NEW GROWTH THEORY, EFFECTIVE DEMAND, AND POST-KEYNESIAN DYNAMICS

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This paper provides a critical appraisal of new growth theory from the perfective of post-Keynesian approach to macroeconomic dynamics. It argues that new growth theory appears new from the point of view of introducing endogenous growth only if one ignores many non-neoclassical contributions to old growth theory. New growth theory also suffers from other problems, including the fact that it does not incorporate effective demand issues and unemployment in the analysis, which play an important role in post-Keynesian growth models that draw on earlier non-neoclassical growth theory. By examining the role of technological change in the post-Keynesian growth model, it argues that the contribution of new growth theory is not very novel, and that the analysis of technological change can be improved by going beyond it, although by drawing from it as well. It also argues that new growth theory, by overemphasizing technology, has ignored many important issues which are relevant for the growth process, which can be usefully examined within post-Keynesian growth theory. This is illustrated with the example of the problem of consumer debt.

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1. Introduction

What is called new growth theory or endogenous growth theory has changed the face of modern macroeconomics and the study of economic growth since the 1990s.

After enormous enthusiasm and excitement from the late 1930s to the mid 1960s, the subfield of growth economics became a dormant one. Solow (1982), one of the major contributors to growth theory in these early glory days, wrote in the late 1970s that "I think there are definite signs that [growth theory] ... is just about played out, at least in its familiar form. Anyone working inside economic theory these days knows in his or her bones that growth theory is now an unpromising pond for an enterprising theorist to fish in." Undergraduate intermediate macroeconomic texts, which are usually quite quick to incorporate major recent developments in the subject, normally devoted a brief chapter to growth economics tucked away towards the end of the book, containing a brief description of Solow's (1956) neoclassical growth model and some growth accounting related to it, and perhaps some mention of Harrod and Domar's pioneering contributions. To be sure, there were some economists who were working on growth-theoretic issues in heterodox traditions (see, for instance, Harris (1978), Marglin (1984) and Taylor (1983)), but they were well outside the mainstream of the subject.

The publication of the papers by Romer (1986) and Lucas (1988) has changed all this. There has been an enormous outpouring of papers on new growth theory. The number of papers published on growth economics in the leading economics journals has ballooned, and a new journal devoted solely to the study of economic growth has appeared, entitled *Journal of Economic Growth*. Several new textbooks on growth theory have appeared, and a popular graduate macroeconomic text by David Romer (1996) begins with the study of economic growth. Undergraduate texts have also followed this lead, moving their discussion of growth to a prominent spot towards the beginning of the book, before getting down to the analysis of the determination of output and prices in the short run. Growth has been put on center stage.[i]

[i] The entire credit for this change does not necessarily lie with new growth theory. A general

Although "new" growth theory has certainly made a positive contribution by placing growth back on the agenda of mainstream economics, questions can and have been raised about how new it really is, and regarding the extent to which it makes a useful contribution to the understanding of the phenomenon of growth. This paper will argue that although there are some contributions of the new theory which can be said to be major new contributions, its newness has been greatly exaggerated by its proponents. It will also argue that new growth has not adequately captured some of the issues regarding the growth process and left out some others completely, and therefore made rather limited contributions to our understanding of the phenomenon of economic growth. A large part of the problem of new growth theory lies in its failure or unwillingness to examine issues relating to effective demand and unemployment, which are issues stressed in post-Keynesian dynamic models. Such post-Keynesian models can therefore overcome some of the problems faced by new growth theory, although these models can also profitably draw from new growth theory as well.

The rest of this paper proceeds as follows. Section 2 provides a quick summary of what new growth theorists call old growth theory and contrasts it to an earlier view of growth theory. Section 3 reviews the contributions of new growth theory, and discusses its criticisms, including its neglect of unemployment and aggregate demand. Section 4 provides a brief discussion of post-Keynesian growth theories and section 5 points out some new issues in post-Keynesian growth theory, first concerning technological change, in the analysis of which it can profitably draw on some aspects of new growth theory, and then concerning issues entirely neglected by new growth theory, using the example of consumer debt.

2. "Old" growth theory

An analytical history of what is now often referred to as "old" growth theory, that is, the theory

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interest in the problem of economic growth in the West as a result of slow economic growth along with high growth in East Asia certainly had a part to play, as did the appearance of the purchasing power parity adjusted internally comparable data in the form of the Penn Tables. Nevertheless, the nature and direction of the revival of growth economics can largely be explained by the advent of new growth theory.

of growth prior to the advent of "new" growth theory, goes something like this (see, for instance, Sen, 1970, Solow, 1994, p. 45-7).

The foundation of modern growth theory was laid by Harrod's (1939), who focused on two major problems.[ii] The first - the knife-edge instability problem - referred to the fact that if planned investment (represented by the accelerator) and saving (represented by a Keynesian saving function) were not equal, economic adjustments were likely to be destabilizing, that is, they would take the economy further away from saving-investment equilibrium and what Harrod called the warranted rate of growth. The second was the long-run problem of the equality of the warranted rate of growth which was determined by s/v, where s is the constant saving-income ratio and v the constant capital-output ratio, which determined the rate of growth of labor demand (with a fixed labor-output ratio) and the natural rate of growth of the economy as determined by the growth of labor supply and the rate of labor productivity growth, which was given by n+8, where n is the rate of growth of labor supply or population and 8 is the rate of growth of labor productivity. Since there was no reason to expect s/v and n+8 to be equal, the economy would either experience persistent increases in unemployment, or growth would falter due to labor shortages.

Many subsequent contributions to growth theory can be seen as reactions to Harrod's problems, especially to his long-run problem. The Solow-Swan neoclassical growth theory with full employment growth can be seen as "solving" the long-run problem by allowing for capital-labor substitution by cost-minimizing firms, which brought about adjustments in v; Solow (1956) in fact motivates his model in this manner. Kaldor (1955-56) and others developed models which allowed the saving rate to change in response to changes in the distribution of income, given differential propensities to save for different income groups. This Cambridge model, like

[ii] Domar's influential paper, which is bracketed with Harrod's in the so-called Harrod-Domar model, does not figure prominently in this story, and had an arguably more important influence on early development economics and planning, leading to the emphasis on policies for increasing the saving rate and reducing the capital-output ratio.

the neoclassical model, assumed full employment growth although Kaldor tried to provide reasons based on the buoyancy of investment rather than neoclassical wage-price flexibility to do the job. He also pointed out that if income distribution could not be changed due to wage or profit constraints, the adjustment mechanism need not work and unemployment could result. A third set of models - such as those of Kahn (1959) and Robinson (1962) - accepts the Harrodian conclusion and examines actual growth paths which may not make the economy grow at its natural Indeed, other models which determine capital accumulation by saving, but which assume that distribution is exogenously determined and unemployed labor exists in the economy - that is, models in the Marx-von Neumann tradition, can also exhibit growth at the rate of growth of capital at a rate different from the rate of growth of labor supply. These, of course, do not exhaust all possibilities. Adjustments in s due to reasons other than changes in income distribution, changes in v due to technological change, and in n due to changes in labor supply as in the classical models of Malthus and Ricardo, could also solve Harrod's problem and make the economy eventually grow at its natural rate.

But what of Harrod's knife-edge instability problem? Neoclassical growth theory simply assumes the problem away by making investment identically equal to saving and by assuming that factor-price flexibility and smooth substitution in a frictionless model always ensures full employment, not just in the long run. The Kaldor model also assumes full employment in the long run, not in terms of the neoclassical adjustment story but in terms of an analysis of how in the growth process investment demand will be sufficient to produce full employment. Kaldor therefore allows for investment and saving to be different from each other, but argues that investment will be enough to generate full employment in the long run, and that distribution will adjust to bring saving into equality with investment. Thus the Harrodian knife-edge is averted by assuming the economy to be at full employment and examining changes in the price level and distribution in response to goods market disequilibria: investment is fixed while saving adjusts to it. Robinson (1962) and others who have analyzed actual growth paths which do not imply full employment, have introduced investment and saving functions which allow both desired investment and saving to adjust to changes in the rate of profit (as in Robinson's banana diagram), but which ensure stability by making saving respond more strongly to changes in the profit rate than does investment. Thus, different contributions have bypassed (in the case of the neoclassical model) or overcome (in the case of the Cambridge and Robinsonian model) Harrod's knife-edge instability problem in different ways.

