International finance
Problem set 7

1. Please stress to students that overshooting happens if the shock affects the money market and requires a change in prices. Since prices are sticky in the first period, the nominal interest rate and, given UIP, the expected rate of depreciation have to adjust to clear the money market.

   Introduce the equations of the Dornbusch model from the lecture (IS, LM, UIP, money growth equation, AS in period 1 and $t > 1$ respectively). Derive the relevant reduced form equations for period 1 and period $t > 1$. Remind them that the classical dichotomy holds in periods $t > 1$. Real variables are determined on real markets (AS determines output, IS+AS determine real exchange rate) with money market determining nominal variables (price level and nominal exchange rate) given real ones.

   For period $t > 1$ these are (talk students through how you obtain them)

   $$\bar{y} = \bar{z} + \eta(e_t + p_t^* - p_t) \tag{1}$$
   $$m_t - p_t = \bar{y} - \Delta e_{t+1} \tag{2}$$
   $$\Delta e_{t+1} = \pi_{t+1} - \pi_{t+1}^* = \mu - \pi_{t+1}^*. \tag{3}$$

   For period $t = 1$ they are

   $$y_1 = \bar{z} + \eta(e_1 + p_1^* - \bar{p}) \tag{4}$$
   $$m_1 - \bar{p} = \bar{y} - (e_2 - e_1). \tag{5}$$

   Once you have solved for e_2 from the second period, the LM curve determines e_1 and the IS determines y_1.

   (a) Draw the path of the price level and the exchange rate in the absence of the shock and after the shock. Suppose $\mu = 0$ before the shock and $\mu > 0$ after the shock (it makes no difference but things are easier to draw).

   Notice that we are assuming that $\bar{p}$ is fixed at its flexible price equilibrium level before the shock. So, before the shock the price level is constant and equal to $p_t = m_t - \bar{y}$ (LM) and given that the IS curve implies the real exchange rate is constant, so is e_t. (You could derive the exact value, but do not do it).

   Consider now the shock. m_1 is unchanged, but m_2 increases to $m_1 + \mu$.

   Start from period 2. $\Delta e_{t+1} = \mu$, so the real money demand in equation (2) falls. m_2 has increased, so p_2 has to increase to reestablish money market equilibrium. Since, the real exchange rate is unaffected, e_2 increases one-to-one with p_2 to keep the real exchange rate constant.

   Both p_t and e_t grow at rate μ from $t = 2$ onwards.

   Moving to period 1, e_2 has increased. Yet, since m_1 and $\bar{p}$ are unchanged, the real money supply is unchanged and, in equilibrium, so must be the real money demand. Therefore, the nominal interest rate and therefore $e_2 - e_1$ have to be unchanged. $e_2 - e_1$ was zero before the shock. So e_1 must jump up to

the new value of e_2 to achieve this. The real exchange rate falls at $t = 1$ and output is above full employment. So, the real exchange rate is overshooting its unchanged equilibrium value at $t > 1$. So is the nominal exchange rate, since the price level is prevented to increase to clear the money market. Therefore, the nominal interest rate cannot increase as it does from $t > 1$ onwards and e_1 as to increase by more to achieve this.

(b) Assume again $\mu = 0$. So the paths for e_t and p_t before the shock are the same as in point (a).

Start from period $t > 1$. Since Δe_{t+1} is unchanged at zero, equation (2) implies the price level has to fall to reestablish money market equilibrium. In particular p_t must fall by an amount that keeps $p_t + \bar{y}$ constant (one-to-one with $\bar{y}$). Equation (1) implies that the real exchange rate has to depreciate for total desired expenditure (through higher net exports) to increase in line with production. Note that the fall in prices already implies a depreciation of the real exchange rate. So does the nominal exchange rate need to change or not? Two cases: (i) $\eta = 1$. Since $\bar{y}$ and p_t enter with the same coefficient. The fall in p_t which ensures money market clearing also ensures goods market clearing. No need for change in e_t. If $\eta < 1$, e_t needs to depreciate (fall in prices is not enough to generate the required real depreciation).

For the rest of the question, discuss only point (i). It is easier to draw and you get overshooting in both cases.

Moving back to t_1, but money demand on the RHS of (5) has increased with the increase in $\bar{y}$. Since the real money supply is unchanged, the nominal interest rate, i.e. $e_2 - e_1$, must increase to keep real money demand at its original level. This requires $e_1 > e_2$. Since, e_2 is unchanged, e_1 overshoots its long run value e_2. y_1 is above its original full employment level (in fact, if $\eta = 1$ it equals its new full employment level, but do not mention to students as this is a special case).