise in the price of food, and the consequent increase in the value of labour. If there were no such rise, what could prevent population and capital from increasing without limit?
>
> (Ricardo, *Works*, VI: 301)

If land of the best quality were abundant (and its ownership sufficiently dispersed), it would be a free good. From an economic point of view, land can therefore be ignored like the air or the sunlight. Then the graph giving the marginal productivity of labour-cum-capital would be a horizontal line and, therefore, the rate of profits would be constant whatever the amount of labour-cum-capital. This case is illustrated in Figure 12.3. As a consequence, the growth rate would also be constant over time: the system could expand without end at a rate that equals the given rate of profits times the propensity to accumulate. As we have seen, Ricardo was perfectly aware of this implication.

In this case, if we take into account the possibility contemplated in the above that a higher rate of growth of the work force might require a higher level of the real wage rate, then the WDF curve in Figure 12.3 would be higher, but it would still be a horizontal straight line below the CEG and above the WDF straight lines.

Production with a 'backstop technology'

However, to assume that there is no land at all, or that it is available in given quality and unlimited quantity, is unnecessarily restrictive. With the system growing without end, and setting aside land-saving technical progress as contemplated by Ricardo (*Works*, I, Chapter II; see also Gehrke *et al*. 2003),

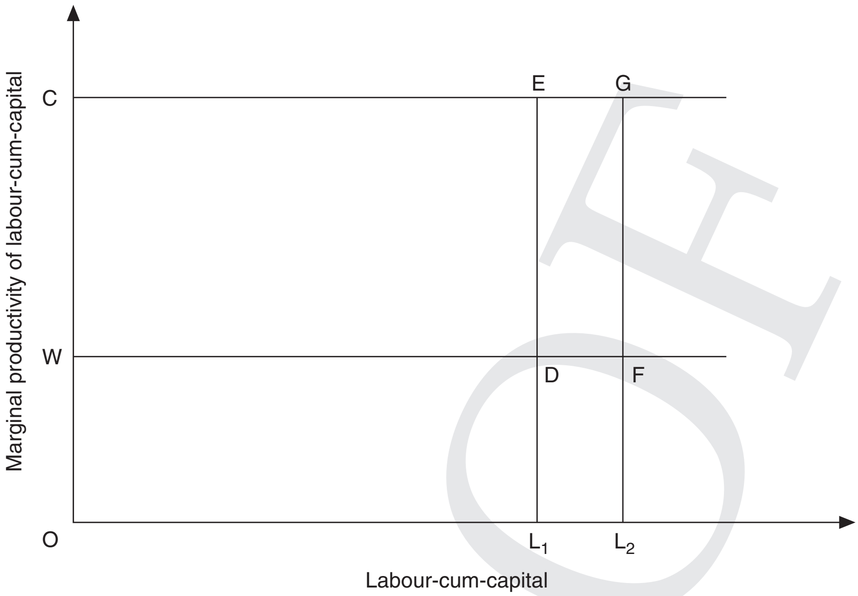

Figure 12.3 Land as a free good

the point will surely come when land of the best quality will become scarce. This brings us to another constellation in which the rate of profits need not vanish as capital accumulates. The constellation under consideration bears a close resemblance to a case discussed in the economics of 'exhaustible' resources: the existence of an ultimate 'backstop technology'. For example, some exhaustible resources are used to produce energy. In addition, there is solar energy that may be considered a non-depletable resource. A technology based on the use of solar energy defines the backstop technology mentioned. Let us now translate this assumption into the context of a Ricardian model with land.

The case under consideration would correspond to a situation in which 'land', although useful in production, is not indispensable. In other words, there is a technology that allows the production of the commodity without any 'land' input; this is the backstop technology. With continuous substitutability between labour-cum-capital and land, the marginal productivity of labour-cum-capital would be continuously decreasing, but it would be bounded from below. This case is illustrated in Figure 12.4, with the dashed line giving the lower boundary. In this case, the profit rate and thus the growth rate would be falling, but they could never fall below certain – positive – levels. The system would grow indefinitely at a rate of growth which would asymptotically approach the product of the given saving rate times the value of the (lower) boundary of the profit rate. In Figure 12.4 the latter is given by WR/OW.

