Cambridge Journal of Economics Advance Access published October 20, 2014

Cambridge Journal of Economics 2014, 1 of 21
doi:10.1093/cje/beu039

Tackling the instability of growth: a Kaleckian-Harrodian model with an autonomous expenditure component

Olivier Allain*

This article presents a basic Kaleckian model, enriched by the simultaneous addition of an Harrodian investment function and an autonomous expenditure component that grows at an exogenous rate. The model shows that the usual short-run properties (wage-led growth) are only transient, since the long-run growth rate converges towards that of autonomous expenditures. However, the impact on the level of variables (output, capital stock, labour, etc.) is permanent. The model also provides a conditional solution to the 'second' Harrod knife-edge problem: the destabilising behaviour of firms (as they adjust their investment decisions to the discrepancy between the actual and the normal rates of capacity utilisation) is now required to achieve the normal rate of capacity utilisation.

Key words: Kaleckian models, Harrod instability, Income distribution, Public expenditure, Automatic stabilizers
JEL classifications: E12, E25, E62

1. Introduction

The aim of this article is to contribute to the intense debate about the long-run properties of the post-Keynesian models of income distribution and economic growth. These models are based on three fundamental assumptions: (i) they are demand-led, drawing on the Keynesian principle of effective demand; (ii) national income distribution is assumed to affect economic activity, since the propensity to save out of wages is lower than the propensity to save out of profits; and (iii) investment is assumed to be partly exogenous and partly endogenous, depending on capacity utilisation as well as profitability.

Although there may be a broad consensus on the short-run properties of these models (the paradox of thrift occurs and economic growth can be wage-led), contrasting positions can be identified when dealing with the long run. Kaleckian models usually

Manuscript received 2 March 2013; final version received 29 April 2014.
Address for correspondence: Bureau 216, Maison des Sciences Economiques, 106–112 Boulevard de l'Hôpital, 75647 Paris cedex 13, France, email: olivier.allain@parisdescartes.fr

*The author is very grateful to Nicolas Canry, Marc Lavoie and two anonymous referees for their comments and suggestions.

extend these short-run properties to the long run.[1] But this implies that the rate of capacity utilisation remains endogenous and permanently deviates from its 'normal' value: an exogenous rise in the profit share, for instance, induces a permanent reduction in the utilisation rate.

This outcome has been criticised on theoretical grounds (a persistent discrepancy between the actual and normal utilisation rates cannot be a position of rest because firms attempt to adjust their capacities) as well as empirical grounds (utilisation rate data often show more stability than is expected from Kaleckian models).[2]

Several models have been built to resolve the problem of capacity utilisation in the long run. Intuitively, to fill the gap between the actual and normal utilisation rates, firms are expected to increase their rate of accumulation when the actual rate of capacity utilisation is over its normal value; the converse is also true. However, as is well known, this behaviour entails the 'second' Harrod instability (knife-edge) problem.

Drawing on Hicks (1950), a few models have put this problem at the heart of their construction. Instability then becomes the engine of cyclically demand-driven dynamics, bounded by a ceiling and a floor, where the latter can depend on an autonomous component of aggregate demand, such as government spending, as in Fazzari *et al.* (2013).

Most models escape the instability problem by leaving aside the investment behaviour of firms. The equality between the actual and normal rates of capacity utilisation is then preserved because of the adjustment of another parameter: the mark-up in the early Cambridge models (Robinson, 1956, 1962; Kaldor, 1955–56, 1957), the propensity to save or the rate of interest in Marxian models (Duménil and Lévy, 1999; Shaikh, 2007). However, these models are characterised by a reversal of the standard properties of the Kaleckian model: growth becomes profit-led in the long run. One may then be 'Keynesian in the short run' but one needs to be 'classical in the long run'.[3]

Finally, the Sraffian super-multiplier models (Serrano, 1995A, 1995B; Bortis, 1997) introduce an autonomous component of aggregate demand. The overall rate of growth adjusts to that of the autonomous component. However, these models once again escape from Harrodian instability by leaving aside the unstable investment behaviour of firms.

The aim of the article is to develop and analyse the properties of a Kaleckian-Harrodian model with an autonomous expenditure component. More precisely, the idea is to enrich a basic Kaleckian framework (Hein *et al.*, 2011, 2012) by combining the destabilising effect induced by the Harrodian behaviour of firms to the stabilising effect of an autonomous aggregate demand component growing at an exogenous rate (as in Fazzari *et al.*, 2013, or in the Sraffian super-multiplier models).

This stabilising mechanism relates to the share of the autonomous demand component in aggregate demand: for instance, a rise in the profit share results in a short-run decrease of both the utilisation rate and the growth rate. But it also results in an increase in the share of the autonomous demand component, which exerts an upward pressure on both the rate of utilisation and the propensity to save. Eventually, the

[1] See Blecker (2002), Allain (2009), Dutt (2011), Hein *et al.* (2011, 2012), and Sawyer (2012) for recent contributions and surveys.

[2] See Allain and Canry (2008), Skott (2010, 2012), and Nikiforos (2011). See also Dallery (2007), who questions the stability of Kaleckian models through a simulation approach.

[3] See Hein *et al.* (2010) for a recent survey. The distinction between Kaleckian, Cambridge and Marxian models is made, for instance, by Lavoie (2012).

accumulation rate adjusts to the growth rate of the autonomous component. However, although the impact on growth vanishes in the long run, its occurrence in the short run causes permanent effects on the level of variables (output, capital stock, labour, etc.). A rise in the profit share therefore induces negative effects on economic activity, as in the basic Kaleckian model, even if the long-run rate of growth of capacity is not affected.

In such a framework, the reaction of firms to a discrepancy between actual and normal utilisation rates does not necessarily produce Harrodian instability, provided that this reaction remains moderate. On the contrary, the peculiar feature of the present model is that such a destabilising behaviour is required for the actual utilisation rate to converge towards its normal level. The intuition behind this is that instability is more than offset by the stability resulting from the introduction of the autonomous demand component.

Of course, the conclusions of the model may differ depending on the nature of the autonomous demand component (exports, capitalists' consumption) that is taken into account and the source of its financing.[4] This article is based on an autonomous public expenditure growing at an exogenous rate. This hypothesis could be motivated by economic policy and full employment concerns. However, one can hardly consider the present article as focussing on fiscal policy. Indeed, because of the complexity arising from the consideration of interest payments on debt, it is assumed for the sake of simplicity that government adjusts the tax rate endogenously to preserve the budget balance. In other words, the effect of the autonomous demand component and the issues related to Harrodian instability, rather than fiscal policy, are the focus of the present analysis.

The basic Kaleckian framework is briefly presented in Section 2. It is followed by a discussion about the long-run equilibrium, with a special focus on the Harrod knife-edge instability problem (Section 3). Government spending is introduced as an autonomous demand component in the basic Kaleckian model and the short-run temporary equilibrium is computed in Section 4. However, this equilibrium is not stable and the model converges towards a medium-run equilibrium where the rate of accumulation is given by the rate of growth of the autonomous component (Section 5). Finally, introducing the usually destabilising reaction of entrepreneurs, it is shown that the actual rate of capacity utilisation can converge towards its normal level without generating Harrodian instability (Section 6). Section 7 contains a few concluding comments.

