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## Harroddian instability in Kaleckian models and Steindlian solutions

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# FMM WORKING PAPER

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## HARRODIAN INSTABILITY IN KALECKIAN MODELS AND STEINDLIAN SOLUTIONS: AN ELEMENTARY DISCUSSION

Eckhard Hein\*

### ABSTRACT

The notion of dynamic instability of demand driven growth put forward by Harrod (1939) has triggered several responses in the history of economic thought. The modern Kaleckian solution, including Bhaduri/Marglin (1990) among several others, considers the rate of capacity utilisation to be endogenous beyond the short run, thus assuming, explicitly or implicitly, that Harrod's warranted rate of growth is either irrelevant or endogenous in the long run, eliminating the problem of Harrodian instability. In the modern debate several authors have criticised this Kaleckian approach, as reviewed in Hein/Lavoie/van Treeck (2011, 2012). In this debate, however, two arguments proposed by Steindl (1979, 1985) in favour of at least partial endogeneity of the warranted rate of growth have received little attention. The first is related to the endogeneity of the capital output ratio through endogenous capital scrapping (Steindl 1979); the second refers to government budget balances and the related effects on the aggregate propensity to save (Steindl 1979, 1985). In this paper we will therefore discuss in particular the two Steindlian arguments. For this purpose the model framework proposed by Hein/Lavoie/van Treeck (2011, 2012) will be extended in order to allow for endogenous capital scrapping and endogenous overall propensities to save through variations in the government financial balance.

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### **Abstract**

The notion of dynamic instability of demand driven growth put forward by Harrod (1939) has triggered several responses in the history of economic thought. The modern Kaleckian solution, including Bhaduri/Marglin (1990) among several others, considers the rate of capacity utilisation to be endogenous beyond the short run, thus assuming, explicitly or implicitly, that Harrod's warranted rate of growth is either irrelevant or endogenous in the long run, eliminating the problem of Harroddian instability. In the modern debate several authors have criticised this Kaleckian approach, as reviewed in Hein/Lavoie/van Treeck (2011, 2012). In this debate, however, two arguments proposed by Steindl (1979, 1985) in favour of at least partial endogeneity of the warranted rate of growth have received little attention. The first is related to the endogeneity of the capital output ratio through endogenous capital scrapping (Steindl 1979); the second refers to government budget balances and the related effects on the aggregate propensity to save (Steindl 1979, 1985). In this paper we will therefore discuss in particular the two Steindlian arguments. For this purpose the model framework proposed by Hein/Lavoie/van Treeck (2011, 2012) will be extended in order to allow for endogenous capital scrapping and endogenous overall propensities to save through variations in the government financial balance.

Keywords: Kaleckian distribution and growth models, Harroddian instability, Steindl

JEL-code: E12, E20, O41

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## 1. Introduction

The notion of dynamic instability of demand driven growth put forward by Harrod (1939) has triggered several responses in the history of economic thought. Neoclassical economists like Solow (1956) ignored Harrod's original problem of a potential cumulative deviation of the demand driven actual growth rate from the warranted rate of growth at which target rates of utilisation of productive capacities are realised. Instead, assuming Say's law to hold, the focus turned towards showing that the warranted rate of growth will adjust towards the natural rate of growth, determined by exogenous labour force growth and technological progress, through capital-labour substitution and a long-run variable capital-output ratio. The first generation post-Keynesian distribution and growth models by Kaldor (1957, 1961) and Robinson (1956, 1962), shifted the focus back to Harrod's original problem and made the warranted rate of growth adjust towards the actual rate through changes in distribution and thus the average propensity to save; Kaldor (1957, 1961) also endogenised the capital-output ratio via his 'technical progress function'. The second generation post-Keynesian distribution and growth models, based on the works of Kalecki (1954, 1971) and Steindl (1952), and put forward by Rowthorn (1981), Dutt (1984, 1987), Bhaduri/Marglin (1990) and Kurz (1990), rather considered the rate of capacity utilisation to be endogenous beyond the short run. It was thus assumed, explicitly or implicitly, that the warranted rate of growth is either irrelevant or endogenous in the long run, eliminating the problem of Harrodian instability.

Against this background, the modern debate has focused on the viability of this Kaleckian approach, and several authors have criticised the treatment of the rate of capacity utilisation as an endogenous variable in the medium to long run – and thus the assumption of the irrelevance or the endogeneity of the warranted rate of growth. Dumenil/Levy (1999), Shaikh (2009) and Skott (2010, 2012) have proposed models with local Harrodian instability around the normal rate of capacity utilisation which is then globally contained by monetary policy (Dumenil/Levy), changes in retention ratios and thus aggregate propensities to save (Shaikh) or by changes in investment behaviour (Shaikh, Skott). The conclusions drawn from these Harrodian and Marxian critiques has been that the main features of the Kaleckian model, the paradox of thrift and the possibility of a paradox of costs,<sup>1</sup> may hold in the short and the medium run, but not in the long run when the system has been brought back to the normal rate of capacity utilisation. Or as Dumenil/Levy (1999) have famously put it, one can be 'Keynesian in the short term' but has to be 'classical in the long term'.

Hein/Lavoie/van Treeck (2011) have reviewed these contributions and did not find the proposed models to be fully convincing. In Hein/Lavoie/van Treeck (2012) they have

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<sup>1</sup> The paradox of costs and a unique wage-led demand and growth regime, i.e. a higher profit share having a depressing effect on the equilibrium rates of capacity utilisation, profit, capital accumulation and growth, is a feature of the neo-Kaleckian distribution and growth model for a closed private economy, as initially proposed by Rowthorn (1981) and Dutt (1984, 1987). However, in the open economy version of this model by Blecker (1989) and then in the post-Kaleckian model put forward by Bhaduri/Marglin (1990) and Kurz (1990), we have the possibility of wage-led or profit-led regimes, or some intermediate cases, depending on model parameters. See Blecker (2002), Hein (2014, Chapters 6-7) and Lavoie (2014, Chapter 6.2 and 6.3) for overviews.

instead considered several Kaleckian justifications for the treatment of the rate of capacity utilisation as an endogenous variable:

First, Chick/Caserta (1997), for example, have argued that expectations and behavioural parameters, as well as norms, are changing so frequently that a long-run equilibrium, defined as fully-adjusted position at normal or target rates of capacity utilisation, is not very relevant. Instead, they argue that the focus should be on short-run analysis and on medium-run or provisional equilibria, in which the goods market equilibrium rate of capacity utilisation may deviate from firms' target rate without triggering further reactions. The long-run is thus nothing else as a succession of medium-run provisional equilibria, an interpretation which is faithful with Kalecki's (1971, p. 165) view that 'the long-run trend is but a slowly changing component of a chain of short-period situations; it has no independent entity', and also with Steindl's (1952, p. 12) remark that '(t)here is no good reason why a state of disequilibrium, with undesired excess capacity, should not persist. For practical purposes, disequilibrium may be permanent.'

Second, Dutt (1990, pp. 58-60, 2010) and Lavoie (1992, pp. 327-332, pp. 417-422) have suggested that the notion of a normal or target rate of utilisation should be defined as a range and not as a single value. Under the conditions of fundamental uncertainty, firms may be quite content to run their production capacity at rates of utilisation that are within that acceptable range for the normal or target rate without triggering adjusting reactions of investment. The normal rate of utilisation thus becomes endogenous with respect to the actual rate within that range.

