

BUSINESS CYCLES AND GROWTH

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Business Cycles and Growth¹

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For a long time business cycles and economic growth were considered to be strongly interconnected. During the interwar period, pioneering work in macroeconomics, by leading economists, offered deep theoretical reflections defining the fundamental purposes of the field, and elaborating different analytical frameworks and methodologies.

After the Second World War, when macroeconomics began increasingly to exploit mathematical tools, the analysis of growth cycles dynamics appeared a real and a mathematical challenge. The difficulty faced by economists in their various attempts to investigate the growth cycles interactions led to business cycles and growth theories to be treated as independent research fields. On the one hand, business cycles theories tried to explain de-trended data movements; on the other hand, growth theory analysed the existence and uniqueness of a stable, long-run equilibrium. This dichotomy was strengthened by the then dominant monetary view, which insisted that monetary policy mattered only in the short run, and had no impact in the long run. However, it would be misleading to assume that all economists believed that business cycles and growth were independent phenomena.

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As pointed out by Solow, this dichotomy is not founded on any serious theoretical argument but rather is the logical consequence of the discipline's shortcomings which should be challenged: "The problem of combining long-run and short-run macroeconomics has still not been solved" (Solow 1988: 310). The great majority of economists consider this (artificial) division not as a scientific choice but rather as a pedagogical dichotomy. While growth theory focuses on productivity-enhancing mechanisms and defines the "natural" path of aggregate activity, short-run analysis identifies the origins of output fluctuations around this path. Macroeconomists have always tried to straddle this artificial frontier and there is an extensive literature based on the numerous different attempts to bridge between those short-run and long-run dynamics.

Although this entry does not pretend to provide an exhaustive survey of the literature, it offers a comprehensive overview of the various approaches which were developed at different times, in order to provide a joint growth-cycles analysis. We identify the pioneering economists and summarize the more recent literature, focusing on those business cycles models that are based on the distinction between shocks and propagation. In what follows, we identify particular episodes in the development of macroeconomics when there was a convergence between analytical growth frameworks and business cycles analysis. These episodes are delimited mainly by Harrod's (1939) seminal essay on dynamics, Brock and Mirman's (1972) stochastic growth model, and the revival in the mid-1980s of growth theories, which opened new perspectives for growth-cycles analysis (see Stadler 1990).

The entry is organized as follows. First, we discuss theories, such as Schumpeter's theory of economic development in which cycle and trend are strongly intertwined. Next, we deal with the fundamental questions and methodological debates addressed by the pioneering authors in the field. We present Harrod's project and the reactions to his 1939 seminal paper, which strongly influenced the development of macroeconomics along two independent paths.

The two types of instability in his model were at the origin of two types of research programmes: those involving economists who identified Harrod's "line of steady advance" as a growth path and saw its stabilization as a way to explain regular growth as it was observed after the Second World War, and those who saw the instability principle as an opportunity to develop a business cycles approach which contained instability within reasonable boundaries. The contributions of Kalecki, Kaldor and Goodwin and their contemporaries are discussed up to the emergence of post-Keynesian contributions.

In the second part of the entry, we analyse the theories that emerged from the modern growth theory starting with Brock and Mirman's (1972) seminal contribution. Their stochastic approach to growth combined with Lucas's (1972) counter-revolutionary approach to business cycles as equilibrium phenomena led to the emergence of real business cycles (RBC) models which eliminated the dichotomy between growth and cycles. We also discuss the potential of endogenous growth models to capture the impact of short-run fluctuations on (long-run) growth. The entry concludes with some comments on recent research agendas promoted by alternative approaches to the issue under consideration.

I - Growth and Cycles: From Schumpeter to Goodwin

I1. Innovations as the impulse of growth and business cycles

"No problem in economics is more difficult than the one posed by the almost universal evidence that while capitalist economies grow, they do not expand steadily. ...There is no obvious solution to this question, and I know of only one economist, Schumpeter, who has ever really constructed a unified theory of growth and cycle." (Goodwin 1953: 89)

From the start, Schumpeter emphasized the wave-like movement of capitalist development, and the important role of innovation (Hagemann 2003). Like Werner Sombart, he was strongly influenced by Karl Marx's analysis of the long-run development of capitalist economies and his emphasis on capital accumulation and technical progress. In Marx's view, crises and cycles were the very essence of the evolution of capitalist economies. For

Schumpeter, studying business cycles “means neither more nor less than analyzing the economic process of the capitalist era” (Schumpeter 1939, vol. 1: v). Schumpeter considered capitalist development as a succession of prosperity and depression. Economic development in the sense of Schumpeter is endogenous and discontinuous, and it is the task of dynamic theory to explain the origin and effects of these processes which essentially are disturbances of the static equilibrium of the economy.

