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Antoine Monserand

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A note on "Zero growth and structural change in a post Keynesian growth model"

Author: Antoine Monserand
Affiliation: Université Sorbonne Paris Nord, CEPN, CNRS, UMR 7234.
Mail: 99 av. J-B Clément, 93430 Villetaneuse.
e-mail: antoine.monserand@univ-paris13.fr

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Abstract

This note is a critique of the results found by Rosenbaum (2015) concerning zero growth and structural change in a post-Keynesian growth model, some of which are shown to be problematic. First, the (im)possibility for a neo-Kaleckian model of growth and distribution to generate a profit-led growth regime is discussed. Next, we review the role played by the "paradox of costs" when introducing the depreciation of capital and how this changes the stability characteristics of the model presented by Rosenbaum. Finally we show that, contrary to what is claimed in the article, the proposed model is not able to show that zero growth is compatible with a positive net rate of profit.

Keywords: Zero growth; Kaleckian; Stability; Wage-led/Profit-led; Profit rate.

JEL Codes: E12, E22, E24, O41, O44.

Introduction

In an article published in 2015 and titled "Zero growth and structural change in a post Keynesian growth model", Rosenbaum investigates in a Kaleckian framework the possibility and conditions for a state of zero growth to be stable. We believe that this question is of high importance, given the negative impacts of economic growth on the environment, and therefore on humans and other species. The field of "post-Keynesian ecological macroeconomics" has recently gained momentum (Fontana and Sawyer 2016) and the article by Rosenbaum (2015) contributes to its advancement. However, several results found in it seem problematic and are analysed in this note. First, the (im)possibility for a neo-Kaleckian model of growth and distribution to generate a profit-led growth regime is discussed. Next, we review the role played by the "paradox of costs" when introducing the depreciation of capital and how this changes the stability characteristics of the model presented by Rosenbaum. Finally we show that, contrary to what is claimed in the article, the proposed model is not able to show that zero growth is compatible with a positive net rate of profit.

Profit-led growth in a neo-Kaleckian model

Rosenbaum builds a neo-Kaleckian model, with the following specifications for the saving and investment functions (the numbers in square brackets refer to the numeration in the article of Rosenbaum):

$$\sigma = s \cdot r^n \qquad [16];(1)$$

$$g = \alpha + \beta u + \tau r^n + \varphi\lambda \qquad [17];(2)$$

where σ and g are the ratios of net saving and of net investment to the capital stock, u is the rate of capacity utilisation, r^n is the rate of profit net of depreciation and λ is the rate of technical progress. The parameter s represents the propensity to save out of profits ; the propensity to save out of wages is assumed to be equal to zero. With the rate of capital depreciation being proportional to technical progress λ, the net rate of profit is given by:

$$r^n = \frac{\pi u}{\nu} - d_1\lambda \qquad [13];(3)$$

where π stands for the profit share and ν for the capital to capacity ratio.

As usual with this type of model, these three equations lead to the equilibrium rate of accumulation $g^\star$:

$$g^{\star} = s\left(\frac{\pi}{\nu}\right)\frac{\alpha + (s-\tau)d_1\lambda + \varphi\lambda}{(s-\tau)(\pi/\nu) - \beta} - sd_1\lambda \qquad [21];(4)$$

From this, Rosenbaum argues that the effect of a change in the profit share π on $g^{\star}$ "depends on the specific parameter configuration", and therefore growth can be either profit-driven or wage-driven. This is at odds with the usual results for neo-Kaleckian models of growth and distribution in a closed economy with no saving out of wages - which is the case here: they can only show wage-led growth (Hein 2014, p. 271). However, since Rosenbaum's model is more complex as it features productivity growth and capital depreciation, it might be the case that a profit-led growth regime is possible. But instead of leaving the question open and examining the properties of this regime, its plausibility should first be examined. In the rest of this section, we do this check and show that the profit-led growth regime is implausible in Rosenbaum's model.

Computing the partial derivative of $g^{\star}$ with respect to π, one obtains:

$$\frac{\partial g^{\star}}{\partial \pi} = -s\beta\frac{\alpha + (s-\tau)d_1\lambda + \varphi\lambda}{\nu[(s-\tau)(\pi/\nu) - \beta]^2} \qquad (5)$$

The sign of this expression depends on the signs of $s\beta$ and on that of the numerator of the fraction. Firstly, Rosenbaum implicitly assumes the propensity to save out of profits to be positive, since he looks at cases where the goods market equilibrium is stable and this can only happen if the propensity s is strictly positive. The stability of the goods market is derived from the assumption that saving is more reactive than investment to changes in the rate of capacity utilisation, which is known as the "Keynesian stability condition". In Rosenbaum's model, this condition is given by equation (6) and requires that s be strictly positive:

$$(s-\tau)(\pi/\nu) - \beta > 0 \qquad [20];(6)$$

Secondly, β must be positive for the model to make economic sense, since it represents the sensitivity of investment to the rate of capacity utilisation[1]. Rosenbaum supports this view himself, as can be seen from his discussion on page 633 where he discards his "Case 1" precisely because it requires β to be negative. Finally, could the numerator of the fraction in equation (5) be negative? Looking at Rosenbaum's equation [18], the expression for the equilibrium rate of capacity utilisation $u^{\star}$:

$$u^{\star} = \frac{\alpha + (s-\tau)d_1\lambda + \varphi\lambda}{(s-\tau)(\pi/\nu) - \beta} \qquad [18];(7)$$

we see that this cannot be the case. Otherwise, $u^\star$ would be negative since the numerator is the same as the one from equation (5) and the denominator is assumed to be positive for the Keynesian stability condition to hold.

