Topic 2:
Exchange Rate Arrangements and **Covered Interest Parity**

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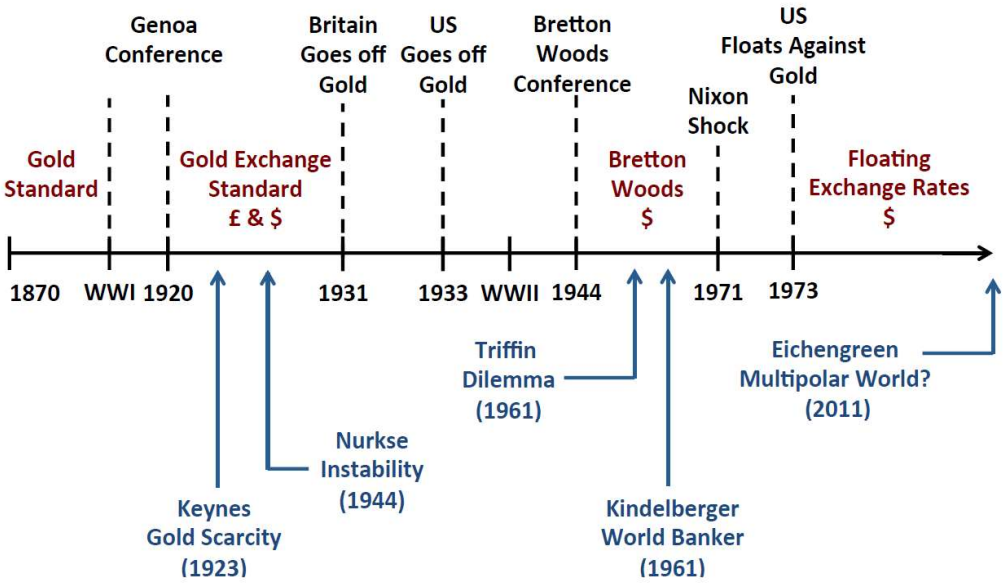
Amir Kermani 9/8/2021

A Short History of the international Monetary System



Source: Farhi Maggiori (2018)

Interwar Period: 1915 to 1944

World War I ended the classical gold standard in August 1914

Major countries followed **sterilization of gold** policy

Countries widely used "predatory" depreciations of their currencies as a means of gaining advantages in the world export market

- Period characterized by economic nationalism, halfhearted attempts and failure to restore the gold standard, economic and political instabilities, bank failures, and panicky flights of capital across borders

Bretton Woods System: 1945 to 1972

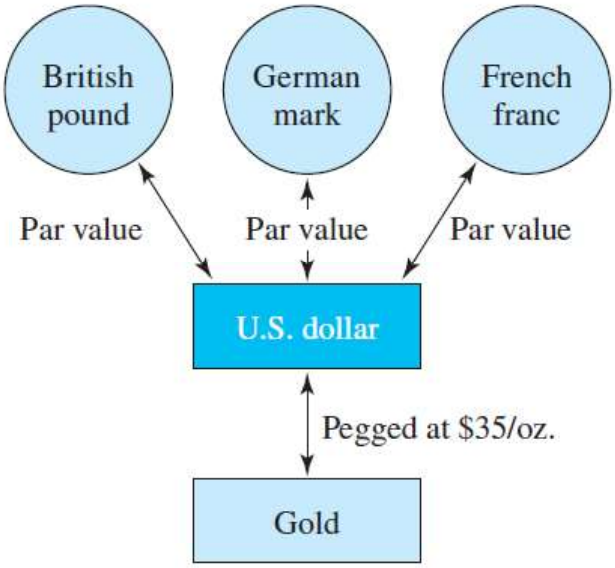
Named for a July 1944 meeting of 44 nations at Bretton Woods, New Hampshire

- Purpose of meeting was to discuss and design the postwar international monetary system (that is, **Bretton Woods system**)
- Described as a dollar-based **gold-exchange standard**

Triffin paradox explains the collapse of this system in the early 1970s

- Reserve-currency country should run a balance of payments deficit, but this can decrease confidence in the reserve currency and lead to the downfall of the system

The Design of the Gold-Exchange System



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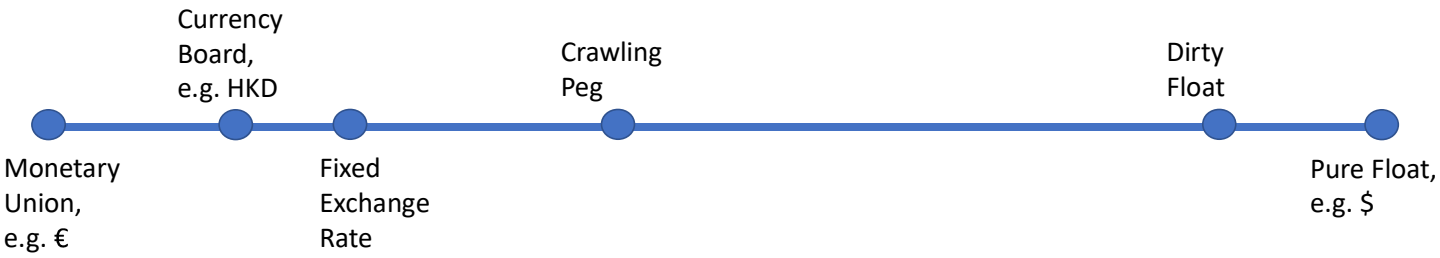
The Flexible Exchange Rate Regime: 1973 to Present

