DBJ Discussion Paper Series, No.1103

The employment-isolation effect under a flexible exchange rate

Masayuki Otaki
(Institute of Social Science, University of Tokyo)

December 2011

The employment-isolation effect under a flexible exchange rate

Masayuki Otaki
Institute of Social Science, University of Tokyo
Email: ohtaki@iss.u-tokyo.ac.jp

Abstract

This article considers the international diffusion of business cycle on the basis of a rigorous dynamic microeconomic foundation. The seminal work of Laursen and Metzler (1950) suggests that the employment-isolation effect under the flexible exchange rate system is imperfect even if international capital mobility is completely prohibited.

Assuming a small country model instead of the two country model by Laursen and Metzler (1950), we obtain the following results: (i) The business fluctuation of the world economy diffuses to the small country through a change in the inflation rate resulting from the change in the real exchange rate. In this sense, the employment isolation is imperfect. (ii) Domestic monetary expansion does not necessarily improve the employment level. This is because the depreciation of the real exchange rate (worsened terms of trade) should always be compensated by the lowered inflation rate and thus reduces the consumption demand.

Keywords: Employment-Isolation Effect, Laursen-Metzler Effect, An Open Macroeconomic Model with Analytical and Dynamic Microeconomic Foundation.

JEL Classfications: F20, F41, E12, E24, E32.

1 Introduction

The international transmission of business cycle is a serious problem under the flexible exchange rate system. We analytically (without using the numerical method adopted, for example, by Obstfeld and Rogoff (1996)) consider this problem on the basis of an overlapping-generations model (OLG model) with a rigorous dynamic microeconomic foundation developed by Otaki (2007, 2009, 2011a).

Generally, in two-period OLG models with no bequest motive, the balance of trade must always equilibrate. This is because the supply of the foreign currency by the old individuals in the home country should always be equal to the demand for the domestic currency by the young individuals in the rest of the world. That is, capital movement is substantially impossible because the difficulty of double coincidence of wants. This is a persuasive property of the long-run structure of the foreign exchange market of a small open country that cannot enjoy international seigniorage.[1]

The two-country model developed by Laursen and Metzler (1950) is a seminal work on the international diffusion of business cycle, which also assumes that international capital movement is prohibited. Although their model is not based on a neoclassical microeconomic foundation, it still has important implications. In particular, the model emphasizes the effect of the terms of trade (the inverse of the real exchange rate) on the domestic consumption resulting from the change in the fiscal expenditure.

Nevertheless, because of the lack of a microeconomic foundation, the obtained result is ambiguous and crucially depends on unknowable parameters. Hence we resolve this problem by using some new methods. The most important factor in our theory is the manner in which the terms of trade affects the real reservation wage and the domestic inflation rate.

Whenever the real exchange rate appreciates by an exogenous increase in export that is accompanied by the worldwide economic expansion, it is in favor of employees because it lessens *the cost of living*. However, as long as the domestic economy is in imperfect unemployment equilibrium and employees have no wage bargaining power, the current nominal (reservation) wages are cut down and the price level falls down.

Nevertheless, if the purchasing power of money (the inverse of the future price level) is kept constant (Otaki (2011a) defines such a situation as money is *credible*), it implies that the equilibrium inflation is accelerated because the fu-

[1] For the analysis concerning the key-currency country, see Otaki (2011b).

ture good becomes more expensive compared to the current good. Thus, future nominal wages simultaneously grow more rapidly. This movement of nominal wages is consistent with that of the price level dominated by its marginal costs.

The accelerated inflation stimulates the consumption of the current goods under some plausible assumption concerning the utility function, thereby increasing the employment. Consequently, the foreign business cycle diffuses the domestic economy through the change of consumption caused by the terms of trade effect (i.e., the Laursen-Metzler effect).

The important economic factor that our model has is money, which is not in Laursen and Metzler (1950). We can analyze how the domestic monetary expansion affects the economic activity in that country. A monetary expansion brings about two effects in the domestic economy. One is a direct effect that stimulates the economy through the multiplier effect induced by Otaki (2007, 2009).