Following the emergence of the Solow-Swan growth model, there emerged a neoclassical literature extending that model, all of it assuming continuous full employment. A few of these contributions relevant for our subsequent discussion may be briefly discussed. Solow (1956) had extend his model to allow for technological change in his original paper. Using a Cobb-Douglas formulation with the production function given by[iii]

$$Y = AK^{\forall}(EL)^{1-\forall} \qquad (1)$$

where K denotes capital stock, L the employment of labor, and E the labor-augmenting productivity parameter, that model can be expressed in terms of its dynamic equation involving k = K/EL, as

$$\hat{}k = s\,Ak^{\forall-1} - n - \hat{}E, \qquad (2)$$

where n is the exogenously fixed rate of growth of labor supply and employment (under conditions of full employment), and overhats denote rates of growth. Solow assumed that ^E is exogenously given at the rate 8, so that this equation becomes

$$\hat{}k = s\,Ak^{\forall-1} - n - 8. \qquad (3)$$

The model implies that in steady state, with ^k=0, so that $Y/EL = Ak^{\forall}$ becomes a constant, per capita income, $y = Y/L$, grows at the rate 8, the exogenous rate of technological change. Several contributions have modified the assumption of exogenous technological change. Arrow (1962) examined the case of learning by doing, in which labor productivity depends on cumulative

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[iii] In presentations of the neoclassical and new growth theory models we will, for simplicity, assume the Cobb-Douglas formulation throughout this paper, except where noted to the contrary. More general constant returns to scale formulations do not change the results, provided E is interpreted as the Harrod-neutral technical progress parameter.

experience, measured by cumulative gross investment. Altering his assumption of the fixed coefficients production function with vintage capital to that of a Cobb Douglas production function with homogeneous capital, and writing the learning function as

$$E = .K^{0} \qquad (4)$$

where . and 0 are positive parameters of the learning function and K denotes cumulative gross investment (assuming away depreciation), equation (2) becomes

$$\hat{}k = s(1\text{-}0)\ Ak^{\forall\text{-}1} - n. \qquad (5)$$

Under Arrow's assumption that 0<1, which reflects diminishing returns to learning, equation (5) determines the steady state level of k, given by

$$k^{*} = \{n/[(1\text{-}0)sA]\}^{-1/(1-\forall)},$$

at which $Y/EL = Ak^{\forall}$ becomes a constant, implying that per capita income, $y = Y/L$, grows at the rate $\hat{}E$, which from equation (3) is seen to be given by $0n/(1\text{-}0)$. Uzawa (1965) examined the case in which the growth of E is related to education. In particular, he assumed that $\hat{}E$ depends positively on the proportion of labor devoted to education, which we express in isoelastic form as

$$\hat{}E = \vartheta\ (L_E/L)^{'}. \qquad (6)$$

Assuming that labor engaged in production does not produce output, so that output is given by

$$Y = AK^{\forall}\ (EL_P)^{1-\forall},$$

where L_P denotes labor engaged in production, with $L_P + L_E = L$, and continuing to assume that a fixed fraction s of output is saved an invested, and that L_E/L is fixed at the level u (in contrast to Uzawa's interest in finding the optimal time path of production by choosing s and u at every point in time), equation (2) can be written as

$$\hat{}k = s\ Ak^{\forall\text{-}1}\ (1\text{-}u)^{1-\forall} - n - \vartheta\ u^{'}. \qquad (7)$$

Solving for the steady state level of k as before we find that the rate of growth of per capita output at this steady state is given by $\vartheta\ u^{'}$. It may be noted that we can think of the "education" sector alternatively as the "research" sector, implying that greater research effort implies faster technological change. Other contributions modified the assumption of a given saving rate with the assumption of optimizing consumer-households. This was done in two ways. One class of models assume that infinitely lived dynasties have instantaneous utility given by a function of the form

$$u\,(c) = c^{1\text{-}\Lambda}/(1\text{-}\Lambda) \quad \text{for } \Lambda 1$$

$$= \ln c \qquad \text{for } \Lambda = 1,$$

and maximize

$$U = \mathrm{I}_0^4\; u\,[c(t)]e^{nt}\, e^{\text{-}\Delta t}\,\mathrm{d}t$$

with the fixed rate of time preference Δ, taking into account family size growing at the rate n. Another class used the overlapping generations (OLG) structure, with individuals maximizing their present utility over two periods, working and saving in the first and retired and dissaving in the second. These models, assuming that labor-augmenting technological change occurs at the exogenous rate 8, also imply that at steady state per capita income grows at this exogenous rate.

3. "New" growth theory

The essence of new growth theory is now generally seen to be captured by the simple AK model, in which output, Y, is assumed to be related to 'generalized' capital, K, by a fixed coefficient, A, in terms of the production function

$$Y = A\,K. \tag{8}$$

It should be noted that this function states that output can be increased indefinitely, without experiencing diminishing returns, with the accumulation of generalized capital and that, moreover, output cannot be increased by increasing the employment of labor. In its intensive per-worker form, it can be written as

$$y = A\,k. \tag{9}$$

where k now denotes K/L, and the efficiency factor for labor, E is fixed and set equal to 1.[iv] If we assume that a constant fraction, s, of output and income is saved and automatically invested, and assume away depreciation, the equation of motion of k is given by

[iv] Assuming that the efficiency of labor grows at an exogenously fixed rate will not change the nature of our conclusions.

$$^\wedge k = s\,A - n. \tag{10}$$

Assuming that $sA>n$, we see that k does not reach a steady state value but grows continuously at the rate sA-n>0, we see that equation (9) implies that per capita income grows forever at this same rate, $^\wedge y = sA$-n. Equation (10) differs from equation (3) of the Solow model by ignoring exogenous technological change, setting 8=0, and more importantly, by setting $\forall$=1, which implies doing away with diminishing returns to capital while maintaining constant returns to scale. It is this latter assumption that is crucial for generating a constant rate of growth of k rather than reaching a constant value of it in steady state. In general, new growth models require that the returns to endogenously accumulable factors is non-diminishing. In this simple model labor is not endogenously accumulable - in the sense that the growth of labor supply is fixed exogenously and capital is, so that the condition for endogenous growth is that we do not have diminishing returns to labor because we have constant returns to labor. If we have diminishing returns to capital, as in the Solow model, in steady state, when the marginal return to capital approaches zero, the exogenously fixed rate of growth of labor supply (in effective units) determines the rate of output growth.

Two comments should be made about this model. First, the model does not require the assumption of full employment of labor: since labor is not productive, the level of employment of labor does not matter. Second, the *AK* form is not necessary to generate "endogenous" growth. A production function of the form

$$Y = AK + BK^{\forall}L^{1\text{-}\forall}$$

yields the equation of motion

$$^\wedge k = s(A + Bk^{\forall\text{-}1}) - n.$$

As long as $sA>n$, this equation will not yield a steady state value of k, and the growth rate of k and hence y will asymptotically tend to the value sA-n. This implies that endogenous growth is consistent with some diminishing returns to the accumulable factor, provided that there is some lower bound to this diminishing returns. Moreover, the model can even allow for increasing returns to capital, in which case the growth rate of k and y will increase over time, without bound. There may be problems with making this consistent with perfectly competitive assumptions, but these problems are not insurmountable, as the subsequent discussion will clarify.

The *AK* formulation, of course, is new growth theory in a skeletal form. Many of the major contributions to the new growth theory can be seen as putting muscle on these bare bones, although they emerged before the *AK* model itself. One formulation interprets *K* as generalized capital including some sort of technology stock which has positive externalities across producers. This is the interpretation of Romer (1986), who essentially uses a production function of the form given by equation (1) with *K* interpreted as the stock of knowledge and assumes that

$$E = K^{A} \tag{11}$$

where K^A denote's the economy's aggregate stock of capital, reflecting how technology improves when the aggregate stock of knowledge (which is a public good) increases, whereas *K* in the individual firm's production function given by (1) denotes private knowledge. The firm invests in research and development expenditures to increase their private knowledge stock, on which they earn the rental rate equal to its marginal product - note that we have diminishing returns to private capital. However, as the knowledge stock of all firms grows, the aggregate stock of capital contributes to increasing productivity from nonexcludable knowledge. Since the sum of all private capital (which we also denote by *K*, assuming for simplicity that there is only one firm) is equal to aggregate capital, equation (11) implies

$$E = K, \tag{12}$$

which implies that ^*A* = ^*K*. This implies that this equation is simply a special case of Arrow's learning equation (4) with 0=1, that is, with no diminishing returns to learning. Substituting equation (12) into equation (1) we obtain

$$Y = AKL^{1-\forall},$$

which yields the *AK* model as long as labor supply is constant (which is what Romer assumes in his basic model) and we assume that full employment of labor prevails. It should be noted that since we have diminishing returns to private capital the model is consistent with perfect competition. We see that Arrow's model, with a slight change in assumptions (0=1 rather than 0<0<1) implies the Romer (1986) model, although Romer uses the infinite horizon optimizing framework, and interprets *K* as increasing due to research and development expenditures rather than learning by doing, becomes the *AK* model.[v] Another formulation, that of Lucas (1988) includes two types of capital - physical and human capital. The structure of Lucas's model is in fact identical to that of Uzawa's, with the difference that he assumes , = 1 in his technical change function given by equation (6) and he introduces externalities due to human capital accumulation, captured by introducing an aggregate human capital formation term in the production function. The presence of externalities, as in the Romer model, makes this model consistent with perfect competition despite the presence of increasing returns. This formulation yields "endogenous" growth but, as we saw earlier, so did Uzawa's model. However, it does not yield the *AK* model. That model, however, can be generated with models of two types of capital - human and physical capital - where both are accumulated and both have similar production conditions, and where raw labor is therefore not a constraint on production. Physical and human capital together exhibit non-diminishing returns, and both are endogenously accumulable. Yet other formulations allow for new products, either in the form of new consumer goods (which in some versions expand the number of goods which consumers consume, and in other versions replace older goods with higher quality goods) or new intermediate goods used in production (see, for instance, Aghion and Howitt, 1998). The development of new products or better technology in these models is modeled as being the result of research and development activities of inventor/innovators who involve themselves in research activity rather than in production. Although these models do not necessarily introduce stocks of capital, they produce results that are similar to the *AK* model because they use production or utility functions of the Dixit-Stiglitz

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[v] If we wish to allow for population growth, it is easy check that if equation (12) is replaced by $A = K/L$, then we will obtain the production function *AK* for this model, yielding exactly the *AK* model. In this formulation what is relevant for productivity increases is not the stock of knowledge but the stock per unit of labor.

type where variety adds to production or to utility. These models are also different from the Solow model because they introduce imperfect competition, thereby allowing them to have neoclassical optimization microfoundations with increasing returns, and also derive (at least temporary) returns from innovations which subsequently become public goods. It should be noted that all of these versions of new growth theory assume explicitly that labor is fully employed: for instance, in models with research and development activity, the total labor force at any moment in time is engaged either in production or in research and development.