2. The basic Kaleckian framework

Let us assume a closed economy whose aggregate production function is given by:

$$Y = qL = uK \tag{1}$$

where Y, L and K correspond to production volume, labour input and capital stock; q is the fixed labour productivity coefficient; u is the actual rate of capacity utilisation. Aggregate demand (Y^d) is given by:

[4] In the neo-Kaldorian models, the long-run economic growth rate is given by the exogenous rate of growth of exports (see Cornwall, 1977; Setterfield and Cornwall, 2002 for the export-led cumulative causation model and Thirlwall, 1979, for the balance-of-payment constraint model). However, I ignore these theories here because they do not explicitly formulate the investment behaviour and then avoid the debates about Harrodian instability.

$$Y^d = C + I \tag{2}$$

where C and I represent consumption and investment. Workers are assumed to consume all their wages. Saving (relative to the capital stock) is then given by:

$$g^s = \frac{S}{K} = s\pi u \tag{3}$$

sp pi u/v

where π is the profit share and s the propensity to save out of profits. Finally, the rate of capital accumulation can be written as:

$$g^i = \frac{I}{K} = \gamma + \gamma_u \left(u - u_n \right) \tag{4}$$

where u_n is the normal rate of capacity utilisation from the entrepreneurs' point of view and γ_u corresponds to the sensitivity of accumulation to the discrepancy between the actual and the normal utilisation rates. Of course, $u = u_n$ results in $g = \gamma$. As a consequence, the γ parameter can be understood as the average expectation of the secular rate of growth (subject to animal spirits), as perceived by the managers of firms.[5]

Substituting C and I into the aggregate demand function and solving gives the goods market equilibrium utilisation rate:[6]

$$u^* = \frac{\gamma - \gamma_u u_n}{s\pi - \gamma_u} \tag{5}$$

The equilibrium rate of accumulation is then:

$$g^* = \gamma + \gamma_u \left(u^* - u_n \right) \tag{6}$$

and the rate of profit is:

$$r^* = \pi u^* \tag{7}$$

These are the main results of the basic Kaleckian model. The main comparative static results are reported in Table 1. Every column gives the qualitative effect that a change in a given parameter (in columns) has on the short-run equilibrium value of the endogenous variables u^*, $g^*$and r^* (in rows).

If entrepreneurs' expectations (animal spirits) are more optimistic, then activity and growth both increase. A rise in the capitalists' propensity to save pushes consumption down and results in a cut in the rate of utilisation (paradox of thrift). Moreover, a rise in the profit share causes a decline of activity and growth (stagnationist regime and wage-led economic growth) because it increases saving and reduces consumption. A rise in π induces a proportionally higher cut in the utilisation rate, and it also results in

[5] For sake of simplicity and without loss of generality, profitability is not included in the accumulation function.

[6] The Keynesian stability condition is supposed to hold, that is, $s\pi - \gamma_u > 0$. As a consequence, the u^* numerator must also be positive ($\gamma - \gamma_u u_n > 0$) for the rate of capacity utilisation to be positive.

Table 1. *The impact effects of the canonical model*

	γ	s	π
u^*	+	– (paradox of thrift)	– (stagnationism)
g^*	+ (animal spirits)	–	– (wage-led growth)
r^*	+	–	– (paradox of costs)

a decrease in rate of profit. The rise in π is therefore as detrimental to capitalists as it is to workers (paradox of costs).

3. The rate of capacity utilisation in the long run

Because the equilibrium utilisation rate u^* only depends on exogenous parameters, there is no guarantee about the equality between u^* and u_n. Does the actual rate have to go back to its normal value? If so, how? Intuitively, it can be expected that entrepreneurs adjust their expected secular rate of growth (γ) to partially or completely make up for to the gap between g^* and γ, which should be:

$$\dot{\gamma} = \psi\left(g^* - \gamma\right) \tag{8}$$

where the dot denotes the rate of change ($\dot{\gamma} = d\gamma / dt$) and $\psi \in [0,1]$ represents the speed of adjustment coefficient ($\psi = 1$ if the firms instantaneously fill the gap between g^* and γ). Substituting with equation (6) the adjustment function is:

$$\dot{\gamma} = \psi\gamma_u\left(u^* - u_n\right) \tag{9}$$

But, as it is well known, such behaviour worsens the situation because $\partial\dot{\gamma} / \partial\gamma > 0$: a fall in u^* results in a decrease of γ, which induces another fall in u^*, and so on. This is the well-known Harrod knife-edge problem.

The literature proposes several alternatives or solutions to this problem.[7] For the sake of the presentation, four kinds of approaches are distinguished here.

First, the Kaleckians maintain the assumption of an endogenous long-run rate of capacity utilisation.[8] They question either the uniqueness of the normal utilisation rate (some authors preferring the idea of a corridor of stability) or the pertinence of long-run analysis (in favor of medium-run or provisional equilibria). Another line consists of assuming that firms have multiple targets whose realisation may be mutually exclusive. As a result, entrepreneurs have to accept a lasting gap between u^* and u_n (Dallery and van Treeck, 2011). Otherwise, some Kaleckians propose reversed causation: Lavoie (1996, p 127), for instance, assumes an endogenous adjustment of the normal rate to its realised value via hysteresis effects.[9]

Second, for many authors, the equality between u^* and u_n as well as the exogeneity of the expected secular rate of growth (γ) are made possible because of the long-run adjustment of another 'parameter' of the model. These approaches include the

[7] See Hein *et al.* (2011) for a more detailed discussion on most of these approaches.
[8] See Hein *et al.* (2012).
[9] See Schoder (2012) for a recent econometric analysis.

early Cambridge models (Robinson, 1956, 1962; Kaldor, 1955–56, 1957) built on the endogenous long-run income distribution hypothesis: entrepreneurs react to a fall in u^* by decreasing prices via a cut in their profit margins. This generates an increase in aggregate demand and the restoration of u_n. In the long run, however, the rate of accumulation and the (endogenous) profit share go hand-in-hand, as they do in a profit-led model.

The literature proposes alternative endogenous 'parameters'. Shaikh (2007), for instance, assumes that the retention ratio of firms (that is the share of retained profits) depends positively on the discrepancy between the actual and normal utilisation rates: a fall in u^* leads to a decrease in the retention ratio and then to a decline in the overall propensity to save. The rise in aggregate demand brings u^* back to its normal value. The wage-led short-run growth model becomes profit-led in the long run.

Another solution has been proposed by Duménil and Lévy (1999), who introduce the interest rate in the accumulation function and assume that central banks target the level of economic activity: monetary authorities react to a fall in u^* by reducing interest rates. This policy boosts investment, there is a rise in aggregate demand and the utilisation rate is brought back to its normal value. Here again, short-run wage-led growth gets reversed into long-run profit-led growth.