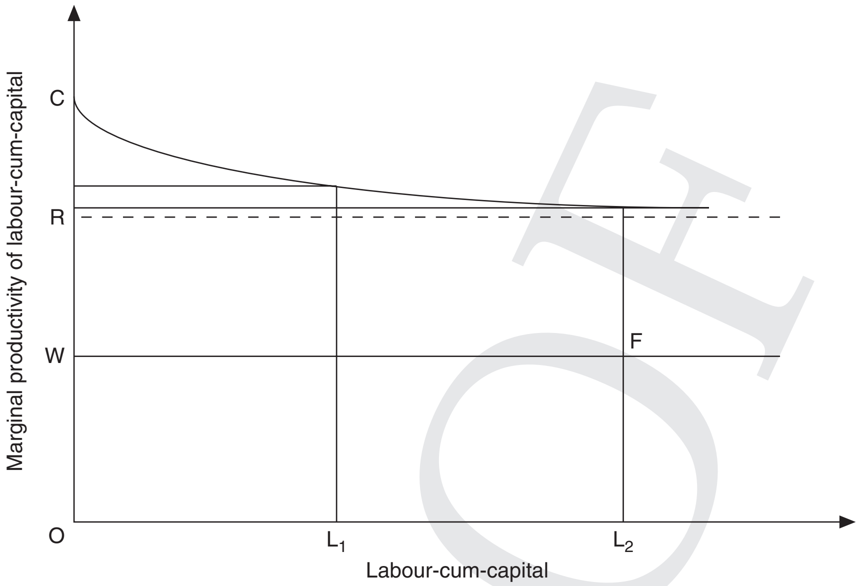

Figure 12.4 A backstop technology

Also in this case we may take into account the possibility contemplated in the above that a higher rate of growth of the work force might require a higher level of the real wage rate. In an expanding system the level of the real wage rate will therefore exceed the level required to keep the work force stationary. The WF curve that in Figure 12.4 is a horizontal straight line becomes a decreasing curve with the horizontal asymptote passing through the point

$$\mathrm{R}' = \left(0, \frac{\sqrt{(1-s)^2\,\overline{w}^2 + 4s\overline{w}\mathrm{OR}} + (1-s)\overline{w}}{2}\right)$$

not in the figure, where $\overline{w}$ < OR′ < OR if and only if $\overline{w}$ < OR. The rate of profits would be bounded from below at a positive level.

To conclude, it must be stressed again that the Ricardesque paths of endogenous growth illustrated in Figures 12.1–12.4 depend on the fact that labour is considered as commodity that is (in some sense) ‘produced’ by means of corn and nothing else. In this conceptualisation the real wage rate is dealt with ‘on the same footing as the fuel for the engines or the feed for the cattle’, as an attentive interpreter of the classical economists remarked. Using neoclassical terminology, the straight line WF might be interpreted as the ‘marginal cost function’ related to the ‘production’ of labour. If the wage rate depends on the growth rate and thus on the amount of work employed, then the marginal cost function ceases to be a straight line.

However, this does not affect the substance of the argument. Put in a nutshell, the 'secret' of the endogeneity of growth in classical authors consists in the assumption that there is a built-in mechanism producing labour, where the rate of production is attuned to the needs of capital accumulation. In this way the non-accumulable factor 'labour' is deprived of the capacity to bring the growth process to a halt.

Classical and neoclassical approaches

Contributions to the classical theory of value and distribution, notwithstanding the many differences between authors, share a common feature: when investigating the relationship between the system of relative prices and income distribution, they start from the same set of data or independent variables. These are:

(C1) the technical conditions of production of the various commodities,
(C2) the size and composition of the social product,
(C3) one of the distributive variables: either the wage rate or the rate of profits, and
(C4) the available quantities of natural resources, in particular, land.

