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〈研究ノート〉

On Supply Shocks in a Two Country World with Wage and Price Rigidities ; the Case of Classical-Keynesian Equilibria

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1. Introduction

Suppose prices do not move fast enough to equilibrate supply and demand, then disequilibrium phenomena may appear where agents perceive quantity constraints in trades. If quantities of some commodities appear as arguments in the excess demand functions then characteristics of the functions could be much different from those in Walrasian equilibria. The non-Walrasian equilibrium two country model analysis has been developed by Dixit and Norman (1980), Laussel and Montel (1983), Negishi (1979), Owen (1985), Persson (1982) and Schittko and Eckwert (1983) among others. One of its contributions might be a framework in which countries characterized by different regime could trade with each other. Recently in their paper analyzing the non-Walrasian equilibria in a two country-two goods model with sticky wages and prices, Lorie and Sheen (1982) derived some interesting propositions in the case of Classical unemployment at home and Keynesian unemployment abroad (C-K equil-

ibria)¹⁾. They are summarized as,

Proposition 1: Fixed exchange rates are stable while flexible rates are not.

Proposition 2: By revaluing its currency, a foreign country can reduce Keynesian unemployment.

Proposition 3: Monetary expansion abroad has no direct impact on the volume of trade (trade balance)²⁾.

Both countries suffer from unemployment but the reasons are different. While Classical unemployment at home emerges because its real wages are too high, Keynesian unemployment abroad appears because of the lack of effective demand for goods it produces. The main purpose of present study is to investigate the monetary mechanism in the C-K equilibria under an alternative possible specifications of rationing schemes and/or properties of the money demand function. Because first two propositions were showed to depend crucially on the Harberger-Laursen-Metzler assumption [Hayashibara (1987)], here we show only that proposition 3 depends on the assumption that if excess demand for local goods emerges, then local exports are initially rationed. In fact, if we adopt the assumption that local consumptions are initially rationed, then we can get the traditional result that monetary expansion in one country worsens its trade balance in the short run.

1) They also analyzed other cases.

2) Lorie and Sheen (1982) p. 850 and pp. 863-6.

2. The basic model

We restrict our studies to an economy comprising two countries with two planning periods, i. e., present and future. However expectations about prices, incomes and quantity constraints in the future period are assumed to be all completely exogenous. Home country (foreign country) specializes production of its export goods, first goods (second goods) which are produced by means of labor and capital specific to it. Prices of goods in terms of producer countries' currencies are exogenously fixed. Further in each country wage rate in terms of its currency is also exogenously given. Thus production real wages are fixed. The transaction rules in disequilibrium are such that, no agent is forced to purchase more than he demands or to sell more than he supplies (voluntary exchange), quantity of actual transaction is the minimum of demand and supply, and households and firms act competitively. We assume that if excess demand for local goods emerges, then local consumptions are initially rationed.

2.1 The household sector

Consider the household in the home country which suffers from Classical unemployment. It determines current consumption of first goods which are domestically produced x_1 , that of second goods produced abroad x_2 and the end-of-period real money balance $m = M/p_1$ by maximizing its reduced utility function:

$$(1) \quad u = U(x_1, x_2, m; \theta),$$

subject to both its budget constraint and possible quantity constraints,

where θ denotes a parameter representing expectations. Assuming that two goods will be both normal and gross substitute in consumption. Let p_i , Y and \bar{M} be price of i^{th} goods in terms of home currency, present period income and initial holding of money balance, respectively. Define $p = p_1/p_2$, $y = Y/p_1$, $\bar{m} = \bar{M}/p_1$ and let x_{ij} and m_j ($i=1, 2$, $j=p, y, \bar{m}$ etc.) denote partial derivatives of x_i and m with respect to j . Under Classical unemployment, suppose that the household faces quantity constraints both in labor market L and first goods market $\bar{x}_1 < x_1(\cdot)$. As labor would not appear in the household utility function, rationing in labor market in the presence of unemployment could not have any direct effect on consumption and money demand, but have its effect through income. Define $\bar{y} = vL + R$ where v , L and R , denote real wage rate, employment, and distributed profit respectively. Then its budget constraint will be:

$$(2) \quad \bar{x}_1 + x_2/p + m = \bar{y} + \bar{m}.$$

So effective demand functions for consumption goods and the end-of-period money equal:

$$(3) \quad x_2 = x_2(p, \bar{y} - \bar{x}_1, \bar{m}), \quad m = m(p, \bar{y} - \bar{x}_1, \bar{m}),$$

with adding-up restraints

$$(4) \quad x_{2p} - x_2 + m_p = 0 \quad \text{and} \quad x_{2y} + m_y = 1.$$

Here *the Harberger-Laursen-Metzler assumption* implies $m_p > 0$, that is, a deterioration of the terms of trade decreases saving and increases expenditure, while in the gross substitute case by Hahn $m_p < 0$ holds.

Next, consider the foreign country where the household faces rationing in labor market. Similar relationships hold for its variables starred and measured in terms of second goods. For example, let $q = 1/p$, $m^* = M^*/p_2^*$, $v^* = w^*/p_2^*$, then its budget constraint and demand functions will be:

$$(5) \quad x_1^*/q + x_2^* + m^* = \bar{y}^* + \bar{m}^*,$$

and

$$(6) \quad x_1^* = x_1^*(q, \bar{y}^*, \bar{m}^*), \quad m^* = m^*(q, \bar{y}^*, \bar{m}^*),$$

respectively.

2. 2 The production sector

During the present period firms employ labor to produce particular goods according to the contract at the beginning of a period and the amount of money obtained from the sales of goods they produce are paid as wage income and distributed profit to the household sector. Formally, production decision of home firm could be described as maximizing its profit $R = y - vL$ with respect to labor input subject to the strictly quasi-concave production function, $y = F(K, L)$. Where y , K and L denote goods supply, capital stock which is historically given and employment, respectively. In Classical unemployment region because no firm faces any quantity constraints, its labor demand and product supply functions are the same as those in Walrasian equilibria.

$$(7) \quad \bar{y} = y(v : K) \quad \text{and} \quad \bar{L} = L(v : K),$$

with the partial derivatives $y_v < 0$, $y_K > 0$, $L_v < 0$ and $L_K > 0$.

In Keynesian unemployment region where foreign firm faces sale constraint in goods market \bar{y}^* , its labor demand function becomes the inverse production function, that is:

$$(8) \quad F^{*-1}(\bar{y}^* : K^*),$$

2. 3 Temporary equilibrium conditions

Suppose the case of Classical unemployment at home and Keynesian unemployment abroad (C-K equilibria). Equations used in subsequent

analysis are equilibrium conditions for two goods markets and the balance of trade equation. Under the assumption that if excess demand for local goods emerges, then local consumptions are first rationed, those would be

$$(9) \quad x_1(\cdot) > \bar{x}_1 = \bar{y} - x_1^*(q, \bar{y}^*, \bar{m}^*),$$

$$y^*(\cdot) > x_2^*(q, \bar{y}^*, \bar{m}^*) + x_2(p, \bar{y} - \bar{x}_1, \bar{m}) = \bar{y}^*,$$

$$b = x_1^*(q, \bar{y}^*, \bar{m}^*) - x_2(p, \bar{y} - \bar{x}_1, \bar{m})/p.$$

3. Exchange stability conditions

We suppose a fictitious auctioneer who provides a dynamic tatonnement process under the flexible exchange rate regime. First, he sets prices of goods and the exchange rate which could generate the equilibria for Classical unemployment at home and Keynesian unemployment abroad. Facing those prices and the exchange rate, both households and firms calculate their Walrasian demands and supplies. Of course there exist excess demands and/or excess supplies in some markets. Consider the case of excess demand for first goods, excess supply of both second goods and labor. Next, the auctioneer sets quantity constraint of first goods to home household because of excess demand, and that of second goods to the firm abroad because of excess supply. Then facing these constraints, prices and the exchange rate, each agent recalculates his constrained effective demands and supplies. The auctioneer adjusts quantities in a following manner. That is,