Thus, the model used by Rosenbaum does not allow for any profit-led growth regime, and thereby the whole discussion of pages 636-40 on the profit-driven case and its (in)stability is in fact irrelevant.

Depreciation and the paradox of costs

The second substantial problem we find in Rosenbaum's article is in the effect of the rate of depreciation of capital on the rate of accumulation. According to him, a higher (lower) rate of depreciation entails a lower (higher) rate of accumulation, seemingly because it would decrease (increase) net investment, for a given amount or rate of gross investment. This is what we understand from footnote 4 of his article, where he discusses a departure from a zero growth state:

> Of course, if the actual depreciation factor is set at a lower value, growth would be positive since investment now exceeds depreciation whereas for higher depreciation factors, growth would become negative. [...] In Figure 3 and Figure 4, different depreciation factors would be captured by shifting the g and σ schedules upward or downward considering that the depreciation factor d_1 enters as a constant in Equations (16) and (17). (Rosenbaum 2015, p. 633)

Equations [16] and [17] are the saving and investment functions of the model, both of which indeed contain the depreciation factor as a constant, coming from the rate of profit net of depreciation. But Rosenbaum is mistaken in assuming that both the the saving (σ) and investment (g) schedules shift upward or downward together by the same distance when the depreciation factor is included (or changes). In his Figure 3, Rosenbaum presumes that both schedules shift down by a height d due to depreciation, therefore allowing a zero growth equilibrium to be reached while maintaining a constant rate of capacity utilisation.

In fact, the coefficients in front of the depreciation term $d_1\lambda$ in Rosenbaum's equations [16] and [17] are not the same: it is $-s$ in the saving equation (s being the propensity to save out of profits), and $-\tau$ in the investment equation (τ being the sensitivity of investment to the net rate of profit). The assumption made that the Keynesian stability condition holds necessarily implies that s is bigger than τ. Hence, if the depreciation factor d_1 increases (decreases), the saving curve σ will shift downward (upward) by a larger amount than the investment curve g. This is not anecdotal, since instead of reducing the equilibrium rate of accumulation while keeping the rate of capacity utilisation constant, as is shown by Rosenbaum, an increase in the depreciation factor would lead to an *increase* in the equilibrium rate of accumulation, as well as in the rate of capacity utilisation.

INSERT FIGURE 1 HERE OR NEARBY

CAPTION FOR FIGURE 1: Change in the equilibrium rates of accumulation and of capacity utilisation when the rate of capital depreciation is introduced.

Figure 1 illustrates this phenomenon: the solid lines g^s and g^i represent the situation of departure (without depreciation costs); the dotted lines $g^{s\prime}$ and $g^{i\prime}$ show the situation after taking depreciation into account, as is proposed by Rosenbaum (the value of the depreciation factor is set in such a way that the equilibrium rate of growth is zero), and the dashed line $g^{i\prime\prime}$ and dotted line $g^{s\prime\prime}$ illustrate the situation when depreciation is properly taken into account (with the same value for the depreciation factor as in Rosenbaum's proposal).

What we observe in the correct representation is the well-known "paradox of costs" (Rowthorn 1981), applied here to depreciation costs[2], that plays the decisive role. In order to meet a given level of aggregate demand, firms need to maintain a certain level of productive capital. If depreciation accelerates, gross investment will have to increase in order to compensate. This higher gross investment generates additional economic activity and therefore a higher rate of capacity utilisation, triggering in turn an increase in investment and in the rate of accumulation.

It should be noted that the mechanism described above (that has to do with the shift of the saving curve) more than compensates the disincentive to invest caused by the initial reduction in the net rate of profit (the shift of the investment curve). The overall effect can be checked mathematically by taking the first derivative of the equilibrium rate of accumulation $g^\star$ with respect to the depreciation factor d_1, using equation (4):

$$\frac{\partial g^\star}{\partial d_1} = \frac{s\beta\lambda}{(s-\tau)(\pi/\nu)-\beta} \tag{8}$$

This expression cannot but be positive, considering our previous remarks on the signs of β and of the denominator, plus the fact that the rate of technical progress λ has to be positive for all the discussions concerning this article. Indeed, from Rosenbaum's saving equation [16] we see that the equilibrium rate of capacity utilisation $u^\star$, in the case of zero growth, is equal to $\nu d_1\lambda/\pi$. Thus, $\lambda > 0$ is required in order to ensure $u^\star > 0$.

