OPEN ECONOMY MACROECONOMICS 1

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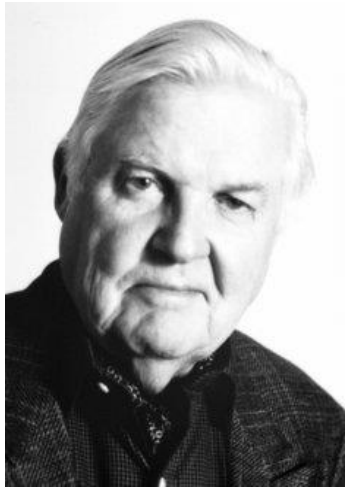
AGENDA

- **International linkage and Balance of payments**
- **Foreign exchange market and Exchange rate determination**
- Macroeconomics framework for open-economy
- Shocks and propagation under open-economy
- Policy effectiveness

Reading: Froyen Ch. 14

This lecture slide will be focusing on the first two agendas.

HOW CAN A COUNTRY BECOME OPENED?



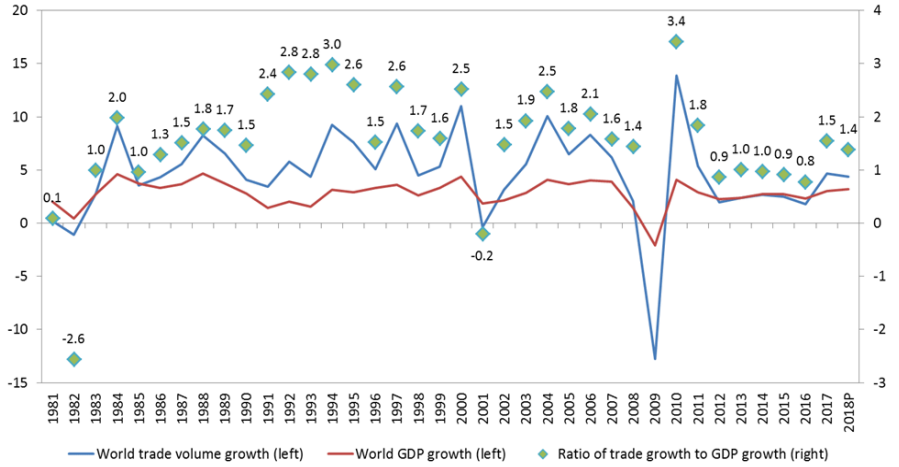
Nobel Laureates 1999

Robert A. Mundell (1956)

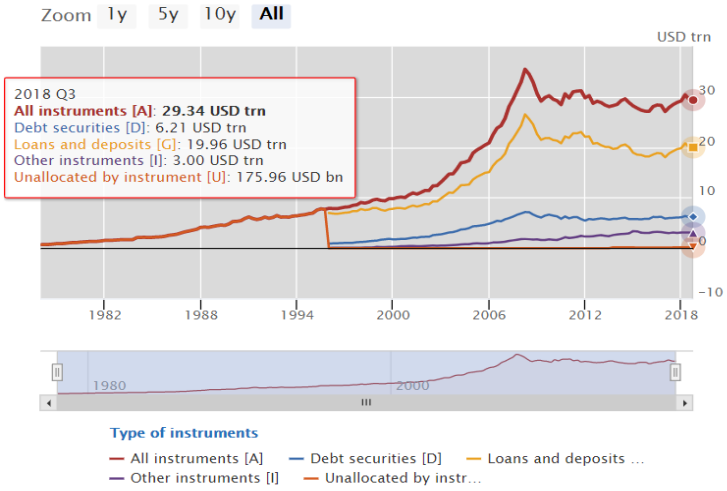
"The world is still closed, but countries have become increasingly opened."

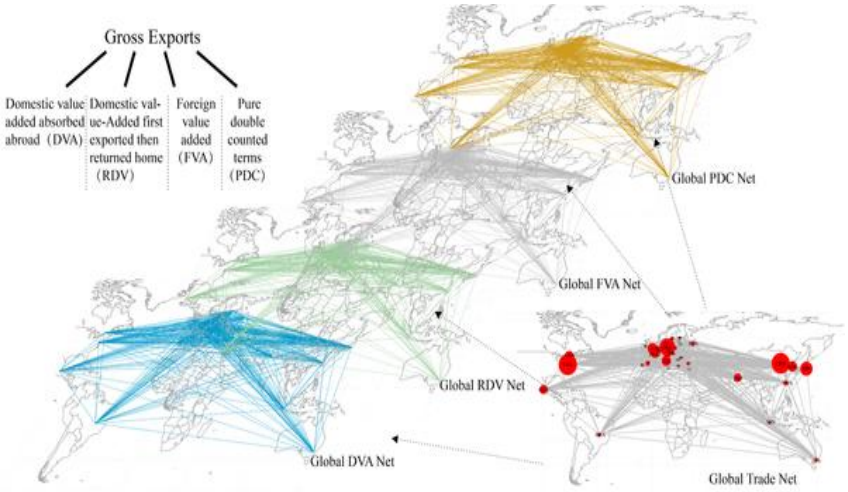
Countries become *opened and linked* in two dimensions: ***Trade and Finance***

GLOBAL LINKAGE: FINANCE



Source https://www.wto.org/english/news_e/pres18_e/pr820_e.htm





Xiao H, Sun T, Meng B, Cheng L (2017) Complex Network Analysis for Characterizing Global Value Chains in **Equipment Manufacturing**. PLOS ONE 12(1): e0169549. https://doi.org/10.1371/journal.pone.0169549 https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0169549

RECORD OF INTERNATIONAL TRANSACTIONS

- Officials record all international activities (trade/finance) by using international accounting standard, so called **Balance of payments**
  - Credit/debit activities between domestic residents and foreign residents
- **The rules:**
  - If you have to pay a foreign resident, normally in exchange for something that you bring into the country, then the something counts as a debit.
  - If a foreign resident has to pay you for something, then the something counts as a credit.

RECORD OF INTERNATIONAL TRANSACTIONS

- Following the guideline of IMF, there are three main **(flow)** accounts
  - Current Account (CA)
  - Capital and Financial Account (KA)
  - Official reserve transaction (ORT)

RECORD OF INTERNATIONAL TRANSACTIONS

Accounts and Subaccounts	Cumulative Balances
CURRENT ACCOUNT (CA)	
Merchandise	
Services	
• Transportation	
• Tourism	
• Business and professional services	Balance of goods and services
"Primary income," mainly investment income	Balance of goods, services, and income
Unilateral transfers ≡ "secondary income"	
• Government grants	
• Private remittances	Current account balance
Capital and financial account (KA)	
Direct investment	
Portfolio investments (securities and banking flows)	
• Long term	Basic balance
• Short term	Overall balance of payments
OFFICIAL RESERVE TRANSACTIONS (ORT)	
Changes in foreign central banks' holding of domestic assets	
Changes in the domestic central bank's holding of foreign assets	
• Gold	
• IMF credits and SDRs	
• Foreign exchange reserves	

Note: Each balance at the right is the sum of the previous balance and the additional items listed before the dotted line.

KEY IDENTITIES IN BOPS

- CA ≡ Rate of increase in net international investment position
  - CA-surplus country (Thailand) accumulates claims against foreigners;
  - CA-deficit country (US) borrows from foreigners

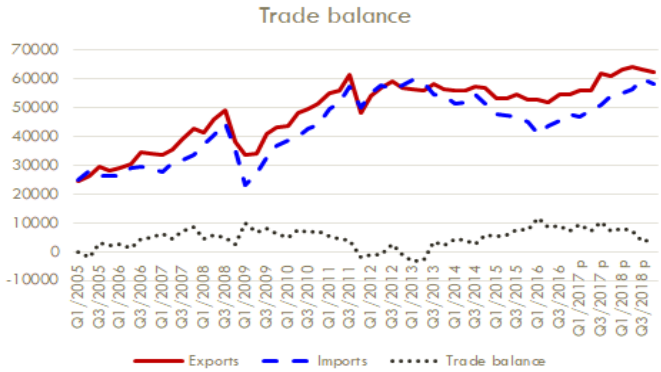
- CA + KA (private) + ORT ≡ 0

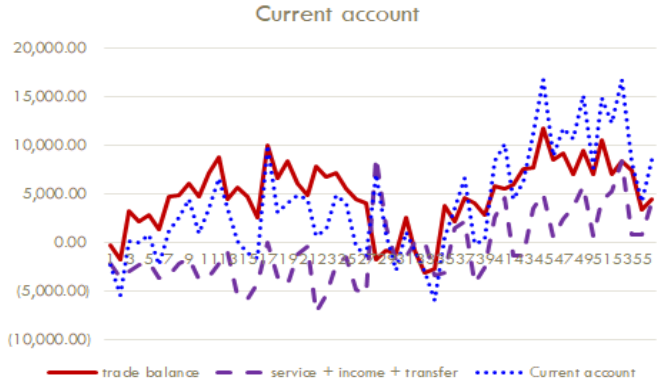
  (practically, it will NOT be exactly equal to zero.)

