

Chapter 2 The International Monetary System

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1 History of the International Monetary System

The international monetary system has evolved dramatically over the past 150 years. As Ronald McKinnon noted: “No world central bank issues a separate currency for commerce across national boundaries. Instead, a ‘system’ of national monies works more or less well in providing a medium of exchange and unit of account for current international transactions, as well as a store of value and standard of deferred payment for longer-term borrowing and lending.”

This means there’s no “world currency” or global monetary authority. Instead, we have a **loose agreement between nations** to exchange their currencies. How this agreement works has changed dramatically over time.

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

filter, lag

The following objects are masked from 'package:base':

```
intersect, setdiff, setequal, union
```

Evolution of the International Monetary System (1879–Present)

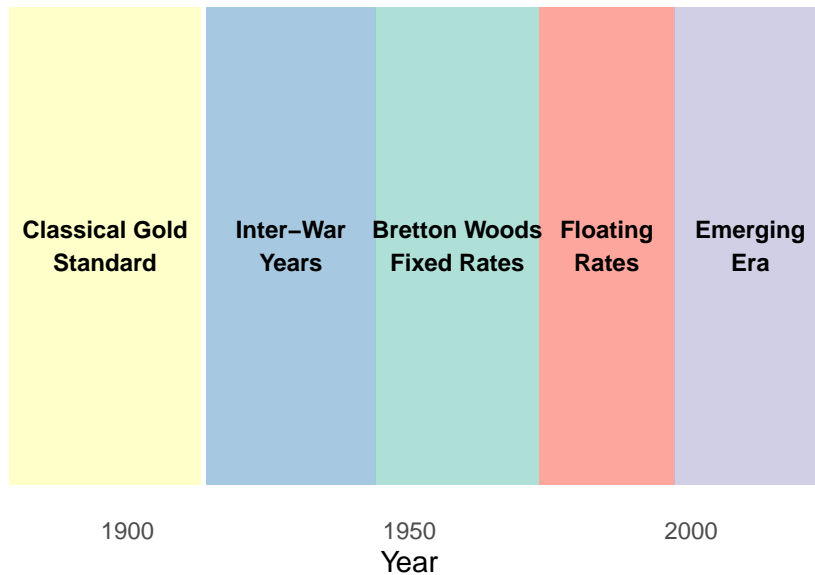


Figure 1: Evolution of the International Monetary System

1.1 The Classical Gold Standard (1879-1913)

The gold standard was the first truly global monetary system. Under this system:

- **Exchange rates were fixed** to gold
- Each country defined its currency in terms of gold
- Paper money could be converted into gold on demand
- Gold flowed freely between countries

1.1.1 How It Worked

Each country set a fixed price for gold in their currency. Exchange rates between currencies were then determined by their relative gold values.

Example: Pre-WWI Exchange Rate Calculation

Before World War I:

- United States: \$20.67 per ounce of gold
- United Kingdom: £4.2474 per ounce of gold

```
# Gold standard exchange rate calculation
us_gold_price <- 20.67 # USD per ounce
uk_gold_price <- 4.2474 # GBP per ounce

# Calculate exchange rate
exchange_rate <- us_gold_price / uk_gold_price

cat("USD per GBP exchange rate:", round(exchange_rate, 4), "\n")
```

USD per GBP exchange rate: 4.8665

```
cat("This means £1 = $", round(exchange_rate, 2), "\n", sep = "")
```

This means £1 = \$4.87

This “par value” of **\$4.8665 per pound** remained fixed as long as both countries maintained their gold prices. Exchange rates could only fluctuate within the narrow “gold points” - the cost of shipping physical gold between countries (approximately $\pm 1\%$).

1.1.2 The Gold Standard Mechanism

Automatic Adjustment: The gold standard had a built-in mechanism to correct trade imbalances:

1. Country runs trade deficit → Gold flows out → Money supply contracts → Prices fall → Exports become cheaper → Trade deficit corrects
2. Country runs trade surplus → Gold flows in → Money supply expands → Prices rise → Exports become more expensive → Trade surplus moderates

1.1.3 Historical Context: The Imperial Russian Government Bond

An interesting artifact from this era: In 1894, Czar Nicholas IV issued bonds for Imperial Russia that could be paid in **six different gold currencies**: French francs, Dutch guilders, Berlin marks, St. Petersburg rubles, British pounds, or U.S. dollars.

Why? Because under the gold standard, all these currencies had **fixed relationships to each other through gold**. The bondholder could choose to be paid in whichever currency was most convenient - they were all equivalent in gold value.

1.1.4 Why It Ended

The classical gold standard collapsed with the outbreak of World War I in 1914:

- **War financing:** Countries suspended gold convertibility to print money for war
- **Trade disruptions:** International commerce broke down
- **Gold hoarding:** Countries stockpiled gold for reserves
- **Political instability:** Made international cooperation impossible

Key Insight: The gold standard worked during peacetime with minimal government intervention, but couldn't survive the strains of modern warfare and activist government policies.

1.2 The Interwar Years and World War I (1914-1944)

This 30-year period saw **chaos and instability** in the international monetary system.

1.2.1 World War I Impact (1914-1918)

- Gold standard suspended across Europe
- Currencies floated or were pegged to neutral currencies (like the U.S. dollar)
- Massive inflation from war spending
- Post-war attempts to restore gold standard failed

1.2.2 The 1920s: Failed Restoration

Many countries tried to return to gold in the 1920s:

- **Britain returned at pre-war parity** (1925) - Massive mistake! Overvalued pound crushed exports
- **France returned at devalued rate** - More successful
- **Germany experienced hyperinflation** (1923) - Money became worthless

1.2.3 The Great Depression (1929-1939)

- Global economic collapse
- Countries abandoned gold to fight deflation
- **Competitive devaluations** - "beggar-thy-neighbor" policies
- International trade collapsed
- Protective tariffs (like U.S. Smoot-Hawley Act)

Example: Britain Leaves Gold (1931)

Britain's pound was overvalued on gold, crushing exports during the Depression. In September 1931, Britain abandoned gold, letting the pound fall by 30%. This helped British exports but hurt other countries still on gold.

Key Lesson: Fixed exchange rates require countries to coordinate monetary policies. When countries face different economic conditions, fixed rates create tensions.

1.2.4 World War II (1939-1945)

- International monetary system essentially ceased functioning
- Most currencies were not convertible
- Trade was managed through bilateral agreements
- Inflation and controls dominated

But: Planning for post-war system began during the war (1944 Bretton Woods Conference).

1.3 Bretton Woods and the International Monetary Fund (1944)

In July 1944, representatives from 44 countries met at Bretton Woods, New Hampshire to design the post-war monetary system. Two brilliant economists dominated the conference:

- **John Maynard Keynes** (British delegation) - Proposed “bancor” as world currency
- **Harry Dexter White** (U.S. delegation) - Proposed dollar-based system

The U.S. proposal won (because the U.S. held most of the world’s gold).

1.3.1 The Bretton Woods System Design

Key Features:

1. Gold-Dollar Standard:

- U.S. dollar pegged to gold at \$35/ounce
- Other currencies pegged to dollar
- Only central banks could convert dollars to gold (not private citizens)

2. Fixed but Adjustable Rates:

- Exchange rates fixed in short run
- Could adjust if “fundamental disequilibrium” existed
- $\pm 1\%$ fluctuation bands allowed

3. Two New Institutions:

- **International Monetary Fund (IMF)** - Monitor system, provide short-term loans
- **World Bank (IBRD)** - Finance post-war reconstruction and development

1.3.2 The Special Drawing Right (SDR)

As the system evolved, the IMF created the **Special Drawing Right (SDR)** in 1969 as an international reserve asset - essentially “IMF money” that countries could hold as reserves.

The SDR is a **basket of currencies**. The current composition (as of 2016):

```
# Current SDR basket (2016 weights)
sdr_basket <- data.frame(
  Currency = c("US Dollar", "Euro", "Chinese Yuan", "Japanese Yen", "British Pound"),
  Weight = c(41.73, 30.93, 10.92, 8.33, 8.09),
  Symbol = c("USD", "EUR", "CNY", "JPY", "GBP")
)

# Calculate total
cat("Total weight:", sum(sdr_basket$Weight), "%\n\n")
```

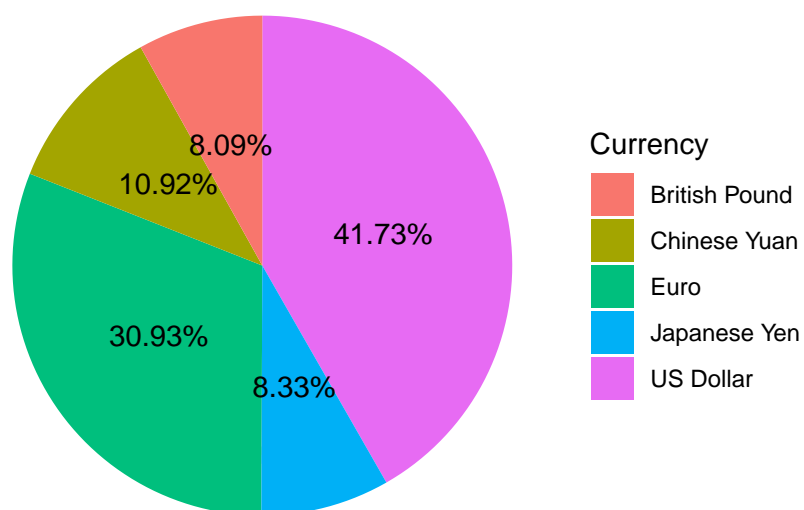
Total weight: 100 %

```
# Display table
print(sdr_basket)
```

	Currency	Weight	Symbol
1	US Dollar	41.73	USD
2	Euro	30.93	EUR
3	Chinese Yuan	10.92	CNY
4	Japanese Yen	8.33	JPY
5	British Pound	8.09	GBP

```
# Create visualization
library(ggplot2)
ggplot(sdr_basket, aes(x = "", y = Weight, fill = Currency)) +
  geom_bar(stat = "identity", width = 1) +
  coord_polar("y", start = 0) +
  theme_void() +
  theme(legend.position = "right") +
  labs(title = "SDR Basket Composition (2016 Revision)",
       fill = "Currency") +
  geom_text(aes(label = paste0(Weight, "%")),
            position = position_stack(vjust = 0.5))
```


SDR Basket Composition (2016 Revision)



Important: Notice that the Chinese yuan (renminbi) was added to the SDR basket in 2016 - a major step in the internationalization of the RMB.

1.4 Fixed Exchange Rates (1945-1973)

The Bretton Woods system operated for nearly 30 years. During this “golden age”:

- **Rapid economic growth** in Western countries
- **Expanding international trade**
- **Currency stability** - businesses could plan with confidence
- **Limited capital flows** - capital controls kept money from moving too freely

1.4.1 How the System Worked in Practice

Example: French Franc under Bretton Woods

Suppose France pegs the franc at 5 francs per dollar, with a $\pm 1\%$ band:

```
# Bretton Woods fixed rate system
par_value <- 5.00 # FF/USD
band <- 0.01 #  $\pm 1\%$ 

# Calculate implied gold value of franc
gold_price_usd <- 35 # USD per ounce
franc_per_ounce <- par_value * gold_price_usd

# Allowable fluctuation band ( $\pm 1\%$ )
upper_limit <- par_value * (1 + band)
```

```
lower_limit <- par_value * (1 - band)

cat("Par value: FF", par_value, "per USD\n")
```

Par value: FF 5 per USD

```
cat("Allowable range: FF", lower_limit, "to FF", upper_limit, "per USD\n")
```

Allowable range: FF 4.95 to FF 5.05 per USD

```
cat("Implied gold value: FF", franc_per_ounce, "per ounce of gold\n")
```

Implied gold value: FF 175 per ounce of gold

French Central Bank's Obligations:

- If franc approaches FF 5.05/\$, **sell francs, buy dollars** (support franc)
- If franc approaches FF 4.95/\$, **buy francs, sell dollars** (weaken franc)
- Must hold enough dollar/gold reserves to defend the peg

1.4.2 The Triffin Dilemma (1960)

Belgian economist Robert Triffin identified a fundamental flaw in the system:

The Problem:

- World needs dollars for reserves and trade
- To supply dollars, U.S. must run trade **deficits**
- But persistent deficits undermine confidence in the dollar
- Eventually, foreign central banks will want to convert dollars to gold
- U.S. doesn't have enough gold to convert all outstanding dollars

The Dilemma: Either:

1. U.S. restricts dollar supply → Global liquidity crisis, trade stagnates, OR
2. U.S. supplies dollars → Dollar loses value, system collapses

This is exactly what happened in the late 1960s and early 1970s.

