Econ 434 Professor Ickes

Fall 2009

Homework Assignment #2

This assignment is due on Thursday, October 15 at the beginning of class (or sooner) .

1. Consider a small economy so the country is a price taker in traded goods. Then we can treat foreign and domestic traded goods as a composite good, T. Suppose that if all resources in the economy are devoted to producing non-traded goods then $NT = 22$. The economy can produce traded goods as well, according to

$$T = 100 - .2NT^2$$

What does the production possibilities set look like for this economy? Draw it.

brief answer *Here is the production frontier. The black line is the initial production frontier.*

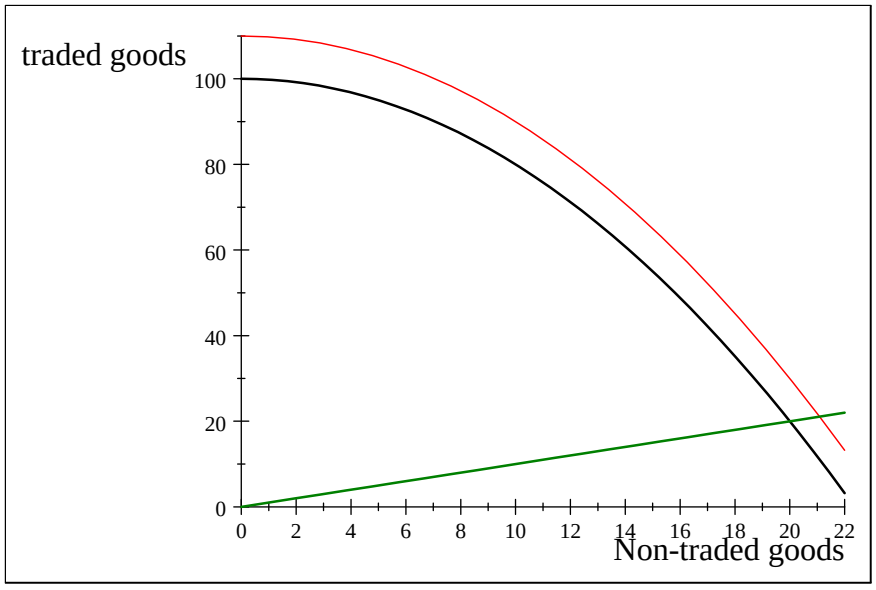


Figure 1: Production Frontier with $T = 100 - .2NT^2$

(a) Suppose that preferences in this economy are such that optimal consumption occurs where traded and non-traded goods are consumed in equal proportions. What will be the initial levels of consumption of T and NT in this economy?

brief answer *By assumption consumption will be where the 45 degree line intersects the production frontier. This is the green line in figure 1 (notice the axes are not equally scaled. You can roughly see that the optimal point is at* $(20, 20)$*. If I grind out the equation I get the same answer:so the answer must be* $NT = T = 20$.

NT	T
1	99.8
2	99.2
3	98.2
4	96.8
5	95
6	92.8
7	90.2
8	87.2
9	83.8
10	80
11	75.8
12	71.2
13	66.2
14	60.8
15	55
16	48.8
17	42.2
18	35.2
19	27.8
20	20
21	11.8
22	3.2

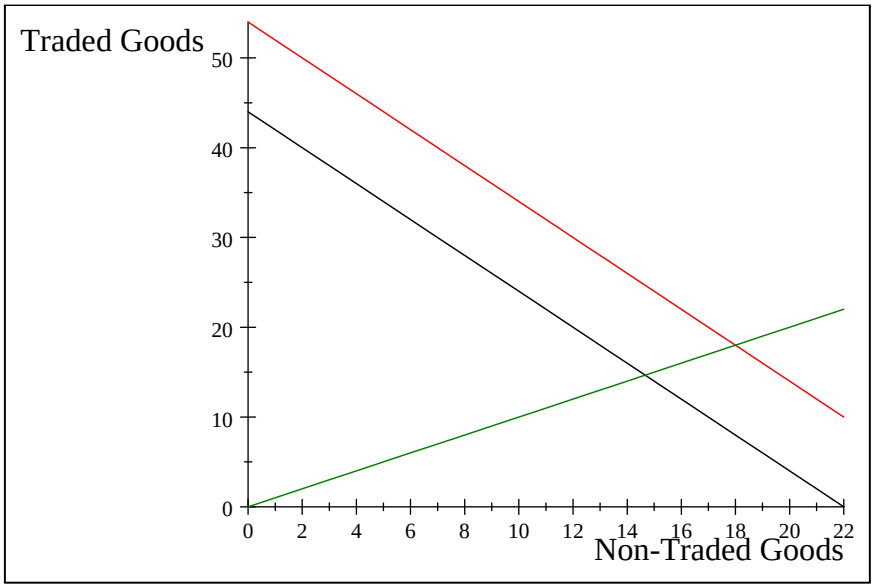
Figure 2:

(b) Suppose that the country received a transfer from abroad of 10 units of the traded good. What will the optimal consumption bundle be in this economy? What will happen to the real exchange rate in this economy as a result of this transfer? Explain.

brief answer *The transfer shifts the frontier upwards by 10 units, to the red curve in figure 1. You can see that the new consumption point is to the northeast of the initial one. So the relative price of traded goods must fall. This makes sense – we are receiving a transfer constituted entirely of T, so this creates an excess supply of T, so its relative price must fall to clear the market. The new optimum is at about (21,21).*

(c) Suppose instead that the transformation curve is given by $T = 44 - 2NT$. How do your answers to parts a and b change? Explain. Does the transfer cause the real exchange rate to change in this case?

brief answer *Now the frontier is linear. The real exchange rate will not change. Consumption increases from about $(15, 15)$ to about $(18, 18)$.Although the transfer initially causes excess demand for NT production can shift without a change in the real exchange rate.*



Production Frontier with $44 - 2NT$

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* 75.21 *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)* \$42.48. *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 (a), 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* $(\frac{1}{75.21})$ *dollars per KES* $= 15.955$ *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. 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) US demand for goods produced in the rest of the world declined.

brief answer *This causes an excess supply for goods in the rest of the world. So the relative price of ROW goods must fall, so the relative price of our goods must rise, hence Q falls.*

(b) US government spending increased.

brief answer *The answer is identical to part (a) since government spending is essentially on non-traded goods. The governments buys goods at home more than abroad (we buy some Kuwaiti oil but most government spending is on domestic goods and services). The relative price of US goods must thus rise. demand for US goods at the current exchange rate, since the supply has not changed. To restore equilibrium the relative price of US goods must rise relative to foreign goods; hence, Q must fall. The dollar thus appreciates in real terms. In other words, the purchasing power of the dollar has increased relative to foreign goods. In figure 3 we have the demand for US goods which is positively related to Q and the supply which we take as given for simplicity. So an increase in demand causes y^d to shift to the right and Q to fall.*

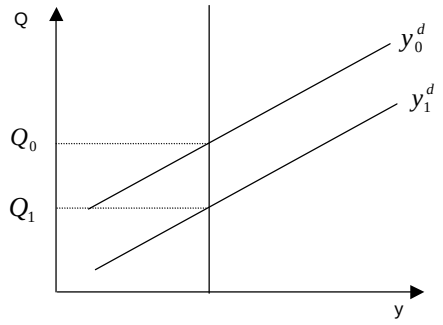


Figure 3: An Increase in the Demand for Domestic Goods

(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 ↓.*

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

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.*

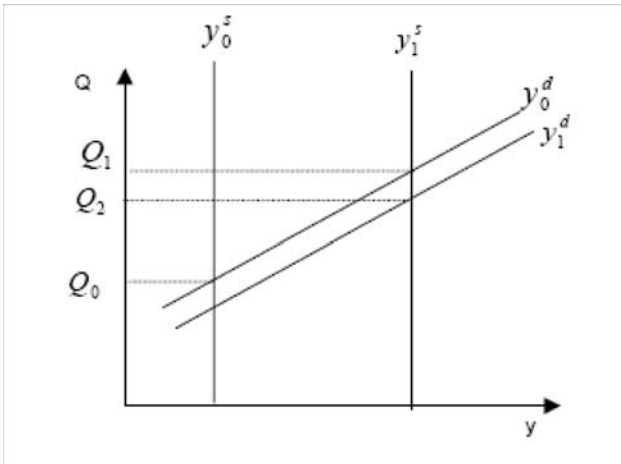


Figure 4:

(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 then the real exchange rate would not change. None of these phenomena would effect the relative price of US goods, since US and foreign goods would have the same price!*

4. Germany and China produce 2 goods: cell phones, the traded good, denoted by T; and haircuts, the non-traded good, denoted by N. Each good is produced in competitive markets with labor as the sole input. Workers are paid their marginal revenue product. Cell phones have no trade costs while haircuts have prohibitively high trade costs. The hourly wage rate in Germany is w euros; that in China is w^* yuan. Denote the exchange rate by e (euros per yuan). Suppose that in one hour a German worker can produce x cell phones while in China a worker produces x^* cell phones. In both countries a worker can produce one haircut per hour. Suppose the price of a cell phone is one euro. Let $x = 20$ and $x^* = 10$.

