EE452 International Monetary Economics

3. Exchange Rate Determination

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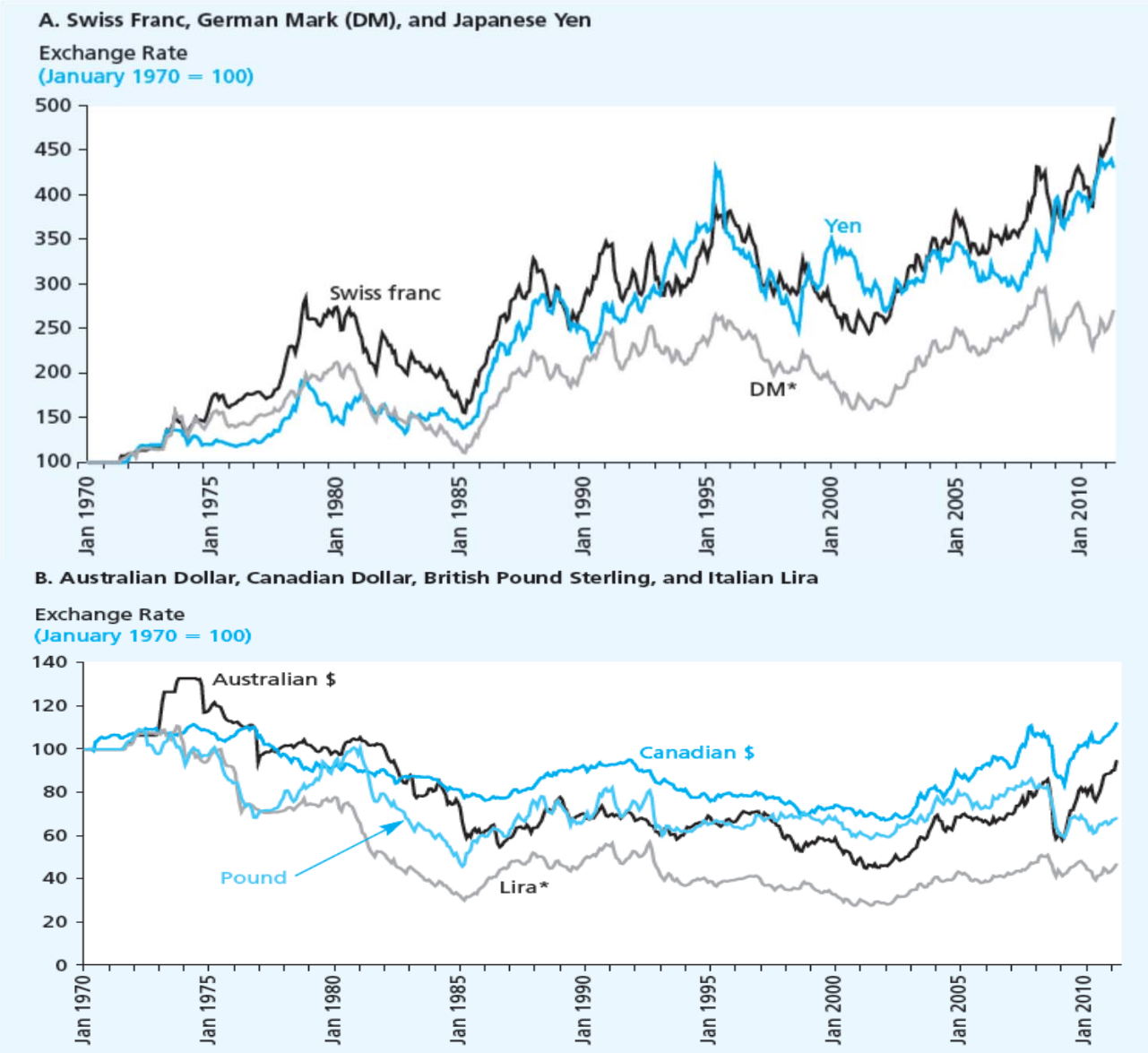
Outline

- The Asset Market Approach
  - The role of interest rates
  - The role of the expected future spot exchange rate
- Purchasing Power Parity (PPP)
  - The Law of One Price
  - Absolute Purchasing Power Parity
  - Relative Purchasing Power Parity
- The Monetary Approach
  - Money, price levels and inflation
  - Money and PPP combined
  - The effect of money supplies on an exchange rate
  - The effect of real incomes on an exchange rate
- Exchange rate overshooting/Dornbusch Sticky-Price)

Objectives

- Students should understand and be able to explain the following:
  - The effects of changes of interest rates on current exchange rates
  - The effects of expectation of future exchange rates on current spot rates
  - What is exchange rate overshooting? Why does it happen?
  - Short-run fluctuation of spot exchange rates from the expected rate based on basic market fundamentals
  - Purchasing power parity hypothesis
  - Quantity Theory of Money in 2-country model
  - Difference between nominal exchange rate and real exchange rate

Selected Exchange Rates, 1970-2011



- 1971-1973: most currencies of industrialized countries rose in value relative to dollar.
- After 1973: era of floating exchange rates
- Long-term trend: JPY, SFr and DM tended to appreciate while AUSD, CAND, ITL, GBP tended to depreciate.
- Medium-term trend: JPY, SFr, DM depreciated.
- Short-term variability.

Source: Pugel (2012), p. 444

THE ASSET MARKET APPROACH

Exchange Rate in the Short Run

- Economists believe that pressures on exchange rates in the short run can best be understood in terms of demand and supplies of assets denominated in different currencies.
- If UIP holds, the differences in returns between domestic and foreign bonds will cause international investors to "reposition" their portfolios.
  - This repositioning creates the pressures that move the two returns toward equality (or close to equality).

The Asset Market Approach

- Explains exchange rates in terms of demands and supplies of all assets denominated in different currencies.
- The *monetary approach to exchange* rates is a variant of this approach in which *only* demands and supplies of the money asset are considered.

Revision from Topic 2: Uncovered Interest Parity (UIP)

- From UIP, major conclusions of our analysis are that the exchange-rate value of a foreign currency is raised in the short run by the following changes:
  - A rise in foreign interest rate relative to our interest rate ($i_f - i$).
  - A rise in the expected future spot exchange rate (e^{ex}).
  - That is, $e = \frac{(1+i_f)e^{ex}}{(1+i)}$

ROLE OF INTEREST RATES

The Role of Interest Rates: Example 1

- i_{US}= 9% per year, i_{Swiss}= 5% per year
- e = USD1.2/SFr, e^{ex} in 90 days = USD1.212/SFr
  - Hence, the SFr is expected to appreciate about 1% during the next 90 days. (the annual rate of expected appreciation is about 4% (1% x 4 quarters).
- If i_{US}= 11%, everything else constant;
  - The return differential shifts in favor of USD-denominated bonds.
  - Increase in demand of USD in foreign exchange market. USD tends to appreciate immediately, assuming that i's and e^{ex} do not change.
  - What is the new spot exchange rate?