1.4.3 Why It Ended

By the late 1960s, the system faced severe strains:

1. **U.S. inflation from Vietnam War and Great Society programs**
2. **Persistent U.S. trade deficits**
3. **Growing dollar overhang** - more dollars abroad than U.S. gold reserves
4. **Speculative attacks** on dollar
5. **Rising gold price** - market price diverged from official \$35/ounce

The Collapse:

- **August 15, 1971:** President Nixon “closes the gold window” - suspends dollar-gold convertibility
- **December 1971:** Smithsonian Agreement - attempted realignment of rates
- **March 1973:** Major currencies begin floating
- **Bretton Woods system ends**

Key Insight: Fixed exchange rate systems require either:

- Countries to coordinate monetary policies, OR
- Capital controls to prevent speculative flows

When the U.S. pursued inflationary policies and capital flowed freely, the system collapsed.

1.5 Floating Exchange Rates (1973-1997)

After 1973, major currencies floated against each other. This didn't mean pure free floating, but rather:

- **Managed float (dirty float):** Central banks intervened occasionally
- **No formal commitment** to specific rates
- Market forces primarily determined exchange rates

1.5.1 The Early Years: Volatility and Adjustment

Initial Concerns:

- Would floating rates be too volatile?
- Would trade collapse without stable rates?
- Would speculation destabilize currencies?

Reality:

- Volatility was higher than under Bretton Woods
- But trade continued to grow rapidly
- Market forces did help adjust imbalances
- Occasional crises occurred (Latin American debt crisis 1982-1989)

1.5.2 The Evolution of Capital Flows

A major change during this era: **capital flows began to dominate trade flows**

1950s-1960s:

- Trade transactions dominated foreign exchange markets
- Capital flows limited by controls
- Central banks could manage exchange rates

1980s-1990s:

- Capital flows exploded
- Daily foreign exchange trading: **\$1 trillion+**
- Capital flows dwarfed trade flows
- Central bank interventions became less effective

Example: Daily FX Market Volume

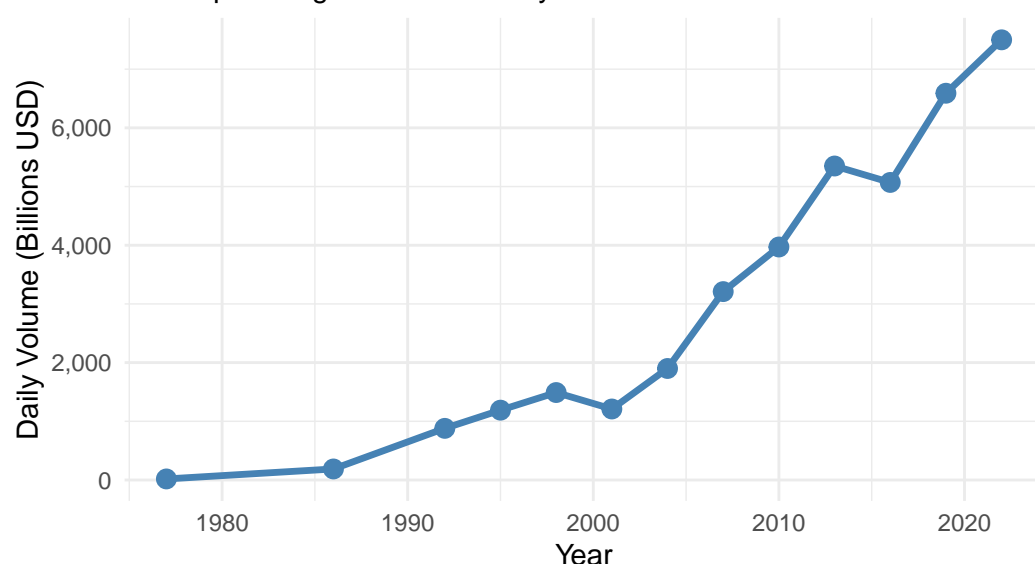
```
# Approximate daily FX trading volume (billions USD)
fx_volume <- data.frame(
  Year = c(1977, 1986, 1992, 1995, 1998, 2001, 2004, 2007, 2010, 2013, 2016, 2019, 2022),
  Volume = c(18, 188, 880, 1190, 1490, 1210, 1900, 3210, 3970, 5350, 5070, 6590, 7500)
)

library(ggplot2)
ggplot(fx_volume, aes(x = Year, y = Volume)) +
  geom_line(color = "steelblue", size = 1.2) +
  geom_point(color = "steelblue", size = 3) +
  scale_y_continuous(labels = scales::comma) +
  labs(title = "Daily Foreign Exchange Trading Volume",
       subtitle = "The explosive growth of currency markets",
       x = "Year",
       y = "Daily Volume (Billions USD)") +
  theme_minimal() +
  theme(plot.title = element_text(face = "bold"))
```

Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
i Please use `linewidth` instead.

Daily Foreign Exchange Trading Volume

The explosive growth of currency markets



By the 1990s, foreign exchange markets were trading over **\$1 trillion per day**, while global trade was only about **\$40 billion per day**. Capital flows now dominated.

1.5.3 Major Events of This Era

Plaza Accord (1985):

- G5 countries agreed to depreciate the dollar
- Coordinated intervention
- Dollar fell by ~50% against yen and deutsche mark
- Showed central banks could still influence rates through cooperation

ERM Crisis (1992):

- Britain forced out of European Exchange Rate Mechanism
- George Soros bet against pound, made \$1 billion
- Showed limits of defending fixed rates against market pressure
- Led to Britain staying out of euro

Mexican Peso Crisis (1994-1995):

- Mexico abandoned peso peg to dollar
- Peso collapsed 50%
- U.S. and IMF bailout
- First major emerging market crisis of the floating era

Asian Financial Crisis (1997):

- Thailand, Indonesia, South Korea, Malaysia hit hard
- Fixed exchange rates collapsed

- Massive capital flight
- IMF bailouts with conditions
- This crisis marked transition to “Emerging Era”

1.6 The Emerging Era (1997-Present)

The Asian Financial Crisis of 1997 marked a turning point. Since then, the system has been characterized by:

1.6.1 Key Features

1. No Single System:

- Major currencies float (dollar, euro, yen, pound)
- Many emerging markets use various pegs or managed floats
- Some use currency boards or dollarization
- “Eclectic” system with many approaches

2. Dominance of Capital Flows:

- Financial transactions overwhelm trade transactions
- Carry trades and derivatives dominate markets
- Central banks struggle to control exchange rates

3. Rise of New Players:

- China becomes economic superpower
- Internationalization of Chinese renminbi (RMB)
- Digital currencies emerging
- Questions about dollar’s future dominance

4. Recurring Crises:

- Russian Crisis (1998)
- Argentine Crisis (2001-2002)
- Global Financial Crisis (2008-2009)
- Eurozone Crisis (2010-2015)
- COVID-19 disruptions (2020-2021)
- Current inflation and rate hikes (2022-2024)

1.6.2 The Post-2008 World

The Global Financial Crisis changed thinking about monetary systems:

Lessons Learned:

- Capital flows can be destabilizing
- Fixed exchange rates can become traps (Greece, Spain, Italy in euro)
- Reserve accumulation by emerging markets (especially China)
- Questions about sustainability of U.S. current account deficits

- Need for better crisis prevention and management

Current Debates:

- Should China allow RMB to float freely?
- Can the euro survive without fiscal union?
- Will digital currencies replace physical cash?
- Can dollar maintain reserve currency status with persistent deficits?
- Should emerging markets use capital controls?

1.7 IMF Classification of Currency Regimes

How do we categorize the bewildering variety of exchange rate regimes in use today? The IMF has developed a classification system.

1.7.1 Brief Classification History

Pre-1998: The IMF classified countries based on what they **said** they were doing (*de jure* classification):

- If country announced a peg, IMF classified it as pegged
- Problem: Many countries didn't do what they said

Post-1998: The IMF switched to classifying based on what countries **actually do** (*de facto* classification):

- Analyze actual exchange rate behavior
- Look at reserves, interventions, policies
- More accurate but more complex

Why the Change?

The Asian Financial Crisis revealed that many countries claiming to float were actually maintaining de facto pegs, making them vulnerable to sudden crises. The new system aimed to capture reality.

1.7.2 The IMF's De Facto System

The IMF currently groups exchange rate regimes into four main categories:

1.7.2.1 Category 1: Hard Pegs

Definition: No separate legal tender, or a currency board arrangement.

Characteristics:

- Strongest commitment to fixed rate
- Essentially gives up independent monetary policy
- Requires large reserves or complete adoption of foreign currency

Types:

1. No Separate Legal Tender (Dollarization)

- Country adopts another country's currency completely
- Examples: Ecuador (USD), El Salvador (USD), Zimbabwe (multiple currencies)
- **Advantage:** Complete credibility, eliminates currency risk
- **Disadvantage:** No monetary policy, no lender of last resort

2. Currency Board

- Domestic currency but legally required to be fully backed by foreign reserves
- Fixed exchange rate by law
- Example: Hong Kong (HKD pegged to USD at 7.8)
- **Advantage:** Credible commitment, maintains own currency
- **Disadvantage:** Still no independent monetary policy

1.7.2.2 Category 2: Soft Pegs

Definition: Countries maintain some form of peg but with more flexibility than hard pegs.

Characteristics:

- Commitment to target rate but can adjust
- More policy flexibility than hard pegs
- More vulnerable to speculative attacks

Types:

1. Conventional Peg

- Fixed rate with narrow bands ($\pm 1\%$)
- Can occasionally adjust (realign or devalue)
- Example: Saudi Arabia (riyal pegged to dollar)

2. Stabilized Arrangement

- Rate fluctuates within narrow 2% margin for six months
- No announced commitment
- De facto stability

3. Crawling Peg

- Periodic small adjustments announced in advance

- Helps manage inflation differentials
- Example: China (historically, though now more flexible)

4. **Crawl-like Arrangement**

- Small changes, but no announced path
- Implicit rather than explicit

5. **Pegged Within Horizontal Band**

- Wider bands than conventional peg ($>\pm 1\%$)
- Example: Denmark (krone pegged to euro with $\pm 2.25\%$ band)

1.7.2.3 **Floating Arrangements**

Definition: Exchange rate primarily determined by market with varying degrees of intervention.

Types:

1. **Floating**

- Market determines rate
- Intervention aims to moderate volatility, not target specific level
- Examples: United States (dollar), Eurozone (euro), Japan (yen)

2. **Free Floating**

- Pure market determination
- Intervention rare and limited
- Very few countries actually free float

Reality: Most “floating” countries are actually “managed floats” or “dirty floats” - they intervene frequently but don’t target specific rates.

1.7.2.4 **Residual**

Definition: Other managed arrangements that don’t fit cleanly into above categories.

Characteristics:

- Usually countries with capital controls
- Multiple exchange rates
- Frequent policy changes

Examples:

- Countries in transition
- Countries with capital controls (like China prior to recent reforms)
- Countries with black markets for foreign currency

1.7.3 A Global Eclectic

Here's the current distribution of regimes worldwide (based on IMF data):

```
# Data from Exhibit 2.5 in textbook
# Number of countries in each regime category over time

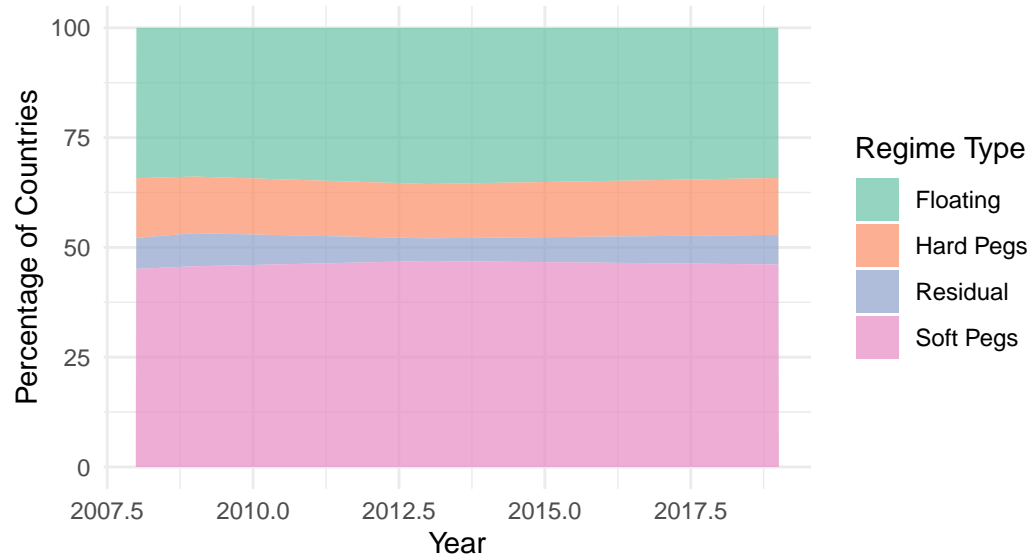
regime_data <- data.frame(
  Year = rep(c(2008, 2009, 2013, 2019), each = 4),
  Category = rep(c("Hard Pegs", "Soft Pegs", "Floating", "Residual"), 4),
  Count = c(
    # 2008
    25, 83, 63, 13,
    # 2009
    24, 85, 63, 14,
    # 2013
    24, 91, 69, 10,
    # 2019
    25, 89, 66, 13
  )
)

# Calculate percentages
regime_data <- regime_data %>%
  group_by(Year) %>%
  mutate(Total = sum(Count),
         Percentage = Count / Total * 100)

# Create stacked area chart
ggplot(regime_data, aes(x = Year, y = Percentage, fill = Category)) +
  geom_area(alpha = 0.7) +
  scale_fill_brewer(palette = "Set2") +
  labs(title = "Distribution of Exchange Rate Regimes (2008-2019)",
       subtitle = "Based on IMF de facto classification",
       x = "Year",
       y = "Percentage of Countries",
       fill = "Regime Type") +
  theme_minimal() +
  theme(plot.title = element_text(face = "bold"),
        legend.position = "right")
```