In correspondence with the underlying long-period competitive position of the economy, the capital stock is assumed to be fully adjusted to these data. Hence the 'normal' desired pattern of utilisation of plant and equipment would be realised, and a uniform rate of return on its supply price obtained.

This analytical structure is also reflected in the simple one-sector models presented in the previous section. Data (C1) and (C4) determine the curve which links the marginal productivity of labour-cum-capital to the amount of labour employed, data (C2) specifies a point on that curve and finally data (C3) determines the distribution of the product. Once the latter is ascertained, growth is determined by the saving-alias-investment or accumulation function (in the case under consideration by equation $g = sr$).

By contrast, the marginalist theories of value and distribution typically start from the following data or independent variables:

(M1) the set of technical alternatives from which cost-minimising producers can choose,
(M2) the preferences of consumers, and
(M3) the initial endowments of the economy and the distribution of property rights among individual agents.

It is easily checked that (M1) is not very different from (C1), whereas (C2) could be thought of as reflecting (M2). What makes the two theories really different are the data (C3) and (M3). However, in the special case in which there is no labour in the economy – and therefore (C3) is automatically deleted because the rate of profits would be endogenously determined and could not be given from outside the system – (M3) would not be very different from (C4).

It will be shown that it is a characteristic feature of some of the most prominent contributions to the modern literature on endogenous growth that they eliminate labour from the picture and put in its stead 'human capital' or 'knowledge', that is, something that a twentieth century audience can accept as a producible (and accumulable) factor of production. However, the conditions of production of this *surrogate of labour* play exactly the same role played in the classical analysis by the assumption of a given real wage rate. This chapter attempts first and foremost to provide a clear statement of this fact.

A theory based on the typical marginalist set of data (M1)-(M3) is hardly able to determine growth endogenously. It would presumably not be much of an exaggeration to claim that the majority of neoclassical authors have been concerned with developing theories that revolved around the concept of an *exogenously* given long-term rate of economic growth. It suffices to recall the efforts of some of the leading advocates of marginalism. Thus, in Chapter V of Book V of his *Principles of Economics*, Alfred Marshall first introduced the 'famous fiction of the stationary state' and then tried to weaken the strong assumptions required by it:

> The Stationary state has just been taken to be one in which population is stationary. But nearly all its distinctive features may be exhibited in a place where population and wealth are both growing, provided they are growing at about the same rate, and there is no scarcity of land: and provided also the methods of production and the conditions of trade change but little; and above all, where the character of man himself is a constant quantity. For in such a state by far the most important conditions of production and consumption, of exchange and distribution will remain of the same quality, and in the same general relations to one another, though they are all increasing in volume.
>
> (Marshall [1890] 1977: 306)

The resulting economic system grows at a constant rate that equals the exogenous rate of growth of population.[6] Income distribution and relative prices are the same as in the stationary economy. In modern parlance: the system expands along a steady-state growth path.

We encounter essentially the same idea in Gustav Cassel's *Theoretische Sozialökonomie* (Cassel [1918] 1932). The model of exogenous growth delineated by Cassel can be considered the proximate starting point of the development of neoclassical growth theory. In Chapter IV of Book I of the treatise, Cassel presented two models, one of a stationary economy, the other one of an economy growing along a steady-state path.