It is well known that innovations, pioneering entrepreneurs, and bank credit are the three main elements of Schumpeter’s *Theory of Economic Development* in which, as Schumpeter (1911 [1934]: xiii) pointed out in his foreword to the fourth German edition, “any single page is dedicated to the problem of the business cycle”. The pioneering entrepreneur is the agent of creative destruction in carrying out new combinations that include the five cases of introduction of new methods of production, new products, the opening of new markets, new sources of supply, and new forms of organization. The interaction between long-run growth and cyclical fluctuations, and particularly the role played by innovations, were the focus of Schumpeter’s attention. However, in 1911 only the classical or Juglar cycle was known to him, the Kitchin, Kondratieff and Kuznets cycles not being discovered until the 1920s. This stimulated Schumpeter to elaborate his basic idea of the superposition of different waves. Thus, in *Business Cycles* he develops a three-cycle scheme in which Kondratieff long waves are combined with the classical Juglar and the shorter Kitchin cycles (see the famous diagram in Schumpeter 1939, vol. 1: 213). Schumpeter based his approach on a mono-causality argument in which both growth and business cycles result from innovation. Not only do innovations constitute the decisive impulse of cyclical fluctuations, the period of their implementation also determines the different lengths of the cycles. Thus, major innovations or fundamental technological breakthroughs cause Kondratieff long waves or growth cycles whereas medium and minor

innovations lead respectively to Juglar and Kitchin cycles. According to Schumpeter (1939, vol. 1: 168), the Industrial Revolution “consisted of a cluster of cycles of various span that were superimposed on each other”. Innovations tend not only to cluster but also lead frequently to a sequence of cycles which are not fully independent of each other. Railroadization, electrification, motorization (and we could add computerization) occur in steps and sequences. Thus for Schumpeter, business cycles and growth are inseparably linked. It can be excluded that Schumpeter would have become an adherent of the later neoclassical steady-state growth model in which the business-cycle problem was assumed away.

I2. Harrod’s project

Harrod’s book *The Trade Cycle. An Essay* (1936) and his article “An essay on dynamic theory” (1939) set the agenda for research into formal business cycle and growth models in the 1950s. The point of departure was the possibility of reconciling the capacity and demand effects of investment. In a model with a fixed capital-output ratio C and a fixed saving-output ratio s , as long as a unit of capital producing $1/C$ unit of output (capacity effect of investment) generates s/C units of net savings (demand effect of investment), capital and output will grow at the same exponential rate s/C , which rate Harrod describes as the “warranted” rate of growth.

This raised two major issues. The first concerned the stability properties of that steady growth path, and the adjustment mechanism between the actual and warranted growth rates. Harrod’s point was that forces will systematically drive the economy away from a steady growth path: any departure of the actual rate of growth from its warranted value will be self-aggravating rather than self-defeating so that cumulative growth at a constant warranted rate is unlikely. An illustration provided by Sen (1970) is of help here; it is a typically knife-edge interpretation which Harrod disliked (Harrod 1973). We treat the case of a saving rate of 20

per cent and a capital-output ratio of 2 so that the warranted growth rate is 10 per cent. Then let us suppose that current output is 90 so that a 10 per cent rate of growth will result in an output of 100, taking the growth rate as a proportion of the final output. How the actual rate behaves depends on the expectations that rule the investment behaviour. If entrepreneurs expect an output of 100 they will invest 20 units in the effort to create capacity for an additional 10 units of demand. This investment of 20 units will generate through the multiplier of 5 (implicit in a savings coefficient of 20 per cent) a demand level of 100, so that the expectation will be fulfilled. However, if they expect too much, say 101 units of demand, then investment will have 22 units to create capacity for 11 additional units to be produced, and through the multiplier the demand generated will be 110 so that investors will feel that they expected too little. The demand effect of investment will dominate the capacity effect. Similarly, if investors expect too little and anticipate 99 units of demand, investment will equal 18 units and actual demand will be 90 units, making the capacity effect stronger than the demand effect.

Harrod's view of the trade cycle was based on the argument that an actual movement away from the "warranted growth path" could be checked because the warranted rate would "chase" the actual rate upwards or downwards: "If the former eventually overtakes the latter a new equilibrium is achieved and if the former goes beyond the latter forces are generated setting up a reverse movement" (Harrod 2003: 1198–9). The way that expectations and income distribution were supposed to change during the adjustment process was essential to explaining the behaviour of the warranted rate of growth, and ultimately proposing a cycle theory endogenously generated along an endogenous trend (see Assous et al. 2014; Bruno and Dal Pont-Legrand 2014). Tinbergen and Marschak were among the first to point out the difficulties inherent in modelling Harrod's theory of cyclical growth. In his review of *The*

Trade Cycle, Tinbergen (1937) made it clear that Harrod's mathematical formulation only applied to exponential growth.

The second issue concerned the adjustment process between the warranted rate (assumed to remain equal to the actual growth rate) and the natural rate. Harrod assumed that the natural rate of growth is given by the maximum rate permitted by the rate of growth of the population, technology, and labour force participation. Thus, in a model with no technical progress and with a constant participation rate, the "natural" rate of growth is the maximum sustainable rate of growth in the long run measured as the rate of growth of the labour force. If the warranted rate of growth and the natural rate of growth are equal, the economy will exhibit steady growth at full employment. However, any change in the parameters which affect the equality among the warranted and natural rates results in a divergence in the capital and labour growth rates. For example, if the warranted rate exceeds the natural rate, redundant capital accumulates until the economy reaches equilibrium. On the other hand, if the warranted rate falls short of the natural rate, this will trigger a cumulative growth in the proportion of unemployment.