Third, in an opposite manner, a few approaches give a core role to Harrodian instability, firms being supposed to behave in the same way as described in equation (9). That is the case in Hicks's (1950) trade cycle analysis where he introduces a novel notion, the super-multiplier, which lumps together the multiplier effect of an autonomous demand component and the accelerator effect of growth on induced investment. The autonomous component corresponds to an autonomous capacity-generating component of investment which imposes a floor to the trade cycle (whilst the ceiling is given by full employment).[10] Such a specification raises several problems, one of them being that 'no hard-and-fast line can be drawn between "induced" and "autonomous" investment [. . . so that] most "autonomous" investment is "induced" from a very long period point of view' (Harrod, 1951, pp 267–8). If this criticism is accepted, the floor of Hicks's model does not operate.

In a closely related recent paper, Fazzari *et al.* (2013) 'embrace the knife-edge property of the original Harrod model as a key feature of the economy that helps to explain long-term growth' (p 5). As for Hicks (1950), Harrodian instability is the engine of cyclical demand-driven dynamics bounded by a ceiling and a floor. The main difference is now that the floor depends on a non-capacity generating autonomous component of aggregate demand such as government spending. A decline in output entails a rise in the share of government spending in the aggregate demand, the multiplier recovers and the system bounces on the floor and onto an unstable increasing growth path.

For their part, Flaschel and Skott (2006), Skott (1989, 2010) and Skott and Zipperer (2012) develop models in which the Harrodian accumulation behaviour is combined with the Kaldorian assumption that a change in output takes time whilst the adjustment of prices is fast. As a result, the conditions for local stability are not met in general, but the fluctuations of the reserve army of labour can give rise to a corridor of stability around a steady growth path: the ceiling depends on full employment (as

[10] The mathematical properties of Hicks's model are developed in Gallegati *et al.* (2003).

previously), whereas the floor is reached when, unemployment being sufficiently high, entrepreneurs start accumulating capital again because they can easily hire workers to work on new capital.

In the last kind of approaches, the long-run equilibrium rests on the endogenous changes of the expected secular rate of growth (γ) despite the absence of Harrodian instability. In Shaikh's (2009) approach, for instance, u^* can deviate from u_n, but this hypothesis is offset by the assumption that firms adjust their investment such that 'output *successfully* targets expected demand with some zero mean error' (p 465). Nevertheless, as pointed by Hein *et al.* (2011), the informal requirements of the latter assumption are overly huge.

In a different way, some Sraffian authors (Serrano, 1995A, 1995B; Bortis, 1997) draw on Hicks's (1950) super-multiplier but retain non-capacity generating autonomous demand components: capitalists' consumption and the non-capacity generating part of investment for Serrano, exports and government spending for Bortis. As a result, the economy converges towards a long-run stable path such that the rates of growth of capacity and production adjust to the exogenous rate of growth of the autonomous demand component (α). In Serrano's model, moreover, a cut in the profit share 'will have a positive long-run level effect (on capacity output), but will have no effect on the sustainable secular rate of growth of capacity' (Serrano, 1995B).

However, these Sraffian super-multiplier models prevent Harrodian instability by assumption. That is explicit in Serrano's hypothesis that 'firms as a whole correctly foresee the evolution of effective demand' (Serrano, 1995B). In fact, the γ parameter takes its 'true' value α and the model skips from a long-run equilibrium to another one, ignoring any traverse analysis.[11] Here again, the informal requirements are huge, a feature that gives rise to criticisms, especially amongst Sraffians such as Trezzini (1998) who underscores that 'the determining role played by aggregate demand in the accumulation process will generally manifest itself in the variability of the average utilisation of productive capacity and is therefore, even in the long run, incompatible with the assumption of normal utilisation' (p 66).[12] Indeed, Serrano recognises that 'if expectations do happen to have a systematic bias in any direction then the actual path of the economy in the long run will move systematically away from the path formed by the corresponding sequence of long-period positions, causing the average actual degree of utilisation to deviate persistently from the planned degree' (1995A, p 87).

The aim of the rest of the article is to draw on these two latter approaches in order to enrich the basic Kaleckian framework. As in the super-multiplier models, an autonomous aggregate demand component (government spending) growing at an exogenous rate is introduced first. Then, as in Harrodian models, firms are assumed to adjust their investment to attempt to restore their normal rate of capacity utilisation. I analyse the conditions under which the resulting instability can be overcome by the presence of the autonomous component.

[11] In Bortis's model, a traverse mechanism operates through short-run adjustments of the mark-up: a permanent rise in, for instance, government spending results in a permanent rise in effective demand (multiplier effect); the mark-up increases, which entails the increase in the rate of accumulation (accelerator effect). The mark-up returns to its normal level when the new long-run equilibrium path is reached.

[12] See, for instance, Trezzini (1995, 1998), Palumbo and Trezzini (2001), or White (2006).

4. model with an autonomous demand component: the short-run temporary equilibrium

A non-capacity generating autonomous demand component is introduced in the basic Kaleckian model of Section 2. As suggested by Serrano (1995A, 1995B) or Bortis (1997), various components are eligible (exports or capitalists' consumption, for instance). We retain the hypothesis of an autonomous public expenditure (G) growing at an exogenous rate (α), that is:

$$G = G_0 e^{\alpha t} \tag{10}$$

Tax revenue results from an income tax whose rate (τ) is supposed to be the same for wages and profits:

$$T = \tau Y \tag{11}$$

These assumptions can be justified by government wanting to provide public goods as well as maintaining full employment. However, the model could hardly be considered an original contribution in public finance because the complexity of the problem of debt interest is bypassed by assuming that government adjusts the tax rate endogenously to preserve budget balance:[13]

$$\tau = \frac{\lambda}{u} \tag{12}$$

where $\lambda = \dfrac{G_0 e^{\alpha t}}{K}$ represents the public expenditure' share (relative to the capital stock).

The introduction of autonomous public expenditure requires distinguishing between three equilibria which will be successively analysed. In the short run, the share of public expenditure relative to the capital stock is assumed to be given and the rate of capacity utilisation adjusts to balance the goods market (this section). But this public expenditure share has no reason to be stable from one period to the next, so every short-run equilibrium is only temporary. It will be shown that the public expenditure share converges towards a position of rest which is the medium-run equilibrium set out here (Section 5).

However the actual and normal rates of capacity utilisation may differ at this stage. The impact of entrepreneurs' behaviour is then analysed by adjusting their accumulation rate to fill the discrepancy between the two utilisation rates. It was shown in the previous section that such behaviour leads to instability (the Harrod knife-edge problem). Here it is shown that depending on the parameters, this behaviour can induce the convergence on the normal rate of capacity utilisation; this is the long-run equilibrium (Section 6).

