

HUMAN CAPITAL ACCUMULATION, GROWTH AND DEVELOPMENT

Considerations about the “New Growth Theory” and Applications to Australia and New Zealand

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Abstract: Endogenous growth models, especially those with human capital accumulation *à la* Lucas, are generally presented as: 1. a macro-dynamic version of Walras’ general equilibrium, with micro-economic bases; 2. a break with Solow’s representation, which proved incapable of explaining growth; 3. identifying motors of technical progress and growth by shining light on notions of increasing returns and externalities, particularly in the educational sector; 4. rehabilitating state intervention, especially in education; 5. closing the gap between neo-classic and heterodox issues. However, these five positions, on which a consensus has been built, are erroneous.

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Introduction

In the neo-classical thought –presently hegemonic in economics–, the success of what is known as the “new growth theory”, or endogenous growth theory, has been extraordinary for more than a decade, to such an extent that this mathematical presentation used to determine long-term growth rates has today achieved a dominant, if not exclusive position in long-term macro-dynamic models. Since Romer’s (1986) and Lucas’ (1988) founding models appeared¹, thousands of more or less sophisticated variants have been published around the world, in the most widespread fields, from human capital accumulation to development². To the best of our knowledge, and surprise, the only serious criticism aimed at this theory –which resisted changes in fashion, unlike its next of kin, the short-term real business cycles (RBC) models³– came from authors who are themselves neo-classics, faithful to the Solowian representation. The lightning breakthrough of endogenous growth theory has, on the contrary, and till now,

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¹ Sketched out in Romer’s doctoral dissertation in 1983 and Lucas’ courses in 1985, the theory was built up with the publication of Romer’s (1986) and Lucas’ (1988) canonical models. Rebelo (1990) proposed a simplified version (AK) and Sala-I-Martin (1990) a survey, then a manual, with Barro (1995), contributing to its diffusion.

² On education, see: Lucas (1988). On development: Azariadis and Drazen (1990). Other fields are, for example: infrastructure (Barro, 1988), innovation (Grossman and Helpman, 1989), international trade (Krugman, 1990), demography (Becker, Murphy and Tamura, 1990), or financial markets (Pagano, 1993), to name only a few.

³ See: Lucas (1981), Kydland and Prescott (1982).

encountered no significant resistance from the heterodox schools. These models are generally presented as: 1. macro-dynamic versions of Walras' general equilibrium with a well-grounded micro-economic bases; 2. a break with Solow's (1956) vision, which proved incapable of "explaining growth"⁴ and falling in line with stylised Kaldorian facts; 3. identifying present motors of technical progress and growth by shining light on the notions of increasing returns and externalities; 4. rehabilitating state intervention, particularly in education and social areas; and 5. closing the gap between neo-classic authors and heterodox preoccupations and issues. The aim of this article is to contribute to show that these five positions, on which a consensus has been built, are erroneous. It tries to throw light on the "dark side" of these models, and particularly on the ambiguities surrounding their definition of the state's role in development. In order to achieve this, we will successively analyze: *i*) what endogenous growth is (and is not); and *ii*) the theoretical problems that undermine these new formalizations.

What is endogenous growth? More of the same...

Think the unthinkable? Prerequisite for the treatise

From the neo-classical point of view, the *endogenization of technical progress* basically means that the latter results from decisional behaviour on the part of *private agents*, motivated by profit and reacting to the market's incentives. To be more precise, it would be better to talk about intertemporal arbitration choices made by *the private agent*, since the *aggregate* models of endogenous technical progress growth formulate the "*Robinson Crusoe economy*". In fact, they can all be construed, in one way or another⁵, as *single agent* models, the agent being both producer (with techniques described by aggregate production functions) and consumer (whose preferences are given by utility functions), and needing to resolve choices of control variables and resource allocations between final good production and reproducible capital formation. We should even avoid referring to the *market* here, since the aggregation of agents is only the duplication of a single individual, said to be "representative", making any reference to an *exchange*, therefore to a *price*, absurd. Left unanswered⁶, this problem is preoccupying in the neo-classical perspective of price and capital remuneration determination. In logical terms, reducing the collective to the individual, this postulate of the agent's uniqueness makes any escape from solipsism impossible. Through a strange course of events following the historical victory of the neo-classics in their attempt to dismiss holistic methods in favour of a atomistic, subjectivist vision, which reduces human behaviour to a universal individualistic psychology and excludes socially constructed institutions, their younger generations of macro-economists have had to move away from methodological individualism and fall back on a simplistic and sterile form of holism. For the main current, the most serious implication is that a single agent postulate makes nonsense of the endogenous growth theory's attachment to what used to be the mainstream's strength –as well as the basis for its claim to scientific status–, *i.e.* general equilibrium's axiomatic framework. Calling upon endogenous growth theory models signifies *de facto* renouncing any hopes of solving the key problems concerning the coordination of decisions made by a multitude of agents, as well as any attempt to define concepts such as "economy, exchange, market or prices". Somewhat provocative, but in our opinion inevitable because it touches the heart of these new neo-classical models, this introduction could in itself make it seem unnecessary to carry out a critical evaluation of these models. But in that case, the mystery of the heterodox currents' silence concerning them would remain. We must, therefore, after all, pursue the line of thought further, and go deeper into the formalizations.