Third, Dallery/van Treeck (2010), building on Lavoie (2002), have argued that firms have multiple goals and targets, the achievement of which may be mutually inconsistent. Therefore, they may have to accept variations in capacity utilisation and hence deviations from their target or normal rate in order to achieve or to come close to achieving other goals, for example a certain target rate of return imposed by shareholders.

Fourth, Lavoie (1995, 1996) and Cassetti (2006) have argued that firms' assessment of the trend growth of demand and of the normal rate of capacity utilisation becomes endogenous to their past experience and thus to actual growth and actual utilisation.<sup>2</sup> Therefore, in the long-period equilibrium we have an equality of actual and normal rates of utilisation, because the latter adjusts towards the former. Schoder (2012) has recently presented empirical support for this view, and Nikiforos (2013) has provided a microeconomic rationale based on the choice of the cost-minimising number of shifts determining the normal rate of utilisation.

Fifth and finally, if we consider the normal rate of utilisation to be determined by a stable-inflation rate of capacity utilisation targeted by inflation averse central banks, Hein (2006, 2008, Chapter 17) has shown that this rate becomes endogenous to the central bank's interest rate policies reacting upon deviations of the actual rate of utilisation from the stable inflation rate of utilisation. The normal rate of utilisation is thus affected by the actual rate of utilisation, albeit in an indirect and complex way.

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<sup>2</sup> For a recent assessment of this mechanism, see the critical contribution by Girardi/Pariboni (2019) and the more supportive modelling in Franke (2020).

Furthermore, recently, several authors have turned towards introducing a Sraffian supermultiplier process into Kaleckian models of distribution and growth.<sup>3</sup> In these models, the autonomous growth rate of a non-capacity creating component of aggregate demand, i.e. autonomous consumption, residential investment, exports or government expenditures, determines long-run growth, and, under the conditions that Harroddian instability in the investment function is not too strong, provides for a stable adjustment towards the normal rate of capacity utilisation. In those models, a change in the propensity to save or in the profit share will have no effect on the long-run growth rate, but will affect the traverse and thus the long-run growth path. The paradox of saving and the possibility of a paradox of costs from the short run thus disappear with respect to the long-run growth rate, but they remain valid with respect to the long-run growth path.

In the debate around Harroddian instability in Kaleckian models, however, two arguments proposed by Steindl (1979, 1985) in favour of at least partial endogeneity of Harrod's (1939) warranted rate of growth and thus on the containment of Harroddian instability have so far received little attention. The first is related to the endogeneity of the capital-output ratio through endogenous capital scrapping (Steindl 1979) and has been used by Allain/Canry (2008) and Cassetti (2006), for example.<sup>4</sup> The second refers to government budget balances and the related effects on the aggregate propensity to save (Steindl 1979, 1985).

Starting from the reviews by Hein/Lavoie/van Treeck (2011, 2012), in this paper we will therefore discuss in particular the two Steindlian arguments. For this purpose the model framework proposed by Hein/Lavoie/van Treeck (2011, 2012) will have to be extended in order to allow for endogenous capital scrapping and endogenous overall propensities to save through variations in the government financial balance. Within this framework we will then discuss the Steindlian solutions to Harroddian instability and compare them to the other approaches in the literature mentioned above. Section 2 will present the problem of Harroddian instability in a basic neo-Kaleckian model and will briefly discuss some of the mechanisms proposed by the critics of the Kaleckian model to tame Harroddian instability. Section 3 will then amend the model allowing for depreciation of the capital stock, capital scrapping and replacement investment in order to discuss the first Steindlian stabilisation mechanism. In Section 4 we will then introduce government deficit spending into the model and examine Steindl's second potential stabilisation process. Section 5 will summarise and conclude.

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<sup>3</sup> See, for example, Allain (2015, 2019), Fiebiger (2018), Fiebiger/Lavoie (2019), Lavoie (2016), Nah/Lavoie (2017, 2018, 2019a, 2019b), Palley (2019), Pariboni (2016), for a recent controversy see Lavoie (2017) and Skott (2017), for a recent survey see Dutt (2019), and for some further critical assessments see Nikiforos (2018) and Skott (2019).

<sup>4</sup> Franke (2019a) has recently proposed another stabilising mechanism via the capital-output ratio making use of Harrod's notion of long-run capital outlays which are not affected by demand dynamics in the goods market. As Franke acknowledges, such a mechanism can be found in the early trade cycle models by Kaldor and Kalecki.

## 2. Harroddian instability in a basic neo-Kaleckian/Steindlian model

Following Hein/Lavoie/van Treeck (2011, 2012),<sup>5</sup> we can, in a nutshell, introduce Harroddian instability into the very basic neo-Kaleckian/Steindlian distribution and growth model for a one-good closed economy without government activity, without technical progress, without depreciation of the capital stock and without overhead labour by including a normal or target rate of capacity utilisation ( $u_n$ ) into the model:

$$(1) \quad r = h \frac{u}{v} = r_n \frac{u}{u_n},$$

$$(2) \quad \sigma = s_{\Pi} r = s_{\Pi} h \frac{u}{v}, \quad 0 < s_{\Pi} \leq 1,$$

$$(3) \quad g = \alpha + \beta(u - u_n), \quad \alpha, \beta > 0,$$

$$(4) \quad g = \sigma,$$

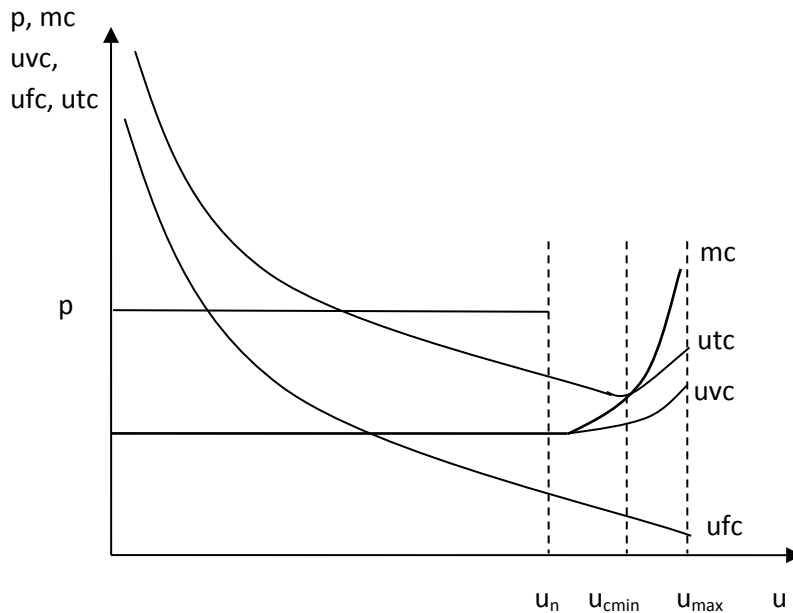
$$(5) \quad \frac{\partial \sigma}{\partial u} > \frac{\partial g}{\partial u} \quad \Rightarrow \quad s_{\Pi} \frac{h}{v} > \beta.$$

Equation (1) defines the realised profit rate ( $r$ ), which depends on the realised rate of capacity utilisation ( $u$ ), on the profit share ( $h$ ) being determined by mark-up pricing of firms, and on the capital-potential output ratio ( $v$ ). The equation can also be rewritten in terms of the normal profit rate ( $r_n$ ) and the normal rate of capacity utilisation ( $u_n$ ).