Taking public expenditure into account, saving and accumulation respectively become:

$$g^s = sr = s(u - \lambda)\pi \tag{13}$$

[13] See You and Dutt (1996) and Schlicht (2006) for analytical models that take both the public deficit and debt dynamics into account. Godley and Lavoie (2007) and Ryoo and Skott (2011) propose simulations in stock-flow consistent frameworks. None of these articles deals with the issue of Harrodian instability.

$$g^i = \gamma + \gamma_u (u - u_n) \tag{14}$$

where $r = (u - \lambda)\pi$ is now the after-tax rate of profit. It should be emphasised that the average secular rate of growth expected by firms (γ) may differ from the rate of growth of public expenditure (α). The short-run goods market equilibrium is then given by:

$$u^{\star} = \Phi(\gamma - \gamma_u u_n + s\pi\lambda) \tag{15}$$

where $\Phi = (s\pi - \gamma_u)^{-1}$ is the Keynesian multiplier. Also:

$$g^{\star} = \gamma + \gamma_u (u^{\star} - u_n) \tag{16}$$

The Keynesian stability condition is still supposed to hold, that is:

$$s\pi - \gamma_u > 0 \tag{C1}$$

As a consequence, the term in brackets must also be positive for the rate of capacity utilisation to be positive.

The comparative static results are reported in Table 2. Note that the sign of the derivatives with regards to s and π is that of $\lambda - u^{\star}$.[14] For economic significance, λ must be lower than $u^{\star}$ (otherwise public expenditure would be greater than aggregate demand and the private demand, $C + I$, would be negative), hence another restriction is given by:

$$\gamma - \gamma_u u_n > -\gamma_u \lambda \tag{C2}$$

Note that because of condition (C1), condition (C2) is more binding than the condition on a positive term in brackets in condition (15). However, condition (C2) is less restrictive than in the basic model because the expression $\gamma - \gamma_u u_n$ can now be negative.

The comparative static results are summarised in Table 2. On the whole they are identical to those of the basic Kaleckian model.[15]

Let us return to the properties of the saving function (13) where the marginal propensity to save ($s\pi$) is given exogenously. According to Serrano (1995A, 1995B), as soon as the autonomous demand component is exogenous (or omitted), any change

Table 2. *Short-run impact effects*

	γ	s	π	λ	α
$u^{\star}$	+	–	–	+	0
$g^{\star}$	+	–	–	+	0
$\tau^{\star}$	–	+	+	?	0
$r^{\star}$	+	–	–	+	0

[14] Actually, $du^{\star}/ds = \Phi(\lambda - u^{\star})\pi$ and $du^{\star}/d\pi = \Phi(\lambda - u^{\star})s$.

[15] Note that the sign of $d\tau^{\star}/d\lambda$ is given by $\gamma - \gamma_u u_n$.

in the rate of accumulation implies a change in the utilisation rate. On the other hand, with the autonomous demand component, the adjustment could at least partially take place through λ rather than through u. It is then formally possible to imagine saving variations that does not affect the rate of capacity utilisation, a possibility that is explored in the following sections.

5. The medium-run equilibrium: the convergence of the rate of accumulation

The crucial point of the model is that the short-run equilibrium (u^*) does not only depend on exogenous parameters. It now includes λ, which varies with time as soon as the accumulation rate differs from the growth rate of public expenditure (α), that is:

$$\dot{\lambda} = \lambda(\alpha - g^*) \tag{17}$$

As a consequence, the medium-run equilibrium combines the goods market equilibrium with a position of rest ($\dot{\lambda} = 0$). The stable medium-run equilibrium is given by:

$$u^{**} = \frac{\alpha - \gamma}{\gamma_u} + u_n \tag{18}$$

$$\lambda^{**} = u^{**} - \frac{\alpha}{s\pi} \tag{19}$$

$$g^{**} = \alpha \tag{20}$$

$$\tau^{**} = 1 - \frac{\alpha}{s\pi u^{**}} \tag{21}$$

$$r^{**} = \frac{\alpha}{s} \tag{22}$$

See Appendix A for the proof. Let us note that the necessary condition for u^{**} and λ^{**} to be positive is that:

$$\alpha > \Phi s\pi(\gamma - \gamma_u u_n) \tag{C3}$$

The comparative static results in Table 3 deserve attention because some of them seem to be at odds with Kaleckian results. Actually, they are not. It is argued here that they might represent a faithful extension of the short-run Kaleckian model.

The next figures help explain the underlying mechanisms. The goods market equilibria correspond to the intersections between the two straight lines representing capital accumulation (g^i) and saving (g^s). The initial short-run equilibrium (E_0) is assumed to be a position of rest ($g_K = \alpha$). Suppose an increase in the profit share (π). This shift will have distinct effects in the short and medium runs.

In the short run (Figure 1), the rise in π leads to a counter-clockwise rotation and a downwards shift of the intercept of g^s. The equilibrium moves to E_1. As in the basic model, there is a decrease in $u^\star$ and $g^\star$.

This solution is not stable because $g_1^\star < \alpha$. There is then a rise in the public expenditure share (λ), which supports aggregate demand and reduces saving. More precisely, a portion of profits that was intended for capitalists' saving is now being redirected towards public expenditure via the increase of the endogenous tax rate: g^s shifts downwards in Figure 2, until the economy once again finds a position of rest at E_0.

We now assume an increase in the entrepreneurs' expected rate of growth (γ). It results in an upwards shift of g^i such that $u^\star$ and $g^\star$ both increase. But as $g^\star > \alpha$, the public expenditure share decreases (g^s shifts upwards), relieving the pressure on capacity. This generates a decrease in both $u^\star$ and $g^\star$, which continues until the economy finds a new position of rest with $g = \alpha$, but at a lower rate of capacity utilisation than in the initial situation.

Eventually, the main result of the model is that the negative effects on capacity utilisation and economic growth vanish in the medium run. Does this mean that the rise in the profit share has no effect in the medium run? Actually, the answer is no. Let us look at Figure 3 to see this. The normal straight line represents the temporal evolution of output assuming there is no shock to π. The bold straight line represents the evolution of capital stock assuming an increase in π at time t_0. In the medium run, the economic

Table 3. *Medium-run impact effects*

	γ	s	π	α
λ^{**}	–	+	+	+
u^{**}	–	0	0	+
g^{**}	0	0	0	+
τ^{**}	–	+	+	–
r^{**}	0	–	0	+