Flexible exchange rate regime was ratified in January 1976 when the IMF members met in Jamaica and agreed to a new set of rules, referred to as the **Jamaica Agreement**:

1. Flexible exchange rates were declared acceptable to the IMF members; central banks could intervene in exchange markets to iron out unwarranted volatilities
2. Gold was officially abandoned (that is, demonetized) as an international reserve asset
3. Non-oil-exporting countries and less-developed countries were given greater access to IMF funds

Exchange rate regimes



Exchange rate regimes

- **Monetary union**: An intergovernmental agreement involving the sharing of a currency.
- **Currency board:** A monetary authority which maintains a pegged fixed exchange rate. The central bank is not independent of the monetary authority, meaning it responds shocks to maintain the peg.
- **Fixed exchange rate:** Currency value is fixed or pegged against the value of another currency, basket of currencies, or commodity (e.g. gold).
- **Crawling peg:** Exchange rate that gradually depreciates or appreciates to move with inflation often upon announcement.
- **Dirty float:** Floating exchange rate where the central bank periodically intervenes to influence it.
- **Pure float:** A flexible exchange rate determined by market forces of supply and demand of a currency against foreign currencies.

Exchange rate regimes

- What are the reasons for pegging to a currency?
  - It becomes a nominal anchor.
  - If country has high inflation, pegging currency slows down inflation.
    - Shock/reset market expectations.
    - Then investors gain more confidence to invest, etc.
    - **But as long as you can keep the peg.**
      - **Indeed it can worsen the shock if you don't have enough reserves.**
  - Bretton-Woods example:
    - Worried about volatility from floating exchange rates.

Impossible trinity

- You can't have all three of these at the same time:

1) Fixed exchange rate
2) Free/flexible monetary policy
3) Free capital flow (no controls)

Impossible trinity

- Consider Hong Kong.
  - Has 1) and 3), but monetary policy directly tied to 1) so does not have 2).
- US, Europe, and others.
  - Has 2) and 3), but not 1).
- China and previously Malaysia.
  - Has 1) and 2), but not 3).
- What happens if you have all three?

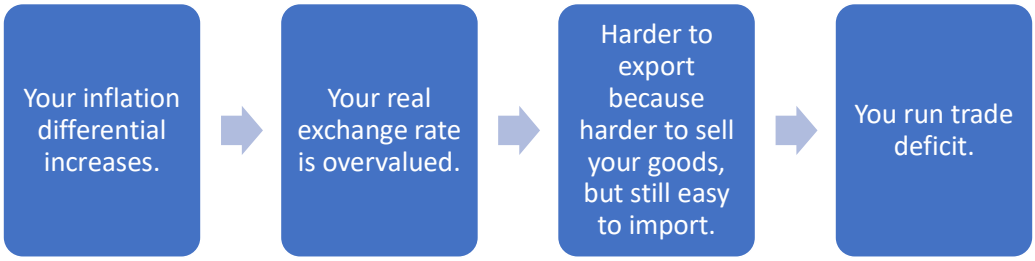
1) Fixed exchange rate
2) Free/flexible monetary policy
3) Free capital flow (no controls)

Currency crisis

- Signals of a currency crisis.
  - Real exchange rate.
  - Long, consistent trade deficits signal a looming currency crisis.
    - Current account and capital account have to balance.
  - Borrowing from foreign entities with short maturities.
  - Borrowing to finance public budget deficits.
- However, despite hundreds of examples of currency crises, models haven't been good at predicting the timing.

Currency crisis

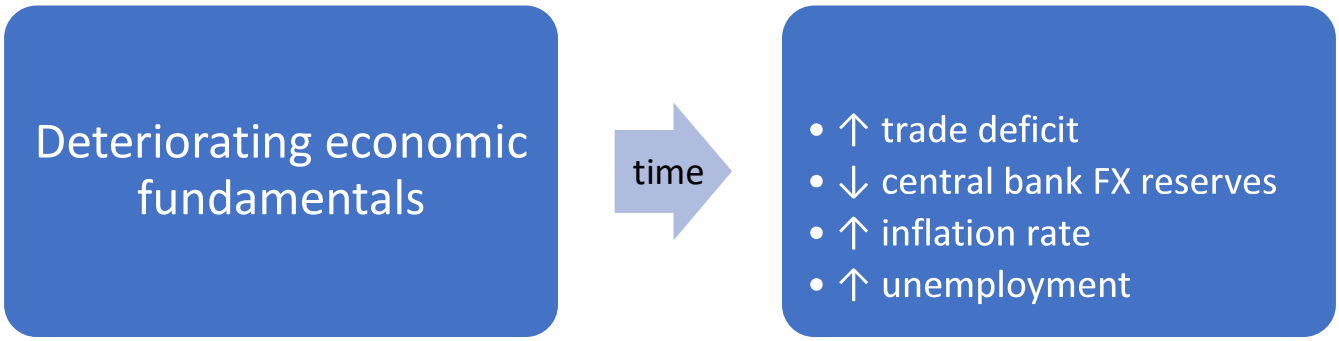
- Imagine a rubber band signifies your country with a pegged fixed exchange rate.