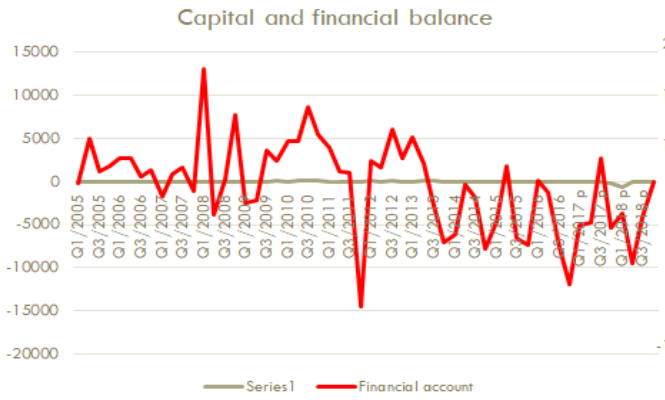
Implication: BoP ≡ CA + KA → **BoP ≡ - ORT**

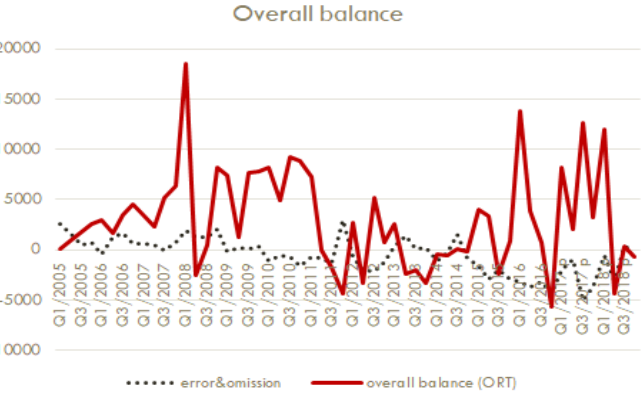
THAILAND MEASUREMENT OF EXTERNAL BALANCE

1	Exports (f.o.b.)
2	Imports (f.o.b.)
3	Trade balance
4	Net services, primary income and secondary income
5	Current account balance
6	Capital account
7	Financial account
8	Central Bank
9	General government
10	Other depository corporations
11	Other sectors
12	Other financial corporations
13	Nonfinancial corporations, households, and NPISH
14	Net errors & omissions
15	Overall balance









Source: http://www2.bot.or.th/statistics/MetaData/EC_XT_048_ENG.PDF

AGENDA

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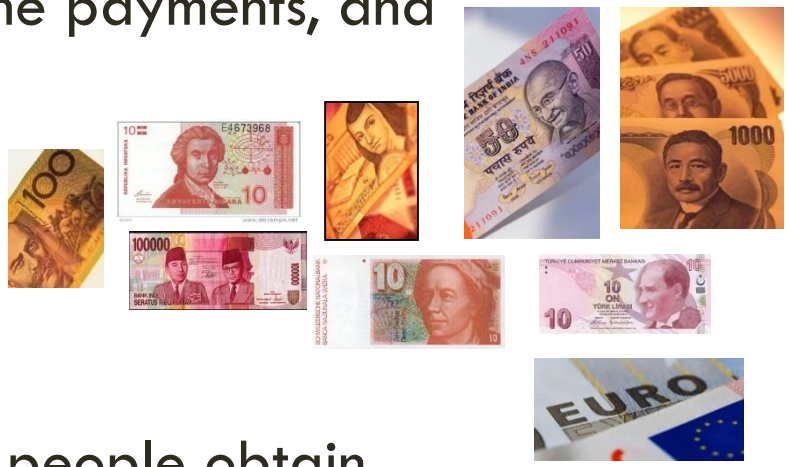
INTERNATIONAL PAYMENTS AND FOREIGN EXCHANGE MARKET

- International transactions require the payments, and hence foreign currency.
  - Each country has their own national currency.



- **Foreign currency market** is where people obtain foreign currency, i.e. trading/converting one currency into another currency.
  - Example: Thai baht traded into USD, Euro traded into JPY etc.

FOREIGN EXCHANGE MARKET

- **Foreign exchange rate** is determined in the foreign currency market; price of one currency in term of another currency
  - **Spot transaction:** immediate (two-day) exchange of bank deposits
    - Spot exchange rate
  - **Forward transaction:** the exchange of bank deposits at some specified future date
    - Forward exchange rate

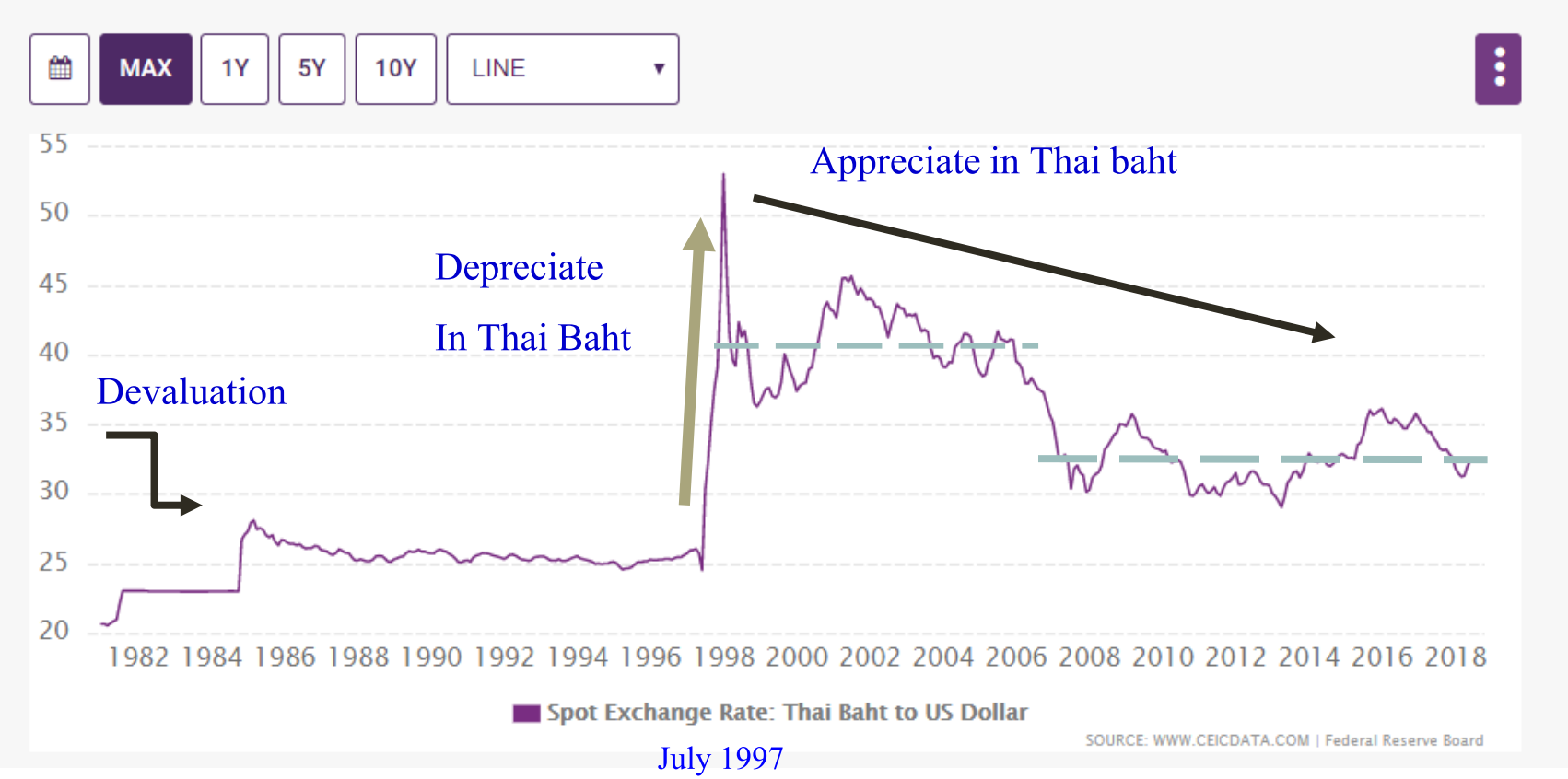
- **The nominal value** of exchange rate can be quoted in several ways, e.g.
  - **Direct quotation:** domestic per a unit of foreign (Baht per 1 USD)
  - **Indirect quotation:** foreign per a unit of domestic (USD per 1 baht)

FOREIGN EXCHANGE MARKET

- The value of exchange rate implies us about the purchasing power of a currency
  - **Appreciation**: a currency rises in (purchasing) value relative to another currency
  - **Depreciation**: a currency falls in (purchasing) value relative to another currency

- Higher value of direct quoted exchange rate → depreciation in domestic currency, but an appreciation in foreign currency
  - **e = 25 B/ 1USD → e = 30 B / 1USD (Baht depreciates/USD appreciates)**

NOMINAL EXCHANGE RATE: THB V.S. USD



July 1997

Fixed exchange rate | Flexible / managed-float

FOREIGN EXCHANGE RATE: NOMINAL V.S. REAL

- **Nominal exchange rate, e = 31 baht / USD**

- **The real exchange rate** (RER: the terms of trade) is the price of foreign goods in terms of domestic goods:
  - P = the price of domestic goods in the unit of domestic currency.
  - P*= the price of foreign goods in the unit of foreign currency.
  - eP* = the price of foreign goods in the unit of domestic currency.

$$real\ exchange\ rate = \frac{eP^*}{P}$$

EFFECTIVE EXCHANGE RATE:

- **Nominal *effective* exchange rate (NEER):** an index constructed to measure the relative (nominal) value of a national currency against other trading partners *(trade-weighted exchange rate)*

$$NEER_t = \frac{\sum_{i=1}^{N} w_{i,0}\, e_{i,t}}{\sum_{i=1}^{N} w_{i,0}\, e_{i,t=0}} * 100$$

