Fundamentals of the Theory of Money and Employment

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We briefly sketch the Keynesian and monetarist models where prices are flexibly determined so as to clear the markets. When markets are interior equilibrium and prices are equal to the marginal cost, money becomes non-neutral and Keynesian- flavored results such as the fiscal multiplier are obtained. On the other hand, if people hold the extraneous belief that prices proportionately increase with nominal money supply, and further, the increase rate of money is sufficiently small, then the full-employment equilibrium (boundary solution) is attained. Thus, monetarism can uphold only in the limited case.

Key words: Non-neutrality of Money, Marginal cost, Fiscal multiplier, Involuntary unemployment, Extraneous belief in quantity theory of money

1. Origin of the problem

When we completely exclude the pair of ad-hoc assumptions, namely, money in the utility function and constraints concerning price realignment such as Calvo-rule and menu cost, the introduction of money to an economy should be based on the overlapping-generations model (OLG model) or the search money model proposed by Kiyotaki and Wright (1991).

Nevertheless, from the view point of the tractability of the model, the OLG model is far superior to the search model. This is owing to the fact that in the search model, how money is injected into the economy is ambiguous. This defect is crucial when we consider the neutrality of money, which is the most fundamental problem in macroeconomic theory. Consequently, it is plausible to rely on the OLG model of the production economy for examining the neutrality of money.

The seminal paper by Lucas (1972) proves that money is neutral when the price signal does not contain multiple shocks, in other words, information is perfect. Since the article is written as if the theorems hold under general conditions, most economists have become to believe that money is neutral in the frictionless neoclassical economy. As a result, the abovementioned unnatural assumptions are required to obtain Keynesian flavored results.

Although Lucas' neutrality theorem seems to be robust at first, it crucially depends on the following two implicit assumptions:

(i) People hold the extraneous belief that the equilibrium price function is linear on the nominal money supply of the previous period. Namely,

$$p_t = m_{t-1}\phi(x_t/\theta_t) \tag{1}$$

where x_t is the current additional money supply, and θ_t is the productivity shock.

(ii) Money is injected as the interest of money itself. That is

$$m_t = m_{t-1}x_t \tag{2}$$

If information is perfect under assumption (i), implying that θ takes a positive constant, it might be plausible to guess the equilibrium price function ϕ as

$$\phi = \kappa x_t \tag{3}$$

where κ is a positive constant. Then, the lifetime budget constraint is

$$p_t c_t + m_t = p_t y_t, \qquad m_t x_{t+1} = p_{t+1} c_{t+1} \Rightarrow c_t + [p_{t+1}/\, p_t\, x_{t+1}]c_{t+1} = y_t \tag{4}$$

where y_t is the real labor income. Substituting Equations (2) and (3) into (4), we obtain

$$c_t + c_{t+1} = y_t. \tag{5}$$

Thus, the factors concerning money supply, m_t and x_t, do not affect individuals' consumption/leisure decision. This implies that the neutrality of money upholds under the abovementioned restrictive assumptions.[1)]

The following heuristic explanation might facilitate an understanding of the reason why the neutrality of money holds in Lucas' model: Since people hold the extraneous belief that the price proportionately increases with the money stock, and they all believe that additional new money is supplied proportionately to their hoardings, the increase in money supply is equivalent to a harmless denomination, which means renaming the unit of money; one dollar becomes one cent. It is evident that such renormalization does not affect the economic activities of individuals as far as it belongs to a *common knowledge* of the economy as the original paper implicitly assumes.

Nevertheless, it is clear that abovementioned assumptions are not relevant to the reality. Actually, money is usually supplied through the indirect purchase of public debts by the central bank. Moreover, the quantity-theory specific extraneous belief is quite unnatural when we consider the following asymmetric example:

Consider that the economy consists of two individuals, A and B, and each of them initially holds two units of money. Then, new four units of money are delivered only to individual A. If the quantity theory holds, the price level increases by double, since the aggregate money

1) κ is determined from the budget constraint (4) as

$$\kappa = 1/[y^*_t - c^*_t]$$

where y^*_t and c^*_t are the equilibrium labor income and current consumption, respectively.

supply increases from 4 to 8 units. Accordingly, the purchasing power of individual A becomes 3/4, and that of B reduces from 1/2 to 1/4. Thus, whenever quantity theory holds, the purchasing power of each individual is sensitive to others' money hoarding. It is apparent from our daily life that no one is anxious about contents of others' purses to check the real value of their own money.

Consequently, we need abandon the quantity-theory specific extraneous belief. In other words, there still exists a serious gap between macro and micro economics. As Keynes (1936; Ch.2) discusses, in microeconomics, prices are determined by their marginal cost, while macroeconomics emphasizes the role of money in determining the price level. How can we bridge this gap?

2. Bridging the Gap

As suggested above, in order to complete this task, it is necessary to adopt pricing due to the marginal cost, instead of the quantity-theory specific extraneous belief. We deal with this problem by using a model almost identical to that of Lucas (1972). In the model, individuals choose whether they work at their discretion when they are young. Let the disutility of labor denote δ. When the utility from lifetime consumption is a linear homogenous function, we can define the nominal reservation wage W_t^R as

$$W_t^R = \psi(p_t, p_{t+1})\,\delta \tag{6}$$

where ψ is also a linear homogenous function.

If the equilibrium concept is Walrasian and unit labor produces unit good, the maximization problem of firm (zero-profit condition) leads us to the following important difference equation:

$$p_t = \psi(p_t, p_{t+1})\,\delta\,. \tag{7}$$

Since ψ is linear homogenous, (7) can be transformed into

$$1 = \psi(1, \pi)\,\delta. \quad \pi \equiv p_{t+1}/p_t \tag{8}$$

Thus, the equilibrium price sequence is determined independent of the nominal money supply, and hence, the current value of money $1/p_t$ relies solely on the rational expectation concerning itself $1/p_{t+1}$.

