

International Finance

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#4. Chapter 4: The theory of purchasing power parity (PPP) and generalized model of the exchange rate

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Outline

- The Law of One Price
- Purchasing Power Parity (PPP)
- Empirical Evidence on PPP
- Explaining the Problems with PPP
- A Long-Run Exchange Rate Model Based on PPP

The Law of One Price (LOP)

- Law of One Price:

- Assume that there are no transportation costs or other trade barriers.
- Then, identical goods are sold at the same price in different countries when the prices are expressed in terms of the same currency.

$$P_t^i = S_t P_t^{i*}$$

P^i the price of homogenous traded good i .

S the nominal exchange rate (home currency price of one unit of foreign currency).

The Law of One Price (LOP) (cont'd)

- Law of One Price:

- $P_i = (E_{\text{VND}/\$}) \times (P_i^*)$

- The VND price of good i is the same wherever it is sold.

- $E_{\text{VND}/\$} = P_i/P_i^*$

- The VND/dollar exchange rate is the ratio of good i 's Vietnamese and US money prices

Purchasing Power Parity (PPP)

- Theory of PPP:
 - Exchange rates between two countries' currencies equals the ratio of the countries' price levels.
 - The theory of PPP is simply an application of LOP to national price levels rather than to individual prices.
- $E_{\text{VND}/\$} = P_{\text{VN}}/P_{\text{US}}$
 - P_{VND} : the VND price of a reference commodity basket sold in Vietnam.
 - P_{US} : the dollar price of the same basket sold in the United States.

PPP (cont'd)

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Why is PPP very important?

- Widely used to measure the equilibrium value of currencies.
- Often used to consider whether a currency is overvalued or undervalued.
- The PPP hypothesis does not appear to be supported by the actual data on exchange rates and prices.
- However, PPP is typically employed in the literature as a good indicator of the long-run values of exchange rates.

Absolute PPP and Relative PPP

- Absolute PPP:

- Exchange rates equal relative price levels.
- $E_{\text{VND}/\$} = P_{\text{VN}}/P_{\text{US}}$

- Relative PPP:

- The percentage change in EXR over any period equals the difference between the percentage changes in national price levels (inflation rate).
- $(E_t - E_{t-1})/E_{t-1} = \pi_{\text{VN}, t} - \pi_{\text{US}, t}$ <equation 15.2>
- $\pi_t = (P_t - P_{t-1}) / P_{t-1}$ <Definition of inflation rates>

Absolute PPP and Relative PPP (cont'd)

- Absolute PPP:

- It makes no sense unless the two baskets whose prices are compared in equation 15.1 are the same

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- Relative PPP:

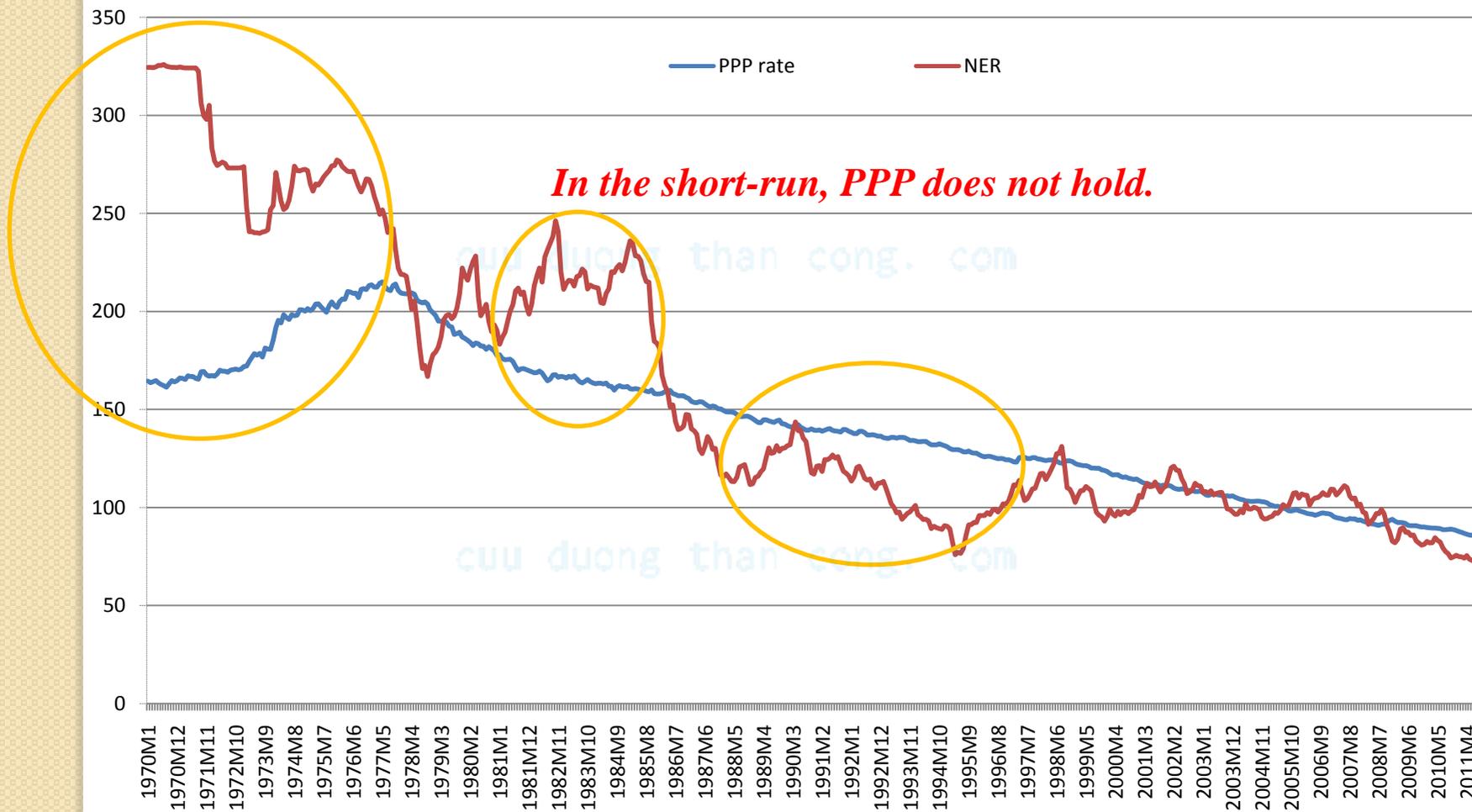
- It makes logical sense to compare percentage changes in EXR to inflation differences, even when countries base their price level estimates on product baskets that differ in coverage and composition.
- Relative PPP may be valid even when absolute PPP is not.

Empirical Evidence on PPP

- How well does the PPP theory explain actual data on EXR and national price levels?
 - All versions of the PPP theory do badly in explaining the facts.
 - Changes in national price levels often tell us little or nothing about EXR movements.

Nominal Yen/USD Exchange Rate and the PPP Exchange Rate 1970M1-2011M9 (2005 = 100)

Note: "PPP exchange rate" = (Japanese Price)/(US Price)