Most endogenous growth theory models do not assume given saving rates as in the *AK* model discussed above, but allow infinitely-lived consumers (one representative consumer or dynasty is considered) to maximize their present discounted utility level over their lifetime under the assumption of perfect foresight. Solow has repeatedly criticized this practice. In Solow (1997, p. 12) he writes: "I find that I resist this practice instinctively. It seems to me foolish to interpret as a descriptive theory what my generation learned from Frank Ramsey to treat as a normative theory, a story about what an omniscient, omnipotent, and nevertheless virtuous planner would do". One can argue that at best what these models do is to allow a comparison of the actual outcome for economies with some social optimum. But even here its value is limited by its assumption that preferences are given, whereas during the growth process one can expect preferences to change, arguably in unknowable ways (see Skott and Auerbach, 1995). In any case, this approach is not unique to endogenous growth theory, even before its appearance, optimizing growth models were already in vogue. Solow (1994, p. 49) also argues that the intertemporally optimizing agent also has the effect of "encumbering it [the growth model] with unnecessary implausibilities and complexities". Finally, this assumption makes no real difference in terms of results. As Solow (1997, p. 12) notes, comparing the optimizing model with models with behavioral saving functions, "[i]t is not a matter of great importance for growth theory. The two approaches come to the same thing in the long run, although they can differ in the short run".

Its proponents claim that new growth theory, unlike old growth theory, determine growth endogenously even in the long run - hence its alternative name, endogenous growth theory - and in particular, have long-run growth depending on the saving and investment rate. These claims have some truth to them, but are exaggerated. The element of truth is that most old growth theories of the neoclassical type implied that long run growth was independent of the saving and investment rate, and depended on exogenously given rates of technological change (as for instance in the Solow model), or parameters of technological change functions (as in the Arrow model). However, it is untrue at least for the Uzawa model in which growth depends on the allocation of labor between production and education sectors which can be affected by the time preference of consumer-workers, as shown in Uzawa's own optimizing model.

Moreover, this view involves a drastic reinterpretation of old growth theory. Old growth theory was not just neoclassical growth theory in which growth in the long run was (for most models) exogenous and in particular independent of saving and investment rates. It also included other growth theories which allowed the rate of growth to be different from its natural rate in the long run. In Robinson's model, for instance, if the investment rate increased due to an upward shift in the desired accumulation function, the rate of growth would increase in the long run. Models in the Marx-von Neumann tradition also implied that a rise in the saving rate out of the surplus would increase the saving rate, capital accumulation, and the rate of growth. These models produced endogenous growth because they assumed that the only possibly endogenously non-accumulable factor - labor - was not a binding constraint on production even in the long run not because it was not productive in the sense of the *AK* model, but because there existed unemployed labor. It is only by reinterpreting "old" growth theory in a way that obliterates these theories, that new growth theory can claim to be the first to endogenize long run growth rates.

New growth theory also has its critics. We review some of their criticisms briefly before turning in more detail to the criticism with which this paper is primarily concerned. First, the main insights of new growth theory - such as: technical change is largely endogenous to the economic system; technology is at least partly proprietary; market structures supporting technical advance are imperfectly competitive; growth fueled by technical advance involves externalities and increasing returns; the investment rate affects growth in the long run - have been well known to students of economic growth and technical change (see Nelson, 1997), including Adam Smith, Karl Marx, Young (1928), Kaldor (1966, 1970) to name just a few, so that there is little which is really new in "new" growth theory in this sense. It can be argued, of course, that it is one thing to know about concepts, but quite another to actually formalize them into models of growth. Second, many of the ways these ideas have been formalized into growth models are hardly different from ways that they were in earlier growth models (see also Bardhan, 1995). For instance, our earlier discussion has shown that Romer's (1986) early growth model was little different from Arrow's (1962) learning by doing model in what may be considered its essence, except for the removal of one restriction in the technological progress parameter, while Lucas's (1987) model is very similar to Uzawa's (1965) model with an education sector, except for removing a parameteric restriction similar to the way in which Romer's analysis changed Arrow's. However, there are some important developments as well: models with new products which allow for imperfect competition in production, and allow for profit-seeking research and development expenditures are genuinely new. But it should be pointed out that some features of these developments were modeled earlier, for instance, imperfect competition; the newness lies in large part in making these ideas consistent with models of maximizing behavior with explicitly defined market forms, and in modeling new product development. Third, it can be argued that some of basic analytical properties endogenous growth models were well known earlier, although in some cases not emphasized because they were considered to be unrealistic. Kurz and Salvadori (1998, 1999) point out that versions of the linear *AK* model can be found in the writings of Ricardo, Knight, and in a more complicated form in von Neumann. For instance, in Ricardo's model, since labor is an endogenously accumulable factor due to endogenous Malthusian dynamics, if land is free or omitted from the model, we have endogenous growth. Kurz and Salvadori argue that the classical notion of endogenously accumulable labor has the analogue in the new growth theory models with human capital that effective labor supply becomes an endogenously accumulable factor due to human capital accumulation. Smith's analytical framework, in which the productivity of labor grew indefinitely due to the division of labor (when output increased), also allowed for endogenous growth in the sense that growth was unbounded and the rate of growth increased with the saving rate. This insight seems to have been used in the model with increasing numbers of intermediate goods. Fourth, as Skott and Auerbach (1995)) and Nelson (1997) argue, the way the insights regarding technological change are incorporated into growth models are often incorrect and seriously incomplete. Endogenous growth models do not take into account some of the main features of technology (including the fact that a great deal of hands-on learning is often required to gain mastery over technology), of firms and their organization and management, and of institutions (including universities, government agencies and banks and banking institutions) and cultural factors determining technological dynamism. In analyzing technological change they abstract from true uncertainty, assuming either perfect foresight or that uncertainty can be treated in terms of probabilistic risk. Much of this is the result, Nelson argues, of constraining the models to remain as close as possible to the canons of general equilibrium theory. Fifth, as Pack (1994) argues, new growth theory provides relative few insights for the understanding of actual trends in productivity growth in OECD countries or in the Asian NICs, or of international productivity differences.

Finally, new growth theory abstracts away from issues relating to Keynesian effective demand and unemployment.[vi] By following the neoclassical tradition of assuming that the labor market clears due to wage flexibility and that all saving is automatically invested, new growth theory models assume that the economy is always at full employment. This sets them apart from all segments of old growth theory which assumed that full employment does not always prevail, and which allow long-run growth to be determined by effective demand considerations. Intermediate macro texts, which now discuss new growth theory right at the start, have to then introduce effective demand issues for short-run models. In this approach, the reason for unemployment and the determination of output by aggregate demand is short-run money wage

[vi] This point has been noted earlier by several authors, including Palley (1996) and Kurz and Salvadori (1998).

rigidity. In the long run, which the money wage flexible, the economy tends to full employment. Therefore, in the long run analysis of growth, so the story goes, we are entitled to ignore these considerations. Even if money wage flexibility is not enough to quickly take us to full employment, government policies can be relied upon to achieve that.