Currency crisis

- Rubber band stretches.
- If the inflation differential keeps increasing, this keeps occurring.
- Cycle continues until it bursts, i.e. a devaluation.
- It is hard to know when it will burst, but everyone knows it will occur.

Modeling of pegged exchange rates: Generation 1 vs. 2 models



Currency Crises

Three major currency crises revealed the fragility of the international monetary system (IMS)

- Mexican peso crisis (1994 to 1995)
- Asian currency crisis (1997 to 1998)
- Argentine peso crisis (2002)

The Mexican Peso Crisis[1]

On December 20, 1994, the Mexican government announced a plan to devalue the peso against the dollar by 14 percent

This decision caused pesos, as well as Mexican stocks and bonds, to be sold rapidly

- By early January 1995, the peso had fallen against the U.S. dollar by as much as 40 percent, forcing the Mexican government to float the peso

Peso crisis rapidly spilled over to other Latin American and Asian financial markets

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U.S. Dollar versus Mexican Peso Exchange Rate (November 1, 1994 to January 31, 1995)

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The Mexican Peso Crisis[2]

Mexican Peso crisis is unique in that it represents the first serious international financial crisis touched off by cross-border flight of portfolio capital

Two lessons emerge:

- It is essential to have a multinational safety net in place to safeguard the world financial system from such crises
- Mexico excessively depended on foreign portfolio capital to finance economic development when a higher priority should have been placed on saving domestically

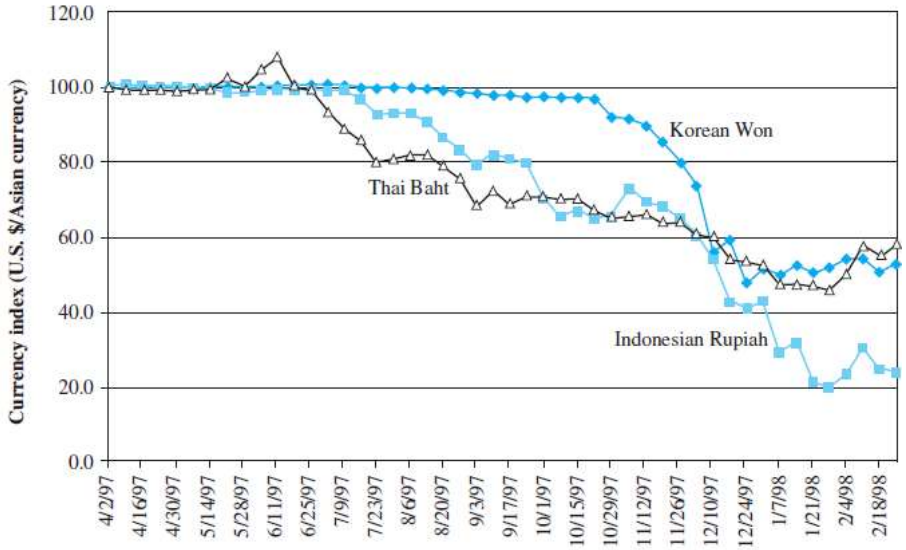
The Asian Currency Crisis

Far more serious than the crises of the EMS and Mexican peso in terms of the extent of the contagion and the severity of the resultant economic and social costs

- Many firms with foreign currency bonds were forced into bankruptcy

Led to an unprecedentedly deep, widespread, and long-lasting recession in East Asia, a region that has enjoyed the most rapidly growing economy in the world over the last few decades

Asian Currency Crisis



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Origins of the Asian Currency Crisis[1]

As capital markets were opened, large inflows of private capital resulted in a credit boom in the Asian countries

Fixed or stable exchange rates also encouraged unhedged financial transactions and excessive risk-taking by both borrowers and lenders

The real exchange rate rose, which led to a slowdown in export growth

Also, Japan's long-lasting recession (and yen depreciation) hurt neighboring countries

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Origins of the Asian Currency Crisis 2

If the Asian currencies had been allowed to depreciate in real terms (which was not possible due to the fixed exchange rates), the sudden and catastrophic changes in exchange rates observed in 1997 might have been avoided

Eventually, something had to give—it was the Thai bhat

- Sudden collapse of the bhat touched off a panicky flight of capital from other Asian countries

Lessons from the Asian Currency Crisis

A fixed, but adjustable, exchange rate is problematic in the face of integrated international financial markets

- Invites speculative attack at the time of financial vulnerability
- **Incompatible trinity** suggests it is very difficult, if not impossible, to have all three conditions:
  1. A fixed exchange rate
  2. Free international flows of capital
  3. Independent monetary policy

The Argentine Peso Crisis 1

In February 1991, the Argentine government passed the Convertibility Law, linking the peso to the U.S. dollar
at parity

The initial economic effects were positive:

- Argentina's chronic inflation was curtailed dramatically, and foreign investment began to pour in, leading to an economic boom

Peso appreciated against most currencies as the U.S. dollar became increasingly stronger in the second half of the 1990s