The normal rate can be interpreted as the rate of utilisation which firms expect to prevail or target in the long run when making their decisions to invest and thus to expand the capital stock. The normal rate of utilisation in this sense does neither imply that firms expect to operate at the technically given maximum capacity ( $u_{max}$ ) in Figure 1. Nor does it mean that they will necessarily operate at the unit total cost minimum level of capacity utilisation ( $u_{cmin}$ ), if they have chosen to hold excess capacity in order to deter entry by threatening competitors with price wars, for example. The variables  $p$ ,  $mc$ ,  $uvc$ ,  $ufc$  and  $utc$  represent price, marginal costs, unit variable costs, unit fixed costs and unit total costs, respectively.

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<sup>5</sup> See also Hein (2014, Chapter 11).

**Figure 1: Unit costs and normal/target rate of capacity utilization**

The normal rate as a target rate of utilisation of firms differs from the goods market equilibrium rate of utilisation, which is the rate of utilisation at which output of firms is equal to aggregate demand in the goods market. We assume that firms have expectations about demand in the goods market and they adjust capacity utilisation towards actual demand within the period. The short-run goods market equilibrium rate of capacity utilisation is thus the rate at which firms' short-run expectations regarding aggregate demand are met and no further adjustment of output and capacity utilisation for this purpose is required.

The saving function in equation (2) relates saving to the capital stock and is the standard classical function for the saving rate ( $\sigma$ ), which assumes away saving out of wages, with a propensity to save out of profits equal to  $s_{\Pi}$ . The propensity to save out of profits may itself be determined by the retention ratio of corporations ( $s_C$ ) and the propensity save ( $s_R$ ) out of rentiers' income ( $R$ ), consisting of interest and dividend payments of corporations:

$$(6) \quad s_{\Pi} = \frac{S_{\Pi}}{\Pi} = \frac{\Pi - R + s_R R}{\Pi} = s_C + s_R (1 - s_C).$$

Equation (3) is the investment function, where the rate of capital accumulation ( $g$ ) depends on a parameter  $\alpha$ , which represents 'animal spirits', and on the deviation of actual from normal capacity utilisation. If actual utilisation equals normal utilisation, capital accumulation will be equal to  $\alpha$ , which therefore can also be viewed as the expected trend rate of growth of sales and output expected by firms. Whenever the rate of capacity utilisation is above its normal rate, firms will be accumulating capital at a rate that exceeds the assessed trend growth rate of sales; whenever capacity utilisation is below its normal



rate firms will slow down capital accumulation. But unless there is some kind of fluke, the actual and the normal rates of capacity utilisation will differ in this neo-Kaleckian model without any further adjustment. Equation (4) is the goods market equilibrium condition and in (5) we find the Keynesian stability condition for the goods market equilibrium, saying that the saving rate has to respond more elastically to a change in capacity utilisation than the rate of capital accumulation.

For the goods market equilibrium of the model the following utilisation and accumulation rates are obtained from equations (2) – (4):

$$(7) \quad u^* = \frac{\alpha - \beta u_n}{s_{\Pi} \frac{h}{v} - \beta} .$$

$$(8) \quad g^* = \sigma^* = \frac{s_{\Pi} \frac{h}{v} (\alpha - \beta u_n)}{s_{\Pi} \frac{h}{v} - \beta} .$$

As condition (5) tells us, Keynesian stability in this model requires that capital accumulation is not too sensitive to changes in the rate of capacity utilisation and the slope of the saving rate function exceeds the slope of the accumulation rate function with respect to capacity utilisation. Keynesian instability would arise when the accumulation rate function is steeper than the saving rate function, and capital accumulation responds more vigorously towards changes in capacity utilisation than the saving rate in the short run.

From this short-run Keynesian instability we can distinguish Harroddian instability as a long-run problem, which arises because of a deviation of the short-run equilibrium rate from the long-run normal rate of utilisation. Harroddian instability can be introduced into our model if we treat the parameter  $\alpha$  of the investment function not as a constant, but as a rising (decreasing) variable whenever the short-run equilibrium rate of capacity utilisation persistently exceeds (is below) its normal rate, with a dot on the variable denoting the time rate of change:

$$(9) \quad \dot{\alpha} = \nu (u^* - u_n), \quad \nu > 0 .$$

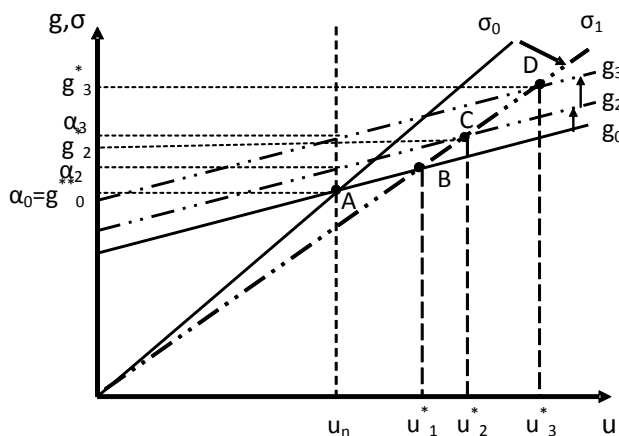
The reason for this is that in equation (3) the parameter  $\alpha$  is interpreted as the assessed trend growth rate of sales and output, and thus as the expected secular rate of growth of the economy. When the short-run equilibrium rate of utilisation is consistently higher than the normal rate ( $u^* > u_n$ ), this implies that the growth rate of the economy is consistently above the assessed secular growth rate of sales ( $g^* > \alpha$ ). Thus, as long as entrepreneurs react to this in an adaptive way, they should eventually make a new, higher, assessment of the trend

growth rate of sales and output, thus making use of a larger parameter  $\alpha$  in the investment function.

Equation (9) may be interpreted as a slow process: Entrepreneurs react with enough inertia to generate short-run Keynesian stability. When rates of utilisation rise above their normal rates (or fall below their normal rates), entrepreneurs take a 'wait and see' attitude, not modifying their parametric behaviour immediately, until they are convinced that the discrepancy is there to stay. If during a certain number of periods the achieved short-run equilibrium rate of utilisation exceeds the normal rate, then the investment function will start shifting up, thus leading to ever-rising rates of capacity utilisation, and hence to an unstable process. This is illustrated in Figure 2.

Let us assume that the economy is in an initial equilibrium at the normal rate of utilisation in point A, and now the propensity to save out of profits declines or the profit share is reduced, so that the saving rate function rotates clockwise from  $\sigma_0$  to  $\sigma_1$ . Since the paradox of thrift and the paradox of costs each hold in the simple neo-Kaleckian model, the economy achieves a higher short-run equilibrium at point B, with a higher rate of capital accumulation and the rate of capacity utilisation exceeding the normal rate of utilisation ( $u_1^* > u_n$ ). If this equilibrium persists, the constant in the investment function will move up from  $\alpha_0$  to  $\alpha_2$  and shift the accumulation function up to  $g_2$ , and short-run equilibrium capacity utilisation will hence be moved to point C and to  $u_2^*$ , which is even further away from the normal rate. This will then after some time shift the constant in the accumulation function up to  $\alpha_3$ , pushing the accumulation function to  $g_3$ , the new short-run equilibrium to point D, and equilibrium capacity utilisation to  $u_3^*$ , and so on. Thus, according to the critics, the equilibrium described by the Kaleckian model in point B will not be sustainable, but will shift to C, D and further on, and will hence not last in the long run.

