

Parity Relationships Exercises-I

1. The value of the Australian dollar (A\$) today is \$0.73. Last year today the value of the Australian dollar was \$0.69. Calculate the change in the value of Australian dollar and change in the value of USD.

Solution

$S_0 = \text{USD}0.69 \text{ per AUD or AUD/USD}0.69$

$S_1 = \text{USD}0.73 \text{ per AUD or AUD/USD}0.73$

The exchange rate expression suggests that AUD is the foreign or base currency and USD is the local or terms currency.

Change in foreign currency is given as $= \Delta\%inFC = \frac{S_1 - S_0}{S_0} = \frac{0.73 - 0.69}{0.69} = 5.80\%$

Change in local currency is given as $= \Delta\%inLC = \frac{S_0 - S_1}{S_1} = \frac{0.69 - 0.73}{0.73} = -5.48\%$

2. At the end of 2016 USD/TRY exchange rate was 2.68. Given the respective inflation expectations of 9% and 1.8% in Turkey and US, what should be the PPP implied exchange rate at the end of 2017? Suppose USD/TRY rate turned out to be TRY3.7 per USD at the end of 2017. Is TRY over or undervalued? What is the extent of under or overvaluation in percentage terms

Solution:

$$S_1 = S_0 \times \frac{(1 + \pi_{TR})}{(1 + \pi_{US})} = 2.68 \times \frac{(1 + 0.09)}{(1 + 0.018)} = \text{TRY}2.86 / \$$$

Since Actual Exchange Rate USD/TRY 3.7 > PPPIER of USD/TRY2.86, TRY is undervalued; in other words, based on PPP Turks should pay TRY2.86 per dollar, but in the market they are paying TRY3.7; this suggests that USD is overvalued and TRY is undervalued. The extent of TRY undervaluation can be calculated as follows:

$$\text{LC Under/over valuation} = \frac{\text{PPPIER}-\text{Actual Rate}}{\text{Actual Rate}} = \frac{2.86 - 3.7}{3.7} = -22.7\%$$

3. The Mexican Current Account Balance has a deficit of 300 million USD as of end of 2007 (this is considered to be an insignificant deficit) where the exchange rate was stabilized around New Pesos 10.8=1 USD. Given the expectations of inflation of 12% and 2% respectively in Mexico and US, what should be the expected PPP implied exchange rate at the end of 2008?

Solution::

$$S_1 = S_0 \times \frac{(1 + \pi_{MXP})}{(1 + \pi_{USD})} = 10.80 \times \frac{(1 + 0.10)}{(1 + 0.02)} = MXP11.64$$

4. The Thai Baht was fixed through a currency peg at THB25/\$ until July 1997. In July 1997, under a massive speculative attack the Thai Baht was forced to be floated and the exchange rate sharply depreciated. One year later, in July 1998, Thai Baht was trading at THB34/\$. During that one year period Thailand's inflation rate was 15% on an annualized basis. Inflation in the United States during that same period was 2% annualized.

Solution:

- a. What should have been the exchange rate in January 2003 if PPP held?

$$S_1 = S_0 \times \frac{(1 + \pi_{THB})}{(1 + \pi_{USD})} = 25 \times \frac{(1 + 0.15)}{(1 + 0.02)} = THB28.19$$

- b. To what extent the Thai Baht undervalued or overvalues on an annualized basis?

$$\text{LC Under/over valuation} = \frac{\text{PPPIER-Actual Rate}}{\text{Actual Rate}} = \frac{28.19 - 34}{34} = -17.1\%$$

Thai Baht was about 17.1% undervalued after the sharp depreciation following the speculative attack.

5. iPhone 7 is sold for CRK 6,000 in Zagreb. The same iPhone with equivalent memory is sold in Apple store in Mall of New Hampshire at \$800. The exchange rate between Croatian kunas (CRK) and U.S. dollars is CRK5.6288/\$. Assuming that conditions for PPP hold, is the Croatian kuna (CRK) overvalued or undervalued?