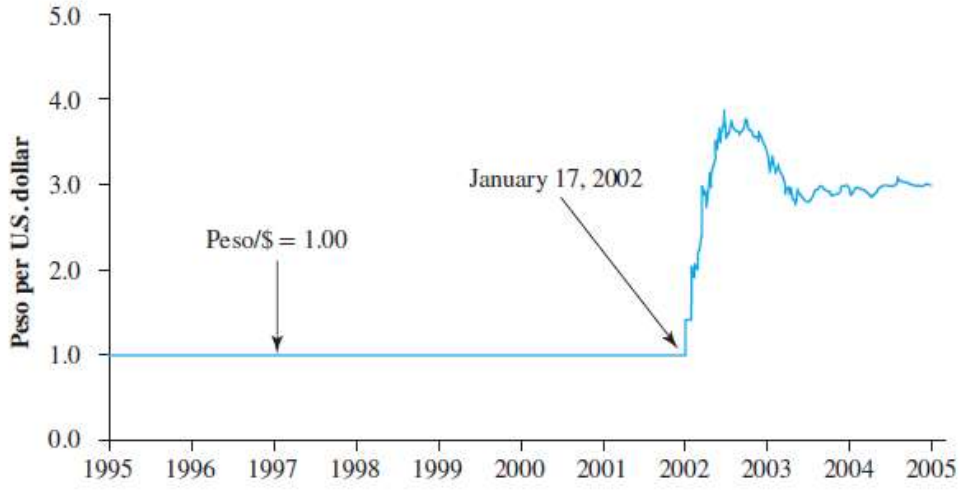
The Argentine Peso Crisis 2

A strong peso hurt exports from Argentina and caused a protracted economic downturn that led to the abandonment of peso–dollar parity in January 2002

This change caused severe economic and political distress in the country:

- Unemployment rate rose above 20 percent
- Inflation rate reached a monthly rate of 20 percent

Collapse of the Currency Board Arrangement in Argentina



Source: Bloomberg.

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The Argentine Peso Crisis (Concluded)

There are at least three factors that are related to the collapse of the currency board arrangement and the ensuing economic crisis:

- Lack of fiscal discipline
- Labor market inflexibility
- Contagion from the financial crises in Brazil and Russia

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Modeling of pegged exchange rates: Generation 1 vs. 2 models

- Theoretically, once central bank foreign exchange reserves reach 0, you'd expect devaluation.
- In real life, asset markets don't wait that long.
- Asset markets may implement a speculative attack shorting the currency with huge amounts of capital which suddenly suck out reserves.

Generation 1 model

- One equilibrium.
- When collapse happens, economic fundamentals tell you it was supposed to happen.

Generation 2 model

- Multiple equilibria.
- Some collapses didn't need to happen.
- Self-fulfilling collapses.
- Models introduced about 25 years ago.

Generation 2 model

- Take a country with its currency pegged and has a slightly high inflation differential.
- Say a hedge fund puts a huge short on the country's currency and normally expects the response to be to suck reserves out of the central bank and raise interest rates.
- However, because high interest rates would be too painful for the country, they would devalue the currency instead.
- Thus, through a trading strategy, the hedge fund induced the currency devaluation.

Thai Bhat collapse of 1997

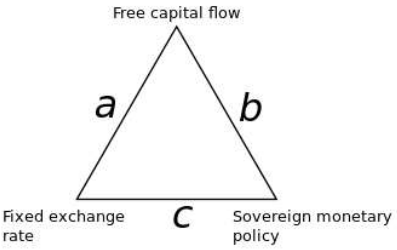
- Devaluations caused exchange rate to go from 25 Bhat:USD to 56 Bhat:USD in one year.
- Many Thai companies with high levels of foreign debt went insolvent which increased unemployment.
- Argument was that if speculation attacks hadn't happened, the devaluation wouldn't have occurred.

Generation 2 model

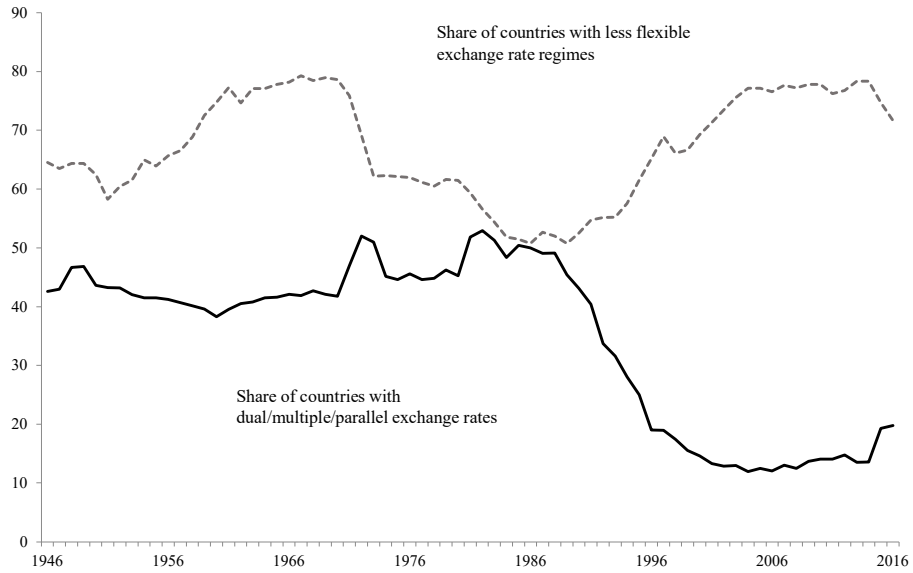
- If generation 2 models do represent the world, then fixed exchange rates do not look like good policy because you can get endogenous currency crashes.
- As a result, many emerging markets have moved to flexible exchange rates.

