

PROBLEM SET 1  
 (Solutions)

Questions 1-3. Answer True, False, or Uncertain. Briefly explain your answer. No credit without explanation (5 points each).

1. Higher domestic interest rates lead to an appreciation of the domestic currency.

UNCERTAIN. *It depends on why the nominal interest rate increases. If the nominal rate is rising because the expected real rate is rising, then the domestic currency would be expected to appreciate. However, if the nominal interest rate is rising due to higher expected inflation, then one would expect the domestic currency to depreciate.*

2. If a country saves more than it invests then it will have a current account deficit.

FALSE. *In class, I showed  $CA = S - I$ . If a country saves more than it invests, then the excess saving flows abroad, and the domestic economy lends to foreigners, i.e., it runs a current account surplus.*

3. If markets are efficient, then real interest rates should be the same in all countries.

UNCERTAIN/FALSE. *This is true if both PPP and UIP hold. PPP implies  $(E^e - E)/E = \pi - \pi^*$ . UIP implies  $(E^e - E)/E = R - R^*$ . Therefore,  $R - R^* = \pi - \pi^*$ . Finally, from the Fisher equation,  $R = r^e + \pi$  and  $R^* = r^{*e} + \pi^*$  Combining these we get*

$$r^e = r^{*e}$$

*So that expected real interest rates are the same. However, if PPP does not hold, perhaps due to Balassa-Samuelson effects, then this argument does not go through, and there is no guarantee that expected real interest rates are equalized (even in frictionless, efficient, markets). From our general expression for the nominal exchange rate in Chpt 15, we know*

$$\frac{E^e - E}{E} = \frac{q^e - q}{q} + \pi - \pi^*$$

*Therefore,*

$$r^e = r^{*e} + \frac{q^e - q}{q}$$

*This is called ‘Real Interest Parity’. So, for example, if a country has a depreciating real exchange rate, we would expect its real interest rates to be relatively high. This discrepancy does not create any incentives for capital flows, because investors in different countries are evaluating real returns differently, due to the changes in the relative prices of goods in different countries. In fact, for any given investor, real returns are the same everywhere. (Sounds like the theory of relativity, no?)*

The following questions are short answer. 15 points each.

4. Suppose the 12-month forward price of the euro in terms of dollars is 1.2 dollars per euro. Suppose the spot price of the euro in terms of dollars is 1.1. Next, suppose that currently the annual interest rate on dollar deposits is 8%, while the interest rate on a comparable euro deposit is 5%. There are no transaction costs. Is there an arbitrage opportunity here? If so, explain exactly how you would take advantage of this situation to make riskless profits.

*Superficially, one might think that since interest rates are higher in the U.S., one should borrow euros and invest in dollars. However, this naive strategy ignores the fact that dollars are expected to depreciate relative to the euro. In fact, given the current spot and forward rates, the dollar is trading at approximately a 9% discount, i.e.  $F/S \approx 1.09$ . This means that the covered dollar return on the euro investment is approximately 14%. (i.e.,  $1.05 \times 1.09$ ). Consequently, one could make arbitrage profits by borrowing dollars and simultaneously lending euro. For each 100 dollars you borrow you must pay back 8 dollars in interest. However, if you use the dollars to buy euro, invest the euro at 5 percent, and then sell the proceeds forward, you will get back (approximately) 14 dollars in interest. That's a 6 dollar net, riskless profit! It may not sound like a big deal, but suppose instead you borrow 1 million dollars. Then your profit becomes \$60,000. Not bad for a few seconds worth of work!*

5. Consider a two-period economy that has at the beginning of period 1 a net foreign asset position of -100. In period 1, the country runs a current account deficit of 5 percent of GDP, where GDP in both periods is 120. Assume the interest rate is constant at 10 percent.

(a) Calculate the trade balance in period 1, the current account balance in period 1, and the country's net foreign asset position at the beginning of period 2.