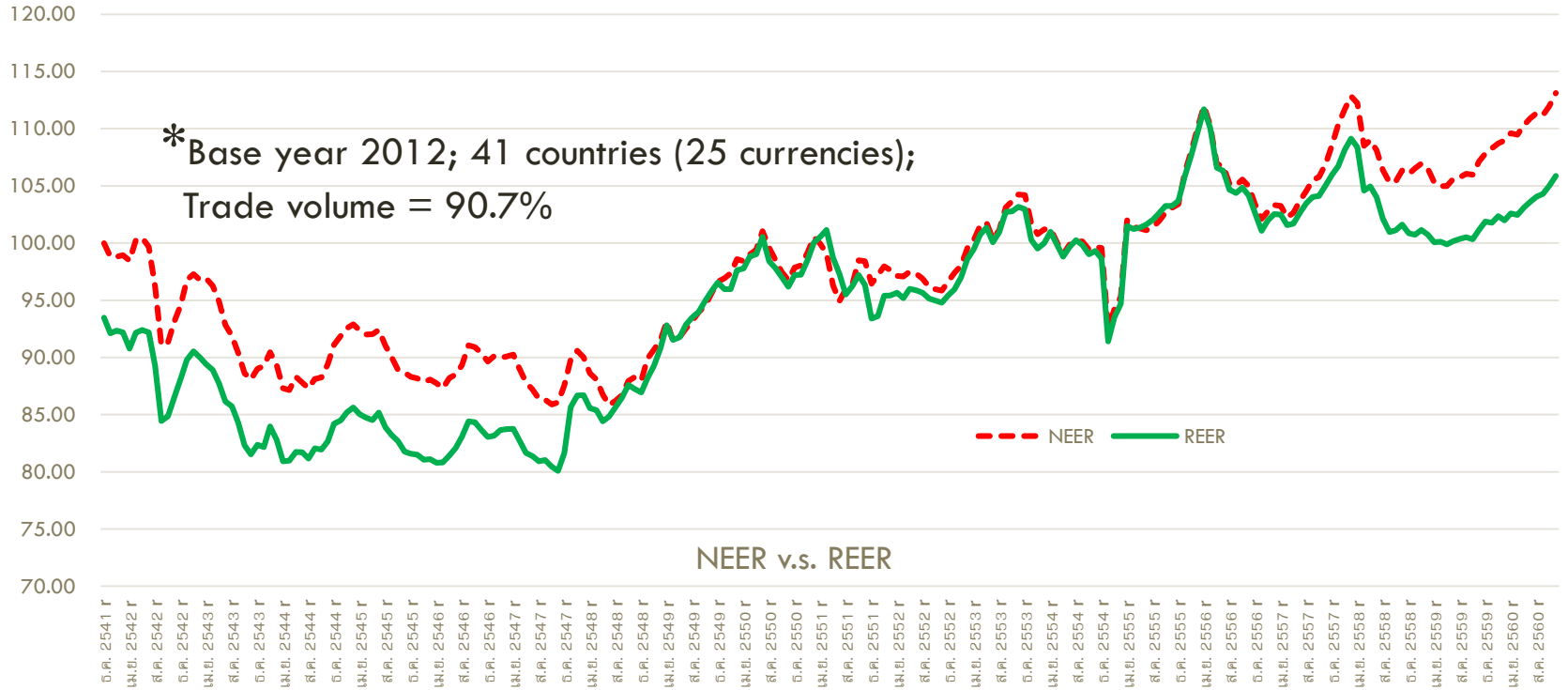
  - $w_{i,0}$: $trading\ basket\ (bilateral\ trade\ share\ with\ country\ \ i)$

- **The real exchange rate (REER):** an index constructed to measure the relative (real) value of a national currency against other trading partners.

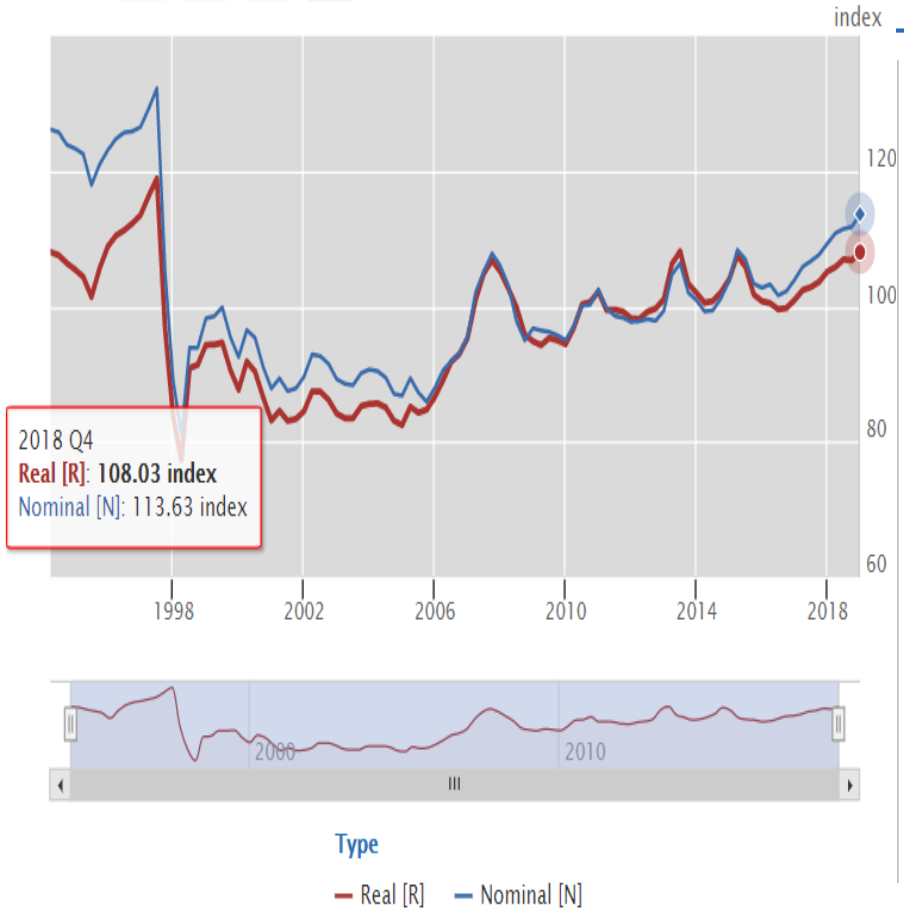
$$REER_t = \frac{\sum_{i=1}^{N} w_{i,0}\, rer_{i,t}}{\sum_{i=1}^{N} w_{i,0}\, rer_{i,t=0}} * 100$$

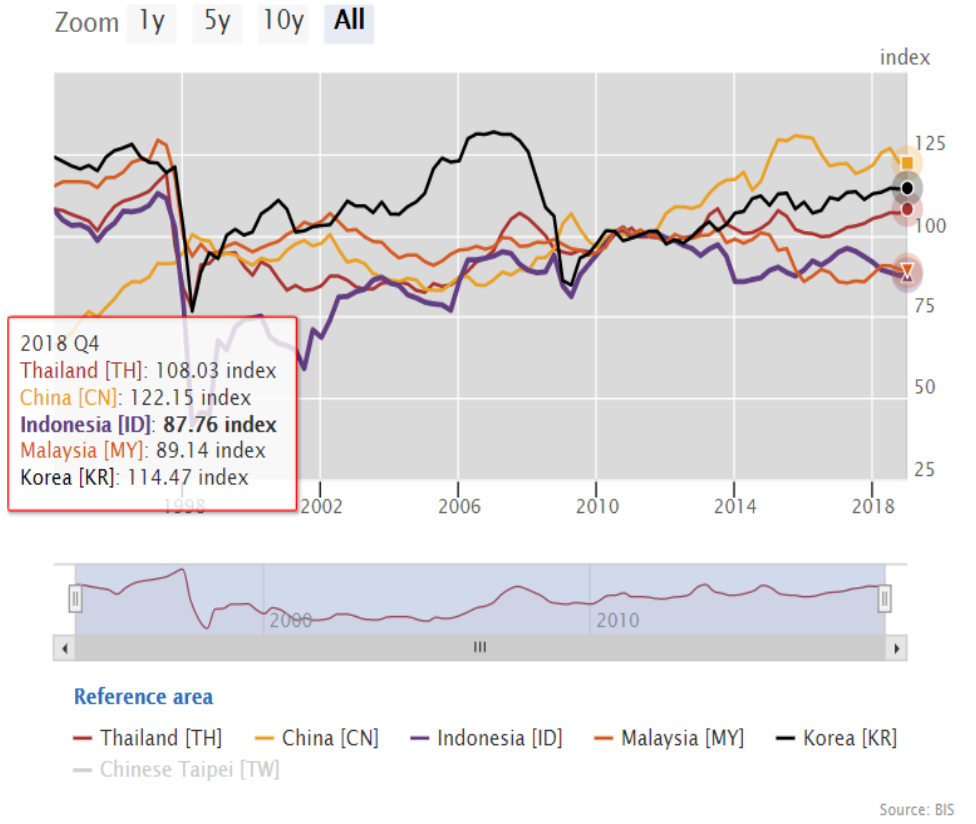
NEER V.S. REER IN THAILAND (BY BOT)

By the way official series are constructed*, an increase in NEER refers to the *baht appreciation* against Thailand's major trading partners and competitors. This reflects relative *disadvantage* of the baht in price competitiveness.



NEER V.S. REER: SOME SELECTED COUNTRIES (FROM BIS)





THEORY AND ISSUES ON EXCHANGE RATE DETERMINATION

- **Long-run v.s. Short-run theory**

- Institutional details and how a country run its **exchange rate regime.**
  - Flexible Exchange Rate
  - Fixed or Pegged Exchange Rate
  - Managed Float

LONG-RUN THEORY: THE PURCHASING POWER PARITY (PPP)

- Accounting for the ***long-run*** **(trend) movement of nominal exchange rate** is often referred to the theory of purchasing power parity, i.e. PPP.