Impossible Trinity and Central Banks Reserves

- Cannot simultaneously achieve exchange rate stabilization, free capital flows, monetary autonomy.
- But central banks may have been accumulating reserves in attempt to circumvent this "trilemma".
  - Accumulated at unprecedented rates in 21st century.
- Complements existing explanations, e.g. precautionary savings, safe assets
  - e.g. Caballero, Farhi, Gourinchas (2017)

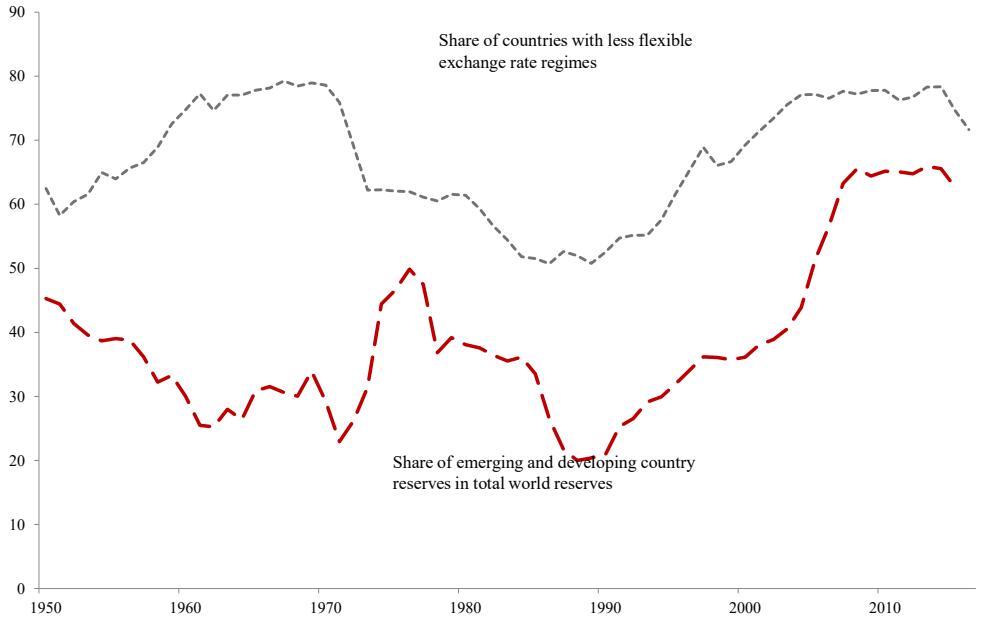


The return of exchange rate stabilization has coincided with increased capital mobility

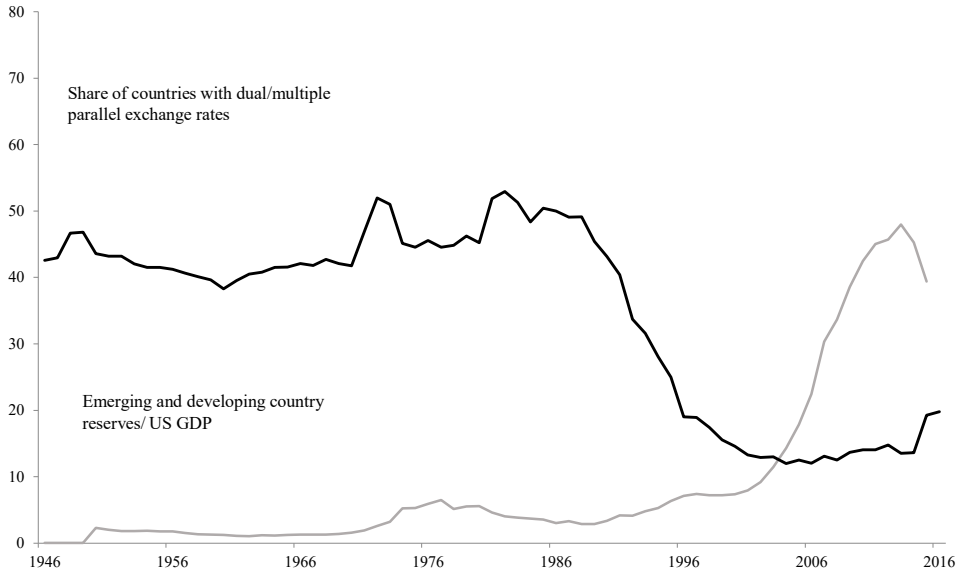


Ilzetzki, Reinhart and Rogoff, 2019

Reserves and Exchange Rate Management



Are Reserves a Substitute for Capital Controls?



The Modern Triffin Dilemma

- Triffin (1960): Demand for dollars will outstrip US gold reserves
  ➔End of Bretton Woods 1973
- Modern Triffin dilemma: Demand for US dollar assets will outstrip US fiscal capacity.
  - Farhi, Gourinchas, Rey (2011); Obstfeld (2013); Farhi and Maggiori (2018).