(a) If $e = 0.5$ what will be the yuan price of cell phones?

brief answer *A cell phone will cost 2 yuan, since the cell phone is tradeable and has the same price in all countries. Thus,* $P_T^* = \frac{1}{e}P_T$, *or* $2 = \frac{1}{.5}(1)$.

(b) What will the hourly wage in Germany be? What will the hourly wage (in yuan) in China be?

brief answer *The marginal product of labor in the traded goods sector in Germany is* $q = 20$, *so* $w = 20$ *euros. The marginal product of labor in traded goods in China is* $q^* = 10$, *so* $w^* = 20$ *yuan (or* 10 *euros).*

(c) What will the price of haircuts be in each country?

brief answer *The price of haircuts will be* 20 *euros in Germany and* 20 *yuan in China.*

(d) How will you answers (to parts a-c) change if e changes to .25?

brief answer *A cell phone will now cost 4 yuan,* $P_T^* = \frac{1}{e}P_T$, *or* $2 = \frac{1}{.25}(1)$. *Nothing else changes, since productivity is unaffected by the change in e.*

(e) Suppose German labor productivity in cell phones doubles. What will happen to the price of haircuts in Germany? What will happen to the real exchange rate between Germany and China? Explain.

brief answer *The price of haircuts will double (to 40 euro) since wages will double when productivity rises. Hence, the price level of German goods rises relative to China so its real exchange rate will fall (recall* $Q = \frac{eP^*}{P}$*). The rise in productivity makes German wages rise and non-traded goods prices must rise in Germany. Since nothing changes in China, German goods are more expensive.*

(f) Suppose that wages in the tradables sector in Germany grows at 3% per year, and that wages in the tradables sector in China grows at 12% per year. Further suppose that the share of non-traded goods in total consumption is 0.5. What should be the growth rate of the real exchange rate between Germany and China? Explain.

brief answer *From our discussion of the Balassa-Samuelson effect we know that the rate of change of* Q *depends on the difference between productivity growth in tradables in the two countries, or:*

$$\widehat{Q} = \alpha \left[\widehat{MPL}_T^* - \widehat{MPL}_T \right].$$

Note we are treating German as the home country. Given that $\alpha = 0.5$*, and assuming that average and marginal products are equal, this gives,* $0.5[12 - 3] = 4.5\%$*. China's currency should appreciate in real terms by 4.5% per year, so Germany's real exchange rate rises by 4.5%.*

5. The US government wants the Chinese government to let its currency (yuan) be flexible (abandon its fixed exchange rate) so it can appreciate in value. Draw a demand-supply diagram for the yuan under these current conditions (i.e., before it becomes flexible).

brief answer *see figure 5. The fixed exchange rate* $\overline{e}$ *is greater than the shadow exchange rate* $\widetilde{e}$*. At* $\overline{e}$ *there is an excess supply of dollars.*

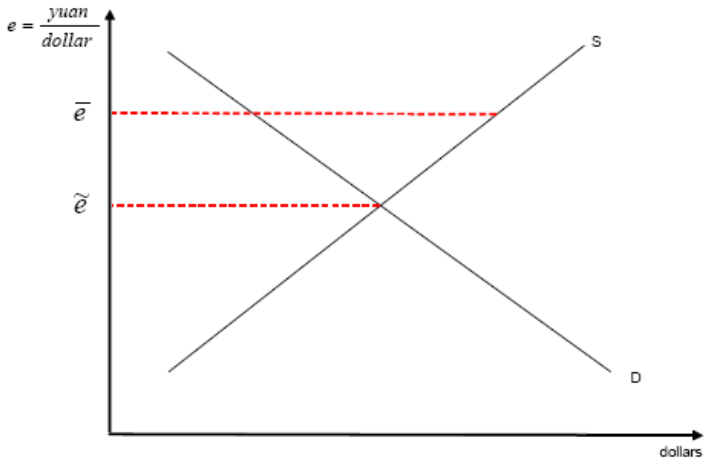


Figure 5:

(a) How can the fixed exchange rate be kept different from the market-clearing exchange rate? Explain. Can the Chinese government persist in this activity over time? Explain.