⁴ According to Barro et Sala-i-Martin (1995), Solow's model "explains everything except growth"...

⁵ Example: in Romer (1986), it is the hypothesis of firm symmetry that leads us to the single agent.

⁶ See on this fundamental point: Kirman (1992).

What this theory is not? A break with Solow and a return to Harrod

It should be recalled that the neo-classical solution to the overdetermination problem of Harrod's (1939) model, to regulate the system, used endogenization –not of the natural rate (of the Malthusian kind), nor of the propensity to save (post-Keynesian option)⁷, but rather– of the *capital coefficient*, thanks to the flexibilization of the capital-output ratio and factorial substitutability. Curiously as the core of these models contains a linearity, endogenous growth theory operated a return to a *rigid* relationship between capital and output, explicit in the *AK* approach (where $Y = AK$, with the apparent productivity of capital, A , as parametric). It is in this similarity with Harrodian formulae, from which Solow (1956) deviated, that lies one of the reasons for which some commentators found it timely to bring together the endogenous growth representation and Keynesian dynamics –thus unfortunately increasing its popularity among heterodox thinkers. And so one of the keys was lost: these are *supply-side models*, not demand-side, as is too often “forgotten”– and the public policy that they encourage considers investment a flow serving to increment different types of capital, that is to say *supply factors*. In no way endogenous growth theory is renewing the ties with the old Keynesian modelling, nor does it suggest the desire to find a new synthesis⁸. By its methodology and mechanisms, the formulations are unambiguously neo-classical⁹, which should be viewed as a prolongation of Solow, and not a break with him. Formally speaking, only one key Solowian hypothesis needs to be relaxed in order to obtain endogenous growth, that is: the marginal productivity of capital being cancelled to infinity (Inada's third condition) and/or a production function with constant returns to scale (with Euler theorem). The use of a linear macro-economic production function with a single reproducible input, whose productivity does not fall during production, suffices to shed light on long run, self-sustaining growth. The node of this axiomatic system lies in the elasticity of output to the stock of all production factors produced being *at least equal to 1*. To ascertain this, we show that endogenous growth can appear from a production function with constant returns to scale on all factors, whether reproducible or not, as in Solow, by asymptotic convergence towards a macro-economic functional form with unitary elasticity of the product to a composite stock of capital (*cf.* box). The model's originality is triple. 1. By maintaining the convexity of technology, it brings to light endogenous growth in a Solowian augmented framework, and so non discontinuity between this framework and the new theory. 2. Its justification for state intervention comes from a neo-classical hypothesis of flexibility on a segmented labour market: a substitutability between human capital and simple labour. And 3. thanks to human capital accumulation under the impetus of state's public education, there is no need for externalities in order to model an endogenous growth process.

MODELLING ENDOGENOUS GROWTH WITH HUMAN CAPITAL ACCUMULATION IN AN EDUCATIONAL PUBLIC SECTOR

The model integrates two types of public expenditures: 1) of consumption, as an argument of the social utility function; 2) of education and of infrastructure, incrementing the capital stocks, as inputs of the macro-production function. The endogenous growth engine is a human capital accumulation in an educational public sector. The production function of the final good is of the Cobb-Douglas type, combining two C.E.S. functions, symmetrical and bi-factorial: one for capital K , the other for labour L . With constant returns to scale on all factors, reproducible and not reproducible, it is written as follows:

$$(1) \quad Y = \left(\mu_P K_P^{\sigma_K - \gamma_{\sigma_K}} + \mu_G K_G^{\sigma_K - \gamma_{\sigma_K}} \right)^\alpha \left(\frac{\phi_K \sigma_K}{\sigma_K - 1} \right) \left[\Lambda^{\sigma_L - \gamma_{\sigma_L}} \left(\mu_N N_Y^{\sigma_L - \gamma_{\sigma_L}} + \mu_S S_Y^{\sigma_L - \gamma_{\sigma_L}} \right) \right]^{(1-\alpha)} \left(\frac{\phi_L \sigma_L}{\sigma_L - 1} \right)$$

⁷ See: Haavelmo (1956) in the first case; and Kaldor (1957), Pasinetti (1960), Robinson (1964) for the second one.

⁸ The *marriage* between multiplier and accelerator is diametrically opposed to its preoccupations.

⁹ These models suppose, among other things, the permanent full employment of available resources.

where $\phi_K = \phi_L = 1$, $0 < \alpha < 1$, $\sigma_K < 1$, $\sigma_L > 1$, $\mu_N + \mu_S = 1$, $\mu_P + \mu_G = 1$, K_P and K_G being private and public capital stocks, S_Y and N_Y skilled (human capital) and unskilled labour, Λ a Harrod-neutral technical progress.

The C.I.E.S. utility function U to be maximized on an infinite horizon and in discrete time is:

$$(2) \quad \text{Max } U_t = \sum_{t=0}^{+\infty} \frac{N_t \left[\left(\frac{C_t}{N_t} \right)^\beta \left(\frac{G_{Ct}}{N_t} \right)^{1-\beta} \right]^{1-\sigma}}{1-\sigma} \cdot \frac{1}{(1+\rho)^t} \quad \text{u.c. } Z_{t+1} - Z_t = r Z_t + R_t - C_t$$

with $\sigma > 0$, $\sigma \neq 1$, $0 < \beta < 1$, N the number of agents, C and G_C private and public consumptions, R the current revenue, Z the stock of assets, r the interest rate on these assets, ρ the rate of time preference.