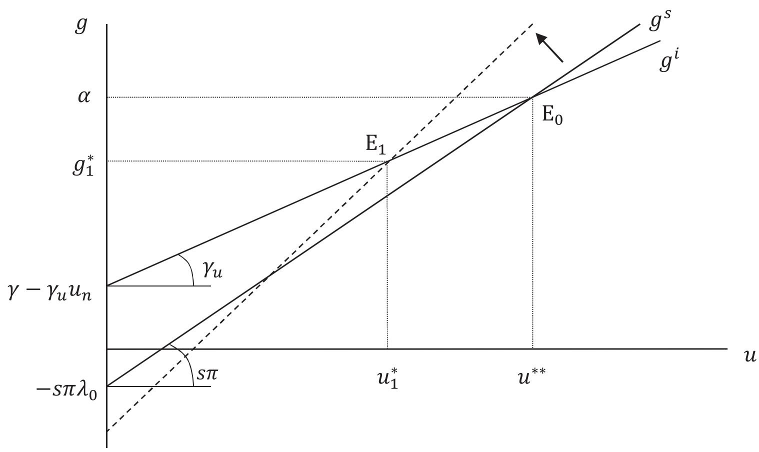

Fig. 1. *Short-run impact of a rise in π*

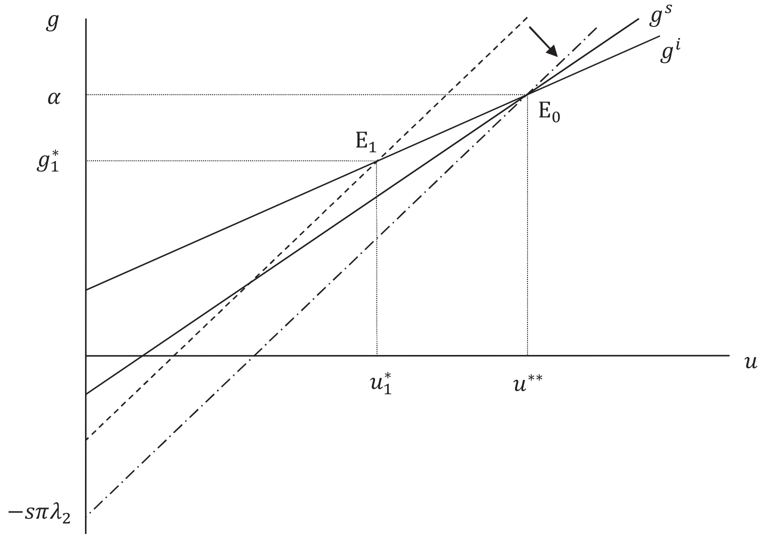

Fig. 2. *Medium-run impact of a rise in* π

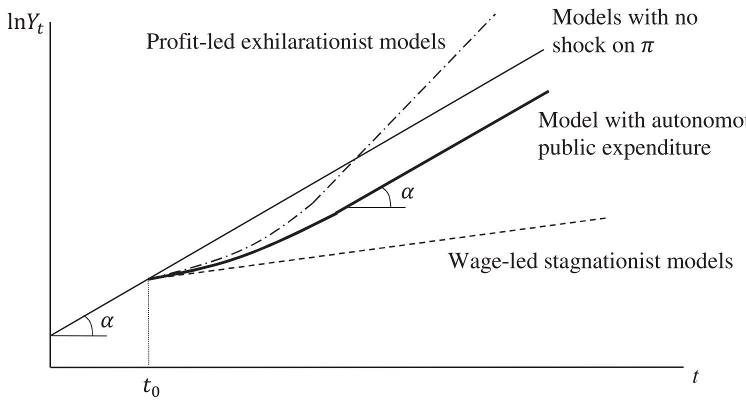

Fig. 3. *Short- and medium-run impacts of a rise in* π

growth rate is brought back to α. But this rate is temporarily lower than α. The output level thus remains permanently lower than it would have been with an unchanging profit share. In this sense, the medium-run analysis does not contradict the short-run one. The model is thus consistent with other Kaleckian models for which, in addition, the growth rate is durably affected (the dashed line). In contrast, the profit-led model (mixed line) leads to positive medium-run effects on the output level, despite temporary short-run negative effects.

Of course, the rise in the profit share causes an increase in the before-tax rate of profit (πu^*). But it is entirely offset by the rise in the tax rate (resulting from the increase in λ). Thus the after-tax rate of profit is brought back to its initial value.

Finally, public expenditure plays a role as an automatic stabiliser of growth, although there is no public deficit (whereas automatic stabilisers usually rest on public deficit variations depending on tax income being more endogenous than expenditure). Stabilisation here comes from tax rate adjustments, which make it possible to transfer some income from capitalists' saving to public expenditure; the converse is also true. Moreover, stabilisation does not apply to the production level, which is permanently affected by exogenous shocks; stabilisation only applies to the rate of capital accumulation, which is brought back to α in the long run. Note that a higher α has a positive impact on every endogenous variable, even the profit rate, thanks to public expenditure-supporting activity.

6. The long-run equilibrium: the convergence of the actual rate of capacity utilisation

In accordance with equation (18), the medium-run rate of capacity utilisation u^{**} may differ from the normal rate u_n. The last step of the model consists in introducing an Harrodian investment behaviour assuming firms adjust their expected rate of growth (via γ) depending on the gap between the actual and normal utilisation rates (see above):

$$\dot{\gamma} = \psi\gamma_u\left(u^* - u_n\right) \tag{9}$$

The long-run equilibrium is given by:

$$u^{***} = u_n \tag{23}$$

$$\lambda^{***} = u_n - \frac{\alpha}{s\pi} \tag{24}$$

$$\gamma^{***} = \alpha \tag{25}$$

$$g^{***} = \alpha \tag{26}$$

$$\tau^{***} = 1 - \frac{\alpha}{s\pi u_n} \tag{27}$$

$$r^{***} = \frac{\alpha}{s} \tag{28}$$

See the proof in Appendix B. Note that λ^{***} is positive only if

$$s\pi u_n - \alpha > 0 \tag{C4}$$

Moreover, the condition for the equilibrium to be locally stable is given by:

$$\psi < s\pi u_n - \alpha \tag{C5}$$

As a consequence, it is not possible to formulate a univocal conclusion. The best that can be said is that there is some room, depending on the parameter values, for the system to converge to its long-run equilibrium. For this to happen, ψ has to be small. This is an original outcome: whilst a positive ψ generates the Harrod knife-edge problem in the existing literature, it is here a necessary condition for the rate of capacity utilisation to converge towards its normal level.

Furthermore, the other results of the previous section are preserved, especially the permanent reduction in both capital stocks and output levels, following an increase in π (see Appendix B for details).

Assuming a stable long-run equilibrium, the comparative static results are shown in Table 4.

Accordingly, a change in saving or investment behaviours has no effect on the long-run utilisation and accumulation rates. As for the medium run, an increase in π (or s) leads to a rise in λ: more saving in the economy means a higher share of public expenditure. In addition, a rise in the rate of growth of public expenditure still induces greater accumulation and profit rates. Interestingly, because of its multiplier effect on consumption and investment, the higher α reduces the share of public expenditure in aggregate demand.

7. Conclusion

This article presents a basic Kaleckian framework that undergoes two successive improvements. The first is the introduction of an autonomous public expenditure growing at an exogenous rate. The only restrictive assumption is that the tax rate adjusts for the public budget to remain in balance. The model confirms the well-known positive and counter-cyclical effects of public expenditure on activity and growth. Moreover, it has been shown that such public expenditure plays an automatic stabilising role on economic growth (rather than on the level of activity). Changes in, say, capitalists' propensity to save or in the profit share have a transient effect on growth: in the long run, the rate of capital accumulation is brought back to its initial value, which is given by the exogenous rate of growth of public expenditure. The underlying mechanism is based on the adjustment of the endogenous tax rate, which results in an income transfer from capitalists to the government: a portion of profits that was intended for capitalists' saving is now redirected towards public expenditure via the increase in the endogenous tax rate. However, increases in the propensity to save or in the profit share have permanent negative effects on capital and output levels.

