Answers - Problem Set 5 (extra credit)

1. The Current Account Balance measures the difference between exports and imports (including goods and services, net investment income and unilateral transfers). A deficit signifies that imports exceed exports and means that there is net foreign borrowing by domestic residents; a surplus indicates net foreign lending. As an identity:

\[ X - M = Y - (C + I + G) = S^p + (T - G) - I \]

where symbols were defined in class. In particular, a balance of trade surplus (deficit) indicates that domestic saving (the sum of private saving \( S^p \) and government saving \( T - G \)) exceeds (is less than) investment.

a) A Current Account deficit is neither bad nor good, per se. As noted above, a deficit implies low current savings or high current investment, and hence borrowing. What it does mean is that Net Foreign Indebtedness will increase, and this debt will (probably) have to be repaid in the future. However, sometimes it makes sense to borrow against future income - for example, a poor country that knows its oil revenue will increase in the future due to current exploration or, by analogy, a college student who knows her (his) income will increase in future years. Furthermore, if the current borrowing is used to increase investment and if this investment has a higher return than the interest rate on the borrowing, then both current and future consumption could be increased. Thus, the issue is not whether there is a deficit, but whether the funds are being "wisely" spent.

b) A US Current Account deficit occurs, as an identity, when US absorption \( (C + I + G) \) is high relative to income, or savings \( S^p + (T - G) \) is low relative to investment. Policies that would help reduce the deficit include policies that would increase income or lower spending; (or increase saving or reduce investment). However, that does not mean these policies are good simply because of to their effect on the current account. For example, if income can be increased (there is unemployment), that should be done regardless of the Current Account deficit. And these policies interact - e.g., a policy that reduces investment (an investment tax) may also reduce income.

c) It is true that Congress has passed laws which would impose tariffs on goods from countries that run large current account surpluses with the US; these laws would come in force if the US deficit exceeded a certain threshold. The question is: what would such tariffs accomplish? They certainly would reduce imports but - from the Current Account identity - the deficit can only decrease if the tariffs lead to reduced US spending or higher income. If there were large unemployment, then possibly the tariffs would redirect spending to domestic goods and increase employment and income (assuming foreigners do not retaliate). However, if the country is near full employment, then the only way the tariff can reduce the deficit is if it reduces domestic spending. There is little reason to expect it to accomplish that.

The above discussion is with respect to across the board tariffs. Raising tariffs on one country is likely to be even less effective in decreasing the overall deficit as imports will just come from other foreign suppliers. Thus, the increased tariff on imports from Japan could reduce our deficit with Japan but would almost surely increase our deficit with other countries and have little impact on the overall deficit.
2. The following Table lists some (current) exchange rates. Answer all questions as if there were no arbitrage costs.

<table>
<thead>
<tr>
<th>Currency</th>
<th>Exchange Rate (as US$ per foreign currency, except for Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada (dollar)</td>
<td>$.749/Can$</td>
</tr>
<tr>
<td>Euro</td>
<td>$1.193/Euro</td>
</tr>
<tr>
<td>180-day forward rate</td>
<td>$1.181/Euro</td>
</tr>
<tr>
<td>British Pound</td>
<td>$1.818/£</td>
</tr>
<tr>
<td>Japanese Yen</td>
<td>106.9¥/$</td>
</tr>
<tr>
<td>180-day forward rate</td>
<td>105.8¥/$</td>
</tr>
</tbody>
</table>

a) The spot rate of the Yen in terms of the British pound can be determined as follows: determine how many yen per US dollar, how many US $ per British pound and multiply:

From the table: (106.9¥/$)x($1.81/£) = 193.49¥/£

b) The semi-annual US interest rate is 1.5%; since the forward rate of the Euro is below the spot rates, you will require a higher interest rate on Euro assets to be willing to hold them. From the formula in class:

\[ R_{us} = R_{uk} + \left( \left( E^{f} - E^{s}\right)/E^{s}\right) \rightarrow .015 = R_{uk} + \left( -.012/1.193\right) = R_{uk} - .01 \rightarrow R_{uk} = .015 + .01 = .025 \text{ or } R_{uk} = 2.5\% \text{ (semi-annual interest rate).} \]

