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INSTABILITY AND TRADE IN CURRENCY AREAS[1]

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Abstract

We present a model of a currency area in which labor markets of country members are isolated but there is trade among these countries. When a country experiences a negative (resp. positive) shock, inflation goes down (up). This causes two effects. On the one hand the real interest rate of this country increases (decreases). On the other hand the goods produced in this country become more (less) competitive. We show that the stability of the system depends on several factors, including a large competitive effect, how inflation expectations are formed and fiscal policy. In general, stability requires a trade-off between the rationality of expectations and budget balance.

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[1] This paper was presented in the Economic Theory Seminar in Malaga. We acknowledge comments from the audience and financial support from CAYCIT, BEC 2002-02194.

INSTABILITY AND TRADE IN CURRENCY AREAS[1]

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ABSTRACT: We present a model of a currency area in which labor markets of country members are isolated but there is trade among these countries. When a country experiences a negative (resp. positive) shock, inflation goes down (up). This causes two effects. On the one hand the real interest rate of this country increases (decreases). On the other hand the goods produced in this country become more (less) competitive. We show that the stability of the system depends on several factors, including a large competitive effect, how inflation expectations are formed and fiscal policy. In general, stability requires a trade-off between the rationality of expectations and budget balance.

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1: INTRODUCTION

In a currency area, compensating the effect of an idiosyncratic shock on a member country by adjusting its exchange rate is no longer an option. The literature recognizes several factors that may take the role of exchange rate: factor mobility (Mundell [1961]), price/wage flexibility (Friedman [1953], Kawai [1987]), fiscal federalism (Kennen [1969]) and trade among member countries (McKinnon [1963]). The latter effect arises either from income or inflation rate differentials[2]. In this note we concentrate on the second effect. The conjecture is that such effect stabilizes the economies in the currency area because if a country experiences, say, a positive shock, its inflation rate goes up, decreasing the competitiveness of this country and neutralizing the initial effect (Alesina et al. [2001] pp. 18-19). We call this the *competitive effect.*

However, when the rate of inflation goes up, the real interest rate decreases. This effect goes in opposite direction to the competitive effect because it stimulates the economy of the country that has experienced a positive shock. We call this the *real interest effect.*

In this note we provide a simple model to study the working of both effects. We assume two countries and that all relevant functions are linear. An interpretation of the latter assumption is that we study the economy in a neighbourhood of the (unique) stationary equilibrium. We also assume that the only difference between countries is the size of potential output. Public expenditure is, either constant or tuned in order to offset inflation. The central bank only cares about maintaining a constant average inflation. We show that if the central bank attains its target, the nominal interest rate is constant (Lemma 1).

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[2] The early literature focussed on price levels, not on inflation rates.

We identify a range of parameters for which equilibrium is stable (Proposition 1). It turns out that without an activist fiscal policy, these values are not very reasonable. In particular, expectations in equilibrium cannot be rational. This is due to the fact that the competitive effect does not work if agents anticipate correctly inflation because in this case supply becomes totally inelastic. Moreover, it might be that a country is gaining share in international markets even if its inflation is rising if this inflation is lower than the inflation of its partners. In other words, a country receiving a positive shock has a rising inflation, but not necessarily a relatively high inflation.[3]

The rest of the paper goes as follows. Section 2 describes the model and analyzes the dynamic trajectories. Section 3 gathers our conclusions.

2: THE MODEL

Time is continuous. All variables are assumed to be twice continuously differentiable with respect to time. A dot above a variable represents its derivative with respect to time. Two dots indicate a second derivative.

There are two countries denoted by j = 1, 2. Let Y^j_n be the potential income of country j. Let λ and 1- λ be the relative size of the potential income of countries 1 and 2, i.e.

$$(1 - \lambda)\, Y^n_1 = \lambda\, Y^n_2 \qquad [1]$$

Countries are assumed to be identical except for the scale factor λ.

[3] If inflation is rising in a country, eventually, it will catch up to the inflation in the other country. However, at this point, potential output is different from real output (except in exceptional cases). Therefore the equality between inflation rates will not persist, producing a cycle. See our comments at the end of Section 2.

