2nd session

26th September 2017

- **Arbitrage**
  - There are foreign exchange trades in many places in the world. Are prices similar in every location?
  - There are many foreign exchange rates relating different pairs of currencies. It is possible to have the price of many currencies in terms of a certain one. Is there a relation between the exchange rates and the cross-rates or are they independent of each other?
  - Definition: Simultaneous purchase and sale of an asset in order to profit from a price discrepancy, without risk. (Closed Position)

- Locational or Two Point Arbitrage

  - When the price of a currency in a financial centre is different from the price of that currency in another financial centre.

S (EUR/JPY) in Tokyo = 149,125

S (EUR/JPY) in Paris = 149,725

- Should buy EUR /sell JPY

in Tokyo

and sell EUR/ buy JPY

in Paris.

- Unicity of exchange rates.

- Role of the spread.

Tokyo: S_a (EUR/JPY) = 149,125; S_b (EUR/JPY) = 148,725

Paris: S_a (EUR/JPY) = 149,725; S_b (EUR/JPY) = 149,125

- Triangular Arbitrage or Three Point Arbitrage
  - When the quoted market cross exchange rate is different from the implicit cross exchange rate obtained from the exchange rates of other currencies.

S (EUR/JPY) = 149,125

S(EUR/GBP) = 0,7880

S(JPY/GBP) = 0,0045

S (EUR/JPY) **x** S(JPY/GBP) **x** S(GBP/EUR) ≠ 1

How can someone with euros obtain a gain?

With 1 EUR, buys 0,788 GBP.

With 0,788 GBP buys 0,788/0,0045 = 175,1111 JPY

With 175,1111 JPY buys 175,1111/149,125 = 1,17425 EUR !

  - Exchange rates consistency

Exercise

- At a certain time, the following exchange rates are registered:

S(USD/CHF) = 1,2240

S(EUR/USD) = 1,2810

S(EUR/CHF) = 1,6000

a) Is there arbitrage opportunity? If so, what are the profitable transactions?

b) What exchange rate S(CHF/EUR) would be consistent with the other two?

- PPP – Several versions

Pugel, chap.19

The LONG RUN

- The Law of One Price
  - $P_B = P_A.S(A/B) \Leftrightarrow S(A/B) = P_B / P_A$
  - It makes sense with highly internationally traded goods and services (Gold and other metals, oil, cereal…)
  - It does not apply to most manufactured goods. Causes: transport costs, restrictions to trade, taxes, price discrimination by firms,…)
  - The Big Mac Index http://www.economist.com/content/big-mac-index

- Absolute Purchasing Power Parity (parity of prices)
  - $P_B = P_A.S(A/B) \Leftrightarrow S(A/B) = P_B / P_A$
  - The expression has the same aspect, but a different meaning. P_B and P_A are the prices of baskets of goods and not the prices of specific goods.
  - Even if the relation does not apply to every good, differences may cancel with each other so that the relation is observed on average.
  - Idea that the value of a currency is related to its power to purchase goods.
  - "Correct foreign exchange rate".
  - If absolute PPP holds, then it implies the real exchange rate = 1.
  - Even though it does not fit reality well, there is evidence that large discrepancies relative to absolute PPP tend to reduce with time, for traded goods.

- Relative Purchasing Power Parity
  - The perspective changes from the verification in one point in time to the verification of a change.
  - With time, the difference between prices of traded goods in different countries will be compensated by the variation of the foreign exchange rate.

$$\frac{S_t(A/B)}{S_0(A/B)} = \frac{P_{Bt} / P_{B0}}{P_{At} / P_{A0}}$$

  - FMI recommendations.
  - If the condition holds in absolute terms, then it also holds in relative terms.

- The relative version is like a guide about the long run evolution of the foreign exchange rate, even if the absolute version is not verified in every moment.
- The relative version is sometimes presented in the following way:

depreciation rate of the home currency =
Inflation rate – inflation rate*

- Countries with low inflation rates have currencies that tend to appreciate.
- If a country wants stable prices when neighbour countries have higher inflation rates this country should be prepared to see its currency appreciate.