The forward rate on the yen is at a premium compared to the spot rate (i.e., the yen increases in value) so Japanese interest rates should be lower than US rates. Thus:

\[ \left( \left( E_{S/Y}^{f} - E_{S/Y}^{s}\right)/E_{S/Y}^{s}\right) \cdot 100 \cong 1.03 \text{, so: } R^{f} = 1.50 - 1.03 = 0.47\% \text{.} \]

c) Suppose your research department forecasts that, in 180 days, the spot price of the Euro will $1.25. On the basis of this information, you buy 1 million Euro forward.

i. If your research department is correct, you will make $.069 per Euro, or $69,000 from this speculative purchase.

ii. If enough people have the same beliefs (or your forward purchases of the euro are large enough), this will cause the forward rate of the Euro to appreciate. As a result of this appreciation in the forward rate, through covered interest arbitrage people will wish to buy Euros spot, or will increase investment in Euro interest bearing assets (decrease holdings of $ interest-bearing assets). Consequently, one of the following must happen: US interest rates increase, Euro interest rates decrease, and/or the spot Euro appreciates. Further, movements in either interest rate (as indicated) will cause the spot Euro to appreciate (unless the European Central Bank (ECB) increases the money supply). Hence, speculation (beliefs) on forward rates will affect spot rates.

3. Use the covered interest arbitrage relationship to explain how the following are likely to affect the spot $/Euro rate. In answering, explain your reasoning (and, in particular, what variables you are holding fixed):
a) An increase in US interest rates: to know exactly what happens, you need to know why US interest rates increased. However, through the covered interest arbitrage relationship, we must have: Euro interest rates increase, the forward Euro appreciates or the spot Euro depreciates. Thus, if we take as given the forward exchange rate and Euro interest rates, the spot rate of the Euro will depreciate. {It is key in all of these to specify what is fixed; not part of the question, but behind the scenes, is the issue of why, for example, US interest rates increased. A consistent explanation here would be a temporary decrease in the US money supply or a change in expectations that led to a appreciation in the forward Euro}. 

b) A change in the forward rate affects the covered interest arbitrage relationship. Thus, if people expect a (future) depreciation of the dollar against the Euro, that will lead to a depreciation of the dollar (appreciation of the Euro) in the forward market, thereby leading to either a spot depreciation of the dollar (appreciation of the Euro) and/or higher US interest rates (or lower Euro interest rates).

c) A decrease in Euro interest rates will work similarly to part (a): US interest rates must decrease, or else US assets look more attractive (in the short run). So, if US interest rates do not decrease, people will sell Euros for $, causing a spot Euro depreciation (and, with covering, potentially a forward Euro depreciation). But to know what happens we need to know what precipitated the decline in Euro interest rates; a consistent explanation would be a temporary increase in the Euro money supply.

4. The “Monetary Theory of Exchange Rate Determination” is the principal theory used to understand how exogenous events are likely to affect exchange rates. In applying the theory, a distinction is made between the “short-run”, when goods prices are held fixed, and the “long run”, when goods prices are assumed to change. A distinction is also made between “temporary” and “permanent” changes in exogenous variables. Use the theory to explain how the following events are likely to effect the $/Euro exchange rate.

a) A temporary decrease in the U.S. money supply. Since the decrease is assumed temporary, it will have no long run effects, and thus no impact on the forward rate. Thus, given goods prices in the short run, US interest rates have to rise to clear the money market. The increase in US interest rates makes US securities more attractive, and thus causes a spot appreciation of the dollar. By assumption, there are no long run effects.

b) A permanent increase in U.S. real income will increase the demand for U.S. money (currency). To figure out the short run effects, it is first necessary to determine the long run effects. In the long run, since the system is stationary, the spot and forward exchange rates must be the same (there is no continual monetary or income growth), and hence the US interest rate must equal the Euro interest rate. Hence, assuming Euro interest rates are unaffected, then the U.S. interest rate (in the long run) must also be unaffected by the increase in U.S. real income. Turning to the money market, since the increase in income increases the demand for money, and since interest rates and money supply (the latter by assumption) are unchanged, that means real money balances must increase to match the increased demand for money. The only way this can happen is through a fall in the nominal price level. Finally, assuming purchasing power parity (so the real exchange rate is unchanged), the fall in the U.S. nominal price level is matched by an appreciation of the U.S. dollar against the Euro (to maintain purchasing power parity). To summarize, in the long run: U.S. nominal prices fall, U.S. dollar appreciates, U.S. interest rates are unchanged.
How does the short run impact differ? Since the nominal price level is given, and the money supply does not change, the increased demand for real money balances has to be met by a (temporary) increase in U.S. interest rates. Given Euro interest rates and given the amount of appreciation of the dollar in the forward market (as determined by the long run analysis above), then covered interest arbitrage implies that the dollar must appreciate even more in the short run than in the long run. Hence, there is overshooting in the exchange rate: the increase in U.S. income causes both a short-run and long-run appreciation of the dollar, but the short-run appreciation is larger than the long-run appreciation.

