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INTEREST RATES IN POST-KEYNESIAN MODELS OF GROWTH AND DISTRIBUTION

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Summary

The goal of this article is to make a heuristic and comparative presentation of how the major post-Keynesian models of growth and distribution integrate money, more specifically interest rates, within their framework. Five variants will be considered, all constructed on the basis of the newer Kaleckian model. It will be shown that increases in real interest rates may have surprising effects on effective demand. It will also be shown that accumulation rates and leverage ratios need not move together. The latter finding reinforces a major hypothesis of the analysis, that is, real interest rates are an exogenous distributive variable.
JEL Classification: E11, E12, E4, O41.
Key words: interest rates, leverage ratios, income distribution.

Résumé

Les taux d'intérêt dans les modèles post-keynésiens de croissance et de répartition. — L'objectif de l'article est de présenter, sous la forme de comparaisons simples et heuristiques, comment les principaux modèles de croissance et de répartition post-keynésiens tiennent compte des aspects monétaires. Cinq variantes de ces modèles sont étudiées, toutes construites sur la base du nouveau modèle kaleckien. On démontre qu'une hausse du taux d'intérêt peut avoir des effets surprenants sur la demande effective. On montre aussi que les taux d'accumulation et les taux d'endettement n'ont pas nécessairement une relation positive. Ce résultat renforce l'une des hypothèses importantes de l'analyse, à savoir que le taux d'intérêt réel est une variable de répartition exogène.
Classification JEL: E11, E12, E4, O41.
Mots-clé: taux d'intérêt, taux d'endettement, répartition du revenu.

INTEREST RATES IN POST-KEYNESIAN MODELS OF GROWTH AND DISTRIBUTION*

Introduction

One of the surprising aspects of the evolution of Cambridgian theory is that, starting from Keynes's *General Theory* which described a monetary production economy, the Cambridge post-Keynesians have failed to incorporate money within their models of growth and distribution. Indeed, this was Davidson's (1972) main critique of these models and as Kregel has pointed out, 'money plays no more than a perfunctory role in the Cambridge theories of growth, capital and distribution' (1985, p. 133).[1] Until very recently, similar criticisms could be addressed to the newer Kaleckian models of growth and distribution, which add an endogenous rate of capacity utilization to an essentially Cambridgian structure. This situation has changed, however, in part as a result of the arguments put forth by some neo-Ricardian authors with regards to the influence of the rate of interest on the normal rate of profit.

The present attempt to integrate money and finance to models of growth and distribution is based on one crucial assumption: the rate of interest is considered to be an exogenous variable, under the control of the central bank, while money and credit are considered to be endogenous variables, responding to the demand for them. These are assumptions often made by post-Keynesian authors of all persuasions,[2] although some specialists would not put things so crudely, arguing for instance that portfolio preferences

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[1] An interesting historical account of the tensions between the monetary production economy views of Davidson and the growth and distribution views of Robinson is given in Turner (1989, ch. 15).

[2] See, among many others, Kaldor (1982), Pivetti (1985; 1991), Moore (1988), Panico (1988), Lavoie (1992, ch. 4) and Le Bourva (1992).

may have feedback effects on interest rates, while firms are often credit-constrained.[3] Only the latter restriction will be taken into account, in the last part of the paper. From now on, it will be assumed that the value of the interest rate is a conventional phenomenon. Those who prefer to cling to a theory of liquidity preference may relate any change in real interest rates to a permanent and exogenous change in the liquidity preference of economic agents. It may be simpler to assume that the *real* rate of interest is under the control of the monetary authorities, or to argue, as Ciccone (1990, p. 455) does, that what the monetary authorities 'are assumed to control *through* the nominal interest rate, is precisely the real rate of interest'.[4] To a different real rate of interest will thus correspond a different monetary regime.[5]

To be valid in the long run as well as in the short run, such assumptions must be based on a non-orthodox monetary approach, where the rate of interest is not tightly linked to the productivity of capital, in contrast to what neoclassical economists believe, and where the determination of the rate of interest is mainly a matter of monetary and income distribution policy (Rogers 1989). It will also be assumed that the pace of accumulation has no feedback effect on the real rate of interest. This is in accordance with Robinson's main view of the role of money in growth models, since she argues that 'the banks allow their total lending (and therefore the supply of money) to increase gradually, at a constant rate of interest, as total wealth increases' (1962, p. 43). If those assumptions appear excessive to the reader, he may suppose instead that inflation has for all times been eradicated.[6]

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[3] See Wray (1990) for instance.

[4] This sort of assumption is acceptable even within the standard Wicksellian view, at least in the short run. According to this view, if the central bank follows an easy money policy, trying to keep monetary rates of interest below the Wicksellian natural rate, inflation may set in, thus reducing further real rates of interest. If the central bank tries to keep monetary interest rates higher than the natural rate, deflation would occur, thus increasing further real rates of interest. Central banks are thus always in a position to pursue a policy of low or high real interest rates.

[5] An assumption made by others, Skott (1989, p. 57) for instance.

[6] Economists often believe that higher accumulation rates induce higher inflationary pressures. However, within Kaleckian models, higher rates of growth may induce lower inflationary pressures. See Dutt (1990, p. 85).

The purpose of this article is to make a heuristic and comparative presentation of how the major post-Keynesian models of growth and distribution integrate money, more specifically interest rates, within their framework. Five models will be considered along the lines described in the above paragraph. For the purpose of comparing the various approaches, the newer Kaleckian model has been chosen as the basis of comparison, although some important features of that model will be omitted. Besides the Kaleckian model, the Eichnerian or Cambridgian model, the neo-Ricardian model, a post-classical model, and a Minsky-Steindl model will be presented. While the names put forth could be questioned on various grounds, it will be argued that they are adequate for the heuristic objectives being pursued. We start with a simple Kaleckian model.

I. The Kaleckian model

As said in the introduction, the basis of comparison is a simplified Kaleckian model. The simplifications arise mainly to make clearer the comparisons over the impact of changes in interest rates in the various models. First, it will be assumed that there is no overhead labour.[7] This will make identical the net and the gross profit margins. Secondly, the direct influence of the rate of capacity utilization on the decisions to accumulate will be ignored in the investment function. This has the heuristic advantage of yielding a system of equations of the decomposable type. It also will eliminate the controversial stagnationist feature of the Kaleckian model, that is the necessary positive relation between the real wage rate and the realized rates of profit and of accumulation.[8] With the following investment function, no relation whatsoever will emerge between the real wage rate and the realized rate of profit:

$$g^i = \gamma + g_r(r^e - i) \qquad (1)$$

[7] See Rowthorn (1981), Kurz (1990a) and Lavoie (1992) for models where such a feature is present.

[8] See Dutt (1984) for the presence of such a stagnationist behaviour. See Kurz (1990a) as well as Bhaduri and Marglin (1990) for a modified investment function that may provide a negative relation between real wage rates and rates of profit and of accumulation within an otherwise similar Kaleckian model.

where γ is a parameter reflecting the expected trend of future sales growth; r^e is the expected rate of profit; i is the permanent real rate of interest; and g_r is a parameter reflecting the sensitivity of the latter two variables over the desired rate of accumulation.[9] Equation (1) is in fact the standard Cambridgian investment function, as seen by Robinson (1962) for instance, with two exceptions. First, the function given here is linear, instead of having the banana shape that gave rise to two possible equilibria. Secondly, the function explicitly introduces the rate of interest, whereas Robinson (1962, p. 43) assumed that a rise in the interest rate would be implicitly reflected in a lower expected rate of profit.