In his first model, Cassel assumed that there are z (primary) factors of production. The quantities of these resources and thus the amounts of services provided by them are taken to be in given supply. The *n* goods produced in the economy are pure consumption goods, that is, there are no produced means of production or capital goods contemplated in the model. Goods are produced exclusively by combining primary factor services at fixed technical coefficients of production. There are as many single-product processes of production as there are goods to be produced; hence there is no choice of technique. General equilibrium is characterised by the following sets of equations: (1) equality of supply and demand for each factor service; (2) equality of the price of a good and its cost of production, that is, the sum total of factor service payments incurred in its production, and thus the absence of what in this literature is called profit; (3) equality of supply and demand for each good produced, where the demand for each good is conceived as a function of the prices of all goods. The resulting sets of equations constitute what is known as the 'Walras-Cassel model' (Dorfman *et al*. 1958: 346). It satisfied the then going criterion of completeness: there are as many equations as there are unknowns to be ascertained.[7]

Cassel then turned to the model of a uniformly progressing economy (which he described only verbally). He introduced it as follows:

> We must now take into consideration the society which is progressing at a uniform rate. In it, the quantities of the factors of production which are available in each period … are subject to a uniform increase. We shall represent by [*g*] the *fixed rate of this increase*, and of the uniform progress of the society generally.
>
> (Cassel [1918] 1932: 152, emphasis added)

In Cassel's view this generalisation to the case of an economy growing at an exogenously given and constant rate does not cause substantial problems. The previously developed set of equations can easily be adapted to it, 'so that the whole pricing problem is solved' (ibid: 153). Cassel thus arrived at basically the same result as Marshall.

The method which marginalist economists, including those just mentioned, generally adopted up till the 1930s was the long-period method inherited from the classical authors. However, with their fundamentally different kind of analysis – demand and supply theory – they encountered formidable problems. These originated with their concept of capital. The sought determination of income distribution in terms of the demand for and the supply of the different factors of production – labour, land and capital – necessitated that they specify the capital endowment of the economy at a given point in time in terms of a 'quantity of capital' that could be ascertained independently of, and prior to, the determination of relative prices and the rate of profits.

Yet, as Erik Lindahl and others understood very well, this was possible only in the exceptionally special case of a corn model in which there was but a single capital good. In order to apply the demand and supply approach to all economic phenomena, neoclassical authors were thus compelled to abandon long-period analysis and develop in its stead intertemporal (and temporary) equilibrium analysis.

Here is not the place to enter into a detailed discussion of these developments (see therefore, for example, Kurz and Salvadori 1995, Chapter 14). We rather jump several decades and turn immediately to the reasons for the recent resumption of (some special form of) long-period analysis in 'new' growth theory. Until a few decades ago, the number of commodities and, as a consequence, the time horizon in intertemporal general equilibrium theory was assumed to be finite and, therefore, arbitrary.

> The principal objection to the restriction to a finite number of goods is that it requires a finite horizon and there is no natural way to choose the final period. Moreover, since there will be terminal stocks in the final period there is no natural way to value them without contemplating future periods in which they will be used
>
> (McKenzie 1987: 507)

The introduction of an *infinite* horizon turned out to be critical (see also Burgstaller 1994: 43–8). It pushed the analysis inevitably towards the long period, albeit only in the very special sense of *steady state*.[8] This was clearly spelled out, for instance, by Robert Lucas in a contribution to the theories of endogenous growth. He observed that

> [F]or *any* initial capital $K(0) > 0$, the optimal capital-consumption path $(K(t), c(t))$ will converge to the balanced path asymptotically. That is, the balanced path will be a good approximation to any actual path 'most' of the time [and that] this is exactly the reason why the balanced path is interesting to us.
>
> (Lucas 1988: 11)

Lucas thus advocated a *(re-)switching* from an intertemporal analysis to a steady-state one. Since the balanced path of the intertemporal model is the only path analysed by Lucas, in the perspective under consideration the intertemporal model may be regarded simply as a step toward obtaining a rigorous steady-state setting.

