Economic Policy Implications of the New Theories of Endogenous Growth: the Role of the State Revisited

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This article makes a short digression on the burgeoning body of literature which are the new theories of economic growth and particularly the endogenous growth theories, with a special interest on their implications for the conduct of economic policy.

These theories mark a significant departure from the traditional neoclassical view of economic growth not only in terms of the theoretical structure but also because of their different significance in terms of economic policy.

In a nutshell, it can be said that a much higher role is attached to the contribution of a broad concept of investment to economic growth and a more active role can be envisaged to State action in promoting economic growth. Moreover, co-ordinated action to spur economic growth, as promoted e.g. through the EC growth initiative, receives additional support from these new theories.

The article begins with very brief reviews of the Harrod-Domar and the neoclassical models (sections 1 and 2) as the new theories bear their inspiration in those former models. Then, section three, a summary presentation of the main features of the endogenous growth theories is made. Section four presents some contributions of these models to the mainstream economic thinking, with particular stress on the role of investment, their externalities, the existence of scale economies at the aggregate level, the consequences of non-linearities and multiple equilibria and the different view they carry to the controversy about the existence or not of a tendency to real catching-up Finally, in section five, an assessment of the key economic policy implications of these models is made, mainly stressing the role of the State to promote investment and also the importance of stabilising budgetary policies.

1. The roots in the Harrod-Domar model

The new theories of economic growth make a departure from the previous neoclassical view exposed in the next section. They both can be seen as a generalisation of the older Harrod-Domar model.

The Harrod-Domar model, Harrod (1939) and Domar (1946), (see for example Taylor (1979) chpt. 6 for a summary presentation) is based on the ex-ante equality between saving and investment. It thus postulates an equalisation between the warranted growth rate with the natural growth rate of an economy. The warranted rate is given by the ratio between the aggregate savings rate and the capital-output ratio. The natural rate is given by the sum of the rate of population growth and the rate of labour-augmenting technical progress (in the sense

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rate of population growth and the rate of labour-augmenting technical progress (in the sense that the amount of labour input provided by a worker tends to increase over time, presumably because of rising knowledge of the job, better education and so on).

A major shortcoming of the Harrod Domar model lies in the fact that it assumes a knife-edge balanced growth path between the warranted growth path and the natural growth rate, where equilibrium is a matter of chance and with no explicit mechanism for a return to equilibrium once this has been disturbed.

Four channels could be envisaged to assure a balanced growth, two relaxing the hypothesis behind the warranted rate and two others related to the natural rate, Ploeg and Tang, (1992). The first channel is through adjustments in the aggregate savings rate arising from changes in the functional distribution of income. This is a feature of the post-Keynesian school sometimes called the UK Cambridge School, associated with the names of Kalecki, Pasinetti, Robinson and Kaldor, among others.

The second channel relaxes the assumption of complementarity between capital and labour, by assuming neoclassical substitution between the factors of production and relies on factor prices being determined in competitive markets. This corresponds to the neoclassical model and the US Cambridge School, associated with Solow and others.

The third and fourth channels arrive at balanced growth through adjustments in the natural rate. The third stresses adjustments in the population growth rate in response to economic and environmental conditions and is associated with Malthus.

The fourth brand hypothesises an endogenous rate of technical progress, and is highlighted by the new theories of endogenous growth.

2. The Solow Model

The neoclassical theory of economic growth dominated the field without contest (but for some years without raising much interest as well) since the mid-fifties to early in the second half of the last decade. It was mainly based on two articles of the Nobel laureate Robert Solow (1956 and 1957). The first of these two articles presents the neoclassical Solow model which, like the endogenous growth theories, can be viewed as an extension of the older Harrod-Domar model. The 1957 article set the accounting framework for explaining economic growth as the sum of technological progress plus a weighted average of the growth of the production factors labour and capital.

The Solow model, sometimes called Solow-Swan, starts like Harrod-Domar with a closed economy where prevails the equality between domestic investment and national saving. However, a neoclassical production function displaying marginal decreasing returns is now assumed.

