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International Monetary Economics

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Solutions

1. This question consists of 5 sub–questions all requiring only short answers. They relate to the following learning objectives: describe and explain Covered Interest Rate Parity (CIP), Uncovered Interest Rate Parity (UIP), and Purchasing Power Parity (PPP) and be able to summarize the empirical evidence on these parity conditions; describe the institutional features of the foreign exchange market products (spot and forward contracts) and be able to distinguish between speculation and arbitrage; describe the main models of exchange rate determination (the Monetary approach to the exchange rate, Dornbusch overshooting model, the portfolio balance model and Lucas asset pricing model) and use these models to analyze the effects of monetary and fiscal policy on the exchange rate, and summarize the empirical evidence on these models.

   (a) False. A sterilized open market foreign exchange operation cannot have any effect on the exchange rate in the flexible price monetary model since the money supply is unchanged. The reason is that domestic and foreign bonds are perfect substitutes.

   (b) True. A sterilized foreign exchange operation involves first the purchase of foreign bonds with domestic money and then the monetary authority offsets the increase in money holdings by selling domestic bonds. This alters the composition of bonds held in portfolios. Since there is a shortage of foreign bonds in portfolios, the exchange rate must depreciate which raises the domestic currency value of holdings of foreign bonds. The excess supply of domestic bonds leads to lower bond prices and therefore higher interest rate.

   (c) False. Both UIP and CIP are derived using the same arbitrage arguments based on the idea of replicating portfolios. Under risk neutrality, an investment in two different currencies must provide the same rate of return.

   (d) True. UIP would imply that the high interest rate currency should be expected to depreciate in the future. Otherwise no one should want to hold the other asset.

(e) No. Speculators who buy at low prices and sell at higher prices will gain according to Friedman. Those who correctly can forecast future changes in exchange rates and who trade on these beliefs will move the exchange rate in the correct direction.

2. This question relates to the learning objective "describe the main models of exchange rate determination (the Monetary approach to the exchange rate, Dornbusch overshooting model, the portfolio balance model and Lucas asset pricing model) and use these models to analyze the effects of monetary and fiscal policy on the exchange rate, and summarize the empirical evidence on these models;". The question focuses on the derivation of money market and goods market equilibria and the derivation of the overshooting effect. The main difference between the model in this question and the version in the curriculum is the specification of the aggregate demand function. It is required to discuss the consequences of a permanent shift in the autonomous part of aggregate demand. Finally, the student is asked to discuss how a change in the speed of adjustment parameter π will affect the size of the overshooting effect. Here it is important that the answer includes a motivation.

   (a) Equation (1) is the standard UIP relation where we have assumed risk neutrality. Equation (2) states that the expected rate of depreciation is determined by the speed of adjustment parameter θ and the gap between the current exchange rate (s) and its long–run equilibrium value ($\bar{s}$). Equation (3) is the conventional money demand function where η is the output elasticity of money demand and σ is the interest elasticity of money demand. Aggregate demand is defined in equation (4) where β is the autonomous or exogenous part of aggregate demand. Finally, equation (5) states that inflation is determined by the gap between aggregate demand and aggregate supply where π is the speed of adjustment of prices.

   (b) To show that

   $$p = m - \eta y + \sigma r^* - \sigma\theta\left(s - \bar{s}\right)$$

   we insert (1) and (2) into the money demand function (3). From (1) we know that $r = \dot{s}^e + r^*$. Then we use (2) such that $r = \theta\left(\bar{s} - s\right) + r^*$ which is then inserted into the money demand to give $p = m - \eta y + \sigma r^* + \sigma\theta\left(\bar{s} - s\right)$ or $p = m - \eta y + \sigma r^* - \sigma\theta\left(s - \bar{s}\right)$. This equation gives us the money–market equilibrium curve. If the nominal exchange rate is equal to the equilibrium rate, then we can determine the equilibrium price level.

   To show equation (7) we simply insert (4) into (5) such that $\dot{p} = \pi\left(\alpha\left(s - p\right) - \bar{y} + \beta\right)$. This equation shows that when demand equals supply, inflation is zero. In a graphical representation of the model this is the goods–market equilibrium schedule.

