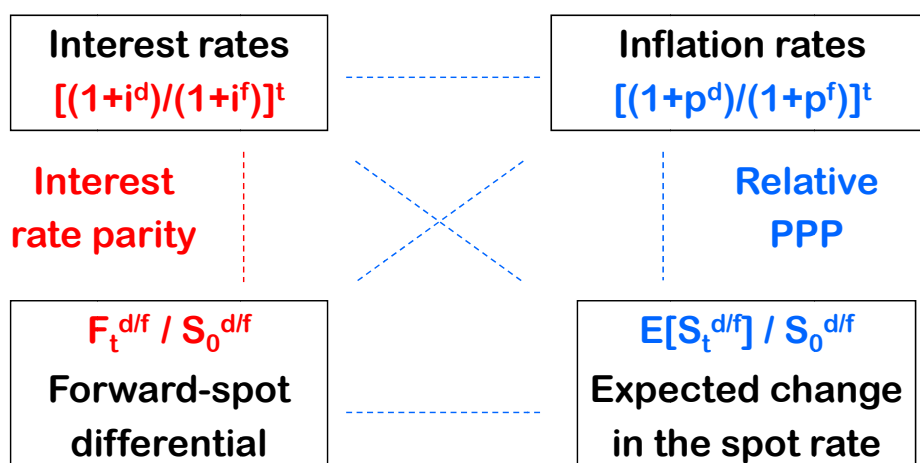


International Parity

International Fisher relation



Forward rates as predictors of future spot rates

Law of One Price

“Equivalent assets sell for the same price”

- Seldom holds for nontraded assets
- Can't compare assets that vary in quality
- May not hold precisely when there are market frictions

Absolute Purchasing Power Parity (Absolute PPP)

$$S_0 = \frac{P_{DC}}{P_{FC}}$$

Given,

S_0 = Spot exchange rate at time 0 quoted as domestic currency (DC) to 1 unit of foreign currency (FC)

P_{DC} = the (basket of) price in domestic currency (DC) at time 0

P_{FC} = the (basket of) price in foreign currency (FC) at time 0

Exchange rate (DC/FC) at time t is the ratio of the (basket of) price in DC to the (basket of) price in FC.

The hamburger standard

	Big Mac prices		Implied PPP* of the dollar	Actual exchange rate: Jan 30th	Under (-)/over(+) valuation against the dollar, %
	in local currency	in dollars			
United States†	\$3.54	3.54	-	-	
Argentina	Peso 11.50	3.30	3.25	3.49	-7
Australia	A\$3.45	2.19	0.97	1.57	-38
Brazil	Real 8.02	3.45	2.27	2.32	-2
Britain	£2.29	3.30	1.55‡	1.44‡	-7
Canada	C\$4.16	3.36	1.18	1.24	-5
Chile	Peso 1,550	2.51	438	617	-29
China	Yuan 12.5	1.83	3.53	6.84	-48
Czech Republic	Koruna 65.94	3.02	18.6	21.9	-15
Denmark	DK 29.5	5.07	8.33	5.82	43
Egypt	Pound 13.0	2.34	3.67	5.57	-34
Euro area§	€3.42	4.38	1.04**	1.28**	24
Hong Kong	HK\$13.3	1.72	3.76	7.75	-52
Hungary	Forint 680	2.92	192	233	-18
Indonesia	Rupiah 19,800	1.74	5,593	11,380	-51
Israel	Shekel 15.0	3.69	4.24	4.07	4
Japan	¥290	3.23	81.9	89.8	-9
Malaysia	Ringgit 5.50	1.52	1.55	3.61	-57
Mexico	Peso 33.0	2.30	9.32	14.4	-35
New Zealand	NZ\$4.90	2.48	1.38	1.97	-30
Norway	Kroner 40.0	5.79	11.3	6.91	63
Peru	Sol 8.06	2.54	2.28	3.18	-28
Philippines	Peso 98.0	2.07	27.7	47.4	-42
Poland	Zloty 7.00	2.01	1.98	3.48	-43
Russia	Ruble 62.0	1.73	17.5	35.7	-51
Saudi Arabia	Riyal 10.0	2.66	2.82	3.75	-25
Singapore	S\$3.95	2.61	1.12	1.51	-26
South Africa	Rand 16.95	1.66	4.79	10.2	-53
South Korea	Won 3,300	2.39	932	1,380	-32
Sweden	SKR 38.0	4.58	10.7	8.30	29
Switzerland	CHF 6.50	5.60	1.84	1.16	58
Taiwan	NT\$75.0	2.23	21.2	33.6	-37
Thailand	Baht 62.0	1.77	17.5	35.0	-50
Turkey	Lire 5.15	3.13	1.45	1.64	-12

*Purchasing-power parity; local price divided by price in the United States

†Average of New York, Chicago, Atlanta and San Francisco ‡Dollars per pound

§Weighted average of prices in euro area **Dollars per euro

Sources: McDonald's; *The Economist*

Source: www.economist.com



Exercise

Use the data to complete the calculation of the implied PPP value of the currency versus the US dollar and the calculation as to whether that currency is undervalued or overvalued versus the US dollar.