Distribution of Exchange Rate Regimes (2008–2019)

Based on IMF de facto classification



```
# Print summary for most recent year
cat("\nDistribution in 2019:\n")
```

Distribution in 2019:

```
regime_2019 <- regime_data %>%
  filter(Year == 2019) %>%
  select(Category, Count, Percentage)
```

Adding missing grouping variables: `Year`

```
print(regime_2019, n = 4)
```

```
# A tibble: 4 x 4
# Groups:   Year [1]
  Year Category    Count Percentage
<dbl> <chr>      <dbl>      <dbl>
1  2019 Hard Pegs     25        13.0
2  2019 Soft Pegs    89        46.1
3  2019 Floating     66        34.2
4  2019 Residual     13         6.74
```

Key Observations:

- **Soft pegs most common** (~46% of countries)

- **Floating arrangements** are significant (~34%)
- **Hard pegs relatively rare** (~13%)
- **Residual category declining** as countries formalize their regimes
- No single approach dominates

Important: The “right” exchange rate regime depends on a country’s specific circumstances:

- Economic structure (trade-dependent vs. diversified)
- Political institutions
- Financial development
- Size and openness
- Historical experience
- Current account position
- Capital flows

There is no one-size-fits-all solution.

2 Fixed vs. Flexible Exchange Rates

One of the longest-running debates in international finance: Which is better, fixed or flexible exchange rates?

Spoiler Alert: There’s no clear winner. Each system has advantages and disadvantages, and the “best” choice depends on a country’s specific circumstances.

2.1 The Theoretical Debate

2.1.1 Advantages of Fixed Exchange Rates

1. Certainty and Stability

- Businesses can plan without currency risk
- Encourages international trade and investment
- Reduces need for hedging (saves transaction costs)

2. Discipline on Monetary Policy

- Governments can’t print money recklessly
- Helps control inflation
- Anchors inflation expectations

3. Eliminates Speculation

- No one-way bets against currency
- Reduces destabilizing capital flows

Example: German exporter sells machinery to U.S. customer

```

# Compare fixed vs floating scenarios
# German exporter sells machine tool to US customer
# Sale price: $1.2 million
# Cost to produce: €800,000

# Scenario 1: Fixed rate at 1.20 USD/EUR
fixed_rate <- 1.20
sale_price_usd <- 1200000

# Scenario 2: Floating rate - could be anywhere
# Let's look at range of possibilities
floating_rates <- seq(1.00, 1.40, by = 0.05)

# Calculate euro receipts under each scenario
cost_eur <- 800000
fixed_eur_received <- sale_price_usd / fixed_rate
fixed_profit <- fixed_eur_received - cost_eur

cat("FIXED RATE SCENARIO\n")

```

FIXED RATE SCENARIO

```
cat("=====\n")
```

=====

```
cat("Sale price: $", format(sale_price_usd, big.mark = ","), "\n", sep = "")
```

Sale price: \$1,200,000

```
cat("Exchange rate: ", fixed_rate, " USD/EUR\n", sep = "")
```

Exchange rate: 1.2 USD/EUR

```
cat("Euro receipts: €", format(round(fixed_eur_received), big.mark = ","), "\n", sep = "")
```

Euro receipts: €1e+06

```
cat("Production cost: €", format(cost_eur, big.mark = ","), "\n", sep = "")
```

Production cost: €8e+05

```
cat("Profit: €", format(round(fixed_profit), big.mark = ","), "\n\n", sep = "")
```

Profit: €2e+05

```
cat("FLOATING RATE SCENARIOS\n")
```

FLOATING RATE SCENARIOS

```
cat("=====\n")
```

=====

```
floating_results <- data.frame(  
  Rate = floating_rates,  
  EUR_Received = sale_price_usd / floating_rates,  
  Profit = (sale_price_usd / floating_rates) - cost_eur  
)  
  
print(floating_results, row.names = FALSE)
```

Rate	EUR_Received	Profit
1.00	1200000.0	400000.00
1.05	1142857.1	342857.14
1.10	1090909.1	290909.09
1.15	1043478.3	243478.26
1.20	1000000.0	200000.00
1.25	960000.0	160000.00
1.30	923076.9	123076.92
1.35	888888.9	88888.89
1.40	857142.9	57142.86

```
cat("\nProfit range: €", format(round(min(floating_results$Profit)), big.mark = ","),  
    " to €", format(round(max(floating_results$Profit)), big.mark = ","), "\n", sep = "")
```

Profit range: €57,143 to €4e+05

Under fixed rates, the German exporter knows exactly what profit to expect. Under floating rates, profit could vary by hundreds of thousands of euros!

2.1.2 Disadvantages of Fixed Exchange Rates

1. Loss of Monetary Policy Independence

- Can't adjust interest rates for domestic needs
- Must maintain rates to defend peg
- "Imported" inflation or deflation from anchor country

2. Requires Large Reserves

- Must hold foreign currency to defend peg
- Reserves could be used productively elsewhere
- Vulnerable to speculative attacks

3. Can't Adjust to Shocks

- Terms of trade shock requires real wage adjustment
- With fixed rate, adjustment comes through unemployment
- With floating rate, currency adjusts instead

4. Target for Speculation

- If peg looks unsustainable, speculators attack
- Can force costly devaluations
- Example: 1992 ERM crisis

2.1.3 Advantages of Flexible Exchange Rates

1. Monetary Policy Independence

- Can set interest rates for domestic objectives
- Can fight recessions with loose policy
- Can target inflation independently

2. Automatic Adjustment Mechanism

- Trade deficit → currency falls → exports cheaper → deficit narrows
- Trade surplus → currency rises → imports cheaper → surplus narrows
- No need for painful deflation

3. No Reserves Needed

- Market determines rate
- Reserves can be used productively
- Can't "run out" of reserves

4. Less Vulnerable to Attacks

- No fixed rate to defend
- Speculators can't force government to "break" peg

2.1.4 Disadvantages of Flexible Exchange Rates

1. Uncertainty and Volatility

- Exchange rate risk complicates trade
- Need hedging (costly)
- Can overshoot fundamental values

2. Less Discipline

- Governments may use inflation to solve problems
- Floating rate can enable bad policies
- Inflation expectations less anchored

3. Speculation Can Be Destabilizing

- Bubbles and crashes possible
- Contagion effects
- May diverge from fundamentals

Example: Euro-dollar exchange rate volatility

```
# Simulate euro-dollar exchange rate volatility
# Based on actual patterns from 2010-2020

set.seed(42)
n_days <- 252 * 5 # 5 years of trading days

# Starting rate
start_rate <- 1.35

# Generate realistic exchange rate path
# Mean reversion + random shocks
returns <- rnorm(n_days, mean = 0, sd = 0.006) # ~0.6% daily volatility
levels <- start_rate * cumprod(1 + returns)

# Create time series
dates <- seq(from = as.Date("2015-01-01"), by = "day", length.out = n_days)
fx_data <- data.frame(Date = dates, Rate = levels)

# Plot
library(ggplot2)
ggplot(fx_data, aes(x = Date, y = Rate)) +
  geom_line(color = "darkblue", alpha = 0.7) +
  geom_hline(yintercept = start_rate, linetype = "dashed", color = "red") +
  labs(title = "Simulated EUR/USD Exchange Rate Volatility",
       subtitle = "Illustrating daily fluctuations under floating rates",
       x = "Date",
       y = "USD per EUR") +
  theme_minimal()
```


Simulated EUR/USD Exchange Rate Volatility

Illustrating daily fluctuations under floating rates



```
# Calculate statistics
cat("Exchange rate statistics:\n")
```

Exchange rate statistics:

```
cat("Starting rate: ", round(start_rate, 4), "\n", sep = "")
```

Starting rate: 1.35

```
cat("Minimum rate: ", round(min(levels), 4), "\n", sep = "")
```

Minimum rate: 0.986

```
cat("Maximum rate: ", round(max(levels), 4), "\n", sep = "")
```

Maximum rate: 1.425

```
cat("Range: ", round((max(levels) - min(levels)) / start_rate * 100, 1), "%\n", sep = "")
```

Range: 32.5%

```
cat("Standard deviation: ", round(sd(returns) * 100, 2), "% (daily)\n", sep = "")
```

Standard deviation: 0.6% (daily)

```
cat("Annualized volatility: ", round(sd(returns) * sqrt(252) * 100, 1), "%\n", sep = "")
```

Annualized volatility: 9.5%

This volatility creates risk for businesses engaged in international trade, but also provides automatic adjustment to changing economic conditions.

2.2 The Empirical Evidence

What does the evidence show? After decades of research:

On Growth:

- No clear winner
- Fixed rates may help developing countries with weak institutions
- Floating rates work well for developed countries
- Quality of institutions matters more than regime choice

On Volatility:

- Fixed rates reduce nominal exchange rate volatility (by definition)
- But don't necessarily reduce real exchange rate volatility
- Inflation can vary to offset nominal stability

On Crises:

- Fixed rates vulnerable to sudden crises (speculative attacks)
- Floating rates have more frequent small adjustments
- Soft pegs ("fear of floating") may be worst of both worlds

On Trade:

- Fixed rates may increase trade slightly
- But effect is small and uncertain
- Other factors (trade agreements, geography) matter more

2.3 The Modern Consensus

"Corner Solutions" Hypothesis (1990s-2000s):

- Countries should either hard peg (currency board/dollarization) OR freely float
- Intermediate regimes (soft pegs) are crisis-prone
- "Vanishing middle" predicted

Reality Check (2010s-Present):

- Most countries still use soft pegs!
- Intermediate regimes persist

- “Fear of floating” - countries reluctant to let rates move freely
- “Fear of pegging” - countries reluctant to commit fully

Current View:

- No one-size-fits-all answer
- Depends on country characteristics:
 - Size and openness
 - Trade patterns
 - Financial development
 - Institutional quality
 - Political constraints
- Flexibility to change regimes may be valuable
- **Institutions matter more than the regime itself**

Key Insight: A well-managed soft peg with strong institutions may outperform a poorly-managed hard peg or free float. The regime choice matters less than the quality of macroeconomic management.

3 The Impossible Trinity

Perhaps the most important concept in international finance for understanding exchange rate regimes. The Impossible Trinity (also called the “Trilemma”) states:

A country cannot simultaneously achieve:

1. **Exchange rate stability** (fixed exchange rate)
2. **Full financial integration** (free capital mobility)
3. **Monetary independence** (independent monetary policy)

You can pick any TWO, but not all three.

3.1 The Theory

Why is this impossible? Let’s think through it:

Scenario: Country tries to maintain fixed rate with capital mobility and independent monetary policy.

1. Country lowers interest rates to stimulate economy
2. Investors move money out (seeking higher returns elsewhere)
3. Capital outflow puts pressure on currency to depreciate
4. To defend fixed rate, central bank must raise interest rates
5. Result: Can’t maintain independent monetary policy!