The savings function, for the time being, will be the usual Cambridge equation, with no savings out of wages. It will be assumed that the distribution of profits between interest income and non-interest income makes no difference for the propensity to save out of profits, s_p. At a later stage, a more appropriate savings function will be considered.

$$g^s = s_p r \tag{2}$$

Combining equations (1) and (2), and letting the expected and the realized rates of profit equate, we get the well known effective demand constraint.

$$r = \frac{\gamma - g_r i}{s_p - g_r} \tag{3}$$

The graphical derivation of the effective demand constraint is to be found at the top of Figure 1. The model is stable provided investment is less responsive than savings to changes in the profit rate, that is, provided that the slope of the g^i function is less than that of the g^s function. This requires that $g_r < s_p$, and hence a positive solution requires a positive γ.

FIGURE 1

[9] Eichner (1987, p. 434) includes this very equation in his discussion of the Kaleckian investment function.

A distinguishing feature of the Kaleckian model, compared to the old Cambridgian model, is that the rate of capacity utilization is endogenous instead of being a given, fixed by conventions or technological considerations. By definition, the rate of profit can be rewritten as:

$$r = \Pi/K = (\Pi/Y)(Y/C)(C/K) = mu(1/v) \tag{4}$$

where Π is (real) profits, K is the stock of capital, Y is output, C is capacity output, while m is the share of profits, u is the rate of capacity utilization and v is the capital/capacity ratio, with the latter being assumed to be given. Equation (4) can be rewritten as:

$$u = (v/m)r \tag{5}$$

We shall call equation (5) the profits cost curve, since it determines the rate of profit, but seen this time from the cost side. However, for a rate of profit given by the effective demand constraint of equation (3), noted *ED* in the bottom of Figure 1, we see that the rate of capacity utilization u depends on the margin of profit m, that is on the markup over variable costs set by the firms. This can be seen by looking at the standard Kaleckian pricing equation:

$$p = (1 + \theta)w/y \tag{6}$$

where p is the price level, θ the markup, w the nominal wage rate and y average labour productivity, and by taking note that the markup θ and the margin of profit are related to one another by the following equation:

$$m = \theta/(1 + \theta) \tag{7}$$

In this simpler formulation, an increase in the real wage rate, that is a fall in the profit margin m, does not lead to an increase in the rate of accumulation but it does lead to an increase in the rate of capacity utilization. A graphical representation of the profits cost curve, noted *PC* and the slope of which is v/m, can be found in the bottom part of Figure 1.

We may now examine in Figure 1 the impact of a change in monetary policy reflected by an increase in the real rate of interest. As a result of this increase, the investment function will shift down, from g^i_0 to g^i_1, leading to a downfall of the realized rate of profit and to a shift of the effective demand constraint, and hence to a downfall of the rate of capacity utilization, from u_0 to u_1. In the Kaleckian model, there is no relationship between the real rate of interest and the margin or the normal rate of profit. Symmetrical effects can be observed when the growth prospects symbolised by γ are improved. In that case, the investment function shifts up, from g^i_0 to g^i_2, leading to an increase in the rate of accumulation, the rate of profit and finally the rate of capacity utilization. What has been assumed to remain constant in both cases is the profit margin, so that $m = \bar{m}$.

II. The Cambridgian or Eichnerian model

At this stage, it might be interesting to compare the results achieved in the new Kaleckian model with those that could be achieved in the old Cambridgian model. A characteristic feature of the Cambridgian model, at least the one put forth by Robinson (1956; 1962), is that in the long run the rate of utilization of capacity must be equal to its normal value. This feature can also be found in many macroeconomic models based on the oligopolistic behaviour of firms in a growing environment. In those models, the markup is a function of the rate of growth of the firm. A particularly vivid graphical expression of this type of hypothesis can be found in the work of Shapiro (1981, p. 89). This can be expressed algebraically under the following equation:[10]

$$m = m_0 + m_g g \qquad (8)$$

Looking at things from a macroeconomic point of view, the higher the desired rate of accumulation, the higher the required profit share m and hence the lower the real wage

[10] A macroeconomic model incorporating this equation is presented in Lavoie (1993).

rate. This is a key result of the old Cambridgian model which has generated a substantial amount of criticism from several authors associated with the Sraffian tradition (Vianello 1985; Ciccone 1986; Kurz 1990b; Garegnani 1992). It is clear that many of the recent post-Keynesian models attempting to give an explanation of the value of the markup based on the size of planned investment generate results which are no different from those of the old Cambridgian models. This is particularly the case of the models developed by Eichner (1976) and Wood (1975). As it has recently been noticed by Agliardi (1988), the causality and the mechanisms underlying the Eichnerian models run often in opposite direction to those of Kaleckian models. This is due to the additional embedded assumption according to which the economy is necessarily operating at its normal rate of capacity utilization in the long run (Wood 1975, p. 129). It follows that the rate of capacity utilization is no longer an endogenous variable in that type of model, a situation which is similar to what could be found in the Cambridgian models. But whereas the latter models relied on competition to achieve such a situation, in the oligopolistic Eichnerian model the investment behaviour of firms or that of government are assumed to be such that eventually the realized rate of capacity utilization equals the given normal rate, $u = \bar{u}_n$.

The impact of increases in the secular rate of growth of sales, given by γ, or in the rate of interest, given by i, is illustrated in Figure 2. The two models, the Kaleckian and the Cambridgian ones, give identical results with respect to effective demand: the top parts of Figures 1 and 2 are identical. In both models, an increase in the inducement to invest leads to higher rates of profit and of accumulation. In the Eichnerian and Cambridgian models however, the rate of utilization is fixed at u_n, and hence considering equation (5), the burden of the adjustment falls entirely on the margin of profit m, which must increase. This is represented by a downward displacement of the PC curve, from PC_0 to PC_2. We thus find again the familiar Cambridgian inverse relationship between the accumulation rate and the real wage rate that some neo-Ricardians have recently questioned. Putting together equations (2) and (5), and assuming that the long run rate of capacity utilization is equal to its normal level, we get the following Eichnerian relation:

$$m = (v/s_p u_n)g \tag{9}$$

which is an extreme specification of equation (8).

FIGURE 2

As to the rate of interest, a fall in it would generate a slowdown in the rate of accumulation of the economy. This would induce a fall in the markup and in the margin of profit, as shown by the rotation of the *PC* curve, from PC_0 to PC_1. As in the previous case, since the rate of utilization is deemed to be equal to its normal value in the long run, a change in the parameter of the Cambridgian or Eichnerian model requires an adjustment which falls entirely on the margin of profit. This is fully compatible with Eichner's belief that the rate of interest has no *direct* impact on the margin of profit which is required to fulfil the financial obligations of the firm (Eichner 1987, p. 481-2). In his view, the markup and the standard rate of profit are entirely determined by the secular rate of growth of the corporation (1987, p. 355). It is only through this indirect route, according to Eichner, that the real rate of interest will have an impact on the markup. If the investment equation given by equation (1) is valid, then a higher real interest rate will be associated with a lower realized rate of profit and a lower rate of accumulation, and hence with a lower normal rate of profit. Under the conditions set by the Eichnerian model, one would thus expect a negative relationship between the real interest rate and the normal rate of profit, but one achieved indirectly through the effective demand constraint.