Many non-orthodox economists, of course, have been wary of this kind of distinction between the short run and the long run. Kalecki (1971), for instance, has argued that the long run is nothing but a succession of short runs. Much of this wariness comes from the lack of confidence among these economists in the ability of either markets or the state which would tend to push the economy to full employment. Keynes (1936) had argued that wage reductions would not necessarily be able to guide the economy to full employment if one takes into account its demand side, as well as its cost side effects. Expectational factors, and redistribution from debtors to creditors, would depress aggregate demand, preventing the interest rate mechanism (paradoxically known as the Keynes effect) from increasing demand. Wage flexibility, in fact, is likely to increase uncertainty, and thereby reduce aggregate demand and increase the demand for money. Post-Keynesian economics have also stressed the fact that income redistribution away from wages also reduces demand, while the endogeneity of money prevents adjustments in interest rates due to excess liquidity in the economy. Moreover, the role of deflation in reducing investment has been stressed by writers of very different stripes - from Fisher to Minsky. Turning to the government, their ability to manipulate aggregate demand to restore full employment should not be overestimated, as should be clear from the ineffectiveness of recent efforts of the US Fed, and from those of the Japanese government. Kalecki (1943) has also drawn attention to the political obstacles to full employment policies, due to the opposition of "industrial leaders" to government interference as such, to government spending, and of the consequences of maintaining full employment because of its effect on worker discipline. One may add to these obstacles those emphasized in political business cycle theory, and to the fears (whether justified or not) of what inflation may do to financial markets if aggregate demand is allowed to expand.

It is not only non-orthodox economists who have raised the issue of the neglect of unemployment in growth models. Even in his paper which laid the foundations of neoclassical growth theory, Solow (1956) noted that his model "is the neoclassical side of the coin. Most especially it is full employment economics - in the dual aspect of equilibrium condition and frictionless, competitive, causal system. All the difficulties and rigidities which go into modern Keynesian income analysis have been shunted aside. It is not my contention that these problems don't exist, nor that they are of no significance in the long run. My purpose was to examine what might be called the tight-rope view of economic growth and to see where more flexible assumptions about production would lead in a simple model. Underemployment and excess capacity or their opposite can still be attributed to any of the old causes of deficient or excess aggregate demand, but less readily to any deviation from a narrow 'balance'." Solow (1982), after his comments on the stagnancy of growth theory noted in the introduction, stated that he did not confidently expect that state to last: "A good new idea can transform any subject; in fact, I have some thoughts about the kind of new idea that is needed in this case". Writing after the advent of new growth theory, Solow (1991, p. 394) states that its basic idea about the endogenous determination of the long-run rate of growth three increasing returns to scale at the macroeconomic level due to externalities in research and development and human capital accumulation was "not the sort of 'new idea' I had been hoping for in 1982. I had in mind the integration of equilibrium growth theory with medium-run disequilibrium theory so that trends and fluctuations in employment and output can be handled in a unified way. That particular idea has not yet made its appearance". Indeed, he has consistently opined that growth theory should pay more attention to demand issues and unemployment. In his Nobel lecture (Solow, 1988, p. 309) he admits of his own models that "I think I paid too little attention to the problems of effective demand", and criticized "a standing temptation to sound like Dr. Pangloss, a very clever Dr. Pangloss. I think that tendency has won out in recent years".

Is it fair to say that unemployment and effective demand are completely neglected in new growth theory? A perusal of textbooks and journals on the subject suggest that this is not entirely accurate, but more or less true. Barro and Sala-i-Martin (1995) have no discussion of unemployment or aggregate demand: according to them even the Harrod and Domar models are treated basically as a neoclassical growth model with a fixed coefficient production function, with all saving automatically invested. Aghion and Howitt (1998) devote an entire chapter to unemployment and growth in which they allow workers to become unemployed due to the scrapping of the capital, but unemployment is due to frictions in the matching of workers to plants. In this chapter Aghion and Howitt discuss the role of the creation of new jobs through the stimulation of demand, but it is only due to intersectoral complementarities in demand among intermediate goods, rather than to Keynesian aggregate demand issues. A chapter on growth and cycles discusses the long-run effects of temporary shocks introduces aggregate demand into the analysis and shows how aggregate demand shocks can affect long run growth by changing the level of output and the learning that results from it. But output fluctuations are possible due to surprise supply functions, rather than due to standard Keynesian output adjustments (though some of the effects that are considered in the chapter would work with such adjustments as well). A perusal of the papers in the *Journal of Economic Growth* reveal little that has to do with unemployment and aggregate demand. I examined its contents over the five years of its existence and found only two papers which seemed to have some promise of dealing with these issues. Fatas (2000) develops a model with a continuum of imperfectly competitive sectors and with consumers who maximize a utility function where the instantaneous utility function implies constant expenditure shares for these goods, and which allows one producer in each sector to increase its productivity by (probabilitistically) by using labor for research. Each monopolist takes aggregate demand as given and decides on the amount of research and production. Aggregate demand is determined in the model by equating total demand to total income (profit and wages in production and research). Although aggregate demand and research and hence technological progress affect each other (greater demand increases the expected profits from research, and aggregate research affects aggregate demand because of its effect on total profits), there is no unemployment in the model and there is no Keynesian distinction between aggregate demand and income. Mani (2001) provides an interesting analysis of the dynamics of income distribution, demand and growth, showing how an unequal distribution of income results in the demand for goods which require rich workers for production, and which therefore do not increase the demand for poor workers, preventing them from accumulating human capital and contributing to productivity growth. However, the model is about demand composition, and not about aggregate demand and unemployment.

As far as I know, there are only two major contributions to recent growth theory which may be called neoclassical in the sense that they explicitly consider optimizing agents, either in terms of the infinite horizon Ramsey framework or in terms of the overlapping generations framework, which explicitly deal with what can be called Keynesian unemployment. Ono (1994) uses the infinite horizon optimization model but departs from the Ramsey framework by assuming that the household's instantaneous utility depends on real money balances in addition to consumption, and that the marginal utility of real balances remains positive even when they become infinitely large. Introducing money in the utility function implies that the household's optimization conditions gives the interest rate an intra-temporal dimension (which equates it to the liquidity premium on money) in addition to the traditional intertemporal dimension. Assuming that the rate of inflation is determined by the level of excess demand in the economy, Ono shows that it is possible to have a steady state at which market disequilibrium prevails in the sense that consumption is less than the exogenously-given level of output (an analysis which he extends to allow for production, employment, the wage and investment). Since the marginal utility of money tends to a positive constant, households keep accumulating real balances without increasing consumption, implying that excess supply persists indefinitely, in contrast his version of the neoclassical models in which deflation increases consumption since the marginal utility of money tends to zero. Ono therefore shows how short-circuiting the real balance effect with his restriction on the utility of money can prevent an otherwise neoclassical economy from reaching full employment despite the flexibility of the wage and the price level. Indeed, Ono (1994, p. 64) shows that greater price (and wage in a more general model) flexibility can hurt, rather than help, in attaining full employment. Hahn and Solow (1995) use the OLG model and introduce real money balances using a variant of the Clower constraint rather than directly in the utility function like Ono. A neoclassical version of the model with perfect wage flexibility, perfect foresight and full employment is found to have an unstable steady state, and it is shown that the dynamics can be cyclical. When they introduce what are "realistic" features of the economy such as imperfect competition and increasing returns to scale, and micro-founded labor markets that introduce issues of bargaining, search, and fairness they find that the model can generate fluctuating output and unemployment. The model also shows that wage and price sluggishness can be stabilizing. However, the models become quite complicated, and has dynamics which are not very transparent; Hahn and Solow in fact resort to simulation techniques to examine some of its properties. Although these two models confirm some of the issues relating to the ability of economies to attain full employment, they become rather unwieldy primarily due to their optimizing assumptions, and introduce money into the models in arguably somewhat artificial ways. Furthermore, they have nothing at all to do with new growth theory models. Although Ono cites the work of Romer and Lucas, his models do not introduce technological change, and Hahn and Solow's list of references do not cite any new growth theory contribution at all, probably seeing itself as a contribution to medium run macroeconomics rather than growth theory proper (although dealing with all aspects of growth theory other than technological change).

4. Post-Keynesian growth theory

In contrast to old neoclassical and new growth theory models Post-Keynesian models of growth bring effective demand issues to center stage. They can also be distinguished from these models because they do not explicitly consider optimizing behavior on the part of consumer-savers and firms. They build on the contributions of Robinson and others who modeled the actual path of dynamic economies which did not grow at their natural rate even in the long run and draw on the contributions of the Cambridge growth theorists, Kalecki, and other writers.