The Three Choices:

```

library(ggplot2)

# Create triangle vertices
triangle <- data.frame(
  x = c(0, 1, 0.5, 0),
  y = c(0, 0, sqrt(3)/2, 0),
  label = c("Exchange Rate\nStability", "Full Financial\nIntegration",
            "Monetary\nIndependence", "")
)

# Country examples positioned on triangle edges
countries <- data.frame(
  Country = c("Eurozone", "United States", "China (pre-2005)",
            "Hong Kong", "Most emerging\nmarkets", "Floating rate\ncountries"),
  x = c(0.5, 0.75, 0.25, 0, 0.5, 1),
  y = c(0, sqrt(3)/4, sqrt(3)/4, 0, sqrt(3)/2, 0),
  Choice = c("Rate stability +\nIntegration", "Independence +\nIntegration",
            "Independence +\nRate stability", "Rate stability +\nIntegration",
            "All three?\n(Impossible!)", "Independence +\nIntegration")
)

# Create plot
ggplot() +
  # Draw triangle
  geom_path(data = triangle, aes(x = x, y = y), size = 1.5, color = "darkblue") +
  # Label vertices
  geom_text(data = triangle[1:3,], aes(x = x, y = y, label = label),
            size = 4.5, fontface = "bold", vjust = c(1.5, 1.5, -0.5)) +
  # Add country positions
  geom_point(data = countries, aes(x = x, y = y),
            size = 4, color = "red", alpha = 0.6) +
  geom_text(data = countries, aes(x = x, y = y, label = Country),
            size = 3, vjust = -1.2) +
  # Add center point showing impossibility
  geom_point(aes(x = 0.5, y = sqrt(3)/6), size = 6,
            color = "red", shape = 4, stroke = 2) +
  annotate("text", x = 0.5, y = sqrt(3)/6 + 0.1,
            label = "IMPOSSIBLE\nto be here!",
            size = 4, fontface = "bold", color = "red") +
  coord_fixed() +
  theme_void() +
  labs(title = "The Impossible Trinity (Trilemma)",
        subtitle = "Countries must choose TWO of three goals") +
  theme(plot.title = element_text(size = 16, face = "bold", hjust = 0.5),
        plot.subtitle = element_text(size = 12, hjust = 0.5))

```

The Impossible Trinity (Trilemma)

Countries must choose TWO of three goals



3.2 Real-World Examples

3.2.1 United States: Monetary Independence + Financial Integration

Choices:

- ☒ Independent monetary policy (Fed sets rates freely)
- ☒ Full capital mobility (no capital controls)
 - Floating exchange rate (gives up stability)

Implications:

- Dollar floats against other currencies
- Fed can fight recessions with low rates
- Exchange rate acts as “shock absorber”
- Currency volatility affects trade

3.2.2 Eurozone: Exchange Rate Stability + Financial Integration

Choices:

- ☒ Fixed exchange rates (euro members locked together)
- ☒ Full capital mobility (single market)
 - No independent monetary policy (ECB decides for all)

Implications:

- Greece can't devalue vs. Germany

- Italy can't lower rates independently
- "One size fits all" policy problems
- Adjustment comes through deflation/unemployment

3.2.3 China (Historically): Monetary Independence + Exchange Rate Stability

Choices:

- ☒ Managed exchange rate (RMB pegged/managed vs. dollar)
- ☒ Independent monetary policy (PBOC controls domestic rates)
 - Capital controls (strict limits on moving money in/out)

Implications:

- Can't freely invest abroad
- Foreign investment restricted
- Black markets for currency
- Limits financial development

Note: China has been gradually moving toward more flexibility on all three dimensions - a challenging transition!

3.2.4 Hong Kong: Exchange Rate Stability + Financial Integration

Choices:

- ☒ Fixed exchange rate (currency board: 7.8 HKD = 1 USD)
- ☒ Full capital mobility (international financial center)
 - No monetary policy (interest rates follow U.S. rates)

Implications:

- Complete credibility on peg
- Hong Kong interest rates track Fed rates
- Real estate bubbles when U.S. rates are low
- Can't fight local recession with monetary policy

3.3 Policy Implications

The Impossible Trinity explains many policy dilemmas:

Why do currency crises happen?

- Countries try to maintain all three (impossible)
- Usually try: fixed rate + capital mobility + some policy independence
- Eventually, market tests commitment → Speculative attack → Crisis

Example: Asian Financial Crisis (1997)

- Thailand tried to maintain: Baht peg to dollar + Open capital account + Some policy flexibility
- Capital inflows → Asset bubbles → Reversal → Speculative attack
- Not enough reserves to defend peg → Forced to float → Baht collapsed 50%
- Indonesia, Korea, Malaysia followed

Why do countries use capital controls?

- To maintain both fixed rate AND monetary independence
- Controls prevent capital flight
- Example: Malaysia (1998) imposed controls during Asian Crisis

Why do some countries adopt currency boards?

- Choose exchange rate stability + capital mobility
- Explicitly give up monetary independence
- Gain credibility but lose flexibility

Why float?

- To maintain monetary independence + capital mobility
- Accept exchange rate volatility
- Most developed countries chose this path

3.4 The Evolution of Policy Choices

How have countries' positions on the trinity evolved over time?

Bretton Woods Era (1945-1973):

- Most countries: Fixed rates + Monetary independence
- Required: Capital controls
- System broke down when controls became ineffective

1980s-1990s:

- Capital mobility increased globally
- Countries had to choose: Fixed rate OR Monetary independence
- Many crises as countries tried to maintain both

2000s-Present:

- Most developed countries: Monetary independence + Capital mobility (floating)
- Eurozone: Fixed rates + Capital mobility (no independence)
- Some emerging markets: Fixed/managed rates + Capital controls
- Hong Kong, Gulf states: Fixed rates + Capital mobility (no independence)

The Key Question: As financial integration deepens globally, can any country maintain both exchange rate stability and monetary independence? History suggests no.

3.5 Extensions and Complications

3.5.1 Fear of Floating

Many countries that officially float actually intervene heavily to stabilize their rates. Why?

- Concern about inflation passthrough
- Large foreign currency debt
- Thin foreign exchange markets
- Political pressure

Result: Try to get benefits of all three (impossible!) → Vulnerable to crises

3.5.2 The “Impossible Quartet”?

Some economists argue there’s a fourth objective: **Financial stability**

With free capital flows, countries may experience:

- Asset bubbles
- Banking crises
- Sudden stops

Do we need capital controls even with floating rates? Controversial debate.

3.5.3 Digital Currencies and the Trinity

Could Central Bank Digital Currencies (CBDCs) change the trinity?

- Might allow better control of cross-border flows
- Could enable negative interest rates
- Might reduce effectiveness of capital controls

Too early to know, but the trinity’s logic likely still applies.

3.6 Practical Exercises

Exercise 1: Classify these countries based on the Impossible Trinity:

1. United Kingdom (floating pound, independent Bank of England, open capital markets)
2. Denmark (pegged to euro, open capital markets)
3. Saudi Arabia (riyal pegged to dollar, open capital markets)
4. India (managed float, some capital controls, independent RBI)

Exercise 2: During the COVID-19 pandemic, the Fed lowered interest rates to near zero. What happened to:

- The dollar? (It initially strengthened, then weakened)
- Capital flows? (Money flowed toward riskier assets globally)

- Other countries' policy choices? (Many followed Fed down, some didn't)

Why did outcomes differ from what the trinity might predict?

4 A Single Currency for Europe: The Euro

The euro represents one of the most ambitious monetary experiments in history. In 1999, eleven European countries abandoned their national currencies to adopt a single currency: the euro (€).

Today: 20 countries use the euro, with a combined GDP rivaling the United States. But the path has been rocky.

4.1 The Maastricht Treaty and Monetary Union

4.1.1 Historical Background

The Vision: European integration to ensure peace and prosperity after two devastating world wars.

Steps Toward Monetary Union:

1. **1957:** Treaty of Rome establishes European Economic Community
2. **1979:** European Monetary System (EMS) created
 - Exchange Rate Mechanism (ERM): currencies pegged with bands
 - Precursor to full monetary union
3. **1992:** Maastricht Treaty signed
 - Set path to single currency
 - Established convergence criteria
4. **1999:** Euro launched for electronic transactions
5. **2002:** Euro cash introduced, replacing national currencies

4.1.2 The Maastricht Convergence Criteria

To join the euro, countries had to meet five criteria:

1. **Inflation:** Must be within 1.5% of three best-performing EU states
2. **Government Finances:**
 - Budget deficit < 3% of GDP
 - Government debt < 60% of GDP
3. **Exchange Rates:** Currency stable within ERM bands for 2 years
4. **Long-term Interest Rates:** Within 2% of three best-performing states

Purpose: Ensure only countries with similar economic conditions and sound finances joined.

Reality: Several countries (including Greece) later found to have manipulated statistics to meet criteria. This would cause problems later.

4.2 The European Central Bank (ECB)

4.2.1 Structure and Mandate

Location: Frankfurt, Germany

Mandate: Maintain price stability (inflation target ~2%)

Unlike Fed: ECB has single mandate (price stability), not dual mandate (also employment)

Governance:

- Executive Board (6 members)
- Governing Council (19 national central bank governors + 6 executive board members)
- Decisions by majority vote

Key Issue: “One size fits all” monetary policy for diverse economies:

- Germany (export powerhouse, conservative finances)
- Greece (tourism-dependent, loose finances)
- Ireland (small, open economy)
- Spain (real estate boom-bust cycle)

The Problem: ECB sets one interest rate for everyone, but countries face different economic conditions.

4.2.2 Monetary Policy Tools

Main Tools:

1. **Interest Rates:** ECB sets refinancing rate for eurozone banks
2. **Reserve Requirements:** Banks must hold reserves at ECB
3. **Open Market Operations:** Buy/sell bonds to influence money supply
4. **Emergency Measures:** Quantitative easing, LTRO, OMT

Example: During eurozone crisis (2010-2015):

- ECB kept rates low to help struggling countries (Greece, Spain, Portugal)
- But this fueled inflation in stronger economies (Germany, Netherlands)
- ECB couldn't raise rates (would crush weak countries) or lower rates (would overheat strong countries)

4.3 The Launch of the Euro

4.3.1 Initial Success (1999-2007)

Benefits Realized:

1. Transaction Costs Eliminated

- No more currency exchange within eurozone
- Businesses save billions on hedging
- Price transparency across borders

2. Trade Increased

- Estimated 5-15% increase in trade among members
- Easier cross-border business

3. Interest Rates Converged

- Weak countries (Greece, Portugal) could borrow at near-German rates
- Massive capital flows to periphery

4. Euro Became Major Reserve Currency

- Second only to dollar globally
- Challenge to dollar dominance

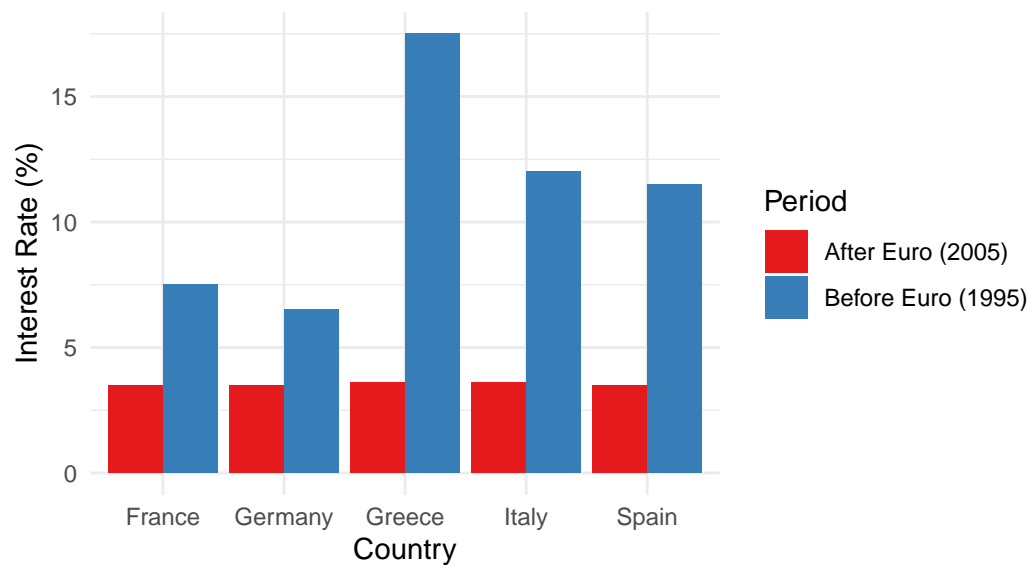
Example: Interest Rate Convergence

```
# Hypothetical country comparison
# Before euro (1995) vs. After euro (2005)

interest_rates <- data.frame(
  Country = c("Germany", "France", "Italy", "Spain", "Greece",
              "Germany", "France", "Italy", "Spain", "Greece"),
  Period = c(rep("Before Euro (1995)", 5), rep("After Euro (2005)", 5)),
  Rate = c(6.5, 7.5, 12.0, 11.5, 17.5, # Before
           3.5, 3.5, 3.6, 3.5, 3.6)    # After
)

library(ggplot2)
ggplot(interest_rates, aes(x = Country, y = Rate, fill = Period)) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "10-Year Government Bond Yields: Before and After Euro",
       subtitle = "Convergence to German rates",
       x = "Country",
       y = "Interest Rate (%)",
       fill = "Period") +
  theme_minimal() +
  scale_fill_brewer(palette = "Set1")
```

10-Year Government Bond Yields: Before and After Euro Convergence to German rates



```
cat("\nAverage spread to Germany:\n")
```

Average spread to Germany:

```
cat("Before euro: ",  
    round(mean(c(7.5, 12.0, 11.5, 17.5) - 6.5), 1),  
    " percentage points\n", sep = "")
```

Before euro: 5.6 percentage points

```
cat("After euro: ",  
    round(mean(c(3.5, 3.6, 3.5, 3.6) - 3.5), 1),  
    " percentage points\n", sep = "")
```

After euro: 0.1 percentage points

This convergence seemed like a miracle - suddenly weak countries could borrow cheaply! But it created moral hazard and encouraged excessive borrowing.