III. The neo-Ricardian model

Exactly the reverse occurs in the neo-Ricardian model. The key characteristic feature of this model is that a *direct* positive relationship between the real rate of interest and the normal rate of profit is deemed to exist. Such a relation was initially based on Sraffa's famous sentence according to which the rate of profit is 'susceptible of being determined from outside the system of production, in particular by the level of the money rates of interest' (1960 #44). That such a view can be called neo-Ricardian is attested by the great number of Sraffian authors who have argued in favour of it or who have endorsed it (Sylos Labini 1971, p. 270; Garegnani 1979, p. 81; Panico 1985, 1988; Vianello 1985, p. 84; Pivetti 1985, 1991; Roncaglia 1988; Schefold 1989, p. 325).

The elaboration of Sraffa's aside has however generated a great deal of responses from irritated post-Keynesians (Pasinetti 1988; Nell 1988; Wray 1988). To some, it is an 'inexplicable suggestion' (Bhaduri and Robinson 1980, p. 103), which is 'excessively fanciful' (Robinson 1979, p. 180). Even some neo-Ricardians have objected to this Sraffian relationship (Schefold 1993).

As many proponents of Sraffa's aside have mentioned, several famous post-Keynesian authors, at one time or another, have however supported the possibility of a direct positive link between interest rates and profit margins.[11] The clearest exponent of Sraffa's aside is however its most ardent opponent, Joan Robinson herself. Reading the following quote of hers is like reading a summary of the neo-Ricardian point of view on this issue:

> The distribution of income between labour and capital depends ... on the rate of profit, that is, the rate of interest *plus* the rate of net profit. If the rate of interest were (and always had been) lower or the entrepreneurs were habituated to a lower rate of net profit, the share of labour and the level of real wages would be so much the higher. (Robinson 1952, p. 96).

Compare the above with the following explanation provided by the main exponent of the neo-Ricardian view presented here:

> In the explanation of distribution ... the normal rate of profit in each particular production sphere will be arrived at by adding up two autonomous components: the long-term rate of interest (*i*) ... plus the normal profit of enterprise (*npe*) .... Provided that *npe* is a sufficiently stable magnitude, and one which is independent of *i* and of lasting changes of *i* ... lasting changes in the rate of interest will cause

[11] Here is a list of such supporting quotes: 'Many companies base their calculations on some "normal" rate of return ... though the entrepreneur's normal standard is likely in course of time to be revised to match an apparently lasting change in market rates' (Sayers 1951, pp. 7-8). 'Firms often have some standard rate of profit, which includes interest, that they add to the input costs' (Harrod 1973, p. 44). 'Sustained low interest will presumably in the long run reduce the normal rate of profit' (Harrod 1973, p. 111). 'The delivered price of an investment good is a positive function of the (short term) interest rate' (Minsky 1982, p. 107). 'Interest costs are passed on in higher prices in much the same way as wage costs' (Kaldor 1982, p. 63). See also Parguez (1975, p. 209).

corresponding changes in profit rates, and inverse changes in the real wage. (Pivetti 1985, p. 86-7).

Sraffa's aside may thus be formalized by the following equation:

$$r_n = i + npe \tag{10}$$

where i and npe are defined as in Pivetti's statement, and where r_n is the normal rate of profit, not the actual one.

It is important to stress this distinction, because some of the opposition to Sraffa's aside may be based on a confusion between the normal and the realized rates of profit. Neo-Ricardians are not arguing that higher rates of interest necessarily induce higher realized rates of profit; what they are arguing is that higher interest rates are inducing higher normal rates of profit, that is higher markups. Provided the realized rate of capacity utilization is not always equal to its normal value, a higher normal rate of profit may accompany a lower realized rate of profit. As Pivetti (1988, p. 281) points out: 'The analysis concerns the explanation of the *normal* rate of profit, in the meaning that this term has always had in economic theory, and never refers to the actual rate of profit and actual profits which are of course acted upon by demand'. In our notations, the impact of the rate of interest is on the rate of profit defined by the profits cost curve at normal capacity: a rise in the permanent rate of interest leads to a rotation upwards of the profits cost curve.[12]

This can be more clearly seen by linking equation (10) to the cost-plus pricing model. As Pivetti (1991, ch. 11) points out, Sraffa's aside may be related to theories of full cost pricing, or more specifically, to modern theories of target-return pricing. In target return pricing procedures, the margin of profit is set at a level that will provide a normal rate of profit when firms are producing at the normal (or standard) level of capacity utilization. In our much simplified Kaleckian model, this implies, from equation (5), that:

[12] For those who are uncomfortable in linking Sraffa's aside to growth analysis, the following quote may bring some recomfort: 'If the causal connection between the rate of interest and the rate of profit is to have any meaning at all, it must hold true in a growing as well as in a stationary economy' (Vianello 1990, p. 109).

$$r_n = mu_n/v \tag{11}$$

Combining equations (10) and (11), it can be seen that the margin of profit m is a positive function of the real rate of interest, and it can be written in the following linear form:

$$m = m_o + m_i i \tag{12}$$

where:

$$m_0 = (npe)v/u_n \tag{13}$$

$$m_i = v/u_n \tag{14}$$

Equation (12) is thus a reduced form of the neo-Ricardian view of the determination of the normal rate of profit, as described notably by Pivetti. It can be found in a few independently written works (Dutt 1992, p. 105; Lavoie 1992, p. 362). Now, one may wonder whether i is the nominal rate or the real rate of interest. Pivetti himself pays little attention to the issue, until he finally recognizes that the rate of profit should 'move in sympathy with the real rate of interest, rather than with the nominal one — the former constituting the actual price for the use of capital in production, or its opportunity cost' (1985, p. 100). Further reflection should make clear that i must be the real rate. It can be noted that the real wage rate, given by equations (6) and (7), is $w/p = y(1 - m)$. Through the profit/wage frontier, this real wage must be inversely related to the real normal profit rate, and not to the nominal rate of profit. One would therefore expect the margin of profit m, which determines the real normal profit rate, to depend upon the real rate of interest rather than the nominal rate.[13]

This issue being settled, equation (12) allows us to use the previous graphic apparatus to analyze the impact of an increase in the real rate of interest in an economy depicted by the neo-Ricardian model. As can be seen in Figure 3, the top part of the graph is again left

[13] Ciccone (1990) also clearly indicates that the real rate of interest is the relevant one. Dutt (1992) supposes that i is the nominal rather than the real interest rate. The conditions under which he examines the behaviour of his model, however, are such that any increase in the nominal rate of interest is accompanied by a rise in the real rate.

unchanged compared to the previous Kaleckian and Cambridgian model. The main change occurs at the bottom of Figure 3, where the rise in interest rates brings on a downward rotation of the *PC* curve, from PC_0 to PC_3, as a result of the induced increase in the margin of profit. While the realized rate of profit and the rate of accumulation fall no more than they do in the Kaleckian model, the realized rate of capacity utilization falls further, from u_0 to u_3, because of the induced fall in the real wage rate. This is a consequence of the fact that the margin of profit has been raised to adjust the normal rate of profit to the new real interest rate, the normal rate of profit rising from r_{n0} to r_{n3}.

