::Solutions::

Problem Set #1: Due end of class September 18, 2017

You may discuss this problem set with your classmates, but everything you turn in must be your own work.

1. Download the foreign exchange rate data for: US-Canada; US-Mexico; and US-China. An easy place to find these data are the FRED database at https://fred.stlouisfed.org/. The data should be monthly and span January 1994 to September 2018.

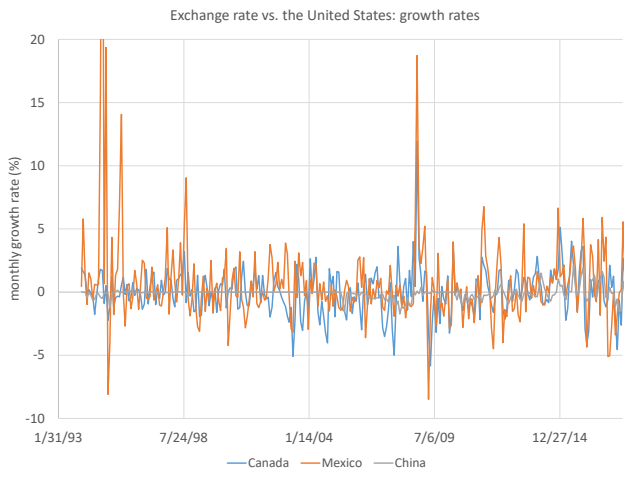
   (a) Compute the percent growth rates of each exchange rate. Report the standard deviation of each exchange rate. Report the three (US-CA&US-MX; US-CA&US-CH; US-MX&US-CH) correlation coefficients.

   > See the workbook posted on the course web site for the calculations.
   > std(US-CA) = 1.81; std(US-MX) = 3.87; std(US-CH) = 0.56
   > corr(US-CA, US-MX) = 0.36; corr(US-CA, US-CH) = 0.22;
   > corr(US-MX, US-CH) = 0.08

   (b) In a few sentences, summarize the results you found in part a. What do you think might drive the differences in volatility across the exchange rates?

   > The exchange rates growth rates are all positively correlated, but the Mexico & China exchange rate correlation is very weak.
   >
   > The US-Mexico and US-Canada exchange rates are much more volatile than the US-China exchange rate. This is because China follows a **fixed exchange rate** regime that forces the exchange to not move very much.

   (c) Turn in a well labeled plot of the growth rates you computed in a. for the three exchange rates. This should be one plot with three lines.



2. Explain **why** you can compute the Mexico-China exchange rate given the data you have in

question 1. Provide the formula for the Mexico-China exchange rate, in terms of other exchange rates.

We can compute the Mexico-China exchange rates as

$$E_{CAD/YUAN} = \frac{E_{CAD/\$}}{E_{YUAN/\$}}.$$

Notice that the units are correct — the dollar cancels out of the fraction of the right-hand side.

Why does this formula hold? If it did not hold, then a **triangle arbitrage** exits, and it would be possible to earn a riskless profit by buying and selling the three currencies. There are enough currency traders and speculators in the market to ensure that there are no triangle arbitrage opportunities.

3. Consider a Dutch investor with 1,000 euros to place in a bank deposit in either the Netherlands or Great Britain. The (one-year) interest rate on bank deposits is 2% in Britain and 4.04% in the Netherlands. The (one-year) forward euro-pound rate is 1.575 euros per pound and the spot rate is 1.5 euros per pound. Answer the following questions using CIP and UIP where appropriate.

   [This is mostly question six from the problems in Feenstra and Taylor, chapter 13.]

   (a) What is the euro-denominated return on Dutch deposits for this investor?

   The net return is $i_€ = 0.0404$.

   (b) What is the riskless euro-denominated return on British deposits for this investor using forward cover?

   The gross return is $(1 + i_£)\frac{F_{€/£}}{E_{€/£}} = 1.02\frac{1.575}{1.5} = 1.071$

   The net return is 0.071

   (c) Is there an arbitrage opportunity here? Why or why not?

   Yes. The riskless rate of return in Britain is higher than the riskless rate of return in the Netherlands.

   (d) If the spot rate is 1.5 euros per pound and the interest rates are as stated previously, what is the equilibrium forward rate, according to CIP?

   The CIP condition is

$$\frac{1 + i_€}{1 + i_£} E_{€/£} = F_{€/£}$$

$$\frac{1.0404}{1.02} 1.5 = F_{€/£} = 1.53$$

(e) If uncovered interest parity holds, what is the expected depreciation of the euro (against the pound) over one year?

The uncovered interest parity condition is

$$(1 + i_{£})\frac{E^e_{€/£}}{E_{€/£}} = 1 + i_{€}$$

$$\frac{E^e_{€/£}}{E_{€/£}} = \frac{1.0404}{1.02} = 1.02$$

So the expected depreciation rate of the euro is 2 percent.

(f) Based on your answer to e, what is the expected euro-pound exchange rate one year ahead?

I know the depreciation rate is two percent

$$\frac{E^e_{€/£}}{E_{€/£}} = 1.02$$

and I know that the spot rate 1.5

$$\frac{E^e_{€/£}}{1.5} = 1.02$$

$$E^e_{€/£} = 1.53$$

Notice that if CIP and UIP both hold, the expected future spot rate is equal to the forward rate.

4. Your U.S. firm needs 10,000 Mexican pesos to pay for imported parts one year from today. Looking to remove the exchange rate risk from the payment, you devise two strategies.

(a) Put X in a U.S. bank account that earns 5% interest per year. Buy a forward contract to purchase pesos at 0.2 ~~pesos per dollar~~ dollars per peso in one year. What is the dollar-cost (X) of the imported parts under this strategy?

$$\frac{X(1 + i_{us})}{F_{\$/peso}} = 10,000$$

$$\frac{X(1.05)}{0.2} = 10,000$$

I need 2,000 dollars in one year to execute the forward contract at 0.2 dollars per peso. If I earn 5 percent on my investment, I need to put 1,904.76 dollars in the savings account. So the dollar cost of the parts is $1904.76.

(b) If covered interest parity holds, is there an advantage to the following strategy? Sell Y dollars for pesos today and put the pesos in a Mexican bank account that earns 20% interest per year.

Under this strategy I need

$$\frac{Y}{E_{\$/peso}}(1+i_{mx}) = 10,000$$

Both strategies are worth 10,000 pesos, so set the left-hand side of each equal to each other

$$\frac{Y}{E_{\$/peso}}(1+i_{mx}) = \frac{X(1+i_{us})}{F_{\$/peso}}$$

$$\frac{Y}{X} = \frac{1+i_{us}}{1+i_{mx}}\frac{E_{\$/peso}}{F_{\$/peso}}$$

If CIP holds, the right-hand side of the equation is equal to 1, so $X = Y$ and there is no advantage. Intuitively, part a. is investing at home with forward cover and part b. is investing abroad. CIP says these have to have the same return. [Note we never used the 20% interest rate in Mexico.]

(c) What is the spot exchange rate (in dollars per peso) if CIP holds?

$$F_{\$/peso} = \frac{1+i_{us}}{1+i_{mx}}E_{\$/peso}$$

$$0.2 = \frac{1.05}{1.20}E_{\$/peso}$$

$$E_{\$/peso} = 0.2285$$