In focusing on the process of adjustment between the warranted (assumed to remain permanently equal to the actual growth rate) and the natural growth rates, neoclassical economists overlooked the issue of cyclical growth. This led to the out-of-equilibrium interpretation of observed growth being abandoned in favour of an equilibrium interpretation, and the widespread view that economic dynamics, rather than being essentially endogenously driven, was the response to continuous external forces. These developments led to the employment of two critical assumptions: (1) the development of growth models based on the assumptions of permanent full employment and equality of savings and investment with the result that the possibility of fluctuations vanished, and (2) the possibility of a steady and continuous increase in productivity.

Solow was aware that the neoclassical growth model had shunted aside all the rigidities and general (short-run) coordination problems likely to generate cyclical growth. In 1956, he expressed an interest in such questions, saying that “It is not my contention that these problems don’t exist, nor that they are of no significance in the long run” (Solow 1956: 91; see also Hagemann 2009: 85). Later, he repeatedly tried to find a way to deal with Harrod’s instability problem related to adjustment of the actual and warranted growth rates (Assous 2015). He concentrated mainly on finding a way to define a robust investment function capable of explaining the failed expectations of entrepreneurs who deviated from the equilibrium path. With no adequate fact-based treatment of representing expectations, and no solution to the sensitive problem of valuing durable capital in the context of an uncertain future, Solow doubted that a satisfactory solution was possible (Solow 2012). In his opinion, the dichotomy between cycles and growth analysis was no more than the unsatisfactory outcome of the difficulties faced by economists when dealing with growth and cycles simultaneously.

I3. Kalecki and the problem of trend and cycle

Unlike Harrod, Kalecki did not believe that cycles arise along an endogenous trend. In order for growth to be self-perpetuating, investment, and therefore gross capital stock have to grow exponentially, at the same rate. This requires that via profits, gross investment must generate a larger gross investment in the next period. Kalecki’s point was that this condition was unlikely to be met. First, a part of savings accrues outside enterprises, while firms are not in a position to indebt themselves sufficiently. Second, a capacity is created which depresses investment. Its strength will depend on the prevailing technique; a high capital coefficient providing relatively little capacity for a given investment, will favour the automatic increased growth, while a low capital-coefficient will have the reverse effect.

In addition, Kalecki's belief in the absence of an endogenous trend was connected to the issue of cycles. Frisch and Holme (1935) show that Kalecki's initial business cycle model could produce damped cycles but no trend or alternatively trend but no cycles. In discarding the trend solution, Kalecki could explain growth only as due to an exogenous stimulus which was able to propose an explanation for why cycles do not fade away. More generally, this approach was more relevant to an explanation of capitalist contradictions: "I believe that the antinomy of the capitalist system is in fact more far-reaching: the system cannot break the impasse of fluctuations around a static position unless economic growth is generated by the impact of semi-exogenous factors such as the effect of innovation upon investment" (Kalecki 1962: 134).

Kalecki considered that the main shocks were innovations. The effect of innovations on investment rests on the innovator's expectation of extraordinary profits, an expectation which is created not by the actual process of the cycle but is part of the circular system of demand and investment as extraneous factors which is based not on earnings experience but on the anticipation of something quite new. The trend-generating effect depends essentially on the assumption of a continuous stream of innovations: in other words, the stimulus has to be repeated again and again, so that the negative effect of creation of new capacity is compensated.

I4. Kaldor's non-linear trade cycle theory

In 1940, Kaldor presented an ingenious graphical presentation of his business cycle theory based on Harrod's principle of instability. By means of S-shaped investment and saving functions, showing that if the investment curve intersects the saving curve three times, the stationary equilibrium might become unstable while, for a wide range of values of capital stock, the economy will stabilize to either a low or a high equilibrium. These considerations – under the assumption that the speed of quantity adjustment in the goods market is high,

while real capital stock moves slowly – result in a self-sustained output and capital stock cycle model in which the economy moves from a stable, to an unstable, to a stable equilibrium. The model, though sufficient to obtain endogenous cycles around a static position does not address the issue of growth-cycle equilibrium values of income and capital. It produced local instability but only in a trendless economy. As Asada (2009) noted, in the 1950s Yasui and Morishima attempted to extend Kaldor's model through a mathematical formulation that would produce cyclical growth. However, in assuming that growth and cycles were linearly superimposed, their attempts were far from challenging Harrod's view that trend and cycle were indissolubly mixed.

In the 1950s, Goodwin engaged in efforts along similar lines to model Harrod's insights. With the help of his French Harvard colleague, Philippe Le Corbeiller, he attempted to determine how to exploit the Van der Pol-Raleigh limit-cycle theory of dynamics. In his 1951 pioneering contribution, he showed that this could be achieved within a non-linear formulation of the accelerator interacting with a stabilizing multiplier. However, like his Japanese contemporaries, Goodwin was unable to integrate both growth and cycles, assigning to trend only the role of a benchmark - a role that remained largely unexplained. It was not until the late 1960s that he succeeded in drafting a new approach.