Although several versions of post-Keynesian growth models are available in the literature, we present it in in the form of a simple model which draws on the work of Kalecki and Steindl.[vii] Following Kalecki (1971) it is assumed that the price of the representative firm is set as a markup on variable costs, assumed for simplicity to be only labor costs, so that

$$P = (1+z)bW$$

where P is the price level, b the labor-output ratio assumed to be fixed, and W the money wage. The markup rate, z, is assumed to be a constant, representing Kalecki's degree of monopoly. Firms are assumed to adjust output in response to effective demand, and to maintain excess capacity. Employment is less than full employment and the money wage is assumed to be fixed for simplicity. Assuming that there are only two factors of production - labor and capital - and that all non-wage income goes to profits, this equation implies that the profit share is given by

$$\Phi = z/(1+z).$$

Workers are assumed to spend all their income while profit recipients are assumed to save a constant fraction, s, of profits, so that we have consumption given by

$$C = (1-\Phi)Y + (1-s)\Phi Y, \qquad (13)$$

where the first term is the labor share in output and income and the second term capitalist consumption. Assuming a closed economy and no government fiscal activity, the only other source of aggregate demand is investment demand. We assume that investment demand is exogenously fixed at a point in time. We denote the investment rate by

$$I/K = g \qquad (14)$$

where I and K are real investment and the physical stock of capital. In the longer run we assume that firms adjust their investment rate to their desired rate of investment, which we formalize with the equation

$$\mathrm{d}g/\mathrm{d}t = 7\,(g_d - g), \qquad (15)$$

[vii] See Rowthorn (1982) and Dutt (1984) for the original models, and Taylor (1983, 1991), Dutt (1990) and Lavoie (1994) for further analysis.

where 7 is a positive constant and where g_d is the desired rate of investment. Following Robinson (1962), Kalecki (1971), and especially Steindl (1952) we assume that desired investment depends positively on the rate of profit and on the rate capacity utilization, which we measure as $u=Y/K$. Since the profit share, Φ, is constant as long as the markup, z, is constant, the profit share is proportional to the rate of capacity utilization. For simplicity we therefore write the desired investment function as

$$g_d = (_0 + \ (_1\, u, \tag{16}$$

where $(_i$ are positive investment parameters.

In the short run we assume that g and the stock of capital, K, are fixed and that the level of output adjusts to meet effective demand, given by the sum of consumption and investment demand, so that in short-run equilibrium

$$Y = C + I.$$

Substituting from equations (13) and (14) and dividing by Y and solving for u we get the short-run equilibrium value of capacity utilization to be given by

$$u = g/s\Phi. \tag{17}$$

We constrain g to be always positive, so that equilibrium u will be positive, and if output adjusts to excess demand, the short-run equilibrium will be stable. We also assume that there is enough capital (as well as labor) available not to be a constraint on production.

In the longer run we assume that K and g can change. Assuming away depreciation we have the rate of growth of capital given by g. The dynamics of g are given by equation (15) with (16) and (17) holding at every instant. Substituting these equations into equation (15) we get

$$\mathrm{d}g/\mathrm{d}t = 7\ [(_0 + \ (_1\, (g/s\Phi) - g], \tag{18}$$

which can be used to find the long-run equilibrium value of g, given by

$$g = s\ \Phi\ (_0/(s\Phi - (_1). \tag{19}$$

The existence and stability of this long-run equilibrium requires that $s\Phi > (_1$, which is the familiar macroeconomic stability of Keynesian models, that is the responsiveness of saving to changes in the adjusting variable (in this case the capacity utilization rate) is greater than the corresponding responsiveness of investment. It may be noted that the long-run equilibrium rate of growth depends inversely on the capitalist saving rate and the profit share, and positively on the investment parameters. The result that growth depends negatively on the profit share can be altered if one amends equation (16) to make desired investment also depend positively on the profit share (as is done by Bhaduri and Marglin, 1990).

Alternative models in heterodox traditions can be thought of as special limiting cases of this model.[viii] If aggregate demand is high enough so that in the short run the economy reaches full capacity utilization, output can no longer adjust in response to excess demands. If the price level adjusts to clear the market, then in effect the markup rate, z, and hence income distribution, Φ, vary to clear the market. With output always at full capacity, the model becomes the Robinsonian model, or what Marglin (1984) calls the neo-Keynesian growth model. This model assumes that the real wage can take whatever level is necessary to clear the goods market. If, however, the real wage reaches a floor before the goods market clears, and reductions in the real wage lead to increases in the money wage due to wage resistance, the goods market cannot clear to bring aggregate demand and output to equality. One way to ration demand is to assume then that actual investment is determined by actual savings, and the gap between desired and actual investment (or saving) only results in inflationary pressures which do not affect the actual rate of accumulation. This model, in which the real wage (and hence distribution) is fixed due to wage resistance and accumulation is driven by saving, can be thought of as the classical-Marxian model, which Marglin (1984) calls the neo-Marxian model. In all of these models we have unemployed workers, and in that sense they all deviate from neoclassical models.

It may be argued that it is inappropriate to have a model in which capital, output and employment grow at a rate different from the rate of growth of labor supply, as all of these models imply, since that means that the unemployment rate will continuously rise or fall during

[viii] See Dutt (1990) for a discussion and comparison of these alternative models.

the growth process. This may be considered to be theoretically implausible and empirically unrealistic. Against this argument it may be said that the rate of unemployment in capitalist economies has been known to fluctuate, increasing and staying at high levels for relative long periods of time, and remaining low at other periods. It can also be argued that the unemployment rate is actually kept within bounds for a number of reasons, some of them having to do with government policies (which does not necessarily maintain full employment) and the nature of technological change which affect the growth of labor demand, but some having to do with the supply of labor as well, including changes in social norms (women joining the work force), labor legislation (restricting hours worked, or child labor), individual responses to changes in real wages, migration (including illegal immigration facilitated by changes in the degree of laxity in the enforcement of immigration laws) and discouraged worker and deskilling effects. This is a “problem” that is faced by many heterodox models, including neo-Marxian ones, and not just the post-Keynesian model discussed here, and “solutions” to it can be sought in the rich analysis provided by these approaches (see Marglin, 1984, for instance). More specific to the post-Keynesian model discussed here, it may be objected that it is inappropriate to have the rate of capacity utilization endogenously determined in long-run equilibrium, rather than be at some exogenously-given desired or normal rate. This issue has attracted a fair amount of attention in the discussion regarding this post-Keynesian model. While some authors argue that while in the short run, deviations from some exogenously given ‘normal’ capacity are permissible, in the long run the economy must adjust so that actual and ‘normal’ capacity utilization are equalized, others argue in favor of the endogenous determination of capacity utilization even in long run equilibrium, on the grounds that firms may not have a unique level of normal capacity utilization, but be content if it remains within a band, or that ‘normal’ or ‘desired’ capacity utilization itself may be endogenous (see, for instance, Dutt, 1990 and Lavoie, 1995).

This skeletal post-Keynesian model, or those very much like it, have been modified in numerous ways to examine a host of issues relevant for both advanced and developing capitalist economies, by introducing inflation, asset markets, the rentier class, government expenditures, non-industrial or primary producing sectors, sectoral interaction involving different types of sectors, technological change, open economy considerations, and trade between developed and developing countries.[ix] For present purposes it suffices to discuss two kinds of such modifications, to which we turn in the next section.

5. New issues in post-Keynesian growth theory

In this section we turn to modifications of the post-Keynesian model to discuss two new issues relevant for post-Keynesian growth theory. The first introduces technological change into the model, given the paramount importance of technological change in the new growth theory literature, and the second introduces consumer debt into the model to consider an example of new applications of post-Keynesian growth models which deal with important issues which are completely neglected by new growth theory given its excessive preoccupation with technological change.

As mentioned earlier, the incorporation of technological change in post-Keynesian growth models is not new. As in the neoclassical approach, such changes can be incorporated into the post-Keynesian model of the previous section in terms of changes in the efficiency of labor. Labor productivity can be measured in the previous model by $A = 1/b$, where it will be recalled that b is the unit labor requirement used in the markup equation. Technological change, then can be seen as a rise in A or a fall in b. However, equations (17) and (19) show that such an exogenous parametric shift will have no effect on the rate of capacity utilization in the short run (the growth of capital stock is given in the short run) or on capacity utilization and the rate of growth of capital stock in the long run. If we assume that technological change results in an exogenously given rate of growth of labor productivity at the rate $\hat{A} = -\hat{b}$, it follows that g and u will be unaffected both in the short or long runs. This result may be taken to imply that

[ix] For a discussion of a number of such models see Dutt (1990) and Taylor (1991) and for a recent survey, see Dutt (2001).

technological change has no effect in the post-Keynesian growth model. Since the rate of growth of output is unaffected by technological change, the effect of a higher rate of technological change in merely to reduce the rate of growth of labor demand, resulting in a greater increase in the unemployment rate over time if the growth rate of labor supply is exogenously given.

This result, however, depends on the assumption that none of the other parameters in the model change when the rate of technological change changes. Post-Keynesians have long argued that changes in the rate of technological change will alter some of the other parameters in the model directly and indirectly. First, and perhaps most importantly, a higher rate of technological change will have a positive effect of investment as firms need to invest in order to make use of new technology embodied in new machines, to use new processes, and to produce new products. This was an important theme in the work of Kalecki (1971), and this effect has been incorporated into numerous post-Keynesian models (see Rowthorn, 1982, Dutt, 1990). Thus, higher rates of technological change push the desired investment upwards, implying higher rates of investment and capacity utilization in the long run. Second, a higher rate of technological change can also reduce the saving rate of capitalists, if it increases the variety of goods available to capitalist consumers, thereby increasing capacity utilization in the short run, and both growth and capacity utilization in the long run. Third, a higher rate of technological change can change the markup rate charged by firms, z, and hence, Φ. Suppose that faster technological change implies that firms increase their degree of monopoly which increases the markup. A higher markup in the model presented above, however, has the somewhat counterintuitive effect of reducing the degree of capacity utilization in the short run and reducing both capacity utilization and the rate of growth in the long run, because of the redistribution of income from workers to profit recipients which reduces aggregate demand. However, modifications of the desired investment function represented by equation (16) can lead to different conclusions. For example, with the Bhaduri and Marglin (1990) desired investment function mentioned above, an increase in Φ (due to the faster rate of technological change and consequent increase in the markup) will reduce the rate of capacity utilization in the short run due to the fall in consumption demand, but will have an ambiguous effect on the rate of desired accumulation, having a positive effect due to the increase in Φ and a negative effect because of the short-run fall in *u*. The eventual long-run impact on growth and capacity utilization could be positive if the positive impact of the profit share on desired investment is strong enough.