The resolution of the optimization program, thanks to an Hamiltonian, gives the growth rate:

$$(3) \quad \frac{C_t}{C_{t-1}} = (1 + n_t) \left[\left(\frac{1+r_t}{1+\rho} \right) \left(\frac{G_{Ct}}{N_t} \right)^{(1-\beta)(1-\sigma)} \right]^{\frac{1}{1-\beta(1-\sigma)}} \quad \text{with: } r_t = (1 - \tau_T) \frac{\partial Y_t}{\partial K_{Pt}} - \delta_{Kp}$$

and where $n_t = N_t / N_{t-1}$ and τ_T is the total taxation rate.

Human capital S is increased by an investment I_E , output of the educational public sector:

$$(4) \quad I_E = \xi_E \left(\mu_N N_E^{\theta_L} + \mu_S S_E^{\theta_L} \right)^{1/\theta_L} \quad \text{where } S_t = S_{t-1}(1 - \delta_S) + I_{Et-1} \quad \text{with } S = S_Y + S_E \text{ et } \tau_{Et} Y_t = w_{St} S_{Et} + w_{Nt} N_{Et}$$

where ξ_E is an efficiency parameter, δ_S a depreciation rate, τ_E the tax which finances the wages w_S et w_N of skilled (S_E) and unskilled (N_E) workers allocated to education.

The dynamics of the private and public capital stocks are given by:

$$(5) \quad K_{Pt+1} = K_{Pt}(1 - \delta_{Kp}) + I_t \quad \text{and} \quad K_{Gt+1} = K_{Gt}(1 - \delta_{KG}) + G_t \quad \text{where } \tau_{It} = G_t / Y_t \text{ finances infrastructure.}$$

The account equilibrium of the economy is:

$$(6) \quad I_t = (1 - \tau_C - \tau_E - \tau_I) Y_t - C_t.$$

The factorial contributions to GDP growth can be approximated through:

$$(7) \quad \frac{\dot{Y}}{Y} = \left[\mu_P \left(\frac{K_P}{K} \right)^{\sigma_K - \gamma_{\sigma_K}} \left(\frac{\dot{K}_P}{K_P} \right) + \mu_G \left(\frac{K_G}{K} \right)^{\sigma_K - \gamma_{\sigma_K}} \left(\frac{\dot{K}_G}{K_G} \right) \right]^\alpha + \left[\mu_N \left(\frac{N}{L} \right)^{\sigma_L - \gamma_{\sigma_L}} \left(\frac{\dot{N}}{N} \right) + \mu_S \left(\frac{S}{L} \right)^{\sigma_L - \gamma_{\sigma_L}} \left(\frac{\dot{S}}{S} \right) \right]^{1-\alpha} + \left(\frac{\dot{\Lambda}}{\Lambda} \right)$$

Endogenous growth appears under three conditions: *i*) skilled and unskilled labour must be substitutable to alleviate the constraint of non reproducibility of simple labour and avoid the third Inada condition in the composite labour function; *ii*) the human capital growth rate must exceed the Solowian natural growth rate (demographical and technological) to determinate the long-term growth rate of the labour aggregate and impulse the convergence of the macroeconomic production function towards a form with constant returns to scale on reproducible capital stocks only; and *iii*) the rate of time preference must be inferior to the long-run interest rate. This can be written mathematically as: *i*) $\sigma_L > 1$; *ii*) $I_E/S > n + g_A$; *iii*) $\rho < r$.

Note: For more details about the mathematical and algorithmical structure of this model, see: Herrera (1998).

Theoretical thought or mathematical tools? Endogenization mechanisms

When studied close up, endogenous and Solowian growths use similar formalizations. Yet, in the literature, endogenization processes often push aside a hypothesis of *technological convexity* (or concavity of the production function, with decreasing marginal factorial returns and globally constant returns), which is generally translated by the introduction of increasing returns, *via* externalities. In this manner, a purely *endogenous* source of growth is obtained, *i.e.* an internal motor of the economic system mobilising only price mechanisms –save on the prerequisite. So the long-run rate of growth depends on endogenous technical progress, which itself depends on accumulation variables intrinsic to the model: capital and/or labour factors. The accent is often placed on the presence of increasing returns –a sufficient, although not necessary condition to endogenization– to the extent that these non convexities play a crucial role within the micro-economic corpus: their incorporation implies the invalidation of welfare

theorems, by breaking the equivalence between Pareto optimum and competitive equilibrium. The stakes are high for the orthodox line of thought in this debate: the possible existence of *infra*-optimal equilibria calls the question of the state meddling in the allocation of resources. It is consequently not by chance that the neo-classics placed increasing returns at the center of their formalizations –when they tried to answer the criticism aimed at Solow’s model relative to its non conformity with empirical verification¹⁰ or with stylised Kaldorian facts¹¹, and to its incapacity to understand technical change within its optic of convergence towards a steady state¹². A solution preserving both perfect competition and balanced growth can be built by retaining returns external to the firm¹³, in reference to Marshall’s industrial organisation: optimization is achieved with increasing global returns (allowing endogenous growth) and constant individual returns (saving competitive equilibrium). Although the implications of these external Marshallian effects were identified very early on¹⁴, getting around imperfect competition posed serious technical problems¹⁵. The contribution of the new growth models – especially Romer’s (1986), in which externality is derived from capital investment by a traditional learning-by-doing process– is to have resolved these difficulties –mathematical and not theoretical¹⁶– accompanying the macro-dynamic incorporation of non convexities.