The Role of Interest Rates: Example 2

- i_{US}= 9% per year, i_{Swiss}= 5% per year
- e = USD1.2/SFr, e^{ex} in 90 days = USD1.212/SFr
  - Hence, the SFr is expected to appreciate about 1% during the next 90 days. (the annual rate of expected appreciation is about 4% (1% x 4 quarters).
- If i_{Swiss}= 7%, everything else constant;
  - The return differential shifts in favor of SFr-denominated bonds.
  - Increase in demand of SFr in foreign exchange market. SFr tends to appreciate immediately, assuming that i's and e^{ex} do not change.
  - What is the new spot exchange rate?

Role of Interest Rate

- What happens if both interest rates change at the same time?
  - What matters is the interest rate differential ($i - i_f$).
  - If interest rate differential increases, the return shifts in favor of domestic-currency bonds, and *e* tends to decrease (domestic currency appreciates).

ROLE OF EXPECTED FUTURE SPOT EXCHANGE RATE

Example

- i_{US}= 9% per year, i_{Swiss}= 5% per year
- e = USD1.2/SFr, e^{ex} in 90 days = USD1.212/SFr
  - Hence, the SFr is expected to appreciate about 1% during the next 90 days. (the annual rate of expected appreciation is about 4% (1% x 4 quarters).
- If e^{ex} in 90 days = USD1.236/SFr (because investors believe that political situation in Switzerland will improve rapidly), everything else constant;
  - The return differential shifts in favor of SFr-denominated bonds.
  - Increase in demand of SFr in foreign exchange market. SFr tends to appreciate immediately, assuming that i's and e^{ex} do not change.
  - What is the new spot exchange rate?
  - As with the interest rate, the effect of a change in the expected future spot rate on the current spot exchange rate can happen very quickly.

Given the powerful effects that exchange rate expectations can have on actual exchange rate, we ask: WHAT determines these expectations?

What influences expected future spot exchange rate? (1/3)

- If expectations simply extrapolate recent trends, then a "bandwagon" is possible.
  - Speculation may be based on destabilizing expectations – expectations formed without regard to economic fundamentals.
  - Speculative bubbles can occur.

“Bandwagon”
“ปรากฏการณ์กระแสนิยม”

- A Situation in which investors expect the recent trend in exchange rates to extend into the future.

What influences expected future spot exchange rate? (2/3)

- If expectations are based on a belief that exchange rates eventually follow PPP, then they lead to stabilizing speculation- speculation that tend to move the exchange rate toward a value consistent with the economic fundamentals of national price levels.

What influences expected future spot exchange rate? (3/3)

- Expectations are affected by various kinds of news about economic, social and political circumstances.

Determinants of Exchange Rate in the Short Run

Change in Variable	Direction of International Financial Repositioning	Implications for the Current Spot Exchange Rate (e = Domestic currency/Foreign currency)
Domestic Interest Rate (i)		
Increases	Toward domestic-currency assets	e decreases (domestic currency appreciates)
Decreases	Toward foreign-currency assets	e increases (domestic currency depreciates)
Foreign Interest Rate (i_f)		
Increases	Toward foreign-currency assets	e increases (domestic currency depreciates)
Decreases	Toward domestic-currency assets	e decreases (domestic currency appreciates)
Expected Future Spot Exchange Rate (e^{ex})		
Increases	Toward foreign-currency assets	e increases (domestic currency depreciates)
Decreases	Toward domestic-currency assets	e decreases (domestic currency appreciates)

Source: Pugel (2012), p. 447

PURCHASING POWER PARITY

Long Run Exchange Rate

- Our understanding of exchange rates in the long run is based on the proposition that there is a predictable relationship between product price level and exchange rates.
  - The relationship relies on the fact that people chose to buy goods and services from one country or another according to the prices they may pay.

Purchasing Power Parity (PPP) Hypothesis

- The Law of One Price (for a single product)
- Absolute PPP (for a set of products)
- Relative PPP (for a set of products)

The Law of One Price

- The law of one price posits that a product that is easily and freely traded in a perfectly competitive global market should have the same price everywhere, once the prices at different places are expressed in the same currency.
- $P = e \cdot P_f$
- The law of one price works well for heavily traded commodities; eg., gold, other metals, crude oil, and various agricultural commodities.
- However, for many products, the law of one price does not hold closely.
  - International transport costs
  - Free trade not really practiced
  - imperfectly competitive markets
    - eg., Price discrimination

Absolute PPP

- A basket of products will have the same price in all countries when the prices are converted into a single currency using the market exchange rates.
- At a point in time,

  $$P = P_f \cdot e \quad \text{or} \quad e = P/P_f$$

- Even if the law of one price does not hold exactly, absolute PPP can still be a useful guide if the discrepancies tend to average out over the different products in the bundle.
- When we examine actual prices and exchange rates, divergences from absolute PPP (and the simpler law of one price) can be large.
  - Particularly if non-traded products are included in the bundle.
  - Governments do not use the same bundles of products for the different countries

National Income per Capita, 2009, Relative to US = 100

Country	Using the Exchange Rate	Using Common Prices	Domestic Price Level (This Country/U.S.) as a Percentage of the Level Predicted by PPP
Norway	183	121	150
Singapore	80	109	74
Switzerland	141	103	137
United States	100	100	100
Australia	94	84	112
Sweden	105	83	126
Canada	91	82	111
Germany	92	81	113
Britain	89	79	114
France	92	74	124
Japan	82	73	112
Italy	76	70	108
South Korea	43	60	72
Israel	56	59	94
Saudi Arabia	37	53	71
Czech Republic	37	52	71
Russia	20	40	50
Poland	26	40	66
Mexico	19	31	63
Turkey	19	30	64
Chile	20	29	69
Brazil	17	22	78
South Africa	12	22	56
Thailand	8	17	48
China	8	15	52
Egypt	4	12	36
Indonesia	4	8	54
India	3	7	37
Pakistan	2	6	37
Nigeria	3	5	57
Ghana	3	3	77
Tanzania	1	3	36

- If PPP holds, then every number would be 100.
- Differences in PPP-measured real average income (middle column) is not as high relative to that of the US as the exchange-rate figures (left column) imply.
- Using exchange rates overstates the real income gaps between rich and poor nations.
- Why do lower-income countries have prices so much lower than US prices?
  - Wide international gaps in the prices of non-traded goods like housing, haircuts and local services.