15. Goodwin's growth cycle

Eschewing any reference to shocks as a way of modelling fluctuating growth, Goodwin carved out his own path towards an integration of Harrod and Marx's insights. In Goodwin's (1967) growth cycle, economic fluctuations in output, unemployment and wages are generated endogenously in a model that combines elements of Harrod's growth model and the Phillips curve. The key equations in the Goodwin model are the Lotka–Volterra equations for the rate of growth of the share of wages in output, and of capital. Goodwin adopts the Lotka–Volterra equations which are used in biology in order to model predator-prey

interaction, to explain the dynamical contradictions of capitalism in a Marx–Kaleckian spirit. Due to innovations and productivity growth any upswing can carry the economy beyond the previous peak. Goodwin (1987) agrees with Schumpeter that economic growth is therefore likely to occur in waves. Goodwin’s model has been discussed intensively and elaborated over the last decades (see, for example, Flaschel 2009: ch. 4). An important characteristic of the Goodwin model is that it can create economic fluctuations endogenously without relying on exogenous shocks – whether monetary or technological.

16. Modern post-Keynesian developments: growth, instability and cycles

A substantial literature emerged in the early 1980s on the interplay between economic growth and income distribution in economies in which failures of effective demand can have permanent effects on the utilization of productive resources. The model developed by Rowthorn (1981), Dutt (1984) and Taylor (1985) is characterized by the presence of an independent investment function. Assuming low sensitivity of accumulation to variations in utilization, with a given or changing mark-up, their models were able to address growth-cycles issues simultaneously. However, others – like Skott (2010) – argued that the integration of cycles and growth analyses was better explored by incorporating an Harroddian investment function likely to generate an unstable warranted growth path. A Harroddian investment function could be compatible with multiple steady growth solutions (some stable), allowing for new foundations for endogenous cycles along an increasing trend. For instance, Skott (2010) shows that destabilizing Harroddian effects with stabilizing Marxian mechanisms can produce a combined understanding of growth and cycles.

II - New Classical Approach to Growth-Cycles Interaction(s)

Despite the contributions we just presented, up to the early 1970s, the great majority of economists had disregarded business cycles as a major issue (see Bronfenbrenner 1969).

Business cycles analysis resurfaced with the successive “oil shocks” and the inability of the then dominant approaches (namely, the Keynesian, Monetarist, and neoclassical synthesis views) to propose an efficient economic policy. The re-emergence was triggered by Lucas (1972), but the important point in our context is that this work was the starting point for a new macroeconomic approach which deeply affected the way economists analyse the interaction of business and growth cycles.

Introducing rational expectations in the sense of Muth (1961), Lucas developed an equilibrium business cycles theory in which the trend – defined as the optimum equilibrium position – is given, and where cycles – interpreted as temporary deviations from the trend – are always (non-optimal but) equilibrium positions. Although this model does not include any growth-cycles interactions, it was a first step in a new approach. In this model, business cycles disturbances are minimized and the necessity for stabilization policies is strongly questioned (see Dal Pont-Legrand and Hagemann 2010). Indeed, stabilization policies are useless precisely because fluctuations are determined independently of the trend. Although Lucas’s methodology came to dominate macroeconomics, his business cycles theory was heavily attacked for two main reasons. First, it was difficult to defend the idea that fluctuations could only be caused by (unexpected) monetary shocks, and second, the dynamics of his model could not mimic (or only on an ad hoc hypothesis) the persistence effect of shocks observed at that time.

Part of the solution to critiques addressed to Lucas’s business cycles theory can be found in two papers by Lucas and Rapping (1969) and Brock and Mirman (1972). The former proposed an intertemporal substitution mechanism which acts as a propagation

mechanism for shocks compatible with an equilibrium approach with the result that a single shock could initiate recurrent fluctuations, and those fluctuations would be the outcome of the optimal reactions of agents. Brock and Mirman (1972) introduced an intertemporal substitution mechanism but their contribution consisted mainly of providing the first optimal growth model for an economy with stochastic productivity shocks. They proposed a unified framework for growth and cycles (which we describe as shocks and propagation) dynamics, which was the first step towards their joint analysis.

III.1. Real business cycles: cycles interpreted as random walk

Real business cycles models are usually considered the second generation of models within the New Classical School founded by Lucas. These models were proposed to address some of the critiques of Lucas's model, and in a criticism of Lucas's business cycles theory made by Tobin (1980: 798), we can find an exact description of these future RBC models. Real business cycles models were presented as directly inspired by Frisch (1933) and Schumpeter – Frisch because RBC theory distinguishes between impulse and propagation mechanisms, and Schumpeter because it considers innovations (here productivity shifts) as the main driving force of business cycles. However, for historians of economic thought, the links between these two literatures are rather tenuous.

