Exchange rates and price levels

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The law of one price

- Definition: in presence of integrated international markets, the same good will have the same price (in the same currency) in two different markets.

$$P_i = SP_i^* \tag{1}$$

- This happens thanks to arbitrageurs.
- Considering transport costs, CT, (1) becomes

$$P_i = SP_i^* + CT_i$$

Tradable and non-tradable goods

- Non-tradable goods: goods whose transport cost is so high to make international trade unfeasible. For these goods, the law of one price does not hold because arbitrageurs cannot operate.
- Tradable goods: goods for which transport costs are so low with respect to the value of the good that international trade is profitable.

Purchasing power parity

- Definition: two identical baskets - sold in different countries - have the same price expressed in the same currency.

$$P = SP^* \tag{2}$$

with $P = \sum_{i=1}^{m} \alpha_i P_i$ and $P^* = \sum_{i=1}^{m} \alpha_i P_i^*$.

- From (2) it follows that the value of the exchange rate equals the ratio of the general price levels (expressed in a common currency) in the two countries.

$$S = \frac{P}{P^*}$$

- History: Gustav Cassel and the Gold Standard redux.

Purchasing power parity

- Definition: the exchange rate is proportional to the ratio between price indexes

$$S = c\frac{P}{P^*} \tag{3}$$

- From (3) an interesting dynamic relation follows

$$\frac{\dot{S}}{S} = \frac{\dot{P}}{P} - \frac{\dot{P}^*}{P^*}$$

so that countries with a higher inflation tend to experience exchange rate depreciations.

Competitiveness and real exchange rate

- Competitiveness: ability to export domestic goods on foreign markets and to use them to satisfy domestic demand.
- The nominal exchange rate is not a correct indicator for a country's competitiveness: its variations can be compensated by inflation rate differentials.
- A better indicator for competitiveness is the real exchange rate, which can be defined as the ratio between the foreign level of prices (expressed in terms of the domestic currency) and the domestic level of prices. It is a measure of the number of domestic consumption baskets necessary to buy one unit of the foreign consumption basket.

$$Q = \frac{SP^*}{P} \tag{4}$$

The real exchange rate

- From (4) it follows that

$$\frac{\dot{Q}}{Q} = \frac{\dot{S}}{S} + \frac{\dot{P}^*}{P^*} - \frac{\dot{P}}{P}$$

- If the nominal exchange rate follows the inflation rate differential $\frac{\dot{Q}}{Q} = 0$
- If $\frac{\dot{Q}}{Q} > 0$, one has a *real depreciation* of the domestic currency (it is necessary a greater number of domestic consumption baskets to buy one unit of foreign consumption basket, as a consequence competitiveness increases)
- If $\frac{\dot{Q}}{Q} < 0$, one has a *real appreciation* (competitiveness decreases).

The effective real exchange rate

- Competitiveness is *multifaceted or global* concept. E.g.: the Euro could appreciate against the Dollar and depreciate against the Yen.
- To keep into account this aspect, one defines the effective real exchange rate as the weighted average of various bilateral exchange rates, whose weights reflect the relevance of each partner country for the domestic economy in terms of trade volume.

$$QE_{It} = \sum_{n=1}^{m} Q_{It,n} w_n$$

where w_n is the share of the $n-th$ country on the whole international trade of the domestic economy.

- Fig. 4.1 here.

Real exchange rate, terms of trade and non-tradables goods

- If all the goods are tradables, the real exchange rate is the inverse of the terms of trade

$$Q = \frac{SP^*}{P} = \frac{1}{P_{EX}/P_{IM}}$$

- Under this hypothesis, a real appreciation is the same as an improvement in the terms of trade, while a real depreciation is the same as a worsening of terms of trade.