Source: Pugel (2012), p. 455

Relative PPP

- Exchange rate will change to offset difference in the rates of product price inflation in different countries.
- Changes over time (relative PPP): From time *0* to time *t*:

$$\left[\frac{P_t}{P_0}\right] = \left[\frac{P_{f,t}}{P_{f,0}}\right] \cdot \left[\frac{e_t}{e_0}\right]$$

or

$$\left[\frac{e_t}{e_0}\right] = \left[\frac{P_t}{P_0}\right] \Big/ \left[\frac{P_{f,t}}{P_{f,0}}\right]$$

or, approximately:

$$\%\Delta e = \%\Delta P - \%\Delta P_f$$

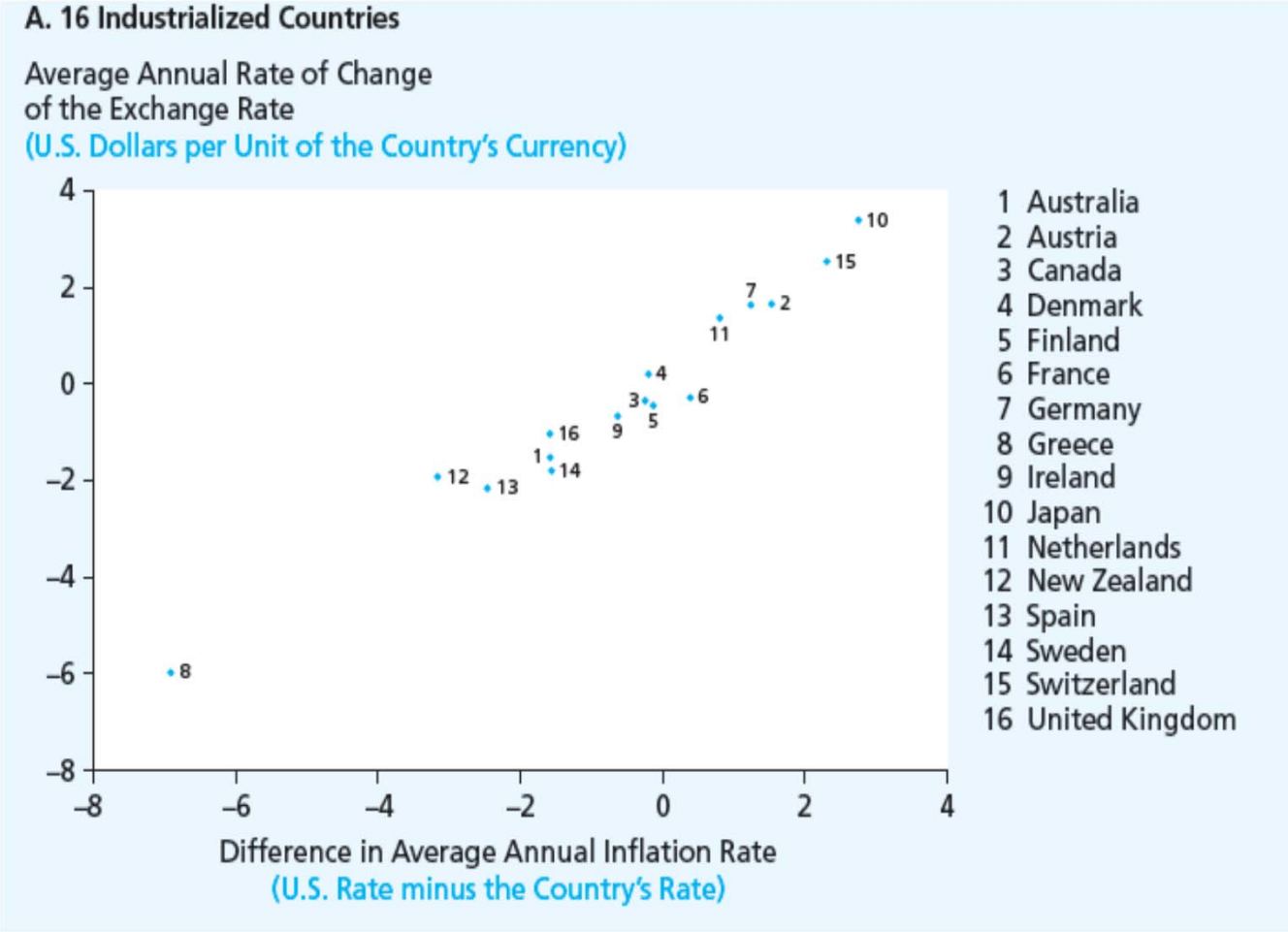
(See derivation in Footnote 3, Pugel p. 453)

Implications of Relative PPP

- Low inflation countries tend to have appreciating currencies.
  - Example: Switzerland. The country seeks to keep domestic prices stable when the rest of the world is inflating. If prices rise elsewhere by 10%, in the long run, the country must accept a rise in 10% in exchange value of its currency in terms of inflating-country currencies.
- High inflation countries tend to have depreciating currencies.