The other is an indirect one that affects the economy through the change in the real exchange rate. A monetary expansion depreciates the real exchange rate. This raises the current nominal wages because the depreciation is disadvantageous for employees. Hence the current price level also increases. However, if the purchasing power of money is kept constant (*if money is credible*), this also lowers the equilibrium inflation rate and the increment of nominal wages. That is, the depreciation of the real exchange rate causes disinflation and reduces the consumption demand.

Thus, the indirect effect conversely reduces the economic activity. Accordingly, the power of monetary policy is weakened under the flexible exchange rate. This result contrasts that of the Mundell (1963)-Fleming (1962) model.

The remainder of this paper is organized as follows: In Section 2, the basic model is constructed. Section 3 deals with comparative statics. Section 4 contains brief concluding remarks.

2 The Model

2.1 The Structure of the Model

We consider a small open economy assuming that (i) the economy behaves as if the international price of the foreign good is exogenously given, and (ii) the world inflation rate is not affected by domestic affairs such as a change in monetary policy.

This economy specializes in single good production (good a). Since numerous

firms produces goods, the market is under perfect competition. In addition, there is the other good produced in foreign countries (good b). The economy imports good b as a price taker. Furthermore, both goods are perishable.

At the beginning of each period, individuals are born with Lebesgue measure 1, and live in two periods. They can supply unit labor at their discretion only when they are young. Unit labor produces unit good a.

There are two currency a (the domestic currency) and b (the world currency). Exchanging the same type of currency is required for purchasing some type of good. Although it is not an unavoidable assumption, for simplicity, we assume that the trade between young generations can be done by barter. The balance of payment of this small economy B becomes

$$B \equiv p^a[E_1^a + E_2^a] - \pi p^b[M_1^b + M_2^b], \tag{1}$$

where p^a is the domestic price of good a. π and p^b denote the nominal exchange rate and the international price of good b respectively. E_i^a is the volume of export toward foreign i-th generation ($i = 1(young),\ 2(old)$). M_i^b is the volume of i th generation's import.

Since the loan within the same generation is infeasible, $p^a E_1^a = \pi p^b M_1^b$ holds. Thus, Equation (1) is transformed into

$$B \equiv p^a E_2^a - \pi p^b M_2^b. \tag{2}$$

That is, the balance of payment is equal to the difference between the sum of the supply of currency b from the old generation in a foreign country and the demand for the same currency of the young generation in this economy preparing for his/her retirement. Since the latter generation can never trade hereafter, Equation (2) takes value zero.

2.2 Optimization Problem of Each Economic Agent

2.2.1 Individuals

Each individual has an identical utility function U:

$$U \equiv u(c_1, c_2) - \delta\alpha, \quad c_i \equiv [a_i]^\beta [b_i]^{1-\beta}, \quad 0 < \beta < 1. \tag{3}$$

c_i is the aggregate consumption level during i th stage of life. a_i and b_i are the consumption level of good a and b respectively. α denotes the disutility of labor. δ is a definition function that takes value unity when employed and zero when unemployed. $u(\ \cdot\ )$ is a well behaved homothetic utility function concerning consumption stream.

Elementary calculation leads us to the corresponding expenditure function Φ:

$$\Phi \equiv \phi\Big([p_1^a]^\beta[\pi_1 p_1^b]^{1-\beta},\ [p_2^a]^\beta[\pi_2 p_2^b]^{1-\beta}\Big) f(u), \tag{4}$$

where u is a utility level. Since ϕ is a linear homogenous function, we can transform (4) into

$$\Phi = p_1^a \phi\Big(e_1^{1-\beta},\ \rho^a \cdot {e_2}^{1-\beta}\Big) f(u) = p_1^a [e^*]^{1-\beta} \phi(1, \rho^a) f(u), \tag{5}$$

where ρ^a is the equilibrium inflation rate. e^* is the *stationary* equilibrium real exchange rate, where *stationary* means that the fluctuation of the real exchange rate e is converged, and hence $e_1 = e_2$ holds.