Its fundamental equation of capital accumulation states that capital deepening equals per capita saving minus capital widening (an attractive presentation can be found in Sachs and Larrain (1993, chpt.18):

$$dk/k = sq - (n+d)\,k$$

where k - capital per worker
q - output per worker
s - saving rate
n - growth rate of total population and the labour force
d - capital depreciation rate

The long-run equilibrium of the model occurs when the capital per worker reaches a steady state, dk/k=0, i.e., when the amount of savings per capita (sq) is just enough to equip the new entrants into the labour force (nk) and to replace depreciating capital (dk).

The model is stable in the sense that higher savings than required for capital widening lead to a capital deepening (dk/k)>0 and conversely, until a new equilibrium is reached.

In the steady state, even without technological progress, q and k constants are compatible with a positive growth of output and the capital stock, which then grow at the rate of population growth n. Integrating "labour augmenting" technical progress in the model (in the above defined sense), the amount of labour can be replaced by "effective labour input" and the equilibrium growth rate of the economy is then n+ , instead of n, where -growth rate of technical progress . In other words, the long-run per capita equilibrium growth rate of the economy is given by the (exogenously determined) technological rate of technical progress.

The growth literature, dominated by the Solow model, hibernated between the mid-sixties and the mid-eighties. Dissatisfaction with a number of insufficiencies of the traditional model, partly raised long ago by the Kaldor (1961) stylised facts, see Boltho and Holtman(1992) and King and Robson(1992), was a major stimulus to endogenous growth theory. Among such factors can be mentioned:

- the growth accounting literature cannot nearly account for the growth of output by the growth of inputs, a large residual (Solow residual or total factor productivity) being attributed to technical progress;

- there is no apparent tendency for growth rates to decline over time, despite rising capital-labour ratios;

- it provides no explanation for what causes the key variable technical progress;

- a stable steady state bears no resemblance to the real world, where profits, investment and economic growth rates have exhibited long term accelerations and decelerations;

- there is no overall tendency in the real world towards convergence in per capita incomes, contrary to neoclassical growth and international trade theories;

- output per worker and the capital labour ratio move one-for-one in the real world, contrary to the traditional theory that limits the later' s contribution to only the share of capital in national income, usually around 30%;

3. The New Theories of Endogenous Economic Growth

Romer (1986), borrowing on the inspiration of Arrow's (1962) learning-by-doing model, deserves much of the credit for the revival of interest in the subject of economic growth.

Arrow supposed that technical progress was a function of accumulated investment but with an elasticity below one. This made growth depend in the end on the expansion of the labour force. Thus, with a stationary population, ultimately decreasing returns to investment limited growth.

Romer also considered capital accumulation to result in learning which cannot be internalised, emulation then raising efficiency in the economy as a whole. His main difference from Arrow's model is that he made the learning parameter equal to at least one. This broke the link between output and population growth as growth can now proceed indefinitely with capital accumulation even in the presence of a stationary labour force.

A burgeoning body of literature has extended this kind of research in many areas. However, a number of common features allow to identify the class of models known as endogenous growth models.

The word endogenous can here be interpreted in at least two ways. First, these models aim at explaining the economic growth process in terms of a rational behaviour of maximising economic agents. Thus, **technical progress** is **not any more "manna from heaven"** like it appeared in the neoclassical model but is now taken as the result of a deliberate search of profit-maximising agents for new products, new techniques, new methods. The engine of growth of the neoclassical model thus becomes **endogenous and related to economic behaviour**.

Second, growth becomes endogenous because of one of the key elements of these models. As it already appeared in Romer(1986), these models stipulate significant positive **externalities** from the investment of one firm to the others. These can include supply of cheaper inputs, new products more fitted to their needs, learning and demonstration effects and in general they change the environment in which a firm operates, by creating new opportunities. Thus, while individual firms face constant returns to scale at any time, **increasing returns** are encountered at the **aggregate** level, which as explained above, allows endogenous or self-sustained economic growth to materialise.