A farewell to pure public good? Origin and originality of the new models

The main objective driving endogenous growth authors in their efforts to grasp technical progress was openly opposed to the concept of technology as a *public good* –which was Solow’s (1956) concept, limited by the tools at his disposal. “*What endogenous growth theory is all about*, explains Romer (1999), *is that it took technology and reclassified it, not as a public good, but as a good which is subject to private control*”¹⁷. Yet, the idea of public good does not necessarily imply “heaven-sent” technical progress, “fallen from the sky” or exterior to economic spheres, simply a function of time; it can also lead to it being seen as boosted by the state and *publicly provided by it*. Romer’s (1986) choice to classify technology as a non-rival good, partially excludable –so privately appropriable and remunerable–, was certainly realistic, given the historic context of the time. However, it was not neutral in such normative representations: it excludes the state from any direct role in the production of technology, thereby reducing its action to indirect intervention aimed at encouraging private investments on the market in this field. This is how neo-classical macro-economists called up the concepts of public micro-economics, thus moving their center of concern towards the relationship between innovation-externalities-increasing returns-market structure in imperfect competition. In Romer’s (1990) model, endogenous growth stems from the progress of knowledge, linear in its stock, issuing from R&D activity on the competitive market where innovations (*designs* for production) are protected and remunerated by an exclusive patent system. And the heart of

¹⁰ The unexplained residual in studies *à la* Denison (1967) is a “*confession of ignorance*” (Arrow, 1962).

¹¹ The existence of international divergences of productivity growth trajectories is the only stylized fact that Solow (1972) admitted as irreducible to his explanation of growth.

¹² As increasing returns are incompatible with perfect competition, Solow needs an exogenous motor for growth, independent from individual arbitration choices (savings behaviour).

¹³ The participation of firms in a given activity causes an increase in market size.

¹⁴ Arrow’s (1962) learning by doing already pointed to an access route to endogenous technical progress, by making the total productivity of factors dependent on capital-knowledge dynamics.

¹⁵ Arrow and Kurz (1970), as Sheshinski (1967) before them, only abandoned the idea of trying to resolved “*dynamic Walrasian equilibrium*” in increasing returns (*positive*, balanced *per capita* growth, in the absence of exogenous technical progress) due to purely technical difficulties.

¹⁶ Resolving growth paths with saddle point and system of second-degree differential equations...

¹⁷ “*What I wanted was a way to have some private provision. I wanted to capture the fact that private individuals and firms made intentional investments in the production of new technologies... there is some private control over technology, there are incentives that matter. I worked hard at the mathematics of that...*”.

Lucas' (1988) model, incorporating knowledge into human capital, resides in the fact that by escaping Inada's third condition, avoiding the extinction of growth, it uncovers a form which insures the linearity of the accumulation of individual competencies in the level of individual human capital, in such a way that the externality carried by this capital modifies the degree of homogeneity of the production function of the final good, linking it to increasing returns, without itself actually being the cause of endogenous growth¹⁸. But the Becker-type formation process depends entirely on an allocation decision made by a private agent, whose results are privately appropriated by him, and him alone. So, it is based on a peculiar way of thinking, in many ways similar to the one animating the tenants of the new classical school –that the liberal legacy is claimed by the model's designers (Adam Smith in particular)¹⁹–: that of a *marketization* of knowledge along with its diffusion, but addressing only the *lone individual*.

A critique of endogenous growth: theory and ideology

Are the heterodox thinkers subjugated or subsumed? Inside the whale's belly

By putting to work their new optimization techniques, the mainstream theoreticians provided themselves with the means of investigating subjects (such as innovation, knowledge, training...) that had for a long time been forsaken in macro-dynamics²⁰, and left to the post-Keynesian (Kaldor, 1957) or Marxist (Goodwin, 1967) heterodoxies²¹. The modernization of Solow's old instruments, by a series of clever techniques, now makes it possible to integrate these subjects –whose theoretical and practical implications were evacuated as a block by a more than slightly brutal solution of the problems of growth instability and full-employment unlikelihood– into the heart of the analytical neo-classical framework, by a methodology once purged of any heterodox “impurity”. One of the symptoms of the crisis facing economics under neo-classic hegemony is the fact that the endogenous growth models' lack of originality was underlined very early –by Solow (1987) and others²²–, yet these declarations remained unnoticed by the new generations of model builders and in no way slowed their torrential flow of publications. Endogenous growth is indeed seductive, particularly for heterodox thinkers: it “explains” *per capita* GDP growth and tolerates path divergence from one country to another; it provides Rosenstein Rodan's *Big Push* model with multiple equilibria; it concentrates on knowledge; it formalises Schumpeter by stochastic processes, as well as cognitive capitalism with knowledge externalities; it can be “applied” and gives rise to recommendations as far as

¹⁸ In the absence of externalities, Lucas' (1986) model approaches an AK type diagram.