- Empirical verification of purchasing power parity
  - Froot e Rogoff, 1994, Perspectives on PPP and long-run real exchange rates, NBER WP No.4952 (*published in book in1995)*
  - Law of One Price for single goods – extrapolation for identical baskets of goods. Use of Price Indexes.
  - Test of absolute PPP like H_0 – Frenkel (1978)

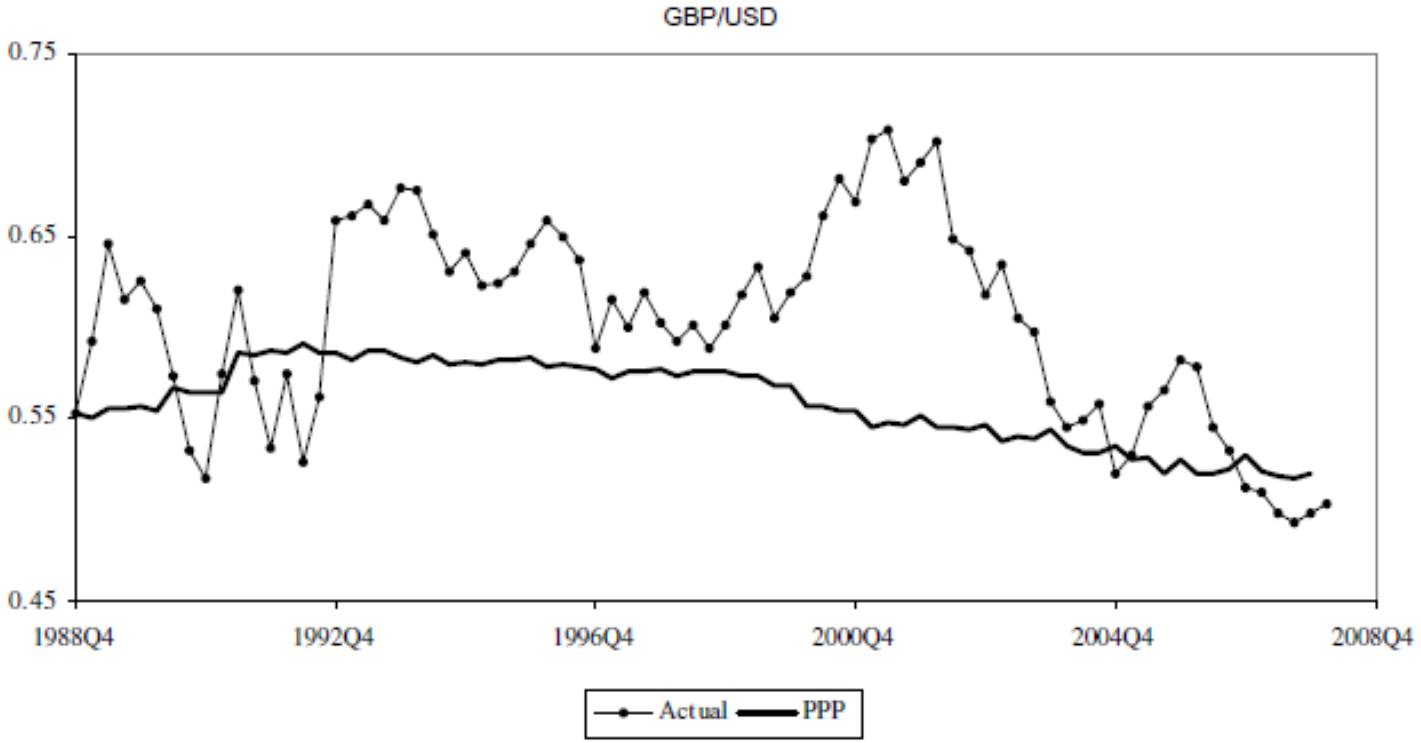
$$s_t = \alpha + \beta(p_t - p^*_t) + \varepsilon_t$$

Data from countries with hyper-inflations.

Found β's close to 1.

  - Frenkel (1981) – Data from industrialized countries, without hyper-inflation: β's far from 1 (some <0, others >2).

