# INTRO TO FINA 7360

## Class Overview, FX Rates, The FX Market & FX Rate Regimes

(for private use, not to be posted/shared online)

**• Everything is online (syllabus, lecture notes, class slides, cases, data, old exams, schedule, etc.)**

Check my homepage: www.bauer.uh.edu/rsusmel/7386/7386.htm

**• Exams and Grading**

- Midterms 2: Week 8 (**March 9**) and Week 14/15 (**April 20/27**)
- Paper: Week 10/11 (**March 30/April 6**)
- Case Presentations: First: Week 4 (**Feb 9**); Second: Week 6 (**Feb 23**).
- Homework: Due on case presentation dates

**• Case Presentations**

Small groups (2-3 students). Ideally, 4-5 presentations.

**• Homework**

Every case comes with a Class Assignment, which is a small part of the case. Every student not in the group presenting the case has to do the Case's Class Assignment.

**• Class Structure**

Given last semester experience, we will restrict each lecture to two 60'-75' segments, with a 15' break in the middle.

PPT slides are already available on my homepage.

**• Two Midterms**

The midterms are open everything, computer included. Collaboration with others is not allowed.

If taken online. I will send you the exam 10'-15' before 6 PM. You will have to return the exam by 9:10 PM. Every 10' of delay will be penalized with 10 points off.

You can type the exam or just send me pictures taken with your phone of your work (some students have sent me individual pictures numbered or a pdf with the pictures).

**• Comments from previous classes**

***- "Class is somewhat technical"***

We will emphasize the numerical/mathematical aspects of international finance. We will use regressions, simulations, the CAPM, NPV formulas, Black-Scholes option pricing formulas, etc. We will review all topics in class.

***- "Class covers a lot of material"***

We cover FX rates and how to manage FX risk (first part of the class), International asset allocation, International Stock Markets, International Corporate Finance, Currency Swaps, International Bond Market and Eurocurrencies.

***- "Instructor (me) goes fast"***

Questions are a great way to slow me down. Ask questions. All questions and interruptions are greatly appreciated.

**• More comments from previous classes**

"It was difficult to keep awake in the class."

"Very technical course."

"Learned a lot. Good course. Enjoyed the exams. One of the good courses in MBA (program)."

"This course is much too quantitative."

"We covered too much info too fast."

"This is one of the few courses that I feel I've truly earned what I'm paying the university."

"I enjoyed the AMA at the beginning of each class."

"He fried my brain."

**• International Finance**

**- Similar to (Domestic) Finance**

We use same models and formulas: NPV, CAPM, option pricing, etc.

**- What makes International Finance a different class**

- Different currencies across the world (USD, EUR, JPY, MXN)

- Different countries, with different political and legal systems, regulations, social structures, institutions, etc.

These two features come with an associated a risk

- FX or Currency risk
- Country Risk

**- Goal of the class**

Learn how to minimize these risks in different markets.

**• International Finance**

**- Questions to answer**

- When does a Central Bank intervene in the FX Market?
- Does arbitrage in FX Market work? More specific, does IRP hold?
- Which theory best explain the behavior of the exchange rate?
- What tools do companies have to protect against Currency Risk?
- How does a company protect a FC receivable from currency risk?
- Does international diversification pays?
- How do companies compute the NPV of CFs in an foreign investment?
- How do companies compute the expected return of a foreign asset?
- What methods are used to establish the Country Risk of a country?
- What tools do companies have to protect against Country Risk?
- How does a MNC issue bonds in the World Bond Market?
- What are the advantages of using Eurobond debt over domestic debt?
- How do companies do financial engineering in international markets?

**• Today's class**

It will look more like an Economics class, than a Finance class. Next class, we will go over more Finance oriented topics.

**- FX Market**

- Exchange Rate, $S_t$, & Determinants of Supply & Demand
- FX Market: Organization, Activities, Players, & Segments

**- FX Rate Regimes**

- Flexible & Fixed
- Central Bank Intervention

## FX Market: Exchange Rates

• **Definition**

An exchange rate is a price: The relative price of two currencies.

**Example:** On January 4, 2023, the price of a euro (EUR) in terms of USD was USD 1.0630 per EUR ⇒ EUR 1 = USD 1.0630

Notation: $S_t$ = Exchange rate = 1.0630 USD/EUR.

• **Remark - Exchange Rate: Just a Price**

An exchange rate is just like any other price.

⇒ Price of a gallon of milk: USD 3.50 (or 3.50 USD/milk).

Think of the currency in the denominator as the good you buy/sell.

**Q: What is confusing in the FX Market?**

A simple price, $S_t$ = **1.0630 USD/EUR** ⇒ EUR 1 = USD 1.0630

But, a little bit different: Both, the numerator (USD) and the denominator (EUR), are easily exchanged for each other. We can also write:

$S_t$ = 0.9407 EUR/USD ⇒ USD 1 = (EUR 1/**1.0630**) = EUR 0.9407

In the case of the price of milk, only one good (USD) can be used to buy the other.

Q: What makes exchange rate quotes tricky?

A: Both traded goods (USD and EUR) can be exchanged for the other.

Again, we will think of the currency in the denominator as the good we buy/sell, the FC. (***direct quote***.) Easy to translate FC prices to DC:

Multiply a foreign price (in FC) by direct quote = price in DC

**• Just a Price, but an Important One**

$S_t$ plays a very important role in the economy. It influences the current account (CA = X (exports) – M (imports)), cross-border investments, the domestic price level, $P_d$, and real wages.

**Examples:** Suppose the EUR appreciates vs the USD –i.e., EUR is more expensive in terms of USD. Using direct quote, $S_t$↑.

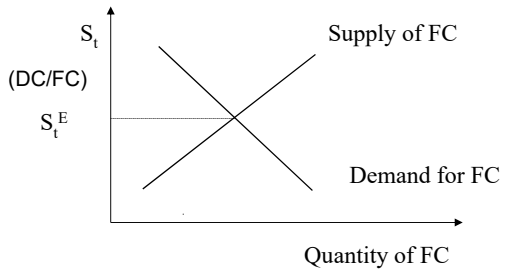
- When $S_t$↑, imports become more expensive in USD ⇒ M ↓ & $P_d$ ↑
  ⇒ Real wages ↓ (through a reduction in purchasing power).

- Also, when $S_t$↑, USD-denominated goods and assets are more affordable to foreigners.
  ⇒ Foreigners buy more goods and assets in the U.S. (X, bonds, real estate, companies, etc.).

Note: Under normal circumstances, CA ↑ ("improves"). ¶

**• Supply & Demand in the FX Market**

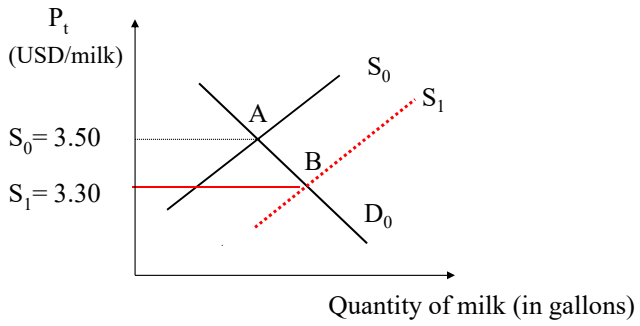
Like any other price, $S_t$ is determined by supply and demand.




• Standard Demand and Supply graph:
- Price, $S_t$ (=units of DC per unit of FC), on the vertical axis.
- Quantity (of FC) on the horizontal axis.

**• Similar to Supply & Demand in other Markets**

Milk Market determines the price of milk, $P_t$ (= Units of DC per gallon).

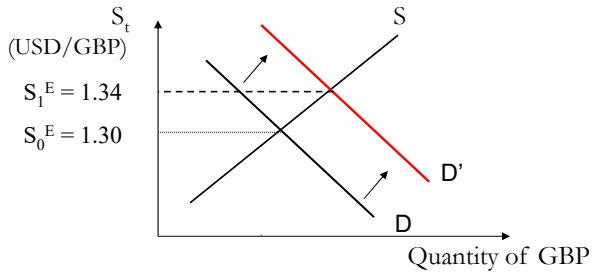



- New technology increases milk production (Supply ↑)

- $S_t$ moves from A to B
  ⇒ Milk becomes less expensive in terms of USD.

**• Effect of a Change in Supply**

Suppose that there is a craze for British goods.




Demand for GBP ↑ (D moves up to D').

⇒ Value of the GBP increases (more USD needed to buy GBP 1): $S_t$ ↑

Terminology: We say the USD *depreciates* against the GPB (or the GBP *appreciates* against the USD).

**• The Real Exchange Rate ($R_t$)**

$S_t$ is a *nominal* variable: The price (in DC) of one unit of FC. Economists distinguish between Nominal & Real values.

To compare where things are more expensive, *the real exchange rate*, $R_t$, is used. $R_t$ measures the cost of foreign goods relative to domestic goods, once denominated in the same currency (DC):

$$R_t = S_t P_f / P_d,$$

where $P_f$ is the price of foreign goods (in FC) and $P_d$ is the price of domestic goods (in DC).

**Example**:

Price of Oil in Europe: $P_f$ = **EUR 68**;

Price of Oil in U.S.: $P_d$ = **USD 70**

$S_t$ = **1.0630 USD/EUR**

⇒ $R_t$ = **1.0630 USD/EUR** * **EUR 68**/**USD 70** = **1.0326**

**• The Real Exchange Rate ($R_t$)**

$R_t$ gives a measure of competitiveness:

$R_t > 1$, Domestic goods are more competitive.

**Example (continuation)**: Once translated to same currency, oil is cheaper in the U.S.: **3.26%** cheaper ⇒ "*U.S. more efficient.*"

Terminology:

If $R_t$ increases, DC *depreciates in real terms* ⇒ domestic goods become more competitive (*cheaper*) relative to foreign goods.

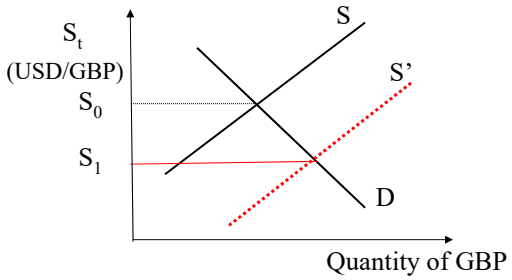
## Supply & Demand in the FX Market

• **Who supplies GBP in the (U.S.) FX market?**

- UK investors, investing in the U.S.
- US exporters, exporting to the U.K.
- UK tourism

Remark: More UK investments, US exports, or UK tourism:

⇒ Higher supply of GBP in the FX USD/GBP market.

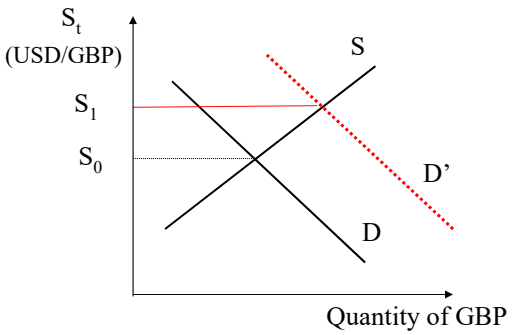



• **Who demands GBP in the (U.S.) FX market?**

- US investors, investing in the U.K.
- US importers, importing from the U.K.
- US tourism

Remark: More US investments, US imports, or US tourism:

⇒ Higher demand for GBP in the FX USD/GBP market.