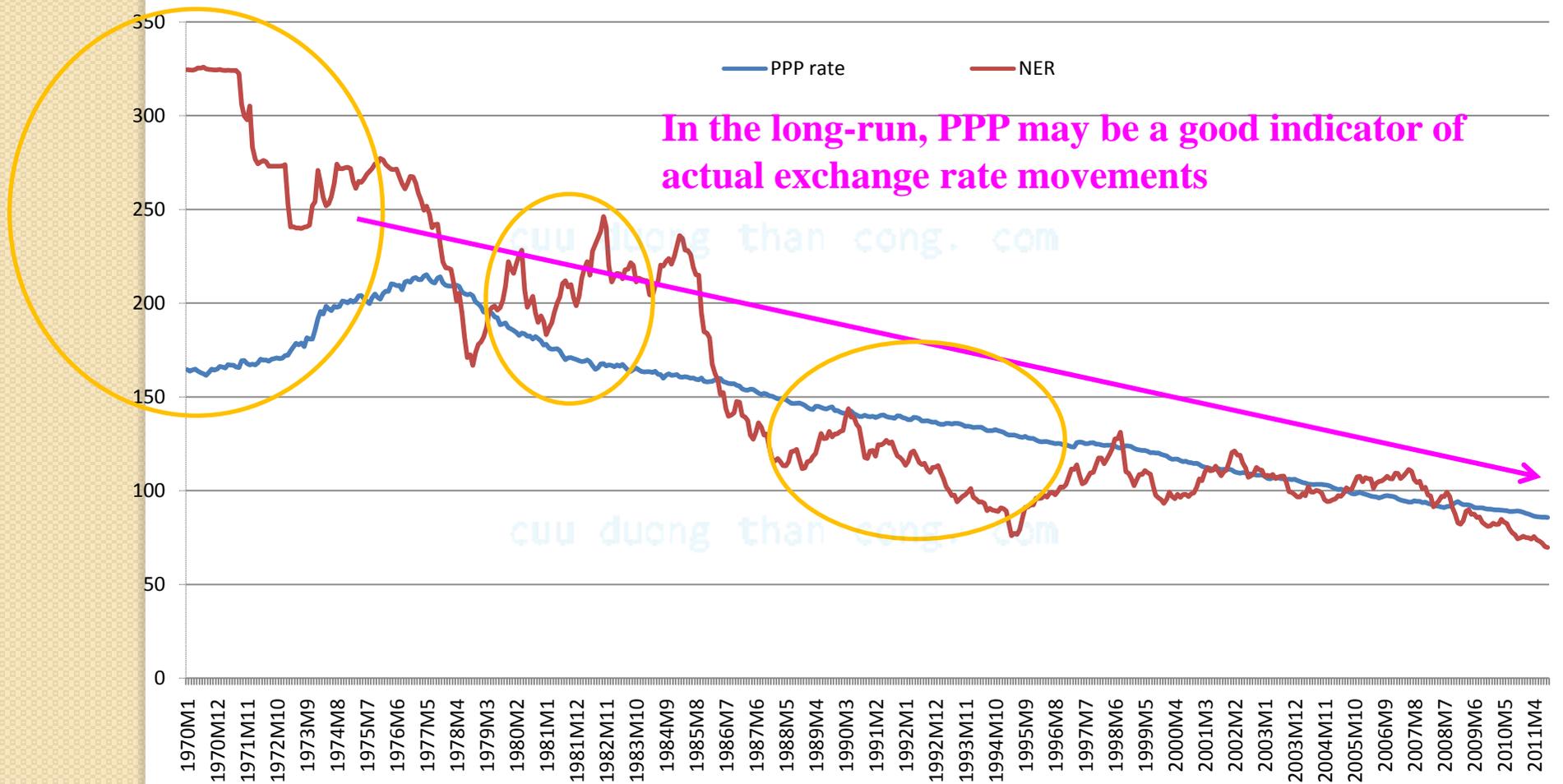
Why deviating from PPP?

- Goods must be tradable:
 - The existence of non-traded goods and services allows systematic deviations even from PPP.
- Commodity basket is not the same between countries.
- Trade barriers (transportation costs, restriction on trade) do exist.
- Imperfectly competitive structures
 - A firm sells the same product for different prices in different markets. (Pricing-to-market).

Why is PPP still used?

- But, PPP is still widely used in a long-run exchange rate model. → Why?
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- See the long-run trend of the nominal exchange rate and PPP exchange rate.
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Nominal Yen/USD Exchange Rate and the PPP Exchange Rate 1970M1-2011M9 (2005 = 100)



The Economist's Big Mac Index

- See *The Economist*, April 26, 2003, p.67.
- In 1986, *the Economist* magazine started to conduct an extensive survey on the prices of Big Mac at McDonald's restaurant throughout the world.
- A McDonald's Big Mac is produced locally to roughly the same recipe in 118 countries.

The Economist says....

- The Big Mac Index should serve as a useful guide to whether currencies are at their “correct” level.
- Purchasing Power Parity (PPP) predicts:
 - In the long run, exchange rate should move toward rates that would equalize the prices of an identical basket of goods and services in any two countries.
- The Big Mac PPP is the exchange rate that would leave burgers costing the same as in the USA.