Moreover, Lucas abandoned one of the characteristic features of all neoclassical theories, that is, income distribution is determined by demand and supply of factors of production. If we concentrate on the balanced path, capital in the initial period *cannot* be taken as given along with other 'initial endowments'. Since distribution cannot be determined by demand and supply of capital and labour, in Lucas's model it is determined in the following way. Labour is considered the vehicle of 'human capital', that is, a producible factor. Hence all factors are taken to be producible and the rate of profits is determined as in Chapter II of *Production of Commodities by Means of Commodities* (Sraffa 1960). At the beginning of that chapter (§§ 4–5), wages are regarded as entering the system 'on the same footing as the fuel for the engines or the feed for the cattle'. In this case the rate of profits and prices are determined by the socio-technical conditions of production alone – the 'methods of production and productive consumption' (Sraffa 1960: 3). The introduction of several alternative processes of production does not change the result.

The similarity between the determination of the rate of profit in Lucas's model and at the beginning of Chapter II of Sraffa's book is not surprising, since the assumption of a given real wage rate, put in a growth framework, is formally equivalent to the assumption that there is a technology producing 'labour'. The 'human capital' story could be seen as simply a rhetorical device to render the idea of a given real wage more palatable to modern scholars. As regards their basic analytical structure (as opposed to their building blocks), some of the so-called 'new' growth theories can therefore be said to exhibit a certain resemblance to 'classical' economics. In particular, in the free competition versions of the theory, the 'technology' to produce 'human capital' (or, alternatively, 'knowledge' in some approaches) plays the same role as the assumption of a given real wage rate in 'classical' economics.

From the end of Chapter II of *Production of Commodities by Means of Commodities* to the end of the book, workers may get a part of the surplus. As a consequence, the quantity of labour employed in each industry has to be represented explicitly, and the rate of profits and prices can be determined only if an extra equation determining income distribution is introduced into the analysis. The additional equation generally used by advocates of neoclassical analysis is the equality between the demand for and the supply of 'capital', which requires the homogeneity of this factor.[9] But no extra equation is required in the class of 'new' growth theories under consideration, since as in the Ricardo we dealt with here there is a mechanism attuning the size of the workforce – dubbed 'human capital' or 'knowledge' in the literature under consideration – to the requirements of an expanding economic system.

Concluding remarks

We have argued that in the classical economists economic growth and development of a nation were considered genuinely endogenous. This is exemplified with respect to a highly stylised version of one aspect encountered in the writings of the classical authors, especially Ricardo: The 'natural' course an economy would follow in the hypothetical case in which capital accumulates and the population grows but there is no technical change.

The respective argument is expounded in terms of a simple 'corn' model. In the constellation under consideration, decreasing returns will sooner or later make themselves felt due to the scarcity of land(s). With the real wage rate given and constant the rate of profits is bound to fall and the rents of land will increase. The falling tendency of the rate of profits entails a deceleration of capital accumulation and growth until the system comes to a standstill (setting aside depletable resources). Essentially the same holds true in the case in which a higher rate of growth of the workforce requires a higher real wage rate, reflecting some kind of Malthusian population mechanism. It is argued that the latter does not affect the basic logic of the classical point of view, namely, that in the conditions contemplated, the pace at which capital accumulates regulates the pace at which the labouring population grows. In other words, labour is considered as generated within the process of capital accumulation and thus cannot bring growth to a halt. Growth might, however, be suffocated by the scarcity of natural resources, especially land.

Next we dealt briefly with neoclassical models of growth whose natural starting point was a system in which the long-term rate of growth equals some exogenously given rate of growth of the factor(s) of production. It is then argued that the endogenisation of the growth rate in a class of 'new' growth models is effected in a way that is reminiscent of classical economics. In the Solow model labour is treated as a non-producible and non-accumulable factor of production whose fixed rate of growth constrains the long-term expansion of the economic system. In contradistinction, in some new growth models this factor is replaced by 'human capital' or 'knowledge', which are taken to be producible, accumulable or costlessly transferable among subsequent generations of the population. Very much like the classical assumption of a given real wage rate this is equivalent to the assumption that there is a mechanism generating 'labour'.

Acknowledgements

This chapter uses some of the material contained in some earlier papers by us on the so-called 'new' growth theory; see, in particular, Kurz and Salvadori (1996, 1998a, 1998b, 1999). We thank Christian Gehrke, Mark Knell and Rodolfo Signorino for useful comments.