Big Mac Index: April 1997

Country	Big Mac price in local currency	Actual exchange rate (7th April, 1997)	Big Mac prices in dollars	Implied PPP of the dollar	Local currency undervaluation (-) / overvaluation (+)
United States (dollar)	2.42	-	2.42	1.00	-
Argentina (peso)	2.50	1.00			
Brazil (reais)	2.97	1.06			
Chile (peso)	1,200.00	417.00			
Mexico (peso)	14.90	7.90			

Big Mac Index: March 1999

Country	Big Mac price in local currency	Actual exchange rate (7th April, 1997)	Big Mac prices in dollars	Implied PPP of the dollar	Local currency undervaluation (-) / overvaluation (+)
United States (dollar)	2.43	-	2.43	1.00	-
Argentina (peso)	2.50	1.00			
Brazil (reais)	2.95	1.73			
Chile (peso)	1,250.00	484.00			
Mexico (peso)	19.90	9.54			

Big Mac Index: April 2002

Country	Big Mac price in local currency	Actual exchange rate (7th April, 1997)	Big Mac prices in dollars	Implied PPP of the dollar	Local currency undervaluation (-) / overvaluation (+)
United States (dollar)	2.49	-	2.49	1.00	-
Argentina (peso)	2.50	3.13			
Brazil (reais)	3.60	2.34			
Chile (peso)	1,400.00	655.00			
Mexico (peso)	21.90	9.28			

Exercise

Why absolute purchasing power parity does not hold in reality?

Exercise

In countries with no McDonald's, which product would you suggest to be used instead of Big Mac to compute implied PPP?

Example

Given the following financial information,

Current spot exchange rate is THB 40.00/USD

USD interest rate: 5.00 percent per annum.

THB interest rate: 10.00 percent per annum.

Explain international parity conditions.

International Fisher Effect (IFE)

Expected future spot exchange rate is current spot exchange rate multiply by the difference in interest rate.

$$E[S_t] = S_0 \frac{(1 + i_{DC})^t}{(1 + i_{FC})^t}$$

Given,

S_0 = Spot exchange rate at time 0 quoted as domestic currency (DC) to 1 unit of foreign currency (FC)

$E[S_t]$ = Spot exchange rate at time t quoted as domestic currency (DC) to 1 unit of foreign currency (FC)

i_{DC} = Interest rate of domestic currency (DC)

i_{FC} = Interest rate of foreign currency (FC)

t = number of periods

Fisher Effect (FE)

Nominal interest rate is real interest rate compounded with inflation rate.

$$(1 + i_{nom}) = (1 + i_{real})(1 + \pi)$$

Given,

i_{nom} = Nominal interest rate

i_{real} = Real interest rate

π = Inflation rate

Relative Purchasing Power Parity (Relative PPP)

Expected future spot exchange rate is current spot exchange rate multiply by the difference in inflation rate.

$$E[S_t] = S_0 \frac{(1 + \pi_{DC})^t}{(1 + \pi_{FC})^t}$$

Given,

S_0 = Spot exchange rate at time 0 quoted as domestic currency (DC) to 1 unit of foreign currency (FC)

$E[S_t]$ = Expected Spot exchange rate at time t quoted as domestic currency (DC) to 1 unit of foreign currency (FC)

π_{DC} = Inflation rate of domestic currency (DC)

π_{FC} = Inflation rate of foreign currency (FC)

t = number of periods

Interest Rate Parity (IRP)

Forward exchange rate is current spot exchange rate multiply by the difference in interest rate.

$$F_t = S_0 \frac{(1 + i_{DC})^t}{(1 + i_{FC})^t}$$

Given,

- F_t = Forward exchange rate quoted at time 0 for actual exchange at time t in terms of domestic currency (DC) to 1 unit of foreign currency (FC)
- S_0 = Spot exchange rate at time 0 quoted as domestic currency (DC) to 1 unit of foreign currency (FC)
- i_{DC} = Interest rate of domestic currency (DC)
- i_{FC} = Interest rate of foreign currency (FC)
- t = number of periods

