

## EC 247 Financial Instruments and Capital Markets

### Class Exercise 6

These questions correspond to chapter 15 of the Frederic S. Mishkin and Stanley G. Eakins, *Financial Markets and Institutions*, 7<sup>th</sup> Edition, Pearson Prentice Hall, 2012.

Chapter 15 analyzes the foreign exchange market. First, the long-run determinants of the exchange rate are laid out, and then the information about the long-run determinants is embedded in a model of the short-run determination of exchange rates. The key idea is that the demand for domestic currency (say dollar) assets is determined by the relative expected return on these assets.

**Questions 1 and 2** of this week's problem set have to do with the theory of purchasing power parity (PPP). The starting point for understanding how exchange rates are determined in the long run is the idea of the law of one price, which states that if two countries produce an identical good, and transportation costs and trade barriers are very low, the price of the good (expressed in a common currency) should be the same throughout the world no matter which country produces it. The theory of purchasing power parity (PPP) is simply an application of the law of one price to national levels. The PPP suggests that long-run changes in the exchange rate between two countries' currencies are determined by changes in the relative price levels in the two countries. If for example one country's price level rises relative to another's its currency should depreciate (the other country's currency should appreciate). Other factors that can affect the exchange rate in the long-run are tariffs and quotas, import demand, export demand, and productivity.

The answer to question 1, extracts directly from the notion of PPP that if one country's price level rises relative to another's, its currency should depreciate (the other country's currency should appreciate).

To answer question 2, we become more explicit, and we introduce an equation that reflects exactly the idea behind the PPP. This equation can be given as follows:

$$\frac{S^1}{S^0} = \frac{1+I_F}{1+I_D} \quad (1)$$

Where:

$S^0$  : is the spot exchange rate at the start of the period (the foreign price of one unit of domestic currency)

$S^1$  : is the spot exchange rate at the end of the period

$I_F$  : is the inflation rate, over the period, in the foreign country

$I_D$  : is the inflation rate, over the period, in the domestic country.

Equation (1) is the exact relationship of the (relative) PPP condition<sup>1</sup>. However, we can also work out a linear approximation of equation 1. This looks like equation (2) below:

$$\frac{S^1}{S^0} - 1 \cong I_F - I_D \quad (2)$$

What we have actually derived, is an equation that states that exchange rate movements should exactly offset any inflation differential between the two countries. This is the notion behind PPP.

In question 2 we can directly apply equations (1) and/or (2). In this question, we are given the current exchange rate, the expected foreign and domestic inflation rates and we are looking for the expected exchange rate 1 year ahead as predicted by the theory of PPP.

**In question 3** we have to find the investor's total return in Canadian Dollars (C\$). We know that the investor in Canada purchased 100 shares of IBM in January 1<sup>st</sup> at a price of \$93.00 per share. After 1 year, IBM paid an annual dividend of \$0.72 per share and the stock was sold for the price of \$100.25 per share. We are also given the exchange rates in January (\$0.68/C\$) and in December (\$0.71/C\$).

Given the above information we know that the investor in Canada invested in January \$9.300 (100 shares x \$93.00 per share) in IBM. According to the exchange rate in January, this corresponds to C\$13.676 Canadian Dollars. In December he/she received \$72.00 as dividends (\$0.72 per share) and \$10.025 from his sale of the shares (100 shares x \$100.25 per share) i.e. \$10.097 in total. According to the exchange rate in December, this amount corresponds to C\$14.221 Canadian Dollars. As a result, the investor's total return (TR) in Canadian Dollars can be calculated as:

$$TR = \frac{C\$14.221 - C\$13.676}{C\$13.676} = 0.03988 = 3.98\%$$

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<sup>1</sup> You can introduce expectations in equation 1 and interpret  $S^1$  as the expected exchange rate one period ahead,  $I_F$  and  $I_D$  as expected inflation rates and  $S^0$  as the current exchange rate. For those who are interested in the concept of PPP and generally on the various international parity relations, more information (optional) can be found in: Bruno Solnik, *International Investments*, 4<sup>th</sup> Edition, Addison Wesley Longman, Inc, 2000.