Solution:

The PPPIER for Kuna can be calculated as follows:

$$S = \frac{P_{CRK}^{iPhone}}{P_{USD}^{iPhone}} = \frac{6,000}{800} = CRK7.5 / \$ \text{ (or USD/CRK 7.5)}$$

Since the USD/CRK rate in the market is USD/CRK 5.6288 it is clear that Croatians are paying less kunas per USD than PPP suggests. That makes kuna (CRK) overvalued. We can calculate the extent of overvaluation as follows:

$$\text{LC Under/over valuation} = \frac{\text{PPPIER}-\text{Actual Rate}}{\text{Actual Rate}} = \frac{7.5 - 5.6288}{5.6288} = +33.24\%$$

6. You are planning a summer vacation, one year from now in Marbella, Spain. You are negotiating over the rental of a 3 bedroom condo. The Spanish landlord wishes to preserve his real income against both inflation and exchange rate changes, and so the current weekly rental for the Condo is €1,600 will be adjusted upwards or downwards for any change in the Spanish cost of living between now and then. You are basing your budgeting on purchasing power parity (PPP). Spanish inflation is expected to average 3.5% for the coming year, while U.S. dollar inflation is expected to be 1.5%. The current spot rate is \$1.1980/€. What should you budget as the U.S. dollar cost of the one week rental?

Solution:

Current Cost in USD: €1,600 x \$1.1980/€ = \$1,916.80

In one year the rental is expected to be: €1,600 x (1+0.035) = €1,656

The exchange rate according to PPP should be:

$$S_1 = S_0 \times \frac{(1 + \pi_{US})}{(1 + \pi_{EUR})} = 1.1980 \times \frac{(1 + 0.015)}{(1 + 0.035)} = USD1.1749$$

The USD Price of Condo = €1,656 x \$1.1749 = \$1,945.55

This means that in real terms the rental remained constant from your perspective. Since there is 1.5% inflation in US, the rental is expected to go up from \$1,916.80 to \$1,945.55.

7. Suppose expected inflation in the US and Brazil are 1.6% and 12% respectively.
- What is the expected change in the value of USD?
 - What is the expected change in the value of Brazilian Real (BRL)

Solution:

We can use the RPP to derive the following relationship:

$$\hat{S}_{t+1} = S_t \times \frac{(1 + \hat{\pi}_H)}{(1 + \hat{\pi}_F)} \rightarrow \frac{\hat{S}_{t+1}}{S_t} = \frac{(1 + \hat{\pi}_H)}{(1 + \hat{\pi}_F)} \rightarrow \frac{\hat{S}_{t+1}}{S_t} - 1 = \frac{(1 + \hat{\pi}_H)}{(1 + \hat{\pi}_F)} - 1$$

$$\frac{\hat{S}_{t+1}}{S_t} - 1 = \frac{(1 + \hat{\pi}_H)}{(1 + \hat{\pi}_F)} - 1 \rightarrow \frac{\hat{S}_{t+1} - S_t}{S_t} = \frac{\pi_H - \pi_F}{(1 + \pi_F)}$$

The above relationship gives us the change in the value of foreign currency. Change in the value of home currency is given with the following relationship:

$$\frac{S_0 - S_1}{S_1} = \frac{\pi_F - \pi_H}{(1 + \pi_H)}$$

Now we have the tools to calculate the expected change in the value of home and foreign currency. In this question since we are not given an exchange rate quote, we do not know which currency is home currency and which currency is foreign currency. It is up to us to decide.

Let's assume that USD is the home currency and BRL is the foreign currency.

- a. Then the change in USD will be the change in the home currency which is given with the following formula:

$$\frac{S_0 - S_1}{S_1} = \frac{\pi_F - \pi_H}{(1 + \pi_H)} \rightarrow \% \Delta \text{ in USD} = \frac{\pi_F - \pi_H}{(1 + \pi_H)} = \frac{0.12 - 0.016}{(1 + 0.016)} = 0.1023 \text{ or } +10.23\%$$

In other words, USD is expected to appreciate by 10.23%

- b. The change in BRL is

$$\frac{S_1 - S_0}{S_0} = \frac{\pi_H - \pi_F}{(1 + \pi_F)} = \frac{0.016 - 0.12}{(1 + 0.12)} = -9.28\%$$

The change in the value of BRL is -9.28% or BRL is expected to depreciate by 9.28%.