Table 4. *Long-run impact effects*

	s	π	α
γ^{***}	0	0	+
λ^{***}	+	+	–
u^{***}	0	0	0
g^{***}	0	0	+
τ^{***}	+	+	–
r^{***}	–	0	+

The second improvement is the combination of this automatic stabiliser mechanism with a Harrodian behaviour of firms as they adjust their expected secular rate of growth. Whilst this behaviour is well known for generating instability, it has been shown that, depending on the parameter values, the former mechanism can be strong enough to preserve the model's stability and provide a solution to the Harrod knife-edge problem. In this case, the actual rate of capital utilisation converges towards its normal value.

Of course, since this solution to the Harrodian instability is conditional, which depends on parameter values, it is only a partial solution, but it opens new perspectives for further research.

In addition to the efforts required to improve the robustness of the present conclusions, the analysis could be enriched in at least four ways. First, its realism could be improved by relaxing both the no-public-deficit and endogenous tax rate assumptions. However this task is not so easy because it is necessary to include the interest paid to sovereign asset holders and then take into account another dynamics, namely that of public debt.

Second, the results support the use of discretionary counter-cyclical fiscal policies to maintain activity, employment and economic growth. Indeed, according to the model, both the level and the growth rate of national income depend on government spending, not the reverse. Consequently, a policy that responds to a national income recession by a reduction in the level and growth rate of government spending has a clear negative effect on economic activity and growth. Here again, however, the improvements mentioned in the previous paragraph must certainly be made before one addresses issues of fiscal policy.

Third, the model could be extended to other autonomous demand components, especially to exports. Blecker (1998, 2002, 2011) amongst others has developed the Kaleckian model in an open economy framework. But his models cannot fully highlight the role of exports as an automatic stabiliser because they are restrained to the short run so that the dynamics of the share of exports in the aggregate demand is not analysed as it has been here for the share of government spending. Some further explorations about the potential role of exports as a growth stabiliser should also fuel the debate between Kaleckian models and other post-Keynesian models, such as the export-led cumulative causation or the balance-of-payment constraint models.[16]

Last, the model does not take account of the labour market and unemployment. It thus provides no solution for the 'first' Harrodian problem (except in arguing that government sets the rate of growth of public expenditure in accordance with demographic growth to stabilise or eliminate unemployment). This question, which is taken into account by the 'Harrodian' authors,[17] deserves more attention in further research.

Bibliography

Allain, O. 2009. La modération salariale: le point de vue des (néo-)kaleckiens, *Revue Economique*, vol. 60, no. 1, 81–108

[16] See Cornwall (1977) or Setterfield and Cornwall (2002) for the former and Thirlwall (1979) for the latter. See also Blecker (2010) for a critical survey of the two approaches.

[17] See the already cited research of Hicks (1950), Skott (1989, 2010), Gallegati *et al.* (2003), Flaschel and Skott (2006), Skott and Zipperer (2012), and Fazzari *et al.* (2013).

Allain, O. and Canry, N. 2008. Growth, Capital Scrapping, and the Rate of Capacity Utilization, paper presented at the 12th conference of the Research Network Macroeconomics and Macroeconomic Policies, Berlin

Blecker, R. A. 1998. International competitiveness, relative wages, and the balance-of-payments constraint, *Journal of Post Keynesian Economics*, vol. 20, no. 4, 495–526

Blecker, R. A. 2002. Distribution, demand, and growth in neo-Kaleckian macro models, in Setterfield, M. (ed.), *The Economics of Demand-Led Growth: Challenging the Supply-Side Vision of the Long Run*, Cheltenham, Edward Elgar

Blecker, R. A. 2010. Long-run growth in open economies: export-led cumulative causation or a balance-of-payments constraint?, in Harcourt, G.C. and Kriesler, P. (eds), *The Oxford Handbook of Post-Keynesian Economics*, Oxford, Oxford University Press

Blecker, R. A. 2011. Open economy models of distribution and growth, in Hein, E. and Stockhammer, E. (eds.), *A Modern Guide to Keynesian Macroeconomics and Economic Policies*, Cheltenham, Edward Elgar

Bortis, H. (1997) *Institutions, Behaviour and Economic Theory: A Contribution to Classical-Keynesian Political Economy*, New York, Cambridge University Press

Cornwall, J. 1977. *Modern Capitalism: Its Growth and Transformation*, New York, St. Martin's Press

Dallery, T. 2007. Kaleckian Models of Growth and Distribution Revisited: Evaluating their Relevance through Simulations, paper presented at the 11th conference of the Research Network Macroeconomics and Macroeconomic Policies, Berlin

Dallery, T. and van Treeck, T. 2011. Conflicting claims and equilibrium adjustment processes in a stock-flow consistent macroeconomic model, *Review of Political Economy*, vol. 23, no. 2, 189–211

Duménil, G. and Lévy, D. 1999. Being Keynesian in the short term and classical in the long term: the traverse to classical long-term equilibrium, *Manchester School*, vol. 67, no. 6, 684–716

Dutt, A. K. 2011. Growth and income distribution: a post-Keynesian perspective, in Hein, E. and Stockhammer, E. (eds.), *A Modern Guide to Keynesian Macroeconomics and Economic Policies*, Cheltenham, Edward Elgar

Fazzari, S. M., Ferri, P. E., Greenberg, E. G. and Variato, A. M. 2013. Aggregate demand, instability, and growth, *Review of Keynesian Economics*, vol. 1, no. 1, 1–21

Flaschel, P. and Skott, P. 2006. Steindlian models of growth and stagnation, *Metroeconomica*, vol. 57, no. 3, 303–38.

Gallegati, M., Gardini, L., Puu, T. and Sushko, I. 2003. Hicks' trade cycle revisited: cycles and bifurcations, *Mathematics and Computers in Simulation*, no. 63, 505–27

Godley, W. and Lavoie, M. 2007. Fiscal policy in a stock-flow consistent (SFC) model, *Journal of Post Keynesian Economics*, vol. 30, no. 1, 79–100

Harrod, R. F. 1951. Notes on trade cycle theory, *Economic Journal*, vol. 61, no. 242, 261–75

Hein, E., Lavoie, M. and van Treeck, T. 2011. Some instability puzzles in Kaleckian models of growth and distribution: a critical survey, *Cambridge Journal of Economics*, vol. 35, no. 3, 587–612

Hein, E., Lavoie, M. and van Treeck T. 2012. Harrodian instability and the 'normal rate' of capacity utilization in Kaleckian models of distribution and growth—a survey, *Metroeconomica*, vol. 63, no. 1, 139–69

Hicks J. R. 1950. *A Contribution to the Theory of the Trade Cycle*, Oxford, Clarendon Press

Kaldor, N. 1955–56. Alternative theories of distribution, *Review of Economic Studies*, vol. 23, no. 2, 83–100

Kaldor, N. 1957. A model of economic growth, *Economic Journal*, vol. 67, no. 268, 591–624

Lavoie, M. 1996. Traverse, hysteresis and normal rates of capacity utilization in Kaleckian models of growth and distribution, *Review of Radical Political Economics*, vol. 28, no. 4, 113–47