FIGURE 3

It should be noted that the qualitative results of the analysis would not be different even if it were assumed that investment is not a function of the realized rate of profit, but instead is a function of the normal profit rate, or more precisely, a function of the normal profit of enterprise. Indeed, in trying to refute the validity of the Kaleckian model, some neo-Ricardians have argued just that (Pivetti 1985, p. 97; Ciccone 1986; Petri 1993). In our model, this would imply that the g^i function at the top of Figure 3 would be a horizontal line, which would depend neither on the realized rate of profit nor on the real interest rate. The investment function, given by equation (1), would now become:

$$g^i = \gamma + g_r (r_n - i) = \gamma + g_r(npe) \tag{15}$$

If desired accumulation were given by equation (15), a lower rate of interest would induce no change in the rate of accumulation, and the realized rate of profit would remain at r_0. Still, the profits cost curve at the bottom of Figure 3 would shift, and the new rate of utilization would have to fall to u_4. Now this result contradicts some of the assertions made elsewhere by some of the same neo-Ricardian authors. Pivetti (1985, p. 99) has claimed that the direction of influence of changes in interest rates over aggregate demand cannot be predicted apriori. The main reason for this is that changes in interest rates modify the distribution of income. We must now investigate how, within our simple Kaleckian and neo-Ricardian framework, changes in interest rates could generate uncertain results. To do so, we shall construct a *post-classical* model, that is a model that entertains features of both the Kaleckian and the neo-Ricardian traditions.

IV. The post-classical model

In this section, I wish to give a graphical demonstration that increases in real interest rates may indeed lead to increases in aggregate demand, and hence in rates of profit, of accumulation and of capacity utilization. The demonstration relies on a modified savings function, that takes into account the distinction between retained profits and interest payments.

This new savings function is based on the dichotomy highlighted by Robinson (1962, p. 38), when she claimed that 'the most important distinction between types of income is that between firms and households' (1962, p. 38). As is well known, this distinction was put to task by Kaldor (1966) in his famous neo-Pasinetti theorem, but as Davidson (1972) pointed out, the model takes no account of interest payments, the assumption being that all wealth is held in the form of shares. Here we shall devise the contrary assumption, by supposing that all wealth is held as banking deposits. Alternatively, it could be assumed that the rate of dividend payments is made in accordance with the rate of interest paid to those agents holding banking deposits or bonds. Under these simplifying assumptions, the income distributed to households as property income does not depend on whether financial capital is held through bonds or shares. This assumption will be relaxed in the next section.

Let us continue to assume the classical case of no savings out of wages. Let us suppose however that households save out of property income, that is the dividends and interest payments which they receive. Let us call s_h this propensity to save out of property income by households. Their savings per unit of capital are then $s_h i$. The savings of the firms are their retained earnings. The new savings function is thus made up of two components: one related to corporate retained earnings and the other to household savings out of their share of profit.[14]

[14] Capital gains are omitted from the model, but including them would not alter the substance of the results obtained. This is shown by Skott (1989, p. 57) in a model which introduces banking deposits with exogenous rates of interest alongside Kaldor's securities

$$g^s = (r - i) + s_h i = r - (1 - s_h)i \tag{16}$$

This new savings function is different from the standard Cambridge relation in two ways. It incorporates the distributional impact of interest payments in its simplest form, and it distinguishes between firms and households. With respect to the former characteristic, it must be said that while several authors have incorporated the rate of interest in the investment function, it has generally been omitted from the savings function.[15] It can be seen from equation (16) that the rate of growth of savings is reduced whenever the interest rate is higher. Higher interest rates redistribute profit income from firms to households, whose propensity to save is lower than that of firms.[16] Higher interest rates thus induce more consumption spending, not less as the neoclassical authors would say on the basis of a model of the individual agent. Taking into account income classes and the distinction between households and firms leads to radically different conclusions. Note that the positive relation between interest rates and consumption had already been recorded by Joan Robinson.

> A permanent fall in the level of interest rates relatively to the rate of profit has reduced the rentiers' share in profits (assuming that dividends have not been raised correspondingly), and this is likely to have a more important effect in reducing the proportion of consumption to profits than any effect there may be of lower interest in increasing the ratio of consumption to rentier income (Robinson 1956, p. 253).

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market with its endogenous valuation ratio. Money and interest rates thus do have a role to play in a theory of growth and distribution, even when an adjusting mechanism based on an endogenous valuation ratio is at work, as is the case in the models proposed by Kaldor (1966) and Skott.

[15] Recent instances can be found in the papers of Jarsulic (1990) and Gallegati and Gardini (1991), which deal nonetheless with the importance of financial obligations for investment behaviour.

[16] Higher interest rates also redistribute income away from workers, but because the model has a decomposable form, the lower real wage has no impact on the rate of accumulation.

One may wonder why the usual Cambridge savings function, $g = s_p r$, or some variation of it, has not been kept. The reason is that s_p cannot be considered an exogenous parameter any more, since its major component, the retention ratio, is now endogenous. The retention ratio is dependent on the interest rate, a factor which is not under the control of the firm. It would thus be a mistake to assume that the retention ratio is constant, unless one only dealt with states that did not differ in their monetary policy, or unless the retention ratio only applied to profits net of interest payments, as will be seen in the next section.

Let us now put together the investment and the savings function, given by equations (1) and (16), to obtain the effective demand constraint:

$$r = \frac{\gamma}{(1 - g_r)} + \frac{i(1 - g_r - s_h)}{(1 - g_r)} \tag{17}$$

The continuous lines of Figure 4 provide an illustration of this effective demand constraint, initially set at point A. As before, the model is stable provided investment is less responsive than savings to changes in the rate of profit. Here, this requires $g_r < 1$. A positive solution occurs only if $(1 - s_h) > g_r - \gamma/i$, where γ need not be positive.

Let us see what happens to the realized rate of profit when there is an increase in the real interest rate. Taking the derivative of equation (17), one gets:

$$\frac{dr}{di} = \frac{1 - g_r - s_h}{1 - g_r} < 1 \tag{18}$$

It is clear that the derivative may be positive, provided $(1 - s_h) > g_r$, that is provided households consume a large fraction of their property income compared to the unfavourable effects that high interest rates have on investment behaviour. This is the B case illustrated on Figure 4, with the effective demand constraint shifting to the right, from ED_0 to ED_1. When households consume a small fraction of their property income, an increase in interest rates will lead to a fall in the realized rate of profit. This is illustrated by case C in Figure 4. Thus, as is concluded by Dutt (1992, p. 119) in a similar but more complex model, the impact of higher interest rates are more likely to be negative if the holders of bonds and securities are rich people with low propensities to consume.

FIGURE 4

Similar results are obtained with regards to the impact of changes in interest rates on the rate of capacity utilization. Using equations (5), (12) and (17), and solving for u, one gets:

$$u = \frac{[\gamma + i(1 - g_r - s_h)]\,v}{(1 - g_r)(m_0 + m_i i)} \tag{19}$$

Taking the derivative of u with respect to i, one finds that it is positive provided the following condition holds:

$$(1 - s_h) > g_r + (m_i/m_0)\gamma \tag{20}$$

Again, an increase in the real rate of interest may lead to an increase in the rate of capacity utilization if the propensity to consume out of property income is sufficiently large. Point B at the bottom of Figure 4 illustrates such a case.

The crucial question, however, is whether there could be a positive relation between the real rate of interest and the rate of accumulation. In the present simplified model, such a relationship could not exist. This is obvious from the derivative obtained in equation (18): the increase in the realized rate of profit r is always smaller than the exogenous increase in the rate of interest i. This implies that the realized rate of profit, net of interest payments, is always smaller when the interest rate increases. Going back to the investment function given by equation (1), it follows that the resulting rate of accumulation must decrease when real interest rates rise. It would thus appear that the contention of some neo-Ricardians, regarding the uncertain effects of changes in the interest rate on the rate of investment, is not verified.

To come to such a conclusion would however be a mistake. It has been shown in models similar to the post-classical one presented here, but with the addition of the current rate of capacity utilization in the investment function, that a rise in the interest rate could lead to an increase in the rate of accumulation (Dutt 1992; Lavoie 1992, ch.6). Even without taking into account the rate of capacity utilization, such a situation may occur in a modified version of the basic Kaleckian model presented here. We now turn our attention to this final post-Keynesian model.

