Homework Assignment #3: Answer Key

1. *Productivity growth has increased in Central and Eastern European countries relative to Western European countries. This has implications for the real exchange rate. Let's look at the Czech Republic versus France (suppose they are the only two countries).*

    (a) *What happens to the Czech real exchange rate if the Czech Republic has a onetime increase in productivity (measured by aggregate TFP) relative to that of France?*

    brief answer The increase in relative productivity of the Czech economy means more output being produced in the Czech Republic. However, because output and, hence, income in France do not change, the demand by foreigners for domestic goods is still the same. This means that there will be an excess relative supply for Czech output at the previous real exchange rates. To eliminate this excess supply, a decrease in the price of Czech products relative to French products has to occur. This price change is a real depreciation of the Czech currency. If the nominal exchange rate is $e_{K/e}$, then: $q = \frac{eP_F}{P_C}$, a fall in $P_c \Longrightarrow \uparrow q$.

    (b) *How does the effect on the real exchange rate differ if, instead of a one-time increase in productivity, Czech productivity relative to France continues to increase for a very long time?.*

    brief answer In the case of a permanent productivity increase, there is a continued expected real depreciation of the Czech currency against the euro and a continuous decrease in prices in the Czech Republic.

2. *A robust empirical fact is that price levels for services (or more generally, nontradable goods) are generally lower in poor countries. Can you explain why this might be the case?*

    brief answer Over the long run, price levels are flexible and have completed their adjustments to equilibrium levels. Taking the hint from the problem set about how firms engaged in international trade may react to large and persistent cross-border price differentials, we can see why relative PPP holds more closely in the long run. Think of two economic regions, the US and Europe. Recall that PPP says that depreciation from time t to $t+1$ is given by $\frac{e_{t+1}-e_t}{e_t} = \pi_{US,t} - \pi_{E,t}$. Suppose in the short run, European inflation exceeds US inflation and that PPP does not hold. In the case of this inflation differential, then trading firms will face an incentive to substitute, where possible, US goods for European goods in their purchases on both sides of the Atlantic. If many firms over time behave in this way, then, all else equal, this should drive down the euro and drive up the dollar. This means that the dollar price of the euro will fall over time, leading the left side to become smaller and more negative. This brings the left side of the expression more into line with $\pi_{US,t} - \pi_{E,t}$. The same reasoning follows symmetrically if $\pi_{US,t} > \pi_{E,t}$. Thus, it is conceivable that purchases by international trading firms can

lead to more of an alignment between inflation differentials and currency depreciation in the long run.

(a) *Suppose I told you that the price of a massage in Kenya is 3195 KES (Kenyan shillings) and the price of a massage in the US is $80. Now, go on the web and look up Kenya's actual market exchange rate (http://www.centralbank.go.ke/). Using this market exchange rate, calculate the price in dollars of a massage in Kenya. Is this price higher or lower than the US price? Is this answer consistent with the Balassa-Samuelson theory?*

   brief answer The actual market exchange rate between the US and Kenya is approximately 71.9 KES/$. Then if the price of a massage in Kenya is 3,195 KES, its price in dollars (using the market exchange rate) is (approximately) $44.44. Clearly, this is lower than the US price of a massage. This is largely consistent with the Balassa-Samuelson theory of international price differences. Because the US is more productive at producing tradable goods than Kenya, we expect prices of non-traded goods (and the overall price level) to be higher in the US than in Kenya.

(b) *Again using the prices given in part (b), calculate the implied PPP exchange rate between dollars and KES. Now, suppose that the Kenyan GDP is approximately 1,200 billion KES. Calculate the value of Kenyan GDP in dollars using both the market exchange rate and the PPP exchange rate you calculated. Is the value of Kenyan GDP higher or lower when using the PPP exchange rate relative to when you use the market exchange rate? Can you explain why?*

   brief answer The implied PPP equilibrium exchange rate between the dollar and the Kenyan Schilling is $\frac{P_{US}}{P_K} = \frac{80}{3195} = .025$ dollars per KES (or, the direct quote for the KES is 40 KES per dollar). Then using the PPP exchange rate, we see that Kenyan GDP in dollars is 1200 billion KES times 0.025 dollars per KES = 30 billion dollars. If we use the market exchange rate instead, then Kenyan GDP in dollars is 1,200 billion KES times $(\frac{1}{71.9})$ dollars per KES = 16.68 billion dollars. So, Kenyan GDP in dollars is higher when we use the PPP exchange rate. This makes sense because the PPP exchange is constructed so as to make currency conversions in a way that accurately represents the purchasing power of the currency. For example, at the PPP exchange rate, someone starting with $80 in the US can pay for a massage. Converted at the PPP exchange rate, this $80 yields exactly 3195KES, which allows one to pay for a massage in Kenya as well. In general, because prices are lower in poor countries, a poor country's GDP measured in dollars using PPP exchange rates will exceed their GDP in dollars using market exchange rates to convert currencies.

3. *Suppose you expect the Croatian currency, the Kuna, to appreciate 5% relative to the USD over the next 6 months. What additional information would you need in order to decide whether it is a good time to buy Kuna?*

   brief answer In order to decide whether you should buy Kuna, you need to know the interest differential between a Croatian deposit and a USD deposit.

