Essay on International Financial Crisis
and Endogenous Growth Theory

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Abstract

This paper reviews endogenous growth theories in the light of the modern reality. It seems that economies which are similar in technologies and preferences are expected to converge to the same level of per capita income. The question "How are repetitions of financial crisis best predicted?" is still not answered. It also seems that combining of these models in a singular theory of business coexistence between neo-classical growth models during "Peace time", and unpredicted forces and engines, which move economics during "Crisis time", provide a treatment solution.

Keywords: Business Coexistence, Endogenous growth theories

JEL classification: E20, G10, M21

1. Introduction

The global financial crisis, brewing for a while, really started to show its effects in the middle of 2007 and into 2008. Around the world stock markets have fallen, large financial institutions have collapsed or been bought out, and governments in even the wealthiest nations have had to come up with rescue packages to bail out their financial systems. Until the 1980s, long-run productivity growth was interpreted mostly with exogenously driven explanations. In the mid-1980s, a number of growth theorists became dissatisfied with this approach. "This dissatisfaction motivated the construction of a class of growth models in which the key determinants of growth were endogenous to the model" states Barro (1995, p.38), led to determination of the long-run growth within the approach, more than some exogenously growing variables. The neo-classical growth model, based on works of Solow (1956) and Swan (1956), has seen a revival of interest with the appearance of the new endogenous growth theories that have challenged its predictions as well as its consistency with the new stylized facts of growth.

The main prediction of the neo-classical model, supported by the refinements of Cass (1965) and Koopmans (1965), is that economies which are similar in technologies and preferences are expected to converge to the same level of per capita income. If technologies exhibit constant return to scale and declining capital productivity, the per capita growth rate tends to be inversely related to the starting level of output or income per capita. Therefore, an initially poorer economy with a lower starting value of the capital/labor ratio tends to grow faster in per capita terms than a richer one. Since the growth rate would fall to zero as capital per worker increases, a related prediction of the standard neo-classical model is that internal growth is feasible until the capital stock reaches a steady-state. When it is reached, the growth rate of income per capita is independent of internal factors of growth, such as the rate of saving and investment, and depends only on the rate of exogenous technological progress. On the assumption that the latter is a public good, available to all, the neo-classical model predicts that GDP per capita in all countries will grow at the same rate.

Economic theory, which was originated essentially under the impact of economic development, indicates the rise of an endogenous, self-sustaining mechanism of cumulative economic growth. This mechanism hinges on entrepreneurial initiative which, chiefly through innovative decisions, harnesses the resources of technology, in the broadest sense, focuses on how to serve, making them one main basis of profitability and competition. The studies on endogenous growth that followed Kaldor's (1960) function of technical progress, Arrow's (1962) idea of learning by doing and Shell's (1967) specification on the inventive sector devoted to produce knowledge represent the most advanced answer to some of these weaknesses. Romer (1990), Grossman and Helpman (1991) have enriched Shell's intuition by linking the appearance of new intermediate products and quality based innovation to the development of knowledge.

All the above models explain endogenous growth through the addition of some particular factors in the production function. Hence, they consider production simply as the transformation of given inputs into output, ignoring that modern dynamic economies are characterized markedly by repeated shifts of production functions due to innovation, as well as by uncertainty and the entrepreneurs' discovery role.

2. Models of Long-Run Growth and Endogenous Technological Change

The long-run growth model is based on the suggestion that growth rates can be increasing over time (Romer, 1986). For the aggregate growth model, over time, states Romer (1986, p.1002), "...wage rate and capital-labor ratios across different countries are expected to converge". The absence of technological change, lead to convergence per capita output with a steady-state value with no per capita growth. Convergence in the alternative endogenous growth model is defined as such models that can generate positive steady state per capita growth rates of the main economic variables k, c and y. This model, in which per capita income can grow indefinitely, departs from the traditional theory in some important ways (rate of investment, rate of return on capital, level of per capita output in different countries etc.). "The model proposed here offers an alternative view of long-run prospects for growth" (Romer, 1986, p. 1003).

The new growth theory relies more on the Arrow mechanism, rather than on Kaldor's technical progress function, in assuming that there are important externalities with the development of technical change. Arrow analyzed a model in which improvement in techniques depends on the experience within the production process, such experience being measured by cumulated investment. The consequences are analogous to increasing returns to scale: the higher the investment, the greater the opportunity for learning, the faster the rate of technical progress and thus the level of production. Arrow's idea was incorporated by Sheshinski (1967) in a model in which the level of knowledge of workers is a function of the wide capital stock. In contrast to Arrow's model, in which technical change is embodied in the latest vintage of capital, Sheshinski treats technical progress in a disembodied way. However, the Arrow-Sheshinski model was not suitable to generate endogenous growth, as in Solow model, the incentive to accumulate capital vanishes as K increases and growth ceases to occur if population growth becomes zero.