Real exchange rate, terms of trade and non-tradables goods

- In fact not all the goods are tradables.
  - Let us mark tradables with T and non-tradables with N.
  - Let us suppose that the general level of prices is a geometric mean of the prices of the two kinds of goods: $P = P_N^{\gamma} P_T^{1-\gamma}$
  - Let us suppose that the foreign economy produces only tradable goods
  - Keeping into account that PPP holds only for tradable goods ($P_T = SP_T^*$), we can define the real exchange rate as

$$Q = \frac{SP_T^*}{P} = \frac{P_T}{P_N^{\gamma} P_T^{1-\gamma}} = \left(\frac{P_T}{P_N}\right)^{\gamma}$$

Shock, purchasing power parity and exchange rate

- Consider (3) under the hypothesis that $P^* = 1$ and $c = 1$

$$P = \frac{1}{Q} S$$

- Fig 4.2
- Monetary shocks do not change the long-run real exchange rate. They have only short term effects on the real exchange rate and on competitiveness. This comes from the quantitative theory of money according to which an increase in the quantity of money does not have real effects, as the level of prices increases accordingly- The exchange rate is a price.
- Fig. 4.3

Shock, purchasing power parity and exchange rate

- Real shocks
  - They can be the result of changes in technology, preferences and trade policies
- Real shocks deriving from preference shifts in favour of domestic goods. Fig. 4.3.
- Real shocks deriving from changes in productivity. Fig. 4.4. Harrod-Samuelson-Balassa effect: a country, that experiences a greater productivity growth than in other countries, will go through an appreciation of the real exchange rate, as an equilibrium phenomenon: relative price variation makes resource reallocation possible.

Empirical evidence on the law of one price

- For raw materials, the law of one price tends to hold (Table 4.1), given that there exist homogeneous and standardized goods.
- For manufacturing goods, the law of one price tends not to hold
  - Big mac index:
    - http://www.economist.com/markets/bigmac/about.cfm
    - http://www.economist.com/media/audio/burgernomics.ram
  - IKEA index: the change in prices cannot be only explained by local factors (fiscal system for instance). If it was so relative prices of IKEA products should be the same everywhere (e.g.: the price of squared mirrors with respect to the oval ones). IKEA, therefore, fix prices strategically according to local conditions.

Empirical evidence on the law of one price

- Causes of failures of the law of one price
  - goods are not homogeneous. E.g.: the Big Mac is done with different meats and accessories (mustard, mayonnaise) across countries
  - transaction costs, duties, tariffs make many goods non-tradables in different countries
  - markets are not competitive: many firms do not sell their products at the same price on different markets
  - the exchange rate and the level of prices are too rigid and so they do not adjust and the law of one price does not hold (Engel and Rogers, 1996)

Empirical evidence on PPP

- Preliminary difficulty: the consumers' price index is computed using different reference baskets in different countries (goods are not identical and they receive different weights in different countries due to the variety in their preferences). This would not hamper a test for relative PPP if the price of each good grew at the same speed.
- Qualitative analysis. Figg. 4.5, 4.6, 4.7
- Econometric analysis.
  - Reference model
    $$\ln Q_t = \beta \ln Q_{t-1} + \epsilon_t$$
  - $\beta < 1$ or $\beta = 1$? In the latter case - which receives empirical support - the real exchange rate does not tend to go back to equilibrium: the best possible forecast for the future exchange rate is the current one.

Empirical evidence on PPP

- Econometric analysis
  - Taking into consideration longer time horizons than 70 years, PPP finds empirical support. However, the convergence rate is low, being about 15% a year.
  - Monetary shocks implies temporary changes in the real exchange rate, while real shock change equilibrium values. It is difficult to single them out with the exception of some specific situations.
    - Monetary shocks. Economies that experience hyperinflation are mainly hit by monetary shocks. Frenkel (1978, 1980) and Taylor and McMahon (1988) focused on these economies finding evidence in favour of PPP.
    - Real shocks. Alquist and Chinn (2002), Asea and Mendoza (1994), De Gregorio et al. (1994) and Canzonieri et al. (1999) find empirical evidence in favour of the Harrod-Balassa-Samuelson effect: economies growing faster experience appreciation trends (e.g.: Fig 4.8).