

Suggested Solutions to Problem Set 1

Problem 1: National income accounts

Using the national income identity we replace the known values to find the unknown variables:

$$\begin{aligned}
 Y &= C + I + G + EX - IM + NFP \\
 100 &= 70 + 40 + 20 + 20 - IM + 0 \Rightarrow \boxed{IM = 50} \\
 CA &= EX - IM + NFP \\
 CA &= 20 - 50 + 0 \Rightarrow \boxed{CA = -30}
 \end{aligned}$$

We find that imports total 50 and that there is a current account deficit of 30, that is, the country is a net borrower from the rest of the world.

In open economies, savings equals investment plus the current account balance. The savings rate is then calculated by dividing savings by output. Replacing we have,

$$\begin{aligned}
 S &= I + CA \\
 S &= 40 - 30 \\
 S &= 10 \Rightarrow \boxed{s \equiv \frac{S}{Y} = 10\%}
 \end{aligned}$$

If we breakdown savings into private and government savings and use $T=10$ we have

$$\begin{aligned}
 S^p &= Y - T - C & \Rightarrow & \quad S^p = 20 & \Rightarrow & \quad \boxed{s^p = 20\%} \\
 S^g &= T - G & \Rightarrow & \quad S^g = -10 & \Rightarrow & \quad \boxed{s^g = -10\%} \\
 S &= S^p + S^g & \Rightarrow & \quad S = 10 & \Rightarrow & \quad \boxed{s = 10\%}
 \end{aligned}$$

Problem 2: BoP transactions

Recall that every export of a good, service or asset (financial or cash) enters the balance of payments accounts with a positive sign (+), counting as a credit. Likewise, every import of a good, service, or asset (financial or cash) enters the balance of payments with a negative sign (-), counting as a debit.

- (a) Purchase of Portuguese stock: U.S. asset import – debit in the financial account.
Paying via a wire transfer from Wells Fargo to a Portuguese bank: U.S. asset export – credit in the financial account.
- (b) U.S. company earnings abroad that are not repatriated are credited to the U.S. investment income account. They do not actually have to cross a border. And

firms do have to report these earnings to the U.S. government, so they are observed. They enter the current account with a positive sign, as a credit.

The purchase of the machine would enter the financial account under foreign direct investment (as a debit since it is an acquisition of an asset located abroad), because the U.S. company is expanding its foreign holdings of capital.

- (c) Car rental: U.S. service export – credit in the current account.
Purchase of claim on Australian credit card: U.S. asset import – debit in the financial account.

Problem 3: BoP identity

Yes, it is possible for a country to have a current account surplus and a balance of payments deficit. Recall that

$$CA + KA + NRFA + SD = OSB$$

where CA is the current account surplus, KA is the capital account balance, $NRFA$ is the non-reserve portion of the financial account balance, SD is the statistical discrepancy, and OSB is the official settlements balance or the balance of payments. Therefore, if a country is running a current account surplus of, say, \$100 billion but there is a non-reserve financial account deficit of \$150 billion, then the balance of payments has a \$50 billion deficit.

The situation described above could happen in a country undergoing an economic crisis accompanied by a domestic currency depreciation. On the one hand, imports tend to fall and exports tend to increase due to the currency depreciation, thus generating a surplus in the current account. On the other hand, a deficit in the non-reserve financial account is likely to occur as a consequence of a reversal in capital flows.

Problem 4: BoP accounts

- (a) Recall that the overall balance of payments must equal zero at all times (i.e., $CA + KA + (NRFA + ORT) + SD = 0$). Ignoring the capital account and the statistical discrepancy, this simplifies to $CA + NRFA = -ORT = OSB$. Thus, Kumar's official settlements balance is equal to: $OSB = CA + NRFA = -\$500 \text{ billion} + \$250 \text{ billion} = -\$250 \text{ billion}$. That is, Kumar has a official settlements balance deficit of \$250 billion.
- (b) The change in the net foreign asset position of a country is equal to the country's current account (i.e., the net amount it is saving or dis-saving). Thus, because Kumar's CA is in deficit, it is dis-saving or, equivalently, its net foreign assets are falling.
- (c) If foreign central banks are neither buying nor selling claims on Kumar, then the OSB surplus includes only transactions made by the Kumari central bank. Namely, the Kumari central bank must be selling its foreign exchange reserves (i.e., selling its holdings of foreign assets) to finance the current account deficit. So the central bank's foreign exchange reserves must fall by \$250 billion and this

shows up as a \$250 billion dollar credit in the financial account (ORT portion) or, equivalently, a deficit in the OSB or balance of payments of Kumar.