In the discussion so far I have assumed that the rate of technological change is given exogenously. However, post-Keynesian growth theory has also endogenized the rate of technological change by assuming that ^*A* depends on economic variables. They have followed the lead of Kaldor (1957, 1961), who argues that capital accumulation and technological change are necessarily interdependent and formalizes the dependence of the latter on the former with the technical progress function which makes labor productivity growth a positive function of the rate of growth of the capital labor ratio. Using a linear form, we assume

$$\hat{}A = \vartheta_0 + \vartheta_1 \hat{}k.$$

Noting that $\hat{}k = \hat{}(K/Y) - \hat{}(L/Y)$, we can rewrite this equation as

$$\hat{}A = [\ \vartheta_0/(1-\vartheta_1)] + [\vartheta_0/(1-\vartheta_1)]\hat{}(K/Y).$$

In long-run equilibrium *u* attains its equilibrium level, so that $\hat{}(K/Y) = 0$, implying that

$$\hat{}A = \vartheta_0/(1-\vartheta_1),$$

or in other words, that the rate of labor productivity growth is determined only by the parameters of the technical progress function. In the model, therefore, in the long run, the rate of growth of capital and that of output per capita is endogenous, but the rate of growth of output per worker remains exogenous in the sense that it depends only on the parameters of the technological progress function. This property is not shared by all post-Keynesian models, however. For instance, a model which incorporates Arrow's learning by doing function given by equation (4), so that we have $A = .K^0$, we get

$$\hat{}A = 0g,$$

which can be analyzed as follows. This learning by doing function is shown as the positively sloped line *g* = (1/0)^*A* in Figure 1: it shows the rate of labor productivity change due to learning

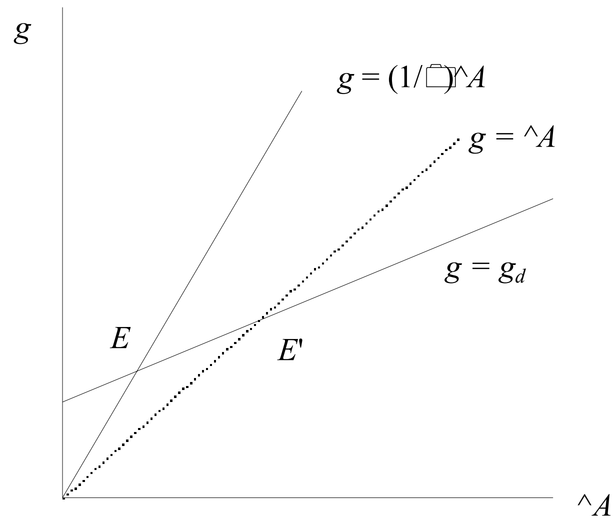

Figure 1

by doing for any given rate of growth of capital, *g*. The curve g=g_d shows the long-run relation between ^*A* and *g* from the model of the previous section, from equation (15), (16) and (17), with equation (16) replaced by

$$g_d = (_0 + (_1 u + (_2 \,\hat{}A$$

to take into account the positive effect of technological change on desired investment, as discussed earlier in this section. The equation for the curve is given by

$$g = s\Phi((_0 + (_2 \,\hat{}A)/(s\Phi - (_1)$$

which replaces equation (19), and shows that a higher rate of technological change increases investment, increases aggregate demand, and thereby directly and indirectly, through its effect on *u*, increases *g*. The intersection of the two curves in Figure 1 shows how ^*A* and *g* are determined in the long run.[x] In this model, not only changes in the parameters of the technological progress (or learning) function, but also the saving and investment parameters

[x] Willy Cortez's unpublished dissertation written at the University of Notre Dame earlier used this diagram for a related post-Keynesian model.

affect the long-run values of the growth rate of capital and output, as well as labor productivity growth.[xi]

Drawing on this brief discussion of the treatment of technological change in post-Keynesian models it is possible make several comments on the relationship of the post-Keynesian approach to new growth theory. First, the dramatic change that has occurred within neoclassical growth theory due to the changes in the assumptions regarding technological change made by new growth theory do not result in any such change in the post-Keynesian approach. For neoclassical theory we found that almost all formulations of technological change (Uzawa excepted) long run growth is determined by forces exogenous to the economy, and in particular, saving and investment parameters had no effect on long-run growth. In the Arrow model, for instance, with 0<1, the long-run growth rate was independent of the saving rate. New growth theory in essence removed the restriction that 0<1 and the result was that the long-run rate of growth of the economy became endogenous as in the *AK* model (for the case of 0=1). For post-

[xi] The model discussed here as the property that the saving and investment rates (as a proportion of output) are not positively associated with the rate of growth or the rate of growth of productivity, contrary to the usual empirical evidence which finds that higher saving and investment rates are positively related to growth. This can be seen as follows. The equilibrium saving and investment rates in this model are given by $I/Y = S/Y = g/u$. Equation (17) implies that $g/u = s\Phi$, which implies that the only parameters that increase the saving and investment rate, that is, s and Φ, also reduce the rate of growth, g. An upward shift in the investment parameters, such as $(_0$, have not effect on the saving and investment rate, although it also increase g, because it increases u equiproportionately. This anomaly, however, depends on certain simplifying assumptions of the models. For instance, if the capitalist saving function is given by

$$S = s\Phi Y - \exists K,$$

with $\exists>1$ to capture the positive effect of wealth in the form of capital on capitalist consumption, we get $g = s\Phi u - \exists$. This implies that $g/u = s\Phi - \exists/u$. An upward shift in the investment function will now increase u and g, but increase g/u and hence the saving and investment rates. Note now, however, that the precise relation between the saving and investment rates and the growth rate depends on what causes changes in both. For instance, contrary to the case of the increase in the investment parameters, and increase in s can increase the saving and investment rates and reduce the rate of growth of the economy.

Keynesian theory, such a change in assumption which changes the value of 0 from less than one to one creates no qualitative change. In both cases the rate of growth and the rate of productivity growth are endogenous and not independent of saving and investment parameters. The assumption that 0=1 merely shifts the technological change curve to the one denoted by $g = \hat{}A$ in Figure 1, merely increasing the rates of growth of capital and productivity.[xii] Second, post-Keynesian growth models with technological change, by allowing aggregate demand to play a major role and incorporating unemployment, has important implications for economic policy regarding saving and investment. New growth theory does not distinguish between saving and investment, and argues that faster growth and technological change requires policies to increase saving and investment. Post-Keynesian models, however, distinguish between the effects of saving and investment parameters: while policies to increase investment can increase growth and technological change, those to increase the saving rate of capitalists can depress aggregate demand and reduce the rate of growth.[xiii] Third, post-Keynesian models, unlike most new

[xii] See Palley (1996) for an earlier attempt to develop a synthesis of Keynesian and new growth approaches. This earlier contribution, however, suffers from at least two problems in characterizing both new growth and Keynesian approaches. First, Palley assumes that in old neoclassical growth theory labor productivity growth is exogenous, while new growth theory it depends, among other things, on the capital-labor ratio. This way of distinguishing old from new growth theory is not quite accurate, given that old growth theory also endogenized technological change, yet generally found it to be exogenous in long run equilibrium. Second, and more importantly for our discussion, the Keynesian features of the model do not allow effective demand to determine output, which is still determined by a production function in which labor grows at rate of growth of the exogenously given supply of labor although capital grows according to investment demand (with the role of saving ignored). Effective demand is introduced into the model by specifying that changes in effective demand growth are caused by deviations of output growth from excess demand growth, and by assuming that the investment rate depends on the growth of effective demand. In the Keynesian framework adopted in the model here output is determined by effective demand in where both saving and investment functions play a role in determining output and its growth.

