Midterm 2 Answers

The total time for the exam is 60 minutes, although you are given 70 minutes to complete it. Points are allocated proportionally to the time allocations.

**Part I: Multiple Choice (21 minutes, 3 minutes each)**

1. If prices are perfectly flexible, then a 10 percent increase in the money supply will
   **a. increase the price level by 10 percent.**
   b. increase income by 10 percent.
   c. increase the interest rate by 10 percent.
   d. increase the demand for real balances by 10 percent.
   e. none of the above.

2. With freely floating exchange rates, a higher degree of international capital mobility implies
   a. there will be large appreciations following monetary expansion.
   b. money comes into the country faster following fiscal expansion to augment the expansion in income.
   **c. the exchange rate will adjust to discourage net exports following a fiscal expansion.**
   d. fiscal expansion may lead to a balance of payments surplus.
   e. none of the above.

3. The term “sterilization” refers to
   a. central bank actions to nullify fiscal policy measures.
   **b. central bank actions that prevent foreign exchange reserve changes from altering the monetary base.**
   c. making sure nothing ever happens in the economy.
   d. all of the above.
   e. none of the above.

4. Along the BP schedule (with imperfect capital mobility), higher income leads to
   a. a trade surplus, a higher interest rate and a capital inflow which leaves the overall balance of payments above zero.
   **b. a larger trade deficit (or smaller surplus), a higher interest rate and a capital inflow which leaves the overall balance of payments at zero.**
   c. a trade surplus, a lower interest rate and a capital outflow which leaves the overall balance of payments at zero.
   d. a trade deficit, a higher interest rate and a capital inflow which leaves the overall balance of payments below zero.
   e. none of the above.
5. Uncovered interest parity
   a. implies that expected returns expressed in a common currency are equalized.
   b. means that interest rates are equalized.
   c. implies that actual depreciation equals the interest differential.
   d. will not typically hold if agents are risk averse.
   e. both (a) and (d) above.

6. Covered interest parity
   a. might hold even if uncovered interest parity doesn’t hold.
   b. always holds.
   c. is holding if the interest differential equals the forward discount, which is the percentage gap between the forward rate and the spot exchange rate.
   d. is the same as uncovered interest parity.
   e. both (a) and (c) above.

7. Purchasing power parity may fail to hold because of the presence of
   a. tariffs and transportation costs.
   b. imperfect information, contracts and momentum in consumer buying habits.
   c. permanent shifts in the terms of trade between traded goods.
   d. non-traded goods and services in price indices.
   e. all of the above.

Part II: Short Answer (39 minutes)

1. Mundell-Fleming model under floating rates. Suppose you are given a standard IS-LM-BP model under floating exchange rates:
1.1 (5 minutes) Suppose the interest rate in the rest of the world exogenously falls. Show what happens both immediately and over time. Clearly label new equilibrium values of output and interest rates, and indicate curve shifts with arrows.

The answer to this question is inverse of the example in textbook chapter on flexible exchange rate regimes. If the rest of the world’s interest rate, \( \bar{i} \), should fall, the initial effect can be discerned by examining the BP=0 schedule. Notice that \( \bar{i} \) enters in one-for-one in the determination of the interest rate that equilibrates the balance of payments.

\[
i = -\left(\frac{1}{K}\right)\left[(\hat{E}\hat{X}\hat{P} - \hat{I}\hat{M}\hat{P} + \hat{K}\hat{A}) + (n + v)q\right] + \bar{i} + \left(\frac{m}{K}\right)Y
\]

So to determine how far the BP = 0 line shifts, take the total differential,

\[
\Delta i = -\left(\frac{1}{K}\right)\left[(\Delta \hat{E}\hat{X}\hat{P} - \Delta \hat{I}\hat{M}\hat{P} + \Delta \hat{K}\hat{A}) + (n + v)\Delta q\right] + \Delta \bar{i} + \left(\frac{m}{K}\right)\Delta Y
\]

and set \( \Delta Y = 0 \) (as well as the other autonomous components, as well as holding \( q \) constant).

\( \Delta i = \Delta \bar{i} \) (this is extent of the first shift in the BP=0 curve)

For a RoW interest rate shock, see Figure 1, below, which depicts the outcome in the high capital mobility case.

\[\text{Figure 1: Exogenous increase in RoW interest rate under floating exchange rates, high capital mobility}\]

BP=0 shifts down point for point (dark arrow) resulting in the interest rate equilibrating the external account \((\hat{i}_{BP=0}|Y_0)\) being lower than equilibrium \((i_0)\). The home currency appreciates shifting in the IS curve, and shifting up the BP=0 curve again (light gray arrows), until equilibrium is re-established at \(i_1\) and \(Y_1\).
1.2. (5 minutes) Discuss what happens economically, to the composition of output by the end when the new equilibrium has been achieved. What happens to the trade balance?

The interest rate consistent with external balance drops as described above, so the currency appreciates. This induces expenditure switching that shifts in the IS curve, and up the BP=0 curve.

Since interest rates are lower, then investment is higher. The trade balance is likely lower, given that investment is higher, and the real exchange rate is appreciated. There is some ambiguity since income is lower so imports are lower. (Analytically, the answer depends on whether the expenditure switching effect outweighs the income reduction effect.)

Notice that in the end home interest rates fall in response to RoW interest rate increases, although not one-for-one.

1.3. (5 minutes) Show what happens, both immediately and over time, if the central bank wishes to keep the exchange rate constant against the rest-of-the-world. Use a graph. Explain the economics of your answer.