¹⁹ Example: increasing returns which Romer (1990) calls upon, corresponding to a widening of the range of capital goods inputs, seems to evoke a deepening of the Smithian labour division stretched to the inter-firm dimension (*à la* Young, 1928). One of Smith's mentors, Ferguson had stated in his *Essay on the History of Civil Society* (1767) that the art of thinking, at a time when everything was separate, can in itself form a profession. The neo-classics present themselves as classics' heirs and consider any break with them –utility-value, short-run equilibrium through price adjustment, methodological individualism– as the growing pains of their science.

²⁰ With few exceptions: *cf.* the optimal growth model provided by Uzawa (1965), in which technical progress is derived from education by improving labor productivity.

²¹ These thoughts preoccupied the greatest thinkers. “*Education is the most difficult problem facing man. Enlightenment depends on education, and in turn, education depends on enlightenment*”. Kant situates the perfecting of human nature at the end of an infinite education process. Present education is produced by that which came before and can only become better if it is already engaged in improvement. By entering into this spiral, it is necessary to isolate an educator who himself has been educated. By refusing divine intervention, Kant provides an identical logical alternative. Empirically immortal, understood in the light of its inter-individual relations, lit spontaneously by a community culture, the human beings are capable of developing *ad infinitum* man's attempts to use reason. Lucas' “*dynasty*” solution is quite different: it is an individualistic fiction.

²² See: Solow (1987). The counter attack remaining faithful to Solow upholds that the old neo-classical model retains the power to explain, provided it is amended (Mankiw, Romer and Weil, 1992).

state intervention in research and education is concerned; thereby, it fascinates Keynesians, institutionalists... The expansion of the mainstream was not limited to the multidimensional annexation of social science concerns over the past few years; it also allowed it to conquer the heterodox schools that are the most compatible with its way of thinking, thanks to endogenous growth theory in particular. Nevertheless, its models remain enclosed within the limits of the neo-classical program and condemn themselves *de facto* to encounter difficulties they are not in a position to resolve in any *endogenous* way, by calling upon the internal resources of the methodology they rely on.

The absence of a micro-foundation or the wanderings of the single agent

Endogenous growth macro-economists pretend to draw the micro-economic foundations of their models from the axiomatic framework of the theory of the general equilibrium of markets. According to Romer (1999), in the same way that the Solow model “*persuaded economists to take general equilibrium models seriously*”, these macro-dynamic formalizations appear to make “*the connection between what we did in macroeconomics and what the rest of the profession had been doing in general equilibrium theory*”. In spite of its narrow vision of the scientific community –the micro-economists on one side, and the macro-economists on the other, all *neo-classics*–, which avoids the confrontation of key theoretical questions at the heart of our discipline, he is not unaware that exogenous or endogenous growth models from the mainstream are not truly any different from representations of intertemporal choices with a representative agent. This is how the crucial issues of action aggregation and decision coordination are emptied of all their weight, as they are given as resolved *a priori*, while the characteristics of perfect competition are constructed – by the association of price trajectories to those of quantities or by postulating permanent full employment. The widespread idea that these are true dynamic general equilibrium models²³ is false. These models do nothing but import and revitalise key concepts from micro-economics, such as “externalities”, bringing about a growth in returns and technical progress but presenting no collective dimension. Why should the effect a single agent has on himself be considered an “externality”? What are the *social* projections of firms’ external effects under the hypothesis of their symmetry? In what way does Lucas (1988) capture any sort of alterity when he employs the notion of “*dynasty*”, substituted with the agent’s finite nature, and whose only reason for being is to justify his rather unintuitive hypothesis concerning the linearity of the process of *individual* human capital accumulation? Why would strictly identical agents seek to trade and to fix prices? This simply makes no sense –or no more than calling a Robinson Crusoe economy a “*society*”²⁴. It is in this way that it should be understood that what is considered to be the “new” growth theory as well as a scientific progress corresponds in fact –as far as can be seen, and given its lack of micro-economic foundations– to a step backwards, in neo-classical terms themselves. The origin of this strategic withdrawal into the domain of the single agent is to be found in the theoretical impasse issuing from Sonnenschein-Mantel-Debreu’s (1973) indetermination or impossibility theorems.

²³ The so-called “*dynamization of Walras’ general equilibrium*” takes place in an economy where the single agent’s intertemporal optimum choices correspond to *per capita* quantities resulting from the calculation of a “multitude of individuals” on perfectly competitive markets.

²⁴ These *robinsonnades* can be found in Bastiat (“*our Robinson*”), Jevons (“*isolated individual*”), Menger (“*suffering from short-sightedness on a desert island*”), Böhm-Bawerk (“*in his isolated cabin in the middle of the virgin forest*”)... “*Naturally, Robinson’s choices are governed by his search for individual benefit... the optimal behaviour postulate, central to economics*” (Barro, 1993). Walras (1988) was however slightly more subtle: “*one should not simply state that the individual is the foundation and the ends of any society without immediately adding that the social state is also the foundation and the environment of all individuality*”.