**• What moves Supply & Demand?**

– International Investing

– International Trade

– International Tourism

– Other factors (Central Banks needs, international transfers, etc.)

All these activities are reflected in the Balance of Payments (BOP).

**• Balance of Payments**

BOP = Current Account (CA) + Capital Account (KA)

CA = Net Exports of goods and services (main component) + Net Investment Income + Net Transfers

KA = Financial capital inflows – Financial capital outflows

The BOP = 0 ⇒ The CA is financed by the KA.

**• Balance of Payments**

BOP = Current Account (CA) + Capital Account (KA)

• We model:

- CA as influenced by prices: $P_d$, $P_f$, $S_t$ (or $\mathbf{R_t}$)

- KA as influenced by expected rates of returns. In the short term, interest rates ($i_d$ & $i_f$) dominate.

- Y (income) influences both CA & KA.

- Factors that affect prices, expected rates of returns, & income, such as taxes, tariffs, tech, uncertainty, etc., also have an influence on the BOP.

- **Economic Variables ("*Fundamentals*") Affecting the BOP (S & D)**
  - Interest rates ($i_{USD} - i_{FC}$)
  - Inflation rates ($I_{USD} - I_{FC}$)
  - Income growth rates ($y_{USD} - y_{FC}$)
  - Others: Tariffs, quotas, other trade barriers, expectations, taxes, tastes, expected returns in financial assets/real estate, technology, etc.

    ⇒ Changes in the fundamentals will affect $S_t$.

**• A Word about Models**

In the economy variables are interrelated. *Models* simplify interactions & focus on the main impact, say money markets, goods markets.

**• Remarks**

◊ *Interactions among variables*: In S & D graphs, we assume that only one variable changes (*ceteris paribus* assumption). But, variables are interrelated. For example:

Higher I ⇒ higher i;

Restrictions to trade affect Y & P; Y affects i, P affects I, etc.

S & D graphs make assumptions about which curve moves more ("dominant" effect).

◊ *No dynamics*: In S&D graphs we present two situations:

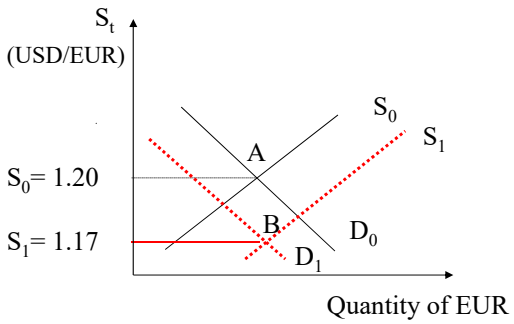
- Initial equilibrium (with $S_0$)
- Final equilibrium (with $S_1$).

We pay no attention to the adjustment process.

**Example: Changes in interest rate differentials**

The U.S. Fed increases interest rates ($i_{USD}\uparrow$) $\Rightarrow$ ($i_{USD} - i_{EUR}$)$\uparrow$

Two effects: – European residents buy more U.S. T-bills (S of EUR $\uparrow$)
– U.S. residents buy less European T-bills (D for EUR $\downarrow$)
$\Rightarrow$ both Supply and Demand curves shift.




- $S_t$ moves from A to B

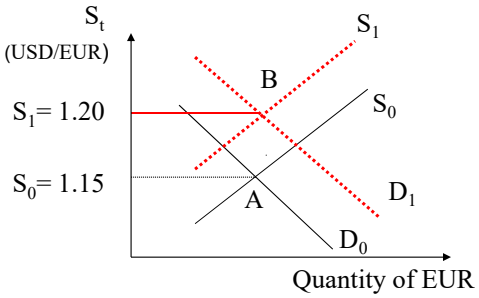
$\Rightarrow$ EUR becomes cheaper in terms of USD: $S_t\downarrow$. We say "the EUR *depreciates* against the USD" (or "the USD *appreciates*"). ¶

Intuition check: The U.S. Fed decreases interest rates ($i_{USD}\downarrow$)

$\Rightarrow$ ($i_{USD} - i_{EUR}$)$\downarrow$

– European residents buy less U.S. T-bills (S of EUR $\downarrow$)

– U.S. residents buy more European T-bills (D for EUR $\uparrow$)




- $S_t$ moves from A to B

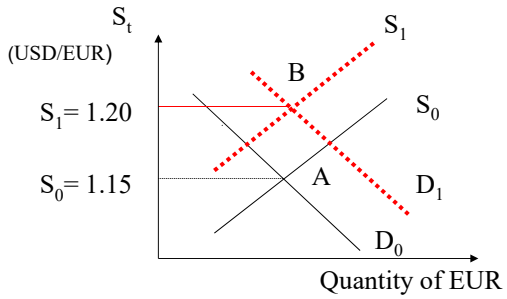
$\Rightarrow$ EUR becomes more expensive in terms of USD: $S_t\uparrow$. That is, the EUR *appreciates* against the USD. ¶

**Example: Changes in inflation rate differentials**

U.S. inflation increases ($I_{USD}$) ⇒ ($I_{USD} - I_{EUR}$)↑

Foreigners buy less U.S. goods (Supply ↓)

U.S. residents buy more European goods (Demand ↑)

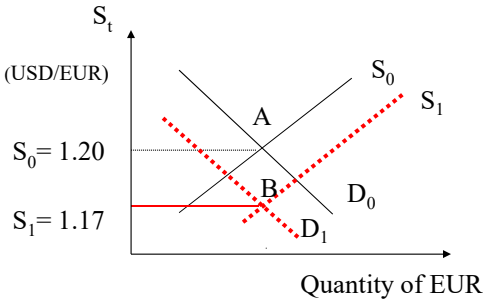



- $S_t$ moves from A to B

  ⇒ $S_t$ ↑. EUR *appreciates* against USD. ¶

Intuition check: U.S. inflation decreases relative to European inflation

($I_{USD} - I_{EUR}$) ↓ ⇒ $S_t$ ?




– European residents buy more U.S. goods (Supply of EUR ↑)

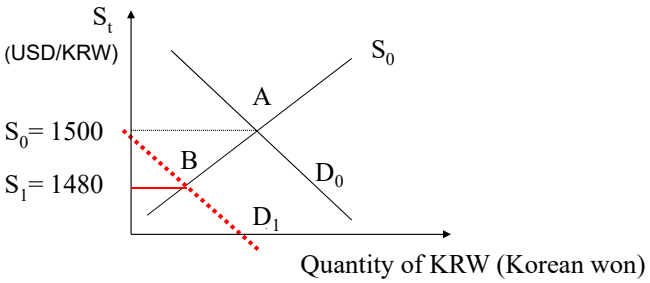
– U.S. residents buy less European goods (Demand for EUR ↓)

$S_t$ moves from A to B

⇒ $S_t$ ↓. EUR *depreciates* against USD.

**Example: Changes in other factors: Tariffs**

U.S. government imposes tariffs on Korean steel. Assume no trade wars.




– U.S. residents buy less Korean goods (Demand for KRW ↓)

– No movement on U.S. exports to Korea (Supply unchanged)

$S_t$ moves from A to B

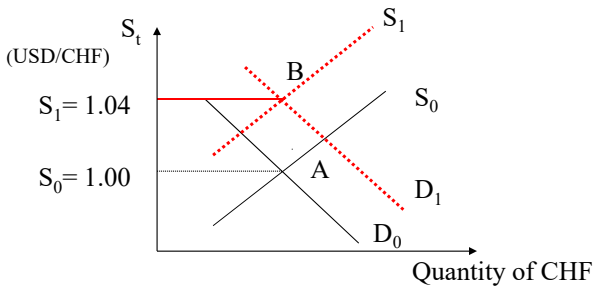
⇒ $S_t$ ↓. KRW *depreciates* against USD.

**Example: Change in other factors: Uncertainty**

Terrorism threats increase. Switzerland is considered a safe haven.

- Foreign residents bring less CHF to the U.S. (Supply of CHF ↓)

- U.S. residents buy more CHF (Demand for CHF ↑)




- $S_t$ moves from A to B

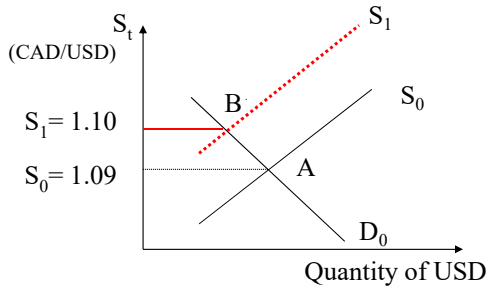
⇒ $S_t$ ↑. CHF *appreciates* against USD. ¶

**Example: Changes in Other Factors: Export Prices**

Price of oil decreases significantly (⇒ Negative wealth shock for Canada)

- Canadian oil exports are worth less USD. (Supply of USD ↓)

- There may be a secondary effect –Canadians may be able to buy less imports. (Demand for USD may go down.)




- $S_t$ moves from A to B

  ⇒ The USD *appreciates* against the CAD. ¶

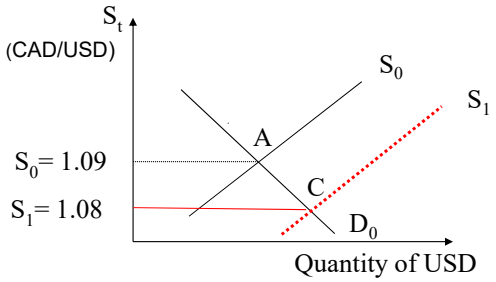
**Example: Changes in Other Factors: Export Prices**

Intuition check: Price of oil increases significantly (Positive wealth shock)

⇒ Canadian oil exports increase in USD value (Supply↑)

- $S_t$ moves from A to C

  ⇒ $S_t$ ↓. CAD *appreciates* against USD. ¶




- If wealth effect is big ($P_d$ ↑) & since Canada is a *small economy* ($P_f$ – $P_d$) ↓.

  ⇒ $\mathbf{R_t} = S_t P_f / P_d$ ↓.

- The drop in $\mathbf{R_t}$ can be big, causing a big CA deficit (*Dutch disease*). ¶

**Example: The Role of Expectations**

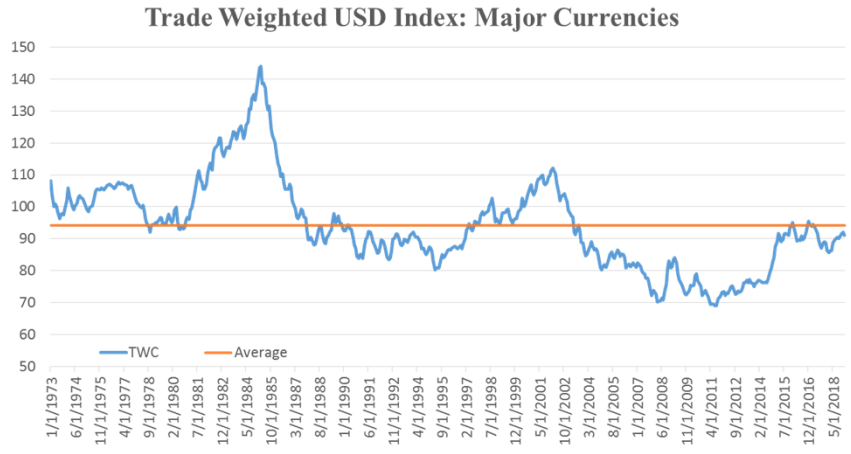
Story: Because of an expectation (say, based on a rumor) people expect the GBP to depreciate. Then, it may be optimal to sell GBP, regardless of the truth behind the rumor/expectation.

