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Solution to written exam for the M. Sc in Economics International Monetary Economics

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1. This question consists of four 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) True. An increase in the money supply brought about by an unsterilized open market purchase should lead to an increase in the relative price level, causing the euro to depreciate

   (b) True. An unsterilized open market purchase will decrease the amount of domestic bonds on the market and lead to excess money supply. There is excess demand for both domestic and foreign bonds resulting in a lower interest rate and a depreciation of the exchange rate which will raise the value of foreign bonds measured in home currency terms.

   (c) False. The Peso problem refers to the case when we have the correct exchange rate model and incorporate the news that a new finance minister will be appointed in the future. In such a case, the actual exchange will be affected immediately. If it turns out that the finance minister is not appointed, then the earlier movements in the exchange rate will appear to be unrelated to fundamentals. The model will not be wrong but empirical test would reject the model.

   (d) False. In an efficient market, prices reflect all available information including fundamentals such as the money supply. This implies that anticipated changes in the money stock will already be incorporated in the price whereas unanticipated changes (news) will have an effect. The statement would have been correct if it instead had said that "the exchange rate is unaffected by *anticipated* changes in

monetary policy". Since the statement does not specify whether it is unanticipated or anticipated changes it must be false.

2. 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 second generation model discussed in Sarno and Taylor section 8.2. The first part of the question aims at a discussion and comparison of the credibility problem facing the monetary authority whereas the last part is more focused on how currency crises are generated within this type of currency crisis models.

   (a) Equation (1) is a standard loss function which should be minimized. It is assumed that the government is using this relation when conducting exchange rate policy. The loss is a function of inflation (we implicitly assume that the target inflation rate is zero) and the deviation of actual output y from its target $\tilde{y}$. Equation (2) is the expectations augmented Phillips–curve where output (in real terms) depends on the natural level of output $\bar{y}$ and the difference between actual inflation and expected inflation. There is also a supply shock υ which is assumed to be a white noise sequence. A negative supply shock (a positive υ) leads to lower output. Equation (3) states that there is a wedge between the natural level of output and the target level of output such that the target exceeds the natural level, the parameter k is positive. The variable k represents the output target bias. The argument for a positive value of k is that the socially optimal level of output is higher than the natural level for example due to the fact that labor market imperfections drives a wedge between what is optimal from a society's point of view and the equilibrium level of output. The effect of this assumption is that there will be a temptation towards inflationary policies. If actual inflation exceeds expected inflation, then output will be higher than the natural level. In case the government can surprise households with a devaluation leading to higher inflation, output may increase. However, this is known by the households (since they also have full knowledge about the economy), they know that the government may be tempted to devalue the currency or abandon the fixed exchange rate. Equation (4) is the PPP relations.

   (b) The sequencing of events is standard. To derive the loss function under no commitment to a fixed exchange rate regime we insert the supply function into the loss function we obtain

$$\mathcal{L} = \theta \left(\dot{s}\right)^2 + \left(\bar{y} + \dot{p} - \dot{p}^e - \upsilon - \tilde{y}\right)^2$$

   and then using equations (3) and (4) and assume that the foreign price level is zero (we can always normalize away the foreign price level since we assume a small open economy) we find that

$$\mathcal{L} = \theta \left(\dot{s}\right)^2 + \left(\dot{s} - \dot{s}^e - \upsilon - k\right)^2 .$$

The governments reaction function under no (or zero) commitment, i.e., they allow for a devaluation $\dot{s} > 0$ can be found if we differentiate the relation above with respect to $\dot{s}$ setting the first order condition equal to zero

$$\frac{\partial \mathcal{L}}{\partial \dot{s}} = 2\theta\dot{s} + 2\left(\dot{s} - \dot{s}^e - \upsilon - k\right) = 0$$

implying that

$$\dot{s} = \frac{\dot{s}^e + \upsilon + k}{1+\theta}$$

which is the reaction function. Note that a devaluation leads to higher inflation through PPP and for given inflation expectations output will be higher (or closer to the target value $\tilde{y}$) which also minimizes the loss function.The rate of depreciation is an increasing function of the expected rate of depreciation, the output shock, k and a decreasing function of the weight of inflation θ in the loss function. This illustrates the temptation to cheat and the willingness to allow the actual exchange rate to depreciate.

(c) The rational expectation of a devaluation when there is no commitment is

$$\mathrm{E}\left[\dot{s}\right] = \frac{k}{1+\theta} + \frac{\dot{s}^e}{1+\theta}$$

since we have assumed that υ is white noise.

In equilibrium. private agent's expectations must be model consistent ($\mathrm{E}\left[\dot{s}\right] = \dot{s}^e$) such that

$$\mathrm{E}\left[\dot{s}\right] = \frac{k}{\theta}$$

which is the solution under no commitment. From this equation we note that as long as there is a wedge between the target and natural levels of output, there will be a depreciation.