From Equations (3) and (5), we can obtain the nominal reservation wage W^R as

$$W^R = p_1^a [e^*]^{1-\beta} \phi(1, \rho^a) f(\alpha). \tag{6}$$

The equilibrium nominal wage is equal to W^R as long as the economy is fallen into underemployment equilibrium. It is the market clearing condition for the labor market.

2.2.2 Firms

Since all firms are assumed to be price takers with the linear production function and a unit productivity, the zero profit condition corresponds to the solution of the maximization problem. Thus, we obtain

$$p_1^a = W^R \quad \Rightarrow \quad 1 = [e^*]^{1-\beta} \phi(1, \rho^a) f(\alpha). \tag{7}$$

Since ϕ is an increasing function of ρ^a, Equation (7) clearly shows that the inflation is accelerated whenever the real exchange rate e^* appreciates.

2.2.3 The Government

In accordance with Otaki (2007, 2009, 2011a), the government keeps the real cash $m_i \equiv \dfrac{M_i}{p_i^a}$ constant through time once it decides the initial value m_1. Hence the budget constraint of the government becomes

$$g = (1 - \frac{1}{\rho^a}) m_1, \tag{8}$$

where g is the wasteful real government expenditure.

2.3 Market Equilibrium

Our model contains four markets: the domestic good market; labor market, domestic money market, and foreign exchange market. By Walras' law, we abbreviate the equilibrium condition for the domestic money market. The labor market is in interior equilibrium iff Equation (6) holds.

The foreign exchange market is cleared iff B in Equation (2) is equal to zero. Again, elementary calculation leads us to

$$E_2^a = \beta[1 - c^b(\rho^b)]e^* y^b, \quad e^* M_2^b = [1 - \beta][1 - c^a(\rho^a)]y^a,$$

where c^j $(j = a, b)$ is the marginal propensity to consume of each economy. b^j is the real GDP in terms of each economy's good. Accordingly, we obtain the following equation as the equilibrium condition for the foreign exchange market:

$$\beta[1 - c^b(\rho^b)]e^* y^b = [1 - \beta][1 - c^a(\rho^a)]y^a. \tag{9}$$

Taking Equation (9) into consideration, the domestic good market is in equilibrium when

$$y^a = c^a(\rho^a)y^a + m_1 \tag{10}$$

holds. $c^a(\rho^a)$ is the marginal propensity to consume of the economy.

In sum, we have three endogenous variables: $(y^a,\ \rho^a,\ e^*)$. These variables are determined by Equations (7), (9), and (10). Thus, the model is completely closed.

3 Comparative Statics

3.1 The Diffusion of the World Economy's Business Cycle

We consider the effect of the world economy's business cycle on the domestic economy. The rigorous discussion is extended in the Mathematical Appendix. Assume that the world economy is upturned and y^b increases. It directly stimulates the export and results in the appreciation of the real exchange rate e^* . This is in favor of employees because the import price is lowered. However, in the imperfect employment equilibrium, where some employees are unemployed, there is a room for firms to cut down the nominal wage, and thus the price of the current domestic good p_1^a is also lowered.

As long as money is *credible* and its purchasing power $\dfrac{1}{p_2^a}$ is kept intact, the inflation is accelerated. Hence, if $\dfrac{dc^a}{d\rho}$ is positive, the real effective demand y^a

increases and the upturn of the world economy diffuses to the domestic economy. In this sense, the employment-isolation effect is certainly incomplete under the flexible exchange rate system.

3.2 The Monetary Expansion

Let us consider the effect of the domestic monetary expansion (i.e., increase in m_1). Contrary to the Mundell (1963)-Fleming (1962) model, our model suggests that the effect of the domestic monetary expansion becomes weaker, or even ambiguous when the intertemporal substitution of the consumption stream is adequately high.

Equation (10) clearly shows that *ceteris paribus*, a monetary expansion increases the real GDP y^a through the multiplier effect formulated by Otaki (2007). Nevertheless, it depreciates the real exchange rate and employees are in a disadvantageous position. Subsequently, firms are forced to raise the nominal wage and, as a result, the current price p_1^a becomes high.