4.3.2 The Euro in Action (2008-Present)

The Global Financial Crisis (2008-2009):

- European banks heavily exposed to U.S. subprime mortgages

- Banking crisis spread to Europe
- Governments had to bail out banks
- Government debts exploded

The Eurozone Sovereign Debt Crisis (2010-2015):

In late 2009, Greece revealed it had massively understated its budget deficit. Markets panicked.

The PIIGS Crisis:

- Portugal
- Ireland (though Ireland's problem was different - banking crisis)
- Italy
- Greece
- Spain

Key Problem: Countries couldn't devalue to restore competitiveness (locked into euro). Adjustment required:

- Wage cuts
- Deflation
- Unemployment
- Austerity

Example: Greece

```
# Greek crisis by the numbers
greece_data <- data.frame(
  Metric = c("GDP decline", "Unemployment rate", "Government debt",
             "Youth unemployment", "Pension cuts", "Public sector wage cuts"),
  Peak_Value = c("-25%", "27.5%", "180% of GDP",
                 "60%", "-40%", "-30%"),
  Period = c("2008-2016", "2013", "2016",
             "2013", "2010-2015", "2010-2015")
)

print(greece_data)
```

	Metric	Peak_Value	Period
1	GDP decline	-25%	2008-2016
2	Unemployment rate	27.5%	2013
3	Government debt	180% of GDP	2016
4	Youth unemployment	60%	2013
5	Pension cuts	-40%	2010-2015
6	Public sector wage cuts	-30%	2010-2015

```
cat("\n")
```

```
cat("Total bailout packages: €289 billion\n")
```

Total bailout packages: €289 billion

```
cat("Conditions: Harsh austerity, tax increases, spending cuts\n")
```

Conditions: Harsh austerity, tax increases, spending cuts

```
cat("Social cost: Emigration, poverty, political instability\n")
```

Social cost: Emigration, poverty, political instability

The human cost was devastating. Greece suffered a depression worse than the U.S. in the 1930s.

ECB Response:

1. **LTRO (Long-Term Refinancing Operations):** Cheap loans to banks
2. **OMT (Outright Monetary Transactions):** Promise to buy government bonds “whatever it takes”
3. **Quantitative Easing:** Buy bonds to lower interest rates
4. **Negative Interest Rates:** Charge banks for holding reserves

Mario Draghi’s Famous Quote (July 2012):

“Within our mandate, the ECB is ready to do whatever it takes to preserve the euro.
And believe me, it will be enough.”

This speech alone calmed markets and is credited with saving the euro.

4.3.3 Current Status

The Euro Today:

- 20 member countries (Croatia joined 2023)
- ~350 million people
- Second most-held reserve currency (~20% of global reserves)
- Survived existential crisis but scars remain

Unresolved Issues:

1. No Fiscal Union

- Banking union incomplete
- No mechanism for fiscal transfers
- “No bailout” clause often violated

2. North-South Divide

- Northern countries (Germany, Netherlands) want austerity
- Southern countries (Italy, Spain, Greece) want stimulus
- Persistent tensions

3. Democratic Deficit

- ECB not directly accountable to voters
- Austerity imposed by unelected technocrats
- Rise of populist parties

4. Competitiveness Gaps

- Germany runs massive surpluses
- Southern countries can't compete
- No easy adjustment mechanism

The Future:

Will the euro survive? Most economists now say yes, but:

- Needs deeper integration (fiscal union, banking union)
- Political will may not exist
- Next crisis will test system again

4.4 Brexit and the Pound

Important Contrast: The United Kingdom never adopted the euro, keeping the pound sterling.

Why?

- Historical attachment to pound
- Desire for monetary independence
- Skepticism about European integration

Brexit (2016-2020):

- UK voted to leave European Union
- Pound fell sharply (from ~\$1.50 to ~\$1.20)
- Question: Was staying out of euro wise? Most economists say yes.

Lesson: Exchange rate flexibility helped UK adjust to Brexit shock. Euro members couldn't have devalued.

4.5 Lessons from the Euro Experience

What Worked:

- Transaction costs eliminated
- Trade increased
- Financial integration deepened
- Euro established as major reserve currency

What Didn't:

- “One size fits all” policy created imbalances
- No fiscal union to complement monetary union
- Crisis adjustment extremely painful
- Political integration insufficient

Key Insight from Impossible Trinity:

The euro represents choice of: **Exchange rate stability + Financial integration**

This requires giving up: **Monetary independence**

But without fiscal union, this creates persistent tensions and risks future crises.

Robert Mundell's Optimum Currency Area Theory:

Countries should share currency if:

1. High degree of trade integration
2. Similar business cycles
3. Labor mobility across borders (limited in EU)
4. Fiscal transfers (doesn't exist)
5. Flexible wages and prices

Europe gets mixed grades. The euro works for core countries (Germany, France, Netherlands) but is challenging for periphery.

5 Internationalization of the Chinese RMB

One of the most significant developments in international finance: China's efforts to make the renminbi (RMB, also called yuan) a major international currency.

Why It Matters:

- China is world's second-largest economy
- Largest trading nation
- Massive foreign exchange reserves
- Yet RMB plays minimal role in international finance

The Question: Can the RMB challenge the dollar's dominance?

5.1 Renminbi Valuation

5.1.1 Historical Background

1949-1994: Multiple exchange rate system

- Official rate
- Swap market rate
- Black market rate
- Complex and inefficient

1994: Unification at 8.7 yuan per dollar

1994-2005: Fixed peg at ~8.28 yuan per dollar

2005-2008: Managed appreciation

- Allowed yuan to strengthen gradually
- Rose to ~6.8 per dollar by 2008

2008-2010: Re-pegged during Global Financial Crisis

- Stability during crisis
- Fixed at ~6.83 per dollar

2010-2015: Resumed appreciation

- Reached ~6.0 per dollar by 2014
- Then depreciated as growth slowed

2015: Surprise devaluation (August)

- 3% devaluation in one day
- Markets panicked, fearing competitive devaluation war
- Capital outflows accelerated

2016-Present: Managed float

- PBOC manages rate vs. basket of currencies
- Allows more flexibility but intervenes heavily
- Currently ~7.2 yuan per dollar (early 2024)

5.1.2 The Currency Debate

Is the RMB Undervalued?

Those who say YES:

- China runs persistent trade surpluses
- Large current account surplus historically
- Massive reserve accumulation
- Intervention to prevent appreciation

Those who say NO:

- Labor costs rising rapidly
- Productivity catching up
- Current account surplus has declined
- Some years actually had capital outflows

Reality: Valuation debates are notoriously difficult. Most economists think RMB was significantly undervalued in 2000s, less clear today.

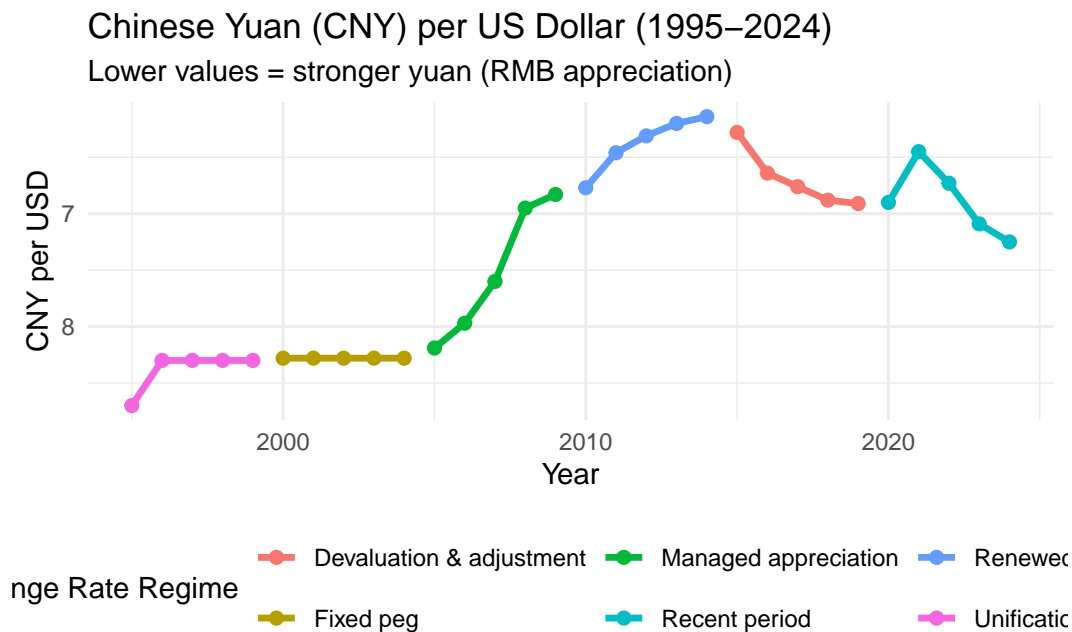
```
# CNY/USD historical pattern (simplified)
# Note: These are approximate values for illustration

rmb_data <- data.frame(
  Year = seq(1995, 2024, by = 1),
  Rate = c(
    8.7, 8.3, 8.3, 8.3, 8.3, # 1995-1999: Post-unification adjustment
    8.28, 8.28, 8.28, 8.28, 8.28, # 2000-2004: Fixed peg
    8.19, 7.97, 7.60, 6.95, 6.83, # 2005-2009: Appreciation then re-peg
    6.77, 6.46, 6.31, 6.20, 6.14, # 2010-2014: Resumed appreciation
    6.28, 6.64, 6.76, 6.88, 6.91, # 2015-2019: Devaluation and stability
    6.90, 6.45, 6.73, 7.09, 7.25 # 2020-2024: COVID and current
  ),
  Regime = c(
    rep("Unification adjustment", 5),
    rep("Fixed peg", 5),
    rep("Managed appreciation", 5),
    rep("Renewed appreciation", 5),
    rep("Devaluation & adjustment", 5),
    rep("Recent period", 5)
  )
)

library(ggplot2)

# Create plot
ggplot(rmb_data, aes(x = Year, y = Rate, color = Regime)) +
  geom_line(size = 1.2) +
```

```
geom_point(size = 2) +
scale_y_continuous(trans = "reverse") + # Reverse so up = RMB appreciation
labs(title = "Chinese Yuan (CNY) per US Dollar (1995–2024)",
      subtitle = "Lower values = stronger yuan (RMB appreciation)",
      x = "Year",
      y = "CNY per USD",
      color = "Exchange Rate Regime") +
theme_minimal() +
theme(legend.position = "bottom")
```



```
# Key events annotations
key_events <- data.frame(
  Year = c(1994, 2005, 2008, 2015, 2020),
  Rate = c(8.7, 8.19, 6.83, 6.28, 6.90),
  Event = c("Unification", "End of peg", "GFC re-peg", "Surprise\ndevaluation", "COVID")
)

# Would add geom_text for events but keeping it simple
```

5.2 Two-Market Currency Development

China has developed a unique **two-market system** for the RMB:

5.2.1 CNY (Onshore Yuan)

Location: Mainland China

Characteristics:

- Traded only in mainland China
- Tightly controlled by PBOC
- Capital controls prevent free movement
- Official rate set by PBOC daily
- Limited trading band (currently $\pm 2\%$ from fix)
- Must use for all domestic transactions

Access: Foreign companies operating in China use CNY

5.2.2 CNH (Offshore Yuan)

Location: Hong Kong (primarily), also Singapore, London, others

Characteristics:

- Freely tradable
- Market-determined rate
- No capital controls
- Can differ from onshore rate
- Used for international transactions
- Growing pool of offshore yuan liquidity

Access: International investors and companies use CNH

5.2.3 Why Two Markets?**Capital Controls:**

- China wants to control capital flows
- Prevent destabilizing inflows/outflows
- Maintain monetary policy independence
- But also wants RMB internationalization

Solution:

- Keep domestic market controlled (CNY)
- Create offshore market for international use (CNH)
- Gradually allow more connections

The Spread: CNY and CNH rates usually differ slightly:

```
# Simulated CNY vs CNH rates
# Typically CNH is more volatile and can differ from CNY

set.seed(123)
days <- 1:252 # One year
cny_rate <- 6.50 + cumsum(rnorm(252, mean = 0, sd = 0.002))
```