- The theorem is founded upon one the most important concepts in international trade theory so called "**the law of one price (LoP)**"

- **LOP: an identical product should be priced the same across countries.**
  - Holds under (i) zero transport cost and (ii) no trade barriers.

THE PURCHASING POWER PARITY (PPP)

- **The law of one price: $P_i = eP_i^*$.**
- If the condition doesn't hold, we are under the **arbitrage condition.**
  - Profit-making with no risk!

- If $eP_i^* > P_i$, domestic good-i is cheaper.
  - Foreigners buy more domestic good-i; P_i is rising.
- If $eP_i^* < P_i$, foreign good-i is cheaper.
  - Domestic consumers buy more foreign good-i; P_i is falling.

THE PURCHASING POWER PARITY (PPP)

- The idea is ***extended*** to the *aggregate level*.

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

where P and P* are the consumer price index (CPI).

- This version is called an "***absolute***" PPP.
  - **Holds under two assumptions**: LOP with Identical basket of consumption across countries
- An alternative (more relaxed) version is called a "***relative***" PPP.

$$\hat{e} = \hat{P} - \widehat{P^*}$$

where $\hat{x}$ is the growth rate of x.

THE PURCHASING POWER PARITY (PPP)

- Following the relative version, **domestic currency should be depreciating if domestic inflation rate exceeds the inflation rate of foreign country.**

- Question is: **"what are the determinants of inflation rate?"**

THE PURCHASING POWER PARITY (PPP)

- Inflation occurs when **too much money** chasing **too few goods**.
  - Output does not grow as fast as the rate at which money grows.

- In the long-run, **money growth and productivity growth** matters for the exchange rate movement – e.g.,
  - A high money growth country should be experiencing a depreciation in its national currency.
  - A fast-growing productive economy (such as China) should have its national currency appreciated.

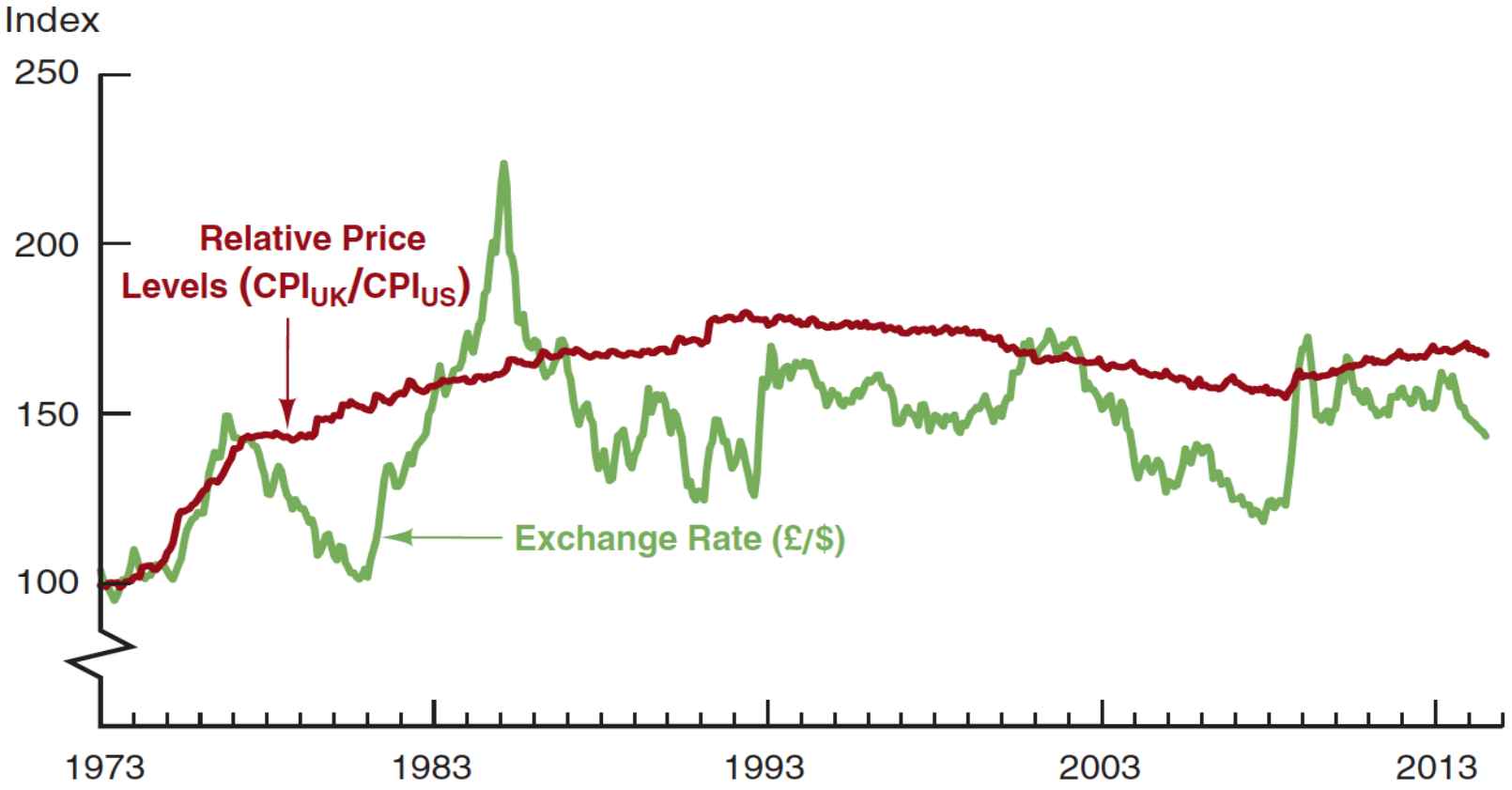
HOW WELL DOES THE PPP ACCOUNT FOR THE EXCHANGE RATE MOVEMENT?

- Testable implications?
  - If PPP holds, **the real exchange rate is fixed over time.**

$$RER = \frac{\boldsymbol{e}P^*}{P} = \frac{\left(\frac{\boldsymbol{P}}{\boldsymbol{P^*}}\right)P^*}{P} = 1$$

- Studies have found that RER (real) has **strong positive correlation** with NER (nominal).

HOW WELL DOES THE PPP ACCOUNT FOR THE EXCHANGE RATE MOVEMENT?



Source: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.

HOW WELL DOES THE PPP ACCOUNT FOR THE EXCHANGE RATE MOVEMENT?

- Better theory of guiding the **long-run trend** of exchange rate!
  - PPP holds in the case of **traded goods** with low transport cost, e.g., crude oil.
  - PPP may not hold with **non-traded goods** (due to physical and legal barriers), e.g., **services**.

- In the long-term, strong market forces push foreign and domestic prices towards PPP.
  - Physical and legal barriers tend to be overcome by consumers and firms as the **technology has become more advanced**.

APPLICATION: THE IMPLIED PPP EXCHANGE RATE / OVERVALUATION AND UNDERVALUATION

- The nominal exchange rate implied by PPP is treated as *the long-run equilibrium rate*.

- **Ex**: Item X is an **internationally-traded** good.
  - **The US**: the price of X is $10.
  - **Thailand**: the price of X is THB200.
  - The PPP rate: THB200/$10 = THB20/$1.
  - But the nominal rate is THB30/$1.
  - So the Thai baht is **undervalued** by 33%!

- **The Big Mac Index** by *the Economist*.

BURGERNOMIC INDEX

The Big Mac index

Country		2000 — 2018	Under/over valued, %
New Zealand	NZ$		-23.2
Britain	Pound		-23.2
Colombia	Peso		-24.9
Chile	Peso		-26.5
South Korea	Won		-26.8
Costa Rica	Colón		-26.8
UAE	Dirham		-30.8
Sri Lanka	Rupee		-33.9
Thailand	Baht		-34.9
Honduras	Lempira		-35.7
Japan	Yen		-36.4
Kuwait	Dinar		-37.0

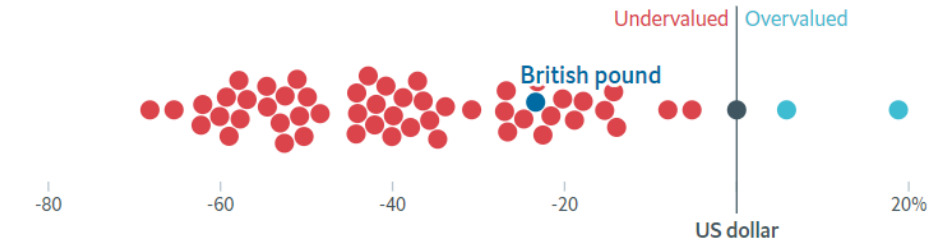
Choose a base currency: US dollar

Show index at: Jul 2018

Adjust the index to account for GDP per person: Raw index | GDP-adjusted

The British pound is 23% undervalued against the US dollar

July 2018



A Big Mac costs £3.19 in Britain and US$5.51 in the United States. The implied exchange rate is 0.58. The difference between this and the actual exchange rate, 0.75, suggests the British pound is 23.2% undervalued

2000-2018

BURGERNOMIC INDEX

The Big Mac index

Country		2011 —— 2018	Under/over valued, %
Brazil	Real		34.7
Colombia	Peso		33.3
Chile	Peso		15.6
Thailand	Baht		15.0
Sweden	Krona		11.5
Pakistan	Rupee		6.7
Euro area	Euro		5.1
Canada	C$		4.3
Peru	Sol		2.6
Switzerland	Franc		1.3
Israel	Shekel		0.8
United States	US$		BASE CURRENCY

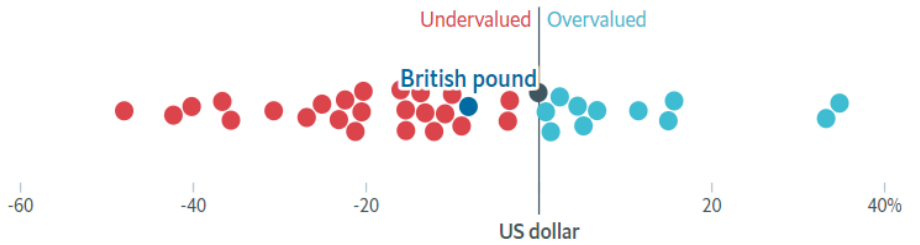
Choose a base currency: US dollar

Show index at: Jul 2018

Adjust the index to account for GDP per person: Raw index | GDP-adjusted

The British pound is 8% undervalued against the US dollar

July 2018



A Big Mac costs 23% less in Britain (US$4.23) than in the United States (US$5.51) at market exchange rates. Based on differences in GDP per person, a Big Mac should cost 16% less. This suggests the pound is 8.4% undervalued

2011-2018

150%

EXCHANGE RATE DETERMINATION: SHORT-RUN THEORY

- Determined by demand and supply for foreign currency in the foreign exchange rate market.