The “present absent” state or the planner without planning

One of the weightiest internal incoherencies associated with logical reasoning pertaining to the single agent concerns the concept of the state used in the endogenous growth theory. In fact, the state is grasped in a contradictory manner as being, at the same time, both present and absent. Technically, Romer’s (1986), Lucas’ (1988) and Barro’s (1988) models exhibit *infra*-optimal competitive equilibria, due to their decision to integrate externalities linked to knowledge, training or infrastructure, thereby creating a disjunction between centralized and decentralized equilibrium growth rates. The state is therefore *present* –even omnipresent– in these models that systematically justify a recommendation for public intervention in order to re-establish Pareto optimality, usually through subsidies and lower taxes in favour of private agents powering the long-run growth motor. But at the same time, the state as an autonomous entity is itself *absent*, since by construction it can be nothing other than the single agent *itself*: the state institution is taken into account through an optimisation program, said to operate in a “centralized economy” in which the agent –who other, he is *alone?*–, although spontaneously incapable of reaching optimal competitive equilibrium, is able to internalise the external effect by changing himself suddenly into a “*planner*”²⁵. To be fair, the new models should be given some credit for having extirpated the neo-classics from their tense attitude on this subject, by helping them to cease to view the state as the sole disturber of price adjustment mechanisms. It may be recalled that they spent entire decades frozen in total hostility towards any public intervention, due to the fact that they based their analysis on efficient financing rather than the impact on growth. This orientation led them to underline public spending generating crowding-out effects, operating to the detriment of private savings, since financing it implied negative consequences²⁶, *via* money issuing, public loans and/or taxation²⁷. The *new classics*’ ambition –expressed through Lucas’ rational expectations or the Ricardian equivalence revisited by young Barro– was to prove the uselessness of Keynesian policies, was it not? Given new conditions, this project is underway in the new neo-classical models constructed to weaken the idea of public good, defining taxation as financing public spending that contributes to the stimulation of the private accumulation of the engine factor of GDP growth, and focalises on supply components and on the calculation of a fiscal optimum *à la* Laffer. Stripped of institutional and social content, the neo-classical growth planner without planning –logical nonsense– is the means of theorising a re-regulation of the economy by the market.

The undetermined heart of growth or the (well-kept) secret of capital

Before spelling out this thesis, let us pursue the internal criticism. On closer inspection, the neo-classical models, from Solow to Romer, truly seem to have persevered in their being, that is to say in their inability to model technical change, relying on a striking oscillation of the determination of the heart of growth in their new representations. The *AK* model, with its ultra-simplified unifying functional form, is no more likely to reveal anything conceptual about this *K* engine of self-maintaining growth that it is, than the numerous generic variations proposed concerning total factor productivity endogenization. The “capital” in question can in fact correspond to any factor subject to accumulation (knowledge-capital, human capital or infrastructure capital...), provided it is imaginable to write the appropriate mathematical relationship positively linking this thing to productivity²⁸. It has been said that these models

²⁵ See: Sala-I-Martin (1990), Barro and Sala-I-Martin (1995)...

²⁶ There are abundant examples. Particularly: Feldstein (1974), Stiglitz (1978), Becker (1985)...

²⁷ Respectively: Blanchard and Fisher (1989); Tanzi (1990); Friedman (1976).

²⁸ It could be corruption (if we accept, as do certain neo-liberals, that bribes stimulate labor productivity), a herd of zebus (Madagascan version, where the animal is capital) or symbolic cultural capital (Bourdieu style)!

are rich; it should instead be said that they are *too* rich, because there are several (that is to say always too many) candidates to explain growth. Yet the conceptual foundations of *lato sensu* capital are not explored by the orthodox schools –if they are explorable. These models can incorporate everything precisely because their methodology incorporates nothing: operating by plundering and transferring, it is nothing but theoretical *conquista*. Do the neo-classics remember the traumatic events of the polemic over the two Cambridges which proved to be their Waterloo? As hegemonic in the field, they now have the means of covering it up. We view this critique as the opportunity to create links with the radical heterodoxies of the past, daring to attack mainstream pillars²⁹.

Renouncing realism or the neo-classics' ad hoc-ness

All things considered, void of any conceptual basis, the discretionary choice of factors whose accretion formally allows endogenous growth is nothing more than a further level of *ad hoc-ness*³⁰, superposing itself onto the ones already characterizing these new neo-classical models. Some examples: the hypothesis of agents' symmetry is a condition for aggregation; the incorporation of externalities has neither theoretical reference nor definition; the knife-edge growth path is indispensable to balanced growth if it is to be both inexhaustible and non-explosive; the technology in the accumulation of knowledge is linear... With such a degree of *ad hoc-ness*, the neo-classical vision tends towards arbitrary and intrinsically disappears as a theory, in the sense that it abandons any hope of telling us anything useful concerning the reality of our life within society. The criticism also applies to the ideological content of the concept of equilibrium –a short-term one through price adjustment, substituting itself to the classical long-term equilibrium with quantity adjustment–, translating imaginary, mystifying social relations, in opposition with history and artificially linked to physics³¹. It cannot be said that these models are of no interest, at least for those who are interested in economic science-fiction –but not in science. Abandoning realism did not shake the Lucas (1981) of real cycles: “*The demand for ‘realism’ in an economic model prejudices its potential for thinking about reality. Any model sufficiently elaborate enough to provide clear answers to the questions asked will necessarily be artificial, abstract and manifestly ‘unreal’*”. How could it embarrass the Lucas of endogenous growth? We feel almost sorry for Solow (1986): “*I would tend to believe that the attempt to build economics into a pure and axiomatic science is destined to fail. It is my impression that the most brilliant people from the profession proceed as if economics was a physics of society, as if a single, universally valid model existed that need only be applied*”. Does neo-classic salvation reside in empirical investigation –in a level of abstraction often comparable to theory–? Certainly not. Let us take the example of education. Econometric tests using *catching-up* equations and/or cross-sectional data *à la* Barro (1991) are not robust and give biased results. As far as improved panel econometric techniques are concerned, they often lead to a loss of any positive effect produced by education on growth – that is if they do not find a negative impact³². The problems are particularly noticeable in the