  ➔End of Bretton Woods II?
- Alternatives
  - Eurozone has similar limited fiscal capacity, instability
  - RMB?
  - Multipolar system/SDR
    - Eichengreen (2011); Farhi, Gourinchas and Rey (2011).

Covered Interest Parity

The Theory of Covered Interest Rate Parity

- The intuition behind interest rate parity
  - Interest rate parity
    - Equality of returns on comparable money market assets when the **forward** foreign exchange market is used to eliminate foreign exchange risk
    - Relationship between forward/spot rates and the interest rate differential between two countries
      - $(1 + i_h) = (1 + i_f)S(f/h)/F(f/h)$
  - Why there must be interest rate parity
    - If not, arbitrage possibilities would exist.

The Theory of Covered Interest Rate Parity

- $10M to invest, iUS = 8%; iUK = 12%; S = $1.60/£; F1-year = $1.53/£
- Steps:
  - Convert using spot rate: $\$10M \div (\$1.60/£) = £6.25M$
  - Invest at foreign interest rate: $£6.25M \times 1.12 = £7M$
  - Convert back at forward rate: $£7M \times (\$1.53/£) = \$10.71M$
  - Compare to what you could have earned by just investing in your home nation:
    - $\$10M \times (1 + 0.08) = \$10.8M$
  - Investing at home (U.S.) is more profitable for Kevin.
- But what if he could borrow or lend? Is the answer still the same?

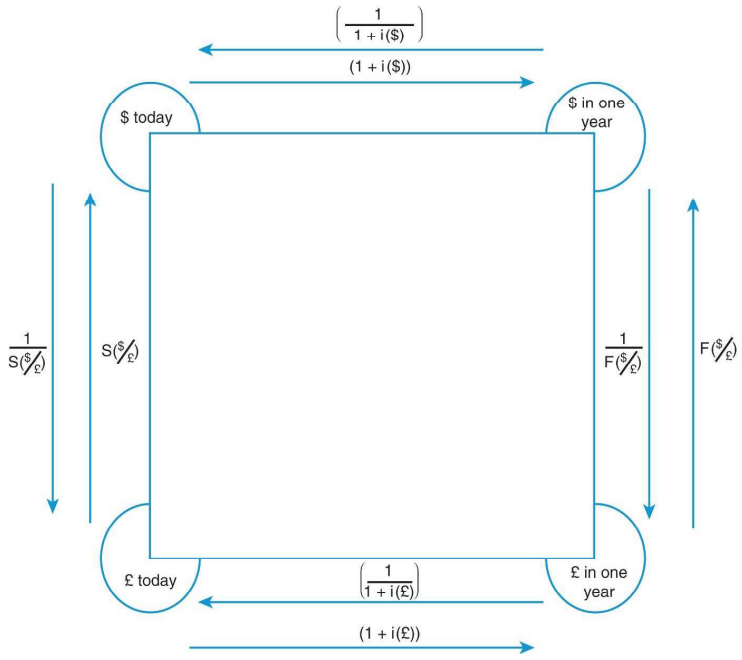
The Theory of Covered Interest Rate Parity

- $10M to invest, iUS = 8%; iUK = 12%; S = $1.60/£; F1-year = $1.53/£
- Steps:
  - Borrow pounds: $£1M \times 1.12 = £1.12M$ (what Kevin owes at end of investment term)
  - Convert pounds to dollars: $£1.12M \times (\$1.60/£) = \$1.6M$
  - Invest at U.S. interest rate: $£1.6M \times 1.08 = \$1.728M$
  - Convert back at forward rate: $\$1.728M \times (\$1.53/£) = £1{,}129{,}411.76$
- Kevin would make £9,411.76 (Step 4 – Step 1) profit for every £1M that is borrowed!

The Theory of Covered Interest Rate Parity

- Deriving interest rate parity
  - When the forward rate is priced correctly, an investor is indifferent between investing at home or abroad
  - General expression for interest rate parity
    - $[1 + i] = [1/S] \times [1 + i*] \times F$
  - Interest rate parity and forward premiums and discounts
    - $(1 + i)/(1 + i*) = F/S$
  - With continuously compounded interest rates
    - $(i - i*) = \ln(F) - \ln(S)$