Real business cycles models – the first of which was proposed by Kydland and Prescott (1982) – were an attempt to avoid the criticisms levelled at Lucas's model – mainly its inability to explain (and to reproduce) the persistence of shocks, and the exclusive reliance on the occurrence of regular monetary shocks (a somewhat doubtful hypothesis) in order to depict (recurrent) fluctuations. Real business cycles were built on optimal growth models in which fluctuations are driven by productivity shocks – either temporary or permanent– which have a direct impact on fully informed and rational agents' (optimal) decisions. Consequently, business cycles are expressed not only in equilibrium terms but are also the

direct outcome of fully rational economic and perfectly informed agents. That is, they are also optimal positions. So the trend became both an equilibrium and optimal position, and cycles were interpreted as fluctuations of the trend. This can be considered as a sterilized version of business cycles, that is, a conception of cycles that is unrelated to the idea of disequilibrium or instability, in other words a totally new perspective on fluctuations.

Supported by Nelson and Plosser (1982), RBC models interpreted fluctuations of the level of productivity as a random walk (see Mata and Louça 2009 for a history of “residual” interpretation). The main criticisms of these models were (1) the exclusive reliance of RBC models on technological shocks, a hypothesis which implied that recessions should be seen as periods of technological regress, which is a questionable interpretation, (2) their neglect of the role played by monetary and financial factors, and, more generally, that demand-side shocks could not by definition, generate any consequences for long-run dynamics, and (3) their totally unrealistic reliance on the elasticity of substitution in order to generate fluctuations. These affected the credibility of their analysis of the persistence of fluctuations (for detailed critiques, see, for example, Summers 1986; Hoover 1988; Stadler 1994). The two generations of models (Lucas’s and RBC) reveal a clear inclination among economists at that time to progressively exclude any sort of instability from the core of the model. Nevertheless, as in the interwar period, business cycles were analysed by a shock/propagation representation, and the notion of (endogenous) instability progressively disappeared to be substituted by a deeper analysis of shocks.

Thus, there is a sort of paradox in the RBC approach: while it relies exclusively on technological progress in order to generate fluctuations, it still considers it to be an exogenous factor. In addition, growth is also exogenous. The consequence of this is that despite growth and cycles being modelled jointly, this framework fails to explain business cycles and especially growth-cycles interactions. At best RBC models can only mimic

observed fluctuations, a position for which RBC economists take credit but which remains controversial.

II.2. From business cycles to growth

In the mid-1980s new growth theory (NGT) emerged with Romer (1986) and Lucas (1988) as its main proponents. What is less well known is that this research contributed to the debate on business cycles and growth interactions, and as a corollary, to arguments about the necessity (or not) of stabilization policy. The initial project of NGT was to endogenize technical progress and to take into account different elements (institutions, education, and innovation) that influence growth. This objective was supported by the existence of a substantial empirical and theoretical literature which documented the endogenous nature of technical progress. It should be noted that previous contributions had emphasized the importance of some of the mechanisms inherent in those models (for example, the well-known contributions by Arrow 1962 about learning by doing, and Eltis 1971 on the importance of research and development expenditures for economic growth), but the novelty certainly lay in the tractability of those models and in their capacity to be tested econometrically.

Because NGT models build on endogenous growth mechanisms, long-run trends are not predetermined, a characteristic which confers on them only a “relative stability” (Hénin 1994). More precisely, shocks affecting such a dynamics exhibit a – positive or negative – persistence. Indeed, Stadler (1990) proved that endogenous technical change acts as a strong propagation mechanism, whatever the nature (demand or supply) of the shocks: “real and monetary business cycles models with endogenous technology differ from the conventional models” (Stadler 1990: 764). Moreover, growth dynamics is characterized in these models by a kind of hysteresis phenomenon: an economy consecutively affected by two shocks, identical with the exception of the sign of their persistence, will not return to its initial rate of

growth. With the inclusion of a learning by doing production function, the model exhibits a positive persistence of the shocks while models based on a learning or doing mechanism, claimed to be inspired by Schumpeter and dealing explicitly with the process of input reallocation between production and increased productivity (sort of research and development – R&D) sectors, exhibit a negative persistence of the shocks. The authors of the second category of models (Aghion and Saint Paul 1991, 1998; Saint Paul 1997) refer explicitly to Schumpeter's concept of the cleaning and restructuring effects both associated with periods of recession, in their emphasis (paraphrasing Schumpeter) that recessions are but temporary and that each occurrence represents the means to reconstruct the economic system according to a more efficient plan. Based on the "opportunity cost" approach, they consider that research and development activities that enhance productivity in the long run are nevertheless costly in the short run since they divert efforts (and the resources) from the productive sector. Thus, a recession can be seen as an opportunity to finance at low cost, a productivity enhancing activity, and in this case, the persistence of the shock has a negative impact. Both endogenous mechanisms are interesting and contribute to our understanding of how growth may be affected by the nature of business cycles which means by their amplitude, frequency, and persistence. However, there is debate over the sign of persistence of shocks

Starting with the paper by Ramey and Ramey (1995), many contributions (see, for example, Barlevy 2004; Blackburn and Pelloni 2004, 2005) have tried – without success – to determine the sign of the relationship between growth and volatility; their conclusions are indeed oversensitive to the nature of the endogenous growth mechanism, and empirical investigations cannot tackle this issue. It is difficult then to draw sharp economic policy conclusions from these models, a weakness which certainly contributes to explaining the waning interest in these kinds of models. Along the same lines but within a different

analytical framework is the paper by Stiglitz (1993) which proposes a complete growth-cycles model and analyses how recessions can negatively impact on growth if they lead to an interruption in the financing of research and development, a decision which has direct consequences on the (future) rate of growth.