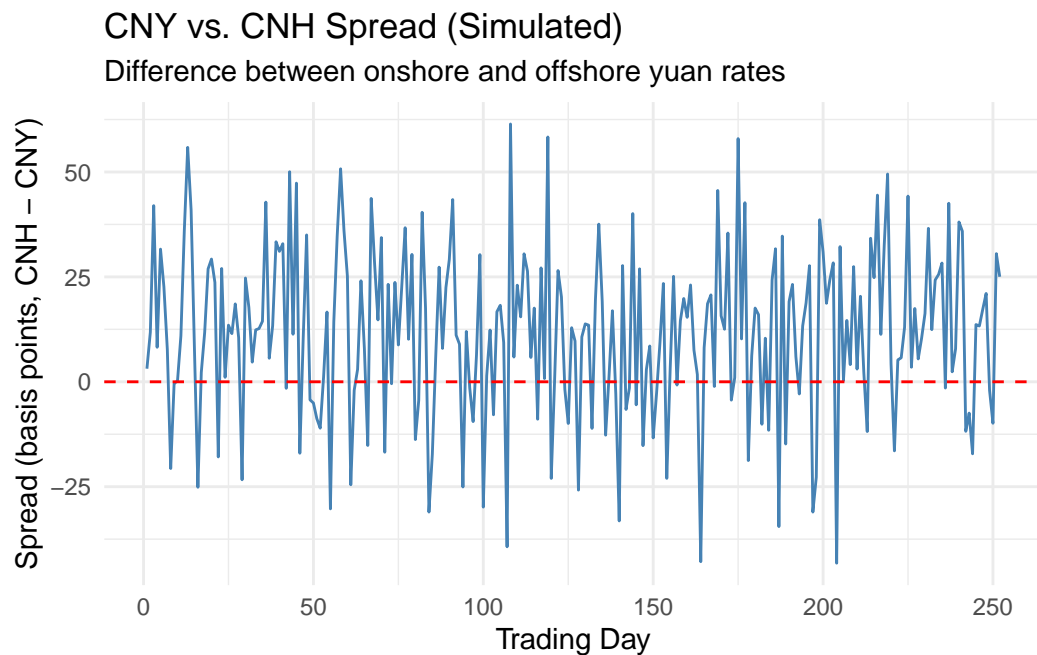
```

cnh_rate <- cny_rate + rnorm(252, mean = 0.01, sd = 0.02) # CNH slightly different

spread_data <- data.frame(
  Day = days,
  CNY = cny_rate,
  CNH = cnh_rate,
  Spread = (cnh_rate - cny_rate) * 1000 # In basis points
)

# Plot the spread
ggplot(spread_data, aes(x = Day, y = Spread)) +
  geom_line(color = "steelblue") +
  geom_hline(yintercept = 0, linetype = "dashed", color = "red") +
  labs(title = "CNY vs. CNH Spread (Simulated)",
       subtitle = "Difference between onshore and offshore yuan rates",
       x = "Trading Day",
       y = "Spread (basis points, CNH - CNY)") +
  theme_minimal()

```



```
cat("Average absolute spread:", round(mean(abs(spread_data$Spread)), 1), "basis points\n")
```

Average absolute spread: 18.9 basis points

```
cat("Maximum spread:", round(max(abs(spread_data$Spread)), 1), "basis points\n")
```

Maximum spread: 61.4 basis points

During crises, the spread can widen significantly as offshore yuan trades freely while onshore yuan is controlled.

5.3 Internationalization: Theoretical Principles and Practical Concerns

5.3.1 The Three Degrees of Currency Internationalization

A currency becomes international through three stages:

5.3.1.1 First Degree: Trade Settlement

Basic Use: Denominating and settling international trade transactions

Current Status - RMB:

- China has signed **bilateral swap agreements** with 40+ countries
- Many countries can settle trade in RMB
- Growing but still limited use

Data (2019 IMF Study):

- 93% of China's imports still denominated in USD
- 95% of China's exports denominated in USD
- RMB trade settlement only 2-5%

Why So Low?

- Network effects - everyone uses dollar
- Dollar invoicing reduces transaction costs
- Trading partners prefer dollars
- Limited RMB liquidity outside China

5.3.1.2 Second Degree: Financial Transactions

Advanced Use: International bond issuance, bank deposits, loans

Current Status - RMB:

- "Dim sum bonds" - RMB bonds issued in Hong Kong
- Growing RMB bond market
- Some international reserves held in RMB
- Still very small vs. dollar, euro

Obstacles:

- Capital controls limit RMB flows
- Shallow financial markets
- Legal uncertainty
- Concerns about rule of law

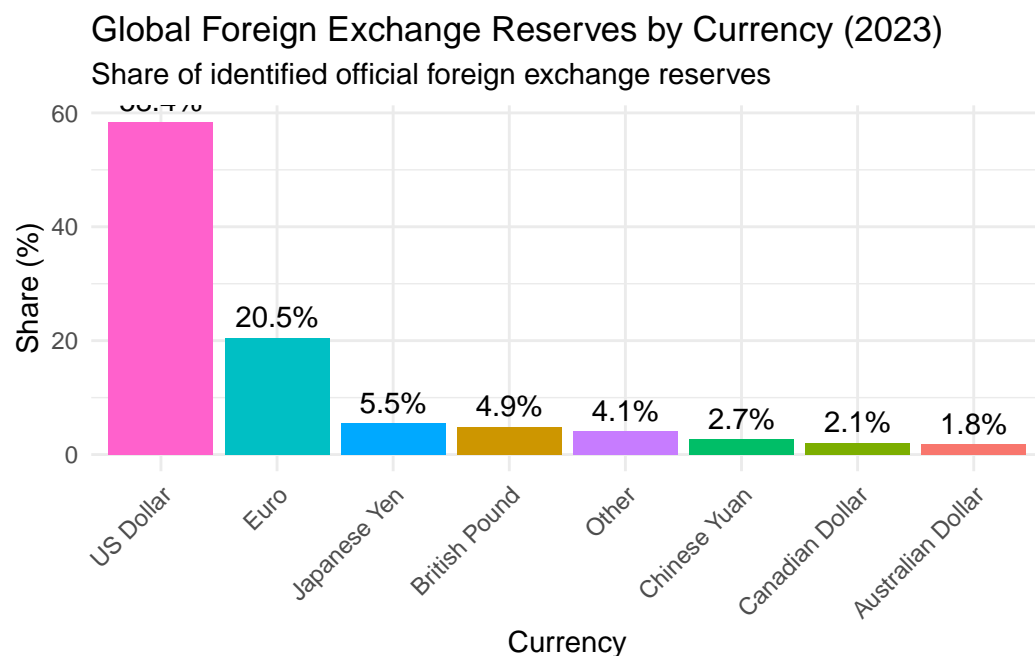
5.3.1.3 Third Degree: Reserve Currency

Ultimate Status: Central banks hold currency as official reserves

Current Status - RMB:

```
# Global reserve currency shares (Q1 2023 approximate)
reserves <- data.frame(
  Currency = c("US Dollar", "Euro", "Japanese Yen", "British Pound",
               "Chinese Yuan", "Canadian Dollar", "Australian Dollar", "Other"),
  Share = c(58.4, 20.5, 5.5, 4.9, 2.7, 2.1, 1.8, 4.1),
  Code = c("USD", "EUR", "JPY", "GBP", "CNY", "CAD", "AUD", "Other")
)

library(ggplot2)
ggplot(reserves, aes(x = reorder(Currency, -Share), y = Share, fill = Currency)) +
  geom_bar(stat = "identity") +
  labs(title = "Global Foreign Exchange Reserves by Currency (2023)",
       subtitle = "Share of identified official foreign exchange reserves",
       x = "Currency",
       y = "Share (%)") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1),
        legend.position = "none") +
  geom_text(aes(label = paste0(Share, "%")), vjust = -0.5)
```



```
cat("\nKey observations:\n")
```

Key observations:

```
cat("- Dollar dominates despite decline from 70%+ in 2000\n")
```

- Dollar dominates despite decline from 70%+ in 2000

```
cat("- Euro second but stable\n")
```

- Euro second but stable

```
cat("- RMB only 2.7% despite China's economic size\n")
```

- RMB only 2.7% despite China's economic size

```
cat("- RMB share was 0% in 2015, so growing rapidly from low base\n")
```

- RMB share was 0% in 2015, so growing rapidly from low base

The RMB's Challenge:

China is world's #2 economy, but RMB only 2.7% of reserves. Why?

1. **Capital controls** - Hard to get RMB in/out of China
2. **Shallow financial markets** - Limited RMB assets to invest in
3. **Lack of transparency** - Concerns about data quality, policy predictability
4. **Legal uncertainty** - Will China enforce contracts? Property rights?
5. **Network effects** - Dollar has 75+ years of incumbent advantage

5.3.2 What Would It Take for RMB to Become Major Reserve Currency?

Requirements:

1. **Fully convertible capital account**
 - Free flow of capital in and out
 - China is moving slowly in this direction
 - But fears destabilizing flows
2. **Deep, liquid financial markets**
 - Need large, safe RMB bond market
 - Chinese government bond market growing
 - But still heavily controlled
3. **Rule of law and property rights**

- Predictable legal system
- Protection of foreign investors
- Major concern given China's political system

4. **Stable macroeconomic policies**

- Low inflation
- Sustainable fiscal policy
- Independent central bank (PBOC not independent)

5. **Time and patience**

- Network effects are powerful
- Dollar took decades to displace pound
- Even then, required two world wars!

China's Dilemma:

- Want RMB internationalization for prestige and reduced dollar dependence
- But full capital account liberalization threatens domestic control
- Fear of capital flight and financial instability
- Political system requires capital controls

Most Likely Path: Gradual, controlled internationalization over decades, but RMB unlikely to truly rival dollar without fundamental political reforms.

5.4 The Triffin Dilemma

Remember the Triffin Dilemma from Bretton Woods? It applies to any reserve currency country.

The Dilemma for China:

If RMB becomes major reserve currency:

Problem 1: World needs RMB for reserves and transactions

- To supply RMB, China must run **current account deficits**
- But China's economic model depends on trade surpluses
- Conflict between domestic and international roles

Problem 2: If China runs persistent deficits

- Foreign holdings of RMB grow
- Eventually, questions about China's ability to maintain value
- Potential loss of confidence and currency crisis

The U.S. Experience:

- U.S. has run current account deficits for decades
- Supplies dollars to the world
- But deficits raise questions about sustainability
- "Exorbitant privilege" but also "exorbitant burden"

China's Choice:

- Continue growth model (surpluses) → RMB won't become reserve currency
- Run deficits for RMB internationalization → Sacrifice growth model
- Try to thread the needle with capital controls → Limits full internationalization

No easy answer. This explains why RMB internationalization has been slower than some predicted.

5.5 The Digital Yuan (e-CNY)

China is a global leader in Central Bank Digital Currency (CBDC):

e-CNY Project:

- Launched pilots in 2020
- Millions of users testing digital yuan
- Can use without bank account
- Programmable money (expiration dates, usage restrictions possible)

Potential International Implications:

1. Bypass SWIFT System

- Could enable transactions outside dollar system
- Reduce U.S. sanctions leverage
- Appeal to countries concerned about U.S. power

2. Better Capital Controls

- Track all transactions
- Prevent capital flight
- Maintain control while internationalizing

3. Financial Inclusion

- Reach unbanked populations in Belt & Road countries
- Leapfrog traditional banking

Concerns:

- Privacy and surveillance
- Authoritarian control
- Cybersecurity risks
- Whether other countries will adopt

Reality Check: Even with e-CNY, the fundamental requirements for reserve currency status don't change. Technology alone won't make RMB dominant without addressing capital controls, rule of law, and financial market development.

6 Emerging Markets and Regime Choices

Emerging market countries face particularly difficult choices about exchange rate regimes. Unlike developed countries with deep financial markets and strong institutions, emerging markets must deal with:

- **Volatile capital flows** (sudden stops and surges)
- **Original sin** - inability to borrow abroad in own currency
- **Currency mismatches** - debts in dollars, revenues in local currency
- **Limited credibility** - history of inflation, default, or devaluation
- **Thin financial markets** - vulnerable to manipulation
- **Political instability** - frequent policy changes

Given these challenges, what should emerging markets do?