Though some models focus only on some particular kinds of investment, e.g. Lucas(1988) on education, Grossman and Helpman(1990) on research and development, Barro(1990) on public infrastructure, there is no doubt a **broadening of the concept of investment** in these models. This broader concept includes not only machinery and equipment but also learning by doing, human capital, research and development (R&D), public infrastructure and even, as claimed by Scott(1992, pg. 35), "all the cost, in terms of consumption forgone, of changing (hopefully of improving) economic arrangements".

Some examples can be given to stress the importance of external effects. For example, learning spillovers can help to explain why high-technology companies tend to cluster in specific areas, like Silicon Valley near S. Francisco or Route 128 near Boston. Neither France nor the United Kingdom would ever have considered building the Channel Tunnel on their

own. The passes in Switzerland which are crucial to the efficient flow of traffic within the European Community are another example of an external effect of investment .

Knowledge can to a large extent be considered as a public good. For example, it is not much use to be able to speak a particular language if the people that one has professional and social relations with do not speak it. External effects are here very significant. The same applies to computer software. Also in the business life in general for the efficiency of a company matters not only their own resources but very much the environment in which it operates.

4. Impact upon economic thinking

One first consequence of these models is the **much more important role attached to investment**. While in the traditional growth accounting models the contribution of investment was the share of capital revenue in national income (often about one third), these models find a value much higher, sometimes three times higher. Scott(1992) interprets the traditional growth accounting studies as made for instance by Denison(1967) as being fundamentally flawed, and argues that if growth accounting is properly done, there is no substantial growth residual to be explained.

He claims that the contribution of investment to growth should not be in proportion to the change in the capital stock, as is usually done in the growth accounting studies, but in proportion to gross investment. The large difference he finds between the two concepts could thus easily explain the residual in conventional growth accounting.

The change in the capital stock is generally measured in one of two ways: it is either gross investment minus depreciation (giving net investment, which is the change in the capital stock), or it is gross investment minus retirements or scrapping (giving the change in the so-called gross capital stock). Scott contends that neither one of these measures is correct, thus lowering the level of the capital stock and its contribution to growth.

In the first case, the implicit assumption is that each $1 of depreciation reduces output as much as each $1 of gross investment increases output. However, capital depreciates almost entirely because of obsolescence, because of relative price changes, and not because of physical deterioration. But relative price changes which reduce material asset values, make human capital, land or other asset values go up, thus implying just a transfer of wealth and not any net loss in a closed system.

In the second case, he argues that assets are retired or scrapped because they are worthless to their owners, so they reduce output by approximately zero.

Using a simple regression with only two variables, the rate of growth of quality adjusted employment and the share of gross investment in output, Scott claims to have found investment to account for more than one half of USA growth between 1948-73 as compared with Dennison' s estimate of less than one fifth of the growth of non-residential output.

Externalities and increasing returns to scale at the aggregate level open the way to non-linear growth paths and **multiple equilibria**, some of them eventually non-stable in contrast with the neoclassical growth model which had a single and stable equilibrium. King and Robson(1992)

simulated such a kind of model with two stable equilibria (low and high growth) and an unstable intermediate equilibrium. One country could thus stay there only for some time while for example shifting from a high growth to a low growth equilibrium or the reverse.

One main consequence relates to the real convergence/divergence controversy. The **neoclassical growth theory** assumes a single steady state per capita growth rate for which all the countries would converge. Indeed, the long-run per capita growth rate equals the rate of technological progress. Given that technology is universally available and applicable, **convergence of the long run rates of per capita growth** takes place in the long-run. The model's stability properties ensure that the steady-state growth path is achieved starting from whichever level of income.

Diminishing marginal productivity of capital also assures that. Indeed, under this hypothesis, poor countries with low capital endowment face high real interest and profit rates and have good investment opportunities to be exploited. Thus, this gives consumers a stronger incentive to postpone consumption and save, and contributes to attract more capital from outside. As a consequence, this will allow those countries to experience higher short term growth rates until a levelling-off in the profitability rates takes place.
Moreover, though this is not uncontroversial, the neoclassical model is generally interpreted as leading not only to a real catching-up in terms of growth rates but also in terms of the per capita levels of income, as a result, as occurs in the Stopper-Samuelson theorem of the neoclassical model of international trade, of an equalisation in the capital-labour ratios and thus in the levels of productivity.