- (d) Now we are given new information a foreign central bank is buying Kumari assets. Then Kumar's foreign reserves increase by \$50 billion because the official settlements balance is now in surplus: $-\$500 \text{ billion} + \$250 \text{ billion} + \$300 \text{ billion} = \50 billion . So Kumar's balance of payments accounts are $CA = -\$500 \text{ billion}$, $KA = 0$, and FA is composed by $NRFA = \$550 \text{ billion}$ and $ORT = -\$50 \text{ billion}$.

Problem 5: Exchange rates

- (a) If you believe the Polish zloty will depreciate versus the USD, you would want to delay the payment (for example, if the exchange rate now is $1\$/1\text{zloty}$ and $1\$/1.2\text{zloty}$ 3 months from now, you prefer to exchange dollars for zloty at the latter rate). Otherwise, if you expect the zloty to appreciate, you would like to speed up the payment. If you can't change the date of payment, you can buy zloty in futures exchange markets (i.e. borrow dollars, buy zloty in exchange for these dollars and pay back the loan when you receive the payment from the German distributor; so the amount of dollars you borrow has to be such that $1 + \text{interest rate times this amount}$ is equal to \$1 million) or I can buy a put on dollars in the options markets to eliminate exchange rate uncertainty.
- (b) Because you don't know for sure whether the deal will go through, you need to use options. Because you may need to buy Kronor 3 months from now, you need to buy a call. If you expect the Kronor to depreciate though, you might not use any market hedging instrument because you prefer buying Kronor at a cheaper rate in the future.
- (c) Since China's production of asphalt employs petroleum and this is priced in US dollars, a fall in the yuan price of the dollar (yuan/\$) - that is, an appreciation of the yuan - would lower the costs of production (measured in yuan; think for example $\$50/\text{gal}$ multiplied by 5 yuan/\$ is 250 yuan, whereas $\$50/\text{gal}$ at 4 yuan/\$ is 200 yuan). To describe what happens to profits, we also need to know what happens to revenues as the currency appreciates. Assuming that China's asphalt production is priced in yuan, any change in the exchange rate would have no effect on revenues. Hence, in this case, profits would raise (revenue stays the same, costs fall). In the case where production is priced in dollars, profit would not be affected (revenues and costs rise proportionately).
- (d) When a domestic-based firm moves part of its production abroad, the foreign production costs will increase when the dollar depreciates. As the foreign production becomes relatively more expensive, firms whose costs were marginally smaller abroad will shift their production back to the US. An example of outsourcing is Mexico's maquiladoras, which are factories near the US border that assemble parts of products produced in the US. A depreciation of the exchange rate would increase the wage of Mexican workers when measured in dollars, leading firms whose assembly costs were marginally smaller in Mexico to shift their assembly lines back to the US.

Problem 6: Understanding exchange rate movements

- (a) The exchange rate is determined in the foreign exchange market, according to the dollar returns on US and European assets. The relevant graph is the two-sided diagram (see Figure 1). This diagram includes both the domestic money market and foreign exchange markets and links money, the interest rate, and the exchange rate together. In the money market, the real money supply and demand together determines the equilibrium interest rate, which is the return on dollar deposits. Similarly, the European interest rate is determined in the European money market. In the foreign exchange market, the return on US assets and the expected dollar return on euro deposits together pin down the equilibrium exchange rate.

The exogenous (given, shifter) variables that affect equilibrium exchange rates are: foreign interest rates, exchange rate expectations. You can add output here also, since we are holding it constant (for now). Note that the domestic interest rate is endogenous because it is determined in the bottom part of the diagram.

- (b) What we know today is that the Euro area interest rate is “likely” to change, that means it is just expected to go up in the future. Since it has not changed yet, the only thing we know is that the future expected exchange rate is higher. This shift in the expected exchange rate means that the exchange rate depreciates today.

A good way to answer the question is to present two foreign exchange diagrams: one for tomorrow and another for today. In the diagram for the future (when/if the European interest rate goes up), we could see that the exchange rate then will depreciate due to the increase of the Japanese interest rate. In the diagram for the forex market today, what we see is that given the change in expected future exchange rate, the exchange rate today will depreciate (see Figure 2).