6.1 Currency Boards

A **currency board** is the strongest form of fixed exchange rate short of full dollarization:

Key Features:

1. **Domestic currency fully backed by foreign reserves** (usually 100%+)
2. **Fixed exchange rate set by law**
3. **Automatic monetary policy** - money supply changes only with reserve flows
4. **No discretion** - central bank cannot print money or lend to government

Advantages:

- **Credibility** - Can't print money, so inflation expectations anchored
- **Eliminates currency risk** (mostly)
- **Imports credibility** of anchor currency
- **Forces fiscal discipline** - Government can't monetize debt

Disadvantages:

- **No monetary policy flexibility** - Can't fight recessions with rate cuts
- **No lender of last resort** - Banks vulnerable to runs
- **Requires massive reserves** - Expensive to maintain
- **Vulnerable to asymmetric shocks** - If anchor country doesn't face same conditions

6.1.1 Argentina (1991-2001)

Background: Argentina suffered hyperinflation in the late 1980s

- Inflation reached **3,000%+ per year**
- Multiple currencies in use
- Economy collapsed
- Political instability

The Convertibility Plan (1991):

Economy Minister Domingo Cavallo implemented currency board:

- **1 peso = 1 USD** fixed by law
- Peso fully backed by dollar reserves
- Central bank prohibited from printing pesos without matching dollar reserves

Initial Success (1991-1998):

```
# Argentina currency board results
argentina_data <- data.frame(
  Indicator = c("Inflation", "GDP growth", "FDI inflows", "Unemployment"),
  Before_1990 = c("3,000%+", "-2%", "$1B", "8%"),
  After_1995 = c("2-3%", "+4%", "$5B", "12%")
)

print(argentina_data)
```

	Indicator	Before_1990	After_1995
1	Inflation	3,000%+	2-3%
2	GDP growth	-2%	+4%
3	FDI inflows	\$1B	\$5B
4	Unemployment	8%	12%

```
cat("\nImpressive achievements:\n")
```

Impressive achievements:

```
cat("- Hyperinflation crushed\n")
```

- Hyperinflation crushed

```
cat("- Credibility restored\n")
```

- Credibility restored

```
cat("- Investment returned\n")
```

- Investment returned

```
cat("- GDP grew rapidly\n")
```

- GDP grew rapidly

The Problem: Rigid System Couldn't Adjust

Late 1990s brought challenges:

1. **Brazilian devaluation (1999)** - Main trading partner's currency fell 50%
 - Argentine exports became uncompetitive
 - But couldn't devalue due to currency board
2. **Strong dollar** - Argentina locked to appreciating dollar
 - Made exports expensive
 - Imports cheap → Trade deficit
3. **Recession begins (1998)**
 - Need monetary stimulus
 - But currency board prevented rate cuts
 - Couldn't devalue
4. **Debt problems**
 - Government borrowing in dollars
 - Recession → Tax revenues fell
 - Debt service costs rose

The Collapse (2001-2002):

- Bank runs → Government froze deposits ("Corralito")
- Social unrest → President resigned
- Multiple presidents in one month
- **Default on \$82 billion** (largest in history at time)
- **Currency board abandoned** (January 2002)
- Peso devalued to 3:1, then floated
- Economy contracted 20%

Lessons:

- Currency boards provide credibility but at high cost
- **Can't adjust to asymmetric shocks**
- Works during good times, fails in crisis
- Fiscal discipline also essential (Argentina failed here)
- Exit can be catastrophic

Argentina's Subsequent History:

- Continued economic instability
- Multiple subsequent crises

- Chronic high inflation returned
- Never regained pre-crisis prosperity
- Shows dangers of wrong regime choice

6.2 Dollarization

Full dollarization means abandoning domestic currency entirely and adopting a foreign currency (usually USD) as legal tender.

Key Features:

- No domestic currency at all
- All transactions in foreign currency
- No central bank needed (for monetary policy)
- Complete monetary policy dependence

Even More Extreme Than Currency Board:

- Can't even issue domestic currency in crisis
- No “exit” option - very hard to reverse

6.2.1 Ecuador (2000-Present)

Background: The Sucre Collapses

Late 1990s crisis:

- Oil prices fell
- El Niño disasters
- Banking crisis
- Currency crisis

The Sucre's Collapse:

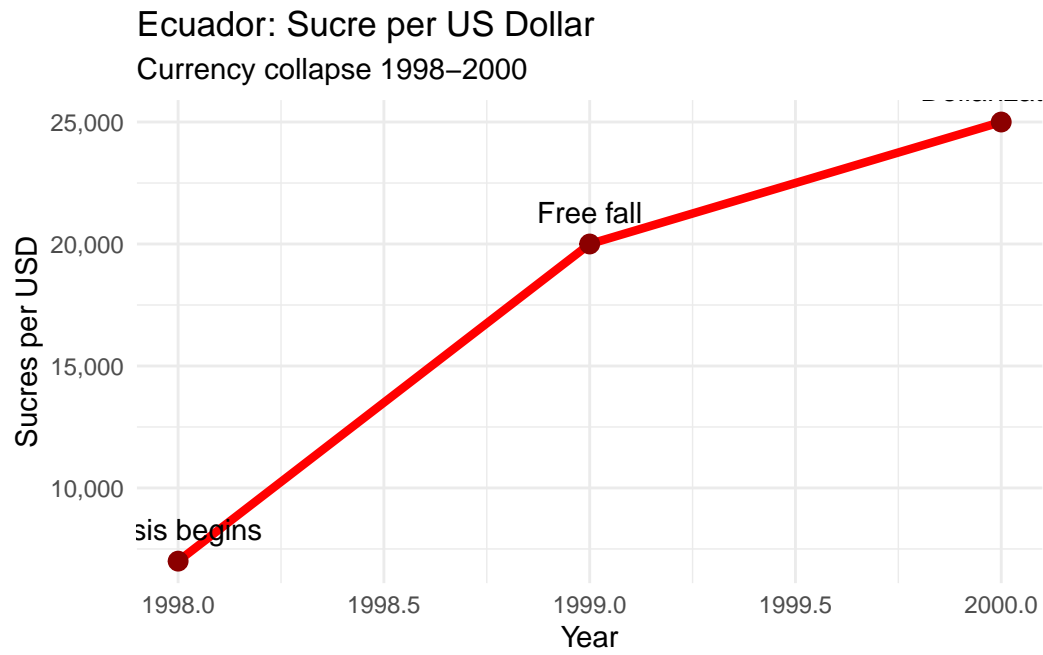
```
# Ecuador sucre depreciation (approximate)
sucre_data <- data.frame(
  Year = c(1998, 1999, 2000),
  Rate = c(7000, 20000, 25000),
  Event = c("Crisis begins", "Free fall", "Dollarization")
)

library(ggplot2)
ggplot(sucre_data, aes(x = Year, y = Rate)) +
  geom_line(color = "red", size = 1.5) +
  geom_point(size = 3, color = "darkred") +
  geom_text(aes(label = Event), vjust = -1) +
  scale_y_continuous(labels = scales::comma) +
  labs(title = "Ecuador: Sucre per US Dollar",
```

```

    subtitle = "Currency collapse 1998-2000",
    x = "Year",
    y = "Sucres per USD") +
    theme_minimal()

```



```

cat("\n\nThe collapse:\n")

```

The collapse:

```

cat("- 1998: 7,000 sucres/dollar\n")

```

- 1998: 7,000 sucres/dollar

```

cat("- 1999: 20,000 sucres/dollar (down 65%)\n")

```

- 1999: 20,000 sucres/dollar (down 65%)

```

cat("- 2000: 25,000 sucres/dollar (down 72% from 1998)\n")

```

- 2000: 25,000 sucres/dollar (down 72% from 1998)

```
cat("- Annual inflation: 60%+\n")
```

- Annual inflation: 60%+

Dollarization Decision (January 2000):

President Jamil Mahuad announced:

- Sucre would be replaced by USD
- Fixed rate: 25,000 sucres = \$1
- Conversion over several months
- USD became sole legal tender

Results (2000-Present):

Positives:

- **Inflation controlled** - Fell from 60% to ~2-3% annually
- **Exchange rate stability** - By definition!
- **Financial stability improved**
- **Credibility restored** somewhat

Negatives:

- **No monetary policy** - Can't respond to local shocks
- **No lender of last resort** - Vulnerable to bank runs
- **Adjustment through recession** - Economic downturns last longer
- **Loss of seigniorage** - Government can't print money for revenue
- **Tied to U.S. economy** - Fed policy may not fit Ecuador's needs

Example: 2008-2009 Global Financial Crisis

- U.S. needed low interest rates
- Ecuador needed different policy (commodity exporter)
- But Ecuador had no choice - used U.S. rates
- Recession deeper and longer than might have been with own currency

Has Dollarization “Worked”?

Depends on Criteria:

- **Inflation:** Success - Inflation controlled
- **Growth:** ± Mixed - Moderate growth, but volatile
- **Financial stability:** Improved - No currency crises
- **Flexibility:** None - Can't adjust to shocks

Would Ecuador Reverse It?

Very difficult politically:

- Population doesn't trust government with currency

- Businesses adapted to dollars
- Would need to rebuild entire monetary system
- Risk of another crisis in transition

Dollarization is essentially irreversible once implemented.

6.2.2 El Salvador (2001-Present, plus Bitcoin 2021)

Background:

El Salvador dollarized in 2001 after civil war and currency instability.

Similar Story to Ecuador:

- Adopt dollar for stability
- Lose monetary policy flexibility
- Tied to Fed's decisions

The Bitcoin Experiment (2021):

In June 2021, El Salvador became first country to adopt **Bitcoin as legal tender** alongside the dollar!

President Nayib Bukele's Rationale:

- Reduce remittance costs (many Salvadorans work in U.S.)
- Financial inclusion (40% unbanked)
- Attract crypto investment
- Technological leadership

Implementation:

- Government app "Chivo Wallet"
- Businesses required to accept Bitcoin
- Government holds Bitcoin reserves
- \$30 in Bitcoin given to citizens who sign up

Results (2021-2024):

Problems:

- **Extreme volatility** - Bitcoin fell from \$69,000 to \$16,000
- **Government losses** - Bought Bitcoin at high prices
- **Low adoption** - Most businesses and citizens avoid using it
- **IMF criticism** - Concerns about fiscal risks
- **Technical issues** - Wallet malfunctions, poor user experience

Bitcoin Holdings:

- Government bought ~2,700 BTC
- Average price ~\$43,000
- Currently underwater on investment

- Continues to buy more (“buying the dip”)

The Irony:

El Salvador dollarized to gain monetary stability. Adding Bitcoin reintroduced massive monetary instability!

Lesson: Gimmicks don’t solve fundamental economic problems. Sound institutions, fiscal discipline, and good governance matter more than currency choice.

6.2.3 Zimbabwe (2009-2019, 2020)

Zimbabwe’s experience is a cautionary tale about **when dollarization is forced by hyperinflation**.

Background: Hyperinflation

Robert Mugabe’s policies destroyed Zimbabwe’s economy:

- Land seizures destroyed agriculture
- Money printing to finance government
- Hyperinflation

How Bad Was It?

```
# Zimbabwe hyperinflation was so extreme it broke normal scales
# Peak estimate: 89.7 sextillion percent (2008)
```

```
cat("Zimbabwe Hyperinflation:\n")
```

Zimbabwe Hyperinflation:

```
cat("=====\n\n")
```

=====

```
cat("July 2008: 231,000,000% annual inflation\n")
```

July 2008: 231,000,000% annual inflation

```
cat("November 2008: 89.7 SEXTILLION percent (unofficial estimate)\n")
```

November 2008: 89.7 SEXTILLION percent (unofficial estimate)

```
cat("    That's: 89,700,000,000,000,000,000,000%\n\n")
```

That's: 89,700,000,000,000,000,000,000%

```
cat("Currency denominations issued:\n")
```

Currency denominations issued:

```
cat("- $1 (original)\n")
```

- \$1 (original)

```
cat("- $100,000\n")
```

- \$100,000

```
cat("- $1,000,000\n")
```

- \$1,000,000

```
cat("- $100,000,000\n")
```

- \$100,000,000

```
cat("- $100 TRILLION (largest ever issued)\n\n")
```

- \$100 TRILLION (largest ever issued)

```
cat("Prices doubled every: 24.7 hours (at peak)\n\n")
```

Prices doubled every: 24.7 hours (at peak)

```
cat("Example: Loaf of bread\n")
```

Example: Loaf of bread

```
cat("- 2000: Z$0.55\n")
```

- 2000: Z\$0.55

```
cat("- 2008: Z$1.6 TRILLION\n")
```

- 2008: Z\$1.6 TRILLION

De Facto Dollarization (2008-2009):

- Zimbabwean dollar became worthless
- Population spontaneously adopted foreign currencies
- USD, South African rand, Botswana pula, others used
- Multiple currencies circulated

Official Multi-Currency System (2009-2020):

Government formally abandoned Zimbabwe dollar (April 2009):

- USD became primary currency
- Also: Euro, Pound, Rand, Pula, Yuan, Yen, Indian Rupee, Australian dollar
- **Nine official currencies!**

Results:

- Inflation crushed immediately
- Economic stability improved
- But growth remained weak
- Chronic cash shortages (couldn't print money)

Attempted Return (2019-2020):

Government tried to reintroduce Zimbabwe dollar:

- February 2019: "RTGS dollar" introduced
- June 2019: Zimbabwe dollar returns as sole legal tender
- Result: **Inflation immediately returned**
- By 2020: Triple-digit inflation again
- **USD banned but used on black market**

Lesson: Currency is not just symbolic. Without fiscal discipline and sound institutions, any currency will fail. Zimbabwe's problem wasn't the currency choice - it was governance.

Current Status (2024): Officially Zimbabwe dollar, but USD widely used informally. Government tolerance of dollar use varies.

6.3 Currency Regime Choices for Emerging Markets

Given these experiences, what should emerging market countries choose?

6.3.1 The “Fear of Floating” Phenomenon

Many emerging markets officially float but actually intervene heavily. Why?

Reasons for Fear of Floating:

1. **Currency mismatches** - Debts in foreign currency, revenues in domestic
 - Depreciation increases debt burden
 - Can cause bankruptcies
2. **Pass-through to inflation** - Currency depreciation → Higher import prices
 - Weak institutions can't control inflation
 - Floating = Inflation risk
3. **Loss of competitiveness** - If currency appreciates too much
 - Exports become expensive
 - Jobs lost
4. **Political pressure** - Exchange rate very visible
 - Government blamed for depreciation
 - Easier to intervene than explain

Result: “Fear of floating” - Countries that claim to float actually manage rates heavily.