Unbiased Forward Rate (UFR)

Forward exchange rate is an unbiased estimator of future spot exchange rate.

$$F_t = E[S_t]$$

Given,

- F_t = Forward exchange rate quoted at time 0 for actual exchange at time t in terms of domestic currency (DC) to 1 unit of foreign currency (FC)
- $E[S_t]$ = Spot exchange rate at time t quoted as domestic currency (DC) to 1 unit of foreign currency (FC)

Exercise

Using the following information for questions 1 to 7.

The international parity holds and given the following financial information:

	<u>Thai baht</u>	<u>Euro</u>	<u>Great Britain Pound</u>
Real interest Rate	3.00 percent	3.00 percent	
Inflation Rate	4.00 percent	2.50 percent	
Nominal interest rate			4.50 percent

1. Compute UK inflation rate.
2. Compute THB nominal interest rate.
3. Compute EUR nominal interest rate.
4. Given current spot exchange rate of THB 45.00/EUR, using purchasing power parity compute
 - 4.1 THB/EUR Expected 1-year spot exchange rate
 - 4.2 THB/EUR Expected 6-month spot exchange rate
 - 4.3 THB/EUR Expected 2-year spot exchange rate
5. Repeat question 4, using international fisher effect.
6. Given current spot exchange rate of THB 52.00/GBP, compute
 - 6.1 THB/GBP Expected 1-month forward exchange rate
 - 6.2 THB/GBP Expected 6-month forward exchange rate
 - 6.3 GBP/THB Expected 3-year forward exchange rate
 - 6.4 For 6.1 to 6.3, which international parity being applied here?
7. Given current spot exchange rate of USD 1.20/GBP and 1-year forward rate is USD 1.22/GBP. Compute USD inflation rate.
8. Given current spot exchange rate of MYR 2.7810/SGD and the following interest rates:

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
SGD	1.25 percent	1.37 percent	1.10 percent	1.90 percent
MYR	3.40 percent	3.31 percent	3.78 percent	4.50 percent

Compute expected spot exchange rate for each year for the next 4 years.
9. Current spot exchange rate is SEK 12200/NOK and in two years, spot exchange rate is expected to be SEK 1.4839/NOK. What is the inflation rate in Sweden given 3.75 percent inflation rate is Norway.
10. 6-month forward exchange rate is quoted at the bank for GBP 0.8420/USD. What is the expected USD/GBP spot exchange rate in 6 months.

11. Given current spot exchange rate is THB 32.5000/USD and expected spot exchange rate in 1 year is THB 34.5782/USD, inflation rate in Thailand is double of that in America. Compute inflation rate for Thailand and America.

12. Given Current spot exchange rate of RUB 5.6700/CNY
 Russian ruble interest rate of 3.40 percent per annum, monthly compounded
 Renminbi interest rate of 9.50 percent per annum, monthly compounded

Compute expected future exchange rate in (1) 3 months, (2) 5 months, (3) 1 year and (4) 3 years.

13. Given current spot exchange rate of EUR 1.2100/GBP and the interest rate in each of the following quarter as follows:

	<u>Quarter 1</u>	<u>Quarter 2</u>	<u>Quarter 3</u>	<u>Quarter 4</u>
EUR	2.50 percent	2.70 percent	3.10 percent	3.50 percent
GBP	3.60 percent	3.30 percent	4.00 percent	4.80 percent

These rates are quarterly compounded. Compute the following forward exchange rates:

13.1 3-month forward exchange rate

13.2 6-month forward exchange rate

13.3 1-year forward exchange rate

14. Today certain product costs 10,000 baht in Thailand and the same product costs 300.00 US dollars in America. One year from now price of these products expected to be 10,500 baht and 306.00 US dollars.

14.1 Using absolute purchasing power parity to compute current spot exchange rate.

14.2 Using absolute purchasing power parity to compute expected spot exchange rate in 1 year.

14.3 Given answer in 14.1, using relative purchasing power parity to compute expected spot exchange rate in 1 year.

14.4 Which currency is appreciated? Depreciated? Also, compute percentage of change in currency value.

15. If US dollar is depreciated 1.75 percent per year with respect to Great Britain pound, compute expected spot exchange rate in (1) 1 year and (2) 2 years, given current spot exchange rate of USD 1.3300/GBP.