- (c) The theory we learned in the class suggests that exchange rates should not be completely impossible to predict. According to the interest rate parity condition, interest rate differentials should give an indication of how much currency depreciation to expect. In practice, however, empirical evidence on the UIP shows that it is notoriously difficult to predict exchange rate. Firstly, the exchange rates behave just like an asset price. They response strongly to “news,” that is, to unexpected economic and political events, therefore they are very hard to forecast. Secondly, unexpected or surprise currency movements are much greater than interest rate differences and swamp the predictable movements in exchange rates. Therefore in the short run, it’s hard to predict the exchange rates. As for the long run, forecasts based on economic models seem to be most successful when used for long run predictions, that is, predictions of the exchange rates years ahead. Besides, the theory of exchange rate overshooting could help us to reconcile volatile currency movements with rational behavior of foreign-exchange markets. Because of price rigidities, exchange rates have to move around a lot in order to maintain equilibrium in the foreign-exchange market. So conditional on expectations of events and policy moves, wild exchange-rate swings are by themselves not compelling evidence of irrational markets.

Problem 7: Interest parity transactions

- (a) In order to decide whether you should buy Kuna, you need to know the interest differential between a Croatian deposit and a USD deposit. The expected dollar return on Kuna deposits is $R_{kuna} + \text{Expected depreciation}_{\$/kuna} = 7\% + 5\% = 12\%$ (the dollar depreciates by 5% relative to the Kuna. If uncovered interest parity holds, the US interest rate must be 12%.
- (b) (i) Whenever such two quotes don't overlap, there exists an arbitrage opportunity. How to do the arbitrage? Basically we could sell dollars for Swiss francs at 1.7761 and immediately sell Swiss francs for dollars at 1.7766. By this transaction, we could pocket the difference of 0.0005 dollars for each dollar we trade. For dealer A, he would build up an inventory of dollars while his Swiss francs inventory would shrink. For dealer B, he would build up an inventory of Swiss francs while his dollar inventory would shrink. Eventually, dealer A and B would adjust their bid-ask spread to manage their portfolios, which leads to the overlap of these two quotes. If other forex traders follow our strategy, this arbitrage opportunity will disappear and there will be only one quote for USD/GBP. In other words, because of arbitrage, quotes A and B cannot coexist, they will eventually overlap.
- (ii) Uncovered Interest Parity (UIP) condition implies:
$$0.04 = 0.027 + (E^e - 1.7)/1.7 \Rightarrow E^e = 1.7221 \approx 1.72.$$
- (iii) Yes, there does exist an arbitrage opportunity. Suppose this year is period 1, next year is period 2. Then you can either:
- (1) invest \$1 at 4% to earn 1.04 in period 2, or
 - (2) convert \$1 into CHF at the current exchange rate: 1/1.7. Invest this at the CHF interest rate of 2.7% and you end up with: $(1/1.7)*1.027$. Buy USD at the forward rate for the second period (that equals the expected exchange rate) of 1.79: $(1/1.7)*1.027*1.79=1.0814$. So, you have the opportunity to make a profit of $1.0814-1.04=0.0414$ dollars for each dollar invested. Why does this work? That's because the forward rate is mis-priced, creating an arbitrage opportunity. Given the exchange rate markets move instantaneously, this arbitrage opportunity will disappear immediately if all the traders start doing the same. The forward rate should move to 1.74. (Here we assume that the current equilibrium exchange rate is unchanged, it is still 1.7).
- (c) Strategy 1: If I know I will receive 100 million won one year from now, I can borrow won now, change them in dollars at 990 won/\$, deposit the dollars in a US account and a year from now use the payment from the Korean distributor to pay back my won loan. Since I will have 100 million won, I need to borrow an amount b of won such that $b * (1 + R_{won}) = 100\text{million won}$. Solving we get $b = 95.69$ million won. At the spot rate this is \$96,656. After a year of having this amount of dollars in a US account, I get $\$96,656*1.035 = \$100,039$.