- a) if quantity of goods 1 assigned to the household is larger (smaller) than quantity constraint, then its constraint goes up (comes down),
- b) if there exist positive (negative) excess effective demand over produc-

tion constraints for second goods, then the level of production quantity goes up (comes down), and

c) when the trade balance is surplus or deficit, the exchange rate will be appreciated or devaluated. That is,

$$(10) \quad \begin{aligned} d\bar{x}_1/dt &= -\bar{x}_1 - x_1^*(q, \bar{y}^*, \bar{m}^*) + \bar{y}, \\ d\bar{y}^*/dt &= x_2^*(q, \bar{y}^*, \bar{m}^*) + x_2(p, \bar{y} - \bar{x}_1, \bar{m}) - \bar{y}^*, \\ de/dt &= -b = -x_1^*(q, \bar{y}^*, \bar{m}^*) + x_2(p, \bar{y} - \bar{x}_1, \bar{m})/p, \end{aligned}$$

where d/dt denotes time derivative. Within the flexible exchange rate regime we assume that above dynamic process will be stable.

4. Comparative statics

Totally differentiating the equation (9), we can represent equations for the changes in three endogenous variables:

$$(11) \quad \begin{bmatrix} -1 & -c_1^* & 0 \\ -c_2 & -(1-c_1^*) & 0 \\ -c_2 & -c_1^* & 1 \end{bmatrix} = \begin{bmatrix} x_{1q}^* de + x_{1m}^* d\bar{m}^* \\ -x_{2m} d\bar{m} + (x_{2p} - x_{2q}^*) de - x_{2m}^* d\bar{m}^* \\ -x_{2m} d\bar{m} + (x_{1q}^* + x_{2p} - x_2) de + x_{1m}^* d\bar{m}^* \end{bmatrix}$$

where $c_1 = p_1 x_{1Y}$ and $c_1^* = p_1^* x_{1Y}^*$. Solving the system for the changes in trade balance, we obtain:

$$(12) \quad \begin{aligned} db/d\bar{m} &= -x_{1m}(1-c_1^*-c_2^*)/D < 0 \\ db/d\bar{m}^* &= (1-c_2)\{x_{1m}^*(1-c_2^*) + c_1^*x_{2m}^*\}/D > 0 \text{ and} \\ db/de &= [m_y^*\{(1-c_2)(x_{2p}-x_{2q}^*) - c_2m_p\} - (1-c_2)(1-c_2^*)m_q^*]/D \end{aligned}$$

where $D = 1 - c_2^* - c_1^*c_2 > 0$ is the determinant of the left hand side. From these equations we can get comparative statics effects on the trade balance of the home country. Simple calculation shows that $db/de > 0$ must hold under the gross substitute assumption on money demands, $m_p <$

0 and $m_q^* < 0$ which could be consistent with stability. From first two equations we can get a traditional result that monetary expansion in one country worsens its trade balance in the short run, so Lorie and Sheen's Proposition 3 which says monetary expansion abroad has no direct impact on the volume of trade (trade balance), depends crucially on the assumption that if excess demand for local goods emerges local exports are initially rationed.

5. Summary and conclusions

In this note we have analyzed comparative statics effects of monetary policy and exchange rate devaluation on balance of trade. As was demonstrated, Lorie and Sheen's proposition 3 does not appear very robust against alternative assumptions on rationing in goods market. That monetary expansion abroad has no direct impact on the volume of trade (trade balance) depends crucially on the assumption that under excess demand for goods local exports are initially rationed.

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