⇒ It is optimal to behave like the average.

The GBP can depreciate in a hurry (think of the Keynesian beauty contest). Expectations matter.


**• Exchange Rates Move a Lot**

The Federal Reserve constructs an index to reflect the value of the USD against a basket of currencies (TWC). The Fed changes the basket, accordingly to trade patterns. The old basket: the EUR (58%), the JPY (14%), the GBP (12%), the CAD (9%), the SEK (4%), and the CHF (4%). It *is quoted in TWC/USD terms.*



• **Exchange Rates Move a Lot**

The new basket, Nominal Broad USD Index, started in 2020, is retroactively calculated to 2006. It is quoted in TWC/USD terms.


# FX Markets: Organization

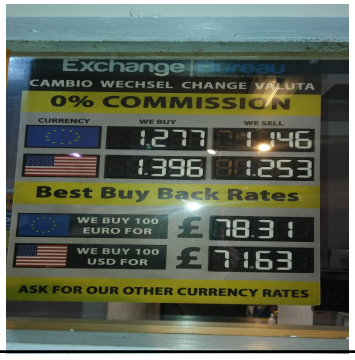
**Q: How is the FX market organized?**

A: Organized in two tiers:

i. *Retail tier*

ii. *Wholesale tier* (the "market")

Retail Tier: Where small agents buy and sell FX.

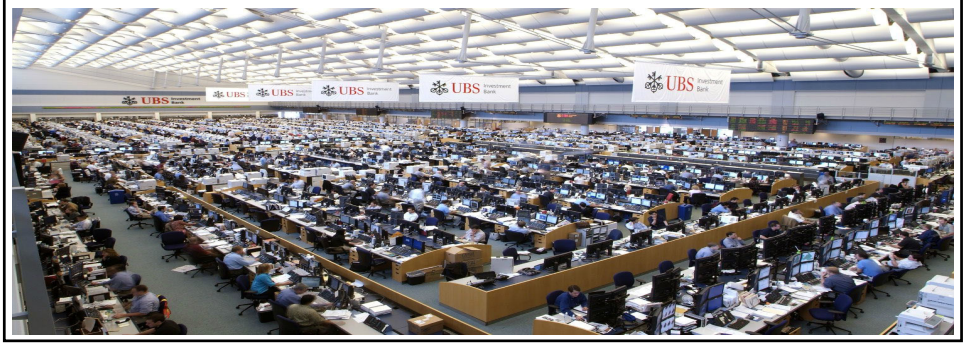



**Wholesale Tier**: Informal network of about **2,000 banks** and currency brokerage firms that deal with each other and with large corporations.

The wholesale tier is where FX rates are determined (**97% of volume**). These FX rates usually reported on financial websites and newspapers.

It is an Over-the-counter (**OTC**) market. There is no central exchange or clearinghouse.

Bloomberg FX Quotes




**Wholesale Tier:** Quotes from Bloomberg.

Before it's here, it's on the Bloomberg Terminal. Learn More

Overview Americas EMEA APAC

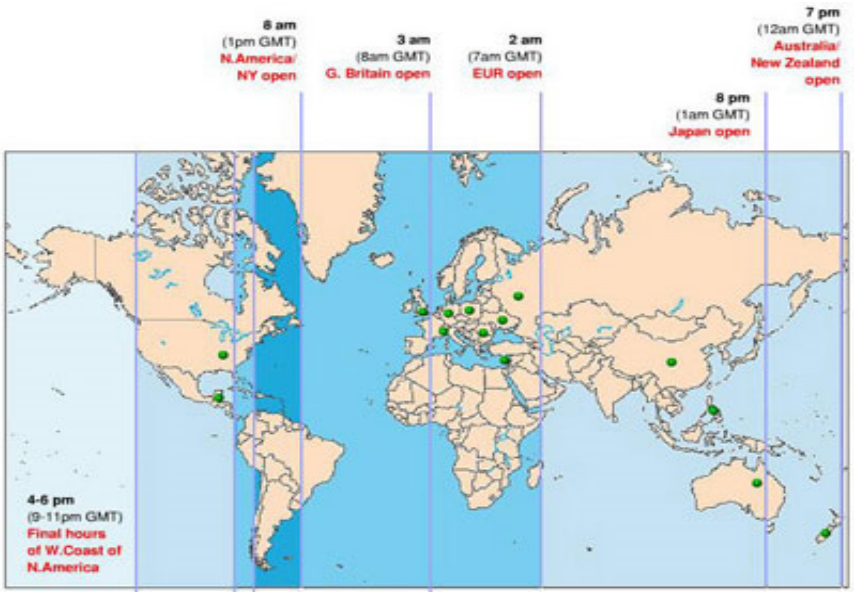
Currency data is 5 minutes delayed (times in ET) and based on the Bloomberg Generic Composite rate (BGN). See full details and disclaimer.

United States Dollar (USD) $ ↔ Euro (EUR) €

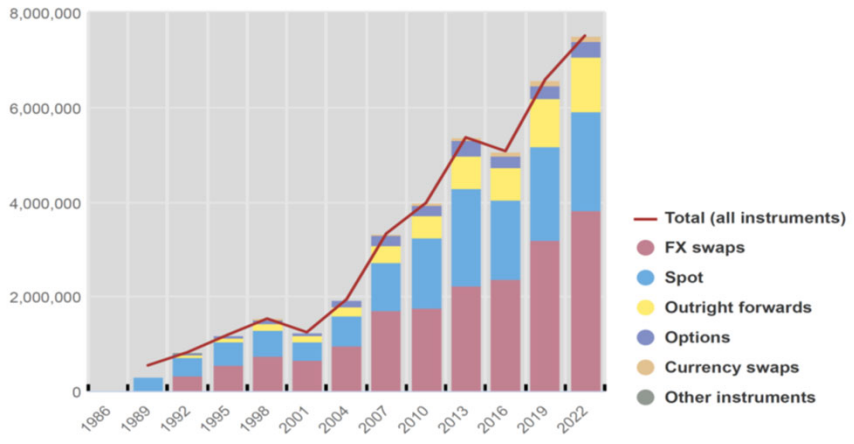
1 USD = 0.8182 EUR (2 day) 1 EUR = 1.2222 USD (2 day)

| CURRENCY | VALUE | CHANGE | NET CHANGE | TIME (EST) | 2 DAY |
|---|---|---|---|---|---|
| EUR-USD | 1.2222 | -0.0016 | -0.13% | 1/19/2018 | |
| USD-JPY | 110.7700 | -0.3400 | -0.31% | 1/19/2018 | |
| GBP-USD | 1.3858 | -0.0036 | -0.26% | 1/19/2018 | |
| AUD-USD | 0.7995 | -0.0006 | -0.07% | 1/19/2018 | |
| USD-CAD | 1.2493 | 0.0075 | +0.60% | 1/19/2018 | |
| USD-CHF | 0.9628 | 0.0039 | +0.41% | 1/19/2018 | |
| EUR-JPY | 135.4500 | -0.5300 | -0.39% | 1/19/2018 | |
| EUR-GBP | 0.8818 | 0.0010 | +0.12% | 1/19/2018 | |
| USD-HKD | 7.8171 | 0.0001 | +0.00% | 1/19/2018 | |
| EUR-CHF | 1.1777 | 0.0043 | +0.36% | 1/19/2018 | |
| USD-KRW | 1,065.9000 | -4.5600 | -0.43% | 1/19/2018 | |

• **FX Market**: Geographically Dispersed ⇒ Always Open




• **FX Market**: Huge daily turnover: **USD 7.5 T** ⇒ Largest Financial Mkt




**USD 7.5 trillion** = 40 times daily volume of international CA flows.
= 85 times the U.S. daily GDP.
= 40% of total official foreign exchange reserves.
= 50 times daily volume on NYSE.

• **Characteristics of the FX market** (continuation)

- Geographically dispersed, but volume concentrated in a few markets: Tokyo (4% of volume), HK (7%), Singapore (**9%**), Zurich (5%), **London** (largest market, **38%**), **NY** (**19%**).

- Open 24 hours a day, 365 days a year.

- Organization:
  - ◊ OTC market, where brokers and dealers negotiate directly.
  - ◊ Typical transaction in USD: About 1 million ("one dollar").
  - ◊ Typical minimum trading size is 100K units (a standard "lot").

- Currencies are noted by a three-letter code, the ISO 4217: USD, EUR, JPY, GBP, CHF, AUD, CAD, SEK, HKD, MXN.

- USD, EUR, and JPY are the major currencies.

- USD involved in **88%** of transactions (EUR **31%**, JPY **17%**).

- USD/EUR most traded currency pair (**23%** of turnover).

• **Characteristics of the FX market** (continuation)

- Emerging market currencies: **18%** of turnover (CNY, HKD, KRW).

- **78%** of emerging market currencies are traded against the USD (for the MXN **98%** of trades are against the USD).

- **62%** of transactions involve a cross-border counterpart.

- Counterparties: Reporting dealers (**46%**), other financial institutions (non-reporting banks, HF, Institutional investors, **48%**)

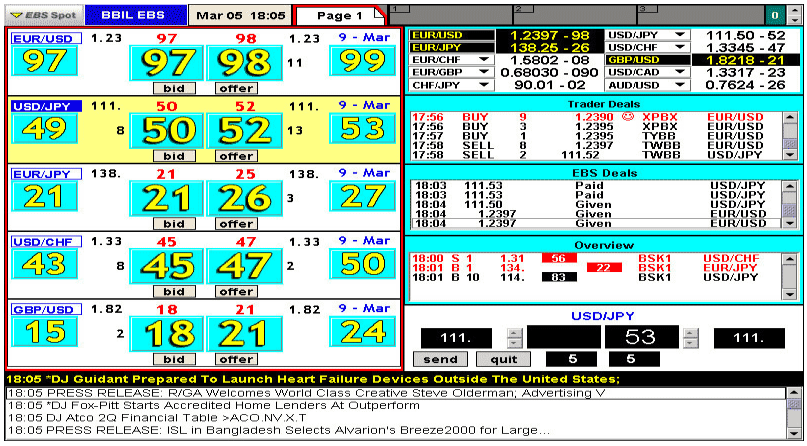
- Electronic trading (direct & indirect) dominates (**58%**). Voice direct still popular (**28%**).

- "Non market-facing" trading –i.e., deals with no contribution to price formation- amounted to **12%** of volume.