*To answer this part of the question, you just need to know that the current account (CA) and trade balance (TB) are related as follows*

$$CA_1 = TB_1 + rB_1$$

*where  $B_1$  is the net foreign asset position at the beginning of period 1. So, for example, if  $B_1 < 0$ , meaning that the country is currently a net borrower/debtor, then the current account deficit will exceed the trade balance deficit. In fact, it is even possible for a country to have a trade surplus and at the same time have a current account deficit. (This has often been the case in Canada). Now, it is obviously the case that  $CA_1 = -6$ , since  $120 \times .05 = 6$ . Also, given that  $B_1 = -100$  and  $r = .10$ , one can use the above equation to compute  $TB_1 = 4$  (i.e., the country runs a trade surplus of 4). Finally, another way to think about the current account is that it represents the change in a country's net foreign asset position, i.e., if  $CA > 0$  then the country is adding to its net asset position, or alternatively, reducing its net debt position. That is, we have*

$$CA_1 = B_2 - B_1$$

*Using our previous results, this tells us that  $B_2 = -106$ .*

(b) Is the country living beyond its means? To answer this, calculate the country's current account balance in period 2 and the associated period 2 trade balance. Is the required trade balance feasible? (Hint: Remember, the trade balance cannot exceed GDP!).

*The key to answering this part of the question is to realize that with only 2 periods, it must be the case that  $B_3 = 0$ . You are not allowed to die in debt! There's no uncertainty here, so no lender is going to allow you to die in debt. Of course, it's possible that  $B_3 > 0$ , but this would be tantamount to throwing money away, since you would be letting someone else die while they*

owe you money! Since we already know  $B_2 = -106$  we can easily compute the required period 2 current account

$$CA_2 = B_3 - B_2 = 0 - (-106) = 106$$

That is, the country must run a current account surplus of 106 in order to pay off its debt. From this, we can then use our earlier current account expression to infer what the trade balance must be

$$TB_2 = CA_2 - rB_2 = 106 - .10(-106) = 116.6$$

Since  $116.6 < 120$ , it is in principle feasible for the country to run a current account deficit of 5% in period 1 (although that makes period 2 kind of painful, since nearly all of the domestic output must be shipped abroad during period 2).

(c) Now suppose that in period 1, the country runs a larger current account deficit, of 10 percent of GDP. Find the country's net foreign asset position at the end of period 1 in this case. Is the country now living beyond its means? If so, show why.

We just have to repeat the above calculations. Now we have  $CA_1 = -.1(120) = -12$ . Therefore, we now have  $TB_1 = -2$  and  $B_2 = B_1 + CA_1 = -112$ . So now the period 2 CA surplus must be 112. In this case we get

$$TB_2 = CA_2 - rB_2 = 112 - .10(-112) = 123.2$$

This is not feasible. In this sense, the country would indeed be 'living beyond its means'.

6. It is often asserted that China's exchange rate is 'undervalued', and that this gives China's exporters an unfair advantage in world markets. Given what you've learned in class so far, how would you decide whether this is true? (Hint: How would you use data to measure the extent of over- or undervaluation?)

The most common strategy for measuring over- or undervaluation is to look for deviations from Purchasing Power Parity. (An even simpler strategy would be to look for deviations from the 'law of one price', e.g., the 'Big Mac Index' discussed in class. This is not very accurate though). If China has an undervalued exchange rate then we would expect to see the U.S. dollar prices of goods in China to be lower than in the U.S. However, one must be careful when doing this, since overall price levels might differ across countries for other reasons, that do not reflect currency manipulation. From Balassa-Samuelson, we know that since China is still a relatively poor country, we might expect its currency to appear as if it is 'undervalued' relative to a rich country like the U.S. (Of course, given its rapid productivity growth, we should expect this apparent undervaluation to decrease over time). With these caveats in mind, one simple way to compute a quantitative measure to the degree of undervaluation is just to compute a percentage deviation from PPP. In fact, doing this is what gives rise to the common assertion that China's exchange rate is at least 20% undervalued.

7. It is often asserted that China imposes capital controls. Given what you've learned in class so far, how would you measure the severity of China's capital controls?

Same logic here as in the previous question, except now we look for departures from Covered Interest Parity or Uncovered Interest Parity. Deviations from Covered Interest Parity provide the cleaner test, since it is based on arbitrage, whereas UIP incorporates assumptions about expectations and risk premia, so that one might detect deviations from UIP even if capital markets are perfectly open.

8. Suppose there is a permanent reduction in the money supply. Illustrate the short-run and long-run effects on the exchange rate, interest rate, and price level (i.e., graph the time paths).

This is just the mirror image of the example discussed in the text (Chpt 14). Just stand on your head and read the book.