c) An increase in the rate of monetary growth in the US from 3% to 6%. By money neutrality, assuming no change in real income growth, the increase in the US money supply growth rate from 3% to 6% will lead to a 3% increase in the inflation rate in the US. Assuming, for simplicity, the Euro/$ rate had been stable prior to this increase in the US monetary growth rate, this implies the Euro will appreciate by 3% per year against the dollar to maintain purchasing power parity. Assuming the forward rate matches the future spot rate (because of rational expectations), covered interest arbitrage implies the U.S. nominal interest rate must increase by 3% (this also maintains U.S. real interest rates unchanged, and presumably equal to European real interest rates if p.p.p. holds). Finally, the increase in nominal interest rates in the US – which occurs immediately, leads to an immediate depreciation of the dollar, followed by a continuing 3% per year depreciation rate. Since prices adjust immediately (in this model), and purchasing power parity holds, the immediate depreciation of the dollar leads to an immediate jump in the U.S. price level (even though the money supply is unchanged at the instant the new monetary policy is introduced). Thus, in summary, the increase in the monetary growth rate leads to an immediate depreciation of the dollar (even before the money supply has actually changed) and an immediate increase in dollar prices and the US nominal interest rate, followed by a continuing depreciation of the dollar (to match the money supply growth rate). The results come from the following formulas:

\[ M^{eu} = P^{eu} \cdot L^{eu} \left( Y^{eu}, i^{eu} \right); \quad M^{us} = P^{us} \cdot L^{us} \left( Y^{us}, i^{us} \right); \quad i^{us} = i^{eu} + \left( \frac{e^f - e^s}{e^s} \right) \]

where:

- \( e^f \) is the forward rate (\$/Euro),
- \( e^s \) is the spot rate and
- \( i^x \) is the nominal interest rate (in country \( x \)).

Using purchasing power parity: \( P^{us} = e_{$/Euro} \cdot P^{eu} \) we have:

\[ \frac{M^{us}}{M^{eu}} = \left( \frac{P^{us}}{P^{eu}} \right) \left( \frac{L^{us} \left( Y^{us}, i^{us} \right)}{L^{eu} \left( Y^{eu}, i^{eu} \right)} \right) = e_{$/Euro} \left( \frac{L^{us} \left( Y^{us}, i^{us} \right)}{L^{eu} \left( Y^{eu}, i^{eu} \right)} \right) \]

Thus, if the US money supply growth rate increases by 3%, the (continual) depreciation of the dollar will have to increase by 3% (i.e., in a steady state equilibrium, with no real income growth: \( \Delta e/e = \left( \Delta M^{us}/M^{us} \right) - \left( \Delta M^{eu}/M^{eu} \right) \)). By covered interest arbitrage, that means the 3% increase in US monetary growth rates (causing the change in forward rates) increases US long-term nominal rates by 3%. Finally by the exchange rate determination equation, the higher nominal US interest rates (due to the increased monetary growth rate in the US) lead to an immediate depreciation of the dollar (even though money supplies have not yet changed) and hence an immediate jump in US prices (in dollars).

d) A revised forecast in April 2003 indicating higher European income levels for 2005 and thereafter than previously believed. From the exchange rate determination equation given in
part (c), we know that, *ceteris paribus*, higher European income levels will increase the
demand for Euros and thus cause the Euro to appreciate (dollar to depreciate) in 2005.
Hence, if people believe this forecast for 2005, they will expect the $ to depreciate in 2005 -
meaning the current forward rate of the $ will depreciate. Through covered interest arbitrage,
this will make US securities look less attractive (compared to foreign securities), meaning
U.S. interest rates will rise or the spot rate of the $ will depreciate (both will happen: the
increase in US interest rates causes the spot depreciation). Thus, in this case higher U.S.
interest rates are associated will a weaker (depreciating) dollar. On the other hand, for
example, a temporary decrease in the U.S. money supply will cause higher interest rates and a
(temporary) appreciation of the dollar. Thus, you cannot say that higher interest rates lead to
an appreciation (or depreciation) of the dollar because interest rates, like exchange rates, are
endogenous - determined by supply and demand. You have to explain why interest rates
change in order to predict how the exchange rate will change (note the difference in the two
examples cited). Also note that the current exchange rate depends on current income and
money supplies, and *current forecasts of future income levels and money supplies.*

5. Using the aggregate demand-aggregate supply model of Chapter 16:

a) Show how a permanent increase in the money supply affects the exchange rate and income levels
in the short run and in the long run.