The income of j, denoted by Y^j, is the sum of consumption, investment, public expenditure, denoted by G^j and net exports denoted by S^j. Investment is an affine function of the real interest rate, denoted by r^j. Consumption is affine on income net of taxes. Taxes are affine on income. Thus,

$$Y^j = F_j - B_j r^j + C_j S^j + D_j G^j, \qquad F_j, B_j, C_j, D_j > 0. \qquad [2]$$

This is the usual IS curve. Taking units, $D_1 = D_2 = 1$. Since countries are identical except for the scale factor, $C_1 = C_2 = C$, say, and the relative impact of the interest rate on output equals the relative size of this country, i.e. $(1 - \lambda) B_1 = \lambda B_2$. If i is the nominal interest rate and π_e^j is the expected rate of inflation of country j, $r^j \equiv i - \pi_e^j$. Expectations are formed according to

$$\pi_e^j = a \pi^j - b \dot{\pi}^j \quad a > 0. \qquad [3]$$

Thus, if the inflation rate is constant and a = 1 we have perfect foresight. From [3] we get $\dot{\pi}^j_e = a \dot{\pi}^j - b \ddot{\pi}^j$.

The supply side is modelled by a Phillips curve with expectations, i.e.

$$\pi^j = \beta \frac{(Y^j - Y^j_n)}{Y^j_n} + \pi_e^j$$. Let $\bar{\beta}_j \equiv \beta / Y^j_n$. Then,

$$\pi^j = \bar{\beta}_j (Y^1 - Y^j_n) + \pi_e^j \qquad [4]$$

Notice that $\bar{\beta}_j (Y^j_n - Y^1) = \pi_e^j - \pi^j = (a - 1) \pi^j - b \dot{\pi}^j$. Therefore if $a \approx 1$, $b < 0$ is absurd because it implies that when real output is above potential output, the inflation rate is decreasing. Thus, from now on we assume $b > 0$.

Net exports are assumed to be

$$S^1 = Q \, Ln \left(\frac{P^2}{P^1}\right)^{\alpha}, \; Q > 0, \alpha > 0.$$

where P^j is the price in j. Clearly, $S^1 = - S^2$. When prices are identical in both countries, $S^1 = 0$. Setting $K \equiv Q \alpha$, we obtain

$$\dot{S}^1 = K (\pi^2 - \pi^1) \quad [5]$$

National fiscal authorities implement fiscal policies to stabilize their respective economies in such a way that the variation in public expenditure is linear on the rate of change of inflation.[4]

$$\dot{G}^j = - \delta_j \dot{\pi}^j, \qquad \delta_j \geq 0, \qquad (1 - \lambda) \delta_1 = \lambda \delta_2. \quad [6]$$

Finally, we assume that the central bank stabilizes weighted average inflation, denoted by $\bar{\pi}$ and defined as $\bar{\pi} \equiv \lambda \pi^1 + (1 - \lambda) \pi^2$.

Lemma: *If average inflation is constant, the nominal interest rate is constant.*

Proof: Plugging [2] and [4] in the definition of $\bar{\pi}$,

$$\bar{\pi} = \lambda\{ \bar{\beta}_1[F_1 - B_1(i - \pi^1_e) + CS^1 + G^1 - Y^n_1] + \pi^1_e\} +$$
$$+ (1 - \lambda)\{ \bar{\beta}_2[F_2 - B_2(i - \pi^2_e) - CS^1 + G^2 - Y^n_2] + \pi^2_e\}$$

[4] For simplicity, we disregard boundary problems associated with the non-negativity of public expenditure.

Differentiating with respect to time and rearranging.

$$\dot{i} = \frac{\dot{\pi}_e^1[\lambda(\bar{\beta}_1 B_1+1)]+\dot{\pi}_e^2[(1-\lambda)(\bar{\beta}_2 B_2+1)]+C\dot{S}^1[\lambda\bar{\beta}_1-(1-\lambda)\bar{\beta}_2]\lambda\bar{\beta}_1\dot{G}^1+(1-\lambda)\bar{\beta}_2\dot{G}^2}{\lambda\bar{\beta}_1 B_1+(1-\lambda)\bar{\beta}_2 B_2}$$

Using [3], [5] and [6]

$$\dot{i} = \frac{\dot{\pi}^1 a\lambda[\bar{\beta}_1(B_1-\delta_1)-\bar{\beta}_2(B_2-\delta_2)]-\ddot{\pi}^1 b\lambda(\bar{\beta}_1 B_1-\bar{\beta}_2 B_2)+K[(\bar{\pi}-\pi^1)/(1-\lambda)]C[\lambda\bar{\beta}_1-(1-\lambda)\bar{\beta}_2]}{\lambda\bar{\beta}_1 B_1+(1-\lambda)\bar{\beta}_2 B_2}$$

Thus, under our assumptions, $\dot{i} = 0$.□

From now on we assume that the central bank achieves its objective. Plugging [2] and [3] in [4],

$$\dot{\pi}^1(\bar{\beta}_1 B_1+1)b = \pi^1[(\bar{\beta}_1 B_1+1)a-1]+\bar{\beta}_1(F_1-B_1 i+CS^1+G^1-Y^n{}_1)$$