• Characteristics of the FX market (continuation)

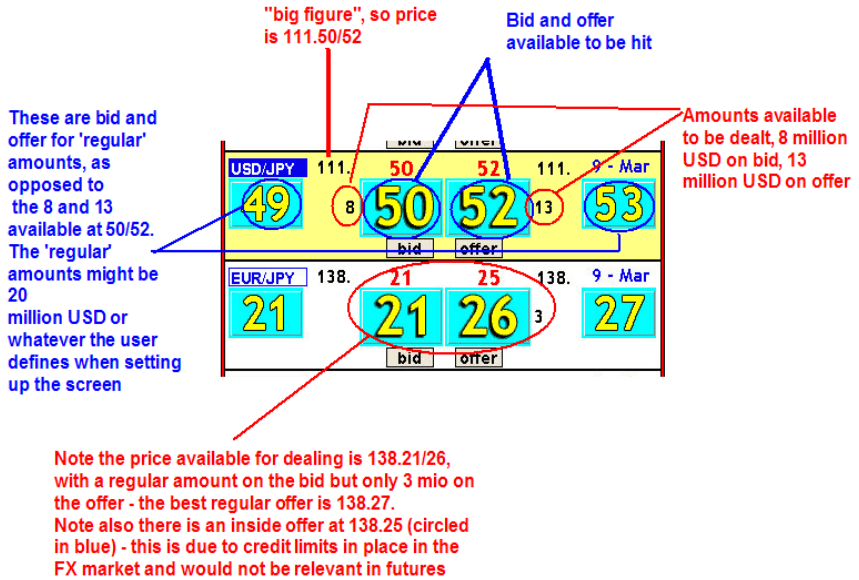
- Very small *bid-ask* spreads for actively traded pairs, usually no more than 3 *pips* –i.e., 0.0003.

**Example**: A bid/ask quote of USD/EUR: 1.2397/1.2398 (spread: one *pip* or 0.008%). See screenshot from electronic trading platform EBS below:




• **Characteristics of the FX market** (continuation)

**Example (continuation)**: Explanation of EBS screenshot.



• **Characteristics of the FX market** (continuation)

**Example**: A bid/ask quote of USD/GBP: 1.8218/1.8221 (spread: three *pips*). As a percentage (relative to the ask quote):

*bid-ask spread (%)* = .0003/1.8221 = **0.0165%**

Compare this spread to the retail one (see below, from Edinburg, U.K.):

*bid-ask spread (%)* = .143/1.396 = **10.24%**


• **Characteristics of FX Mkt: Direct & Indirect quotes with spreads**

i. ***indirect quote*** or "*European*" quote

S(*indirect*) = units of FC that one domestic unit will buy.

ii. ***direct quote*** or "*American*" quote.

S(*direct*) = units of DC that one foreign unit will buy.

**Remark**: indirect quotation = reciprocal of the direct quotation.

**Example**: A U.S. tourist wishes to buy JPY at LAX.

(A) Indirect quotation (JPY/USD).

A quote of JPY **108.04** – **113.90** means:

Dealer buys one USD for JPY **108.04** (*bid*)

sells one USD for JPY **113.90** (*ask*).

For each round-trip USD transaction, she makes a profit of JPY 5.86.

(B) Direct quotation (USD/JPY).

If the dealer at LAX uses direct quotations, the bid-ask quote will be 0.008780 – .009256 USD/JPY. ¶

Calculation: $S(direct)_{bid} = 1/S(indirect)_{ask} = 1/113.90 = 0.008780$ USD/JPY

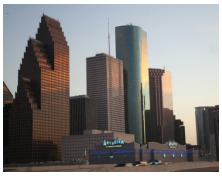
**Note:** $S(direct)_{bid} = 1/S(indirect)_{ask}$,
$S(direct)_{ask} = 1/S(indirect)_{bid}$.

Remark: In class, we will use ***direct*** quotations. Think of the currency in the denominator as the currency you buy, the FC.

**Example**: Quotes:

$S_t$ = 1.03 **CHF**/USD ⇒ You are in **Switzerland**

$S_t$ = 1.06 **USD**/EUR ⇒ You are in the **U.S.**



• **Characteristics of FX Mkt: Cross-quotes**

Most currencies are quotes against the USD. *Cross-rates* are rates calculated from USD quotations. (Think of liquidity!)

Rule for cross-rates with 3 currencies: X (CHF), Y (EUR), and Z (common currency, usually, **USD**):

$$\Rightarrow S_{X/Y,t} = \frac{S_{X/Z,t}}{S_{Y/Z,t}}$$ (common currency Z cancels out!)

**Example**: Calculate the CHF/EUR cross rate, based on the following quotes:
$S_t$ = 1.03 CHF/USD
$S_t$ = 1.06 EUR/USD

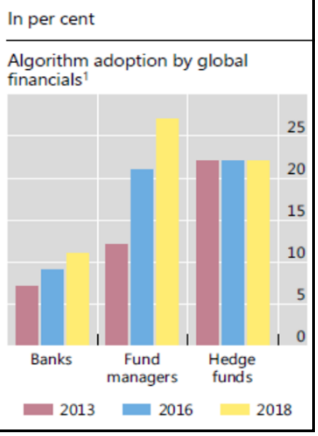
Common currency (Z) = **USD**

$$S_{CHF/EUR,t} = \frac{1.03\ CHF/USD}{1.06\ EUR/USD} = 0.9712 \text{ CHF/EUR.}$$ ¶

• **Players:** Big Corporations, Speculators, Banks, Central Banks
⇒ Financial institutions are involved in **93%** of transactions:
**42%** Reporting dealers ("interbank")
**51%** Other financial institutions (hedge funds 8%)

- A large bank trades billions of dollars daily. Largest dealer bank (2016): Citi (12.9%). The top 5 include JP Morgan (8.8%), Deutsche Bank (7.9%), UBS (8.8%), BOFA/ML (6.4%).

- The interbank market gets the majority of commercial turnover.
- Banks trade on behalf of customers and for themselves.
- HFT (high frequency trading) accounts for 35% of volume (and growing over time).




• **Dealers:**

— *Market-makers* (Hold inventories to provide liquidity. Give a two-way quote: *bid* and *ask*)

— *Traders* (Buy and sell on their own accounts)

— *Brokers* (Finds the best price for another player)

Until recently, FX brokers did large amounts of business for small fees.

• **Typical Trading Day (from the early 90s):**

For a DEM trader (DEM: German Mark):

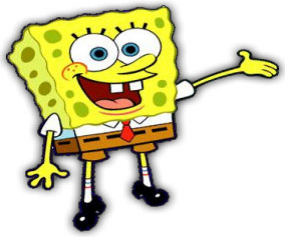
Executed about **270 transactions** a day (one every 67").
Average daily volume traded **USD 1.2 billion**.
For large transactions brokers were used.
Median spread: **DEM .0003** (.02% of the spot rate).


• **Speculation and Trading**

A market participant that holds an open FX position at the end of the day is classified as a *speculator*.

An FX trader will attempt to be *square* or *flat* by the end of the day. That is, with ***no*** open FX position or *exposure* (or risk) on the FX market.

*Terminology*: Squaring up/going flat is when you have an open position and you are going to close. A trader is:
– '*squaring up*' when buying a currency to close a position (the trader sold the currency before)
– '*going flat*' when selling a currency to close a position.



• **Segments of the FX Mkt**

**1. The Spot Market**

The spot market is the FX market for payment and delivery today. In practice, "today" means today only in the retailer tier. Usually, it means 2 business days.

The Spot Market represents **28%** of total daily turnover.

**Example**: Bank of America (BOFA) buys **GBP 1M** in the spot market at $S_t$ = 1.20 USD/GBP.

In 2 business days, BOFA will receive a GBP 1M deposit and will transfer to the counterparty a USD 1.2M deposit. ¶

• Settlement of FX transactions

At the wholesale tier, no real money changes hands:

⇒ Electronic transactions. Banks involved transfer bank deposits.

**Example**:

– Parties: Argentine Bank: Banco de Galicia (BG)
Malayan Bank: Malayan Banking Berhard (MBB)

– Transaction: BG sells BRL (Brazilian real) to MBB for JPY.

– Settlement: a transfer of two bank deposits:

(1) BG turns over to MBB a **BRL deposit** at a bank in Brazil,
(2) MBB turns over to BG a **JPY deposit** at a bank in Japan. ¶

## 2. The Forward Market

A forward transaction is generally the same as a spot transaction:

⇒ but settlement is *deferred* much further into the future.

"Further into the future" = Maturity = T: 7-day, 15-day, 1-, 2-, 3- and 12-month settlements (& up to 10 years).

Notation:

$F_{t,T}$: Today's (time t) forward price of a forward contract with maturity T.

Characteristics:

- Transactions are tailor-made.
- Contracts allow firms and investors to transfer risk.
- Forward transactions are classified into two classes:
  - *Outright*
  - *FX swap*

*Outright* & *FX swap*

◊ The (outright) Forward Market represents **15%** of total daily turnover.

⇒ Outright forward transaction: *Uncovered* speculative position in a currency.

- **40%** of outright forwards have duration of **less than 7 days**.

◊ The FX Swap combines a forward transaction with a spot transaction.

**Example**: Outright forward.

BOFA ***sells*** **GBP 1M forward** using a 7-day GBP forward contract at $\mathbf{F_{t,7\text{-}day}}$**= 1.205 USD/GBP**.

In 7 days, BOFA will receive a **USD 1,205,000** deposit and will transfer to the counterparty a **GBP 1M** deposit. ¶

Terminology: FX premium

• A FC is a *premium* (*discount*) currency if its forward rate is higher (lower) than the spot rate.

$F_{t,T} > S_t$ for a premium currency.
$F_{t,T} < S_t$ for a discount currency.

**Example**: From previous examples
$S_t$ = **1.20 USD/GBP**
$F_{t,7\text{-day}}$ = **1.205 USD/GBP**
$F_{t,7\text{-day}} > S_t$ ⇒ "*GBP trades at a premium in the forward market.*" ¶

Premium & discount are expressed as an annualized percentage deviation from $S_t$.

The forward premium, $p$, is calculated as follows:

$$p = \frac{F_{t,T} - S_t}{S_t} * \frac{360}{T}$$

Note: $p$ could be a premium (if $p > 0$), or a discount (if $p < 0$).

The forward premium, $p$, is calculated as follows:

$$p = \frac{F_{t,T} - S_t}{S_t} * \frac{360}{T}$$

**Example**: The 7-day USD/GBP forward premium is:

$$p = \frac{1.205 - 1.20}{1.20} * \frac{360}{7} = .2143$$ (or **21.43%**.)

The GBP is trading at an annualized **21.43%** premium for delivery in 7 days. ¶

Remark: Think of $p$ as the annualized return of:
- Selling forward the FC for T days
- Buying the FC spot today.

**3. The FX Swap**

FX swap involves 2 transactions:

- A spot & a forward with opposite signs (a sale & a purchase).
- With approximately an equal amount of FC.
- Executed together (*simultaneous*).

FX swap: Simultaneous sale (or purchase) of spot foreign exchange against a forward purchase (or sale) of approximately an equal amount of the foreign currency.

Rationale of an FX Swap: A position taken to reduce the exposure in a forward trade.

— The FX Swap Market represents **51%** of total daily turnover.

— The majority of FX Swaps (≈70%) are **short-term** (**≥ 7 days**).