   (c) In order to derive the equilibrium values we make use of (7) noting that in equilibrium $\dot{p} = 0$, $s = \bar{s}$, $p = \bar{p}$ and $y = \bar{y}$. We obtain

   $$\dot{p} = \pi\left(\alpha\left(\bar{s} - \bar{p}\right) - \bar{y} + \beta\right) = 0$$

$$\bar{s} = \bar{p} + \frac{1}{\alpha}(\bar{y} - \beta)$$

and from (6) we find that

$$\bar{p} = m - \eta\bar{y} + \sigma r^*.$$

From these relations we also find that $\frac{d\bar{s}}{dm} = \frac{d\bar{p}}{dm} = 1$ and that $\frac{d\bar{s}}{d\beta} = \frac{1}{\alpha}$. The latter result suggest that the nominal exchange rate adjustment in response to an exogenous change in the autonomous part of aggregate demand implies that PPP cannot hold. Permanent shocks lead to permanent deviations from PPP, even in the long–run. The two former results show that money is neutral in the long–run.

(d) To derive the overshooting effect we take the total differential of the money demand function noting that $dp = dy = 0$ and that $d\bar{s} = dm$

$$dp = dm - \sigma\theta(ds - d\bar{s}) = dm - \sigma\theta(ds - dm) = 0$$

which implies that

$$\frac{ds}{dm} = 1 + \frac{1}{\sigma\theta}.$$

Here we find that the short–run effect of an increase in the money supply is greater than one since both σ and θ are positive. An increase in σ implies that the slopes of both the GG–curve and the MM–curve increase and the size of the overshooting effect will decrease. An increase in θ increases the slope of the money market curve and therefore also dampen the overshooting effect. The slope of the goods market curve is unaffected.

(e) π is the speed of adjustment of prices and will not enter the expression for the overshooting effect. However, if $\pi = \infty$ we would immediately move from the initial equilibrium to the new instantaneously, we would continuously be in equilibrium. Therefore there cannot be any overshooting effects in this case. As long as $\pi < \infty$ the goods market spends some time in disequilibrium and the adjustment towards the new long–run equilibrium occurs gradually. It is possible to solve for θ as a function of π, i.e., to solve for the perfect–foresight value of θ which is a positive function of π, but this is not required.

3. This question relates to the learning objective "describe, explain and compare first-, second- and third-generation models of currency crises and apply these models to analyze actual currency crises". The question relates to the third generation model developed by Aghion, Bacchetta and Banerjee. The first part of the question considers the model and its implications under the assumption of floating exchange rates and the existence of multiple equilibria whereas the last part considers the case of fixed exchange rates.

   (a) Main assumptions are:

- PPP holds *ex ante* but not necessarily *ex post.*
- Imperfect credit markets, firms are credit constrained and can borrow only a fraction of their wealth and they are forced to borrow abroad.
- UIP holds and it is assumed that domestic and foreign assets are perfect substitutes.
- Standard production function and size of capital stock depends on "working capital".
- Prices are sticky and predetermined such that a shock to PPP implies only a change in the nominal exchange rate.

The IPLM–curve is derived using a standard money demand function and UIP. The W–curve (wealth curve) is derived from the profit function and using the credit constraint.

The credit market plays a critical role in the model. The constraint is binding and this imperfection tends to amplify effects of shocks. Deviations from ex post PPP caused by unexpected shocks imply a negative relation between the exchange rate E_1 and production in the next period y_2. In the absence of shocks, PPP holds and the W–curve is a vertical line in the y_2–E_1 plane. If there is no shock, there will be no change in the real exchange rate, no change in the debt burden and therefore no change in production.

(b) The position of the IPLM– and the W–curves are given by the predetermined levels of period–1 prices and output, the level and composition of the debt and the monetary policy variables. As figure 1 shows, this means that once a shock hits the economy there are three possible short-term scenarios: (i) The "good" case, where the economy is healthy or the shock is small so that a crisis equilibrium does not emerge following the shock, and thus the exchange rate will stay low and output high (depicted in figure 1(a)). (ii) The "bad" case, in which the shock is so large and/or the state of fundamentals so bad that a crisis is the only possible outcome, i.e. the unexpected currency depreciation is so large that it drives profits and thus second period output to zero (figure 1(b)). (iii) Finally, an intermediate case where there are two locally stable equilibria: a "good" and a "crisis"-equilibrium (figure 1(c)). As can be observed from figure 1, a necessary condition for a currency crisis to emerge (either with certainty in the "bad" scenario or depending on expectations in the intermediate scenario) is that the IPLM–curve intersects the y_2-axis above the W-curve. This can be formulated as:

$$E_1|_{W,y_2=0} = \frac{P_1[y_1 - (1+r_0)d_1^c]}{(1+i^*)(d_1 - d_1^c)} < \frac{1+i^*}{1+i_1}\frac{M_2^S}{m^d(0,i_2)} = E_1|_{IPLM,y_2=0}$$

Note that it is not required to derive this condition.