V. The Minsky-Steindl model

1. Building blocks of the model

As was pointed out in the introduction, the Cambridgian models of growth and distribution drew criticisms from some post-Keynesian authors because these models left out any explicit analysis of the monetary and financial aspects. Recently, there have been many attempts to build models of growth or of business cycles that incorporate financial variables, the inspiration of which has been Kalecki's (1937) principle of increasing risk and the work of Minsky (1975).[17] The goal of the last model to be presented here is to take into account financial variables, more precisely interest payments and the debt ratio, both in the investment and in the savings functions. In this sense the model will contain Minskian features.

The model may however also be associated with the name of Steindl. While Steindl's work has been given credit in the course of the Kaleckian revival, his contribution to the destabilising role that financial variables can play in a capitalist economy has been somewhat downplayed. Steindl (1952, pp. 113-121) provides a very perceptive analysis of the macroeconomic paradoxes, similar to the Keynesian thrift paradox, that may arise when firms or their bankers attempt to reduce debt ratios. This paradox occurs when firms decide to reduce their rate of investment whenever they find their debt ratios to be too high. Steindl's analysis is particularly interesting because he considers the effects of debt ratios on both the savings and the investment functions. It thus seems appropriate to call a Kaleckian model incorporating these effects by the name of Minsky-Steindl model.

[17] There are many such models, of which only a few are mentioned here: Jarsulic (1990), Gallegati and Gardini (1991), Franke and Semmler (1991), Moon (1991), Skott (1992). In addition, there are many recent models in the New Keynesian tradition.

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With concern focused on financial variables, from now on no attention will be paid to the rate of capacity utilization or to the profits cost curve. The model will thus basically consist of the effective demand constraint. The crucial financial variable is the debt ratio, which will be called ℓ for *leverage* ratio. The leverage ratio is here defined as the amount of loans L contracted by the firms over the replacement value of capital:

$$\ell = L/pK \tag{21}$$

While ℓ may be considered to be given in the short run, ℓ will be changing over time, unless a steady state is reached. The evolution of this variable will be considered later. For the moment let us deal with the savings function, which will turn out to be a more accurate variant of the savings function introduced in the post-classical model — equation (16). Since firms have borrowed an amount L from households, either indirectly in the form of banking loans or directly in the form of bonds, they must pay out an amount of iL. The profits net of this amount may now be either distributed to households in the form of dividends or be saved by firms as retained earnings. Let us call s_f the retention rate out of profits net of interest payments, s_s the propensity to save of households holding shares, and s_b the propensity to save of households holding bonds or bank deposits.[18] The savings function is now the sum of three components: the savings of the firms, the savings of shareholders and the savings of bond holders:

$$g^s = (r - i\ell)s_f + (r - i\ell)(1 - s_f)s_s + s_b i\ell \tag{22}$$

Rearranging, we get:

$$g^s = [s_f + (1 - s_f)s_s]r + \{s_b - [s_f + (1 - s_f)s_s]\}i\ell \tag{23}$$

The reduced form of the savings function is thus:[19]

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[18] As before, capital gains are omitted, or it is assumed that they are entirely saved.

[19] This reduced form can be found in Taylor (1991, p. 130). Similar savings functions may be found in Moon (1991, p. 156) and Dutt (1992, p. 102).

$$g^s = s_r r - s_\ell (i\ell) \tag{24}$$

with: $$s_r = s_f + (1 - s_f)s_s \quad > 0 \tag{24.a}$$

and: $$s_\ell = [s_f + (1 - s_f)s_s] - s_b \quad >< 0 \tag{24.b}$$

The most remarkable aspect of equation (24) is that s_ℓ may be positive or negative. An increased relative weight of interest payments may or may not lead to more savings. The cause of this uncertain effect, if we may go back to Robinson's quoted assertion to the contrary, is that the rise in the interest rate leads to a decline of the dividend rate, the retention rate being assumed to be constant. Higher interest rates increase aggregate consumer spending if, as pointed out by Robinson, 'dividends are not [lowered] correspondingly'. This shows the crucial importance of institutional arrangements for the modelling of effective demand.

Let us now deal with the investment behaviour of firms. The following investment function will be assumed, which shows some symmetry with the savings function:[20]

$$g^i = \gamma + g_r r - g_\ell (i\ell) \tag{25}$$

It could be argued that investment should only be responsive to profits net of interest payments, that is to the difference $r - i\ell$. However, since firms have some liberty in fixing their retention ratio, it will be maintained that firms would not react with equal intensity to a fall in net profits arising from a fall in the realized rate of profit as from a rise in interest payments. As a consequence two parameters, g_r and g_ℓ, are being used. It could however also be argued that firms would not react with equal intensity to a rise in interest payments that would arise from an increase in the rate of interest as from an increase in the leverage ratio. We shall fall back on the elegance of symmetry with the savings function to justify the proposed specification, and on the following justification.

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[20] A similar investment function, with an additional term to take capacity utilization into account, is proposed by Jarsulic (1990, p. 93).

If tranquillity is defined as the ratio of realized profits to normal profits, that is r/r_n, whereas financial fragility is defined as the ratio of interest payments to normal profits, that is $i\ell/r_n$, then the specification of equation (25) appears to be a reasonable one. Within a Minskian framework, one would expect investment to be a positive function of tranquillity and a negative function of financial fragility.[21] The Minsky part of the investment function would thus be justified. With respect to the Steindl part, it must be pointed out that Steindl (1952, p. 129) himself wrote down an investment equation with the rate of profit, the leverage ratio and the rate of utilization as separate arguments of the function. The real rate of interest was not included in his function, but it must be recalled that in the fifties there were only small variations in the interest rate. As a consequence, changes in the burden of debt could almost entirely be attributed to changes in the leverage ratio, rather than to changes in the real interest rate. Over the last dozen years, changes in interest rates have been such that they cannot be ignored any more.

The leverage ratio ℓ being a constant in the short run, we may combine the new savings function — equation (24) — and the new investment function — equation (25) — to obtain the profit rate and the accumulation rate pertaining to the short run. One obtains:

$$r = \frac{\gamma + (s_\ell - g_\ell)i\ell}{(s_r - g_r)} \tag{26}$$

$$g = \frac{s_r\gamma + (s_\ell g_r - g_\ell s_r)i\ell}{(s_r - g_r)} \tag{27}$$

Short-run stability prevails provided the savings function responds less than the investment function to changes in the profit rate. This requires that:

$$s_r > g_r \tag{28}$$

[21] Skott (1994, p. 54 and footnote 13)) sometimes gives the impression that desired accumulation will be *higher* the *higher* the degree of financial fragility as defined above. What he really means (*ibid.* p.74), however, is the higher ℓ^*, where ℓ^* is the maximum allowable debt ratio, the higher the probability that a firm be granted the requested loans, and hence the higher the effective accumulation rate.

2. Results of the model

Taking the derivatives of equations (26) and (27) with respect to i, one finds that the impact of an increase in the real rate of interest on the rate of accumulation is indeed uncertain, as some neo-Ricardians assert. There could be a positive relationship between the real rate of interest and the rate of accumulation, at least in the short run, as shown in Table 1. We shall call this case the *puzzling* case.