**Example**: A U.S. trader wants to invest in a **GBP 1M** bond position for a 7-day period.

Simultaneously, the U.S. trader

(1) Buys **GBP 1M** spot at $S_t$ = **1.20 USD/GBP**
(2) *Buys* the short-term **GBP 1M** bond position, and
(3) *Sells* **GBP 1M** forward at $F_{t,7\text{-day}}$= **1.205 USD/GBP**.

Selling **GBP 1M** forward protects ("covers") against an appreciation of the USD.

Return of FX Swap = (**1.205** – 1.20)/1.20 = **0.004167** (≈ **0.42%** in 7 days)
⇒ Annualized ≈ **0.004167** * 360/7 = **0.2143** (= *p*). ¶

The FX swap market is the segment of the FX market with the highest daily volume.

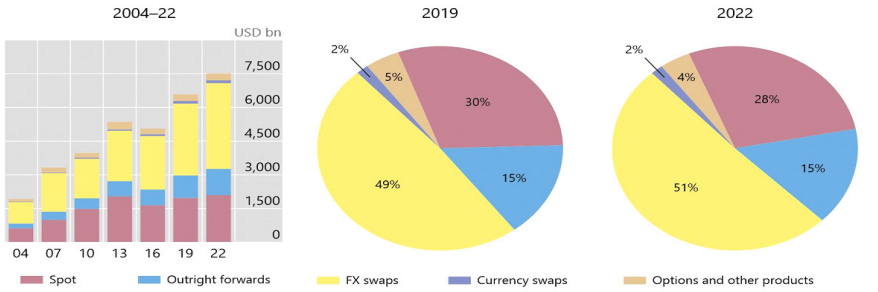
Q: How is the daily volume distributed among the segments?

This USD 7.5 trillion in global FX market turnover is broken down as:

- USD 2.10 trillion in spot transactions (**28%**)
- USD 1.16 trillion in outright forwards (**15%**)
- USD 3.81 trillion in FX swaps (**51%**)
- USD 428 billion estimated gaps in options, currency swaps, etc

Foreign exchange market turnover by instrument[1]

Net-net basis, daily averages in April — Graph 1




[1] Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis.

Source: BIS Triennial Central Bank Survey. For additional data by instrument, see Table 1.



# Exchange Rate Systems

**• Pure FX Rate Systems**

Defined by the role of the Central Bank (CB):

– Free Float or Flexible

– Fixed

**• CB: Brief Review**

A CB is a "bank." It holds:

◊ Assets: Foreign (FC Reserves, FC bonds)) + Gold + Domestic (**U.S. Treasuries**, **Mortgage Back Securities** )

◊ Liabilities: **DC outstanding** + **Deposits of banks**.

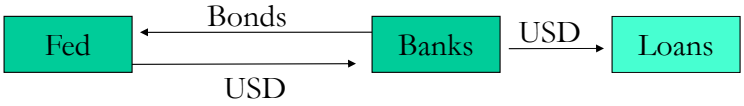
Remark: Change in assets = Change in liabilities

⇒ A purchase of an asset or FC results in an increase in the liabilities, usually through an increase in the MS.

**• CB: Brief Review – Asset Purchases = Change in Liabilities**

**Example:** During the 2008-09 Financial Crisis, the U.S. Fed launched the Quantitative Monetary Easing (QE) program.

Under QE, Fed buys bonds (assets ↑) & pays with USD (Money Supply ↑):



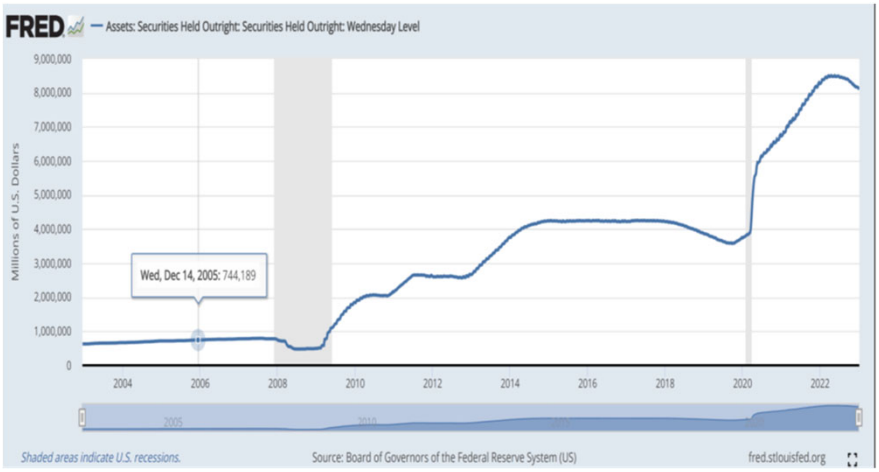

When QE finished, in Oct 2014, the Fed had bought USD 4.5 trillion worth of Treasuries, Mortgage-back securities, and Bank debt.

As a result, the Fed kept $i_{US} \approx 0$ (record low levels) for 6+ years.

Same QE program used for Covid crisis.

**• CB: Brief Review – Asset Purchases = Change in Liabilities**

**Example:** U.S. Fed QE program: QE1 (09-10), QE2 (11), QE3 (12-13), & QE-Covid (20-22)




**Note:** Japan has been on a QE situation since 2001! Bank of England, Swiss National Bank and ECB also had their QE programs.

## • CB: Brief Review – Balance Sheet

**Table II.1**
**U.S. Federal Reserve Balance Sheet (December 2017)**

| Consolidated U.S. Fed Balance Sheet (in USD billions) | | | |
|---|---|---|---|
| ***Liabilities*** | | ***Assets*** | |
| Federal Reserve Notes | 1,569.1 | U.S. Treasuries | 2,454.2 |
| Reverse Repurchase Agreements | 386.8 | Mortgage Backed Securities | 1,764.9 |
| Deposits | 2,445.1 | Gold | 11.0 |
| Other liabilities | 6.3 | SDR | 5.2 |
| ***Total*** | ***4,407.3*** | FC Denominated Assets | 21.2 |
| | | Central Bank Liquidity Swaps | 12.0 |
| ***Capital Account*** | ***41.4*** | Other assets | 180.2 |
| Capital paid in | 31.4 | ***Total*** | ***4,448.7*** |
| Surplus | 10.0 | | |

## • Capital Account

Capital Account = Total Assets – Total Liabilities = **USD 41.4 B**

Surplus: Retained earnings not paid to the US Treasury (USD 10 B).

## • CB: Brief Review – Roles

• Historical roles of a CB:
  – Lender of last resort ("*Bank of banks*")
  – Supervisor of financial institutions.

This is the banking side of a CB.

• But, a CB is also the Monetary Authority: It controls domestic money supply (MS), with responsibility over
  – **Inflation** ($I_d$ low)
  – **Economic GDP** ($Y_d$ close to full employment).

This is the economic policy side of a modern CB (today, the main role).

• Targets are conflicting: $i_d\uparrow \Rightarrow I_d\downarrow$, but $Y_d\downarrow$.
$i_d\downarrow \Rightarrow I_d\uparrow$, but $Y_d\uparrow$.

$\Rightarrow$ CBs set $i_d$, balancing $I_d$ and $Y_d$.

**• CB: Brief Review – Monetary Policy**

• Textbook (Monetary Economics) example:

Fed lowers the Fed rate ⇒ other interest rates in the economy fall ($i_d$ ↓)

⇒ Lower $i_d$ stimulate spending (aggregate demand, AG, ↑).

⇒ Businesses respond, increasing production (AS ↑)

⇒ Economic growth up (Y ↑)

Now, if the increase in AG is big enough $P_d$ ↑ (& $I_d$↑).

• All the above effects take time: 1-3 years.

Some estimates point that a **1% decrease** in a CB rate, increases:

- $Y_d$ by **0.50% - 0.75%** over 2 years.
- $I_d$ by **0.25%** over 2-3 years.

Aside Note: What is the effect on $S_t$? On average, a **1% surprise increase** in $i_d$, increases $S_t$ by **1.5%** almost *immediately*.

**• CB: Brief Review – Policy Rules**

• CBs balance $I_d$ & $Y_d$ following a *policy rule*:

$$i_d = f(I_d, Y\_gap = \text{Real GDP}_d / \text{Real GDP}_{\text{Full Employment}} - 1)$$

In practice, CBs tend to follow a *Taylor rule*:

$$i_d = \omega + \lambda I_d + \theta\, Y\_gap$$

Usually, we set

$\omega = r^* + \gamma\,(-I_d^*)$

$r^*$ = real interest rate = 2%

$I_d^*$ = CB's target $I_d$ = 2%

$\gamma = 0.5$

⇒ $\omega$ = 2% + 0.5 * (-2%) = **1%**

$\lambda = 1 + \gamma = 1.5$

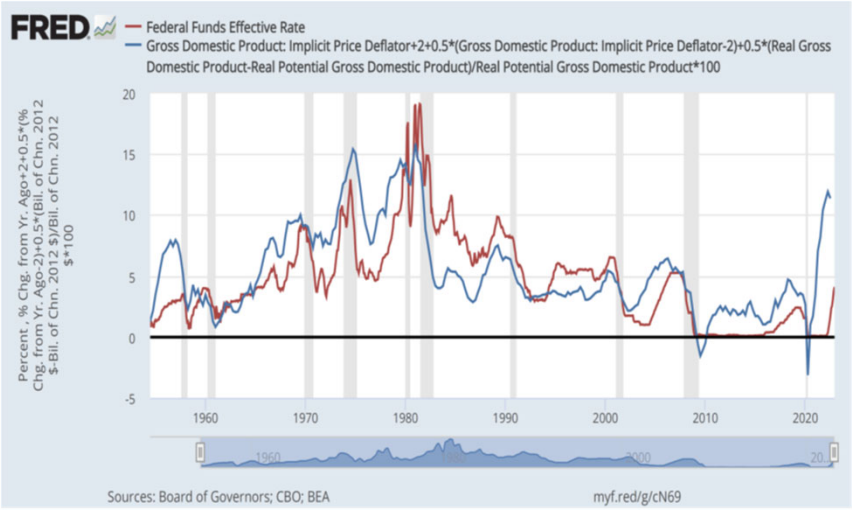
$\theta = 0.5$

**Note:** According to the Taylor rule, $i_d$ is very low now (2021 Q3): It should be **6.21%**, but it is 0.08%.

$$i_d = .01 + 1.5 * (.04) + 0.5 * (-.016) = .062$$

**• CB: Brief Review – Policy Rules**

Below, we show the prescribed by the Taylor rule and the actual Fed rates. According to the Taylor rule, $i_d$ is very low now (2022 Q4): It should be -**11.92%**, but it is 4.10%.

