Parity Relationships Exercises-II

Question-1:

Assume that 1 year T-bill yields in the US and Mexico are 1% and 12% p.a. respectively. If the current spot rate of USD is USD/MXP 7.70 (i.e. Mexican Peso 7.70 per USD) what should be the exchange rate implied by International Fisher Effect in one year?

Solution:

The international Fisher Effect or Fisher Open formulate the expected change in the value of foreign or local currency. On page 156 the following formula was listed:

$$\frac{S_1 - S_0}{S_0} = \frac{i^{LC} - i^{FC}}{(1+i^{FC})}$$

The formula can be restated as:

$$\frac{S_1 - S_0}{S_0} = \frac{i^{LC} - i^{FC}}{(1+i^{FC})} \rightarrow S_1 = S_0 \times \frac{i^{LC} - i^{FC}}{(1+i^{FC})}$$

Since the exchange rate is given as USD/MXP 7.70; MXP is the local and USD is the foreign currency. Since we are given interest rates and the spot rate, we can estimate the one year ahead spot exchange rate by using IFE relationship.

$$S_1 = S_0 \times \frac{(1+i^{LC})}{(1+i^{FC})} \rightarrow 7.70 \times \frac{(1+0.12)}{(1+0.01)} = MXP8.53 perUSD$$ or USD/MXP8.53

In other words, the value of one dollar goes up from MXP7.70 to MXP8.53.

Question-2:

Assume that three month T-bills in the UK yield 2% p.a. and 0.9% in the U.S. What should be the IFE implied exchange rate at the end of three months if the current exchange rate is GBP/USD 1.5200

Solution::

The exchange rate expression suggests that GBP is the foreign currency and US dollar is the foreign currency. Given the US and UK interest rates and the spot rate of GBP; three months ahead exchange rate implied by IFE is given as follows:

$$S_1 = S_0 \times \frac{(1+i^{LC})}{(1+i^{FC})} \rightarrow \$1.5200 \times \frac{(1+0.009)}{(1+0.02)} = \$1.5036$$

In other words, the value of one GBP is expected to decline from \$1.5200 to \$1.5036 or GBP/USD 1.5036

Question-3:

According to the international Fisher effect, if U.S. investors expect a 5% rate of domestic inflation over one year, and a 2% rate of inflation in Japan, and require a 3% real return on investments over one year, what would be the nominal interest rate on one-year U.S. Treasury

Solution:

This question asks you to connect the "Fisher Effect" and the International Fisher Effect.

Fisher Effect suggests that nominal interest rate "I" is composed of real interest rates and inflation premium. An accurate version of the Fisher Effect suggests the following:

$$(1+i) = (1+r^*) \times (1+\pi)$$

This also implies that $i = r^* + \pi + r^* \times \pi$. In some cases for simplification purposes we use the approximate version of the formula which is given as:

$$i = r^* + \pi$$

The approximation is useful for quick calculations, but you are advised to use the accurate formula unless you are told otherwise.

In the question, we are given the US and Japanese inflation rates, but the real interest rate is only given for Japan. Here we need to use an important attribute of Fisher Effect which leads us to IFE.

Under perfect capital mobility assumption, real interest rates are expected to be equal around the world. This practically suggests the following:

$$r_{LC}{}^* = r_{FC}{}^*$$

By using this relationship, we infer that 3% real interest rate in Japan also implies 3% real interest rate in the US. By using this information, we can estimate the nominal interest rate in the US as follows:

$$(1+i) = (1+r^*) \times (1+\pi) \rightarrow i = r_{US}^* + \pi_{US} + r_{US}^* \times \pi_{US}$$

$$i = r_{US}^* + \pi_{US} + r_{US}^* \times \pi_{US} \rightarrow i = 0.03 + 0.05 + 0.03 \times 0.05 = 8.15\%$$

Question-4:

Suppose the U.S. and Swiss investors require a real rate of return of 3%. Also, assume that the nominal interest rates in the US and Switzerland are 6% and 4% respectively. According to the international Fisher Effect, how much do you expect the value of Swiss Franc to change? Does Swiss Franc appreciate or depreciate?

Solution:

In the context of IFE the change in the local currency and foreign currency are given as follows:

$$\%\ \Delta \text{ in LC} = \frac{S_0 - S_1}{S_1} = \frac{i^{FC} - i^{LC}}{(1 + i^{LC})}$$

$$\%\ \Delta \text{ in FC} = \frac{S_1 - S_0}{S_0} = \frac{i^{LC} - i^{FC}}{(1 + i^{FC})}$$

Since we are not given an exchange rate quote, we need to determine the local and foreign currency and we are completely free to choose! Let's set the Swiss Franc as home/local currency and dollar as the foreign currency. In this case, the change in the value of SF is the change in the value of LC. If we plug in the interest rate data we get the following:

$$\%\ \Delta \text{ in LC} = \frac{S_0 - S_1}{S_1} = \frac{i^{FC} - i^{LC}}{(1 + i^{LC})} \rightarrow \%\ \Delta \text{ in Swiss Franc} = \frac{i^{US} - i^{SF}}{(1 + i^{SF})} = \frac{(0.06 - 0.04)}{(1 + 0.04)} = +1.92\%$$

In other words, the value of Swiss Franc (CHF) is expected to appreciate by 1.92%.

Although it was not asked in the question, we can calculate the change in the value of USD as follows:

$\%\ \Delta \text{ in FC} = \frac{S_1 - S_0}{S_0} = \frac{i^{LC} - i^{FC}}{(1 + i^{FC})} = \frac{0.04 - 0.06}{(1 + 0.06)} = -1.89\%$ USD is expected to depreciate by 1.89%!!

Question-5:

If the dollar appreciates by 1000% against the Russian Ruble, by what percentage does Ruble depreciate against the dollar?

Solution

Assume that today the value of USD is 1 Ruble or S_0=RUB1/$ (we set RUB as local currency and USD as foreign currency by the definition of the exchange rate)

If the dollar appreciates by 1000%:

$$\% \, \Delta \text{ in USD} = \frac{S_1 - S_0}{S_0} = 10 \rightarrow \frac{S_1 - 1}{1} = 10 \rightarrow S_1 = 11$$

Verify that USD change is 1000%:

$$\% \, \Delta \text{ in USD} = \frac{S_1 - S_0}{S_0} = 10 \rightarrow \frac{11 - 1}{1} = 10 \text{ or } 1000\%$$

Now, let's check the change in the value of LC or Ruble

$$\% \, \Delta \text{ in LC} = \frac{S_0 - S_1}{S_1} = \frac{1 - 11}{11} = 0.9091 \text{ or -90.91\%}$$

In this case, the value of Ruble depreciated by 90.91%!