**Figure 2: Harroddian instability in the basic neo-Kaleckian/Steindlian model**



In principle, upwards (downwards) Harroddian instability can be contained by forces either rotating the saving function counter-clockwise (clockwise) or forces shifting the investment function down (up), each questioning the validity of the paradoxes of thrift and costs in the long run (Hein 2014, pp. 446-451, Hein/Lavoie/van Treeck 2011, 2012).

The Cambridge price mechanism, initially advocated by Kaldor (1955/56, 1957) and Joan Robinson (1956, 1962), is the main mechanism in the first generation post-Keynesian Kaldor-Robinson distribution and growth model, which assumes normal or full capacity utilisation in long-run growth equilibrium (Hein 2014, Chapter 4.5, Lavoie 2014, Chapter 6.1). Whenever aggregate demand growth exceeds supply growth at the normal rate of capacity utilisation and capacity utilisation tends to exceed the normal rate, increases in the price level and the profit share brings the economy back towards the normal rate of utilisation by means of restraining demand growth. In the present model, the Cambridge price mechanism would thus mean a rotation of the saving rate function in Figure 2 such that an intersection with the shifted accumulation rate function at the normal rate of utilisation is re-established. However, the Cambridge price mechanism is not generally convincing as a stabiliser, because lower real wages (or a lower wage share) that are negotiated and accepted by workers and labour unions can hardly be squared with low unemployment rates and more powerful labour unions that are associated with utilisation rates exceeding the normal rate. Rising real wages and higher wage shares enforced by stronger labour unions and thus falling profit shares, as implied by Kalecki (1954, Chapters 1-2, 1971, Chapters 5-6, 14), or a price-wage-price spiral, hence Robinson's (1962, p. 58) 'inflation barrier', are therefore more likely outcomes. Redistribution in favour of the wage share would then bring our model farther away from the normal rate of utilisation.<sup>6</sup> And accelerating inflation cannot be considered a long-run equilibrium condition either.

Accelerating inflation would require the introduction of economic policy responses in order to bring the system back to the normal rate of capacity utilisation. This is the mechanism proposed in the model by Duménil/Lévy (1999). In their model, whenever short-run equilibrium capacity utilisation exceeds (falls short of) the normal rate, inflationary (disinflationary) pressures will be triggered, and monetary authorities will respond with restrictive (expansive) policies to bring the system back to stable inflation at the normal rate of utilisation. In our simple model this would mean that we make the capital accumulation function in equation (3) interest-elastic, so that the adjustment towards the normal rate of capacity utilisation would be achieved by an appropriate shift in the accumulation function in Figure 2. However, this adjustment process cannot be taken for granted either, as soon as distribution and cost effects of unexpected inflation and of changes in the monetary policy instrument – the interest rate – are taken into account (Lima/Setterfield 2010). In particular, changes in the interest rate will have an influence both on the actual and on the normal rate of utilisation. The normal rate as understood by Duménil/Lévy – a non-accelerating inflation

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<sup>6</sup> See Hein/Stockhammer (2010) for an analysis of a neo-Kaleckian model with conflict inflation. Within a post-Kaleckian model, however, redistribution in favour of wages may dampen aggregate demand and capital accumulation and thus stabilize the economy around the normal rate of capacity utilisation, provided that the economy is in a profit-led regime. See Stockhammer (2004a, 2004b, Chapter 2) for a stability analysis of the post-Kaleckian model.

rate of capacity utilisation (NAICU) – is hence affected by the actual goods market equilibrium rate of utilisation via monetary policy interventions, and the former becomes endogenous to the latter, albeit in an indirect and complex way (Hein 2006, 2008, Chapter 16-17, Hein/Lavoie/van Treeck 2012).

Apart from economic policies as a stabiliser in the face of Harrodian instability, other models have been suggested in which instability is contained or even prevented by the behaviour of capitalist firms themselves. Shaikh (2009) either assumes that firms increase their retention ratio as soon as utilisation exceeds its normal rate, thus leading to an increase in the overall saving rate, hence a rotation of the saving rate function in Figure 2, bringing back the economic system to the normal rate of utilisation. Harrodian instability is thus contained. However, the economic rationale for such behaviour is far from obvious. For example, Dallery/van Treeck (2011) argue that the retention ratio may be endogenous, but under the current paradigm of shareholder value orientation, managers may not be able to change the retention ratio on the basis of the discrepancy between the actual and the normal rates of capacity utilisation, because the decision to distribute profits is likely to be determined by the shareholders' power and claims on profitability. In an alternative model, Shaikh (2009) assumes that firms reduce their accumulation rate as soon as the actual growth rate of sales exceeds the assessed long-run rate, thus shifting down the accumulation rate function in Figure 2. Harrodian instability is hence avoided and utilisation is back at the normal rate. However, this kind of behaviour requires rational expectations on the side of the firms – firms have to know the growth rate of sales when making their investment decisions. But this rate is determined by the actual investment decisions of other firms. There is thus a coordination problem, which is swept away by Shaikh in this model, as also argued by Franke (2015).

In Skott's (2010, 2012) models of a 'mature economy', that is an economy with inelastic labour supply, Harrodian instability is bounded by a Marxian labour market mechanism which generates a limit cycle around the steady growth path determined by labour force growth and the normal rate of utilisation. Capitalists reduce output growth as soon as actual utilisation rates exceed the normal rate, because the rate of unemployment falls and approaches some critically low value, and firms increasingly have problems in recruiting additional labour. Workers and labour unions are strengthened vis-à-vis management, workers' militancy increases, monitoring and surveillance costs rise, and hence the overall business climate deteriorates. This negative effect of increasing employment finally dominates the production decisions of firms, output growth declines, capacity utilisation rates fall, investment falters, and finally profitability declines. In our simple model, this means again that the capital accumulation function in Figure 2 gets shifted downwards whenever utilisation exceeds the normal rate. But also Skott's behavioural assumptions lack plausibility when applied to a capitalist market economy characterised by decentralised production and investment decisions as well as competitive pressures. As already argued above, with tight labour markets, either rising real wages and higher wage shares, which would move the actual rate of utilisation further away from the normal rate in our model (and which would only be stabilising in a profit-led regime

generated in a post-Kaleckian model), or a destabilising price-wage-price spiral can be expected – or a combination of both.

In the following sections we will now look at the properties of the Steindlian stabilisation mechanisms in the face of Harrodian instability, amending our basic model.

### 3. Steindlian stabilisation I: endogenous capital scrapping and replacement

The first approach based on Steindl's work focusses on an endogenous capital-potential output ratio ( $v = K / Y^p$ ) instead of an endogenous rate of capacity utilisation ( $u = Y / Y^p$ ) as an adjustment variable in the long run. This can make the output-capital ratio  $Y / K$  a variable, although the rate of capacity utilisation may be equal to a given and constant normal rate. This approach can be based on Steindl (1979, p. 115), who has argued that

‘a high growth rate and high utilisation will tend to retard withdrawal of equipment [...] a low growth rate and utilisation will lead to some premature withdrawal of equipment’.