Romer offers an alternative interpretation of the Arrow-Sheshinki model. In his version of the model, the input K is the stock of knowledge (rather than the stock of plant and machinery), which, being a non-rival input, displays increasing returns. Knowledge can be created via an R&D process in a specific research sector which uses the same inputs as the production of tangible goods (Romer, 1990). Romer wrote (1990, p.S84) "A new design enables the production of a new good that can be used to produce output. A new design also increases the productivity of human capital in the research sector." A new design can be also a by-product of other investment activities "there is a trade-off between consumption today and knowledge that can be used to produce more consumption tomorrow" (Romer, 1986, p.1015). In both cases, firms contribute unintentionally to a public pool of knowledge from which other firms can benefit. Thus, investment activities create a social benefit that goes beyond the private return that accrues to investors. This benefit is reflected in an addition to the economy knowledge level.

"While exogenous technological change is ruled out" claimed Romer (1986, p.1003), "the model here can be viewed as an equilibrium model of endogenous technological change in which long-run growth is driven primarily by the accumulation of knowledge by forward-looking, profit-maximizing agents. This focus on knowledge as the basic form of capital suggests natural changes in the formulation of the standard aggregate growth model." Romer assumed diminishing returns in the production of private knowledge but increasing returns in the production of final output from labour and total (public and private) knowledge. The condition for sustainable growth depends on the assumption that the former does not outweigh the latter. These assumptions about the nature of knowledge spillovers and dynamic externalities change the main conclusion of the standard model, since increased investment in R&D permanently increases the rate of growth. In the overall literature, technology is usually conceptualized in relation to knowledge and its application. By comparison, whereas elsewhere Romer appears to focus on knowledge and ideas, his specific definition of

technology is wanting in zeal, ". . . technological change - improvements in the instructions for mixing together raw materials - lies at the heart of economic growth'' (Romer, 1990, p. S72). Assuming that for growth theory the interesting case is the set of rivalry and excludability.

> Romer (1990, p.S75) argues "*...nonrivalry has two important implications for the theory of growth. First, nonrival goods can be accumulated without bound on a per capita basis, whereas a piece of human capital such as the ability to add cannot. Each person has only a finite number of years that can be spent acquiring skills... Second, treating knowledge as a nonrival good makes it possible to talk sensibly about knowledge spillovers, that is, incomplete exludability. These two features of knowledge - unbounded growth and incomplete appropriability - are features that are generally recognized as being relevant for the theory of growth. What thinking about nonrivalry shows is that these features are inextricably linked to nonconvexities.*"

The introduction of non convexities is not compatible with the equilibrium framework but if the effects of externalities on productivity are not recognised by individuals they will act as if constant returns prevail. Probably, the solution ensures that an equilibrium can be found. However, because of externalities, it will be inefficient. Market economies in this situation will underinvest.

According to Romer (1990), non-perfect competition allows firms to fix prices greater than the marginal cost so it also inclines the research activity to have a reward. In endogenous growth model with externalities, instead, equilibrium is possible because only labour and capital are compensated, knowledge being treated as a public good. The presence of non-convexities in an endogenous model of growth can be captured with different specifications of the production function. Externalities can derive from the social level of knowledge as in Romer (1986, p.1008) statement "...the focus is generally on the social optimum and the set of taxes necessary to support it as a competitive equilibrium."

When technological knowledge is not a random process but it is the outcome of intentional investment activity by profit seeking firms, we would expect to find a wide variation in the rate of growth of different economies without negative correlation with the initial level of per capita income. This correlation should be positive if the cumulative effect of the technological progress is taken into account. Every new variety or quality of machinery or products adds to the stock of knowledge already possessed so that the cost of innovation falls as knowledge accumulates. Consequently, the rate of growth of an economy will vary directly with the rate of innovation and technical progress, which offsets any tendency to diminishing returns.

3. New Growth Theories and Menu of Policy Directions

The growth of GDP depends on growth of aggregate hours of work, quantity of capital per hour of work and improvements in technology. The influences on economic growth interact with each other to make some economies grow quickly and other slowly. Sometimes, a country's long-term growth rate speeds up and sometimes slows down. Comparing the new growth theory with neoclassical growth theory and classical growth theory, based on the postulate that population growth is determined by the level of income per person, the neoclassical growth theory explain how capital accumulation and saving interact to determine the economy's growth rate. The different point of view shows that the growth rate depends on the exogenous rate of technological change, or in other words, the growth results from technological advances that are themselves determined by chance. The endogenous growth theory suggests that scarcity leads people to devote resources to innovation in the pursuit of monopoly profit. The models presented by Romer, are "...one-sector neoclassical model with technological change, augmented to give an endogenous explanation of the source of the technological change" (Romer, 1990, p.S99). The knowledge in the model of long-run growth is supposed to be an input in production, which is increasing marginal productivity. In the model with endogenous technological change growth rates could be increasing over time. Also the effects of small interruptions and changes could be fixed and increased using the actions of private agents.