RELATIVE PPP: EVIDENCE

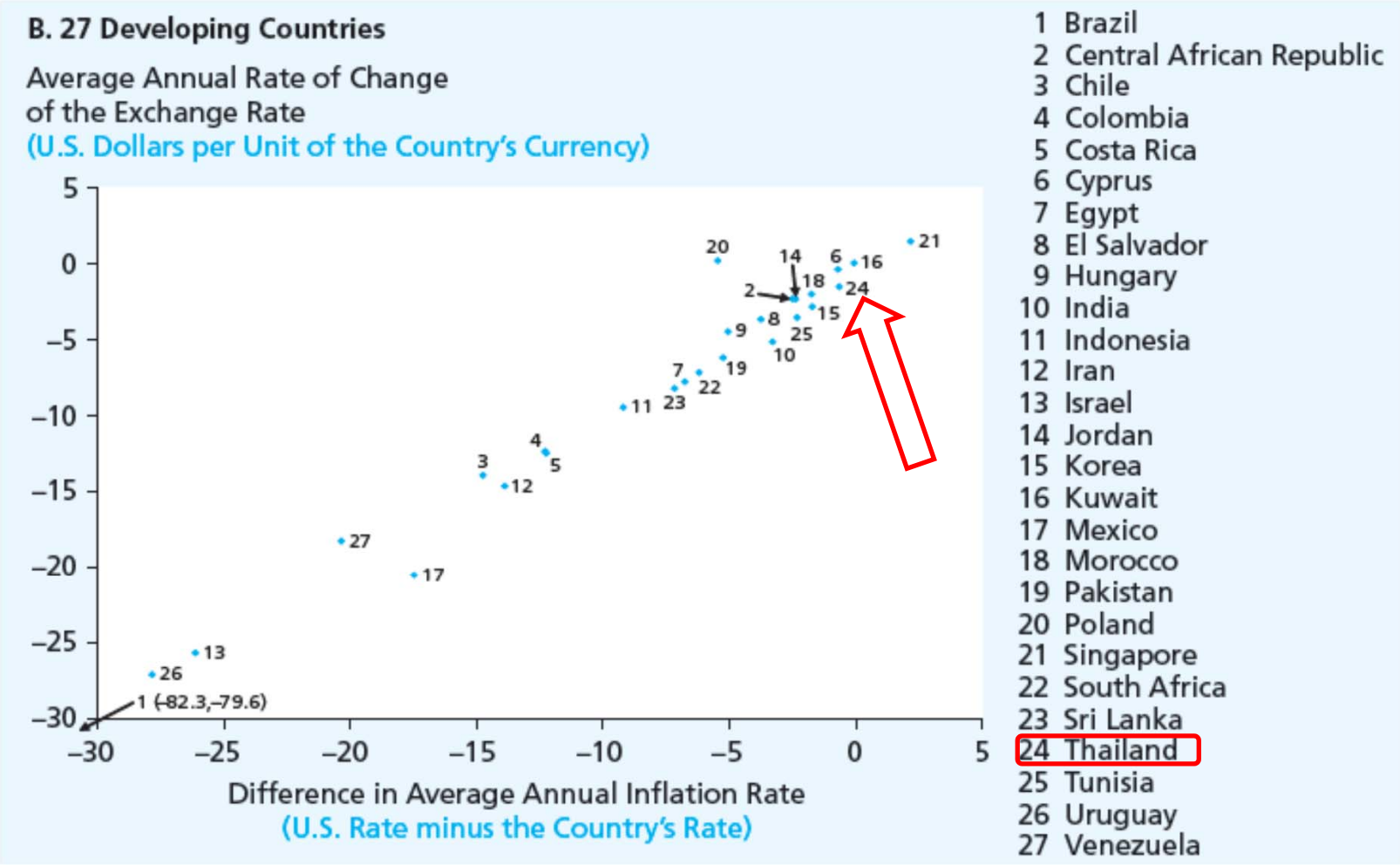
Relative Purchasing Power Parity: Inflation Rate Differences and Exchange Rate Changes, 1975-2009
16 Industrialized Countries



- On average, from 1975-2009, strong support is found for PPP. If US inflation rate is higher than the other country's inflation rate, the country's currency tend to appreciate.

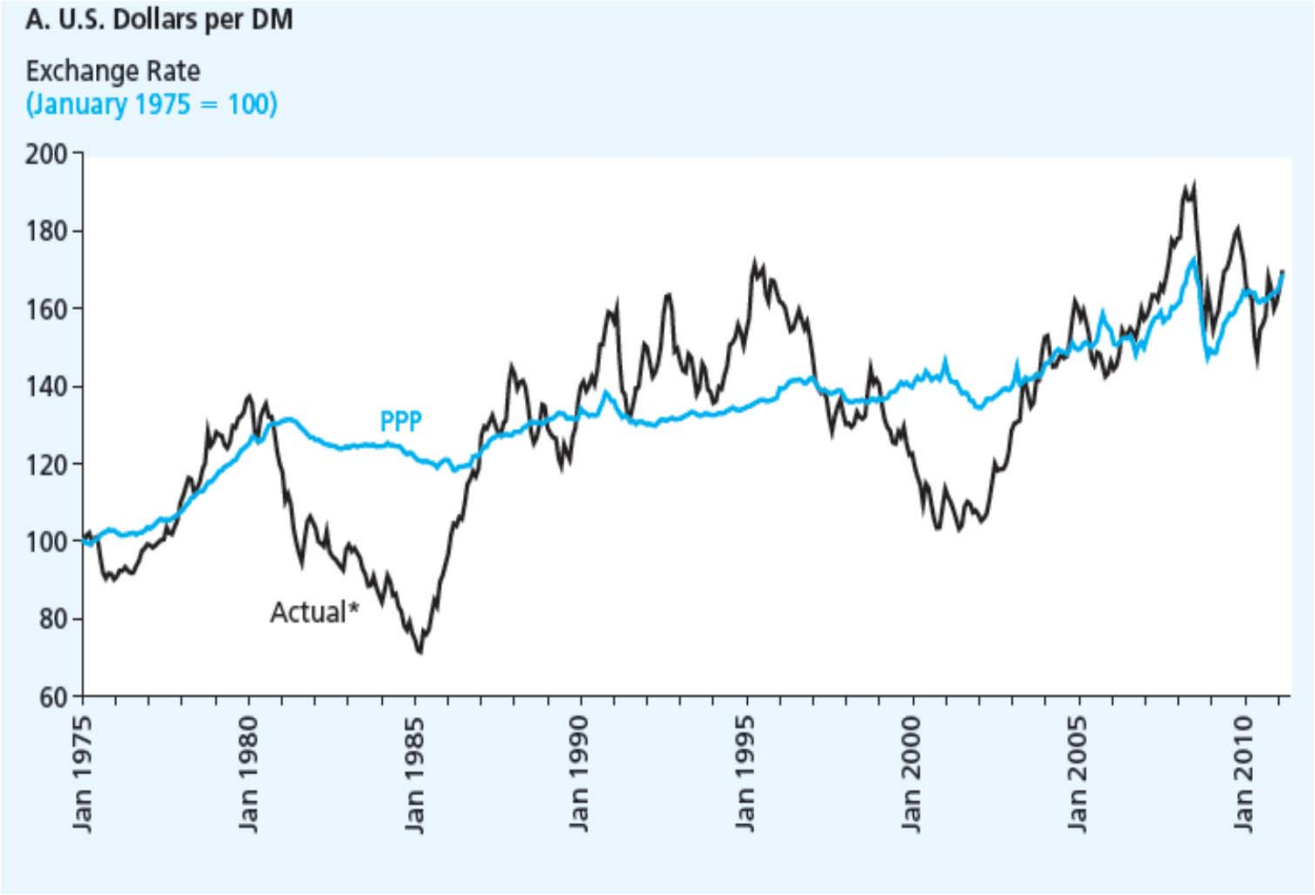
Source: Pugel (2012), p. 457

Relative Purchasing Power Parity: Inflation Rate Differences and Exchange Rate Changes, 1975-2009
27 Developing Countries