Table 1

Uncertain effect of an increase of the real rate of interest on the realized rate of profit and the rate of accumulation in the short run

	$s_t < g_t$	$g_t < s_t < g_t(s_r/g_r)$	$s_t > g_t(s_r/g_r)$
dr/di	−	+	+
dg/di	−	−	+

Going beyond the short run, however, the value of the leverage ratio will be changing, and this will have repercussions on the other variables of the model. The dynamics of the leverage ratio can be expressed by taking the logarithmic derivative of equation (21). Assuming away inflation (the markup may change, but not the price level), and using the sign ^ to denote the rate of change of a variable, we have:

$$\hat{\ell} = \hat{L} - \hat{K} = \hat{L} - g \tag{29}$$

With the assumptions that have been made, the new loans contracted by firms correspond to the savings of the bond holders. In growth terms, we have:

$$\hat{L} = s_b i \tag{30}$$

We are now in a position to find the leverage ratio that could occur in the long run. Setting $\hat{\ell} = 0$ in equation (29), and making use of equations (27) and (30), we get the long run value of the leverage ratio, which must be, by definition, between 0 and 1:

$$\ell^* = \frac{s_b i(s_r - g_r) - s_r \gamma}{(s_\ell g_r - s_r g_\ell) i} \tag{31}$$

Taking the derivatives of the above equations leads to Table 2, which will allow us to construct the various possible cases occurring in the long run.

Table 2

Puzzling behaviour and long run stability

		$s_\ell/s_r - g_\ell/g_r$	
		+	−
A: (27)	$dg/di, \ \ell = \bar{\ell}$	+	−
B: (27)	$dg/d\ell, \ i = \bar{i}$	+	−
C: (27, 29, 30)	$d\hat{\ell}/d\ell, \ i = \bar{i}$	−	+
D: (31)	$d\ell^*/di$	+	−

Table 2 shows that the main features of the model depend on a single condition, the relative sensitivity of the savings coefficients compared to the relative sensitivity of the corresponding investment coefficients. In particular, part C of Table 2 tells us under which condition the long run leverage ratio ℓ^*, computed in equation (31), is a stable equilibrium. For long run stability to occur, the derivative $d\hat{\ell}/d\ell$ must be negative, that is s_ℓ/s_r must be larger than g_ℓ/g_r.[22] This implies in fact that both the denominator and the numerator of ℓ^*

[22] Note that it is sufficient for s_ℓ to be negative for the long run equilibrium to be unstable. Dutt (1992, p. 104) gets a similar condition. In his model, $g_\ell = 0$, and hence the

are positive. It requires that bond holders have a relatively low propensity to save, which one would expect when bond holders are poorer people, and that firms (or their bankers) show little sensitivity to changes in leverage ratios or in the weight of interest payments. This stable case is illustrated in Figure 5.

FIGURE 5

The graph illustrates what happens when the real interest rate is increased permanently. The effective demand curve *ED* rotates upwards (part A of Table 2), while the long run leverage ratio increases, from ℓ_0* to ℓ_1* (part D of Table 2). The long run stable case thus corresponds to what was called the *puzzling* case when discussing the short run possibilities of Table 1. An increase in the real rate of interest generates an immediate increase in effective demand and hence in the rate of accumulation, from g_0* to g_1. The higher interest rate induces a gradual increase in the leverage ratio of firms, accompanied by a higher rate of accumulation (part B of Table 2), until the new long run equilibrium leverage ratio is reached (the stability requirement given by part C of Table 2). Therefore, while higher real interest rates lead to higher leverage ratios, a result one would expect, they also lead to higher rates of accumulation, a result that is rather unexpected. Stability in the long run sense must therefore be associated with puzzling effective demand results.[23]

Let us now consider the unstable case, that is the case where economic forces are such that the economy diverges from the long run equilibrium leverage value. This occurs when s_ℓ/s_r is smaller than g_ℓ/g_r, that is when wealthy bond holders have a relatively high propensity to save while firms are rather sensitive to the evolution of their leverage ratio.

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condition for stability becomes $s_\ell/s_r > 0$. His long run equilibrium is unstable whenever $s_\ell < 0$.

[23] Higher rates of accumulation are also generally associated with higher rates of capacity utilization. From equations (5), (12) and (26), we know that:

$$u = \frac{[\gamma + (s_\ell - g_\ell)i\ell]v}{(m_0 + m_i i)(s_r - g_r)}$$

so that, for a given interest rate i, $du/d\ell > 0$ whenever $s_\ell > g_\ell$. The latter condition necessarily occurs in the *puzzling* case, because of the requirements of short run stability given by condition (28).

Under those conditions, unless the historically given leverage ratio corresponds exactly to the equilibrium ratio, the leverage ratio will tend towards zero or towards unity. This implies that the share of capital held by bond holders tends either towards zero or towards unity. An unstable case is represented in Figure 6. The relationship between the rate of accumulation and the leverage ratio is then negative (part B of Table 2). Let us start from a situation where the leverage ratio happens to be at its equilibrium value given by $\ell_0{*}$. The rate of accumulation will then be $g_0{*}$. Let us now assume an increase in the real rate of interest. The new equilibrium leverage ratio will shift to the left, to $\ell_1{*}$ (part D of Table 2), while the effective demand curve *ED* will rotate downwards (part A of Table 2). The increased rate of interest will induce a fall in the rate of accumulation, from $g_0{*}$ to g_1. The higher interest rate induces a gradual increase in the actual leverage ratio, away from its equilibrium value. This will be accompanied by a decrease in the rate of accumulation. If nothing else is to change, the decrease in the rate of accumulation will continue until the leverage ratio reaches unity, that is until the rate of accumulation equates $g_1{*}$.[24]

FIGURE 6

Although the long run solution is unstable, the model features characteristics that one has been trained to expect. Excessively high real rates of interest have unfavourable consequences on the actual leverage ratio, effective demand and the rate of accumulation. Indeed, this is precisely the situation that many economies seem to be facing in the eighties and in the nineties. The ever-increasing leverage ratios, despite constant real rates of interest, are inducing entrepreneurs to cut the amount of funds they wish to borrow, in order to reestablish more conservative gearing and borrowing ratios. This is done by restraining investment expenditures. Such a behaviour is however unsuccessful. As can be seen in Figure 6, leverage ratios continue to rise although accumulation is being slowed down and interest rates stay constant.

This is a situation that was explored and described in great detail by Steindl (1952, ch. 9). It illustrates another fallacy of composition: although entrepreneurs and their bankers

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[24] In this case, recalling the previous footnote, a fall in the rate of accumulation, the rate of interest being given, need not be associated with a fall in the rate of utilization, since the condition $s_f > g_f$ need not hold.

may wish to reduce leverage ratios in a recession, the macroeconomics may be such that this reduction need not occur. In the stable case of Figure 5, higher leverage ratios accompany higher rates of accumulation. This could be attributed to the fact that in a boom the acceptable leverage ratio usually rises, a fact emphasized by Minsky (1975, ch. 5-6) within the framework of his financial fragility hypothesis. But, as is also occasionally recognized by Minsky himself, 'the improvement of realized profits partially frustrates the planned debt-financing of investments of firms' (1975, p. 114). The targets set by individual firms may systematically be missed for macroeconomic reasons. This sort of paradoxical situation would seem to occur in the case described by Figure 6 and it was clearly the subject of Steindl's attention as the following quote demonstrates.