- Problem with the estimation of the previous equation: endogeneity – simultaneity of p and s.
- Krugman (1978) and Frenkel (1981) reestimation with use of instrumental variables. The PPP in continuous still rejected.
- Another problem: non stationarity of the residuals (not possible to test the hypothesis $\beta = 1$). Now the tested hypothesis is H_0 that the foreign exchange rate follows a random walk against the hypothesis that the PPP holds in the Long Run.
- Results from these studies: the random walk is not rejected for most of floating rates, but it is rejected for the european exchange rates against the DM.
- Problem: Need of more observations. Slow mean reversion or random walk? Solutions: long time series of data or *cross sections*.
- With data of centuries, reversions in PPP are found. On average, it takes 4 years for the deviation from PPP to be cut to half.



Source: Moosa & Bhatti, 2009, Why do we study exchange rates?

- The prices of Traded goods and services are equalized between the two countries, through arbitrage. That does not happen with Non-Traded goods and services.
- The overall price (P) in each country i, (i = A, B), is

$$P_i = \alpha_i(PT_i) + (1-\alpha_i)\,(PNT_i)$$

- If absolute PPP stands for Traded but not for Non-Traded goods and services, $S_{(A/B)} = P_{TB} / P_{TA}$

$$P_B / P_A = \frac{\alpha_B.(PT_B) + (1-\alpha_B).(PNT_B)}{\alpha_A.(PT_A) + (1-\alpha_A).(PNT_A)}$$

(Dividing the numerator by PT_B and the denominator by $S.PT_A$),

$$P_B / P_A = \frac{\alpha_B + (1-\alpha_B).(PNT_B)\,/PT_B}{\alpha_A/S + (1-\alpha_A).(PNT_A)/(S.PT_A)}$$

- $$P_B / P_A = \frac{\alpha_B + (1-\alpha_B).(PNT_B / PT_B)}{(1/S)\,[\alpha_A + (1-\alpha_A).(PNT_A / PT_A)]}$$
- $$S_{(A/B)} = (P_B / P_A).\ \frac{\alpha_A + (1-\alpha_A).(PNT_A / PT_A)}{\alpha_B + (1-\alpha_B).(PNT_B / PT_B)}$$

- If absolute PPP stands overall, $S_{(A/B)} = P_B / P_A$
- PPP will lead to an underestimation of the value of currencies for developed countries (where P_{NT} tends to be higher) and an overestimation of the value of currencies for developing countries (where P_{NT} tends to be lower).

- If in the LR the inflation diferencials determine the exchange rate,
- what determines inflation?
- MONETARY THEORY

- In the Long Run, the growth of money supply determines Inflation . Therefore, it makes sense to analyse the evolution of the foreign exchange rate based on the evolution of domestic money supplies.

- The larger the money supply comparing with money demand, the lower must its value be.

The Monetary Approach to the Determination of Foreign Exchange Rates

- Money demand is a result of the need to trade. Therefore, it should be proportional to the volume of transactions (proportion k).