Source: Pugel (2012), p. 457

Actual Exchange Rates and Exchange Rates Consistent with Relative PPP, Monthly, 1975-2011
U.S. Dollars per DM



Source: Pugel (2012), p. 458

- Since Jan 1999, the German mark is fixed to euro, so its rate is tracking the US$/euro movement.
- The exchange rate implied by PPP is the ratio of national price levels P/Pf
- Divergence can persist for several years, but there is a tendency for the actual rate to following PPP in the Long run.

Actual Exchange Rates and Exchange Rates Consistent with Relative PPP, Monthly, 1975-2011
U.S. Dollars per Yen

Source: Pugel (2012), p. 458

THE MONETARY APPROACH

Money, Price Levels and Inflation

- If exchange rates follow national price levels in the long-run, the next question is:
  - *What determines national price levels in the long run?*

Money, Price Level and Inflation

- In the long run, the national money supply (or its growth rate) determines the national price level (or the national inflation rate), through the equilibrium between money supply and money demand.

Simple Logic

- A currency is less valuable the more of it there is to circulate!

Quantity Theory of Money

- Money is held to facilitate transactions, so that money demand is based on the annual turnover of transactions that require money, and this turnover is proxied by the level of (nominal) domestic product (P·Y, where Y is real GDP).
- The Quantity Theory of Money says that, for each country, $MS = k \cdot P \cdot Y$.
  - *MS* is money supply -> controlled by national monetary policy
  - *k* is behavioral parameter (like velocity in Physics: *Total Distance = velocity · time*)

PPP and Quantity Theory of Money Combined

- $e = \frac{P}{Pf} = \frac{MS}{MSf} \cdot \frac{kf}{k} \cdot \frac{Yf}{Y}$
- If the ratio of the k's is steady, then the exchange rate will change over the long run as the money supplies change and as real GDPs grow, with elasticities of one.
- Other thing equal, in the long run, a lower level (or slower growth over time) of the country's money supply, or a higher level (or faster growth) of its real GDP, tend to result in a higher value (an appreciation over time) of the country's currency because each implies a lower level (or slower rate of increase) in the country's price level.
- Another implications of exchange rate elasticities: An exchange rate will be unaffected by balanced growth.

Overview of the world's currency

- Can we use the monetary approach to understand the long run trend of some exchange rates? Yes.
- Since 1970s turn to flexible exchange rate, Japan's yen rose because of stronger real economic growth (growth in Y), combined with the fact that MS did not grow faster than the average, kept inflation down in Japan and raised the international value of Yen.
- The Swiss Frank rose because Switzerland kept tight control over its money supply.
- The lira sank because Italy's money supply rose faster than the average.
- US$ depreciates because of QEs

EXCHANGE RATES

Real Exchange Rate

- Deviation from PPP can be measured using the real exchange rate, which can be measured as an index between two currencies (bilateral) or as a weighted average index relative to a number of other currencies (effective).
- If PPP holds in the long run, then the real exchange rate tends to return to its "normal" value.
  - We will later see in Topic 5 that changes in the real exchange rate also can be used as an indicator of changes in the international price competitiveness of a country's products.

Nominal Bilateral Exchange Rates

- Nominal bilateral exchange rates are simply the standard rates quoted in the foreign exchange market.
- Example: THB/USD, THB/Euro, THB/GBP

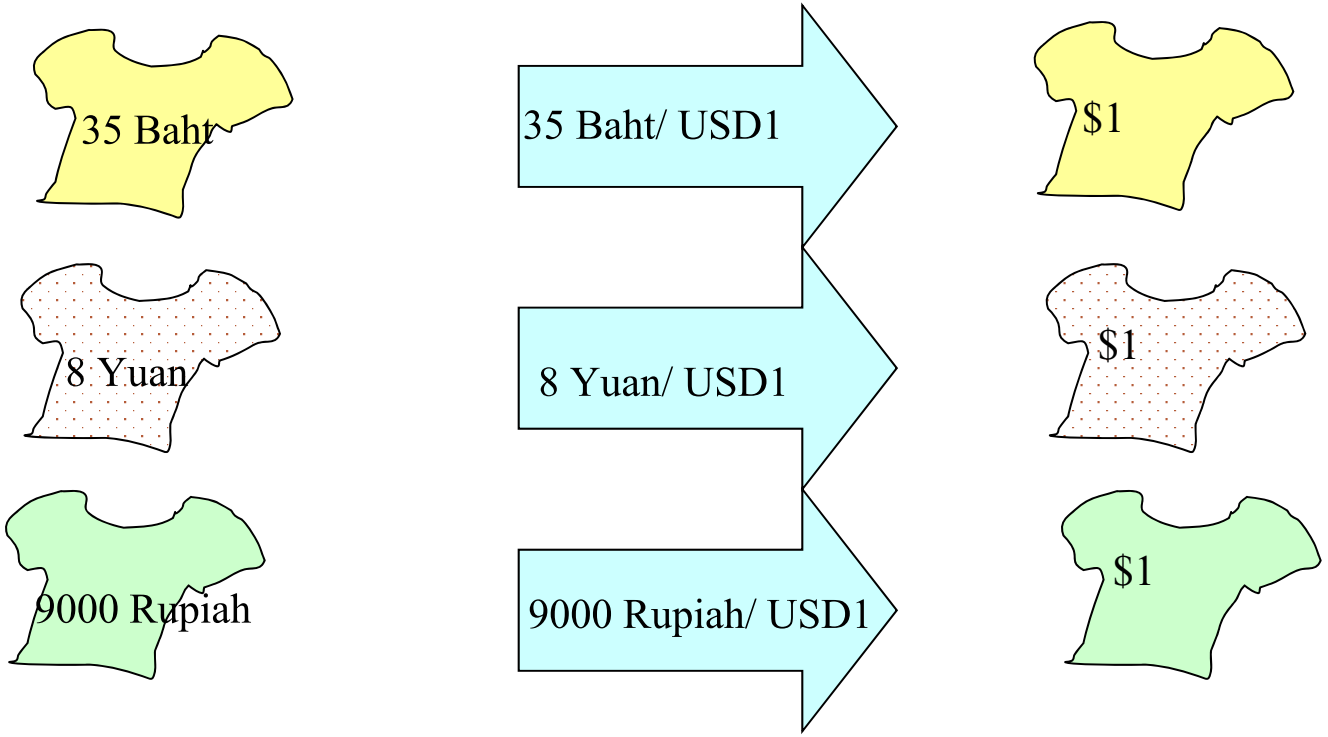
Nominal Effective Exchange Rate

- Nominal effective exchange rate is an index that tracks the weighted-average nominal value of a country's currency.
- Effective exchange rate is the exchange rate of one currency relative to a basket of other currencies.