The Economist attempts to

1. Calculate the implied PPP for each country.
2. Compare the implied PPP with the actual exchange rate vis-à-vis the US dollar.
3. The test results of whether a currency is undervalued or overvalued are reported in the last column.

Table: The Hamburger Standard

- 1st column: local currency price of a Big Mac.
- 2nd column: US dollar price of a Big Mac (by using the actual USD exchange rate).
- 3rd column: Big Mac PPP (obtained by comparing the US price with the local currency price).
- 4th column: actual exchange rate vis-à-vis the US dollar.
- 5th column: the percentage by which the Big Mac PPP exceeds the actual exchange rate.

The Hamburger Standard Table illustrates

- The currency is overvalued only in some European countries.
- Japanese yen is undervalued by 19 percent.
- Vietnam dong is
- There are some persistent deviations from PPP.
 - All emerging market (including East Asian) currencies are consistently undervalued.
 - One exception is South Korea that is exactly at its PPP.

A Long-Run Exchange Rate Model Based on PPP

- Monetary Approach to the exchange rate:
 - A long-run theory:
 - → (1) It maintains full employment
 - → (2) PPP holds.
 - Prices are assumed to be perfectly flexible.

The Fundamental Equation of the Monetary Approach

- Assumption (in the Forex market):
 - In the long-run, exchange rates are determined so that PPP holds.
 - $E_{\text{VND}/\$} = P_{\text{VND}}/P_{\text{US}}$ <equation 15.1>
- Assumption: (in the domestic money market)
 - $P_{\text{VN}} = M_{\text{VN}}/L(R_{\text{VND}}, Y_{\text{VN}})$.
 - $P_{\text{US}} = M_{\text{US}}/L(R_{\$}, Y_{\text{US}})$.
- Fundamental Equation <equation 15.4>
 - $E_{\text{VND}/\$} = (M_{\text{VN}}/M_{\text{US}}) \times L(R_{\$}, Y_{\text{US}})/L(R_{\text{VND}}, Y_{\text{VN}})$

The Fundamental Equation of the Monetary Approach (cont'd)

- The monetary approach predicts:
 - EXR is determined in the long-run by the relative supplies of those monies and the relative real demands for them.
- $E_{VND/\$} = P/P^* = (M/M^*) \times L^*(R^*, Y^*)/L(R, Y)$
- 1) A permanent rise in money supply:
 - $M \rightarrow P \rightarrow E$ (proportional long-run depreciation)
- 2) A rise in interest rates:
 - $R \rightarrow L(.) \rightarrow P \rightarrow E$ (long-run depreciation \rightarrow Why?)
- 3) A rise in domestic output:
 - $Y \rightarrow L(.) \rightarrow P \rightarrow E$ (long-run appreciation)
 - $\begin{matrix} \uparrow & \uparrow & \downarrow & \downarrow \end{matrix}$

Inflation, Interest Parity, and PPP

- A permanent increase in M (level):
 - A proportional rise in P (level), but no effect on the long-run values of R and Y.
- What are the long-run effects of money supply growth rate?

Money Supply	Price	Interest Rate
(1) Level (Permanent ↑)	(2) Proportional ↑ in price level	(3) No effect on the long-run value
(1') Growth Rate (Permanent ↑)	(2') Inflation rate ↑ at the same rate	(3') Long-run interest rate ↑

Inflation, Interest Parity, and PPP (cont'd)

- Interest rate condition:
 - $R = R^* + [E(e) - E]/E$
- Expected version of relative PPP:
 - $[E(e) - E]/E = \pi(e) - \pi^*(e)$
 - Where $\pi(e) = [P(e) - P]/P$
- Combining both conditions:
 - $R - R^* = \pi(e) - \pi^*(e)$

Inflation, Interest Parity, and PPP (cont'd)

- Fisher Effect:
 - All else equal, a rise (fall) in a country's expected inflation rate will eventually cause an equal rise (fall) in the interest rate.
 - These changes would leave the real rate of return on domestic assets (measured in terms of domestic goods and services) unchanged.