In contrast, increasing returns to scale and the associated non-linearities point to a **much less optimistic view of the endogenous growth models** as regards real catching-up. While equilibrium market forces such as the above depicted are accepted to be at work, externalities and increasing returns stress the importance of the point of departure. Indeed, these models make the growth rate dependent on the level of initial capital, physical or human, thus opening the possibility of divergent patterns of growth, which is supported by the proof that multiple equilibria can coexist, King and Robson, (1992).

This corroborates the findings of most empirical studies which have shown that real convergence has not occurred when a large sample of countries is considered, though it is found for particular sub-sets of countries like the Western European countries in the last decades.

All this has ignited the interest in explanations of the existence of the so-called "growth clubs". Chatterji (1992) claims to have found evidence favouring mutually exclusive growth clubs. Depending on the initial per capita income levels, countries would tend to cluster in groups and converge to the rate of the leader. Thus, while real catching-up would occur inside any club, no convergence in the levels of income per capita would take place between the members of different clubs.

This would lend support both to the endogenous growth theory (because of multiple equilibrium and divergent clubs) and to the so-called diffusion hypothesis (because of the convergence to the leader). The basic idea of this latter view is that the growth rate of technological progress in any country depends on the gap between the country and the world leader in technology, through innovation and diffusion. Countries with a very small gap to the

leader would be under little pressure to imitate it, while countries with a large gap would be under high pressure to mimic but would lack the ability to do so. As a result, the relationship between the rate of technological change and the distance to the world leader would be inverted U-shaped.

It has to be mentioned however that a country is not condemned to belong forever to the same group. Factors such as strong international aid, political conditions favouring or inhibiting investment, macro-economic policies, strong exogenous shocks, political revolutions, wars, etc. may allow one country to pass to a higher or lower club and eventually to overshoot its new long run growth path (post- Second World War Germany and Japan could be two examples).

From a technical point of view, multiple equilibria may have also awkward consequences in terms of cross-country correlations to test growth theories, as misleading results can be generated from short periods of observation.

5. Economic policy implications

A common implication of these models is that, owing to the presence of externalities, **laissez-faire does not allow a Pareto optimum to be achieved**. Indeed, investors do not appropriate the whole of benefits stemming from their investment, even when (as in the case of a patent to reward inventions) they can charge for part of the contribution their output makes. As a result, the **level of investment** which results from the play of unrestricted market forces is **sub-optimal**.

Externalities leading to a divergence between private and social costs suggest that a case can be made for **subsidies to** promote **investment** in its broad sense, encompassing both physical and human capital and research and development. This contrasts with the neoclassical view, which implies that policy measures cannot influence the long-run steady-state rate of growth (though a rise in the savings rate can raise the level of income per capita).

Moreover, given the higher impact that these theories attach to investment in promoting economic growth, subsidies to R&D, training and schooling programmes and provision of public material and immaterial infrastructure can be expected to have a more significant impact on growth than previously accounted.

Despite this almost straightforward implication, most **researchers** in the field have remained **prudent** to draw strong policy implications. This can be interpreted in the light of two factors.

On the one hand, there remain all the problems associated with the **efficiency of State activism**, as market failures have to be weighed against Government failures. Thus the detrimental effects of higher taxes have to be deducted from the beneficial effects of subsidies to investment (or from higher public investment). Moreover, there are the public-choice problems stressing that the beneficial effects of government action are conditional on benevolent and efficient authorities. In particular, discretionary action may always be vulnerable to rent-seeking behaviour, once pressure groups may hijack in their favour any policy that might help investment.

The second reason for the reluctance to produce strong economic policy statements derives from the fact that **empirical results** so far have been relatively **fragile** (Scott's work is one exception), which also renders more difficult targeting specific growth factors as candidates for subsidisation.