The key here is identifying what variables can change, and what are fixed, in each “time period”.
*By assumption*, in the short run prices are fixed, but real income levels can change; in the long
run, prices may adjust, but real income will equal its full employment level (and thus is not
affected by policy).

*Working backward*, in the long run prices and the exchange rate will “increase” (depreciate) in
proportion to the money supply increase, but income levels and interest rates will not change.

Thus, for the **long run**:

$$\frac{\Delta P}{P} = \frac{\Delta E}{E} = \frac{\Delta M}{M}$$

In the short run, prices are fixed; thus, interest rates must change (decrease) to absorb the
additional money supply. In addition, the forward exchange rate depreciates; thus, the spot
exchange rate must depreciate, and **by more** than in the long run (because of the temporary
decrease in the interest rate due to the price rigidity). The lower interest rate (in the short run)
and depreciation of the currency (implying a short run depreciation of the real exchange rate)
increases the demand for domestic goods, implying that the money supply increase temporarily
increases income.
In the figure above, \( K \) represents the original equilibrium, and \( Y^* \) represents the equilibrium (full employment) level of income. **Given prices**, the money expansion shifts the money market curve (AA) out to (A’A’), reflecting the short run depreciation of the currency. **Given prices**, this depreciation makes domestic goods relatively cheaper, and leads to higher income in the short run. The point \( L \) marks the short run impact of the monetary expansion.

Over time, **prices of goods increase**: this shifts the \( A’A’ \) curve downward, to \( A^*A^* \) (since higher prices reduce real money balances) and shifts the aggregate demand curve \( DD \) upward to \( D^*D^* \) as, given the exchange rate, higher prices reduce demand for domestic goods (through the current account). Thus, in adjusting to the long run equilibrium, the exchange rate appreciates and income declines (relative to the short run effect); the long run equilibrium is at \( M \). The dotted line from \( L \) to \( M \) shows this adjustment, and reflects the “overshooting” phenomenon discussed in Chapter 14.

b) Show how a temporary increase in government spending affects the exchange rate and income level in the short run. What is the short run effect of a permanent increase in government spending? Why?

Again, the distinction between short run and long run depends on whether prices (or income) are held fixed, whereas the distinction between temporary and permanent depends on whether the forward exchange rate changes (which is crucial in determining how the spot rate and interest rates change).

**With a temporary increase**, the forward exchange rate does not change. The increased fiscal spending increases demand and hence leads to an appreciation of the real exchange rate; since prices are fixed, this must come about due to a spot appreciation of the nominal exchange rate \( (E) \). In the money market, the spot appreciation, coupled with an unchanged future exchange rate, means domestic interest rates rise (as they must so that money demand accommodates the increased income levels). This is all shown in the diagram below; the AA curve **does not shift** (since prices, money supply and the forward exchange rate are all fixed), while the DD curve...
shifts down due to the fiscal expansion; the equilibrium temporarily moves from $L$ to $M$. The temporary policy leads to a (temporary) increase in income and appreciation of the exchange rate.

Finally, a **permanent** increase in fiscal policy will cause a permanent increase in the real exchange rate. In the long run, real income will be unchanged (by the assumption of full employment) and the nominal interest rate will be unchanged (since, in the long run, spot and forward exchange rates will be equal). But, from money market equilibrium, this implies that the long run domestic price level **will not change** from its current level (otherwise real money balances would change, which would be inconsistent with money market equilibrium). **Thus, the long run impact** of the permanent fiscal expansion is to lead to an appreciation of the nominal (and real) exchange rate, but no change in the price level or in income levels. But since price levels do not change, the short run and long run impacts are identical! **Permanent fiscal policy has no impact on equilibrium income, even in the short run.**

This result can be represented in a diagram like that above; the only difference is, since the forward rate appreciates, the $AA$ curve shifts down (to $A'A'$). And since the short run and long run are the same, the new equilibrium income must be the same as the old equilibrium. Hence, in the diagram, the equilibrium jumps immediately from $L$ to $N$. 