Equations (7) and (8) imply that money is essentially a kind of "bubble" in the sense that if it is believed to possess its intrinsic value, it becomes self-fulfilling, and vice versa. This view on the nature of money comes from the fact that it is not contained in the utility function, and is relevant considering the reality.

From the linear homogeneity of the utility function, the aggregate consumption function

of the young generation becomes

$$C_t = c(\pi)[W_t^R/p_t]\, L_t = c(\pi)\, y_t \qquad (9)$$

where L_t is the employment level and y_t is the real effective demand.

To close the model, we must specify the path of nominal money supply. We assume that it follows two rules.

(i) The government arbitrarily set the initial nominal supply M_t and use the seigniorage as wasteful consumption g_t. Namely,

$$g_t = [M_t - M_{t-1}] / p_t = m - M_{t-1} / p_t,\ m = M_t / p_t \qquad (10)$$

holds.

(ii) In priod t+1 and thereafter, the government keeps the real money supply m. That is, the stationary government expenditure g is controlled as

$$g \equiv [M_{t+j} - M_{t+j-1}] / p_{t+j} = m - m/\pi = (1 - 1/\pi)m \qquad (11)$$

Whenever the labor market is located at some imperfect-employment equilibrium, the equilibrium nominal wage is equal to the nominal reservation wage W_t^R. Thus, it is enough to consider the equilibrium condition for the good market. Combining Equations (9), (10), and (11), we obtain

$$y_t = C_t + M_{t-1} / p_t + g_t = c(\pi)\, y_t + m. \qquad (12)$$

Since π is predetermined by Equation (8), Equation (12) determines the real GDP y_t. This is the strict microeconomic foundation for Hicks-Samuelson's 45 degree line analysis without price friction. We also note that the equilibrium Equation (12) depicts is time-independent. In other words, contrarily to the New Keynesian models, imperfect employment is not transitory but stationary.

3. Some Modifications

3.1. The Role of Monopolistic Competition

The above model contains no implication on the welfare effect of the fiscal-monetary policy. This is because the Walrasian equilibrium does not bear any surplus in our setting. If the equilibrium concept for the good markets is extended to monopolistic competition, the surplus emerges as the monopoly rent of each firm. Since the rents proportionately increases with the equilibrium real GDP,[2] expansionary fiscal-monetary policy improves economic welfare, even if the corresponding government's expenditure is wasteful.

2) See Otaki (2007) for the precise calculation.

This result seems somewhat paradoxical, because the monopolistic power is detrimental in static models. However, in the dynamic model in the monetary economy, the source of distortion moves from the relative price between leisure and consumption to that between current and future consumption π.

Given that monopolistic power lowers the real wage, excess leisure and shortage of consumption emerges in static models. Nevertheless, this problem is entirely dismissed by the proper fiscal-monetary policy [see Equation (12)]. Consequently, the welfare-harmful factor is confined to the distortion caused by the inflation. Elementary calculation leads us to

$$1 = \psi(1, \pi)\,\delta / [1 - \eta^{-1}],\ 1<\eta \qquad (13)$$

where η is the price elasticity of the demand.

Since ψ is an increasing function of π, by comparing Equation (13) with (8), it is evident that monopolistic power lessens the equilibrium inflation rate. It immediately lowers the nominal reservation wage, since the upturn in the purchasing power of money eases the economical life. Thus, the reduction of the inflation rate through the exercise of the monopolistic power brings about a surplus into the economy as the monopoly rents.

3.2. The Existence of *Involuntary* Unemployment

The abovementioned model contains no involuntary employment in the sense that individuals are indifferent to whether they work or not. When we extend the equilibrium concept of the labor markets to the following two-step game, it can be proved that involuntary unemployment exists owing to the lack of effective demand.[3)]

(i) An employer determines offer price and its corresponding employment level in order to maximize its profits.

(ii) The employer and his incumbent employees share the surplus along with the asymmetric Nash bargaining solution, of which threaten point is $(0, W_t^R)$.

Before sketching the proof, we should define involuntary unemployment.

・Definition.

We say that involuntary unemployment exists iff the economy's equilibrium satisfies the following two conditions:

(i) The nominal equilibrium wage is strictly higher than the nominal reservation wage.

(ii) The reduction of the nominal equilibrium wage never improves the employment level.

3) See Otaki (2009) for the rigorous discussion.

Then we sketch the proof. The equilibrium outcome of the second-stage bargaining game is

$$W_t=[1-\theta]p_t+\theta W_t^R \qquad 0<\theta<1 \tag{14}$$

where θ is the bargaining power of the employer. Accordingly, the maximization problem in the first stage becomes

$$\begin{aligned}\max_p [p_t-W_t]D(p_t/P_t) &= \max_p\{p_t-([1-\theta]p_t+\theta W_t^R)\}D(p_t/P_t)\\ &= \theta\max_p[p_t-W_t^R]\,D(p_t/P_t).\end{aligned} \tag{15}$$

Thus, the profit maximization is equivalent to the case where the nominal wage is set at the nominal reservation wage. Hence, the equilibrium employment level is not affected by lowering θ, and it implies that Condition (ii) is satisfied in equilibrium. Further, it is apparent from Equation (14) that the nominal equilibrium wage exceeds the nominal reservation wage. Therefore, Condition (i) is also satisfied and there exists involuntary unemployment caused by the shortage of effective demand.

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