Despite their main focus on supply-side policies and in particular on subsidising investment, these theories can also have a word to say about **budgetary policy, trade and income distribution.**

Most of these studies adopt the assumption of debt neutrality. Under such assumptions, the ratio of government debt to national income does not affect private consumption, does not affect the resources available for investment and does not affect the rate of economic growth.

However, Ricardian debt neutrality may fail for a number of reasons: because of uncertainty about future incomes, because the agents have finite lives (model with overlapping generations), new generations may enter the economy and share the burden of future taxes and because of liquidity constraints.

If the model is enlarged to allow for Ricardian debt neutrality not to hold, a **postponement of taxes** makes private agents not save all of the increase in their after-tax current income, thus consuming more and reducing the amount of resources for investment, which makes the rate of **economic growth fall**.

In an integrated capital market, convergence of interest rates makes the private agents have the same incentives to postpone consumption and convergence tends to hold. However, loose fiscal policies damage more the growth prospects in the home country, because of the accumulation of current account deficits and an accumulation of foreign debt, Ploeg and Tang(1992).

In short, excessive public consumption is detrimental to long-run growth, which is simply a familiar result, though here vested in new clothes.

As to external trade, while the theory of comparative advantage focused on the static gains of specialisation, the theories of endogenous growth look at the impact of trade on the long run rate of growth. International integration can affect the rate of growth: (i)through higher efficiency of economic activity in general and of research activities in particular as it leads to specialisation and prevents duplication; (ii)by promoting the access of a country to the global knowledge stock, both of R&D and technical information; (iii) by affecting the incentives of entrepreneurs in different countries to innovate. However, Grossman (1991), there is here a trade-off since a larger market increases the profitability of those investments but the existence of more rival firms reduces its profitability. Moreover, as part of the spillovers occur at the national level, a larger country has more to gain with trade than the smaller country, a result opposite to that reached by the theory of comparative advantage. Once again there are factors which tend to spread the advantages fairly while others point to an asymmetry in the gains in terms of long run growth.

Trade can still affect growth by altering the intersectoral allocation of resources and so shifting them to the higher or the lower end of innovative potential. In this case as well, a poor country

can experience welfare gains from **trade openness** but see its rate of economic growth deteriorate. Once more, the **new theories** of economic growth **open the way for divergent patterns of economic growth**, in this case through the engine of trade pulling technical progress.

The existence of important market externalities in investment, as a general feature of these models, is also at the centre of Baldwin' s findings (1989) that the Cecchini Report understated the Single Market gains, because if market integration in Europe were to raise the investment rate, then the result would be a sustained rise in the EC growth rate.

Another corollary of these models stresses the importance of a fairer distribution of income and wealth, through generating political conditions conducive to growth-promoting policies. A key argument stresses that in societies with **unfair distribution of income and wealth**, the **median voter** is likely to be poorer and **ask for higher taxes on capital income and higher transfers,** which are **detrimental to economic growth**. Ploeg and Tang(1992) claim that there is strong empirical evidence supporting this view.

The literature has not yet touched upon the legal and institutional framework which some view as important for explaining cross-country differences in growth rates. However, the development of models in which the equilibrium growth rate itself is path dependent means that a wider range of policies, among which macro-economic demand management policies, potentially affect growth. In particular, a policy which could **prevent wide swings in business cycles could raise the growth rate.**

In conclusion, both in terms of demand stabilisation and encouragement of the growth factors emphasised by the new literature, theory seems to be catching-up with practice. And given recent results which show a positive correlation between output growth and various definitions of investment, policy-makers may not have been that wrong. Boltho and Holtman(1992) conclude in this sense with the statement: "While economists may not trust politicians, it would seem that politicians have not trusted economists either - and perhaps with at least as good a reason".

Looking at the measures included in the Community Growth Initiative, and in particular the promotion of public and private investment at the expense of lower public consumption, these appear well supported by the new theories of endogenous growth, though they create more the foundations for a medium/long term stronger growth than for a short term recovery.

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