Lavoie, M. 2012. History and methods of post-Keynesians economics, in Hein, E. and Stockhammer, E. (eds.), *A Modern Guide to Keynesian Macroeconomics and Economic Policies*, Cheltenham, Edward Elgar

Nikiforos, M. 2011. 'On the Desired Rate of Capacity Utilization', New School for Social Research Working Paper no. 16/2011

Palumbo, A. and Trezzini, A. 2001. Growth without normal capacity utilization, *European Journal of the History of Economic Thought*, vol. 10, no. 1, 109–35

Robinson, J. 1956. *The Accumulation of Capital*, London, Macmillan
Robinson, J. 1962. *Essays in the Theory of Economic Growth*, London, Macmillan
Ryoo, S. and Skott, P. 2013. Public debt and full employment in a stock-flow consistent model of a corporate economy, *Journal of Post Keynesian Economics*, vol. 35, no. 4, 511–27
Sawyer, M. 2012. The Kaleckian analysis of demand-led growth, *Metroeconomica*, vol. 63, no. 1, 7–28
Serrano, F. 1995A. Long period effective demand and the Sraffian supermultiplier, *Contributions to Political Economy*, no. 14, 67–90
Serrano, F. 1995B. 'The Sraffian Supermultiplier', PhD thesis, Faculty of Economics and Politics, University of Cambridge
Setterfield, M. and Cornwall, J. 2002. A neo-Kaldorian perspective on the rise and decline of the golden age, in Setterfield, M. (ed.), *The Economics of Demand-Led Growth: Challenging the Supply-Side Vision of the Long Run*, Cheltenham, Edward Elgar
Schlicht, E. 2006. Public debt as private wealth: some equilibrium considerations, *Metroeconomica*, vol. 57, no. 4, 494–520
Schoder, C. 2012. Hysteresis in the Kaleckian growth model: a Bayesian analysis for the US manufacturing sector from 1984 to 2007, *Metroeconomica*, vol. 63, no. 3, 542–68
Shaikh, A. 2007. 'A Proposed Synthesis of Classical and Keynesian Growth', New School for Social Research Working Paper no. 5/2007
Shaikh, A. 2009. Economic policy in a growth context: a classical synthesis of Keynes and Harrod, *Metroeconomica*, vol. 60, no. 3, 455–94
Skott, P. 1989. *Conflict and Effective Demand in Economic Growth*, Cambridge, Cambridge University Press
Skott, P. 2010. Growth, instability and cycles: Harrodian and Kaleckian models of accumulation and income distribution, in Setterfield, M. (ed.), *Handbook of Alternative Theories of Economic Growth*, Cheltenham, Edward Elgar
Skott, P. 2012. Theoretical and empirical shortcomings of the Kaleckian investment function, *Metroeconomica*, vol. 63, no. 1, 109–38
Skott, P. and Zipperer, B. 2012. An empirical evaluation of three post-Keynesian models, *Intervention*, vol. 9, no. 2, 277–308
Thirlwall, A. P. 1979. The balance of payments constraint as explanation of international growth rate differences, *Banca Nazionale del Lavoro Quarterly Review*, no. 128, 45–53
Trezzini, A. 1995. Capacity utilisation in the long run and the autonomous components of aggregate demand, *Contributions to Political Economy*, no. 14, 33–66
Trezzini, A. 1998. Capacity utilisation in the long run: some further considerations, *Contributions to Political Economy*, no. 17, 53–67
White, G. 2006. Demand-led growth and the classical approach to value and distribution: are they compatible?, in Salvadori, N. (ed.) *Economic Growth and Distribution: On the Nature and Causes of the Wealth of Nations*, Cheltenham, Edward Elgar
You, J.-I. and Dutt, A. K. 1996. Government debt, income distribution and growth, *Cambridge Journal of Economics*, vol. 20, no. 3, 335–51

Appendix A: the medium-run equilibrium

The dynamics of the public expenditure share is:

$$\dot{\lambda} = \lambda\left(\alpha - g^{\star}\right) \tag{17}$$

where $g^{\star}$, depending on $u^{\star}$, is given by equation (16). The medium-run equilibrium is given by the system:

$$\begin{cases} \dot{\lambda} = 0 \\ u^{\star} = \Phi\left(\gamma - \gamma_u u_n + s\pi\lambda\right) \end{cases} \tag{A.1}$$

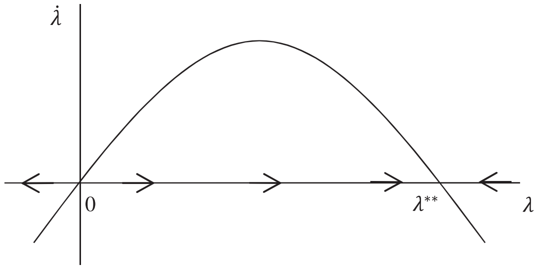

Fig. A1. *Dynamics of* λ *(phase diagram)*

which has two solutions:

$$\begin{cases} u^{\sim} = \Phi\left(\gamma - \gamma_u u_n\right) \\ \lambda^{\sim} = 0 \end{cases} \tag{A.2}$$

and

$$\begin{cases} u^{*} = \dfrac{\alpha - \gamma}{\gamma_u} + u_n \\ \lambda^{**} = u^{*} - \dfrac{\alpha}{s\pi} \end{cases} \tag{A.3}$$

The former corresponds to the assumption that $G_0 = 0$ and is of little interest here (it refers back to the basic Kaleckian model). For the latter to have positive values, the necessary condition is (restrictions are more binding on λ^* than on u^*:

$$\alpha > \Phi s\pi\left(\gamma - \gamma_u u_n\right) \tag{C3}$$

Consequently condition (C3) is fulfilled if $\gamma - \gamma_u u_n$ is weakly negative (such that condition (C2) holds in every transitory period). Eventually, the condition $\lambda^{**} < u^*$ holds whatever the value of the parameters.

The stability conditions depend on the first and second derivatives:

$$\frac{d\dot{\lambda}}{d\lambda} = \alpha - \Phi s\pi\left(\gamma - \gamma_u u_n\right) - 2\Phi\gamma_u s\pi\lambda \tag{A.4}$$

$$\frac{d^2\dot{\lambda}}{d\lambda^2} = -2\Phi\gamma_u s\pi < 0 \tag{A.5}$$

The second derivative being negative, the function $\dot{\lambda}(\lambda)$ is an inverted U-shaped relationship with two roots, $\lambda^{\sim} = 0$ and λ^{**} (see Figure A1). The first derivative for $\lambda = \lambda^{\sim} = 0$ is:

$$\left.\frac{d\dot{\lambda}}{d\lambda}\right|_{\lambda=0} = \alpha - \Phi s\pi\left(\gamma - \gamma_u u_n\right) \tag{A.6}$$

which is positive if condition (C3) is fulfilled. Assuming condition (C3), $\left(u^{\sim}, \lambda^{\sim}\right)$ is unstable and the system converges towards its stable medium-run equilibrium $\left(u^{**}, \lambda^{**}\right)$.