- Quantity Theory of Money

$$M^s_A = k_A . P_A . Y_A \quad \text{and} \quad M^s_B = k_B . P_B . Y_B$$

- $M^s_A / M^s_B = (k_A / k_B).(P_A / P_B).(Y_A / Y_B)$

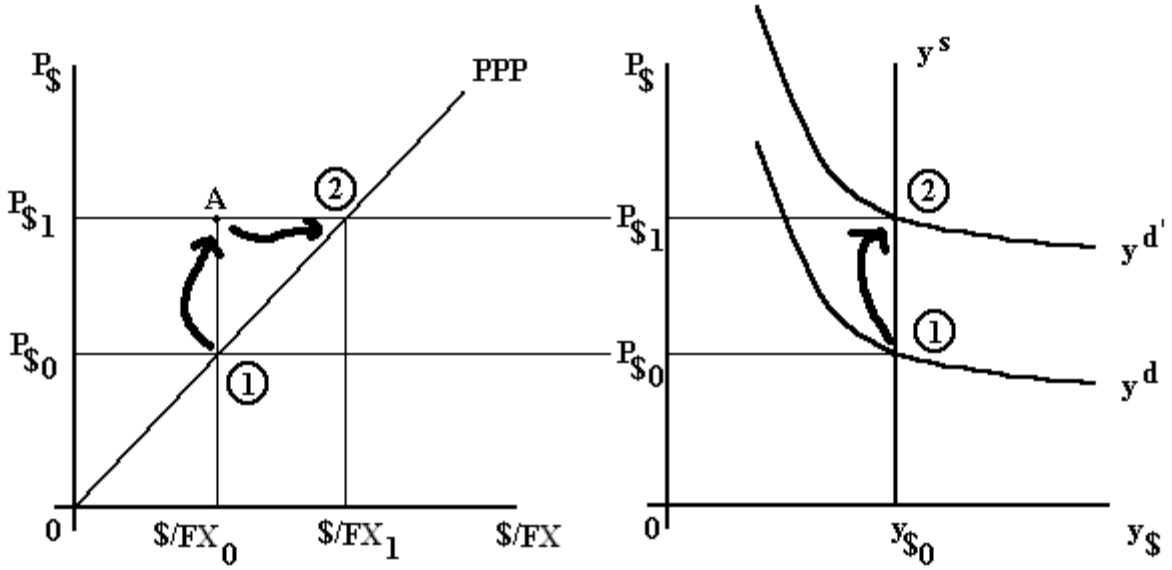
$$(P_A / P_B) = (M^s_A / M^s_B) / [(k_A / k_B).(Y_A / Y_B)]$$

- Combining the PPP (absolute) with the Quantitative Theory of Money, we have:

$$S(b/a) = P_A / P_B = (M^s_A / M^s_B) / [(k_A / k_B).(Y_A / Y_B)]$$

- $S(b/a) = P_A/P_B = (M^s_A / M^s_B) / [(k_A/k_B).(Y_A/Y_B)]$
- Determinants of the appreciation of currency *a* in the LR (what is behind the lower increase in relative prices):
  - Lower growth of the money stock.
  - Larger growth of the real output.
  - Increase in the ratio (k_A/k_B).
- Some elasticities = 1.
  - With everything else constant,
    - 1% increase in M^s_A → 1% depreciation of the domestic currency
    - 1% increase in M^s_B → 1% appreciation of the domestic currency
    - 1% increase in Y_A → 1% appreciation of the domestic currency
    - 1% increase in Y_B → 1% depreciation of the domestic currency

The Monetary Model with an increase in the money supply.



Source: Harvey, J. , 2007, Teaching Post Keynesian Exchange Rate Theory, *Journal of Post - Keynesian Economics*, 30, 2, 147-168