When money is *credible*, it implies the reduction of the inflation rate ρ^a. Thus, employees recover their lifetime utility. However, since lowered inflation rate decreases the aggregate consumption, the contractive effect appears in our model. Accordingly, at least, an easy monetary policy has a weaker effect than that in the case of a closed economy.

4 Concluding Remarks

In this paper, we construct a small open economy model on the basis of the two-period overlapping generation model developed by Otaki (2007, 2009, 2011a). the results obtained are as follows:

First, the employment-isolation effect in the flexible exchange rate system is certainly imperfect, which is ambiguous in Laursen and Metzler (1950). This is because the appreciation of the real exchange rate accelerates domestic inflation. Moreover, the accelerated inflation stimulates the aggregate consumption and the real effective demand.

Second, the power of monetary policy in open economy is weaker than in a closed economy. This is because the depreciation of the real exchange rate always accompanies lower inflation. This theoretical causality does not exist in a closed economy model. Furthermore, such a proposition is counterintuitive from the perspective of the traditional Mundell (1963)-Fleming (1962) model.

Mathematical Appendix

In this appendix, we show the mathematical results concerning propositions in Section 3. We have three structural equations: (7), (9), (10). Since Roy's identity induces us to $\frac{\phi'}{\phi} = s^a \equiv 1 - c^a$, Equation (7) is transformed into

$$[1-\beta]\frac{de}{e} + \rho s^a(\rho)\frac{d\rho}{\rho} = 0. \tag{11}$$

Differentiating both sides of Equations (9) and (10) and substituting (11), we obtain

$$\begin{bmatrix} 1 & -\eta + \frac{\rho s^a}{1-\beta} \\ s^a y^a & -\rho[c^a]' y^a \end{bmatrix} \begin{bmatrix} \frac{dy^a}{y^a} \\ \frac{d\rho}{\rho} \end{bmatrix} = \begin{bmatrix} \frac{dy^b}{y^b} \\ dm \end{bmatrix}, \tag{12}$$

where

$$\eta \equiv -\frac{\rho[s^a]'}{s^a}.$$

Solving (12), we finally obtain

$$\begin{bmatrix} \frac{dy^a}{y^a} \\ \frac{d\rho}{\rho} \end{bmatrix} = \frac{1}{\Delta} \begin{bmatrix} \rho[s^a]' y^a & \eta - \frac{\rho s^a}{1-\beta} \\ -s^a y^a & 1 \end{bmatrix} \begin{bmatrix} \frac{dy^b}{y^b} \\ dm \end{bmatrix}, \tag{13}$$

where

$$\Delta \equiv -\frac{\rho y^a [s^a]^2}{1-\beta} < 0.$$

References

[1] Fleming, J. M. (1962), 'Domestic fiscal policies and floating exchange rates' *IMF Staff Papers* 9: 369-380.

[2] Laursen, S., and Metzler, L. (1950), 'Flexible exchange rates and the theory of employment,'*Review of Economics and Statistics* 32: 281-299.

[3] Mundell, R. A. (1963), 'Capital mobility and stabilization policy under fixed and flexible exchange rates,' *Canadian Journal of Economics and Political Science* 29: 475-485.

[4] Obstfeld, M., and Rogoff, K. (1996), *Foundations of International Economics*, MIT Press, Massachusetts.

[5] Otaki, M. (2007), 'The dynamically extended Keynesian cross and the welfare-improving fiscal policy,' *Economics Letters* 96: 23-29.

[6] Otaki, M. (2009), 'A welfare economics foundation for the full-employment policy,' *Economics Letters* 102: 1-3.

[7] Otaki, M. (2011a), 'A pure theory of aggregate price determination,' *Theoretical Economics Letters* (forthcoming).

[8] Otaki, M. (2011b), 'On the function of key currency,' *DBJ Discussion Paper Series* No. 1102, Research Institute of Capital Formation, Development Bank of Japan.