Appendix B: the long-run equilibrium

It is assumed that firms adjust their expected rate of growth depending on the gap between the actual and normal utilisation rates:

$$\dot{\gamma} = \psi\gamma_u\left(u^* - u_n\right) \tag{9}$$

The long-run equilibrium is the solution of the system:

$$\begin{cases} \dot{\gamma} = 0 \\ \dot{\lambda} = 0 \\ u^* = \Phi(\gamma - \gamma_u u_n + s\pi\lambda) \end{cases} \tag{B.1}$$

where $\dot{\lambda}$ is given by equation (17). The unique solution of this system is:

$$u^{***} = u_n \tag{23}$$

$$\lambda^{***} = u_n - \frac{\alpha}{s\pi} \tag{24}$$

$$\gamma^{***} = \alpha \tag{25}$$

The condition for a positive λ^{***} is:

$$s\pi u_n - \alpha > 0 \tag{C4}$$

The local stability conditions depend on the dynamics of both γ and λ. These conditions can be analysed by means of the Jacobian matrix which (after linearisation) is given by:

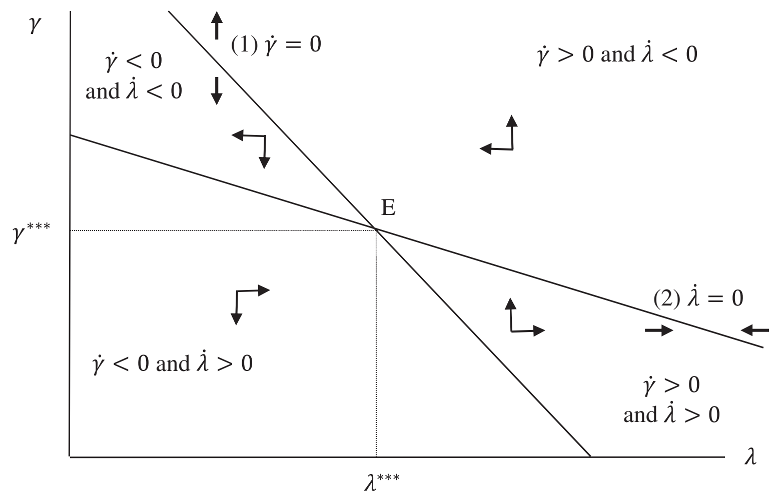

Fig. B1. *Dynamics of λ and γ (phase diagram)*

$$\mathcal{J} = \begin{pmatrix} \frac{\partial \dot{\gamma}}{\partial \gamma} & \frac{\partial \dot{\gamma}}{\partial \lambda} \\ \frac{\partial \dot{\lambda}}{\partial \gamma} & \frac{\partial \dot{\lambda}}{\partial \lambda} \end{pmatrix} = \begin{pmatrix} \psi \Phi \gamma_u & \psi \Phi \gamma_u s\pi \\ -\Phi(s\pi u_n - \alpha) & -\gamma_u \Phi(s\pi u_n - \alpha) \end{pmatrix}$$

For the equilibrium to be stable, the matrix determinant must be positive, whereas the trace must be negative. The determinant is:

$$Det(\mathcal{J}) = \psi \Phi \gamma_u (s\pi u_n - \alpha)$$

This leads to the result that $Det(\mathcal{J})$ is positive, as soon as λ^{***} is positive (see condition (C4)). On the other hand, the trace is given by:

$$Tr(\mathcal{J}) = -\gamma_u \Phi(s\pi u_n - \alpha - \psi)$$

It can therefore be deduced that:

$$Tr(\mathcal{J}) < 0 \Leftrightarrow \psi < \psi^{\#} \ \ with \ \ \psi^{\#} = s\pi u_n - \alpha \tag{C5}$$

In summary, assuming condition (C4) is fulfilled, the necessary condition for the system to converge to its long-run solution is $\psi < \psi^{\#}$, condition (C5). The system's trajectory depends on the discriminant of its eigenvalues, that is:

$$\Delta = Tr(\mathcal{J})^2 - 4Det(\mathcal{J})$$

It can be shown that:

$$\Delta = 0 \Leftrightarrow \psi^2 - 2(1+\rho)\Omega\psi + \Omega^2 = 0$$

where $\Omega = s_\pi \pi u_n - \alpha$ and $\rho = \frac{2}{\Phi\gamma_u}$. The roots of this quadratic function rest on the value of ψ:

$$\psi_1 = \Omega\left[(1+\rho) - \sqrt{\rho(2+\rho)}\right]$$

$$\psi_2 = \Omega\left[(1+\rho) + \sqrt{\rho(2+\rho)}\right]$$

Given that the terms in brackets are respectively lower and higher than unity, then $\psi_1 < \psi^{\#} < \psi_2$. Assuming $Det(\mathcal{J}) > 0$, the results can be summarised as follows (see Figure B1):

a. $\psi < \psi_1 \Rightarrow \Delta > 0$ and $Tr(\mathcal{J}) < 0$: λ and γ converge monotonically towards their long-run equilibrium (stable node).

b. $\psi_1 < \psi < \psi^{\#} \Rightarrow Tr(\mathcal{J}), \Delta < 0 : \lambda$ and γ converge via damped oscillations (stable focus).

c. $\psi = \psi^{\#} \Rightarrow Tr(\mathcal{J}) = 0$ and $\Delta < 0$: oscillations are not damped (the equilibrium is a centre).

d. $\psi^{\#} < \psi < \psi_2 \Rightarrow Tr(\mathcal{J}) > 0$ and $\Delta < 0$: the system diverges since λ and γ oscillations are unstable (unstable focus).

e. $\psi_2 < \psi \Rightarrow Tr(\mathcal{J}), \Delta > 0 : \lambda$ and γ monotonically diverges (unstable node).

In Figure B1, $\dot{\gamma} = 0 \Leftrightarrow \gamma = s\pi\left(u_n - \lambda\right)$ (1), whereas $\dot{\lambda} = 0 \Leftrightarrow \gamma = \dfrac{\alpha}{\Phi s\pi} + \gamma_u u_n - \gamma_u \lambda$ (2). It can be shown that the slope is higher for (1) than for (2), and conversely for the intercepts.

As for the medium run, a rise in π leads to a permanent cut in both capital stock and output. Assuming configuration (a) holds, the rise in π causes a decrease in both u^* and g^*. As $u^* < u_n$, entrepreneurs react in reducing γ. That induces another decrease in g^*, which slows down the equilibrium restoration (compared with the medium-run dynamics), resulting from the increase in λ. The convergence is monotonic, and capital stock and output are permanently lower than they should have been without the initial change in π. Now if the equilibrium is a centre (configuration (c)), g^{***} is also a centre whose decreases are strictly offset by the increases and vice versa. Intuitively, both capital stock and output should oscillate around their initial path. By deduction, the intermediate configuration (b) should show the same permanent cuts in capital stock and output than in configuration (a): the decreases in g^* being not totally offset by its increases, capital stock and output stabilise on a lower path than the initial one.