References

Burgstaller, A. (1994) *Property and Prices. Toward a Unified Theory of Value*, Cambridge: Cambridge University Press.

Cassel, G. (1932) *The Theory of Social Economy*, revised English translation of the 5th German edition of Cassel (1918), *Theoretische Sozialökonomie*, by L. Barron, New York: Harcourt Brace.

Dorfman, R., Samuelson, P. A. and Solow, R. M. (1958) *Linear Programming and Economic Analysis*, New York, Toronto and London: McGraw-Hill.

Eltis, W. (1984) *The Classical Theory of Economic Growth*, London: Macmillan.

Garegnani, P. (1976) 'On a Change in the Notion of Equilibrium in Recent Work on Value and Distribution', in M. Brown, K. Sato and P. Zarembka (eds), *Essays in Modern Capital Theory*, Amsterdam: North Holland.

Gehrke, C, Kurz, H. D. and Salvadori, N. (2003) 'Ricardo on Agricultural Improvements: A Note', *Scottish Journal of Political Economy*, 50: 291–6.

Hicks, J. and Hollander, S. (1977) 'Mr. Ricardo and the Moderns', *Quarterly Journal of Economics*, 91: 351–69.

Kaldor, N. (1955–56) 'Alternative Theories of Distribution', *Review of Economic Studies*, 23: 83–100.

Kurz, H. D. and Salvadori, N. (1995) *Theory of Production. A Long-period Analysis*, Cambridge, Melbourne and New York: Cambridge University Press.

Kurz, H. D. and Salvadori, N. (1996) 'In the Beginning All the World Was Australia …', in M. Sawyer (ed.), *Festschrift in Honour of G. C. Harcourt*, London: Routledge, vol. II: 425–43.

Kurz, H. D. and Salvadori, N. (1998a) 'The "New" Growth Theory: Old Wine in New Goatskins', in F. Coricelli, M. Di Matteo and F. H. Hahn (eds), *New Theories in Growth and Development*, London: Macmillan, and New York: St. Martin's Press: 63–94.

Kurz, H. D. and Salvadori, N. (1998b) ' "Endogenous" Growth Models and the "Classical" Tradition', in H. D. Kurz and N. Salvadori, *Understanding 'Classical' Economics*, London: Routledge: 66–89.

Kurz, H. D. and Salvadori, N. (1999) 'Theories of "Endogenous" Growth in Historical Perspective', in Murat R. Sertel (ed.), *Contemporary Economic Issues. Proceedings of the Eleventh World Congress of the International Economic Association, Tunis. Volume 4, Economic Behaviour and Design*, London: Macmillan, and New York: St. Martin's Press: 225–61.

Kurz, H. D. and Salvadori, N. (2003) 'Theories of Economic Growth – Old and New', in Neri Salvadori (ed.), *The Theory of Economic Growth: A 'Classical' Perspective*, Cheltenham (UK): Edward Elgar: 1–22.

Lowe, A. (1954) 'The Classical Theory of Growth', *Social Research*, 21: 127–58.

Lucas, R. E. (1988) 'On the Mechanisms of Economic Development', *Journal of Monetary Economics*, 22: 3–42.

Marshall, A. (1977) *Principles of Economics*, reprint of the 8th edn (1920), 1st edn 1890, London and Basingstoke: Macmillan.

McKenzie, L. W. (1987) 'General Equilibrium', *The New Palgrave. A Dictionary of Economics*, edited by J. Eatwell, P. Newman and M. Milgate, London: Macmillan, vol. II: 498–512.

Pasinetti, L. L. (1960) 'A Mathematical Formulation of the Ricardian System', *Review of Economic Studies*, 27: 78–98.

Ricardo, D. (1951–72) *The Works and Correspondence of David Ricardo*, edited by Piero Sraffa with the collaboration of M. H. Dobb, Vols I, II, VI and VIII, Cambridge: Cambridge University Press.