Application

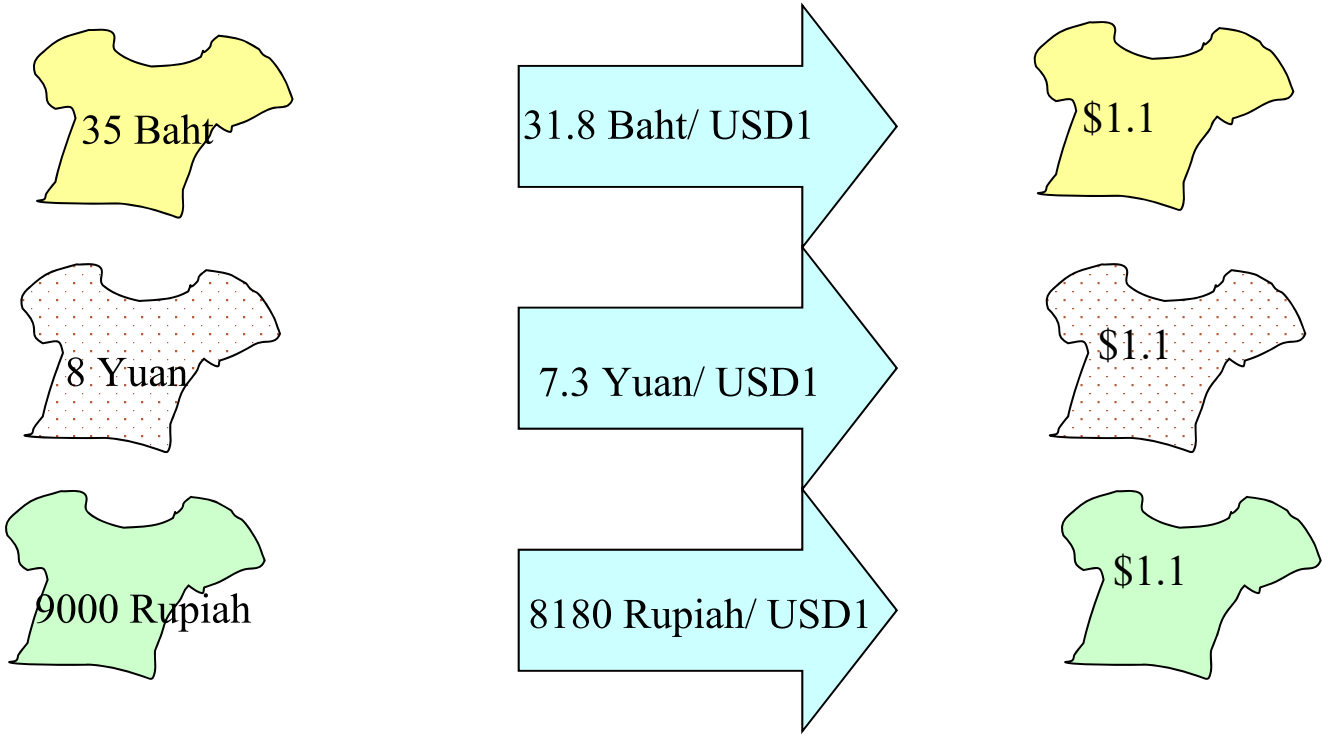
Assume that Thailand, China and Indonesia exports a t-shirt to US.

Baseline case:



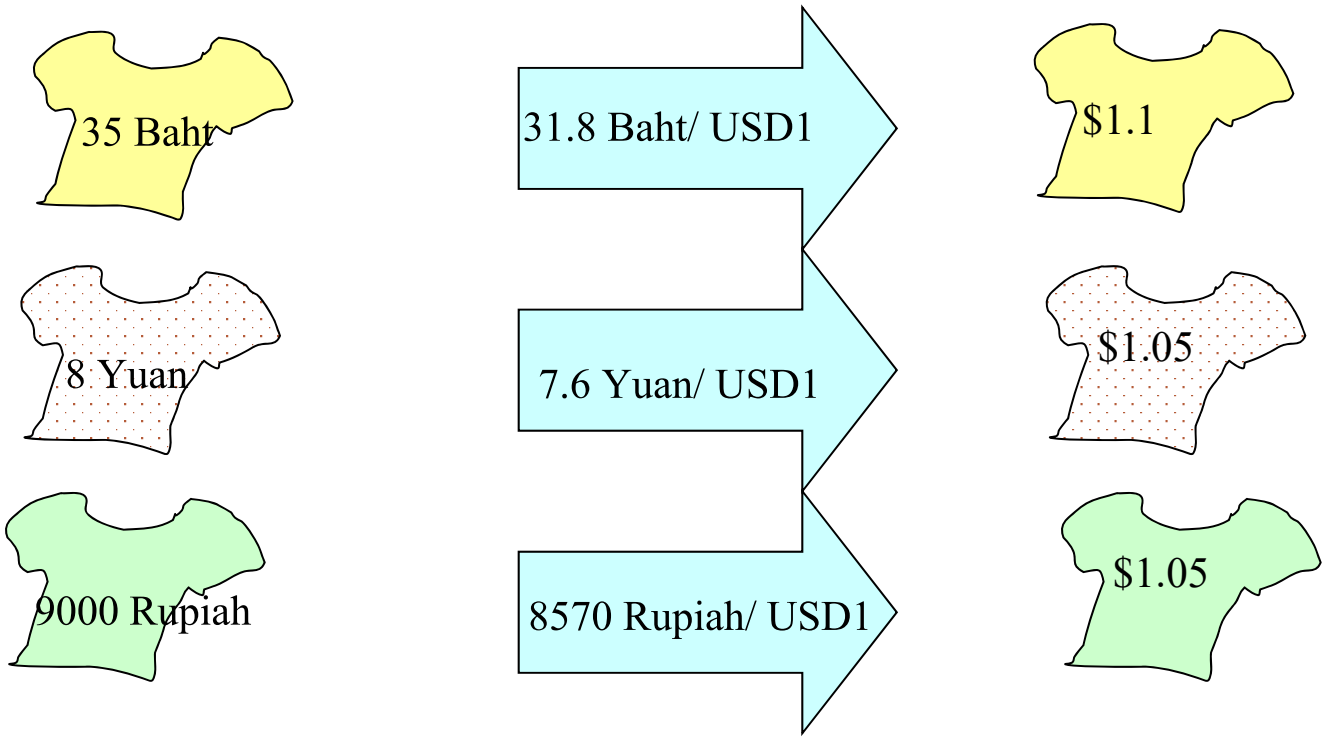
Application

Case 1: Suppose Baht, Yuan and Rupiah to USD appreciate 10%



Application

Case 2: Suppose Thai Baht appreciates by 10% while others appreciate by only 5%



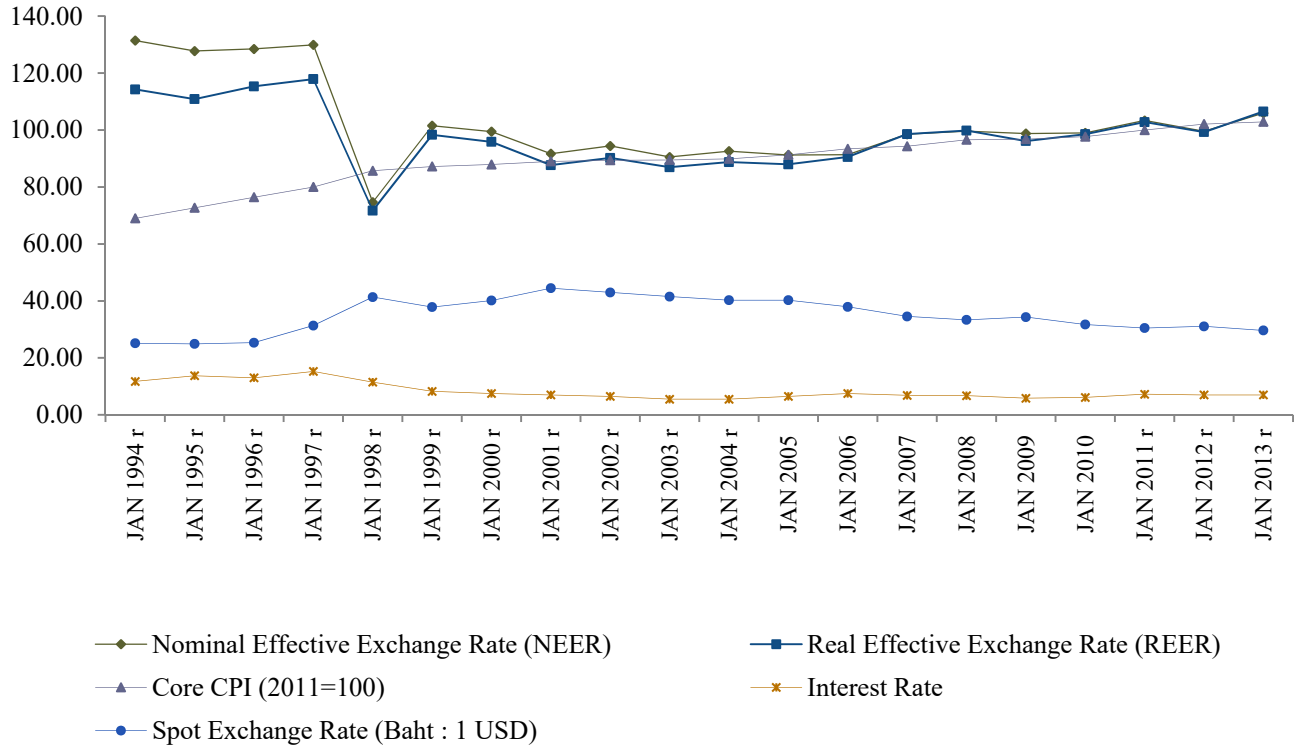
Real Effective Exchange Rate: REER

$$REER = \frac{NEER}{CPI_{others} / CPI_{Thailand}}$$

$$\%\Delta REER = \%\Delta NEER + \%\Delta CPI_{Thailand} - \%\Delta CPI_{others}$$