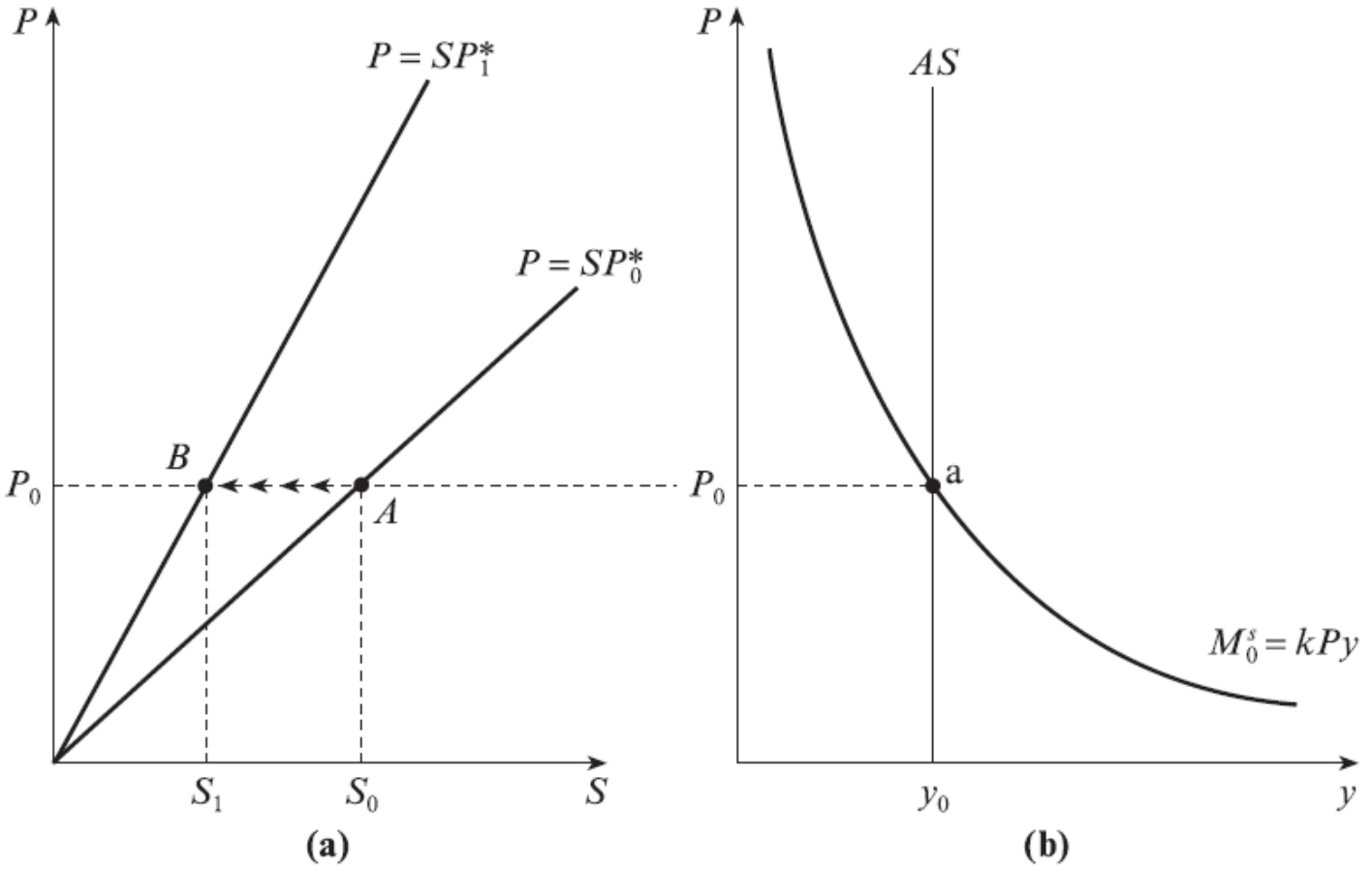
Note: Here, $/FX is the dollar price of the FCurrency, the opposite of our convention.

①- Starting Point : PPP holds; In the LR the Y is the full employment.

Monetary Expansion: Increase in the demand from y_d to y_d'. Increase in P from $P_{\$0}$ to $P_{\$1}$. Temporary unbalance (A) with a US déficit.

②- Lower relative demand of $ in the foreign exchange market → depreciation of $.

The Monetary Model with an increase in the foreign prices



Source: Copeland, L., Exchange Rates and International Finance, Pearson

- Typical Monetarist Conclusion:

The variation of the Money Supply has an effect on the foreign exchange rate. In the Long Run, it has no real effect.

EXERCISE 11 from Pugel, p.470

In 1975, the price level for the US was 100, the price level for Pugelovia was also 100, and in the foreign exchange market one Pugelovian pnut was equal to $1. In 2008, the US price level had risen to 260, and the Pugelovian price level had risen to 390.

a. According to PPP, what should the dollar-pnut exchange rate be in 2008?

b. If the actual dollar-pnut exchange rate is $1/pnut in 2008, is the pnut overvalued or undervalued relative to PPP?

EXERCISE 12 from Pugel, p.471

Here is further information on the US and Pugelovian economies.

	1975			2002		
	M^S	Y	P	M^S	Y	P
US	20,000	800	100	65,000	1,000	260
Pugelovia	10,000	200	100	58,500	300	390

a. What is the value of *k* for the US in 1975? For Pugelovia?

b. Show that the change in price level from 1975 to 2008 for each country is consistent with the quantity theory of money with a constant *k.*

(Carbaugh)

Starting at the point of equilibrium between the money supply and the money demand, a *decrease in the* demand for money in the home country causes the value of the home currency to:

a. Depreciate relative to other currencies

b. Appreciate relative to other currencies

c. Not change relative to other currencies

d. None of the above