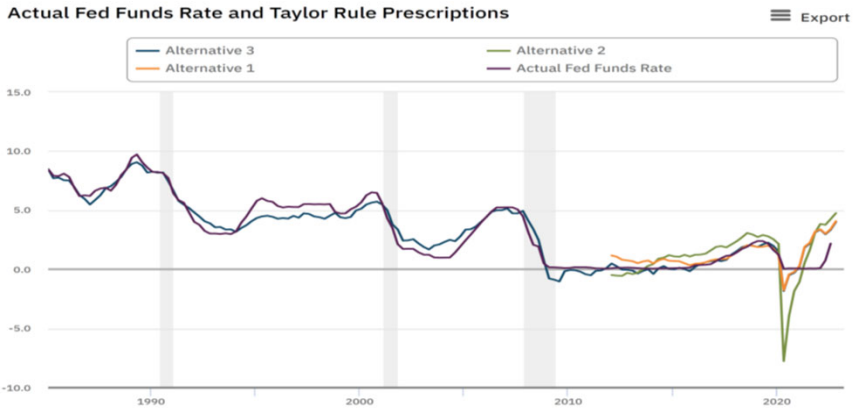



**• CB: Brief Review – Policy Rules**

• Taylor rule variations: Gradual adjustments, reflecting the practice of gradual, small adjustments in interest rates. This *modified Taylor rule* is:

$$i_{d,t} = \rho\, i_{d,t-1} + (1 - \rho)\,[r_t^* + I_{d,t} + \gamma\,(I_{d,t} - I_{d,t}^*) + \theta\, Y\_gap_t]$$

where $\rho$ is the smoothing parameter ($\rho = 0$, original Taylor rule).




• *Modified Taylor rule* ($\rho = 0.5$) has a better fit. Prescribed rate ≈ **4.09%**.

**• CB: Brief Review - Names**

Around the world, CBs have different names: U.S. Federal Reserve System ("The Fed"), European Central Bank (ECB), Bank of Mexico ("Banxico"), Central Bank of UAE, Central Reserve Bank of Peru, Swiss National Bank, Monetary Authority of Singapore, etc.

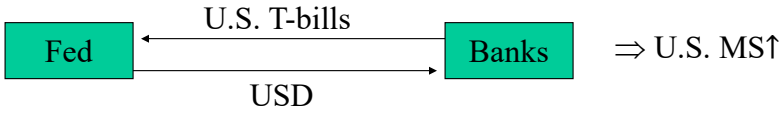
**• CB: Brief Review - Open Market Operations**

CBs have several monetary policy instruments. The most important:

- ◊ Open market operation (OMO)
- ◊ Bank reserve requirement
- ◊ Interest rate policy

**OMO**: Main policy tool. CB tool to put money in and take money out of banking system, by buying/selling government securities (U.S. Treasury bills):

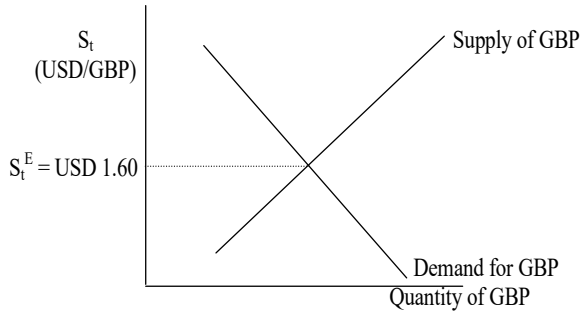
– MS Increase: CB buys securities from banks, paying with DC.




– MS Decrease: CB sells securities to banks, receiving DC.

**1. Flexible Exchange Rate System (Free Float)**

In a *flexible exchange rate system* the CB allows S & D to freely set $S_t$.




All the variables mentioned before ($i_d - i_f$ ; $I_d - I_f$ , etc.) will affect $S_t$. In particular, international capital flows will change $S_t$.

Whatever $S_t$ is, the CB is fine with it.

**Features of a Free Float**

- $S_t$ reflects economic activity, through S & D.
- $S_t$ is subject to volatility (FX risk!).
- Money supply is exogenous, independent of FX Market. Thus, the CB has an independent monetary policy.
- Under certain assumptions (IS-LM model, perfect capital mobility), fiscal policy does not work. But, monetary policy works.
- External shocks (say, oil shocks) can be quickly absorbed by changes in $S_t^E$.

Milton Friedman, Nobel Prize Winner, (1953) argued that under a free float *"changes in $S_t$ occur rapidly, automatically, and continuously and so tend to produce corrective movements before tensions can accumulate and a crisis develop."*

**Terminology**

A currency *depreciates* (*appreciates*) when, under a free float, it becomes less (more) expensive in terms of foreign currency.

**Aside: Mundell-Fleming Model = IS-LM + Perfect Capital Mobility**

Open macroeconomic model combining:

(1) Aggregate demand (IS and LM curves, representing equilibrium in goods and money markets)

(2) Aggregate supply (production function and labor market)

(3) BOP (= CA + KA)

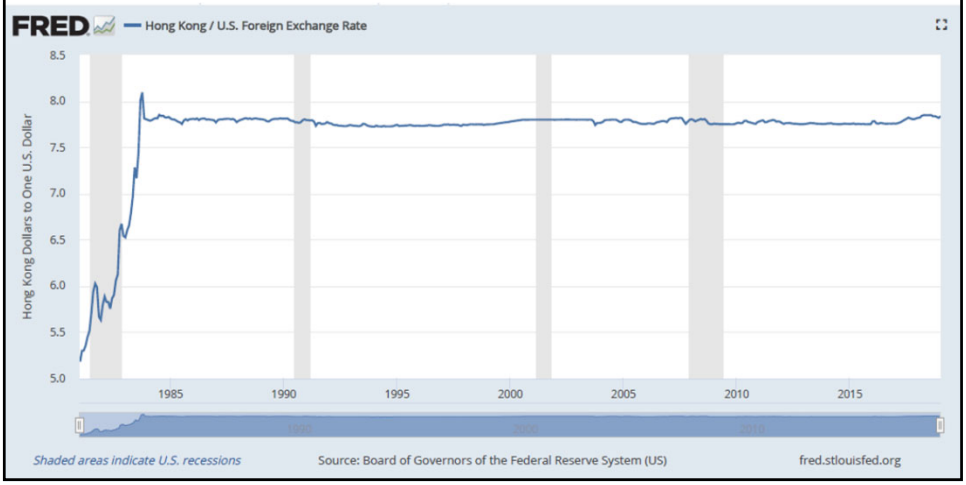
**Mundell-Fleming Model - Assumptions**

- Exchange rate regime: Flexible (Fixed, in the next section)
- Perfect capital mobility.
- Under utilized resources & no supply constraints –i.e., Keynesian world
- The Marshall-Lerner condition is satisfied –i.e., $S_t \uparrow (\downarrow) \Rightarrow CA \uparrow (\downarrow)$
- The price level, $P_d$, is fixed (in particular, no FX rate pass-through)
- No currency substitution (say, dollarization).
- Exchange rate expectations are static and/or there is no risk premium.
- $P_f$, $Y_f$, & $i_f$ are given –i.e., not influenced at all by domestic changes.

**2. Fixed Exchange Rate System**

In a *fixed exchange rate system* the Central Bank is ready to buy and sell *unlimited* amounts of domestic currency at set (*fixed*) price, say **S***.

**Example**: Hong Kong has a fixed exchange rate (a *peg*) system since October 17, 1983. The exchange rate is **S*** = **7.8052 HKD/USD**.



**Example (continuation)**:

Remark: The HKD is not fixed against all FCs, only against the USD:

USD moves against EUR ⇒ HKD moves against EUR.

From 2010 to 2015, USD moved widely against the EUR, HKD also moved: From 11.50 HKD/EUR (Apr 24, 2011) to 9.15 HKD/EUR (Jan 8, 2015). ¶

• Close to 50 countries follow a conventional fixed system. Africa has most of them: 19 countries -14 use the CFA franc, pegged to EUR, & 3 use the South African Rand (ZAR).

• In order to support the fixed parity **S***, a CB needs:

(a) Enough DC to buy "unlimited" amounts of FC.

(b) Enough reserves (FC) to buy "unlimited" amounts of DC.

Two observations:

**(1)** Element (a) is not a problem. CBs own the machines that print DC. Element (b) is the one that causes problems to CBs.

A CB may not have enough FC to buy all the DC in circulation. If there is not enough FC reserves and the demand for FC cannot be met, the CB has a problem: *A currency crisis*.

CB *credibility* plays a big role in currency crisis. A government may reach and use the CB reserves for other purposes, besides supporting the fixed parity.

**Note:** Element (b) can be addressed by placing enough FC reserves to buy the DC MS (keep 100% reserves) outside the reach of a CB/government. This arrangement is called *Currency Board*.

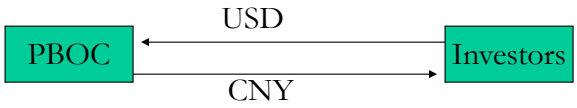
Small Caribbean countries (Grenada, Saint Lucia, Dominica, etc.) have a fixed exchange rate system (pegged to the USD) with a currency board.

**(2)** Every time somebody buys (sells) FC from (to) the CB, the domestic MS decreases (increases) $\Rightarrow$ A CB does not control the MS.

Thus, MS is *endogenous* to the FC demand/supply. Thus, international capital flows affect the domestic MS. Difficult to do monetary policy!

• MS is *endogenous* to the FC demand/supply. Thus, international capital flows affect the domestic MS. Difficult to do monetary policy!

**Example**: International capital inflows to China:




$\Rightarrow$ China's MS↑

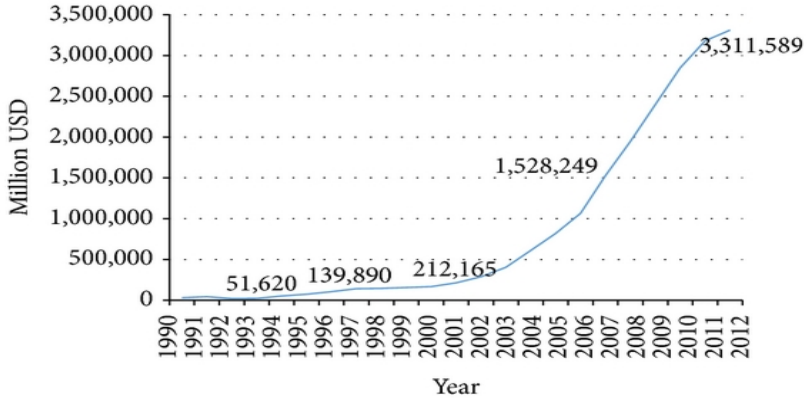
**Note:** The People's Bank of China (PBOC, China's CB) may not like an increase in the MS (along with lower $i_{CNY}$ & inflationary pressures) and take some counteraction to mitigate the increase in MS. ¶

• A CB gives up the control of MS. Only hope for independent monetary policy is to use indirect tools –usually, capital controls and/or change banking required reserve ratios (RRR).

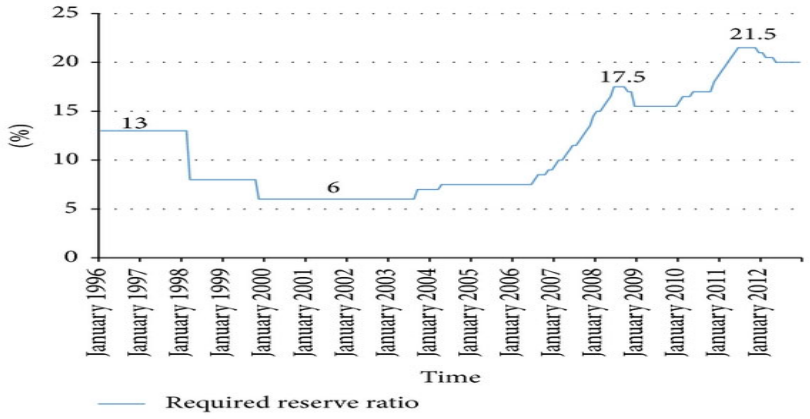
A CB counteraction taken to mitigate the effect of some variable (say, capital inflows) on the domestic MS is called *sterilization*.