The new growth theories successfully overcome errors of previous exogenous growth theories. They are currently in vogue and attempt to incorporate technological change as endogenous growth process. While making a commendable effort to see into that black box of technological change, these so-called new growth theories are also subject to question and critique on a variety of grounds. One of these is that the new growth theories are not really that new. For example, Nobel laureate, Douglass North, places the work of Romer under the overall rubric of ". . . neoclassical models of growth . . .'' (North, 1990, p. 133). Consequently, while the new growth theorists claim to represent a break from neoclassical theory, others still classify them basically as neoclassical. The new growth theories offer a menu of policy directions which goes from policies favouring R&D, education, saving rates, to policies which have the scope to redirect entrepreneurship from rent-seeking activities to productive ones. The role of public policies is even more important. Policies capable of affecting growth could be law, order and justice as well as institutional changes, regulation and the like. Increasing growth of rates implies that there is a tendency of divergence across countries with different levels of income. Therefore, these models exhibit multiplicity of steady state growth paths.

4. Linkage between growth and financial crisis

What is the relationship between growth and the financial system? This is an ancient question that has received many different answers over the years. Different authors emphasize that financial systems played a critical role in igniting industrialization by

facilitating the mobilization of capital (Hicks, 1969). At least during the last 10 years, well-functioning banks encourage technological innovation by identifying and funding entrepreneurs with the best chances of successful innovation. On the other hand, authors, such as Robinson (1952) and Lucas (1988), argue that financial systems do not matter for growth and financial development simply follow or reflect anticipation of economic development. In addition, the role of finance is often simply ignored in development economics. For example, Stern's (1984) review of development economics does not discuss the financial system, even in a section that lists omitted topics. Early models focus on factor accumulation as the engine of growth. In these models, reproducible inputs, such as physical and human capital, ultimately show diminishing returns. This feature leads the models to predict the convergence of economies towards a steady state. Growth based on factor accumulation stops eventually. Long run growth takes place as a result of exogenous technological progress (Cass (1965), Koopmans (1965), Solow (1956), Swan (1956)).

Endogenous growth models usually contain an innovation "production" process. Innovation is the crucial source for long-run growth. Innovative activity requires the use of scarce resources, and the incentives for innovation are provided by monopoly profits. Because of this imperfectly competitive market structure, the market solution is not usually Pareto-optimal (Grossman and Helpman (1991).Romer (1986), (1990)). Financial systems channel household savings to the corporate sector and allocate investment funds among firms. They allow both firms and households to share risks. These channels are the sources connecting financial development and financial structure to economic growth. Numerous researchers have conducted different econometric methods to pick up the correlation between financial development and growth (Goldsmith (1969), King and Levine (1993)). They add financial development (FD) indicators to a growth regression and find a strong positive relationship between financial development and growth. The researches that try to formally analyze the overall cost of financial crises in terms of economic growth and welfare are relatively new. The main result is to show that if it is possible both empirically and theoretically for economies to grow faster and have higher welfare with crises than without them (Obstfeld, 2008). Or, if countries that have experienced occasional crises have grown on average faster than countries without crises. According to an endogenous growth model where the production technology for non-tradable goods, which are used as inputs for tradable consumption goods, is linear in reproducible capital consisting of non-tradable goods, firms can issue default free bonds either in domestic or foreign currency to finance their investments, but the no tradable sector faces contract enforceability problems that might constrain their borrowing to a function of their net worth, which inefficiently depresses investments. The financial crisis of 2008 ruminates a few types of questions. How and why did it start? How is it best fought now? How are repetitions best prevented? How are repetitions best predicted? There are no genuine answers. Generally, sources describe phenomena but cannot predict an exact timing. Nobody predicted the financial crisis starts in 2006, 2007 or 2008. Anup Shah (2008) and many other sources focus on a collapse of the US sub-prime mortgage market and

the reversal of the housing boom in other industrialized economies, which have had a ripple effect around the world. As a result, people will cut back on consumption to try and weather this economic storm, although other businesses will struggle to survive leading to further fears of job losses. The real economies in many countries are already feeling the effects. Many industrialized nations are sliding into recession if they are not already there. Furthermore, other weaknesses in the global financial system have surfaced. Some financial products and instruments have become so complex and twisted, that as things start to unravel, trust in the whole system started to fail.

5. Epilogue

It would be a lack of physician responsibility in provision of a prescription against uninvestigated disease, but it seems, that it would be possible to provide a local treatment against visible symptoms. The gravitation rules determine the following phenomenon: water in its natural course runs away from high places and permeates downwards. The modern physical models explain this phenomenon as conversions of potential and kinetics energies and *vice versa*.

The author concerns about reflections of already discovered scientific approaches, which separately describe physical evidences, and implementation of such knowledge in understanding of mechanisms and driving forces in the global market, and combining of these models in a singular theory of business coexistence between neo-classical growth models which work during "Peace time", and unpredictable forces and engines which move economics during "Crisis time".

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