> The entrepreneurs, even apart from their desire to reduce the initial gearing ratio, will soon be inclined to check this relative growth of their indebtedness, and their only possible reaction against it will be to reduce investment. This however will not put matters right.... Internal accumulation is reduced proportionately more than outside saving, so that the gearing ratio increases. Further reduction of investment will fall more heavily on internal accumulation than on outside savings, so that the gearing ratio will continue to increase, in spite of entrepreneurs' endeavours to reduce it by reduction of investment. Real accumulation, internal accumulation, and the profit rate will thus continue to fall and the gearing ratio will continue to rise. The outstanding feature of this *disequilibrium* is that the gearing ratio *in fact* established is continuously out of harmony with the ratio entrepreneurs *wish* to establish: this indeed is the reason for the continuing disequilibrium. There is a growing relative indebtedness against the wish of entrepreneurs, one might say an 'enforced indebtedness'. (Steindl 1952, pp. 114, 118-9).

An interesting feature of the model is that, depending on the leverage ratio actually inherited from the historical past, a drastic change in interest rates may lead to two different scenarios in the unstable case. This is illustrated in Figure 7. Suppose the initial interest rate and other parameters are such that the economy has been drifting away from the equilibrium leverage ratio given by ℓ_0^*. Suppose now that the monetary authorities attempt to remedy this depressing state of affairs by reducing the real rate of interest, thus changing the equilibrium leverage ratio to its new value ℓ_1*. In the *A* scenario of Figure 7, this reduction will be insufficient because the actual leverage ratio is already too high. The rate of accumulation will increase momentarily to a higher rate, from which it will continually decrease while the leverage ratio continues to rise. By contrast, in the *B* scenario, with a lower historically given leverage ratio, the same reduction in the real rate of interest will induce a continuous rise in the rate of accumulation, while the leverage ratio will fall.

FIGURE 7

It should be noted that the B scenario gives credence to the belief that there are no inexorable forces that propel up real interest rates whenever accumulation is speeded up (Lavoie 1992, pp. 197-203). This belief is based on two important features of a monetary production economy: the causality running from investment to savings, and the concept of money endogeneity. Those, among post-Keynesians, who recognize the validity of these two features while rejecting the theoretical independence of interest rates from accumulation rates, usually associate higher leverage ratios to higher accumulation rates (Wray 1990, pp. 134-8).[25] The *B* scenario of Figure 7 clearly shows that rising accumulation rates need not be associated with rising leverage ratios. As a consequence, one of the main reasons for associating rising accumulation rates with rising interest rates disappears. There are no natural forces which inescapably push up real interest rates. If real interest rates do rise, it is because the central bank has decided to modify the monetary regime.

Conclusion

Five different post-Keynesian models of growth and distribution have been compared with regards to their behaviour following an increase in the real rate of interest set by the monetary authorities. In the simple Kaleckian model, such an increase in interest rates only leads to a slowdown of accumulation. In the Cambridgian and Eichnerian model, higher

[25] This relationship is often linked with Kalecki's principle of increasing risk.

interest rates induce a *lower* normal profit rate, a lower realized profit rate and a lower accumulation rate. In the neo-Ricardian model, higher interest rates bring about a *higher* normal profit rate. A variant of this neo-Ricardian model, called the post-classical model, showed that increased interest rates could induce either higher or lower realized profit rates and rates of capacity utilization. Finally, it was also shown within the context of the so-called Minsky-Steindl model that higher real interest rates could lead to either higher or lower rates of accumulation. Endogenous credit-money and exogenous real interest rates can thus surely be introduced to good effect within post-Keynesian models of growth and distribution.

The Minsky-Steindl model, based on quite reasonable assumptions, showed further that long run stability is necessarily associated with the puzzling positive relationship between real interest rates and accumulation rates. The more standard negative relationship between real interest rates and accumulation rates is necessarily associated with long run instability: the economy is moving away from its equilibrium leverage ratio. If the described Minsky-Steindl model has any link with reality, and if the unstable case is the more likely, then it would appear that capitalist economies are continually in a slow traverse, with leverage ratios and accumulation rates exhibiting a negative relationship. This implies in particular that when individual entrepreneurs restrain their investment expenditures, as a consequence of high leverage ratios or in an effort to reduce their debt and borrowing ratios, they are generally unsuccessful as a group. This is the paradox emphasized by Steindl (1952): the macroeconomics is such that the efforts to reduce the leverage ratio lead to higher values of this ratio.

Another example of the paradoxical behaviour of the economy at the macro level has thus been uncovered, similar to Keynes's paradox of thrift and to Rowthorn's (1981, p. 18) paradox of costs. That such paradoxical results can be achieved within simple and heuristic models of the economy demonstrates their importance.

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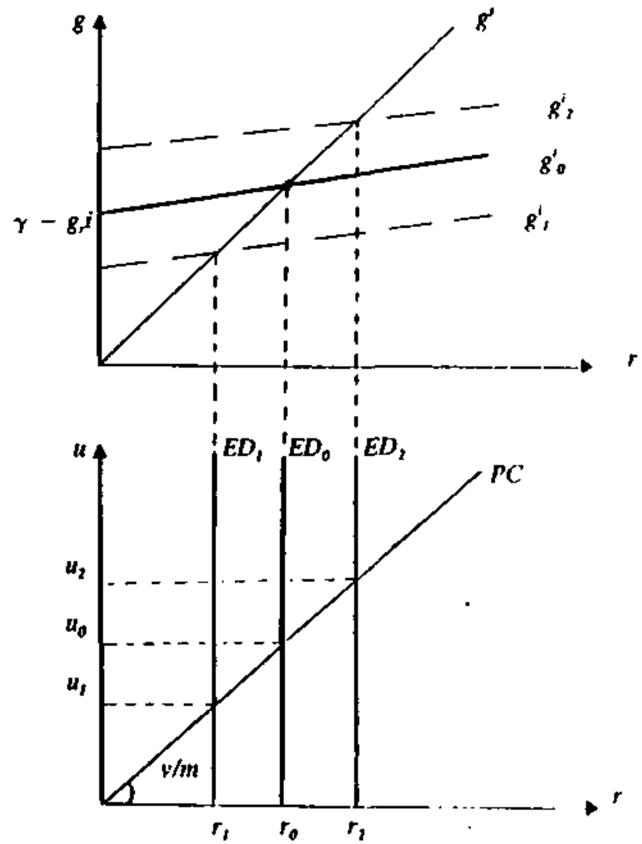


