Journal of Economic Dynamics & Control 48 (2014) 325–348

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

Unemployment, income distribution and debt-financed investment in a growth cycle model

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ARTICLE INFO

Article history:
Received 26 November 2013
Received in revised form
17 September 2014
Accepted 19 September 2014
Available online 28 September 2014

JEL classification:
E32
C61
B41
E12

Keywords:
Growth cycle
Goods market disequilibrium
Goodwin
Minsky
Financial instability
Real/financial interaction

ABSTRACT

As recent experience suggests, the most significant economic fluctuations are those that combine real and financial factors. This paper works out a simple model that couples a version of Goodwin's (1967) growth cycle model of real fluctuations with insights drawn from a model of financial fluctuations based on Minsky's financial instability hypothesis (Vercelli, 2000; Sordi and Vercelli, 2006, 2012). The model suggested substantially modifies that of Keen (1995), who combined insights from Goodwin and Minsky within a model of fluctuating growth. In the real part of the model we introduce the possibility of disequilibrium in the goods market and formalize a mechanism of output adjustment based on the conventional dynamic multiplier. The model so obtained may exhibit persistent dynamics and provide insights to enable better understanding of the nature of real-world fluctuations.

1. Introduction

The purely real growth cycle model of Goodwin (1967) has, over the years, been increasingly recognized as an influential system 'for doing macro-dynamics' with a focus on growth cycles and their pathologies. Despite its simplicity, the iconic elegance and flexibility of this model have in time caught the attention of a great number of researchers. After a slow start in the first decade following its publication, in which only a few contributions, such as those by Atkinson (1969), Desai (1973), Vercelli (1977) and Velupillai (1979), took it as a starting point for their analyses, the literature on growth cycles *à la* Goodwin exploded during the 1980s, giving origin to a rich literature which is too vast to be reviewed here. Moreover, as testified by recent contributions such as those by Bella (2013), Moura and Ribeiro (2013) and Sasaki (2013), this model is still capturing the attention of researchers all over the world.

Since recent experience worldwide suggests that the most significant economic fluctuations are those that combine real and financial factors, it is interesting to reappraise the early attempt by Keen (1995, 1996) to couple Goodwin's model with

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http://dx.doi.org/10.1016/j.jedc.2014.09.030
0165-1889/

Minsky's (1975, 1982, 1986) financial instability hypothesis (FIH). The simple and somewhat incomplete formalization proposed by Keen in these contributions has recently been rigorously revised by Grasselli and Costa Lima (2012). The outcome of these efforts is presented as a 'Goodwin–Minsky'-type model, which is claimed to be a powerful tool in explaining financial crises, including the most recent one (see Keen, 2013).

In this approach, the main bridge between the two models is the consideration that investment is usually greater than savings in the 'euphoric' phase of the cycle, due to the possibility of financing the former by debt. The result of this attempt to embed the essence of Minsky's analysis into Goodwin's growth cycle framework is a model characterized by a *three*-dimensional dynamic system in the variables unemployment rate, share of labor and debt ratio.

However, the formalization suggested by Keen appears to be open to criticism for the following main reason. He assumes that investment may be financed by debt, but does not consider that, as a consequence, the goods market may be characterized by a disequilibrium state. A proper consideration of this possibility requires the introduction into the model of an extra dynamic equation for the adjustment of output to excess demand (see Sordi, 2003, 2010).

In order to suggest a possible way around this shortcoming of Keen's approach, in this paper we attempt a first step in the direction of an alternative coupling of Goodwin's growth cycle model with financial constraints, by extending it to allow for disequilibrium in the goods market. We believe that this crucial modification is a necessary precondition for coupling the Goodwin (1967) model with Minsky's FIH in a satisfactory way.[1]

To this end, in the next section we quickly present Goodwin's growth cycle model. In Section 3, we consider Keen's coupling of Goodwin and Minsky, following the formalization of the model by Grasselli and Costa Lima (2012). In order to prepare the ground for a different coupling of the model, an independent investment function and the possibility of disequilibrium in the goods market are introduced in Section 4. In Section 5 we sketch a more general alternative model that provides a preliminary step towards the study of the interaction between real and financial fluctuations in the spirit of Goodwin and Minsky. Some tentative conclusions are drawn in Section 6. All proofs and lengthy computations are reported in the Mathematical Appendix.

2. The growth cycle model

The aim of Goodwin's (1967) influential paper is to build a model capable of generating cycles in the growth rate of output rooted in the functioning of the labor market and the conflict over income distribution in a capitalist economy. To concentrate on this point, the goods market is assumed to always be in equilibrium so that, as a consequence, the principle of Keynesian effective demand plays no role.

The model is highly schematized and such that its dynamic system can be derived in a few steps by taking into account the simplifying assumptions that are made. Using the original notation – i.e., q, for output, k, for capital, w, for real wage rate, $\sigma = k/q$, for capital–output ratio, l, for employment, $a = q/l$, for labor productivity, n, for labor supply, $u = wl/q = w/a$, for the workers' share of national income and $v = l/n$, for the employment rate – they can be expressed in the following way.

First, both the labor productivity and the labor force are assumed to grow exponentially at the positive constant rates α and β, respectively

$$a(t) = a_0 e^{\alpha t} \tag{1}$$

$$n(t) = n_0 e^{\beta t} \tag{2}$$

Second, it is assumed that all wages are consumed and all profits are saved and invested[2]

$$\dot{k} = q - wl = (1-u)q \tag{3}$$

Third, the real wage rate is assumed to rise with the employment rate

$$\hat{w} = f(v), \quad f'(v) > 0 \tag{4}$$

and, finally, the capital-output ratio is assumed to be constant.[3]

Thus, given Eq. (3), we can write

$$\hat{k} = \hat{q} = \frac{1-u}{\sigma} \tag{5}$$

[1] In this alternative approach to Minsky's theory, a basic role is played by both the liquidity and solvency indexes of firms. However, in this first step of the present research program, for the sake of simplicity, we ignore the crucial role of the solvency conditions.

[2] Here and in the remainder of the paper, a dot over any variable x indicates its first derivative with respect to time ($\dot{x} = dx/dt$) whereas a hat indicates its rate of growth ($\hat{x} = \dot{x}/x$).

[3] It is worth noticing that in this list the only two *behavioral* assumptions are the ones contained in Eqs. (3) and (4), regarding capital accumulation and wages dynamics, respectively.