²⁹ Read J. Robinson: “*The production function has proved a very useful tool for making people stupid. Students are taught that $Q=f(L,K)$, where L is labour and Q production, that we quickly move on to the next part in the hopes that he will forget to ask what type of unit is used to measure the stock of capital. Before he can ask this question, he will have become a professor. The habits of intellectual laziness will have been transmitted...*”.

³⁰ *Ad hoc*: not derived from the axiomatic and/or destined to produce the result aimed at by the model.

³¹ Where did the neo-classic attachment to this paradigm originate? “*Not from the characteristics of the real economy, that bears no resemblance to the equilibrium. Nor from mathematics, which have so far offered no confirmation of these beautiful properties that people attempt to demonstrate. It is ideological, the reflection of an image of economic relationships established a priori, as we imagine things should be. It is difficult to hide the weakness of this method's results. What remains is no longer scientific, but mythological*” (Israël, 1996).

³² See here: Benhabib and Spiegel (1994) or Pritchett (1999). Also: Dessus and Herrera (2000).

articulation between theory and empirical investigation (disconnecting one from the other, difficulty to extract specifications derived from endogenous growth models being tested econometrically), as well as in its confrontation with statistics (very rough measurements of capital, indicating that data are badly adapted to the phenomena being studied).

Compatibility with neo-liberalism or the state vs. the public service

We are now in a position to grasp the key: the reactivation of state intervention –on supply– newly advocated by the neo-classics operates by negating the nature of “free” goods, public and non remunerated, of fundamental components of common human patrimony (such as knowledge), which are formally likened to several types of capital, thus marketized and made profit-oriented. The state is used only to help and accelerate accumulation, with the aim of private appropriation and individual remuneration. Although it gives way to quite different interpretations as far as economic policy is concerned, often leaving the choice of institutional forms open, the endogenous growth theory is not however neutral. Romer-sort formalizations of innovation remove knowledge from the public sphere in an economy where production is closed in by monopolistic and negotiable patents and where “*the signals sent by the market play the key role*”. Referring to reproducible human capital based on the individual’s decision to invest in his own training, Lucas-type education goes against the will of the state to develop public education³³. Not that the latter cannot be modelled within an orthodox framework: our model achieves this (*cf.* box)? But its properties do not escape the problem raised here³⁴ and make it impossible to model the public educational sector other than by forcing it to submit to competitive rules, making it function according to a price system, as if it were an educational market, although receiving state subsidies. This underlines the compatibility of these models with the neo-liberal project. The authors of endogenous growth knew how to take advantage of the ambiguous nature of their interventionist conclusions not to prone an extended and improved public sector, but to have the state support the re-regulation of the markets of the knowledge-merchandise (research, education, training, information, telecommunications...) by the dominant world owners of capital, *i.e.* finance. The message is in line with the attitudes of international organisations such as the World Bank (1999), for whom “*knowledge markets*” enlightening “*the existence of one and all*” address the individual first³⁵. Or else, in the era of neo-liberal globalisation, the capitalist state goes into action against the public service.

Why does this theory exist? To save capitalism from ultra-liberalism

It remains to be seen why these models appeared at such a precise time and place –in the United States, at the end of the 80’s, under the impetus of writers committed to a cause– and how their links with the present transformation of capitalism can be understood. Endogenous growth theory was born in the heart of the U.S. intellectual establishment that brought itself to the forefront years ago by engaging in the most decisive attack against Keynesian therapies. Except perhaps for Romer (and even that remains to be proven)³⁶, its supporters have never

³³ Is the absence of any formalization of a public educational sector an ideological choice? Human capital theory (Becker, 1964) was also a war tactic against free education.

³⁴ Examples: resorting to the representative agent (or planner) in decentralized equilibrium (or respectively centralized), regardless of the definition of the choice of the growth engine; *ad hoc*-ness of the hypothesis of substitutability between skilled or unskilled labour, based on a “*belief*”, to say it with Hamermesh (1986)...

³⁵ Measures advocated are: 1. competition and privatization as remedies for the shortcomings of state monopolies blocking supply; 2. dismantling or putting into trusteeship of public research (“*expose public R&D to market’s influence, transform research institutes into joint-stock companies*”); 3. private education (“*to encourage the development of education, the best way of proceeding being to support the private sector’s action*”).