- Notation:

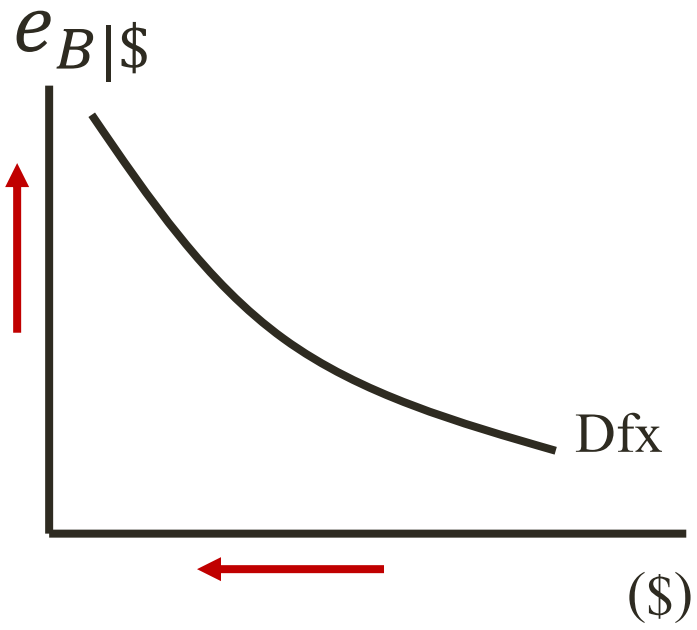
  $e_{B|\$}$ = units of baht required for a USD dollar

  - If $e_{B|\$}$ rises (falls), more (less) baht is required for a USD.
  - USD dollar appreciates (depreciates); Thai baht depreciates (appreciates).

  Demand for foreign currency is downward sloping in $e_{B|\$}$.

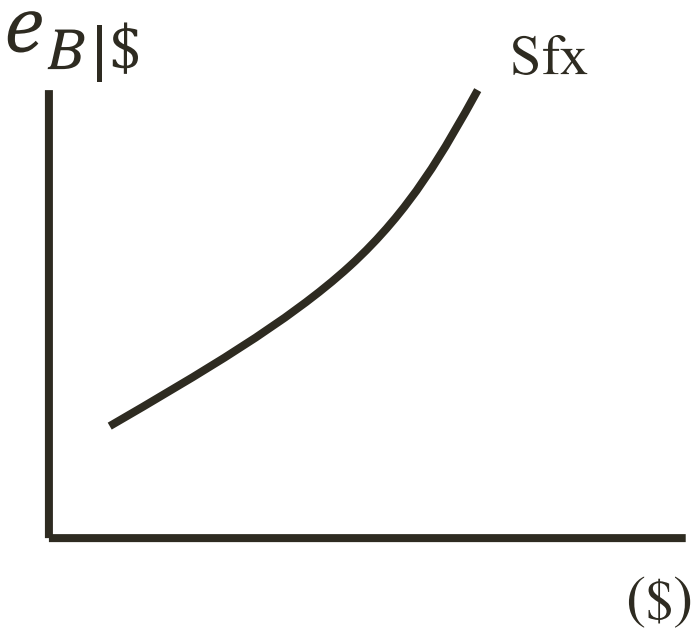
  Supply for foreign currency is upward sloping in $e_{B|\$}$.

FX DEMAND



- Rising e (= domestic depreciation)
  - higher value of imported product (in terms of Thai Baht) $rer = \frac{e*P^*}{P}$ → lower quantity demanded for imports
  - higher foreign asset value (in terms of Thai Baht) → lower relative return on foreign asset: $(1+r) - \frac{(1+r^*)e_{t+1}}{e_t}$ → lower demand for foreign assets.
- Less USD needed → **Downward sloping demand**

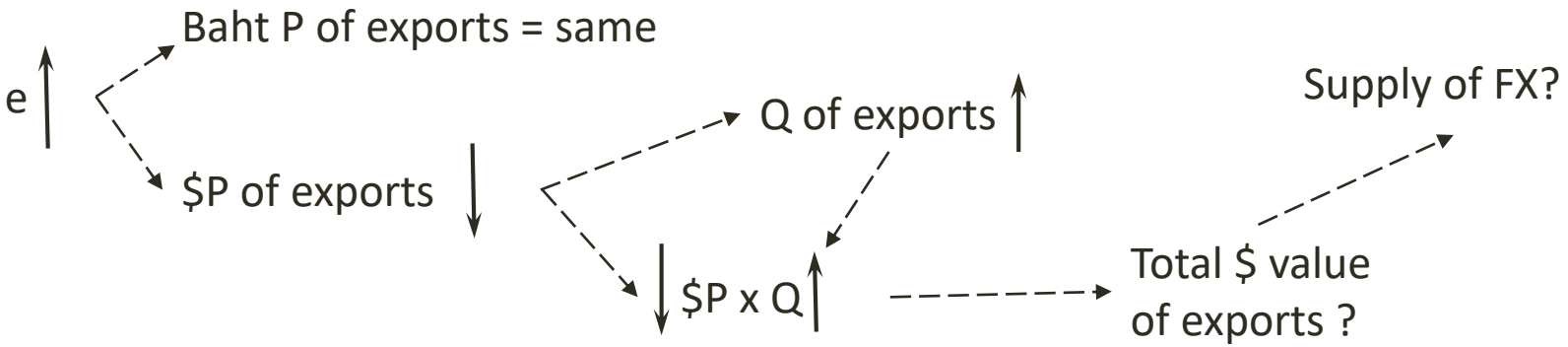
FX SUPPLY



- Rising e (= foreign appreciation) →
  - Lower value of domestic product (in terms of USD) $rer = \frac{e*P^*}{P}$ → higher quantity demanded for domestic product from ROTW
  - Lower domestic asset value (in terms of USD) → higher relative return on domestic asset: $(1+r) - \frac{(1+r^*)e_{t+1}}{e_t}$ → higher quantity demanded for domestic asset from ROTW.

- Always more USD supplied? (More Thai Baht needed?) **Upward sloping supply?**
  - **Quantity v.s. Value!**

- Turn out to be **yes if elasticity of exports is greater than one.**



If $|\varepsilon^d_x| < 1$ ⟶ $\Delta Q < \Delta \$P$ ⟶ Total $ value of exports ↓ ⟶ Supply of FX ↓

If $|\varepsilon^d_x| > 1$ ⟶ $\Delta Q > \Delta \$P$ ⟶ Total $ value of exports ↑ ⟶ Supply of FX ↑

The famous elasticity condition: Marshall-Learner condition
Further study in EE452!

FX MARKET EQUILIBRIUM

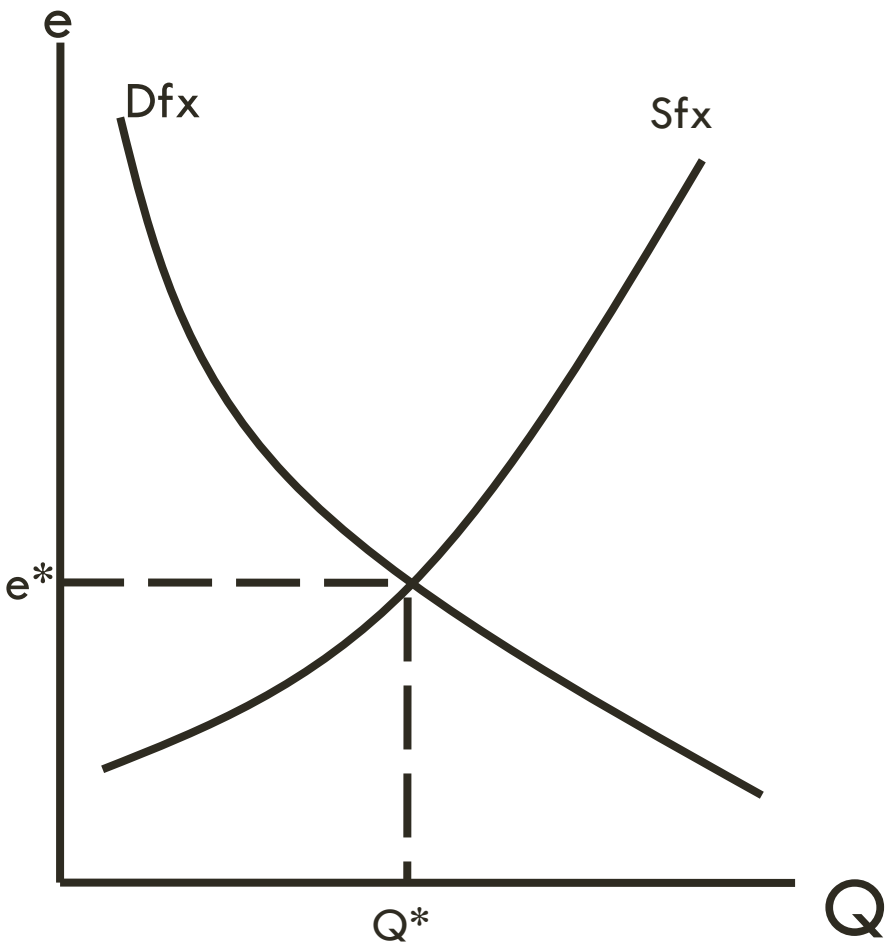
$Q^s_{FX} = Q^d_{FX}$

$X + F_{in} = IM + F_{out}$

$(X - IM) + (F_{in} - F_{out}) = 0$

$CA + KA = 0$

- BOP = 0 when e = e* and FX market is in equilibrium.