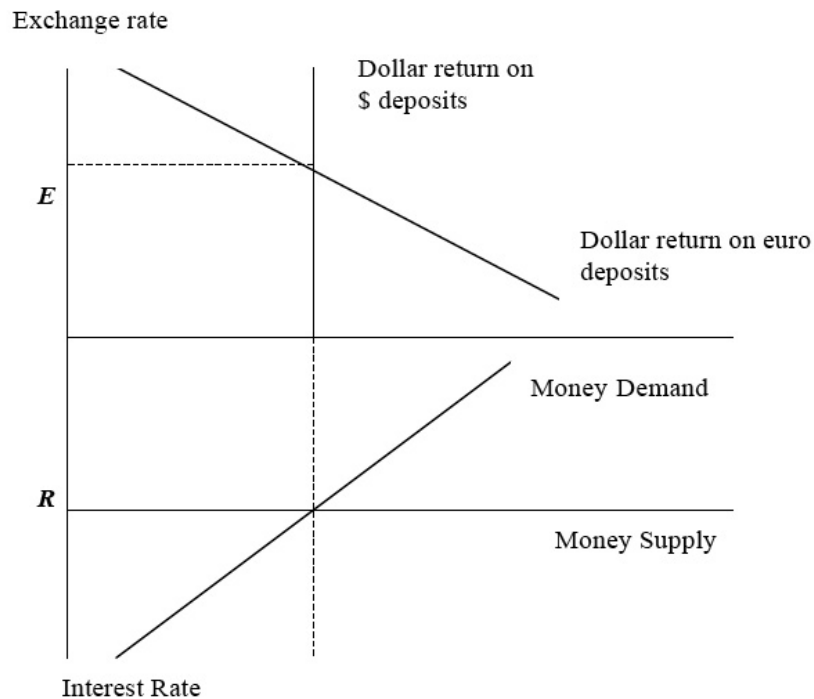
Strategy 2: An alternative is to sell won at the forward rate. This strategy would allow you to sell the 100 millions won at 1010 won/\$ one year from now. This

would give you \$99,000 which is inferior to what you can get under the arrangement described above.

Strategy 3: In this strategy you don't have to do anything, but simply accept the offer from the other Korean partner. Clearly, this offer of \$95,000 one year from now is inferior to both strategies above.

In a world with no arbitrage possibilities, you should get the same amount of USD at the end of the year whether you borrow won today and follow the strategy above or you sell won at the forward rate. In this problem the interest parity is not satisfied: $R_{\$} = 3.5\%$ and $R_{won} + Expected\ depreciation_{\$/won} = 4.5\% - 2.2\% = 6.7\%$.

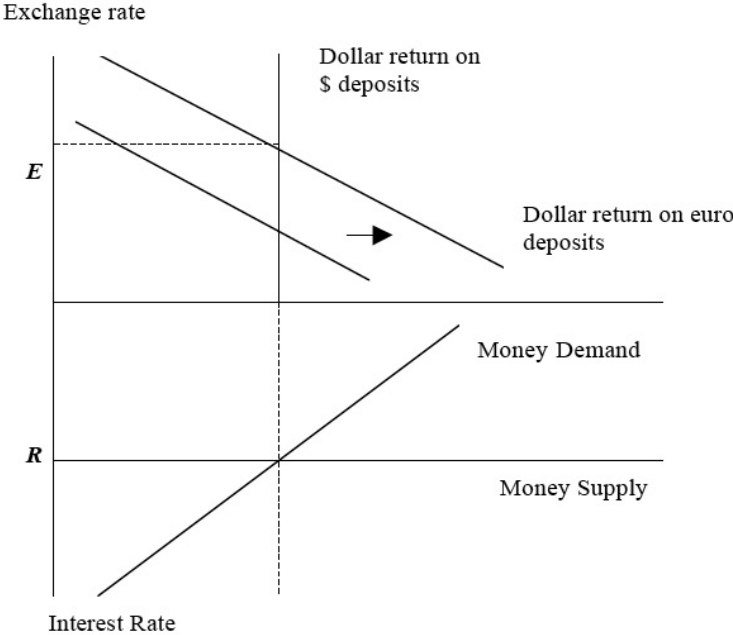
Figure 1 – Exchange Rate Determination



Notes: E is the equilibrium exchange rate and R is the equilibrium nominal US interest rate.

Figure 2 – Effects of a likely increase in the European interest rate.

a. Future – The dollar return on euro deposit schedule shifts out because the euro interest rate increases. The new equilibrium exchange rate is at E .



b. Today – The dollar return on euro deposits schedule shifts out because exchange rate expectations change (in anticipation of a future increase in the euro interest rate).