**Example**: For most of the past 30 years, China has maintained a fixed FX system & received huge capital inflows. To sterilize the PBOC has changed RRR 42 times, currently stands at 20% (twice as in U.S.).

**Accumulation of foreign exchange reserve in China – 2000 to 2012** (taken from Chung, Hwang, & Wang, 2014):




**Change of required reserve ratio in China** (taken from Chung, Hwang, & Wang, 2014):




**Note:** The PBOC is *sterilizing* international capital inflows with changes in RRR. ¶

Another solution to control MS: capital controls.

**Fixed FX System: Variations**

Some CBs have a fixed exchange rate system, but $S_t$ is not really fixed:

- "*Target zone system.*" $S_t$ is kept within a band ("target zone").
- "*Crawling peg system.*" $S_t$ is regularly adjusted.

**Example**:

"*Target zone system.*"

On July 21, 2005, the People's Bank of China (China's CB) announced that the CNY would trade within a narrow 0.3% band against the basket of currencies. The basket is dominated by the USD, EUR, JPY and KOW.

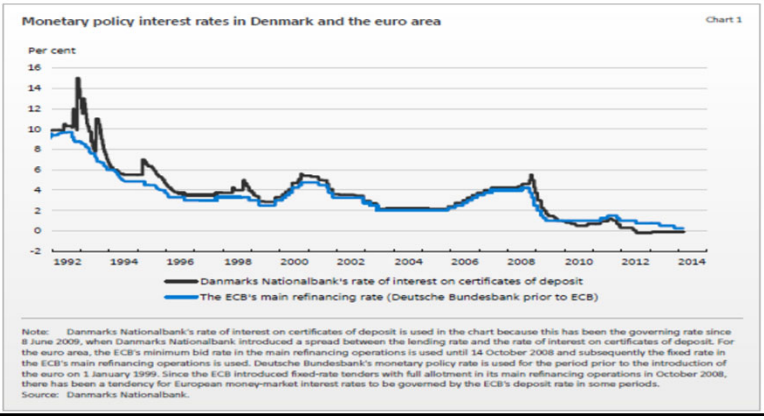
"*Crawling peg system.*"

The Central Bank of Chile, in 1983, adopted a crawling peg with a fluctuation band of ± 0.5%. The CLP/USD is adjusted according to the previous month's inflation minus an estimate of U.S. inflation (around 2% annually). ¶

**Example**: Giving up Monetary Policy

Since 1982, Denmark adopted a target zone system, pegging against the DEM and, in 1999, to the EUR. Following the ERM II, $S_t$ is fixed at **S***= **7.46038 DEK/EUR**, but it may fluctuate by ± 2.25%.

When the ECB changes its interest rates, Danmarks Nationalbank responds by making similar changes.

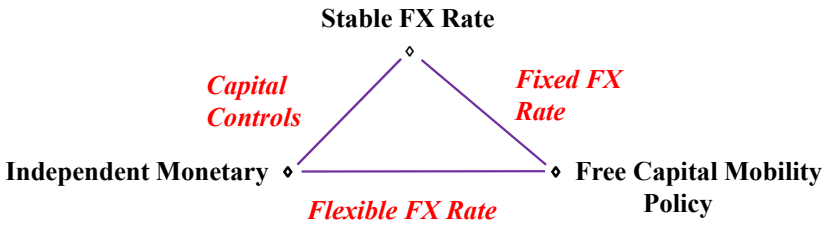


**Trilemma** –due to Robert Mundell (1962), Nobel Prize Winner.

It is impossible for a country to have at the same time:

- ◊ A fixed (stable) FX regime.
- ◊ Free international capital mobility –i.e., no capital controls.
- ◊ An autonomous (independent) monetary policy.

A country can have two, but not the three:




⇒ *Inconsistent* monetary policy = Attempt to have the three things.

Inconsistent monetary policy is the main cause of currency crisis.

**Inconsistent Monetary Policy Problem: Example 1**

• Under a fixed system, $MS_d \uparrow$ to finance deficit spending or to mitigate an external shock:

$MS_d \uparrow \Rightarrow i_d \downarrow \Rightarrow (i_d - i_f) \downarrow$ ⇒ International capital outflows

⇒ CB's FC reserves ↓.

• Notice that under a free float,

$MS_d \uparrow \Rightarrow i_d \downarrow \Rightarrow (i_d - i_f) \downarrow$ ⇒ International capital outflows

$\Rightarrow S_t \uparrow$ (> **S***). That's the adjustment.

• But, under a fixed system, **S*** does not change. This is a problem!

**Inconsistent Monetary Policy Problem: Example 2**

• Under a fixed system, $i_{USD} \uparrow$ but, the CB, to avoid its negative effect on GDP, does not match this increase (& attempts to do monetary policy!).

$i_f \uparrow \Rightarrow (i_d - i_f) \downarrow$ $\Rightarrow$ International capital outflows

$\Rightarrow$ CB's FC reserves $\downarrow$.

• Again, under a free float:

$i_f \uparrow \Rightarrow (i_d - i_f) \downarrow$ $\Rightarrow$ International capital outflows

$\Rightarrow S_t \uparrow (> \mathbf{S^*})$.

Remark from Examples:

Under a free float, $S_t \uparrow (> \mathbf{S^*})$.

Under a fixed regime, $S_t = \mathbf{S^*}$. In DC terms, things are undervalued relative to rest of the world. Domestic Prices, relative to Foreign Prices, increase:

$\Rightarrow \mathbf{R_t} = \mathbf{S^*}\ P_f / P_d \downarrow$.

**Inconsistent Monetary Policy Problems**

• In both situations, under a free float, $S_t \uparrow (> \mathbf{S^*})$.

**Notes:**

- We think of free float $S_t$ as the "*true equilibrium*" (or "*shadow*") rate.
- The size of $(S_t - \mathbf{S^*})$ signals the magnitude of the inconsistency. It is also the size of the potential profit for speculators if CB abandons fixed parity.

Eventually, as inconsistency grows, a *speculative attack* on FC reserves occurs.

Speculators will attack the CB reserves when they have doubts that the CB will defend the parity. In these situations, we usually say a CB (or a country) faces a *currency crisis*.

• CB Dilemma: To Defend or Not To Defend parity?
A CB considers costs & benefits of defending fixed parity, $\mathbf{S^*}$.

Usually, CBs defend $\mathbf{S^*}$.

**• Currency crisis**

Usually, CBs defend **S***. Tools:

- Sell FC reserves
- Borrow FC
- Substantially raise $i_d$
- Impose capital controls.

These actions may be costly & cause (or make worse) a recession.

• Definite solution to a speculative attack: Float the currency (abandon **S***).

• When a CB abandons **S*** because it is running out of FC reserves, a devaluation/depreciation occurs. Speculators gain!

• Speculators questions: Will the CB be able to defend the parity **S***? Will the government bear the costs of defending it?

• *Currency Run*: Domestic residents *run* to banks to exchange DC for FC, before the devaluation occurs (or banks run out of FC!).

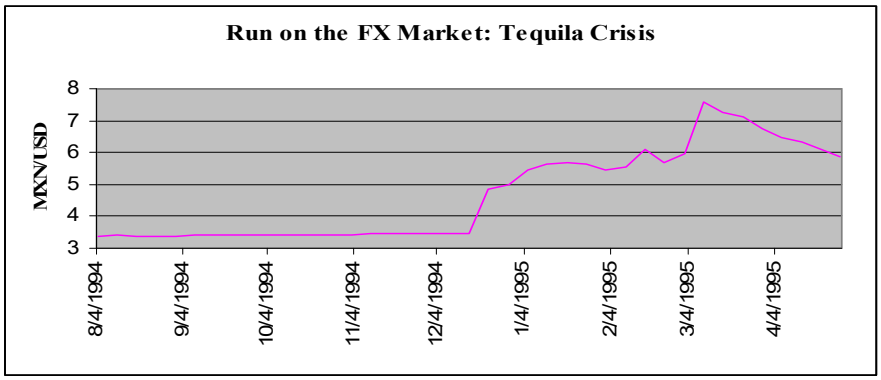
**Currency Crisis**

• Terminology

A *devaluation* (*revaluation*) occurs when the price of FC under a fixed exchange rate regime is increased (decreased) by the CB.

**Note:** The possibility of a currency crisis creates a risk: *devaluation risk*. The magnitude of this risk depends on the CB credibility –i.e., very credible CB, devaluation risk near zero.

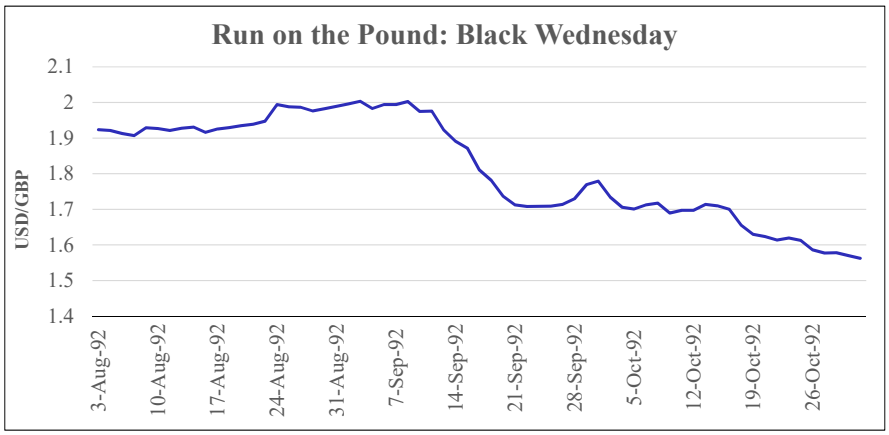
## Currency Crisis: The "Tequila crisis" – Mexico Dec '94




Mexico had a crawling peg to the USD, but due to presidential elections, $MS_d \uparrow$. FC reserves went from **USD 18B** in October 1994 to **USD 5B** in December 1994, when CB abandoned the fixed system.

Overall, Mexico spent **USD 25B** in FC reserves to defend the peso & also borrowed **USD 25B** (bailout funds from the U.S. Fed).

## Currency Crisis: "Black Wednesday" – U.K. Sep 16 '92




U.K. was part of the ERM, with the GBP tied, implicitly, to the DEM at $S_t$=2.95 DEM/GBP, with $\pm$6% band. But, when $i_{DEM} \uparrow$ to contain the spending due to German reunification, the BOE did not follow.

Overall, UK spent **GBP 30B** in FC reserves (and lost **GBP 3.3B**).