REER

- NEER and REER tend to move in the same direction



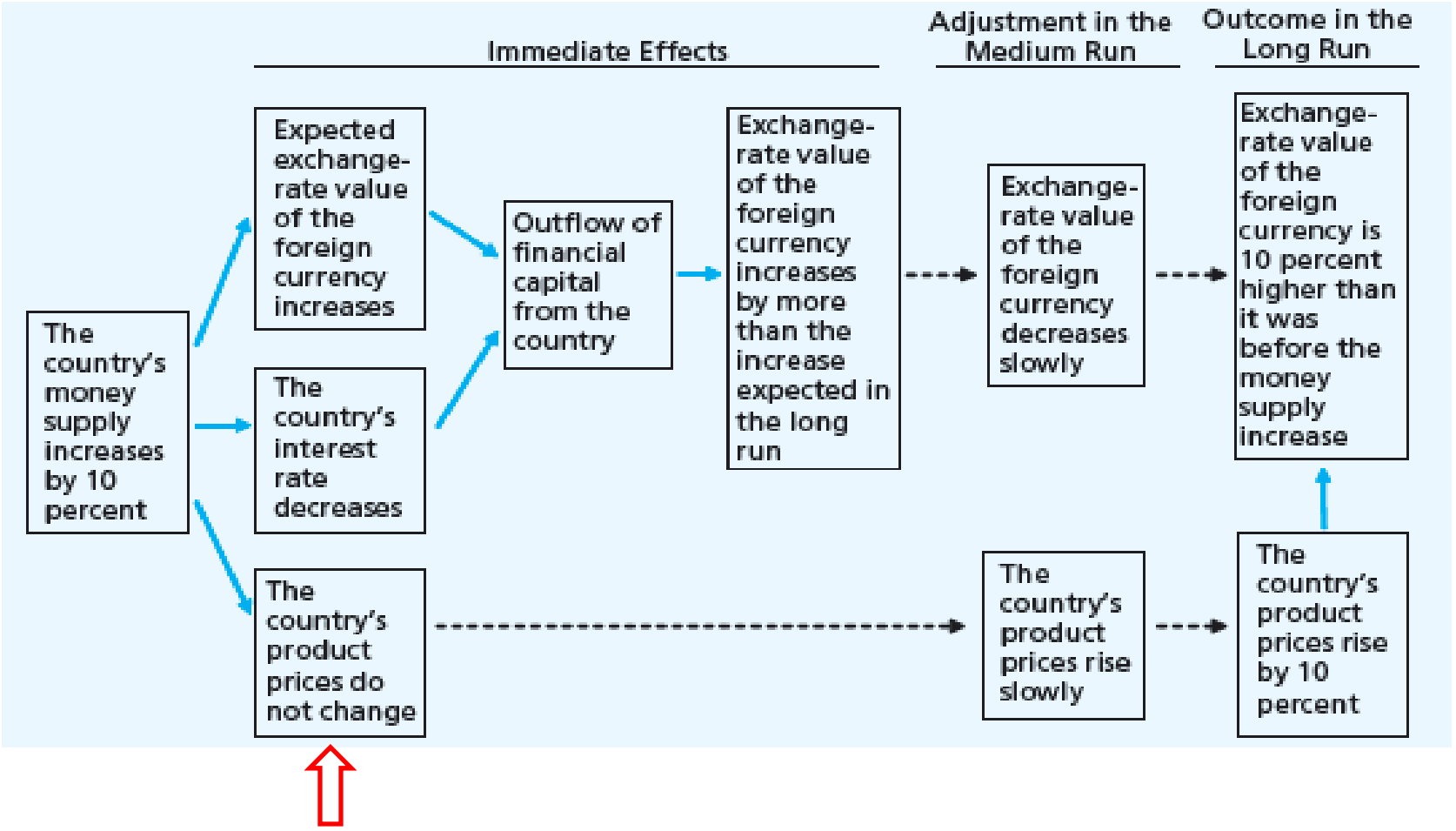
Source: www.bot.or.th

EXCHANGE-RATE OVERSHOOTING

Overshooting

- When the exchange rate is driven past its ultimate equilibrium rate (usually thought to be the PPP level), and then back to that rate later, during the adjustment of the macroeconomy to an exogenous shock. This effect is the consequences of goods prices that are sticky in the short run.
- This is also called Dornbsch Sticky-Price effect.

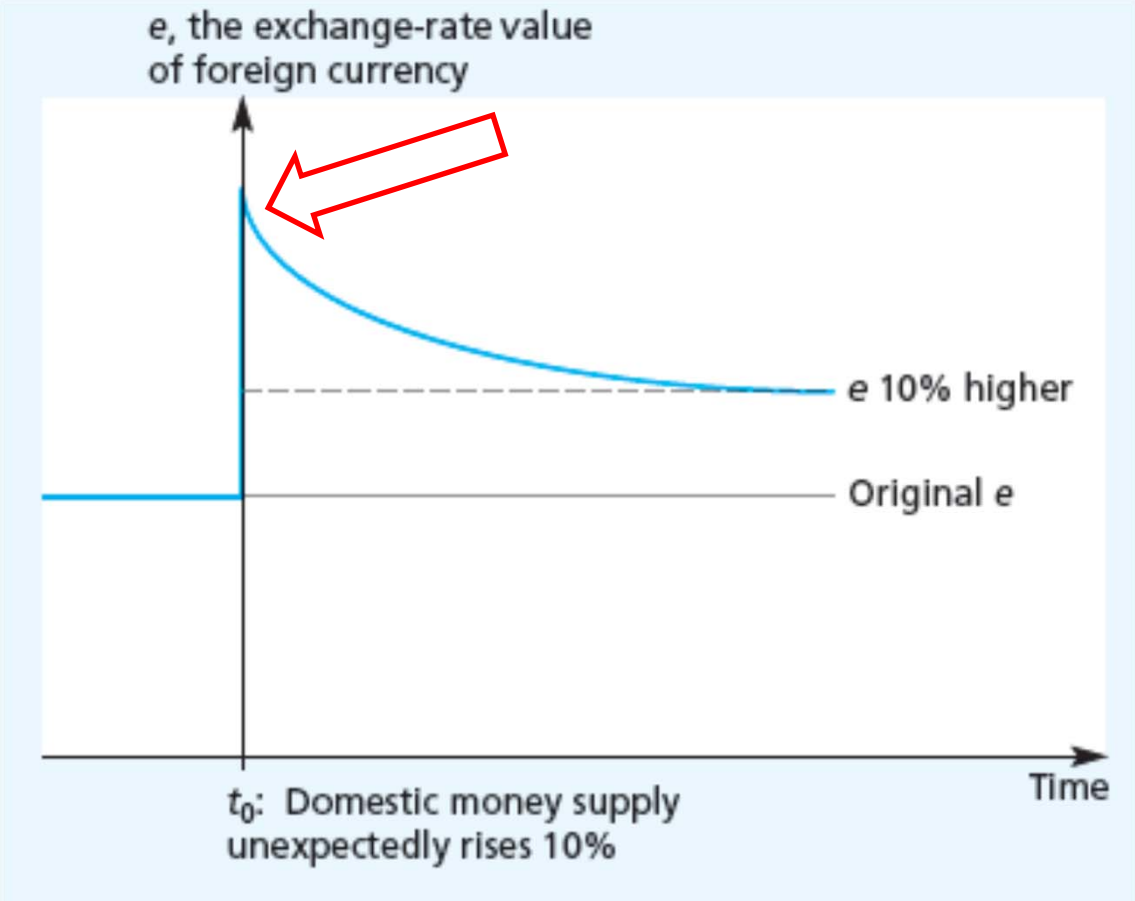
Overview of Key Elements, Exchange-Rate Overshooting



Sticky product price in the short-run

Source: Pugel (2012), p. 463

Exchange-Rate Path, Exchange-Rate Overshooting



Source: Pugel (2012), p. 465

- An unexpected 10 percent increase in domestic MS causes the spot exchange-rate value of the country's currency to decline quickly by more than 10%, "overshooting" its eventual long-run value.
- Then the country's currency appreciates slowly until its exchange rate value is 10 percent lower than what it was before the unexpected money supply increase.