(d) The value of the loss function under no commitment can be found if we insert the reaction function into the loss function

$$\mathcal{L}^D = \theta\left(\frac{\dot{s}^e + \upsilon + k}{1+\theta}\right)^2 + \left(\frac{\dot{s}^e + \upsilon + k}{1+\theta} - \dot{s}^e - \upsilon - k\right)^2$$

which can be written as

$$\mathcal{L}^D = \frac{\theta}{1+\theta}\left(\dot{s}^e + \upsilon + k\right)^2.$$

This is the value of the loss function under no commitment.

(e) We will now derive the loss function under commitment to the fixed exchange rate ($\dot{s} = 0$). Using the loss function in (1) and noting that $(-\dot{s}^e - \upsilon - k)^2 = (\dot{s}^e + \upsilon + k)^2$ we find that

$$\mathcal{L}^R = (\dot{s}^e + \upsilon + k)^2 .$$

Thus, we have shown that

$$\mathcal{L}^D < \mathcal{L}^R$$

since $\theta/(1+\theta) < 1$. The government is indeed tempted to cheat, i.e., to abandon the fixed exchange rate regime and instead follow a discretionary policy.

(f) How are currency crises generated in this model? Large output shocks implies that $\frac{k}{1+\theta} + \frac{\dot{s}^e}{1+\theta}$ is large which will trigger a devaluation. This holds regardless of whether we add a reputation cost as is done in the textbook or not. A more conservative government (or central bank), i.e., an increase in θ will reduce the expected depreciation under no commitment and a lower wedge between target and natural levels of output tends to reduce the likelihood of a currency crisis. In this case there will only be one equilibrium which is consistent with the fixed exchange rate regime. If private agent's expectations of a devaluation is low then the cost of maintaining the fixed exchange rate is low and there will be no devaluation. On the other hand, if agents expect a devaluation, costs are high (in terms of a deviation of actual output from its target) and these expectations will be self–fulfilling so that there will be a devaluation. This discussion implies in general that there must be an exogenous shock to expectation. This is what drives or causes currency crises in this model. Fundamentals are consistent with the fixed exchange rate and do not change, it's only expectations that change.

3. This question relates to the learning objectives 'describe and use Mundell–Fleming models to analyze the effects of economic policy under both flexible and fixed exchange rates' and 'explain the theory of optimum currency area and apply this theory to the analysis of the European Monetary Union'. The relevant curriculum is chapter 10 in Pilbeam.

(a) The model and notation is standard. The money demand function is standard. Note that the price level in the demand function reflects both domestic prices and prices on imports as given by the third equation. Higher output levels and lower interest rates tend to increase the money demand, higher output increases the transaction demand whereas a lower interest rate reduces the return on bonds making it less attractive to hold bonds. The money demand shock is, as stated in the problem, a white noise sequence implying that the shock has mean zero, a constant variance and is not autocorrelated.

The expression for the aggregate price level includes the parameter α which is the weight of the domestic price level in the aggregate price level and is a measure of openness, a small α implies a more open economy.

Aggregate domestic demand is given in the next equation. As can be seen in the equation, an appreciation tends to reduce aggregate demand (reduced foreign demand for domestic goods). A higher real interest rate also tends to reduce aggregate demand. A higher natural level of output implies a higher aggregate demand, higher potential output implies higher income. The supply shock is, as the demand shock, a white noise sequence.

The aggregate supply function is also standard, it is inversely related to the real wage. A higher real wage reduces aggregate supply. The supply shock is a white noise sequence, i.e., has the same properties as the other two shocks.

We also assume that $\eta(\theta+\beta) < \alpha$. This assumption implies that the aggregate demand curve is steeper than the money demand curve. In other words, we assume a large almost closed economy. The elasticity of domestic demand with respect to the real exchange rate and the real interest rate are relatively small compared to α.

In the objective function we assume that the authority only cares about the price level, the objective only involves domestic price stability. The authority wants to minimize deviations from the target price level.

In addition to the equations, we also assume that capital is perfectly mobile and abstract from risk aversion such that UIP holds (and the risk premium is zero). Labor contracts imply that the wage rate is set in the absence of shocks, they are set such that the expected output is equal to the natural level of output (the full employment output). Then the shocks affect the economy leading to short–run deviations of the price level from its target.

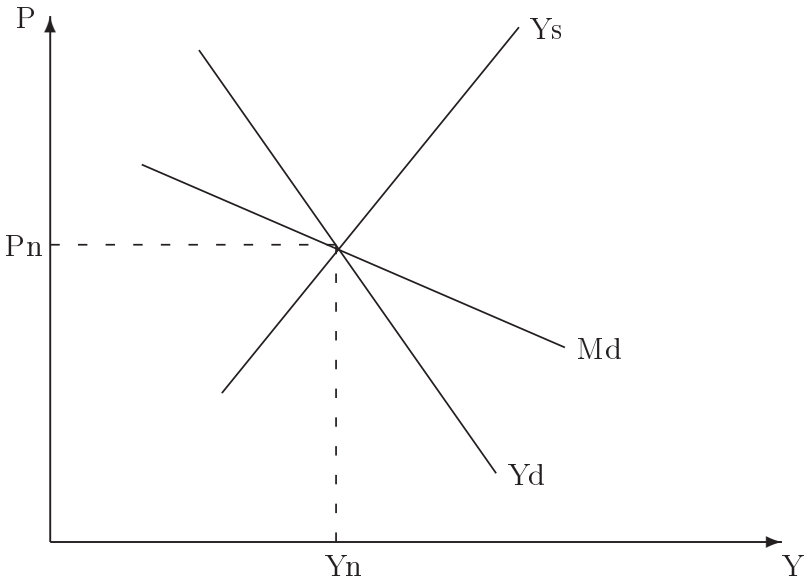
(b) Illustrate the equilibrium of the model. We have full equilibrium when aggregate demand is equal to aggregate supply (which also implies that the money market is in equilibrium). The three curves are shown in the graph below.