Finally, Aghion and Howitt (1992, 1998, 2009) developed another generation of endogenous growth models, the so-called neo-Schumpeterian growth models. Aghion and Howitt started from a monopolistic market structure and introduced Schumpeterian features of innovation and growth; creative destruction, productive recessions (already discussed by Aghion and Saint Paul), cleaning effects, obsolescence of goods, and so on (see Aghion et al. 2013). While it was not their primary objective, Aghion and Howitt covered the different ways growth and cycles intertwine. Their starting point was the concept of general purpose technologies (GPTs), developed by Bresnahan and Trajtenberg (1995) and Helpman and Trajtenberg (1998). General purpose technologies are understood as raising productivity levels in the long run, and as being the cause of cyclical fluctuations due to their absorption into the economic system. Aghion and Howitt also examined how the nature of growth affects fluctuations. Focusing more specifically on firm dynamics, they emphasized that “misallocation of resources is a major source of productivity gap across countries” (Aghion et al. 2013: 36) and again tried to link cycles and growth dynamics.

Conclusions

Of course, there are other ways to organize this rather large literature including distinguishing between market clearing and non-market clearing approaches (as in Aghion and Saint Paul 1998).

We could have paid more attention to optimal growth models and their attempt to exhibit (endogenous) cyclical dynamics. However, we decided to focus in our assessment of

the modern literature on the analysis of cycles based on impulse/propagation mechanisms. There are several fundamental contributions developed from that perspective: (1) Benhabib and Nishimura (1979, 1985) who show that multisectoral models can exhibit oscillating dynamics sometimes even with periodicity, and (2) Benhabib and Day (1982) and Grandmont (1985) who show in overlapping-generations models that under certain conditions optimal trajectories can be cyclical in nature.

Another interesting literature strand that we have not so far mentioned includes work that starts from the assumption of long-run growth as an exogenous trend and then examines how fluctuations could be generated endogenously (see Shleifer 1986) and those papers that try to endogenize both cycles and growth dynamics (see François and Lloyd-Ellis 2003).

Another (still) emerging field of research is founded on agent-based modelling (see Howitt and Gaffard 2007; Dosi et al. 2010). In this perspective, there is no doubt that the Schumpeterian idea that growth and cycles are indistinguishable dynamics, which so far has not been adequately modelled, is still of fundamental importance for modern research programs. What is less obvious is the extent to which those modern approaches can be interpreted as fully Schumpeterian contributions.

References

- Aghion, P. and P. Howitt (1992), ‘A model of growth through creative destruction’, *Econometrica*, **60** (2), 323–51.
- Aghion, P. and P. Howitt (1998), *Endogenous Growth Theory*, Cambridge, MA: MIT Press.
- Aghion, P. and P. Howitt (2009), *The Economics of Growth*, Cambridge, MA: MIT Press.
- Aghion, P. and G. Saint Paul (1991), ‘On the virtues of bad times’, Working Paper no. 578, CEPR, London.

- Aghion, P. and G. Saint Paul (1998), 'Uncovering some causal relationships between productivity growth and the structure of economic fluctuations: a tentative survey', *Labour*, **12** (2), 279–303.
- Aghion, P., U. Akcigit and Howitt (2013), 'What do we learn from Schumpeterian growth theory?', PIER working paper 13-026, Penn Institute for Economic Research, Department of Economics, University of Pennsylvania.
- Arrow, K. (1962), 'The economic implications of learning by doing', *Review of Economic Studies*, **29** (3), 155–73.
- Asada, T. (2009), *Japanese Contributions to Dynamic Economic Theories in the 1940s – the 1970s: A Historical Survey*, Tokyo: Chuo University.
- Assous, M. (2015), 'Solow's struggle with medium-run macroeconomics: 1956-1995', *History of Political Economy*, **47** (3), 395–417.
- Assous, M., O. Bruno and M. Dal Pont-Legrand (2014), 'The "Law of Diminishing Elasticity of Demand" in Harrod's Trade Cycle (1936)', *Cahiers d'Economie politique/Papers in Political Economy*, **67** (2), 159–75.
- Barlevy, G. (2004), 'The cost of business cycles under endogenous growth', *American Economic Review*, **94** (4), 964–90.
- Benhabib, J. and R.M. Day (1982), 'A characterization of erratic dynamics in overlapping generations model', *Journal of Economic Dynamic and Control*, **4** (1), 37–55.
- Benhabib, J. and K. Nishimura (1979), 'The Hopf bifurcation and the existence of stability closed orbits in multisector models of optimal economic growth', *Journal of Economic Theory*, **21** (3), 421–44.
- Benhabib, J. and K. Nishimura (1985), 'Competitive equilibrium cycles', *Journal of Economic Theory*, **35** (3), 284–306.