Inflation, Interest Parity, and PPP (cont'd)

- In the LR equilibrium (Monetary approach):
 - A rise in the difference between home and foreign interest rates occurs, only when expected home inflation rises relative to expected foreign inflation.
- In the SR equilibrium (sticky price approach):
 - The interest rate can rise when the domestic money supply falls. The sticky domestic price level leads to an excess demand for real money balances at the initial interest rate.

Real Exchange Rate

- Real Exchange Rate (q):
 - $q_{¥/\$} = (E_{¥/\$} \times P_{US}) / P_{JP}$ <equation 15-6>
 - A rise in $q_{¥/\$}$ → Real depreciation
 - A fall in $q_{¥/\$}$ → Real appreciation
- Important tool for:
 - (1) quantifying deviations from PPP
 - (2) analyzing macroeconomic demand and supply conditions in open economies.

Real Exchange Rate (cont'd)

- Real Exchange Rate (q):
 - Absolute PPP is not assumed.
 - The same basket of commodities are not assumed in measuring the price level.
 - The domestic (foreign) price level will place a relatively heavy weight on commodities produced and consumed in the domestic (foreign) country.

A General Model of Long-Run Exchange Rate

- Real Exchange Rate (q):
 - If PPP does not hold, the long-run values of real EXR depend on demand and supply conditions in both countries.
- Two specific cases:
 - (1) An increase (fall) in world relative demand for domestic output \rightarrow A long-run real appreciation (depreciation) of the domestic currency.
 - (2) A relative expansion of domestic output supply
 - A fall in relative price of domestic products.
 - A long-run real depreciation of the domestic currency.

A General Model of Long-Run Exchange Rate (cont'd)

- The equation of the general model:
 - $E_{¥/\$} = q_{¥/\$} \times (P_{JP}/P_{US})$ <equation 15-7>.
- Two specific cases:
 - 1st term ($q_{¥/\$}$): captures the effect of change in relative output supply/demand on $E_{¥/\$}$
 - 2nd term (P_{JP}/P_{US}): reflects the monetary approach.
 - The difference between (15.1) and (15.7):
 - (15.7) accounts for possible deviations from PPP by adding the real EXR as an additional determinant.

A General Model of Long-Run Exchange Rate (cont'd)

- 1. A shift in relative money supply levels:
 - $M \uparrow$ (a permanent one-time increase)
 - \rightarrow No change in Y, R
 - \rightarrow No change in q
 - $\rightarrow P$ rises in proportion to M
 - $\rightarrow E \uparrow$

A General Model of Long-Run Exchange Rate (cont'd)

- 2. A shift in relative M growth rate:
 - M growth rate \uparrow (a permanent increase in growth rate of domestic money supply)
 - \rightarrow No change in Y.
 - \rightarrow Increase in long-run domestic inflation rate.
 - \rightarrow Domestic interest rate (R) increases (through the Fisher effect)
 - \rightarrow Relative domestic money demand declines.
 - P must increase \rightarrow E \uparrow
 - q does not change

A General Model of Long-Run Exchange Rate (cont'd)

- 3. A change in relative output demand:
 - Demand \uparrow for domestic output
 - (1) \rightarrow This effect is not covered by the monetary approach.
 \rightarrow No change in P .
 - (2) $\rightarrow q \downarrow$ (q is affected by demand and supply conditions).
 - $\rightarrow E$ (as q falls but P/P^* is constant).
 \downarrow

A General Model of Long-Run Exchange Rate (cont'd)

- 4. A change in relative output supply:
 - Domestic output supply (Y) \uparrow
 - (1) \rightarrow This effect is not covered by the monetary approach.
 \rightarrow No change in P .
 - (2) $Y \uparrow \rightarrow \hat{q}$ (q is affected by demand and supply conditions). $\rightarrow E \uparrow$
 - (2)' $Y \uparrow \rightarrow L(R, Y \uparrow) \rightarrow \hat{P}$ (given M) $\rightarrow E \downarrow$