   (a) *Suppose you find out in the newspapers that the interest rate on Kuna deposits is 7%. What is the expected dollar return on Kuna deposits?*

brief answer The expected dollar return on Kuna deposits is $R_{kuna} + \delta_{\$k} = 7\% + 5\% = 12\%$ (where $\delta_{\$k}$ is the expected depreciation of the dollar relative to the Kuna). The dollar depreciates by 5% relative to the Kuna.

(b) *What must the US interest rate be if the uncovered interest parity condition holds?*

brief answer If uncovered interest parity holds, the US interest rate must be 12%.

4. *You are a foreign exchange trader specialized in the US dollar Swiss franc market (USD/CHF). One morning, you find the following two USD/CHF quotes: From dealer A, Quote A: $1.7750 - 1.7761$; from dealer B, quote B: $1.7766 - 1.7777$ (these are the buy price and sell price).*

(a) *Can you make money from these quotes, how and why? Explain your trade. What will happen if other forex traders decide to follow your strategy?*

brief answer 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/CHF. In other words, because of arbitrage, quotes A and B cannot coexist, they will eventually overlap.

(b) *Another morning, you notice that the one-year dollar interest rate is 4%, while the one-year interest rate on Swiss francs is 2.7%. Today's USD/CHF rate is $1.7. What spot rate do you expect for the USD/CHF in one year?*

brief answer Uncovered Interest Parity (UIP) condition implies: $0.04 = 0.027 + \frac{\widehat{e}_{t+1} - 1.7}{1.7} \implies \widehat{e}_{t+1} = 1.7221 \approx 1.72$.

(c) *You log onto your electronic brokerage account and find that the current quote for the 360-day forward rate on USD/CHF is 1.79. Is there an arbitrage opportunity? If so, describe how you would take profit from it and how much you would get if you invested $1. What do you anticipate if all of your fellow traders start doing the same?*

brief answer 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).

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5. *You are considering a contract with a Korean distributor. Under this contract you receive* 100 *million won in one year. Suppose the spot rate is* 990 *won/$, the one-year forward rate on the won is* 1010 *won/$, the US annual interest rate is* 3.5% *and the Korean annual interest rate is* 4.5%. *Further, suppose another potential Korean partner offers to pay you* $95,000 *one year from now (note that this amount is payable in dollars rather than won).*

   (a) *Which contract is more profitable for you?*

      brief answer *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 $b(1 + R_{won}) = 100$ 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.

   (b) *Is the interest rate parity condition satisfied in this problem? How can you tell? Explain.*

      brief answer 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 $R_{won} + \delta_{\$/won} = 4.5\% - 2.2\% = 6.7\%$.

6. *We can define the real exchange rate as* $Q = \frac{SP^*}{P}$, *where S is the dollar price of foreign currency and P* *is the foreign price level. Explain how would Q change if:*

   (a) *The world demand for US produced goods declined.*

      brief answer This would cause excess supply of US goods, so P would fall, and thus $Q \uparrow$. (this is the exact opposite case (1) of what is covered in part two of the current account lecture, page 15).

   (b) *US government spending increased.*

      brief answer Government spending tends to be concentrated on non-traded goods. So there is an excess demand for US output, since supply has not changed. So the price of US output must rise relative to the rest of the world, so $Q \downarrow$. The stuff the government buys must come from somewhere, so there will be less for the rest of the world to buy from the US. Our net exports must fall.

   (c) *A tsunami suddenly reduced output in the rest of the world.*

      brief answer There is now an excess supply of ROW output. So the price of ROW output must fall relative to ours, so $Q \downarrow$.

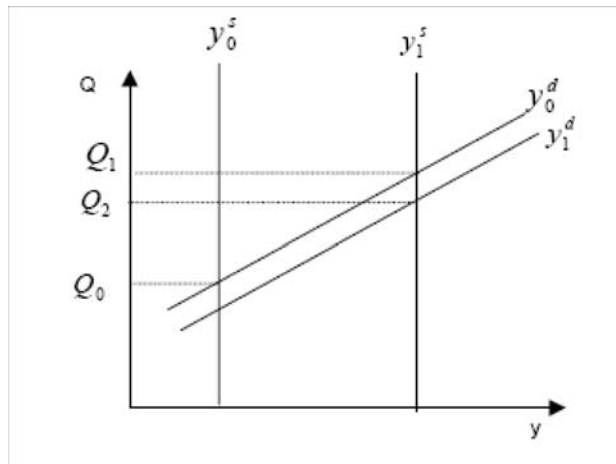   (d) *A technological shock increased US output relative to world output.*

Figure 1:

brief answer Suppose that there is a relative technological shock that increases the efficiency of US output relative to foreign output. With given stocks of capital and labor US output rises. Hence, at unchanged world demand there is an excess supply of US output. Why? This positive supply shock raises US income (wealth), but not all of the increase in income is spent on domestic goods. Some will be spent on foreign goods. Hence, the increase in the demand for US goods will be less than the supply. To restore equilibrium the relative price of US goods must fall; in other words, Q must rise, and the dollar must fall in real terms. This real depreciation of the dollar (or real appreciation of the foreign currency, say the DM) means that the purchasing power of the foreign currency has increased. Thus relative productivity growth causes the real exchange rate to appreciate and the real value of the currency to depreciate.

(e) *Under what conditions would Q be invariant (unrelated) to any of the factors in parts a through c? Explain*

brief answer If there were no non-traded goods, all goods identical, then we would have PPP, and then the real exchange rate would not respond to any of these changes. If people viewed home and foreign goods as the same then prices would not respond to such changes.