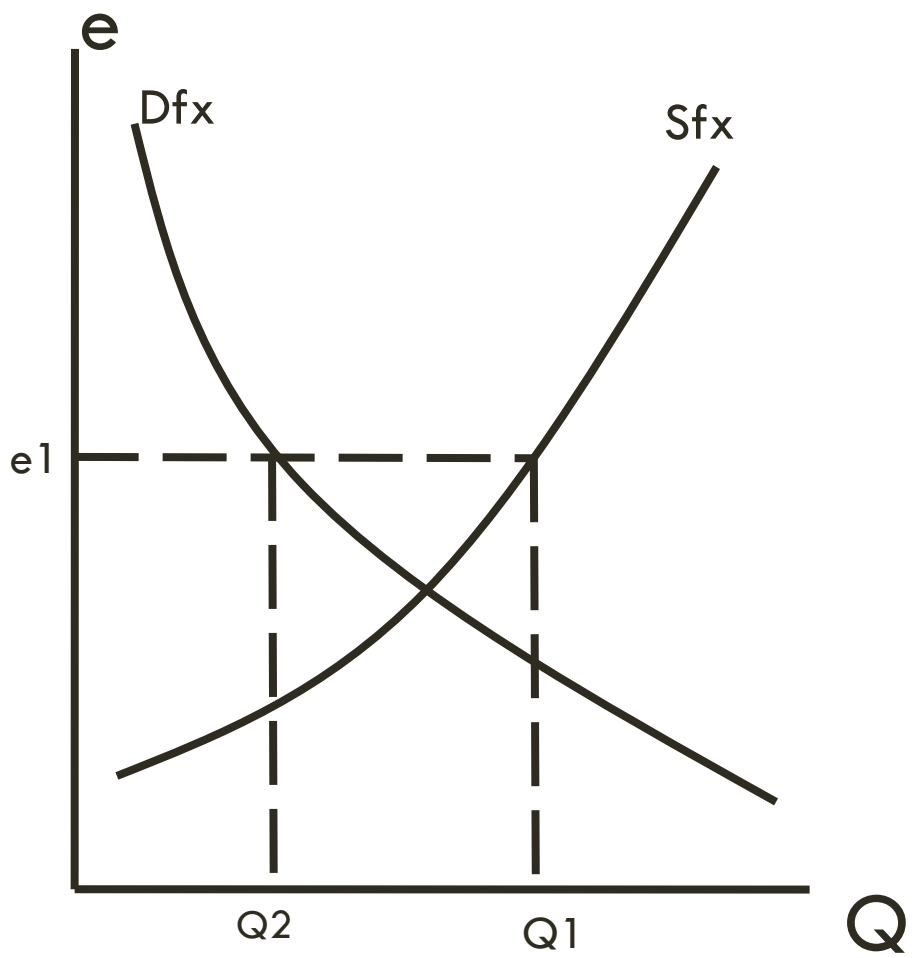


A BOP SURPLUS AND EXCESS SFX

At e1, excess supply of FX.

(CA) + (KA) > 0

BOP registers a **surplus** (BOP > 0).

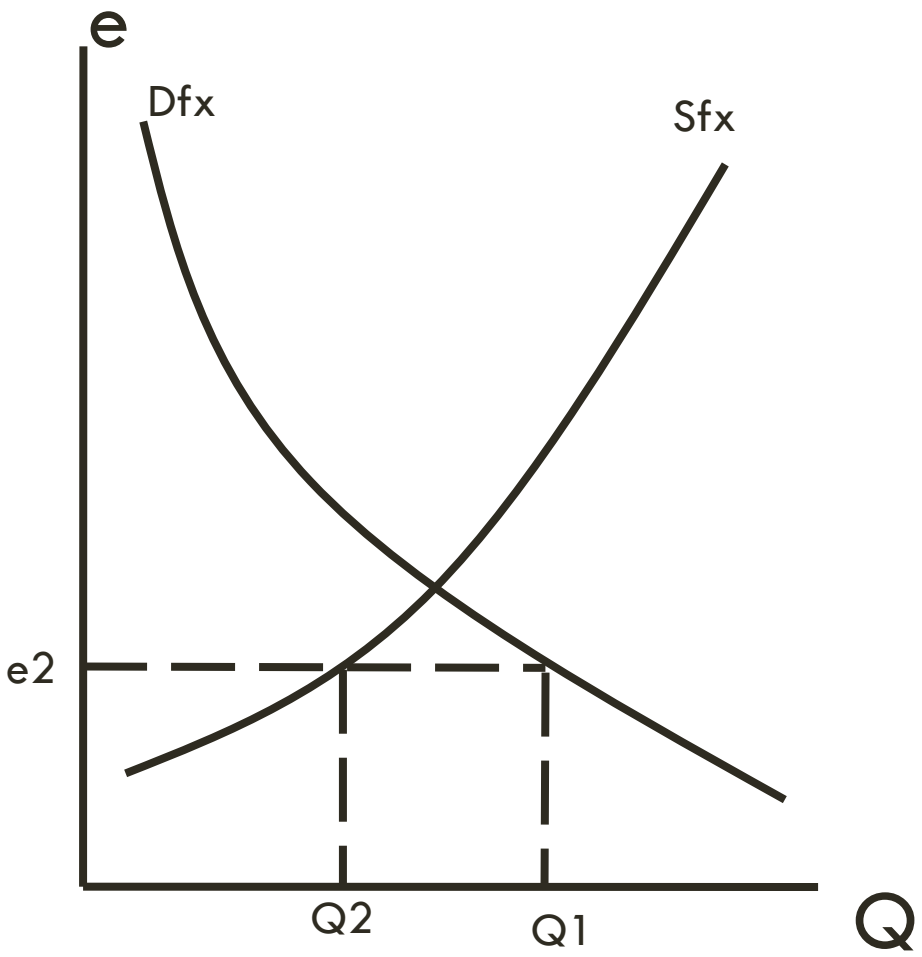


A BOP DEFICIT AND EXCESS DFX

At e2, excess demand of FX.

(CA) + (KA) < 0

BOP registers a **deficit** (BOP < 0).

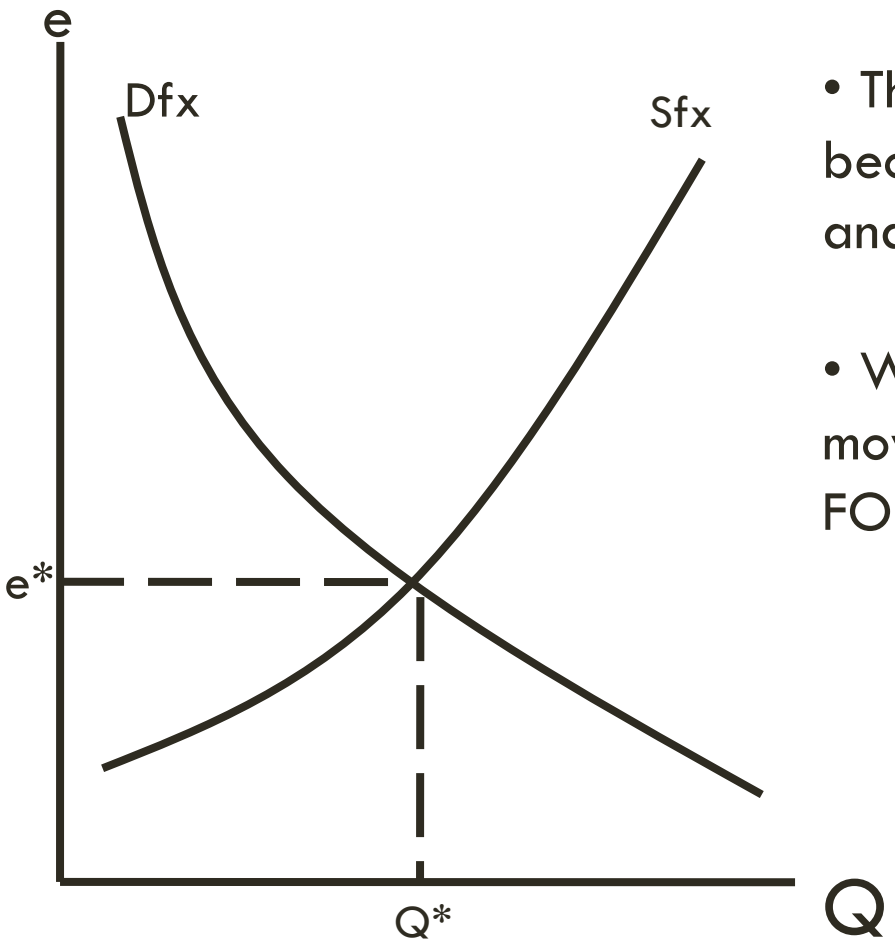


EXCHANGE RATE REGIME

- Institutional details and how a country run its **exchange rate regime** affect the way exchange rate is actually determined.