6.3.2 The “Fear of Pegging” Phenomenon

But emerging markets also fear hard pegs. Why?

Reasons for Fear of Pegging:

1. **Speculative attacks** - Fixed rates are targets
 - Especially with capital mobility
 - Argentina and Asian Crisis examples
2. **Loss of flexibility** - Can't respond to shocks
 - Asymmetric shocks common for emerging markets
 - Commodity price changes
 - Capital flow reversals
3. **Requires massive reserves** - Expensive and risky
 - Reserves could be invested in development
 - May not be enough anyway

Result: Most emerging markets use soft pegs or managed floats. Try to get benefits of both systems but vulnerable to crises.

6.3.3 What Works Best?

Recent Research Suggests:

1. **No universal answer** - Depends on country characteristics
2. **Institutions matter more than regime** - Countries with strong institutions can make any regime work
3. **Capital controls may help** - Allow more policy space
 - But can be evaded
 - May deter investment
4. **Flexible inflation targeting** - For countries that can float
 - Requires credible central bank
 - Clear communication
 - Transparency
5. **Hard pegs or float, avoid soft pegs** - “Corner solutions”
 - But reality: Most countries still use soft pegs!

6.3.4 Country-Specific Factors

Small, open economies: May benefit from hard peg/dollarization

- Large share of trade in one currency
- Limited ability to conduct independent policy anyway
- Example: Small Caribbean islands

Commodity exporters: Need flexibility

- Terms of trade shocks common
- Floating rate helps adjust
- Example: Chile, Australia

Manufacturing exporters: May prefer stability

- Exchange rate certainty helps plan production
- But need competitiveness
- Example: China’s managed regime

Countries with weak institutions:

- Hard peg provides discipline
- But also removes flexibility
- Tradeoff: Credibility vs. flexibility

6.4 Reserve Currencies and What Lies Ahead

We've discussed the Chinese RMB's internationalization attempts. What about the broader picture?

6.4.1 Current Distribution of Reserve Holdings

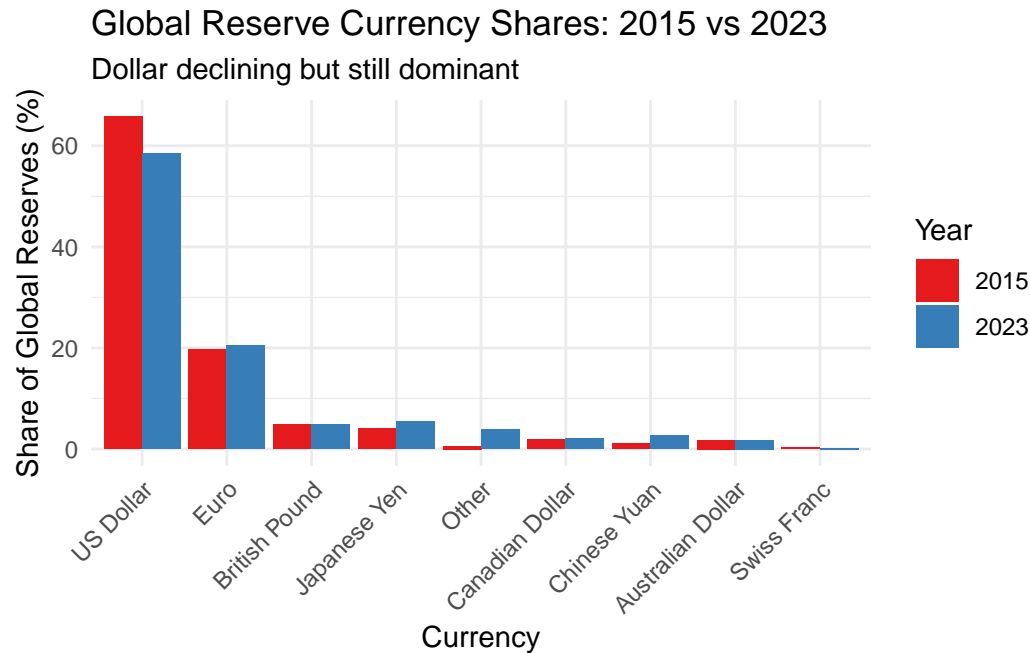
As of 2023:

```
# More detailed reserve currency data
reserve_detail <- data.frame(
  Currency = c("US Dollar", "Euro", "Japanese Yen", "British Pound",
               "Chinese Yuan", "Canadian Dollar", "Australian Dollar",
               "Swiss Franc", "Other"),
  Share_2023 = c(58.4, 20.5, 5.5, 4.9, 2.7, 2.1, 1.8, 0.2, 3.9),
  Share_2015 = c(65.8, 19.7, 4.0, 4.8, 1.1, 1.9, 1.8, 0.3, 0.6),
  Change = c(-7.4, 0.8, 1.5, 0.1, 1.6, 0.2, 0, -0.1, 3.3)
)

library(ggplot2)
library(dplyr)

# Create comparison plot
reserve_long <- reserve_detail %>%
  select(Currency, Share_2015, Share_2023) %>%
  tidyr::pivot_longer(cols = c(Share_2015, Share_2023),
                     names_to = "Year",
                     values_to = "Share") %>%
  mutate(Year = ifelse(Year == "Share_2015", "2015", "2023"))

ggplot(reserve_long, aes(x = reorder(Currency, -Share), y = Share, fill = Year)) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Global Reserve Currency Shares: 2015 vs 2023",
       subtitle = "Dollar declining but still dominant",
       x = "Currency",
       y = "Share of Global Reserves (%)") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1)) +
  scale_fill_brewer(palette = "Set1")
```



```
# Print change data
cat("\nChanges in reserve shares (2015-2023):\n")
```

Changes in reserve shares (2015-2023):

```
print(reserve_detail[, c("Currency", "Change")], row.names = FALSE)
```

Currency	Change
US Dollar	-7.4
Euro	0.8
Japanese Yen	1.5
British Pound	0.1
Chinese Yuan	1.6
Canadian Dollar	0.2
Australian Dollar	0.0
Swiss Franc	-0.1
Other	3.3

Key Observations:

- Dollar share declining but still dominant (~58%)
- Euro stable around 20%
- RMB growing rapidly from low base (1.1% → 2.7%)
- Yen increased share
- “Other” growing - diversification trend

6.4.2 Factors Supporting Dollar Dominance

Why does the dollar remain so dominant despite U.S. challenges?

1. Network Effects (Most Important)

- Everyone uses dollars → Easier to keep using dollars
- Deep, liquid markets
- Global invoicing in dollars
- Most currencies managed vs. dollar

2. Financial Market Depth

- U.S. Treasury market: \$24+ trillion
- Most liquid market in the world
- Always can buy or sell
- Safe haven in crises

3. Rule of Law and Property Rights

- U.S. legal system protects investors
- Independent Fed (mostly)
- Transparent policymaking
- Credible commitment not to expropriate

4. Military and Political Power

- U.S. guarantees global security (for allies)
- SWIFT system (dollar-based)
- Sanctions power
- Global presence

5. Inertia and Path Dependence

- Took decades to displace pound sterling (and required two world wars!)
- Changing reserve currency is costly
- International monetary systems change slowly

6.4.3 Challenges to Dollar Dominance

1. Persistent U.S. Current Account Deficits

- Triffin Dilemma strikes again
- Sustainable? Unclear
- Debtor nation status

2. Political Dysfunction

- Debt ceiling crises
- Government shutdowns
- Polarization

- Questions about governance

3. Weaponization of Dollar

- Sanctions on Russia, Iran, others
- Other countries seek alternatives
- BRICS currency discussions
- Desire to avoid dependence

4. Rise of China

- World's #2 economy
- Largest trading nation
- Growing RMB usage
- Digital yuan

5. Digital Currencies

- Central Bank Digital Currencies (CBDCs)
- Private cryptocurrencies
- Could reduce need for reserve currencies
- Technology-driven change

6.4.4 Scenarios for the Future

Scenario 1: Dollar Continues Dominance (Most Likely, Near Term)

- Network effects too strong
- No credible alternative
- Euro limited by eurozone problems
- RMB limited by capital controls
- Next 5-10 years: Dollar 50-55%, Euro 20-25%, RMB 5-8%

Scenario 2: Multi-Polar System (Medium Term)

- Gradual diversification
- Dollar declines to 40-45%
- RMB rises to 10-15%
- Regional currency blocks
- Next 10-20 years: More balanced distribution

Scenario 3: Digital Revolution (Long Term)

- CBDCs change the game
- Reduced need for reserves
- Multiple digital currencies coexist
- Private cryptocurrencies play role
- 20-30+ years: Unpredictable

Scenario 4: New Bretton Woods

- Major crisis forces reform
- Negotiated new system
- SDR or new reserve asset
- Requires crisis + political will
- Low probability but possible

6.4.5 What Would It Take for Major Change?

Historical Precedent: Pound to Dollar

- Took 50+ years (1900s-1950s)
- Required two world wars
- UK economic decline
- U.S. rise to superpower
- Even then, gradual transition

For RMB to Challenge Dollar:

1. **Capital account liberalization** - Allow free flows
2. **Deep financial markets** - Alternatives to Treasuries
3. **Rule of law** - Independent courts, property rights
4. **Time** - Decades, not years
5. **U.S. mistake** - Major crisis or policy failure

Most Likely Reality: Gradual diversification away from dollar, but no single replacement. Multi-polar system with dollar still first among equals.

6.4.6 The SDR Alternative

Could the SDR become the global reserve currency?

Arguments For:

- Already exists
- Basket of major currencies
- Managed by IMF (international institution)
- No single country dominance

Arguments Against:

- Not actual currency - Just accounting unit
- Limited supply
- No private market
- Political barriers to expansion

Reality: SDR unlikely to become true reserve currency without major reform of international monetary system. Would require agreement among major powers (U.S., EU, China). Politically difficult.

6.4.7 Practical Implications

For Businesses:

- Dollar likely remains dominant for trade and finance
- But diversification prudent
- Monitor FX risks
- Consider multi-currency strategies

For Countries:

- Reserve diversification continuing
- But dollar still essential
- Bilateral currency agreements growing (China)
- Digital currencies worth exploring

For Students/Future Leaders:

- International monetary system will continue evolving
- Next 20 years may see significant changes
- Digital technology will play role
- But fundamental economics still apply

Key Insight: Currency dominance reflects economic, political, and institutional strength. The dollar won't be replaced unless U.S. position fundamentally weakens OR a superior alternative emerges with better institutions. Neither seems imminent, but both are possible over longer time horizons.

7 Key Takeaways and Connections

7.1 Main Lessons from Chapter 2

1. The International Monetary System Has Always Evolved

- Gold Standard → Bretton Woods → Floating Rates → Current Eclectic
- No perfect system exists
- Each era reflects its time's economic and political realities

2. The Impossible Trinity Constrains All Countries

- Can't have: Fixed rate + Capital mobility + Monetary independence
- Countries must choose two of three
- Explains most currency regime choices and crises

3. Fixed vs. Floating: Both Have Tradeoffs

- Fixed: Stability but inflexibility
- Floating: Flexibility but volatility

- Choice depends on country characteristics and institutions

4. **Institutions Matter More Than Regime Choice**

- Good institutions can make any regime work
- Bad institutions doom any regime
- Examples: Zimbabwe (bad), Hong Kong (good)

5. **Reserve Currencies Reflect Power and Trust**

- Dollar dominates due to network effects, deep markets, rule of law
- Changes slowly - requires economic power + institutions + time
- RMB faces long road despite China's size

6. **Emerging Markets Face Especially Difficult Choices**

- Volatile capital flows
- Currency mismatches
- Limited credibility
- No easy answers

7.2 Looking Ahead to Chapter 3

Next class, we'll study the **Balance of Payments** - how countries track international transactions. This connects directly to exchange rates:

- Current account surpluses/deficits affect currency values
- Capital flows drive exchange rate movements
- Understanding BOP helps explain currency crises

7.3 Questions for Reflection

1. If you were advising a small emerging market country, what exchange rate regime would you recommend? Why?
2. Will the dollar still be the dominant reserve currency in 2050? Why or why not?
3. Was the euro a mistake? Should it be preserved?
4. Should the U.S. be concerned about China's RMB internationalization efforts?
5. What role should capital controls play in the international monetary system?

7.4 Further Resources

Books:

- "Lords of Finance" by Liaquat Ahamed - History of interwar monetary system
- "The Battle of Bretton Woods" by Benn Steil - Creation of post-war system
- "Currency Wars" by James Rickards - Modern currency competition

Websites:

- IMF Annual Report on Exchange Arrangements - Current regime classifications
- Bank for International Settlements - Data on FX markets
- Federal Reserve - Data on dollar's international role

Current Events to Follow:

- China's capital account liberalization
- Digital currency developments
- Euro area integration
- Emerging market currency crises

This concludes our coverage of Chapter 2. Come to next class prepared to discuss the Balance of Payments and bring a current news article about a country's trade balance.