Implications for the discussion on stability

Several implications that Rosenbaum claims from his model have to do with the stability analysis of a zero growth economy in various configurations. He distinguishes the cases of "laissez-faire" and "forced" zero growth on one hand, and of profit-driven and wage-driven growth on the other hand, as summarised in his

Table 1. As we have already argued, the profit-driven cases are irrelevant for this model. But what of the stability analysis conducted for a wage-driven economy?

According to Rosenbaum, a wage-driven economy is generally unstable. For instance it is destabilised by an increase in the markup, because of a spiral of falling wages and employment in the absence of automatic stabilisers. But by forcing zero growth through a rapid monitoring of the depreciation factor, the unstable economy is said to be stabilised. The idea is that following an increase in the markup and therefore a fall in the rate of growth, public authorities would change tax rules and/or technical regulations and norms so that the depreciation factor d_1 would decrease, in an attempt to increase the rate of growth. Rosenbaum describes the stabilizing effect in the following way: because depreciation is lower, renewal of capital is slower. As a result, technical progress is slowed, meaning less labour is "saved". This has a positive effect on employment and wages, which in turn tends to increase growth.

One could doubt the strength of this stabilising effect, since the effect of a slight acceleration or deceleration of technical progress on overall employment, and above all the subsequent effect on wages, seems to be of secondary order in our view. But more importantly, the mechanism described here does not work the same way once we take into account the paradox of costs mentioned above. Indeed, after an increase in the markup and a fall in the rate of growth, public authorities should now try to raise the rate of depreciation, since this would bring about higher growth. By doing so, however, the mechanism is reversed: faster renewal of capital would speed up labor saving processes, reducing employment. Wages would fall along with the rate of growth. In the terms of the article's narrative, this would be an unstable economy, and we should then conclude that a wage-driven economy cannot be stable at zero growth, no matter how "free" or "forced" this zero growth is. Future work should put forward other stabilising mechanisms that would allow for a wage-led economy to be stable at zero growth.

Zero growth and the net rate of profit

Our last concern has to do with the discussion on the net rate of profit in the case of zero growth presented in the section "Further considerations" of Rosenbaum's article, on page 643. Starting from the definition of the rate of profit net of depreciation, inserting the condition for zero growth regarding the depreciation factor and using the expression for the equilibrium rate of capacity utilisation, Rosenbaum arrives at a surprising condition which if verified allows for the net rate of profit to be positive while the rate of growth is zero. The condition is the following:

$$\beta \frac{\nu}{\pi} \frac{(1-\beta^2)}{(1-\beta)} < s - \tau \tag{9}$$

We have not ascertained whether this result is due to a typo in Rosenbaum's equation [33] where, on its right-hand side, a coefficient β is missing in front of u in the numerator, or is due to some erroneous calculation, but we can assert that the result is incorrect. Indeed, the correct expression for the net rate of profit is:

$$r^n = \frac{\beta u + \alpha + \varphi\lambda}{\beta \nu/\pi} \tag{10}$$

Replacing u with its value at the zero growth equilibrium and then using Rosenbaum's zero growth condition [23] on d_1, we get:

$$r^n = \frac{\beta d_1 \lambda \nu/\pi + \alpha + \varphi\lambda}{\beta \nu/\pi} = \frac{-\alpha - \varphi\lambda + \alpha + \varphi\lambda}{\beta \nu/\pi} = 0 \tag{11}$$

This result is unsurprising and can be obtained even more easily, by directly using the saving equation (1) taken with $\sigma = 0$, since at equilibrium $\sigma = g$, yielding:

$$0 = s \cdot r^n \tag{12}$$

Therefore $r^n = 0$ since $s \neq 0$ here[3]. Thus we show that the model presented by Rosenbaum does *not* prove that a positive rate of net profit is compatible with zero growth. This compatibility, however, is a standard feature of stock-flow consistent models and has been put forward more explicitly in recent articles related to the "monetary growth imperative" controversy (Cahen-Fourot and Lavoie 2016; Jackson and Victor 2015).

Conclusion

In this note, we have formulated several critiques regarding Rosenbaum's article. First, we showed that the model presented cannot produce the profit-driven growth regime the author studies in parallel to the wage-driven one. Then we demonstrated that, because of the phenomenon of the "paradox of costs", the only remaining stable case (namely the "forced zero growth" wage-driven regime) is in fact unstable. Finally we pointed out that, contrary to the author's claim, the model proposed is not able to show that zero growth is compatible with a positive net rate of profit.

As a concluding remark, we shall stress that understanding the conditions under which modern economies can be stable and provide employment and well-being for all without growth remains an important challenge for the emerging field of (post-Keynesian) ecological macroeconomics.

FOOTNOTES:

1: As a limit case, one could consider the specification $\beta = 0$. This leads equation (5) to be equal to zero and thus also rules out the possibility of profit-led growth.

2: Rowthorn (1981) presents the paradox of costs and shows that the phenomenon holds for any "real cost of production" (wages, fixed capital requirements, taxes, and capital depreciation).

3: In the particular case where $s = 0$, the net rate of profit could be positive. However, as we have argued in the first section, this case is implicitly dismissed by Rosenbaum. Indeed he assumes that the Keynesian stability condition is verified, and in his model this is only possible when $s > 0$.

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