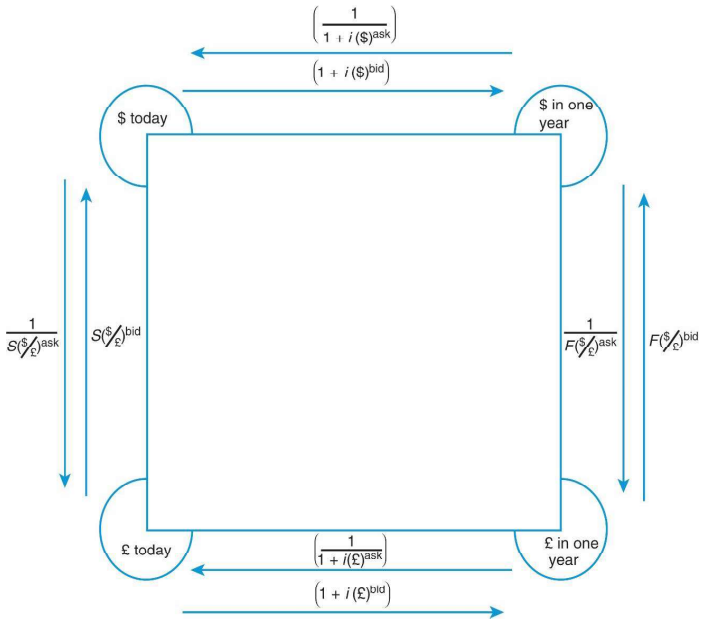
Diagram of Covered Interest Arbitrage



Covered Interest Rate Parity in Practice

- Transaction costs
  - Reduced regulatory burden and strong competition result in very small spreads
- Influence over other markets
  - External currency market influences rates elsewhere
  - Loans to investors/corporations are based on these interbank rates
  - Most important of rates is LIBOR
- Covered interest arbitrage with transaction costs

Covered Interest Rate Parity with Bid-Ask Rates



An Example with Transaction Costs

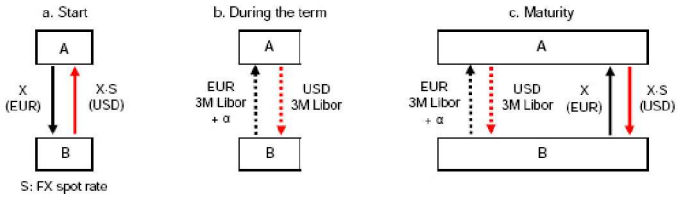
- Convert $10M to yen:
  - $\$10M \times ¥82.67/\$ = ¥826.7M$
- Invest for 3 months
  - $0.46 \times (1/100) \times (90/360) = 0.00115$
  - $¥826.7M \times 1.00115 = ¥827{,}650{,}705$
- Sell forward (enter into forward contract)
  - $(¥827{,}650{,}705)/(¥82.6495/\$) = \$10{,}013{,}983$
- Compare to what we would make in US
  - $\$10{,}013{,}983 - (\$10M \times 1.002775) = -\$13{,}767$
- Lose money this way
  - No arbitrage, but borrowing yen also results in losses

	Bid	Ask
Spot exchange rates (¥ per $):	82.67	82.71
Forward exchange rates (¥ per $):	82.5895	82.6495
Dollar interest rates:	0.91	1.11
Yen interest rates:	0.46	0.58

FX Swaps

- An FX swap agreement is a contract in which one party borrows one currency from, and simultaneously lends another to, the second party.

- Cross-currency basis swap agreement (α is the price of the basis swap, agreed upon by the counterparties).



Definition of the Cross-Currency Basis: $x_{t,t+n}$

- CIP for multi-period interest rates:

$$(1 + y^{\$}_{t,t+n})^n = (1 + y_{t,t+n})^n \frac{S_t}{F_{t,t+n}}.$$

- Cross-currency basis: Deviation from CIP

$$(1 + y^{\$}_{t,t+n})^n = (1 + y_{t,t+n} + x_{t,t+n})^n \frac{S_t}{F_{t,t+n}}.$$

Therefore, we have

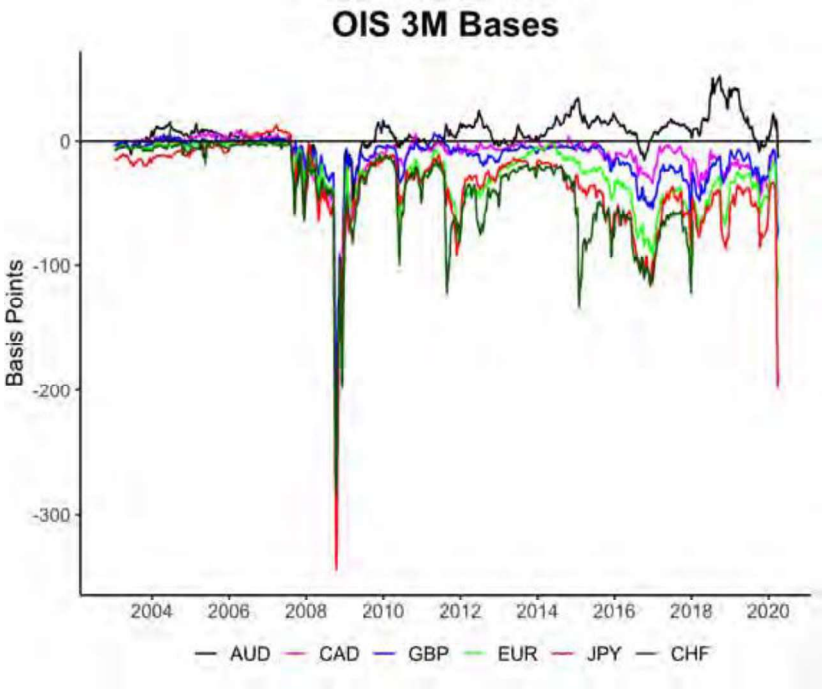
$$x_{t,t+n} = \underbrace{y^{\$}_{t,t+n}}_{\text{cash market \$ rate}} - \underbrace{[y_{t,t+n} - \rho_{t,t+n}]}_{\text{forward/swap market \$ rate}},$$

where the forward premium is given by

$$\rho_{t,t+n} \equiv \left(\frac{F_{t,t+n} - S_t}{S_t} \right)^{1/n}.$$

From: Wenxin Du, Currency Risk Premia and Covered Interest Rate Parity

Does CIP hold in the data?