**In question 4** we directly apply the interest rate parity condition as given by equation (3) below:

$$i^D - i^F = -\frac{E_{t+1}^e - E_t}{E_t} \quad (3)$$

This equation is extracted from the fact that in equilibrium, the relative expected returns on dollar assets must be equal to zero (see the Appendix to chapter 15 in the textbook related to exchange rate determination in the short-run) pages 410-413.

## SOLUTIONS

### Question 1

If the Japanese price level rises by 5% relative to the price level in the United States, what does the theory of purchasing power parity predict will happen to the value of the Japanese yen in terms of dollars?

**Answer:** The theory of PPP predicts that the value of the yen will fall 5% in terms of dollars

### Question 2

The Mexican peso is trading at 10 pesos per dollar. If the expected U.S. Inflation rate is 2% while the Mexican inflation rate is 23% over the next year, what is the expected exchange rate in one year?

**Answer:** We can solve this exercise by using both equations (1) and (2) as stated above. By taking equation (1) we have:

$$\begin{aligned} \frac{S^1}{S^0} &= \frac{1 + I_F}{1 + I_D} \\ \frac{S^1}{10} &= \frac{1 + 0.23}{1 + 0.02} \\ \frac{S^1}{10} &= \frac{1.23}{1.02} \\ S^1 &= 12.059 \end{aligned}$$

As a result, the expected exchange rate in 1 year is 12.059 pesos per dollar.

Alternatively, we can use equation (2) which is the linear approximation version of PPP. This will give a very similar result. Consequently,

$$\frac{S^1}{S^0} - 1 \cong I_F - I_D$$

$$\frac{S^1}{10} - 1 \cong 0.23 - 0.02$$

$$\frac{S^1}{10} \cong 1 + 0.21$$

$$S^1 \cong 12.10$$

This implies that the implied expected exchange rate in 1 year is approximately 12.10 pesos per dollar.

### Question 3

An investor in Canada purchased 100 shares of IBM on January 1st at \$93.00/share. IBM paid an annual dividend of \$0.72 on December 31st. The stock was sold that day as well for \$100.25. The exchange rate is \$0.68/Canadian dollar on January 1st and \$0.71/Canadian dollar on December 31st. What is the investor's total return in Canadian dollars?

**Answer:** As previously analyzed, the investor's total return in Canadian dollars is given as:

$$TR = \frac{C\$14.221 - C\$13.676}{C\$13.676} = 0.03988 = 3.98\%$$

### Question 4

The current exchange rate is 0.75 euros per dollar, but you believe the dollar will decline to 0.67 euros per dollar. If a euro-denominated bond is yielding 2%, what return do you expect in U.S. dollars?

**Answer:** Applying directly equation (3) above, we get:

$$i^D - i^F = -\frac{E_{t+1}^e - E_t}{E_t}$$

$$i^D - 0.02 = -\frac{0.67 - 0.75}{0.75}$$

$$i^D - 0.02 = -[-0.1066]$$

$$i^D = 0.02 + 0.1066$$

$$i^D = 0.1266 = 12.66\%$$

Thus, the return expected in dollar denominated assets, is 12.66%.

**Question 5**

The president of the United States announces that he will reduce inflation with a new anti-inflation program. If the public believes him, predict what will happen to the exchange rate for the U.S. dollar.

This question has to do with the way that long-run determinants of the exchange rate can influence the relative expected return on dollar assets and thus, the current exchange rate. (For the various factors that shift the demand curve for domestic assets and affect the exchange rate see table 15.2 in the textbook).

In this question, the dollar will appreciate. Because expected U.S. inflation falls as a result of the announcement, there will be an expected appreciation of the dollar and so the expected return on dollar assets will rise. As a result, the demand curve will shift to the right and the equilibrium value of the dollar will rise.

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