As already noted above, Cassetti (2006) has already made use of such a mechanism claiming that the rate of capital scrapping is sped up (slowed down) as long as the actual rate of capacity utilisation lies below (above) its normal rate. Similarly, Allain/Canry (2008) argue that low (high) rates of capacity utilisation will lead to more (less) bankruptcies, which entail more (less) capital scrapping and hence a reduction (an increase) of the available capacity. As a result, demand will be spread over a reduced (enlarged) available capacity, thus tending to reduce the discrepancy between measured rates of capacity utilisation and their normal value. Also, Schoder (2014) claims that the capital-potential output ratio will rise (fall) when demand is low (high) and the rate of utilisation has a tendency to fall short of (exceed) the normal rate. He also presents some empirical evidence for this argument based on US manufacturing data (1955-2012). However, the mechanism he refers to are not related to capital scrapping as such but rather to counter-cyclical capital-potential output ratios via the (speed of) implementation of technical progress and via the variation of the number of shifts.<sup>7</sup>

Inspired by the approach of Cassetti (2006), we can introduce the notion of endogenous capital scrapping and replacement by extending the saving and investment equations (2) and (3):

$$(10) \quad \sigma = s_{\Pi} h \frac{u}{v} + \delta, \quad 0 < s_{\Pi} \leq 1, \delta \geq 0,$$

$$(11) \quad g = \alpha + \beta(u - u_n) + \rho, \quad \alpha, \beta > 0, \rho \geq 0.$$

The gross saving function now includes saving out of profits and the depreciation of the capital stock. The gross investment function includes net investment and replacement investment determined by capital scrapping. The rate of depreciation relative to the gross

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<sup>7</sup> For the latter mechanism see also Nikiforos (2013, 2016).

capital stock in value terms ( $\delta$ ) that is included in the saving function may deviate from the actual rate of physical capital scrapping ( $\rho$ ), which requires replacement investment, in the accumulation function. As shown by Bhaduri (1972), the replacement rate will usually fall behind the depreciation rate since the former is a decreasing function of growth whereas the latter is a constant. In a growing economy  $\delta - \rho$  will thus be positive. This means that firms will accumulate non-reinvested depreciations as part of gross profits, which, *cet. par.*, will put downward pressure on aggregate demand. Only in a stationary state,  $\delta = \rho$  will hold, provided that planned and actual lifetime of a capital good are equal. Apart from this, firms may either decide to drop machinery etc. prematurely or they may decide to keep the already depreciated capital goods operating in the firm. In the former case, the difference  $\delta - \rho$  will decline relative to its trend. In the latter, it will rise relative to the trend. The short-run equilibrium derived from equations (10), (11) and (4) now turns into:

$$(12) \quad u^* = \frac{\alpha - \beta u_n + \rho - \delta}{s_{\Pi} \frac{h}{v} - \beta},$$

$$(13) \quad g^* = \sigma^* = \frac{s_{\Pi} \frac{h}{v} (\alpha - \beta u_n + \rho) - \beta \delta}{s_{\Pi} \frac{h}{v} - \beta}.$$

The rate of capital scrapping has a positive effect on the short-run equilibrium rates of capacity utilisation and accumulation. An increase of this rate reduces the capital stock, raises the demand for newly produced investment goods, aggregate demand, capacity utilisation and hence accumulation. A reduction in the scrapping and replacement rate increases the capital stock and will reduce utilisation and accumulation. As noted above, a fall in the scrapping rate is endogenous to positive growth, but it may also be reinforced by decisions of firms to extend the use of already depreciated capital goods.

For the short-run equilibrium we obtain the well-known properties of the neo-Kaleckian distribution and growth model. Whereas the scrapping rate has a positive effect on equilibrium capacity utilisation, accumulation and growth, the depreciation rate has a negative effect. Firms' assessment of long-run growth positively affects the equilibrium values. The paradox of saving and the paradox of costs will hold; aggregate demand, capital accumulation and growth are thus wage-led:

$$(12a) \quad \frac{\partial u^*}{\partial s_{\Pi}} = \frac{-\frac{h}{v} (\alpha - \beta u_n + \rho - \delta)}{\left( s_{\Pi} \frac{h}{v} - \beta \right)^2} = \frac{-\frac{h}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0,$$

$$(13a) \quad \frac{\partial g^*}{\partial s_{\Pi}} = \frac{-\beta \frac{h}{v} (\alpha - \beta u_n + \rho - \delta)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\beta \frac{h}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0.$$

$$(12b) \quad \frac{\partial u^*}{\partial h} = \frac{-\frac{s_{\Pi}}{v} (\alpha - \beta u_n + \rho - \delta)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\frac{s_{\Pi}}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0,$$

$$(13b) \quad \frac{\partial g^*}{\partial h} = \frac{-\beta \frac{s_{\Pi}}{v} (\alpha - \beta u_n + \rho - \delta)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\beta \frac{s_{\Pi}}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0.$$

As suggested by Steindl (1979), Allain/Canry (2008) and Casseti (2006), capital scrapping and replacement will now depend on the dynamics of demand. On the one hand, this means that the scrapping rate will be negatively affected by the rate of capital accumulation, as already noticed by Harrod (1970) and formally shown by Bhaduri (1972). On the other hand, this means that the capital scrapping rate will also depend on the deviation of the short-run goods market equilibrium rate of capacity utilisation from the normal or the firms' target rate of utilisation. Since a higher short-run equilibrium rate of capital accumulation will be associated with a higher rate of capacity utilisation, we make use of a simple dynamic equation in line with Casseti (2006) and also with Steindl's view (1979, p. 116), who argues that the change in the difference between the depreciation and the scrapping rate 'acts, however, only as long as the transition to a new equilibrium proceeds':<sup>8</sup>

$$(14) \quad \dot{\rho} = \psi(u^* - u_n), \quad \psi < 0.$$

Higher growth rates and short-run equilibrium rates of utilisation above the normal or target rate will reduce the capital scrapping rate, increase productive capacity, dampen investment demand and hence aggregate demand and thus also capacity utilisation. This may then stabilise the Harrodian instability process described in equation (9). Therefore, in equations (9) and (14) we now have a two-dimensional dynamic system. Plugging in equation (12) for the short-run equilibrium rate of capacity utilisation, we can derive the Jacobian Matrix for this system:

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<sup>8</sup> According to Steindl (1979), a pro-cyclical change in the profit share through overhead cost digression and counter-cyclicality in the intensity of price competition, and thus a shift (or rotation) in the saving function, contributes to the convergence towards the new equilibrium in a competitive economy. However, in an oligopolistic economy, the profit share remains rather rigid and misses any downward flexibility, in particular, thus blocking this adjustment mechanism. A long-run downwardly flexible utilisation rate replaces the flexible profit share – and contributes to further stagnation. See also Steindl (1985).

$$(15) \quad J = \begin{pmatrix} \frac{\partial \alpha}{\partial \alpha} & \frac{\partial \alpha}{\partial \rho} \\ \frac{\partial \rho}{\partial \alpha} & \frac{\partial \rho}{\partial \rho} \end{pmatrix}.$$

Local stability of the long-run equilibrium requires a negative trace and a non-negative determinant for the Jacobian matrix of the dynamic system. From equation (9), (12) and (14) we obtain:

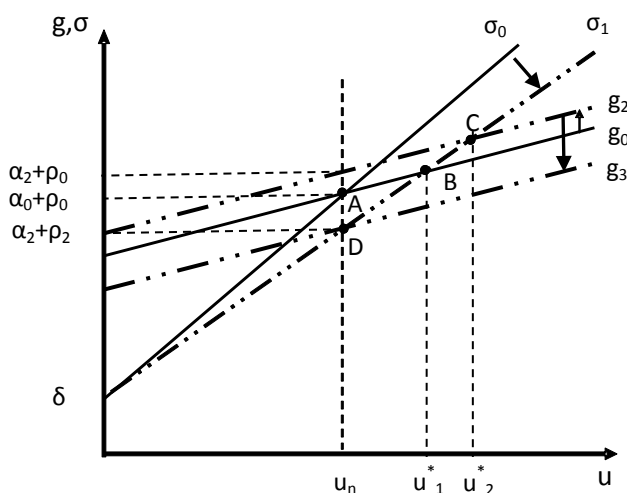
$$(16) \quad \text{Tr}J = \frac{\nu + \psi}{s_{\Pi} \frac{h}{\nu} - \beta} < 0, \text{ if } : \nu + \psi < 0 ,$$

$$(17) \quad \text{Det}J = 0 .$$

With a zero determinant and hence one zero eigenvalue, we have a zero root model and the system displays a continuum of (locally) stable equilibria and thus path dependence, as acknowledged by Cassetti (2006).

