Exchange Rates

Nominal exchange rate = rate at which a person can trade the currency of one country for the currency of another.

For example, $1 = 80 Yen

\[ 1 \text{ Yen} = \frac{1}{80} \approx 0.0125 \]$ $0.0125$

If $1 = 1.3$ Euros,

then \[ 80 \text{ Yen} = 1.3 \text{ Euros}, \]
or \[ 1 \text{ Euro} = \frac{80}{1.3} \text{ Yen} \]
If the value of a dollar increases relative to the yen, then the dollar is said to appreciate relative to the yen. If, instead, the value of a dollar decreases, then the dollar is said to depreciate.

Example: If the exchange rate falls from 80 yen/dollar to 70 yen/dollar, the dollar depreciates (relative to the yen) and the yen appreciates (relative to the dollar).
**Real Exchange Rates**

The real exchange rate is the rate at which a person can trade the goods and services of one country for the goods and services of another country.

- Suppose a car in the US costs $20K (\$20,000).
- Suppose a car in Japan costs Yen 2000K (2,000,000 yen).
- Suppose the nominal exchange rate is 80 Yen/dollar.

The real exchange rate =

\[
\frac{\text{Nominal exchange rate}}{\text{Domestic price}} \times \frac{\text{Foreign price}}{\text{Yen/dollar} \times \text{20K dollars/US car}} = \frac{80 \text{ Yen/dollar} \times 20K \text{ dollars/US car}}{2000K \text{ Yen/Japanese car}} = 0.8 \text{ Japanese cars/US car}
\]
Purchasing Power Parity

- Let $e$ be the nominal exchange rate between the U.S. dollar and a foreign currency. Let $P$ be the aggregate price level in the U.S. and let $P^*$ be the aggregate price level in the foreign country.

- Then the real exchange rate between the U.S. and the foreign country is $\frac{eP}{P^*}$.

- If the real exchange rate $< 1$, goods are cheaper in the U.S. than in the foreign country.

- If the real exchange rate $> 1$, goods are more expensive in the U.S. than in the foreign country.
Purchasing power parity (PPP) is a theory about the long-run behavior of real exchange rates. It maintains that the real exchange rate between any two countries equals 1 in the long run:

\[
\frac{e P}{p^*} = 1 \implies e = \frac{p^*}{p}
\]

In other words, the nominal exchange rate between any two countries is, in the long run, equal to the ratios of the price levels in the two countries.
Purchasing power parity (PPP) is an example of the law of one price: in a market economy, identical goods should have the same price. If they did not, there would be an arbitrage opportunity: an entrepreneur could make a (risk-free) profit by buying the good at the low price and selling it at the high price. As entrepreneurs try to exploit this arbitrage opportunity, prices will adjust.

Lesson: Market forces tend to eliminate arbitrage opportunities.
What might prevent PPP from holding?

1. Transportation costs: entrepreneurs seeking to exploit an arbitrage opportunity must cover the cost of transporting goods.

2. Some goods are simply not traded (e.g., haircuts, housing, restaurant meals).

3. Traded goods within some categories (say, cars) are not identical.

4. Local producers might have market power (e.g., they might be monopolists), inhibiting the competitive forces that eliminate arbitrage opportunities.
The Big Mac and Starbucks Tall Latte Indices (invented by The Economist magazine)

Big Macs and Tall Lattes are sold around the world and are more or less identical everywhere. They are not themselves tradable goods but many of their inputs (beef, coffee beans) are.

What do the relative prices of these two standard goods across different countries say about real exchange rates?
• Suppose a Starbucks Tall Latte costs 14 skr (Swedish kronor) in Stockholm and $2 in New York.

• PPP predicts that the nominal exchange rate (the number of skr that a person could buy with $1) should be \( \frac{14 \text{ skr}}{2 \text{ $}} = 7 \text{ skr/$.}

• In this case, the real exchange rate (the number of Tall Lattes in Stockholm that one could purchase by selling one Tall Latte in NY, exchanging the dollars for skr, and using the proceeds to buy Tall Lattes in Stockholm) would be exactly equal to 1:

\[
\text{real exchange rate} = \frac{\text{nominal exchange rate} \times p}{p^*} = \frac{7 \times 2}{14} = 1
\]
But suppose the nominal exchange rate is 6 skr/$? Then the real exchange rate is \( \frac{6 \times 2}{14} = \frac{5}{7} < 1 \):

the $ is undervalued (it needs to appreciate) relative to the skr. Put differently, the skr is overvalued (it needs to depreciate) relative to the $.

The skr needs to decline in value (depreciate) relative to the $ by \( \frac{7 - 6}{6} \), or roughly 17.90%, for ppp to hold.

If the nominal exchange rate were, instead, 8 skr/$, then the skr is undervalued: it would need to rise in value (appreciate) relative to the $ by \( \frac{8 - 7}{8} \), or roughly 13.70%, for ppp to hold.
## Our hot tips

Local currency under (-)/over (+) valuation against the dollar, %, using:

<table>
<thead>
<tr>
<th>Country</th>
<th>Starbucks tall-latte index</th>
<th>McDonald’s Big Mac index</th>
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</thead>
<tbody>
<tr>
<td>Australia</td>
<td>-4</td>
<td>-17</td>
</tr>
<tr>
<td>Britain</td>
<td>+17</td>
<td>+23</td>
</tr>
<tr>
<td>Canada</td>
<td>-16</td>
<td>-16</td>
</tr>
<tr>
<td>China</td>
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<td>Euro area</td>
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<td>-46</td>
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<tr>
<td>Turkey</td>
<td>+6</td>
<td>+5</td>
</tr>
</tbody>
</table>

Source: The Economist
Using PPP prices to compare international living standards

- Currencies in developing countries tend to be severely undervalued according to PPP calculations.
- It is, therefore, misleading to use actual nominal exchange rates to convert GDP’s of different countries into common units (say, dollars).
- It is much more meaningful to use nominal exchange rates predicted by PPP to do these conversions.
- Example: in 2000, U.S. GDP / Indian GDP = 80 when using the actual nominal exchange rate to convert rupees into dollars. But using the PPP nominal exchange rate yields a ratio of “only” 17.