- Blackburn, K. and A. Pelloni (2004), 'On the relationship between growth and volatility', *Economics Letters*, **83** (1), 123–7.
- Blackburn, K. and A. Pelloni (2005), 'Growth, cycles and stabilization policy', *Oxford Economic Papers*, **57** (2), 262–82.
- Bresnahan, T.F. and M. Trajtenberg (1995), 'General purpose technologies: engines of growth?', *Journal of Econometrics*, **65** (2), 83–108.
- Brock, W. and L. Mirman (1972), 'Optimal economic growth under uncertainty: the discounted case', *Journal of Economic Theory*, **4** (3), 479–513.
- Bronfenbrenner, M. (1969), *Is the Business Cycle Obsolete?*, New York: Wiley.
- Bruno, O. and M. Dal Pont-Legrand (2014) 'The instability principle revisited: an essay in Harrodian dynamics', *European Journal for the History of Economic Thought*, **21** (3), 467–84.
- Dal Pont-Legrand, M. and H. Hagemann (2010), 'Théories réelles versus monétaires des cycles d'équilibre: une mise en perspective des travaux récents au regard des débats de l'entre-deux guerres?', *Revue Française d'Economie*, **24** (4), 189–229.
- Dosi, G., G. Fagiolo and A. Roventini (2010), 'Schumpeter meeting Keynes: a policy-friendly model of endogenous growth and business cycles', *Journal of Economic Dynamics and Control*, **34** (9), 1748–67.
- Dutt, A.K. (1984), 'Stagnation, income distribution and monopoly power', *Cambridge Journal of Economics*, **8** (1), 25–40.
- Eltis, W.A. (1971), 'The determination of the rate of technical progress', *Economic Journal*, **81** (323), 502–24.
- Flaschel, P. (2009), *The Macrodynamics of Capitalism. Elements for a Synthesis of Marx, Keynes and Schumpeter*, 2nd revd and enlarged edn, Berlin: Springer.

- François, P. and H. Lloyd-Ellis (2003), 'Animal spirits through creative destruction', *American Economic Review*, **93** (3), 530–50.
- Frisch, R. (1933), 'Propagation problems and impulse problems in dynamic economics', in K. Koch (ed.), *Economic Essays in Honour of Gustav Cassel*, London, Allen & Unwin, pp. 171–205.
- Frisch, R. and H. Holme (1935), 'The characteristic solutions of a mixed difference and differential equation occurring in economic dynamics', *Econometrica*, **3** (2), 225–39.
- Goodwin, R.M. (1951), 'The nonlinear accelerator and the persistence of business cycles', *Econometrica*, **19** (1), 1–17.
- Goodwin, R.M. (1953), 'The problem of trend and cycle', *Bulletin of Economic Research*, **5** (2), 89–97.
- Goodwin, R.M. (1967), 'A growth cycle', in C.H. Feinstein (ed.), *Socialism, Capitalism and Economic Growth*, Cambridge, Cambridge: Cambridge University Press, pp. 54–8, reprinted in R.M. Goodwin (1982), *Essays in Economic Dynamics*, Basingstoke: Macmillan, pp. 165–70.
- Goodwin, R.M. (1987), 'Growth and cycles', in J. Eatwell, M. Milgate, P. Newman (eds), *The New Palgrave*, vol. 2, London: Palgrave Macmillan, pp. 574–6.
- Grandmont, J.M. (1985), "On endogenous competitive business cycles", *Econometrica*, **53** (5), 995–1046.
- Hagemann, H. (2003), 'Schumpeter's early contributions on crises theory and business-cycle theory', *History of Economic Ideas*, **11** (1), 47–67.
- Hagemann, H. (2009), 'Solow's 1956 contribution in the context of the Harrod-Domar model', *History of Political Economy*, **41** (Supplement 1), 67–87.
- Harrod, R.F. (1936), *The Trade Cycle. An Essay*, Oxford: Clarendon.
- Harrod, R.F. (1939), 'An essay in dynamic theory', *Economic Journal*, **49** (193), 14–33.