Differentiating wrt time and using [5], [6] and the definition of $\bar{\pi}$ we get

$$\ddot{\pi}^1(\bar{\beta}_1 B_1+1)b = \dot{\pi}^1[(\bar{\beta}_1 B_1+1)a-\bar{\beta}_1\delta_1-1]+\bar{\beta}_1 CK\frac{(\bar{\pi}-\pi^1)}{(1-\lambda)} \qquad [7]$$

$$\ddot{\pi}^2 = -\frac{\lambda}{(1-\lambda)}\ddot{\pi}^1 \qquad [8]$$

Clearly, if [7] is solved, [8] is solved too. Therefore let us solve [7].

Proposition 1: *If* $a < (1 + \bar{\beta}_1\delta_1)/(\bar{\beta}_1 B_1 + 1)$ *and the competitive effect is large enough, the trajectory of the rate of inflation of country 1 is stable.*

Proof: [7] can be written as $\pi^1 + d_1 \ddot{\pi}^1 + d_2 \dot{\pi}^1_t = D$ where

$$d_1 \equiv - \frac{(\bar{\beta}_1 B_1 + 1)a - 1 - \bar{\beta}_1\delta_1}{(\bar{\beta}_1 B_1 + 1)\, b}$$

$$d_2 \equiv \frac{\bar{\beta}_1 CK}{(\bar{\beta}_1 B_1 + 1)\, b\, (1 - \lambda)}$$

This is a differential equation whose particular integral is found by setting $\ddot{\pi}^1 = \dot{\pi}^1 = 0$. [7] implies that at this point, $\pi^1 = \bar{\pi}$. To obtain the trajectory we solve the quadratic equation $z^2 + d_1 z + d_2 = 0$, i.e.

$$z = \frac{- d_1 \pm \sqrt{d_1^2 - 4d_2}}{2}$$

The system is stable if both roots are negative. We have three cases.

1) If $d_1^2 > 4d_2$, the roots, say , z_1 and z_2, are two real numbers, $z_1 \neq z_2$. Stability requires $-d_1 \pm \sqrt{d_1^2 - 4d_2} < 0$; i.e. $d_2 < 0$; this condition never holds because d_2 is positive. Thus, the system is unstable and the inflation rate diverges from the stationary equilibrium.

2) If $d_1^2 = 4d_2$, both roots take the same value, $z_1 = z_2 = - d_1/2$. Stability requires $d_1 > 0$ which is equivalent to $a < (1 + \bar{\beta}_1\delta_1)/(\bar{\beta}_1 B_1 + 1)$.

3) If $d_1^2 < 4d_2$, both roots are imaginary. For this case to arise, the competitive effect (i.e. CK) has to be large. In this case the system describes a

cyclic path. For equilibrium to be stable, i.e. for diminishing amplitude in cycle, we need $d_1 > 0$, or, equivalently, $a < (1 + \bar{\beta}_1\delta_1)/(\bar{\beta}_1 B_1 + 1)$.□

Notice that if we have only the competitive effect ($\delta_1 = \delta_2 = B_1 = B_2 = 0$), the sufficient condition for convergence is $a < 1$. If $a = 1$ the trajectory is an orbit. Under no fiscal policy ($\delta_1 = \delta_2 = 0$), the condition is $a < 1/(\bar{\beta}_1 B_1 + 1)$. In both cases stability requires some myopia in the perception of the changes in the rate of inflation (if expectations are quickly revised $a \approx 1$). But if fiscal authorities choose δ_1 such that $d^2_1 \leq 4d_2$ and $a < (1 + \bar{\beta}_1\delta_1)/(\bar{\beta}_1 B_1 + 1)$, inflation rates converge to the stationary equilibrium. This highlights the importance of fiscal policy in order to attain convergence.

3: CONCLUSION

In this note we have studied the stability of a currency area where shocks are compensated by trade among country members. In our model a large competitive effect is necessary but not sufficient for convergence. In absence of fiscal policy, stability also requires expectations not rational at the steady state (i.e. $a < 1$). If this condition fails, fiscal policy becomes necessary for convergence. Needless to say, the robustness of this conclusion must be checked in more general models (more than two countries, asymmetries, non-linear functions). Other suggestions for further research are:

1: In a currency area investment in a country may depend on the differential of real interest rates, i.e. on the differential of inflation rates.

2: It would be interesting to know more about fiscal rules. In particular about the existence of a rule that stabilizes the economy and in which deficits and surpluses produced during the stabilization process cancel out.

3: Perhaps our model can shed some light on the divergent behavior of some countries in the EMU in recent years, particularly Germany and Spain.

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