- Three regimes:
  - Flexible Exchange Rate
  - Fixed or Pegged Exchange Rate (Exchange rate anchor)
  - Managed Float

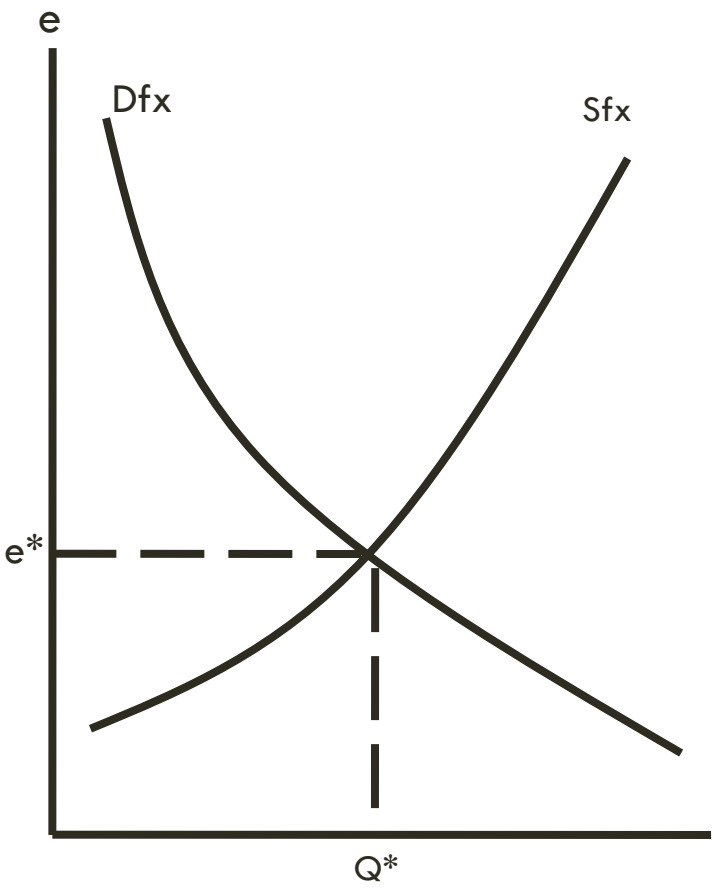
FLEXIBLE EXCHANGE RATE REGIME: FEATURES



- The exchange rate can **freely** move because of the shift/variation in the Dfx and Sfx.

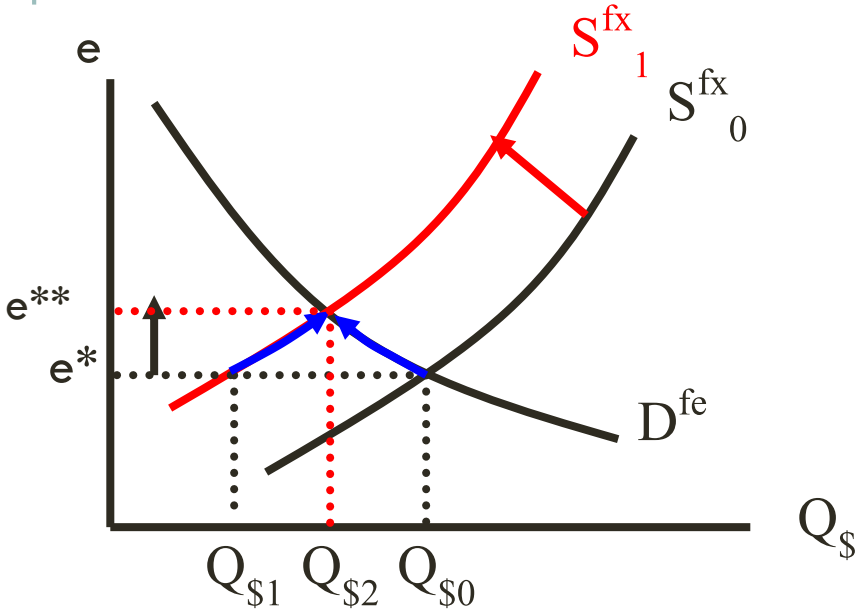
- What are the **factors** that cause the movement in the demand and supply of FOREX?

FLEXIBLE EXCHANGE RATE REGIME: FEATURES



- **Factors Affecting Sfx- e.g.,**
  - Change in the demand for domestic goods (exports): domestic price, ROTW income
  - Change in the demand for domestic asset (inflows): relative return, relative risk etc.
- **Factors Affecting Dfx - e.g.,**
  - Change in the demand for foreign goods (imports): foreign price, domestic income
  - Change in the demand for foreign asset (outflows): relative returns, relative risks etc.

FLEXIBLE EXCHANGE RATE REGIME: EXAMPLE



Question: what would happen to the exchange rate if GDP growth of major trading partners has been slowing down?

- Initial level e*
- Slowdown growth will result in a **short-fall of export**, causing the **supply for USD to shift left**.
- Excess demand will be eliminated by having the foreign currency price appreciated, i.e. depreciation in Thai baht.
- Exchange rate becomes e**.

FIXED EXCHANGE RATE REGIME: FEATURES

- Authority makes an **announcement in advance** for a targeted level of exchange rate, i.e. anchoring.

- The rate can be different from the rate the would arise under the flexible exchange rate regime, i.e. **shadow rate.**

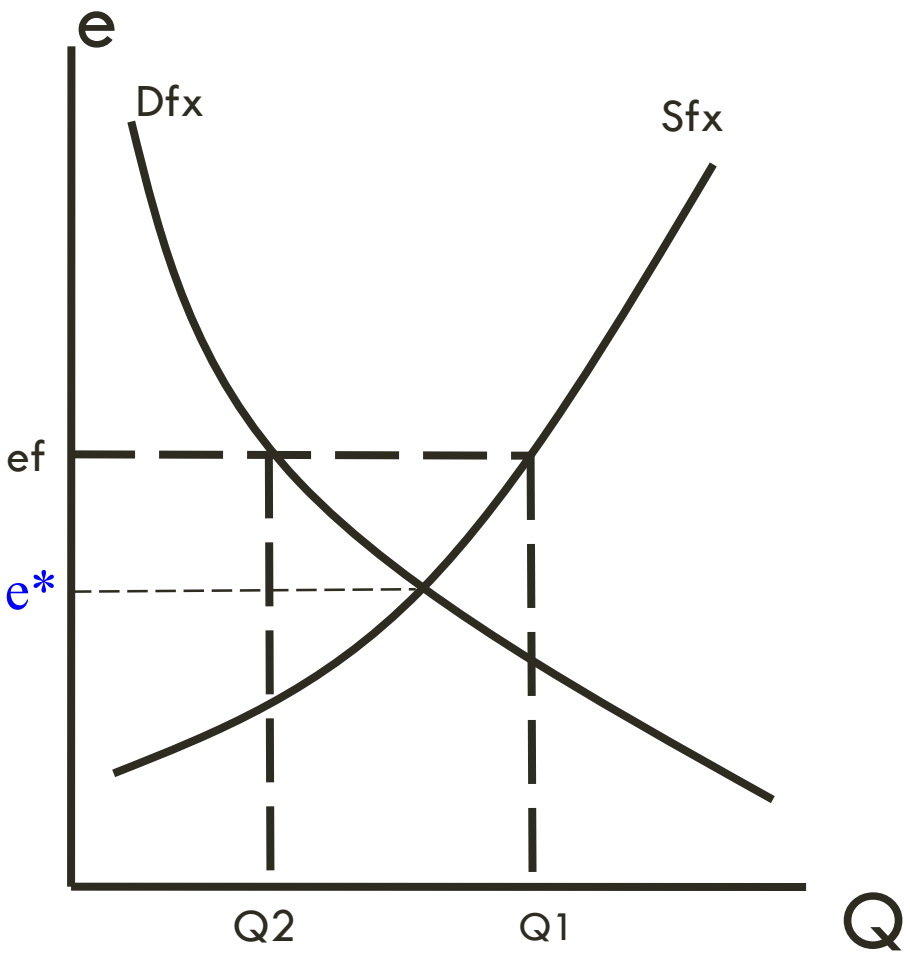
- To make a public commitment, authority (central bank) must be standing ready to ***intervene/support*** the market so that the targeted rate can be attained.

OFFICIAL RATE E_F ABOVE E*: IMPLEMENTATION

Domestic currency (ef) is undervalued.

- Excess Sfx; BOP > 0.
- Central bank buys FX to fix e_f.
- Accumulation of FX.
- Problem?

Revaluation of domestic currency; making domestic currency value stronger.