## Currency Crisis: Devaluations

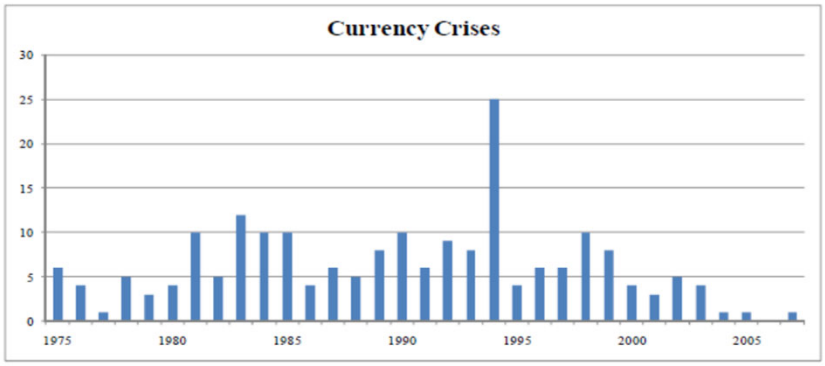
• On average, a currency crisis is followed by a **30%** devaluation of the DC. In many cases, there is a temporary higher drop (say, **50%**).

A very serious crisis: **75%+** (Indonesia '97, Argentina '01).

**Examples**: India '91, UK '92 (Black Wednesday), Mexico '94 (Tequila), Thailand '97 (Rice), Russia '98 (Vodka), Brazil '99 (Caipirinha), Argentina '01 (Tango), Uruguay '03, Iceland '08, Nigeria '16, Turkey '18, Lebanon '20 (ongoing).

## Currency Crisis: Not Rare

Currency crisis are not rare. Figure below shows 208 *successful* currency crises –defined as a **30% depreciation of DC** that is also, at least, a 10% increase from previous year. (Period: 1975 – 2008.)




Note: Currency crisis is defined as a nominal depreciation of the currency of at least 30 percent that is also at least a 10 percent increase in the rate of depreciation compared to the year before. Five-year exclusion windows employed. The figure for 1994 is inflated by the devaluation of the 14 African members of the CFA zone against the French franc and the dollar.
Source: Laeven and Valencia (2008).

**Currency Crisis: Devaluations are not a new phenomenon.**
The first well-documented devaluation is *The Kipper und Wipperzeit* (1619 – 1623), when the Holy Roman Empire states in their efforts to finance the Thirty Years' War (1618 – 48) *debased* its coins.
– *Kipper*: Coin clipping
– *Wipperzeit*: See-saw (an allusion to the counterbalance scales used to weigh species coin).

Two forms of debasement actually fueled the crisis:
(1) Reduce the value of silver coins by clipping shavings from them;
(2) Re-mint coins by melting the old coins and mixing them with inferior metals.

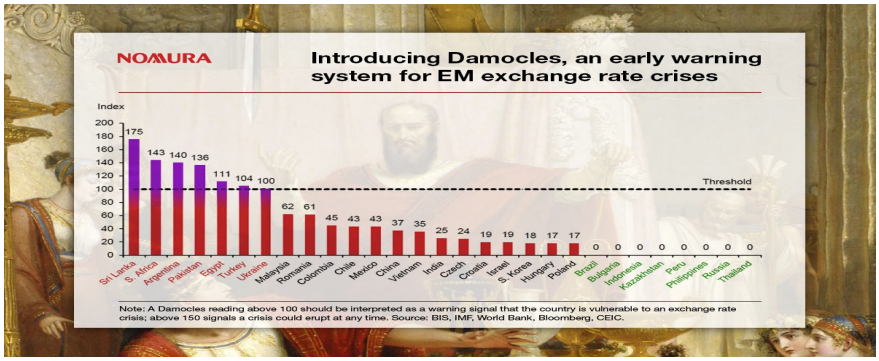
Photograph of a noticeably clipped (shaved) 1622 thaler minted in Prague

Reproduced courtesy of Archives, American Numismatic Society.

**Currency Crisis: Predictors** ("***Early warning signals***")

Predictors of a currency crisis: Low FX reserves, high government deficits, low real exchange rate (DC overvalued, often due to high domestic inflation), weak financial system, high short-term debt, etc.

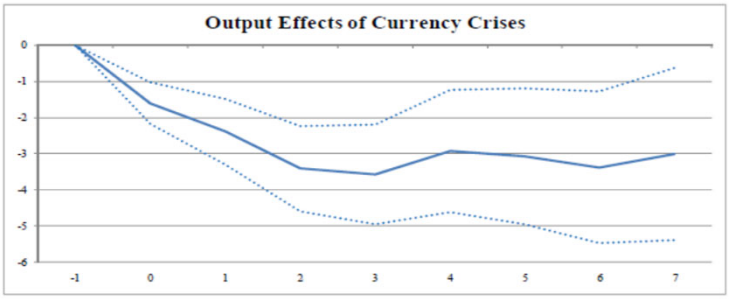
Many traders use an index to predict a currency crisis. A new one is the "*Damocles Index*," used by *Nomura*. (Nomura claims 67% of past 54 EM currency crisis were predicted 12 months in advanced.)



## Devaluations Are Unpopular

• Economic Reasons:
– *Pass-through* to import prices (Domestic prices increase) ⇒ Inflation
– Real wages decrease
– Contractionary impact on the economy, especially in EM: **3%** average loss of GDP after 7 years!

The contraction is usually associated with balance sheet effects –i.e., a mismatch between currency of denomination of debt (mainly, in FC) and income (mainly, in DC)– in corporate and government sectors.




## Devaluations Are Unpopular

• Politicians are run out of office.
– Cooper (1971) finds that heads of state lose their jobs twice as often within 1 year of devaluation:
**30%** as compared to 14% in a non-devaluation control group.

– Frankel (2005), updated sample 1971 – 2003 and measured exit 6 months after devaluation:
**23%** (=43/109) as compared to 12% in control group.

## Twin Ds

• A currency crisis is a product of serious macro-economic problems: Sovereign defaults and/or banking crisis are not rare during these times.

In general, sovereign defaults are accompanied by large devaluations. These are the "*Twin Ds*": *Default* and *Devaluation*.

• Reinhart (2002), looking at the period 1970 – 1999:

- Prob[Devaluation | Default] = **84%**
- Prob[Devaluation | No Default] = 17%

Na et al. (2017) expand sample to 2013: 84% is too high.

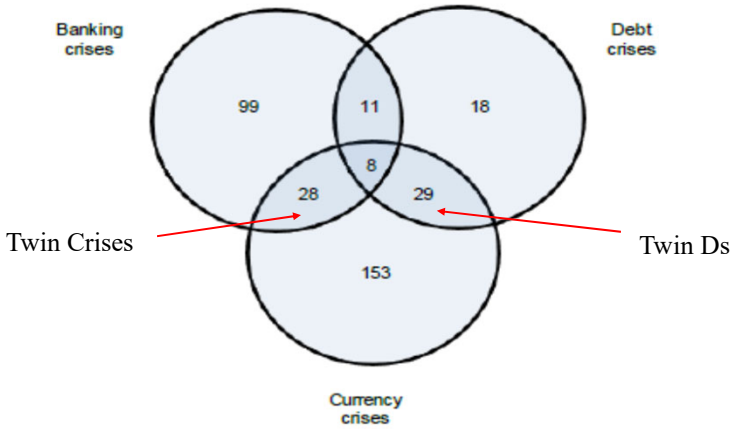
- Prob[Devaluation | Default] = **50%**

Laevan and Valencia (2012), using their own definitions of a currency crisis, find a similar probability: **56%** (=37/66).

## Twin Ds

• Laevan and Valencia (2012) also report the following diagram with the Twin Ds and the *Twin Crisis* (simultaneous banking & currency crises).

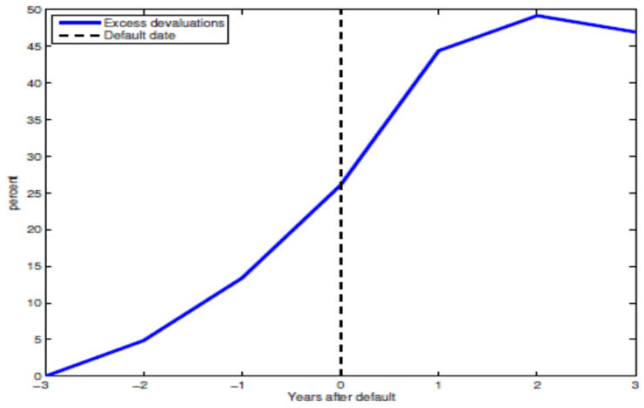
Figure 4. Simultaneous Crises



**Twin Ds**

• Default is usually followed by a large devaluation: **45%** in a 6-year window around a default event.

Figure 1: Excess Devaluation Around Default, 1975-2013




Na et al. (2017) suggest that these large devaluations are needed to realign prices (real wages) to avoid an unemployment shock.

**3. Managed Float**

In practice, the FX rate system is a mixture: *Managed floating* or *dirty float*.
We see a free float, but the CB *intervenes* to buy & sell FC with the *intent* of changing the market determined $S_t$, every time the CB does not like $S_t$. CBs from EM countries tend to intervene much more than others.

**4. Dual Systems**

In some markets, $S_t$ is fixed by the government. But, the government sells FC at the official $S_t$ only for some transactions. For all the other transactions, a *black market* is created.

**Example**: Until 2002, Iran had three officially recognized FX rates:
1) The "official" rate of 1,750 IRR/USD, for oil, gas and essential imports; the "export" rate of 3,000 IRR/USD;
2) The variable Tehran Stock Exchange rate of 7,863 IRR/USD, used by some exporters.
3) For all other transactions, the rate was 8,615 IRR/USD.

## Range of Exchange Rate Regimes

Ranked in terms of (decreasing) flexibility for the CB:

- Free Float or Flexible
- Managed "*Dirty*" Float
- Crawling Peg
- Fixed
- Currency Board (Fixed + 100% FC reserves)
- Adopting a FC as legal tender, for example, "*dollarization*" (Panama, British Virgin Islands, El Salvador, Ecuador, Zimbabwe).

• In 2017, the IMF classifies:
  - 54% of currencies as "*anchored*" (fixed FX rate)
  - 20% as "*stabilized*" (anchored, but allowed to vary in some way)
  - 26% as "floating" (occasional CB Intervention OK).

## Exchange Rate Regimes: Fixed or Flexible?

| Feature | Fixed | Flexible |
|---|---|---|
| | **Cons** | **Pros** |
| Adjustment to imbalances | Difficult | Easy |
| External shocks | Vulnerable | Less vulnerable |
| Support $S_t$ | May need to raise $i_d$ (or cause recession) | No need to do anything |
| Monetary policy | Ineffective | Effective |
| | | |
| | **Pros** | **Cons** |
| FX Volatility | Stable $S_t$ (good for trade & investments) | Volatile ($P_d$ also volatile) |
| $I_d$: Control/Reduce | Good (with credibility) | Harder |
| Fiscal policy | Effective | Ineffective |

**Exchange Rate Regimes: Fixed or Flexible?**

• Both regimes have pros and cons: No clear winner.

• We observe:

– Large economies with sound economic policies, good institutions & high credibility prefer a flexible regime.

– Developed economies with bad economic policies, bad institutions & low credibility rely on a fixed regime.

• Aside Q: If a CB decides to fix, which currency should be the anchor?

Stable trade & investments advantage: Fix against currency of a large trading partner:

– In Latin America, the USD is a good choice.

– In Andorra (between Spain and France), the EUR should be the anchor.