Part B (Long Questions)

Question B.1: Mundell-Fleming Model with Flexible Exchange Rates

Suppose that a small open economy can be represented by the following model with a flexible exchange rate:

$$C^d = 300 + 0.6(Y - T)$$

$$I^d = 175 - 350r$$

$$T = G = 400$$

$$NX = 245 - 0.1Y - 100e$$

$$\frac{M^d}{P} = Y - 85(r + \pi^e)$$

$$\pi^e = 0.20$$

$$P = 1$$

Assume initially that the economy is in a long-run equilibrium, where $e = 2$, the no-arbitrage condition $r = r_{for}$ holds, and output is at its full-employment level $Y = \overline{Y}$. Also assume here perfect capital mobility.

a) [3 MARKS] Find equations for the *IS* and *LM* curves in this economy. Keep the equation for the *IS* curve as a function of e (i.e., do not sub in values yet).

Using the income-expenditure identity, one gets:

$$Y = 880.0 + 0.5Y - 400r - 100e$$

which yields the equation for the *IS* curve:

$$r = -0.00125Y + 2.20 - \frac{1}{4}e$$

while the equation for the *LM* curve is:

$$r = -\frac{1}{85}\left(\frac{M}{P}\right) + \frac{1}{85}Y - 0.20$$

b) [5 MARKS] Assuming that $r_{for} = 0.10$, find the long-run equilibrium values of Y, C, I, and NX. Find as well the nominal money supply M which is necessary to bring about this long-run equilibrium. Finally, represent the long-run equilibrium graphically in the (r, Y) space.

Solving the above system of equations for $r = r_{for} = 0.10$ and thus $e = 2$, one finds:

$$Y = \overline{Y} = 1280$$

$$M = 1254.5$$

$$C = 828$$

$$I = 135$$

$$NX = -83$$

The usual diagram follows.

c) [6 MARKS] There is a surge in expected inflation, and now $\pi^e = 0.40$. Solve for the new *LM and IS* curves in this economy, and find the short-run equilibrium values for r, e, NX and Y. Depict the short-run equilibrium in a diagram, and explain what is at work here.
The new LM curve is given by:

$$r = -\frac{1}{85}\left(\frac{M}{P}\right) + \frac{1}{85}Y - 0.40$$

Subbing in the long-run equilibrium values for the price level and the money supply (both unchanged in the short run), one thus obtains:

$$r = -15.27647059 + \frac{1}{85}Y$$

The IS curve is still initially given by:

$$r = -0.00125Y + 2.20 - \frac{1}{4}e$$

Since we are assuming perfect capital mobility, it means that even in the short-run equilibrium $r = r_{for} = 0.10$. Substituting this in the LM curve yields Y, while substituting thereafter Y in the IS curve yields e. One thus gets:

$$Y = 1297$$

$$r = r_{for} = 0.10$$

Looking at the IS curve, the implied exchange rate is thus:

$$e = 1.915$$

and net exports are:

$$NX = -76.20$$

Looking at the original equation for the IS curve, this would imply an upward shift in the IS curve (coupled with the initial downward shift in the LM curve) due to an increase in net exports as a result of the depreciation of the currency, such that $r = r_{for}$ at the short-run equilibrium.

d) [6 MARKS] The central bank wants to avoid any change in the price level in the long run, following the shock in part c). What policy should it implement, so that the economy moves back to the long-run equilibrium found in b) without incurring any change in P? Find the new value of the money supply M, which corresponds to the central bank's choice of policy. Then, represent the new long-run equilibrium diagrammatically, explaining the transition.

In order to find M, one simply has to look at the equation for the LM curve found in b), where $\pi^e = 0.40$, and assume that $r = 0.10$, $P = 1$ and $Y = \overline{Y} = 1280$. One therefore gets:

$$0.10 = -\frac{1}{85}M + 14.65882353$$

$$\iff M = 1237.50$$

As we would expect that the LM curve must shift upwards to reach the long-run equilibrium, this is consistent with either an increase in prices (which we do not allow) or a decrease in the nominal money supply, which is what we observe here.

In the transition to the new long-run equilibrium, the nominal money supply decreases, thus shifting the LM curve upwards, and raising $r > r_{for} = 0.10$. This creates domestic arbitrage opportunities, which increases the demand for the domestic currency relative to its supply, and causes thus an increase in e (an appreciation of the currency) to $e = 2$. This shifts in (downwards) the IS curve as NX falls (imports increase while exports decrease), until the interest rate parity is re-established. Output is back at its full-employment value. This should be represented diagrammatically.