Please note that the choice of home currency would not affect the answer. If we decided that BRL is the home currency we would have the same results. Let's show that.

a. The Change in the value of USD (note that now the USD is the foreign currency because we decided that BRL is the home currency). Change in the foreign currency is given as:

$$\frac{S_1 - S_0}{S_0} = \frac{\pi_H - \pi_F}{(1 + \pi_F)} = \frac{0.12 - 0.016}{(1 + 0.016)} = +10.23\%$$

b. The change in the value of BRL (or home currency):

$$\frac{S_0 - S_1}{S_1} = \frac{\pi_F - \pi_H}{(1 + \pi_H)} \rightarrow \% \Delta \text{ in BRL} = \frac{\pi_F - \pi_H}{(1 + \pi_H)} = \frac{0.016 - 0.12}{(1 + 0.12)} = -9.28\%$$

8. **Suppose the current exchange rate is MXP 18.18 and the expected inflation in the US and Mexico are 1.5% and 15% respectively.**

a. **What is the expected change in the value of USD?**

b. **What is the expected change in the value of Mexican Peso (MXP)**

Solution:

Note that in this question we are given an exchange rate quote. That quote tells us which currency home currency and which currency is foreign currency. With this we cannot arbitrarily assign home and foreign currencies.

Home Currency: Mexican Peso (because exchange rate shows units of Mexican pesos per USD)

Foreign Currency: USD (it is the unit whose price is expressed in local currency units; in this case Mexican pesos)

a) Change in the value of USD (or foreign currency):

$$\frac{S_1 - S_0}{S_0} = \frac{\pi_H - \pi_F}{(1 + \pi_F)} = \frac{0.15 - 0.015}{(1 + 0.015)} = +9.85\%$$

b) Change in the value of Mexican Peso (Or home currency)

$$\frac{S_0 - S_1}{S_1} = \frac{\pi_F - \pi_H}{(1 + \pi_H)} \rightarrow \% \Delta \text{ in MXP} = \frac{0.015 - 0.15}{(1 + 0.15)} = -8.69\%$$

9. Suppose that expected inflation in the US and Euro zone are expected to be as follows in the next three years:

	Year-1	Year-2	Year-3
US Inflation	3.8%	3.2%	2.5%
Eurozone Inflation	2.5%	2.2%	2.0%

If Current Spot rate is given as EUR/USD1.2200, what should be the expected exchange rate at the end of year 3?

Solution:

The multi period version of the Relative purchasing power is as follows:

$$S_{t+n} = S_t \times \left[\frac{\prod_{n=1}^N (1 + \pi_{H,n})}{\prod_{n=1}^N (1 + \pi_{F,n})} \right]$$

If we plug in the respective inflation figures and the spot rate we get the three year ahead forecast for the EUR/USD rate:

$$S_{t+n} = S_t \times \left[\frac{\prod_{n=1}^N (1 + \pi_{H,n})}{\prod_{n=1}^N (1 + \pi_{F,n})} \right] = 1.2200 \times \frac{(1 + 0.038) \times (1 + 0.032) \times (1 + 0.025)}{(1 + 0.025) \times (1 + 0.022) \times (1 + 0.02)} = 1.2537$$

As of now, three year ahead expected future spot rate of EUR is 1.2537 based on expected inflation rates.

10. Assume that the export price of a Nissan XTerra from Osaka, Japan is ¥3,250,000. The exchange rate is ¥115.20/\$. The forecast rate of inflation in the United States is 3.2% per year and is 1.0% per year in Japan. Assume that PPP holds and the JPY adjusts accordingly. If Nissan adjusts its export price to JPY3,226,619, what is the pass through rate?

Solution:

USD Price of Xterra at current rate: ¥3,250,000/¥115.20/\$ = \$28,211.81

USD/JPY exchange rate after PPP adjustment:

$$S_1 = S_0 \times \frac{(1 + \pi_{JAP})}{(1 + \pi_{US})} = 115.20 \times \frac{(1 + 0.01)}{(1 + 0.035)} = JPY112.74$$

If Nissan allows 100% **Pass-Through** Price should be:

JPY3,250,000/112.74=\$28,826

$$\text{Pass-Through Rate} = \frac{\% \text{ Change in Import Price}}{\% \text{ Change in Exporter's Currency}}$$

$$\% \Delta \text{ in JPY} = \frac{115.20 - 112.74}{112.74} = 2.18\%$$

After the exchange rate change, Nissan Xterra is exported to the US at JPY3,190,000. The dollar price of the imported car is :

JPY3, 226,619/112.74= \$ 28,600

$$\% \Delta \text{ in Import Price} = \frac{28,600 - 28,212}{28,212} = +1.38\%$$

$$PT = \frac{\% \text{ Change in Import Price}}{\% \text{ Change in Exporter's Currency}} = \frac{1.38\%}{2.18\%} = 63.3\%$$