Assuming the short-run stability condition (5) to hold, for long-run stability it is thus required that the speed of change in capital scrapping exceeds the Harrodian instability parameter:  $-\psi > \nu$ . Whether the change in the scrapping rate is able to contain Harrodian instability is thus an empirical question; it depends on the relative strengths of each of these forces. Graphically this can be shown as in Figure 3.

**Figure 3: Steindlian stabilisation of Harrodian instability I – capital scrapping**





If we start again in the initial equilibrium in point A, assume a fall in the propensity to save out of profits or a fall in the profit share and thus a clockwise rotation in the saving function from  $\sigma_0$  to  $\sigma_1$ , the economy will move to a short-run equilibrium in point B. This will then trigger the Harrodian instability process shifting up the investment function from  $g_0$  to  $g_2$  through a rise in the firms' assessment of the trend rate of growth from  $\alpha_0$  to  $\alpha_2$ . This will move the economy towards the new short-run equilibrium in point C. If the change in capital scrapping is supposed to bring the economy back to the normal rate, the scrapping rate will have to fall from  $\rho_0$  to  $\rho_2$ , which will reduce gross capital stock growth relative to net capital stock growth. For this to happen, we need  $-\dot{\rho} > \dot{\alpha}$  and hence  $-\psi > \nu$ , as derived above. In the new long-run equilibrium at the normal rate of capacity utilisation we now have a higher net accumulation rate ( $\alpha_2 > \alpha_0$ ) but a lower gross accumulation rate ( $\alpha_2 + \rho_2 < \alpha_0 + \rho_0$ ). The former does not mean an increasing rate of demand for and production of new capital goods but rather an increasing rate of use of existing capital goods due to the reduction in the scrapping rate and hence in the replacement rate. Furthermore, the share of depreciation in gross saving ( $\delta/\sigma$ ) is higher in the new long-run equilibrium than in the equilibrium from which we have started, because  $\sigma$  is now lower whereas  $\delta$  has been assumed to be constant.

For the long-run equilibrium rates of capacity utilisation and capital accumulation presented in Figure 2 we obtain:

$$(18) \quad u^{**} = u_n,$$

$$(19) \quad g^{**} = \alpha_2 + \rho_2 = \alpha_0 + \rho_0 + (\nu + \psi)(u_1^* - u_n).$$

Since both, firms' assessment of the long-run growth rate ( $\alpha$ ) and the rate of capital scrapping ( $\rho$ ) turn endogenous, the long-run equilibrium rate of capital accumulation at  $u^{**} = u_n$  will now depend on the initial values of firms' assessment of long-run growth ( $\alpha_0$ ) and the initial values of the scrapping rate ( $\rho_0$ ), as well as on the adjustment triggered by any deviation of the short-run goods market equilibrium rate of capacity utilisation from the normal rate. If the long-run stability condition holds, i.e.  $\nu + \psi < 0$ , a positive deviation of  $u^*$  from  $u_n$  will force the long-run equilibrium rate of capital accumulation down, a negative deviation will force it up. A stable long-run equilibrium thus turns to be path dependent.

As is already obvious from Figure 3, in the long run the paradox of saving, as well as wage-led growth will disappear. A fall in the propensity to save out of profits or in the profit share, which each may cause the clockwise rotation of the saving function, will lead to a lower accumulation rate in the new long-run equilibrium. Higher accumulation and growth would require a higher propensity to save and/or a higher profit share. Alternatively, also the depreciation rate could rise which would mean an upwards shift in the gross saving function in Figure 3. Growth thus turns profit-led in the long run. This can also be shown by plugging equation (12) into equation (19) and deriving the respective partial derivatives:

$$(19a) \quad \frac{\partial g^{**}}{\partial s_{\Pi}} = \frac{-(\nu + \psi) \frac{h}{v} (\alpha_0 - \beta u_n + \rho_0 - \delta)}{\left( s_{\Pi} \frac{h}{v} - \beta \right)^2} = \frac{-(\nu + \psi) \frac{h}{v} u_1^*}{s_{\Pi} \frac{h}{v} - \beta} > 0,$$

$$(19b) \quad \frac{\partial g^{**}}{\partial h} = \frac{-(\nu + \psi) \frac{s_{\Pi}}{v} (\alpha_0 - \beta u_n + \rho_0 - \delta)}{\left( s_{\Pi} \frac{h}{v} - \beta \right)^2} = \frac{-(\nu + \psi) \frac{s_{\Pi}}{v} u_1^*}{s_{\Pi} \frac{h}{v} - \beta} > 0.$$

$$(19c) \quad \frac{\partial g^{**}}{\partial \delta} = \frac{-(\nu + \psi)}{s_{\Pi} \frac{h}{v} - \beta} > 0.$$

We can finally summarise our findings for the short- and long-run stable equilibria of the capital scrapping model as in Table 1.

Table 1: Responses of stable short- and long-run equilibria to changes in exogenous variables						
	short run equilibria		long run equilibria			
	$u^*$	$g^*$	$u^{**}$	$g^{**}$	$\alpha^{**}$	$\rho^{**}$
$\alpha$	+	+	0			
$\rho$	+	+	0			
$\delta$	-	-	0	+	-	+
$s_{\Pi}$	-	-	0	+	-	+
$h$	-	-	0	+	-	+

#### 4. Steindlian stabilisation II: government financial balances

Let us now look at a second potential mechanism which may dampen or reverse Harrodian instability, the change in government budget balances and the related effects on the aggregate propensity to save. Steindl (1979, p. 113), discussing downward Harrodian instability, amends the stabilising mechanism discussed in the previous section, the increase in the scrapping and replacement rate, by referring to government's financial balances:

'This downward movement may be braked by increased drop-outs of equipment and, if government is introduced into the model, by automatically increasing budget deficits.'

Since there is this tendency of the drop-out rate to fall increasingly short of the depreciation rate with positive growth in the long run, he finally relies on government deficits as the only way out in order to prevent persistent utilisation problems and the related downward instability and long-run stagnation problems. Also in Steindl (1985) it is argued that the increase in the budget deficit (and in the foreign balance surplus) will soften the downward

pressure on aggregate demand triggered by a rigid or even rising profit share in an economy dominated by oligopolies:<sup>9</sup>

‘But there is, of course, the budget deficit which as explained above, may contribute a great deal to the accommodation of a low growth rate. Somewhat paradoxically, the flexibility of the budget facilitates the rigidity of the profit margin.’ (Steindl 1985, pp. 161-162)

Including the role of government financial balances into our simple model from Section 2, we assume for simplicity that there are no taxes and that government expenditures are financed by credit creation, or even more simply by money creation which relieves us from considering government interest payments. The government deficit rate ( $d$ ), relating government deficits to the capital stock, can therefore be included into the saving function of our model which turns into:

$$(20) \quad \sigma = s_{\Pi} h \frac{u}{v} - d, \quad 0 < s_{\Pi} \leq 1, d \geq 0,$$