brief answer *The Central Bank of China (CBC) can purchase the extra dollars by selling yuan. This puts downward pressure on the value of the yuan. China can print as much yuan as it likes, it just has to build warehouses for the dollar. The only problem is that this policy may be inflationary. China could try to sterilize the inflow of reserves. To do this they must sell bonds to soak up liquidity, offsetting the impact of the inflow of reserves. Given that China limits the investment opportunities of its citizens the cost of this is less than it would be in a country with an open capital account.*

(b) If there was a forward market for yuan what would be the likely relationship between the forward price and the current price of the yuan? Explain.

brief answer *If we consider the forward price of the yuan in terms of dollars (that is the dollar price of the yuan in the future period) then the forward price of the yuan should be higher than the current price if investors expect the yuan to appreciate. How much depends on the probability that the CBC will let the yuan appreciate during the period.*

(c) What if the yuan were overvalued instead of undervalued? What problems would the Central Bank of China face if it tried to maintain the pegged rate?

brief answer *In this case $\overline{e} < \widetilde{e}$ which implies an excess supply of dollars. Now the CBC must sell dollars. Since the CBC (unlike North Korea) cannot print dollars they have only finite resources for this operation.*

6. Suppose that you are a US exporter expecting to receive a payment of 100 euros in 12 months. The one-year interest rate on euro deposits is 5% per annum, and the one-year interest rate on dollar deposits is 8%. The present spot exchange rate is \$0.50 per euro.

(a) What is the one-year forward exchange rate?

brief answer *Covered interest parity implies that $F_t = e_t \frac{1+i}{1+i^*}$, so we have $F_t = .50\frac{1.08}{1.05} = .5142$. The dollar is expected to depreciate, that is why domestic interest rates exceed euro rates.*

(b) Assuming that you ultimately need dollars, describe at least two ways you can cover yourself from the exchange rate risk.

brief answer *You could purchase the dollars for delivery in one year with a forward contract. This would involve a contract with a commercial bank. At the end of the year you deliver euros and get dollars at the price of the contract today. Alternatively, you could purchase a one year ahead futures contract. This is also a commitment to buy foreign exchange at a given price, but it is traded on a centralized market in fixed sizes. At the end of the year you are committed to trade euros for dollars at the price you contracted for today. Notice that if the dollar ended up depreciating by more than the 2.8% that was anticipated, the actual spot price next year will be even higher than .5142. So had you not hedged you would be able to convert the*

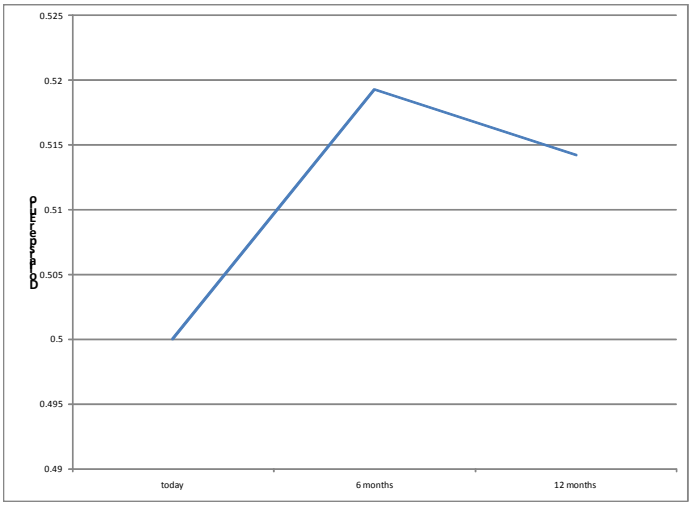


Figure 6:

euros back into even more dollars. But you still hedged the risk.[1] *But there is a third way to hedge the risk: purchasing a currency option. This gives you the right to sell euros for dollars at a fixed rate, but it is not an obligation. If the euro appreciated more than expected you could walk away from the option. If the dollar appreciated, on the other hand, the option would protect you from the currency risk. Notice that you have to pay something for this insurance. That is the price of the option. You might also note that the greater the volatility of currencies the more valuable such an option would be.*

(c) Now suppose your claim on euros is six months hence. The interest rate on 6 month dollar deposits is 8% and on euros it is 4%. What is the six-month forward rate?

brief answer $F_t = .50\frac{1.08}{1.04} = .5192$.

(d) What do your answers to (a) and (c) imply about the "market's expectations" about the path of the exchange rate over the next year? Explain.

brief answer *The dollar is expected to depreciate over the next six months by* 3.8% *and then appreciate over the following six months, by about* 1%. *See picture:*

[1]1If you drive to school and don't have an accident it does not mean you wasted your money on car insurance.