[xiii] It should be noted that merely distinguishing between saving and investment functions is not sufficient for allowing effective demand to affect long run growth or for generating unemployment. This should be obvious from the neoclassical Keynesian macroeconomic models of textbooks which produce full employment in the long run with wage flexibility through Keynes (or interest rate) and real balance effects despite their having investment functions. For examples of growth models with separate investment and saving functions which

growth theory models, imply that not all kinds of technological change will increase the rate of growth of the economy. Post-Keynesian models imply that certain kinds of technological changes, which do not significantly affect investment or consumer demand or industrial structure (which affects the markup), are likely to have the primary impact of displacing labor without speeding up growth. By increasing unemployment and depressing aggregate demand, they may in fact have the consequence of slowing down growth. Other kinds of technological changes, which set in motion major changes in investment demand or consumer demand (involving new products and new processes requiring new machines) or shake up industrial structure, thereby having profitability and demand effects, can lead to increases in the rate of growth. This distinction can be said to formalize Baran and Sweezy's (1966) distinction between 'normal' and 'epoch making' innovations, a distinction which is not to be found in a qualitative sense in new growth theory models. Fourth, post-Keynesian models can bring into consideration a number of mechanisms of technological change which are not addressed in new growth theory. For instance, You (1994) makes labor saving technological change depend on labor shortages as captured by the rate of change in the wage, while Lima (1997) examines the interaction between market concentration, industrial innovation and growth in an attempt to synthesize post-Keynesian macrodynamics with evolutionary and neo-Schumpeterian ideas. Freed from the straightjacket of optimization with specific market structures based on market demand based on explicit utility functions which individuals maximize over infinite horizons,[xiv] post-Keynesian models have been able to incorporate arguably more realistic features from stylized facts about actual economies.

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produce supply-determined full employment growth, see Dixit (1990) and Palley (1996).

[xiv] A similar comment can be made about overlapping generations models, which in addition to optimization insert a rigid dynamic framework in which individuals live for two periods.

Although the discussion so far argues that post-Keynesian models have some advantages over new growth theory models, it would be incorrect to infer that the former can learn nothing at all from the latter. The careful treatment of microfoundations can certainly provide insights from which post-Keynesian growth theories can draw. Rejection of the requirement that all growth models use the dynamic optimization method should not imply that all new growth theory contributions concerning the modeling of firm and innovator behavior should be jettisoned as well. Three issues in particular deserve mention. One, new growth theory models often give careful attention to externalities between firms, taking care to distinguish between firm level variables and economy wide variables (as in the Romer model which distinguishes between private and aggregate capital, although this attention is also to be found in the old neoclassical growth model of Arrow). Post-Keynesian models can do the same, distinguishing more carefully between (say) their own profit rates and aggregate rate of capacity utilization (as an index of the state of the macroeconomy), when they specify behavioral functions which include these variables as arguments. Two, new growth theories derive the values of certain key variables from explicit optimizing decisions, while post-Keynesian models usually take these variables to be exogenously given. Although it is quite legitimate to do this, and perhaps preferable to endogenize these parameters using empirical regularities rather than arbitrary deductive models, it is advisable to check relations based on these regularities against the deductive models. One example is the treatment of the markup rate which is often taken to be given and sometimes taken to be a function of other variables such as the rate of technological change in post-Keynesian models, are derived from explicit profit maximizing decisions of firms operating in markets with clearly specified structures. Another example is the treatment of consumer demand parameters from explicit utility functions, which may be particular useful for the case of the introduction of new products. Three, given the focus of new growth theory on technological change, a great deal of research has been done modeling mechanisms of technological innovation and diffusion, including research and development activities aiming to make profits and education (although the extent to which these contributions are truly new is debatable). Post-Keynesian growth theory can usefully draw on some of these contributions, although not confining attention to only those mechanisms.

While technological change is important, the arguably excessive focus of new growth theory should not divert the attention of post-Keynesian growth theory from other aspects of the growth process. Many such issues come to min, such as the role of financial factors, which have been swept under the rug by new growth theorists arguably because they are relegated to the short and medium run aspects of macroeconomics. But if the distinction between these runs is less clear-cut than is supposed by new growth theorists, and these factors cast their shadow over the longer run, then post-Keynesian models have much to contribute by highlighting these issues. Indeed, there are many post-Keynesian models which stress such factors.

I consider one example of an issue which has almost completely been neglected in the post-Keynesian literature (with the notable exception of a contribution by Palley (1994) on which the following discussion draws), but which is worth more attention: the role of consumer debt. It has been observed that the ratio of consumer debt to income has increased significantly in many advanced countries in recent years (see Palley, 1994, p. 384-5). It is often argued that consumer debt, by increasing consumer demand, helps to keep demand and output buoyant, but that in the long run debt accumulation may create problems for the growth process. I will present a simple extension of the post-Keynesian model of the previous section which incorporates consumer debt, and which attempts to formalize some of these ideas. Note that by excluding effective demand considerations from the start, new growth theory are unable to address the questions raised here (unless they modify the models to introduce some medium-term dynamics).

We assume that workers finance a part of their consumption by borrowing (thereby departing from the Kaleckian assumption that workers spend what they earn), so that

$$C_W = (1-\Phi)Y - iD + \mathrm{d}D/\mathrm{d}t, \tag{20}$$

and that capitalist receive the interest income, so that

$$C_P = (1-s)\,[\Phi Y + iD], \tag{21}$$

where D is the stock of debt in real terms, i the interest rate and C_W and C_P denote the consumption levels of workers and profit-recipients. For simplicity, we assume that banks simply intermediate between lenders and borrowers, and that we do not take account of any other kind of debt in the economy to focus on consumer debt incurred by workers. Moreover, we assume that the real interest rate, i, is held constant by the Central Bank without further effects on aggregate spending (due to changes in money supply, for instance). We assume investment is determined in the same way as in the model of the previous section, that is, with equations (15) and (16), noting in addition that the interest rate can have a negative effect on desired investment, so that $(_0$ can depend on i. We assume that the stock of debt, D, is given at a point in time, and that over time it adjusts according to

$$dD/dt = \Sigma \, (D_d - D), \qquad (22)$$

where Σ is a positive constant, and where the desired level of debt

$$D_d = 2 \, [(1-\Phi)Y - iD]. \qquad (23)$$

The desired level of debt can be interpreted either as a determined by borrowers or lenders, or both, both taking into account the income of borrowers net of interest payments in deciding how much to debt to hold.[xv]

In the short run, as before, we assume that the level of output adjusts to clear the goods market, so that in equilibrium we have

$$Y = C_W + C_P + I.$$

[xv] This formulation follows Palley (1994) in some respects. The assumption that the growth in debt reflects differences between actual and desired debt is used in Palley's third model, and the assumption that desired debt is a fraction of the income of debtors and the interpretation given to this assumption also follows Palley, although in the formulation of the paper the income is taken to be net of interest payments (in contrast to Palley who takes it to be gross of interest payments), to reflect that borrowers and lenders take into account the negative effects of interest payments in their borrowing and lending decisions. There are many other differences between Palley's formulation and the one developed below, which need not detain us here. The major difference is that Palley's models are discrete time models which examine cyclical issues using the multiplier-accelerator type difference equation framework, whereas the model developed here is in a continuous time framework which can examine cycles as well as long run equilibrium issues in a clearer way using phase diagrams.

Substituting from equations (14) and (20) through (23) and dividing through by K we get

$$u = (1\text{-}\Phi)u - i\ast + \Sigma\{2[(1\text{-}\Phi)u\text{-}i\ast]\text{-}\ast\} + (1\text{-}s)(\Phi u + i\ast) + g,$$

where $\ast = D/K$ is the consumer debt to capital stock ratio. Solving for u from this equation we get its short-run equilibrium value, which is

$$u = \{g - [si + \Sigma(1+i2)]\ast\}/\backepsilon, \tag{24}$$

where $\backepsilon = s\Phi\text{-}\Sigma 2(1\text{-}\Phi)$, which shows the impact on saving of an increase in capacity utilization. Assuming that output (and capacity utilization) adjusts in response to the excess demand for goods, the stability of short-run equilibrium requires that $\backepsilon>0$, that is, that saving increases with total income or that the increase in saving by profit recipients more than offset the increase in consumption due to borrowing by workers. We assume that this condition is satisfied, and moreover, that we always have $g > [si+\Sigma(1+i2)]\ast$ to ensure a positive output level. An increase in the desired debt to net income ratio, 2, increases u provided that $(1\text{-}\Phi)u\text{-}i\ast>0$, or that the net income of workers is positive: higher consumption due to greater borrowing is expansionary. However, $\mathrm{d}u/\mathrm{d}\ast<0$: an increase in the stock of debt is contractionary because it results in greater interest income for profit recipients and because higher debt and higher interest payments reduces borrowing-financed consumption. A rise in investment increases demand and output with a multiplier larger than in the model without borrowing, because of a borrowing-induced increase in consumption.