From equation (2), (4) and (20) we obtain the short run equilibrium values for capacity utilisation and capital accumulation:

$$(21) \quad u^* = \frac{\alpha - \beta u_n + d}{s_{\Pi} \frac{h}{v} - \beta},$$

$$(22) \quad g^* = \sigma^* = \frac{s_{\Pi} \frac{h}{v} (\alpha - \beta u_n) + \beta d}{s_{\Pi} \frac{h}{v} - \beta}.$$

It will not come as a surprise that the paradox of saving holds in this variant, too, as does the paradox of costs, and hence wage-led demand and growth:

$$(21a) \quad \frac{\partial u^*}{\partial s_{\Pi}} = \frac{-\frac{h}{v} (\alpha - \beta u_n + d)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\frac{h}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0,$$

$$(22a) \quad \frac{\partial g^*}{\partial s_{\Pi}} = \frac{-\beta \frac{h}{v} (\alpha - \beta u_n + d)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\beta \frac{h}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0.$$

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<sup>9</sup> Upwards instability, however, is limited by capacity constraints: ‘Bottlenecks make it impossible for the real investment to increase beyond a certain volume, and via the multiplier the rest of the economy is constrained too. This is the basic reason why the boom usually does not get out of hand.’ (Steindl 1985, p. 156)

$$(21b) \quad \frac{\partial u^*}{\partial h} = \frac{-\frac{s_{\Pi}}{v}(\alpha - \beta u_n + d)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\frac{s_{\Pi}}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0,$$

$$(22b) \quad \frac{\partial g^*}{\partial h} = \frac{-\beta \frac{s_{\Pi}}{v}(\alpha - \beta u_n + d)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\beta \frac{s_{\Pi}}{v} u^*}{s_{\Pi} \frac{h}{v} - \beta} < 0.$$

Automatic stabilisers and discretionary fiscal policies will affect the government deficit rate in a counter-cyclical way:

$$(23) \quad \dot{d} = \gamma(u^* - u_n), \quad \gamma < 0.$$

Equation (23) can be seen as a dynamic version of the functional finance approach proposed by Lerner (1944), in which government financial balances and thus fiscal policies should stabilise the economy at some target, here given by the normal rate of capacity utilisation, irrespective of the size of the required government deficit and the accumulated stock of government debt.<sup>10</sup>

In equations (9) and (23) we have again a two-dimensional dynamic system for the long run of this model. Plugging in equation (21) for the short-run equilibrium rate of capacity utilisation, we can derive the Jacobian matrix for this system:

$$(24) \quad J = \begin{pmatrix} \frac{\partial \alpha}{\partial \alpha} & \frac{\partial \alpha}{\partial d} \\ \frac{\partial d}{\partial \alpha} & \frac{\partial d}{\partial d} \end{pmatrix}.$$

Local stability of the long-run equilibrium requires a negative trace and a non-negative determinant for the Jacobian matrix of the dynamic system. From equation (9), (21) and (23) we obtain:

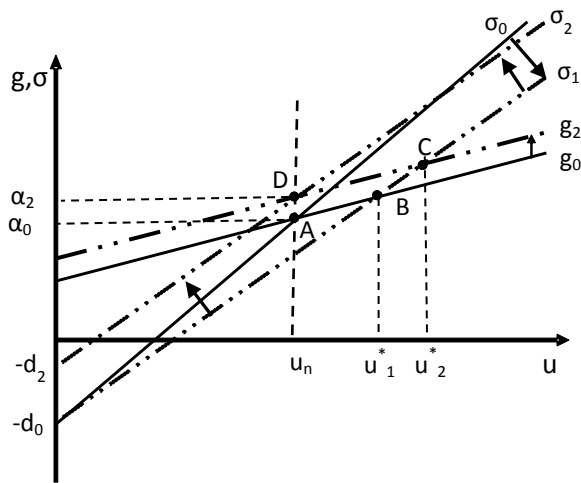
$$(25) \quad \text{Tr}J = \frac{v + \gamma}{s_{\Pi} \frac{h}{v} - \beta} < 0, \text{ if } : v + \gamma < 0,$$

$$(26) \quad \text{Det}J = 0.$$

<sup>10</sup> For a more extensive analysis of government deficit and debt dynamics in Kaleckian distribution and growth models, see Dutt (2013), Hein (2018a) and You/Dutt (1996), for example.

Assuming the short-run stability condition (5) to hold, for long-run stability it is thus required that the speed of change in the government deficit rate exceeds the Harroddian instability parameter. Long-run stability thus becomes an issue of the responsiveness of fiscal policies. With a zero determinant, we have again a zero root model and with a continuum of (locally) stable equilibria and hence path dependence. Graphically, this can be shown as in Figure 4.

**Figure 4: Steindlian stabilisation of Harroddian instability II – government financial balances**



We start again in the initial equilibrium in point A, assume a fall in the propensity to save out of profits or a fall in the profit share and thus a clockwise rotation in the saving function from  $\sigma_0$  to  $\sigma_1$ , which will move the economy to a short-run equilibrium in point B. This will then trigger the Harroddian instability process raising firms' assessment of long-run growth from  $\alpha_0$  to  $\alpha_2$ , shifting up the investment function from  $g_0$  to  $g_2$  and moving the economy towards the new short-run equilibrium in point C. Counter-cyclical government expenditures, both automatic and discretionary, will have to reduce the government deficit rate from  $d_0$  to  $d_2$ , which shifts the total saving function up from  $\sigma_1$  to  $\sigma_2$ . If the change in the government deficit rate is sufficiently strong, this will move the economy back to the normal rate of utilisation at point D. For stability, we need  $-\dot{d} > \dot{\alpha}$  and hence  $-\gamma > \nu$ . In the new long-run equilibrium at the normal rate of capacity utilisation we now have a higher accumulation rate ( $\alpha_2 > \alpha_0$ ) due to the interim improvement of firms' assessment of the trend rate of growth, which is more than compensated for by a lower government deficit rate ( $d_2 < d_0$ ), so that we have  $d_2 - d_0 > \alpha_2 - \alpha_0$ . Therefore, we will now have a higher rate of accumulation and growth, and a higher saving rate due to the endogenous accommodation of the government deficit rate. For the long run equilibrium in Figure 4 we thus obtain:

$$(27) \quad u^{**} = u_n,$$

$$(28) \quad g^{**} = \alpha_2 = \alpha_0 + v(u_1^* - u_n),$$

$$(29) \quad d^{**} = d_2 = d_0 + \gamma(u_1^* - u_n).$$

In the long run, both firms' assessment of the long-run growth rate ( $\alpha$ ) and the government deficit rate ( $d$ ) are now endogenous. The long-run equilibrium rate of capital accumulation at  $u^{**} = u_n$  will thus depend on the initial values of firms' assessment of long-run growth ( $\alpha_0$ ) and on the adjustment triggered by the deviation of the short-run goods market equilibrium rate of capacity utilisation from the normal rate. A positive deviation of  $u^*$  from  $u_n$  will force the long-run equilibrium rate of capital accumulation up, a negative deviation will force it down. The long-run government deficit rate will over-compensate for this and will move down if  $u^*$  exceeds  $u_n$  and will move up when  $u^*$  falls short of  $u_n$ , and will thus guarantee that the economy will converge towards the long-run equilibrium. The stable long-run equilibrium rates of capital accumulation and the related government deficit rate are thus path dependent.

