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Neoclassical labour market dynamics, chaos and the real wage Phillips curve

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Abstract

The relationship between wage inflation and unemployment has been extensively investigated since the early work of Phillips [Phillips, A.W., 1958. The relation between unemployment and the rate of change of money wage rates in the U.K. 1861–1957. Economica 25, 283–299] and Lipsey [Lipsey, R.G., 1960. The relation between unemployment and the rate of change of money wage rates in the U.K. 1861–1957: a further analysis. Economica 27, 1–31], and it is still a matter of debate. In this paper we study the dynamics of a standard neoclassical labour market under the simplest Walrasian adjustment rule. We show that when consumption and leisure are sufficiently low substitutes, the unique Walrasian equilibrium of the economy can be destabilised, and regular or even chaotic fluctuations of wages and employment appear. This leads to an interesting resurrection of a real wage Phillips curve as a long-term phenomenon.

JEL classification: E3; J0

Keywords: Phillips curve; Chaos; Economic cycle

1. Introduction

The relation between wage inflation and unemployment, extensively discussed since the early work of Phillips (1958) and Lipsey (1960), is presently a matter of renewed interest.[1] In this paper we consider a model describing the dynamics of the labour market under standard neoclassical assumptions. The labour market, demand and supply side, is described by a Cobb–Douglas

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[1] See, for instance, University of Rochester (1999).

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technology and by a CES individual utility function. The current labour demand and supply are assumed to adjust to their optimal counterparts following a continuous-time adjustment, and the wage adjusts on the current excess demand for labour according to the usual "Walrasian" rule.

Our main finding is that a robust cyclical and even chaotic behaviour of prices and quantities may occur even in a simple micro-founded economic model characterised by the simplest adjustment mechanism when the substitution between consumption and leisure is sufficiently weak. Furthermore, stickiness in the labour demand of the firm, as well as flexibility in the labour supply, can lead to the following interesting phenomena: (a) a real wage Phillips curve necessarily re-emerges as a long-term phenomenon[2] and (b) in the chaotic case a "trapping" region emerges in which the Walrasian equilibrium (WE from now on), viewed as the "center of mass" around which the system evolves, completely loses its "predictive ability".[3] In our model the points belonging to the Phillips' curve are just the realisation of a single trajectory of the underlying (fully deterministic) process rather than a set of different equilibrium points among which the policy maker could choose as in the traditional view of the curve.

In a related paper by Chichilnisky et al. (1995), their re-discovery of the Phillips curve from complex dynamics is obtained by a less general framework, compared to the one adopted here, because they assume a discontinuous production function with a special discrete-time formulation.

The plan of the paper is as follows. In Section 2, we present the model. Some theoretical results are reported in Section 3, while the numerical simulations are reported in Section 4. Concluding remarks follow.

2. The model

We consider a one-good economy with a single representative firm and a single representative worker–consumer. Labour is the only input. The technology is represented by the following Cobb–Douglas production function:

$$Y = DL^a; \quad 0 < a < 1, \quad D > 0 \tag{1}$$

Let Π and w respectively define the total profit and the wage rate. By setting the price of the unit output equal to one,[4] the profit function is defined as

$$\Pi = DL^a - wL \tag{2}$$

A standard maximization of (2) gives the optimal demand for labour:

$$L^D = f_1(w) = \left(\frac{w}{aD}\right)^{1/(a-1)} \tag{3}$$

[2] As regards the empirical evidence of a real-wage Phillips' curve, various estimates are reported by Staiger et al. (2001) (see their Fig. 1b) for the US economy, 1969–1999 (where the real wage is suitably measured by compensation per hour in the non-farm business sector deflated by the GDP deflator).

[3] Indeed in the chaotic regime the Walrasian equilibrium does not even preserve the role of the average value of the long-term fluctuation.

[4] In this model the nominal and the real wage are equal. However, it would be straightforward to amend the model to add money wages and prices by adding the price sector (for instance by means of a mark-up relation, as in Fanti, 2002). This would imply the complication due to the introduction of the price sector without modifying in a substantial manner the structure of the model.