In the long run we assume that D, K and g can change over time. We examine the dynamics of the economy by focusing on the dynamics of g, which are given by equation (15), and of $\ast$. From the definition of $\ast$ we see that

$$\hat{}\ast = \hat{}D - \hat{}K,$$

which implies, using equations (14), (22) and (23),

$$\hat{}\ast = \Sigma 2(1\text{-}\Phi)(u/\ast) - \Sigma(1+i2) - g. \tag{25}$$

Substitution from equation (25) then implies

$$\hat{}\ast = \Sigma 2(1\text{-}\Phi)\{[(g/\ast)\text{-}(si+\Sigma(1+i2))]/\backepsilon\} - \Sigma(1+i2) - g. \tag{26}$$

Substitution of equation (16) into (15) implies

$$\mathrm{d}g/\mathrm{d}t = 7\ [\ (_0 +\ (_1\ u - g], \tag{27}$$

which, substituting from equation (25) then implies

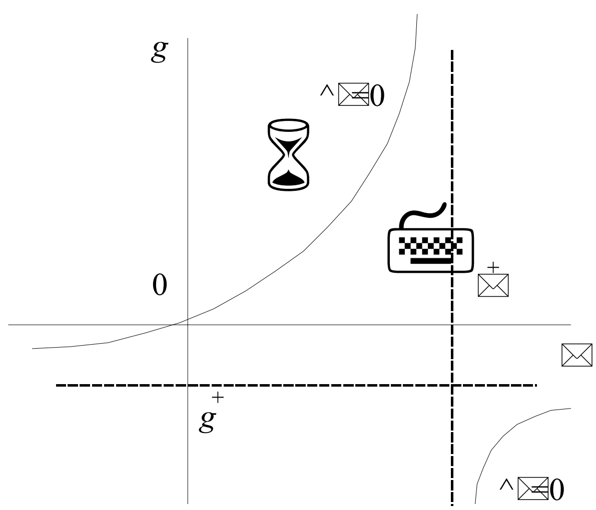
$$\mathrm{d}g/\mathrm{d}t = 7\ \{\ (_0 +\ (_1\ \{g - [si+\Sigma(1+i2)]*\}/э\} - g\}. \tag{28}$$

Equations (26) and (28) comprise a dynamic system in the variables ∗ and g, which we can analyze in terms of a phase diagram. The = 0 isocline is shown in Figure 2, where $*^+ =$ э/Σ2(1-Φ) > 0 and $g^+ = -\ s\Sigma(\Phi+\ i2)/э < 0$. Since we are interested only in the region with g>0, which is required for u>0 with ∗≥0, we confine our attention to the area above the horizontal axis, where the horizontal arrows show the movement of ∗ off the relevant part of the =0 isocline. This part of the diagram is reproduced in Figure 3, which also shows the dg/dt=0 isocline obtained from equation (28), the equation of which is given by

$$g = [(_0\ э/(э-(_1)]-[(_1(si+\Sigma(1+i2))/(э-(_1)]*.$$

If э>(₁, which states that the responsiveness of saving to changes in capacity utilization exceeds the responsiveness of investment, the dg/dt=0 isocline will be a negatively sloped line with a positive vertical intercept, as shown in Figure 3. Equation (28) explains the directions of the vertical arrows.

Figure



2

Long-run equilibrium is attained at the intersection of the dg/dt = 0 and

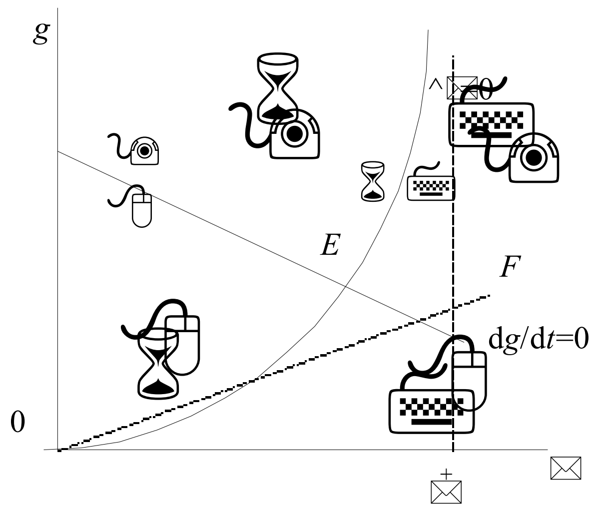


Figure 3

^∗ =0 isoclines, at *E*. The economy must always remain above the 0*F* line, which represents the equation g = [*si*+Σ(1+*i*2)]∗, to ensure *u*>0. As the arrows show, the economy will oscillate around *E* in a clockwise manner, approaching it; it is straightforward to check that the equilibrium is a stable one.

The long-run impact of changes in the parameters of the model can now be examined by considering the effects of such changes on the position of the long-run equilibrium. We confine our discussion to changes in two parameters, $(_0$ and 2. An increase in $(_0$, which represents an upward shift in the desired investment function and captures the effects of an increase in autonomous investment shifts the d*g*/d*t*=0 isocline upwards without shifting the ^∗=0 isocline. This implies that the long-run equilibrium of the economy moves up along the ^∗=0 isocline, increasing the long-run equilibrium values of both *g* and ∗. The effect on capacity utilization and income distribution, however, is unclear. The increase in ∗ implies a long-run distribution of income from workers to profit (and interest) recipients given capacity utilization, since this distribution is given by the ratio (Φ*u* + *i*∗)/[(1-Φ)*u*-*i*∗]. Since workers have a higher propensity to consume than profit and interest recipients, aggregate demand can fall even with a rise in autonomous investment, reducing *u* as well. Even if *u* rises, however, since ∗ rises in the long run, the distribution of income can still worsen even with a rise in employment and output. An increase in 2, which represents an increase in borrowing, as we saw earlier, implied a rise in u and g in the short run. To analyze the long-run effects we note that a rise in 2, by increasing u, increases the desired rate of accumulation g_d, thereby pushing the dg/dt = 0 isocline in the phase diagram upwards. Equation (26), however, can be used to show that as long as workers have a positive income net of interest payments (which was required for the positive short-run effect of increased borrowing on capacity utilization), will rise for given values of ∗ and g when 2 rises, so that the =0 isocline will move downwards and to the right (although the value of $*^+$ must fall.. The overall long-run equilibrium effect on ∗ is positive, and on g, ambiguous. However, if $(_1$ (or the responsiveness of desired investment to changes in the rate of capacity utilization) is small, the upward shift in the dg/dt=0 curve will be small, so that the effect on g in the long run will be negative, as will be the effect on u. Thus, it is quite possible that, despite the short-run expansionary effect of borrowing financed consumption expenditure, the long run effect can be contractionary on capacity utilization and growth. Moreover, the effect on income distribution can be negative, given the increase in ∗. If $(_1$ = 0, the dg/dt=0 isocline will be horizontal, and will not shift at all due to an increase in 2. Since the ^∗ =0 isocline will still shift down and to the right, the effect in the long run will be no change in g but an increase in ∗, so that u will remain unchanged in the long run, but the income distribution will worsen due to an increase in ∗. These results can occur because, despite the increase in demand caused by borrowing, a higher debt burden in the long run shifts income from borrowers to debtors who have a lower propensity to consume, and thereby reduces the rate of capital accumulation. It should be stressed that this result is not due to usual the neoclassical synthesis result that increasing demand can increase output in the short run but have no effect in the long run due to wage/price adjustments. In the model developed here wage price adjustments do not take the economy to full employment or to full capacity utilization in the long run. In fact, if the real wage fell due to unemployment, the economy could actually travel further away from full employment due to reductions in consumption demand.

6. Conclusion

This paper has examined the contributions of new growth theory from the perspective of post-Keynesian growth theory. Its main conclusions regarding the two theories are as follows.

The advent of new growth theory has resulted in a tremendous resurgence of mainstream growth theory because of its alleged advance over old growth theory by endogenizing the rate of growth of the economy in the long run, making it depend on economic behavior. However, the claims of newness of new growth theory for this reason is based on an extremely narrow reading of "old" growth theory which ignores many non-neoclassical contributions to growth theory which, allowing for the existence of unemployed labor in the long run, did make long run growth depend on economic behavior such as investment and saving. Moreover, a careful reading of new growth theory and a comparison with earlier writing on growth and technological change suggests that it has made relatively little progress in terms of addressing new ideas, of developing new ways of modeling macroeconomic dynamics and the mechanisms of technological change, and of understanding the actual growth experiences of capitalist economies regarding productivity changes. Moreover, by assuming away unemployment problems due to the lack of effective demand, it has failed to come to grips with an important feature of the growth process: the integration of medium run macroeconomic phenomenon with long run issues, which are arguably not as separate as is often assumed in mainstream macroeconomic theory.

The paper then presents an alternative to new growth theory in the form of post-Keynesian growth theory, which gives a central place to effective demand and unemployment, and which draws on some of the non-neoclassical contributions to "old" growth theory. It uses this approach to analyze the interaction between technological change and capital accumulation, showing that new growth theory appears far less revolutionary than it claims when seen in terms of this approach, and that while the post-Keynesian approach can learn some things from new growth theory, it can arguably analyze technological change in a more satisfactory way. It also argues that the overemphasis on issues relating to technological change brought about by new growth theory may well divert attention from other important issues such as consumer debt related to the growth process, and examines how post-Keynesian models can be used to rectify this problem.

Seen from a new growth theory perspective post-Keynesian growth theory can do all this, but only in an ad hoc manner, by departing from the model of the dynamically optimizing agent. However, this departure may well be an important strength of post-Keynesian growth models which, by breaking free of the straightjacket of implausible dynamic optimizing myths, offers the flexibility to develop simple models incorporating important issues which are relevant for understanding the growth process of actual economies.

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NOTES