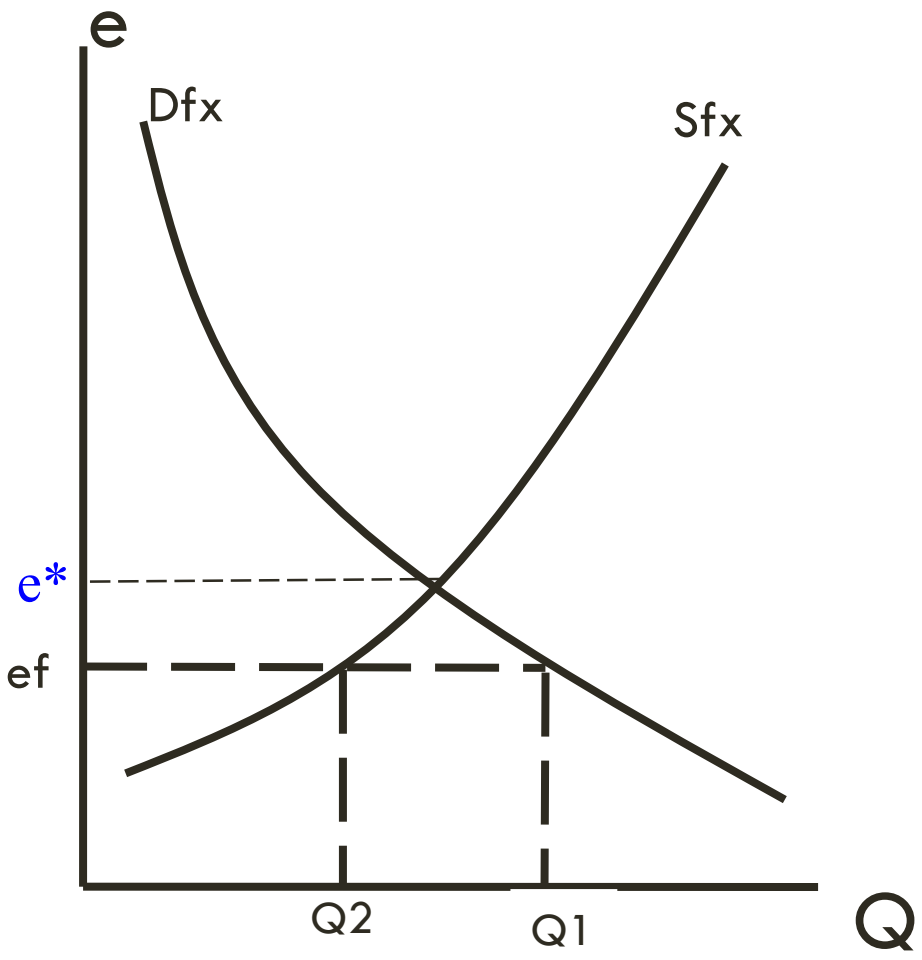


OFFICIAL RATE E_F UNDER E*: IMPLEMENTATION

Domestic currency (ef) is overvalued.

- Excess Dfx; BOP < 0.
- Central bank must sell FX to fix e_f.
- But official reserves are not unlimited?

Devaluation of domestic currency; making domestic currency value weaker.



SPECTRUM OF THE FIXED EXCHANGE RATE REGIME

- **Hard pegs**: the value of domestic currency is fixed relative to foreign currency for the indefinite future.
  - **Dollarization**: use foreign currency as the national medium of exchange (East Timor, Ecuador, El Salvador, Panama).
  - **Currency board**: central bank fixes the nominal exchange rate, then buys and sells foreign-denominated assets to maintain the rate (Bosnia, Bulgaria, Denmark, Hong Kong, Lithuania)

SPECTRUM OF FIXED EXCHANGE RATE REGIME

- **Soft pegs:** no permanent fixed rate.
  - The nominal rate is fixed for a long time period.
  - *Periodic adjustment* to correct imbalances: devaluation (raising e) or revaluation (reducing e).

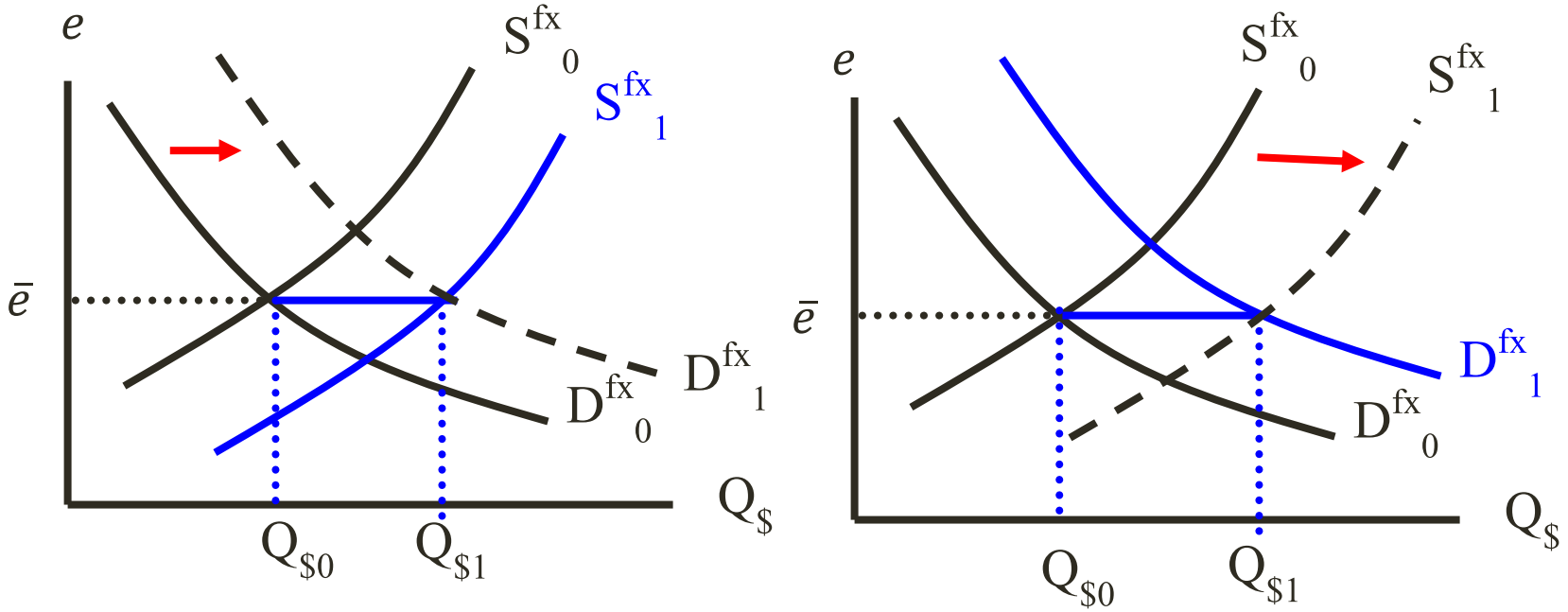
FIXED AND FLEXIBLE: CONS AND PROS

	Fixed exchange rate	Flexible exchange rate
Advantage	No uncertainty in exchange rate.	Reflecting fundamental of economy
Disadvantage	Likely to invite a financial crisis; slow to respond to imbalances.	Prone to subject to high volatility; resulting in unnecessarily high cost for hedging the exchange rate risk.

- **Managed float regime is more popularized regime.**
- Occasional intervention if rate changes at a very dramatic pace.
- So, what is the difference between soft pegged v.s. managed float?

MANAGED FLOAT REGIME: FOREIGN CURRENCY MARKET INTERVENTION

Suppose the authority needs to ***stabilize*** the exchange rate at $\bar{e}$



- $\bar{e}$ → Excess demand (more buy than the sell)→ **Central bank** must supply USD to eliminate the excess demand in USD by $\$Q_{\$0}Q_{\$1}$.

- $\bar{e}$ → Excess supply (more sell than buy) → **Central bank** must buy USD to clear the excess supply in USD by $\$Q_{\$0}Q_{\$1}$

FOREX INTERVENTION AND ITS IMPLICATION FOR CENTRAL BANK BALANCE SHEET

With Forex intervention, domestic financial sector gets impacted.
Consider a simplified balance sheet of the central bank.

Asset	Liability
Government bond (Govt Bond) Gold	Currency in circulations
Foreign currency reserve (FRA) - Foreign-denominated assets - Foreign currencies - SDRs	Commercial bank reserve
	Capital + Net Worth

Monetary Base

- FOREX Intervention will affect the level of monetary base, and hence money supply.
- How? When central bank creates "demand" and "supply" for foreign currency, it buys and sells the foreign currency from commercial banks.

FOREX INTERVENTION AND ITS IMPLICATION FOR CENTRAL BANK BALANCE SHEET

A simplified balance sheet of the central bank.

Asset	Liability
Government bond (Govt Bond) Gold	Currency in circulations
Foreign currency reserve (FRA) - Foreign-denominated assets - Foreign currencies - SDRs	Commercial bank reserve **Capital + Net Worth**

Monetary Base

- BOP surplus → Buying $ (under ES in $) → Rising in FRA → **MB rises, and hence money supply**
- BOP deficit → Selling $ (under ED in $) → Depletion in FRA → **MB falls, and hence money supply**

FOREX INTERVENTION AND ITS IMPLICATION FOR CENTRAL BANK BALANCE SHEET: STERILIZATION

- Forex intervention affects the amount of liquidity in the financial system; *unintended outcome*

- Central bank might pursue some domestic policy actions to **counteract** the unintended outcome of the forex intervention

- The pursued action is called "*sterilized forex intervention*"
  - Intervene forex market, with a simultaneous central bank's OMO to keep the monetary base fixed.

FOREX INTERVENTION AND CENTRAL BANK BALANCE SHEET: STERILIZED INTERVENTION

A simplified balance sheet of the central bank.

Asset	Liability
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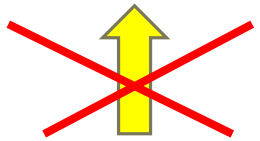
Foreign currency reserve (FRA) - Foreign-denominated assets - Foreign currencies - SDRs	Commercial bank reserve
	Capital + Net Worth



Monetary Base

- Buying $ (ES) → ~~MB rises, and hence money supply~~ → Offset by OMO sale
- Selling $ (ED) → ~~MB falls, and hence money supply~~ → Offset by OMO purchase