Samuelson, P. A. (1959) 'A Modern Treatment of the Ricardian Economy: I. The Pricing of Goods and of Labor and Land Services; II. Capital and Interest Aspects of the Pricing Process', *Quarterly Journal of Economics*, 73: 1–35; 79: 217–31.

Solow, R. M. (1956) 'A Contribution to the Theory of Economic Growth,' *Quarterly Journal of Economics*, 70: 65–94.

Sraffa, P. (1960) *Production of Commodities by Means of Commodities*, Cambridge: Cambridge University Press.

Stirati, A. (1994) *The Theory of Wages in Classical Economics. A Study of Adam Smith, David Ricardo, and their Contemporaries*, Aldershot: Edward Elgar.

Notes

1 This path must, of course, not be identified with the actual path the economy is taking because technical progress will repeatedly offset the impact of the 'niggardliness of nature' on the rate of profits.

2 Real wages may rise, that is, the 'market price of labour' may rise above the 'natural' wage rate. This is the case in a situation in which capital accumulates rapidly, leading to an excess demand for labour. As Ricardo put it, 'notwithstanding the tendency of wages to conform to their natural rate, their market rate may, in an improving society, *for an indefinite period*, be constantly above it' (ibid: 94–5, emphasis added). If such a constellation prevails for some time it is even possible that 'custom renders absolute necessaries' what in the past had been comforts or luxuries. Hence, the natural wage is driven upward by persistently high levels of the actual wage rate. Accordingly, the concept of 'natural wage' in Ricardo is a flexible one and must not be mistaken for a physiological subsistence minimum. See Stirati (1994) and Kurz and Salvadori (1995, Chapter 15).

3 In the more sophisticated conceptualisations underlying the arguments of Smith and Ricardo, higher rates of growth of labour supply presuppose higher levels of the real wage rate. But as we shall see below, the basic logic remains the same: In normal conditions the pace at which capital accumulates regulates the pace at which labour grows.

4 The parallel tendency of the rate of profits and the real wage rate to fall contemplated in the cited passage has recently gained some prominence in the so-called 'New View' of the long-run trend of wages. See, particular, Hicks and Hollander (1977). These interpreters of Ricardo (and of the classical economists at large) feel entitled to superimpose onto Ricardo's analysis the marginalist concept of a 'labour market', conceived of in the conventional way in terms of the confrontation of a demand and a supply function. It should be noted, however, that this concept is extraneous to classical thinking.

5 If $r_{\min}>0$, then $\bar{w}(1+g)=\dfrac{\sqrt{\left[1-s\left(1+r_{\min}\right)\right]^2\bar{w}^2+4sf(L)\bar{w}}+\left[1-s(1+r_{\min})\right]\bar{w}}{2\bar{w}}$

6 It should be noted that Marshall saw reason to suppose that the growth of population depended, among other things, on socio-economic factors and thus could not sensibly be treated, other than in a first step of the analysis, as exogenous (Marshall [1890] 1977, Book IV, Chapter IV).

7 The approach to the theory of general equilibrium in terms of equations was criticised by Knut Wicksell, Hans Neisser, Heinrich von Stackelberg, Frederick Zeuthen, Karl Schlesinger and Abraham Wald and led to the development of the neoclassical theory of general equilibrium in terms of inequalities coupled with the introduction of the Rule of Free Goods (or free disposal assumption); see Kurz and Salvadori (1995, Chapter 13, Section 7).

8 It should be stressed that, contrary to some neoclassical interpreters, in the classical economists the long-period method was not limited to steady states. Indeed, in their analyses (as well as in early marginalist authors such as Knut Wicksell, who still shared to a considerable extent the concerns of the classical economists) the steady state played no essential role whatsoever. See on this the penetrating study of Garegnani (1976).

9 This is the famous critique of that theory put forward in the 1960s; for a review of that critique, see, for example, Kurz and Salvadori (1995, Chapter 14).