

Lecture 12: Purchasing power parity and the law of one price.

Open Economy Macroeconomics, Fall 2006

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- Required readings:
 - Rødseth (2000) chapter. 8.1-8.4
 - Rogoff, K (1996): The purchasing power parity puzzle, *Journal of Economic Literature* 34, 647-668.

- Supplementary readings:
 - Taylor and Sarno (2002) chapter 3
 - Engel, C (1999): Accounting for U.S. real exchange rate changes, *Journal of Political Economy*, vol 107, 507–538.
 - Burstein, A, Eichenbaum, M and S Rebelo (2005): The importance of nontradable goods' prices in cyclical real exchange rate fluctuations, NBER Working Paper 11699

The PPP hypothesis

- The law of one price (LOP)

$$P_i = SP_i^*$$

where P_i and P_i^* are the prices of good i in the home and foreign economy, respectively, and S is the nominal exchange rate (domestic currency price of foreign currency)

- *Absolute* purchasing power parity (PPP) prevails if the *same* basket of goods costs the same when prices are converted to a common currency. That is, when

$$P = SP^*$$

where P and P^* are the local currency prices of the basket in the home and foreign country, respectively.

- *Relative* PPP prevails if the ratio of two broadly defined price indices stays constant when corrected for changes in the exchange rate, i.e., if the real exchange rate $R = SP^*/P$ is constant.

- Note:

- If the law of one price holds for every commodity then absolute PPP holds. However, the law of one price is not *necessary* for absolute PPP (the basket of goods may cost the same even if the prices of individual goods differ)
- Absolute PPP implies relative PPP if the same basket of goods is used in the comparisons. To see this, note that

$$R = \frac{SP^*}{P} = \frac{S \prod_i (P_i^*)^{\omega_i^*}}{\prod_i (P_i)^{\omega_i}}$$

- The law of one price is neither necessary nor sufficient for relative PPP since the weights in the relative price indices may differ.

- Two different underpinnings of PPP:
 1. *The commodity arbitrage view.* In an integrated world market prices are geographically arbitrated so that identical products sell for the same common-currency price in different locations. That is, the law of one price holds for every good.
 2. *Relative PPP as a long run neutrality proposition:* In some models (e.g., the Dornbusch overshooting model) a monetary expansion ultimately leads to an equiproportionate change in nominal variables, leaving the real exchange rate unchanged. If we compare two long-run equilibria which differ only with respect to the money supply, relative PPP appears to hold.
- Note: By itself the PPP hypothesis is a theory about the relationship between endogenous variables and is not a complete model of exchange rate or price level determination.

Empirical evidence

- Two categories of tests of PPP:
 1. Tests of the law of one price comparing the prices of individual goods across countries. Such tests have found that the deviations from the LOP are large, persistent and to a significant degree reflect changes in nominal exchange rates.
 2. Tests of relative PPP investigating whether there is a tendency for the real exchange rate to approach a constant over time (i.e., tests of unit roots in the real exchange rate). Appears to be consensus about a some basic facts
 - Short-run deviations from PPP are large and volatile.
 - Real exchange rates tend towards PPP in the very long run. The speed of convergence is extremely slow; deviations appear to damp out at a rate of roughly 15 percent per year.

Case study: The law of one price at IKEA

- Haskel, J. and H. Wolf (2001): The law of one price. A case study. *The Scandinavian Journal of Economics*, vol 103, 545-558
- Examine local currency catalog prices for 119 identical goods sold in 25 countries by IKEA over the years 1995–1998.
- Table reports 1998 prices of three mirrors in European IKEA stores (in USD)

Table 1. *European Prices (1998, in US\$)*

	Alg Mirror [1]	Krabb Mirror [2]	Ratio of Alg to Krabb [3]	Guldros Mirror [4]
Netherlands	20	20	1.03	100
United Kingdom	25	30	0.83	114
Belgium	22	27	0.80	110
Switzerland	19	27	0.72	68
Finland	13	19	0.70	93
Spain	22	33	0.65	110
France	21	33	0.64	99
Sweden	15	23	0.64	91
Italy	22	43	0.52	78
Austria	24	48	0.49	114
Norway	12	26	0.46	79
Germany	22	51	0.44	96
Denmark	12	30	0.40	104

Notes: Alg: square mirror, 45 × 60 cm, 2 tiles. Guldros: round mirror, 59 × 78 cm, beveled glass. Krabb: designer mirror, 44 × 40 cm. *Source:* IKEA. Exchange rate: annual average (series rf) from IMF *International Financial Statistics*.

- Two key findings:
 - Large deviations from the LOP for identical goods
 - Rankings of absolute prices across countries not the same across different types of mirrors.
- Suggests that differences in local distribution costs (e.g., rents and labour costs) and local taxes (e.g., VAT) do not explain the deviations from the LOP.

The PPP puzzle (Rogoff, 1996)

- *How can one reconcile the short-run volatility of real exchange rates with the slow rate at which deviations seem to die out?*
- Most explanations of short-term exchange rate volatility point to financial and monetary shocks
- Such shocks can have substantial effects on the real economy in the presence of sticky nominal wages and prices (see e.g. the Dornbusch model)
- However; estimates of the rate at which PPP deviations die out are seemingly far too slow to be explained by nominal rigidities

- Slow adjustment can be rationalized if real shocks (e.g., shocks to preferences and technology) are dominant
- However; models based on real shocks seem unable to account for short-term exchange rate volatility.

Sources of PPP deviations

- Using lower-case letters to denote variables in logs, the (log of the) real exchange rate is defined as

$$r \equiv s - p + p^*$$

- The consumer price index in each country is a weighted average of traded and nontraded goods prices

$$\begin{aligned} p &= \gamma p_N + (1 - \gamma) p_T \\ p^* &= \gamma^* p_N^* + (1 - \gamma^*) p_T^* \end{aligned}$$

where superscripts T and N indicate that the variable is defined for traded and non-traded goods respectively, and γ and γ^* denote the shares of non-traded goods in the price indices.

- Substitution into the real exchange rate yields

$$\begin{aligned} r &= s - \gamma p_N - (1 - \gamma)p_T + \gamma^* p_N^* + (1 - \gamma^*)p_T^* \\ &= (s - p_T + p_T^*) - \gamma(p_N - p_T) + \gamma^*(p_N^* - p_T^*) \end{aligned}$$

- The decomposition highlights three potential sources of real exchange rate volatility
 - Deviations from the law of one price in traded goods
 - Movements in the relative prices of non-traded to traded goods between the home and foreign country
 - Variability of the weights used to construct the price indices.

- What do the data tell us about the importance of the different sources?
 - Disagreement in the literature:
 - * Engel (1999): movements in US real exchange rates are almost exclusively driven by movements in the relative price of tradable goods
 - * Burstein et al (2005): fluctuations in the relative price of non-traded to traded goods are an important source of real exchange rate movements
 - Source of disagreement: Engel measures traded goods using retail (consumer) prices of traded goods, Burstein et al use traded goods prices at the docks.

Explaining deviations from the LOP

- Local currency price stickiness
 - If nominal prices are fixed (e.g., due to contracts) in the currency of the buyer (local currency pricing, LCP) exchange rate changes will cause short-run deviations from the LOP.
 - If nominal prices are fixed in the currency of the seller (producer currency pricing, PCP) the LOP will hold continuously.
- Transportation costs and tariffs
- Local distribution costs (e.g., costs of non-traded components such as marketing costs and retail costs)
- International price discrimination and pricing-to-market (Krugman, 1987)