Question B.3: Mundell-Fleming with Fixed Exchange Rates

Consider the following small open economy, with fixed exchange rates and perfect capital mobility:

$$C^d = 245 + 0.67Y$$

$$I^d = 225 - 500r$$

$$T = 0$$

$$NX = 85 - 0.07Y - 65\bar{e}$$

$$\bar{e} = 1.8$$

$$M = 600$$

$$\frac{M^d}{P} = 0.5Y - 75r$$

$$P = 1$$

Assume that the economy is initially in a long-run equilibrium, such that the no-arbitrage condition $r = r_{for}$ holds, and output is at its full-employment level $Y = \overline{Y}$.

a) [3 MARKS] Find equations for the *IS* and *LM* curves in this economy. Keep the equation for the *IS* curve as a function of G and $\bar{e}$ (i.e., do not sub in values yet).

The *IS* curve has the following equation:

$$r = -0.0008Y + \frac{111}{100} + \frac{1}{500}G - \frac{13}{100}\bar{e}$$

While the *LM* curve can be written as:

$$r = -\frac{1}{75}\left(\frac{M}{P}\right) + 0.00666\bar{6}Y$$

b) [5 MARKS] Assuming that $r_{for} = 0.12$, find the long-run equilibrium value of Y. Then, proceed to find the level of government spending G required to sustain this long-run equilibrium, *ceteris paribus*, and find equilibrium values of C, I, and NX. Finally, represent the long-run equilibrium graphically in the (r, Y) space.

We first sub in $r = r_{for} = 0.12$ into the *LM* curve, in the process also using $M = 600$ and $P = 1$, to find full-employment output:

$$\overline{Y} = 1218$$

Then, we sub $r = 0.12$, $\bar{e} = 1.8$ and $\bar{Y} = 1218$ into the *IS* curve to obtain:

$$G = 109.20$$

We thereafter can find:

$$C = 1061.06$$

$$I = 165$$

$$NX = -117.26$$

The usual graph follows.

c) [6 MARKS] Contractionary monetary policies in foreign economies have caused the foreign interest rate to increase above the domestic value, such that $r_{for} = 0.18 > r = 0.12$. Explain what implications this has for the domestic currency: is it now undervalued or overvalued, and why? The government does not want the fixed exchange rate or monetary policy to change in the short run. What fiscal policy must it implement in order to achieve this? Find short-run equilibrium output Y, and the implied policy response by thereafter finding G. Then, illustrate and explain its effect using the *IS-LM-FE* diagram.

As a result of $r_{for} > r$, there are now arbitrage opportunities abroad, which would cause under a flexible exchange rate system the exchange rate to fall. However, $\bar{e} = 1.8$ is fixed, meaning that the fixed rate exceeds its fundamental value. The government must increase the interest rate to world levels if it wants to prevent a devaluation of the currency, or a contraction of the money supply to buoy the fundamental value of the currency up to its pegged rate. This means that the *IS* curve must shift upwards, hence implying an *increase* in G. The exact value of G is found by first substituting in the new short-run interest rate $r = 0.18$ into the *LM* curve, which yields short-run output Y for a constant M and P. This Y is then substituted into the *IS* curve along with $r = 0.18$, with $\bar{e}$ being constant, to find G. This yields:

$$Y = 1227$$

$$G = 142.80$$

d) [6 MARKS] Suppose that instead of intervening right away, the government in c) decides to dither about the choice of policy. This leads speculators to believe that the domestic currency's fixed exchange rate no longer matches its fundamental value.

(i) Based on your answer in c), describe what options the country's central bank has in the event of a speculative run on its currency, and their effects.

(ii) In the end, it turns out that the central bank has no other choice but to change e to match the fundamental value of the exchange rate, and achieve interest parity again. If G, M, and P remain constant at their values specified or found in parts a) and b), what would be the new $\bar{e}$ and the short-run equilibrium Y?

(i) The three options are: devalue the currency (costly as it might hinder the investors' confidence, and trigger a further speculative run, which can only be remediated by a more important devaluation, etc.), decrease money supply (i.e., use foreign reserves to buy Canadian dollars on the currency market; yet this is not sustainable, especially if this speculative run is important or if the currency is strongly overvalued, as foreign reserves are limited), or impose capital controls (tends to be rather badly interpreted by markets, and reviled by many, yet can be effective: cf. Hong Kong, 1990s).

(ii) We want to return to the short-run equilibrium found in c), only now by changing the fixed exchange rate rather than by modifying government expenditures. Since $r = 0.18$, and holding M and P constant, we find once again that $Y = 1227$. Holding G constant at its value found in b) (i.e. $G = 109.20$), this means that we must have an devaluation of the currency, such that the IS curve shifts up (outwards). We can thence find $\bar{e}$ by subbing in Y, r and G into the equation for the IS curve, which yields:

$$1227 = 1310.40 - 65\bar{e}$$

$$\iff \bar{e} = 1.283076923$$