In the absence of countervailing policy, the downward shift in the BP=0 (dark gray arrow) interest rate \(i_0\) would exceed that consistent with external balance, so capital would flow in (or less capital would flow out), resulting in an appreciation of the currency, as in 1.1. If the central bank increases the money supply to shift out the LM curve outward (light arrow), then it could re-establish equilibrium at \(i_2\) and \(Y_2\), with the exchange rate unchanged (because the interest rate would be consistent with that of external balance). The lower interest rate would result in a higher level of investment and hence aggregate demand.
2. **Mundell-Fleming under fixed exchange rates.** Now consider an IS-LM-BP=0 model.

2.1 (5 minutes) Starting from equilibrium, show what happens to output and interest rates in the short term when the real exchange rate is devalued. Assume sterilization.

Output and interest rate start at $Y_0$ and $i_0$. Notice that $q$ enters into the BP=0 equation and in the IS equation; hence a devaluation would shift both curves (gray arrows). The new resulting equilibrium is $Y_1$, $i_1$. At this new equilibrium, the interest rate is higher than the interest rate that equilibrates the external accounts ($i_{BP|Y_1}$). Since $BP > 0$, then foreign exchange reserves increase. With sterilization operations by the central bank, bonds are sold to the public to keep the money base constant, so the LM stays in place.

2.2 (5 minutes) Show what happens to output and interest rates in the short and longer term if the exchange rate is devalued, but the central bank does not sterilize financial capital flows.

Output and interest rate start at $Y_0$ and $i_0$. Notice that $q$ enters into the BP=0 equation and in the IS equation; hence a devaluation would shift both curves (gray arrows). The new resulting equilibrium is $Y_1$, $i_1$. At this new equilibrium, the interest rate is higher than the interest rate that equilibrates the external accounts ($i_{BP|Y_1}$). Since $BP > 0$, then foreign exchange reserves increase. Without sterilization operations by the central bank, the increase in foreign exchange reserves results in increases in money base. That means (with constant link between money base and money supply) the money supply increases shifting out the LM curves (white arrows).

In the end, the output level rises to $Y_2$ and interest rate falls to $i_2$. 
3. Exchange rate determination.
3.1 (5 minutes) Suppose exchange rates are given (in a flex-price model) by:
\[ s = \left( \frac{1}{1+\lambda} \right) \hat{M}_t + \left( \frac{\lambda}{1+\lambda} \right) s^e_{t+1} \]
Where \( \hat{M}_t = (m_t - m^*_t) - \varphi(y_t - y^*_t) \)
Solve for the current exchange rate as a function future fundamentals.

Iterate the expression for \( s \) by one period:

(1) \[ s^e_{t+1} = \left( \frac{1}{1+\lambda} \right) \hat{M}_t + \left( \frac{\lambda}{1+\lambda} \right) s^e_{t+2} \]

substituting equation (10) into (9) yields:

(2) \[ s_t = \left( \frac{1}{1+\lambda} \right) \hat{M}_t + \left( \frac{\lambda}{1+\lambda} \right) s^e_{t+1} + \left( \frac{1}{1+\lambda} \right) \left( \frac{\lambda}{1+\lambda} \right) s^e_{t+2} \]

but consider:

(3) \[ s^e_{t+3} = \left( \frac{1}{1+\lambda} \right) \hat{M}_{t+2} + \left( \frac{\lambda}{1+\lambda} \right) s^e_{t+3} \]

Substituting into

(4): \[ s_t = \left( \frac{1}{1+\lambda} \right) \hat{M}_t + \left( \frac{\lambda}{1+\lambda} \right) \hat{M}_{t+1} + \left( \frac{1}{1+\lambda} \right) \left( \frac{\lambda}{1+\lambda} \right) \hat{M}_{t+2} + \left( \frac{1}{1+\lambda} \right) \left( \frac{\lambda}{1+\lambda} \right) \left( \frac{\lambda}{1+\lambda} \right) s^e_{t+3} \]

So that by substituting iteratively (and assuming no bubbles), one obtains:
\[ s_t = \left( \frac{1}{1 + \lambda} \right) \sum_{\tau=0}^{\infty} \left( \frac{\lambda}{1 + \lambda} \right)^\tau \hat{M}_{t+\tau} \]

Or...

\[ s_t = \left( \frac{1}{1 + \lambda} \right) \times \left[ \hat{M}_t \right] + \left( \frac{\lambda}{1 + \lambda} \right) \times \left[ \hat{M}_{t+1} \right] + \left( \frac{\lambda}{1 + \lambda} \right)^2 \times \left[ \hat{M}_{t+2} \right] + \left( \frac{\lambda}{1 + \lambda} \right)^3 \times \left[ \hat{M}_{t+3} \right] \ldots \]

3.2 (5 minutes) Suppose prices are sticky, but any gap between the current price level and the long run price level is halved in each period. When the US interest rate rises 1 percentage point relative to the euro interest rate, and the inflation rates stay unchanged, what happens to the nominal dollar/euro exchange instantaneously? For your reference, the exchange rate equation is:

\[ s_t = (m_t - m_t^*) - \varphi(y_t - y_t^*) - (1/\theta)(i_t - i_t^*) + \left( \lambda + \frac{1}{\theta} \right)(\pi_{t+1} - \pi_{t+1}^*) \]

In the sticky price model, movements in interest rates are detached from movements in inflation rates; i.e., real interest rates are non-constant. A one percentage point increase in the US rate induces a $1/\theta$ appreciation of the US dollar.

3.3 (4 minutes) If the US inflation rate rises by 1 percentage point relative to the euro area rate, what instantaneously happens to the nominal dollar euro exchange rate?

In the sticky price model, a one percentage point increase in the US inflation rate relative to the euro area induces a $(\lambda + 1/\theta)$ percentage point depreciation of the US dollar.

Credit was given if one used relative PPP to answer the question, despite the fact that "instantaneous" was a hint that the sticky price model should be used.