- Harrod, R.F. (1973), *Economic Dynamics*, London: Macmillan.
- Harrod, R.F. (2003), 'An essay on dynamic theory [1938 draft]', in D. Besomi (ed.), *The Collected Interwar Papers and Correspondence of Roy Harrod*, vol. 3, Cheltenham, UK and Northampton.MA, USA: Edward Elgar, pp. 1188–212.
- Helpman E and M. Trajtenberg (1998), 'A time to sow and a time to reap: growth based on general purpose technologies', in E. Helpman (ed.), *General Purpose Technologies and Economic Growth*, Cambridge, MA: MIT Press, pp. 55–83.
- Hénin, P.Y. (1994), 'L'impact à long terme des chocs de demande', *Revue Economique*, **45** (3), 883–96.
- Hoover, K. (1988), *The New Classical Macroeconomics*, Aldershot, UK and Brookfield, VT, USA: Edward Elgar.
- Howitt, P. and J.L. Gaffard (2007), 'Vers une macroéconomie fondée sur des agents autonomes et intelligents', *Revue de l'OFCE*, **2007/3**, 55–78.
- Kaldor, N. (1940), 'A model of the trade cycle', *Economic Journal*, **50** (197), 78–92.
- Kaldor, N. (1954), 'The relation of economic growth and cyclical fluctuations', *Economic Journal*, **64** (253), 53–71.
- Kalecki, M. (1935), 'A macrodynamic theory of the business cycle', *Econometrica*, **3** (3), 327–44.
- Kalecki, M. (1962), 'Observations on the theory of growth', *The Economic Journal*, **72** (285), 134–53.
- Kydland, F.E. and E.C. Prescott (1982), 'Time to build and aggregate fluctuations', *Econometrica*, **50** (6), 1345–70.
- Lucas, R. (1972), 'Expectations and the neutrality of money', *Journal of Economic Theory*, **4** (2), 103–24.

- Lucas, R. (1988), 'On the mechanics of economic development', *Journal of Monetary Economics*, **22** (1), 3–42.
- Lucas, R.E. and L. Rapping (1969), 'Real wages, employment, and inflation', *Journal of Political Economy*, **77** (5), 721–54.
- Mata, T. and F. Louça (2009), 'The Solow residual as a black box: attempt at integrating business cycle and growth theories', *History of Political Economy*, **41** (Supplement 1), 334–55.
- Muth, J. (1961), 'Rational expectations and the theory of price movements', *Econometrica*, **29** (3), 315–55.
- Nelson, C. and C. Plosser (1982), 'Trends and random walk in macroeconomic time series: some evidences and implications', *Journal of Monetary Economics*, **10** (2), 139–62.
- Ramey, G. and V. Ramey (1995), 'Cross-country evidence on the link between volatility and growth', *American Economic Review*, **85** (5), 1138–51.
- Romer, P. (1986), 'Increasing returns and long-run growth', *Journal of Political Economy*, **94** (5), 1002–37.
- Rowthorn, B. (1981), 'Demand, real wages and economic growth', *Thames Papers in Political Economy*, Autumn, 1–39.
- Saint Paul, G. (1997), 'Business cycles and long-run growth', *Oxford Review of Economic Policy*, **13** (3), 145–53.
- Schumpeter, J.A. (1911), *Theorie der wirtschaftlichen Entwicklung*, Munich and Leipzig; Duncker & Humblot, 2nd edn 1926, English trans. 1934 *The Theory of Economic Development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*, Cambridge, MA: Harvard University Press.
- Schumpeter, J.A. (1939), *Business Cycles. A Theoretical, Historical and Statistical Analysis of the Capitalist Process*, 2 vols, New York: McGraw-Hill.

- Sen, A.K. (ed.) (1970), *Growth Economics: Selected Readings*, Harmondsworth: Penguin Books.
- Shleifer, A. (1986), 'Implementation cycles', *Journal of Political Economy*, **94** (6), 1163–90.
- Skott, P. (2010), 'Growth, instability and cycles: Harrodian and Kaleckian models of accumulation and income distribution', in M. Setterfield (ed.), *Handbook of Alternative Theories of Economic Growth*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar.
- Solow, R.M. (1956), 'A contribution to the theory of economic growth', *Quarterly Journal of Economics*, **70** (1), 65–94.
- Solow, R.M. (1988), 'Growth theory and after', *American Economic Review*, **78** (3), 307–17.
- Solow, R.M. (2012), 'On Pasinetti and the unfinished Keynesian revolution', in R. Arena and P.L. Porta, (eds) *Structural Dynamics and Economic Growth*, Cambridge: Cambridge University Press, pp. 267–75.
- Stadler, G. W. (1990), 'Business cycle models with endogenous technology', *American Economic Review*, **80** (4), 763–78.
- Stadler, G.W. (1994), 'Real business cycles', *Journal of Economic Literature*, **32** (4), 1750–83.
- Stiglitz, J. (1993), 'Endogenous growth and cycles', NBER Working Paper No. 4286, National Bureau of Economic Research, Cambridge, MA.
- Summers, L.H. (1986), 'Some sceptical observations on real business cycle theory', working paper, *Federal Reserve Bank of Minneapolis Quarterly Review*, Fall.
- Taylor, L. (1985), 'A stagnationist model of economic growth', *Cambridge Journal of Economics*, **9** (4), 383–403.
- Tinbergen, J. (1937), 'Review of Harrod, R.F., *The Trade Cycle*', *Weltwirtschaftliches Archiv*, **45** (3), 89–91.

Tobin, J. (1980), 'Are new classical models plausible enough to guide policy?', *Journal of Money, Credit and Banking*, **12** (4), 788–99.

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