FIGURE 1

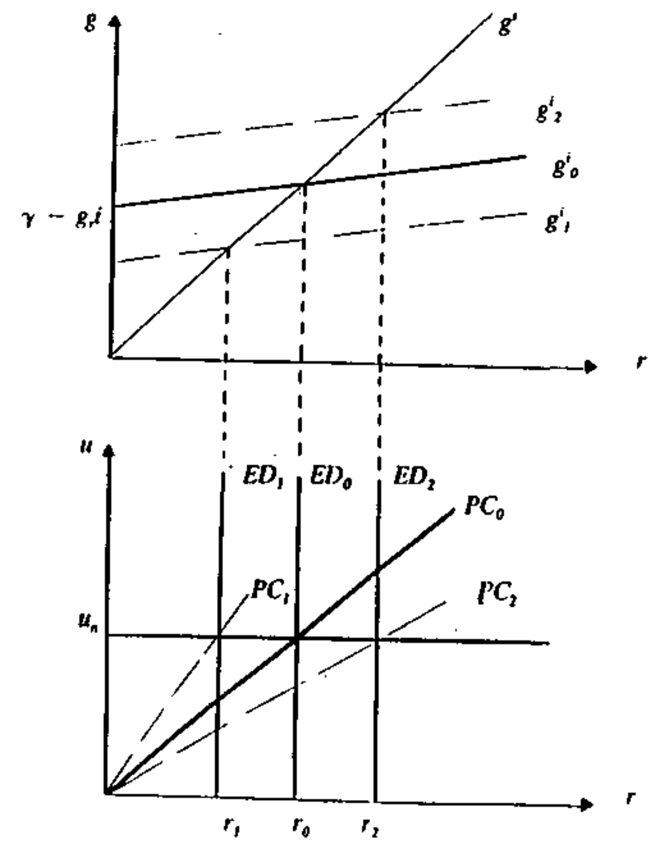


FIGURE 2

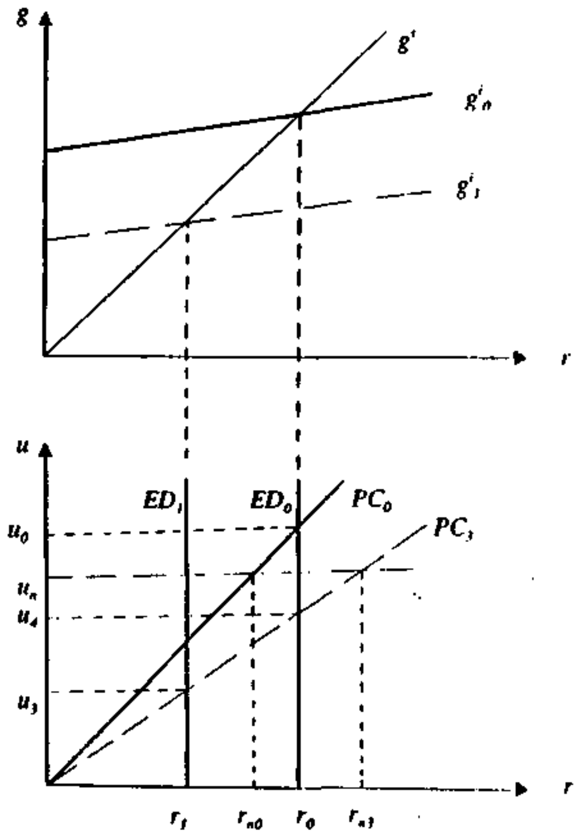
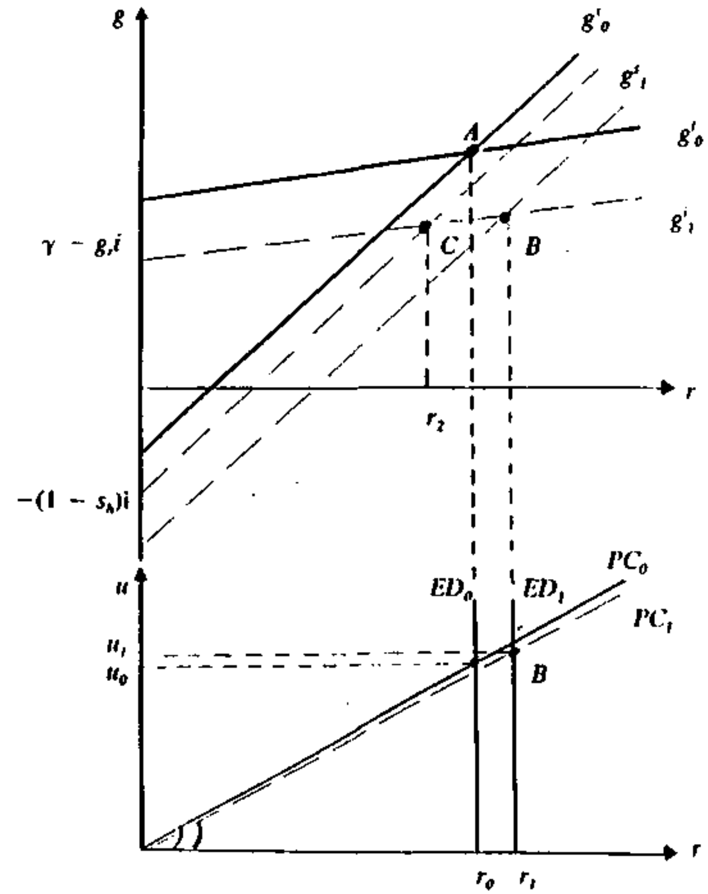


FIGURE 3



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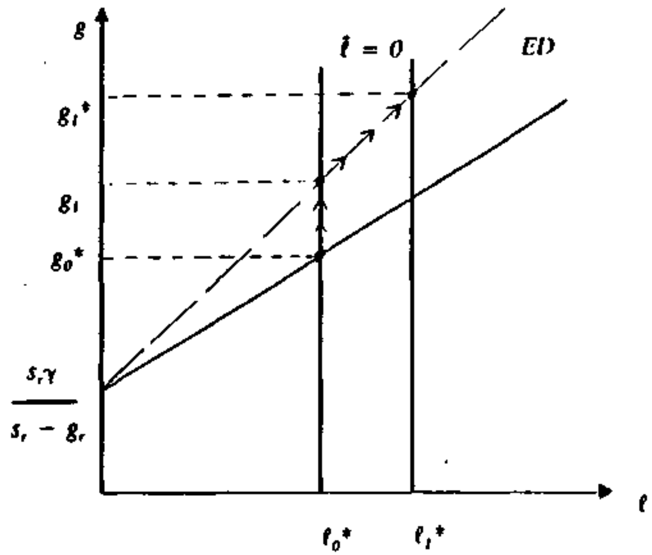

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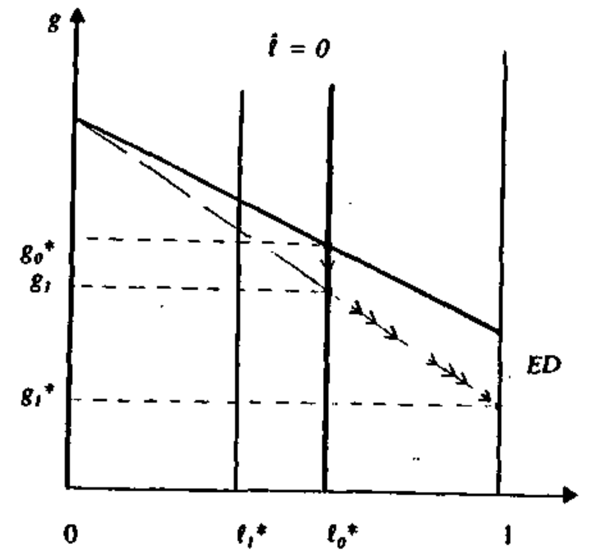

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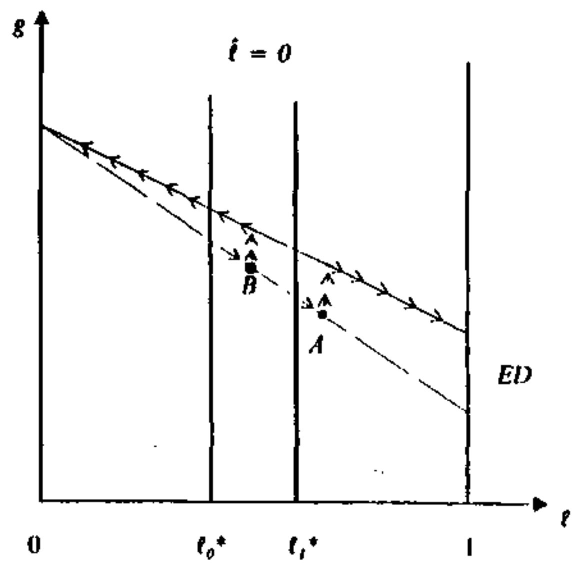

FIGURE 7