³⁶ Disciple of Lucas in Chicago, Romer (1999) is mainly concerned with maths: “*Words are often ambiguous*”...

had any complexes about flaunting their neo-liberal beliefs; whether it be Barro (“we’re all Friedmanians now”), Sala-i-Martin (“liberalism is not a sin and is in fact virtuous”), or Lucas (“state means social injustice”)³⁷. The name of the latter, henceforth linked to the model of positive effects of human capital on growth and to policies in favour of education, still figures among the list of economists, beside those of two of his teachers, Friedman and Becker (and others: Buchanan, Krueger...), who “*enthusiastically endorse the economic plan put forth by G. W. Bush*” in 2000³⁸. Yet the part of this programme devoted to education is anything but a more egalitarian, fair public educational system for the United States. It translates the project of a neo-liberal state: to promote privatisation of education, to insure the control of the labour division by capital, to segment the workforce and to accentuate knowledge polarization, under the *ideology* of rational, efficient, and free individual choices³⁹. The neo-classical theoretical renewal happened at the height of Reaganomics, at a time when the productivity slowdown in the U.S.A. was being watched with concern, along with the “*miracle*” of the Asian catching up, in which the role of the state was decisive to promote infrastructure, training, R&D... These neo-liberal authors understood the imperious need to soften their past anti-state attitude, too obtuse, to *save capitalism from the excesses of ultra-liberalism*: the state should intervene, not in order to modify the structure of capital for its own benefit, but to extend the private appropriation of public goods; not to boost demand, but to stimulate supply; not to plan the economy, but to support thanks to public funds the re-regulation of the markets by capital, serving the interests of the transnationals that remain the masters of the game. Faced with the recent financial crisis, the lucid neo-liberals did not react differently: one ought to “*regulate financial flows*” (Stiglitz) against “*market extremism*” (Soros)! Ultra-liberalism is reserved for the South, where it attacks the state’s regal powers: delegating out defence, privatising tax collection, dollarizing... National sovereignty should be limited there to paying foreign debt.

Applications to the educational sector in Australia and in New Zealand

Australia and New Zealand are presently, with the United States, the leading countries which prone liberalization and deregulation of the markets of higher education, within the General Agreement on Trade in Services (GATS) administrated by the WTO, and which are the most deeply involved in this way. Under strong pressures of transnationals, privatization of education is gaining grounds in these two countries, including through its new institutional forms, such as privatizing funding, driving management towards corporate-sort governance, contracting out of services, bringing in profit-making companies to run schools, introducing competition on staff and salaries bargaining, organizing off-shore campus by “coupling” agreements between private universities⁴⁰, etc., but also thanks to “endogenous-growth type” programmes of public funds destined to support private education by grants, tax exemptions or start-up financing. The Australian government chose early to fund massively the private establishments (Church schools...) –while restricting the budget of the public ones. This trend accelerated in the last years. Similarly, since 2000, the amount of government funding to the private tertiary sector increased sharply in New Zealand. More and more, education tends to be considered as a private good –at one time consumable item, at another time accumulating capital, both to be paid for by the individual agents–, subject to commercial exchanges on markets of non-governmental schooling, but heavily subsidized by the government. In these

³⁷ See, respectively: Klamer (1988), Barro (in *Business Week*, July 13, 1998), Sala-i-Martin (personal website).

³⁸ See the *Ludwig von Mises Institute* site: <http://www.mises.org>.

³⁹ Examples: public funds for vouchers to attend private schools or receive services from private providers, tests scoring, system of penalties for “*disruptive students*”... See: Bush (2001).

⁴⁰ Today, one third part of the 80,000 fee-paying foreign students registered in the Australian universities is studying in such off-shore private establishments, mostly in Singapore and Malaysia. See: World Bank (2002).

conditions, tools frequently used are: increasing fees, student loans, voucher schemes... The Australian Higher Education Contribution Scheme (HECS) is often quoted by the OECD as a model, allowing the government to save a significant part of the costs of higher education. In New Zealand, the number of tertiary students increased by more than 25 percent from 2001 to 2005, while the number of them receiving an allowance dropped by almost 25 percent in the same period. A system of student loans, reimbursable by monthly bills, was introduced to pay for fees. Nevertheless, the risks of these tendencies to privatization of education as well as to discrimination by the state against public schools in favour of private ones are to produce a disincentive for people to study and to encourage division amongst children based on social-economic criteria and/or on particularisms, such as ethnicity, creed, or country.

Conclusion

We have tried to show that the endogenous growth models constitute: 1. a theoretical regression, from the mainstream point of view itself, from which they have cut themselves off by falling back on the absurd hypothesis of the single agent, thus abandoning any thought about agents' decision coordination; 2. an internal extension of Solow's vision of growth, with which they are methodologically and mathematically compatible; 3. the continued inability of the neo-classics to define and measure capital; 4. the neo-liberal project's ethical, mystifying support, in the neo-classical theoretical sphere, calling upon the state to privatize the public sector; and 5. the absorption of "soft" heterodoxies in search of techniques and respectability. It is not simply their internal incoherence and the absence of scientific basis that disqualifies these models; what worries us more is the ideological function and the aims for society that their methodology and conclusion uphold.

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