(c) Consider the effects of monetary policy, i.e., changes in i_1. The position of the IPLM–curve depends on the stance of monetary policy in the first period, so by

Figur 1: Three possible scenarios.

(a) The “good” scenario

(b) The “bad” scenario

(c) The intermediate scenario

raising (lowering) the current nominal interest rate in response to a shock the monetary authorities can shift the IPLM–curve downwards (upwards). This can be seen in the equation for the IPLM–curve stated in the question. The W-curve is not affected, the effect of the interest rate goes through the burden of domestic debt and there is a two-period lag between output and the interest rate. Therefore, there is no effect on the W-curve. The policy recommendation is therefore to raise the interest rate such that the IPLM–curve shifts down. Figure 2 illustrates this:

After a shock, the economy is in the intermediate scenario where it could end in either the "good" equilibrium A or the "crisis" equilibrium B depending on expectations. By raising the interest rate and through this shifting the IPLM–curve down to IPLM' the central bank can bring about an appreciation of the currency and ensure that only the "good" equilibrium C is feasible. In case of an emerging crisis, the monetary policy recommendation is unambiguously to avoid depreciation by raising the interest rate.

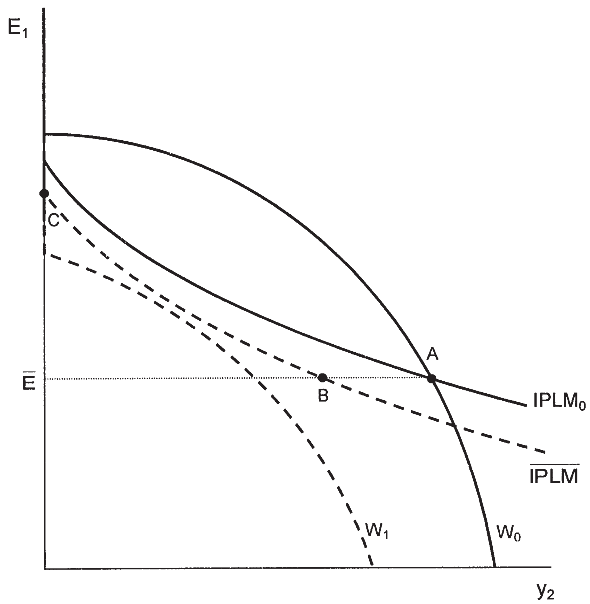
(d) Under fixed exchange rates $E_1 = \overline{E}$ the money supply is endogenous and given by $M_2^S = DC_2 + IR_2$ where DC is domestic credit and IR is international reserves. Assume that international reserves cannot fall below a threshold value $\overline{IR}$ and that domestic credit is fixed $\overline{DC}$. The new IPLM–curve can then be written as

$$E_1 = \frac{1+i^*}{1+i_1} \frac{\overline{DC} + IR_2}{m^d(y_2, i^*)}.$$

We may also define the lowest possible IPLM–curve as

$$E_1 = \frac{1+i^*}{1+i_1} \frac{\overline{DC} + \overline{IR}}{m^d(y_2, i^*)}$$

consistent with the fixed exchange rate $\overline{E}$. Figure 3 depicts these curves and the W–curve. Point B, where the lowest possible IPLM–curve intersects with the W–



curve, gives the fixed exchange rate $\overline{E}$. This illustrates that the fixed exchange rate can only be maintained as long as output is at least equal to to its value at point B.

In case a negative shock affects the model we know that the W–curve shifts down as shown in the Figure 3 (from W_0 to W_1). It is now impossible to sustain the fixed exchange rate since the W_1–curve intersects the horizontal line $E = \bar{E}$ to the left of B. This implies that the fixed exchange rate has to be abandoned and the economy movers to the "bad" equilibrium C.

(e) The difference between this model and the first and second generation models is that a currency crisis is caused by the weakness in the financial health of private firms, not by a decline in international reserves as suggested by first generation models or the emergence of a negative shock as in the second generation models. In this third generation model firms are credit constrained and are forced to borrow abroad. A depreciation increases debt repayments, reduce profits, reduce firms borrowing capacity and therefore reduces future output.