As is already clear from Figure 4, the paradox of saving, as well as wage-led growth will now also hold in the stable long-run equilibrium. A fall in the propensity to save out of profits or in the profit share, which each may cause the clockwise rotation of the saving function, will lead to a higher accumulation rate in the new long-run equilibrium. Higher accumulation and growth require a higher overall saving rate, which is provided by a lower government deficit rate. Growth thus remains wage-led with proper government adjustments, even if the economy operates at a given normal rate of utilisation in the long run. This can also be shown by plugging equation (21) into equations (28) and (29) and deriving the respective partial derivatives:

$$(28a) \quad \frac{\partial g^{**}}{\partial s_{\Pi}} = \frac{-v \frac{h}{v} (\alpha_0 - \beta u_n + d_0)}{\left( s_{\Pi} \frac{h}{v} - \beta \right)^2} = \frac{-v \frac{h}{v} u_1^*}{s_{\Pi} \frac{h}{v} - \beta} < 0,$$

$$(28b) \quad \frac{\partial g^{**}}{\partial h} = \frac{-v \frac{s_{\Pi}}{v} (\alpha_0 - \beta u_n + d_0)}{\left( s_{\Pi} \frac{h}{v} - \beta \right)^2} = \frac{-v \frac{s_{\Pi}}{v} u_1^*}{s_{\Pi} \frac{h}{v} - \beta} < 0.$$

$$(29a) \quad \frac{\partial d^{**}}{\partial s_{\Pi}} = \frac{-\gamma \frac{h}{v} (\alpha_0 - \beta u_n + d_0)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\gamma \frac{h}{v} u_1^*}{s_{\Pi} \frac{h}{v} - \beta} > 0,$$

$$(29b) \quad \frac{\partial d^{**}}{\partial h} = \frac{-\gamma \frac{s_{\Pi}}{v} (\alpha_0 - \beta u_n + d_0)}{\left(s_{\Pi} \frac{h}{v} - \beta\right)^2} = \frac{-\gamma \frac{s_{\Pi}}{v} u_1^*}{s_{\Pi} \frac{h}{v} - \beta} > 0.$$

Table 2 summarises our results for the short- and long-run stable equilibria of the model with government financial balances as a stabiliser of Harrodian instability.

<b>Table 2: Responses of stable short- and long-run equilibria to changes in exogenous variables</b>						
	<b>short run equilibria</b>		<b>long run equilibria</b>			
	$u^*$	$g^*$	$u^{**}$	$g^{**}$	$\alpha^{**}$	$d^{**}$
$\alpha$	+	+	0			
$d$	+	+	0			
$s_{\Pi}$	-	-	0	-	-	+
$h$	-	-	0	-	-	+

The mechanism providing these long-run results bears some similarities with the recent approaches introducing a Sraffian supermultiplier process into Kaleckian models of distribution and growth, as referred to in the introduction. In those models, the autonomous growth rate of a non-capacity creating component of aggregate demand, i.e. autonomous consumption, residential investment, exports or government expenditures, determines long-run growth, and provides for a stable adjustment towards the normal rate of capacity utilisation, under the condition that Harrodian instability in the investment function is not too strong. However, in those models a change in the propensity to save or in the profit share will have no effect on the long-run growth rate, but will only affect the long-run growth path. The paradox of saving and the paradox of costs from the short run thus disappear with respect to long-run growth. In our model, however, in which government expenditure is not constrained by an expenditure path rule, we have maintained the two paradoxes also with respect to the long-run growth rate.

## 5. Conclusions

Starting from the debate on Harrodian instability in Kaleckian distribution and growth models, in this paper we have focussed on two stabilising mechanism to be found in Steindl's work, a variable capital scrapping rate and the variation of government financial balances. Each of these mechanisms may affect Harrod's warranted rate of growth preserving a given and constant normal or target rate of capacity utilisation. A variable capital scrapping rate has an impact on the capital-potential output ratio, a variable government deficit affects the

economy-wide propensity to save. We have integrated each of these mechanisms into the elementary model framework to deal with Harrodian instability in Kaleckian models proposed by Hein/Lavoie/van Treeck (2011, 2012) and have derived the conditions under which these processes will stabilise the economy at normal rate of capacity utilisation in the long run. We have not examined the joint effects of the two stabilising mechanisms but would assume that they will not contradict each other in the sense that ‘two stabilising mechanisms maybe jointly destabilising’, a possibility Franke (2019b) has recently shown.

Since the long-run dynamic models turn out to be zero root models, with the long-run stability conditions given, the long-run equilibrium rates of capital accumulation and growth turn path dependent. For the capital scrapping model, we have shown that for the path dependent long-run equilibria the paradoxes of thrift and costs, and hence wage-led growth, although prevailing in the short run, will disappear in the long run. For this model a higher propensity to save and a higher profit share will each lead to a higher rate of growth in long-run equilibrium; growth thus turns profit-led in the long run. For the model with government financial balances, the paradoxes of saving and costs are maintained in the long-run equilibrium and the economy remains wage led. A lower propensity to save and a lower profit share will each lead to a higher rate of accumulation and growth in the long run, and to a lower government deficit rate.

Whether the long-run stability conditions actually prevail and whether the Steindlian mechanisms are strong enough to prevent global Harrodian instability, stabilising the economy at a given and constant normal rate of utilisation, is an empirical question with regard to the capital scrapping rate and an economic policy question with regard to the government deficit rate. As we have mentioned in Section 4, Steindl (1979) himself argues that the capital scrapping mechanism will need to be amended by the proper adjustment of government financial balances, particularly in the long run of an oligopolistic economy. And regarding government financial balances he is quite pessimistic because of the change in the economic policy stance in the mid/late 1970s, which he terms ‘stagnation policy’, i.e. the reluctance to accept the required government deficits to improve capacity utilisation (and employment).<sup>11</sup> The result, however, is not a violent downturn of the economy, which would have to be stabilised by other forces, but rather stagnation as a trend with persistently low rates of capacity utilisation. This is also in line with Steindl’s (1952, p. 12) earlier microeconomic conclusion, which we have already quoted above, that ‘(t)here is no good reason why a state of disequilibrium, with undesired excess capacity, should not persist. For practical purposes, disequilibrium may be permanent’. This is also consistent with viewing a normal or target rate of utilisation rather as a corridor than a fixed and given point. Only if the economy is driven out of the corridor, stabilising processes set in, among them the two Steindlian processes, which seem to be more plausible than the other mechanism proposed by Dumenil/Levy, Shaikh and Skott, discussed in Hein/Lavoie/van Treeck (2011) and briefly reviewed in Section 2 above. Furthermore, we should also be aware that in his later work even Harrod (1948, pp. 89–91, 1959, 1973, pp. 32–37) himself has discussed and allowed for

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<sup>11</sup> For an application of the Steindlian concept of ‘stagnation policy’ to the current stagnation tendencies in general and in the Eurozone in particular, see Hein (2016, 2018b).



the endogeneity of the warranted rate growth within bounds, through changes in the average propensity to save based on distributional effects of variations in demand, through changes in the capital-potential output ratio in the course of the cycle because of autonomous investment, and also through changes in the firms' target rate of utilisation. Furthermore, he has argued with respect to the warranted rate of growth that '(i)t requires a fairly large deviation, ..., to bring the instability principle into play' (Harrod 1973, p. 33). Therefore, both Steindl and Harrod would probably advise current heterodox authors not to become overly obsessed with Harrodian instability, but, of course, to consider it as serious problem which may arise if economies are driven out of some normal corridor and enter into particularly deep recessions.

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