Aggregate demand is downward sloping since a rise in the price level leads to a fall in demand. The slope is $-1/(\theta+\beta)$ which can be shown if we insert the expression for the aggregate price level into the aggregate demand function. The aggregate demand curve shifts up if there is a positive demand shock.

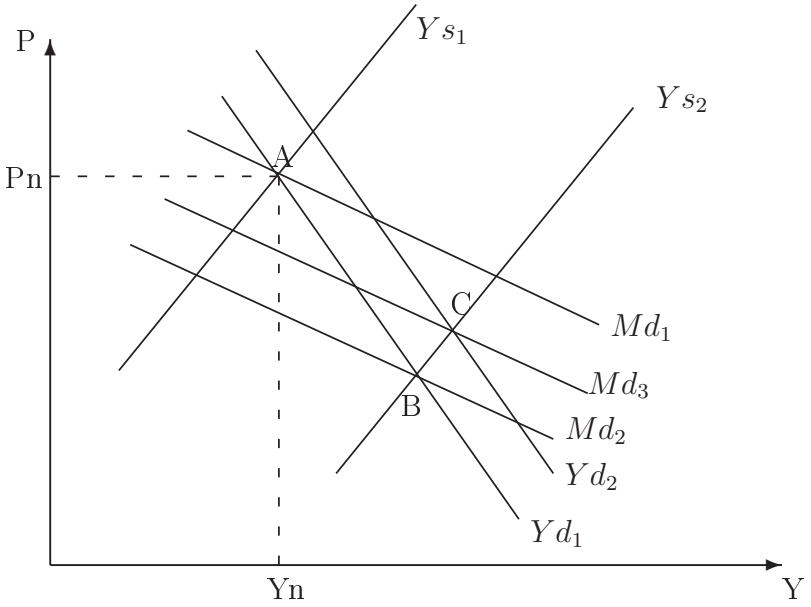
The aggregate supply curve has a positive slope since a rise in the price level reduces the real wage which will tend to increase employment and output. The slope is $1/\phi$ which can be seen if we use the aggregate supply relation.

Finally, the money demand curve is downward sloping since a higher price level increases money demand. The slope is $-\eta/\alpha$. Since we assume that $\eta(\theta+\beta) < \alpha$ it follows that the aggregate demand curve is steeper than the money demand curve.

For latter purposes it is important to note that all points above the Md–curve, there will be excess demand for money and all points above the Yd–curve corresponds to excess demand for goods.



(c) Assume now that the model economy is hit by a positive supply shock (still assuming that the aggregate demand curve is steeper than the money demand curve). The positive supply shock implies that the supply curve shifts to the right, from Ys_1 to Ys_2. Note that as aggregate supply shifts to the right, there will be *excess* supply of money and a tendency for the exchange rate to *depreciate*. The reason is that point B is located below the Md–curve. To avoid a depreciation, the CB must sell foreign bonds and buy domestic currency. The Md–curve shifts to the left from Md_1 to Md_2 and we obtain a short–run equilibrium at point B. Under flexible exchange rates, the exchange will depreciate leading to a fall in the interest rate, increased demand for money and increased aggregate demand for domestic goods. The Yd–curve shifts up to the right to Yd_2 and the Md–curve shifts down to the left to Md_3. The new short–run equilibrium is at point C. Comparing the two regimes and the implied deviations from the target price level, we find that a floating exchange rate is optimal. Note that this holds for a large and almost closed economy such as the US or the Euroarea.



(d) The choice of exchange rate is more complex than the analyzes above indicate. We consider above only transitory shocks but economies are also hit by permanent shocks. In addition we also focus only on one type of shocks and we know from the curriculum that we tend to obtain different policy recommendation when considering other types of shocks. The labor contract we consider is only one out of many different possibilities. Some countries may also have wage indexation (nominal wages linked to prices) which will tend to complicate the analysis since wages then are dependent not only on the domestic price level but also the exchange rate. It may be the case that even if it is optimal for the domestic economy to have a floating exchange rate, its major trading partners may prefer fixed exchange rates. In such cases we have to consider a two country model and may end up in a situation where the optimal regimes differ between the two countries. In such cases, the analysis will be much more complicated. In case we believe in the model we could argue that the model supports the floating euro exchange rate. However, the model cannot support the choice made by the Swedish government to allow the exchange rate to float unless of course that supply shocks are very rare.