What does negative cross-currency basis mean?

What is causing this?

Why Deviations from Interest Rate Parity May Exist?

- Libor is unsecured: Default risks for Libor?
  - Borrow unsecured and lend secured. Deviation from CIP still exists.
- Counterparty risk in FX forwards?
  - Remember Swaps to the first order are collateralized by design. On top f that you have margins.
- Transaction costs?
  - Even with transaction cost it is there.
- Political risk
  - A crisis in a country could cause its government to restrict any exchange of the local currency for other currencies
  - Investors may also perceive a higher default risk on foreign investments.
  - Could be relevant for Emerging markets but less so for DM.

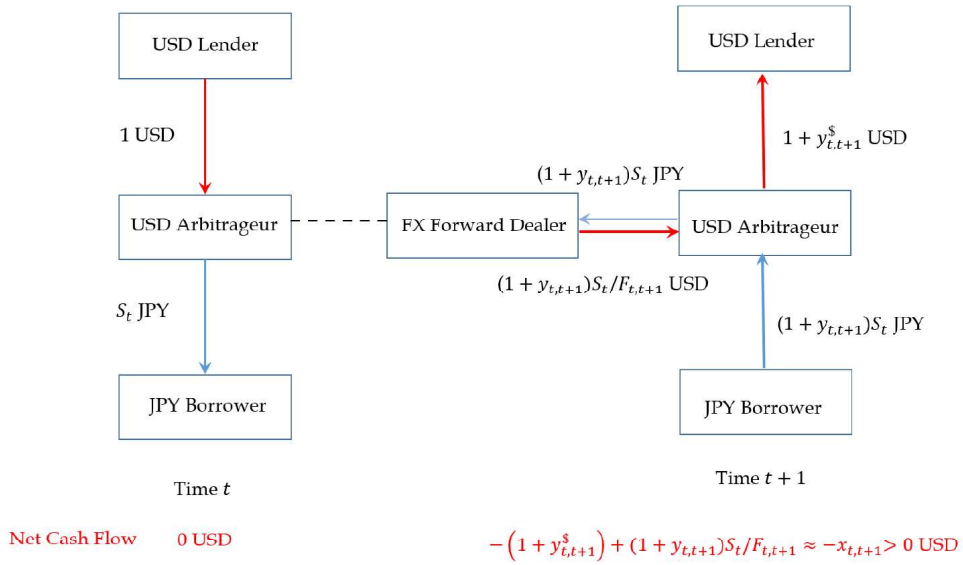
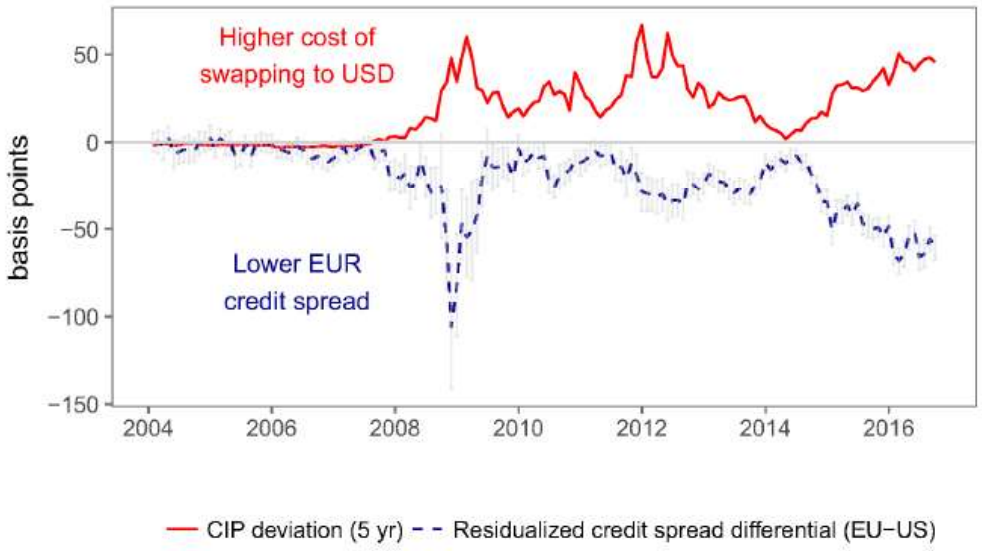


Figure 1. Cash flow dagram for CIP arbitrage with a negative basis. This figure plots the cash flow exchanges of an arbitrageur profiting from a negative cross-currency basis ($x_{t,t+1} < 0$) between the yen and the U.S. dollar. To arbitrage the negative cross-currency basis, the U.S. dollar arbitrageur borrows one U.S. dollar at the interest rate $y^{\$}_{t,t+1}$, converts it into S_t yen, lends in yen at the interest rate $y_{t,t+1}$, and signs a forward contract at date t. There is no cash flow at date t. At date $t+1$, the arbitrageur receives $e^{y_{t,t+1}} S_t \simeq (1 + y_{t,t+1})S_t$ yen, and converts that into $e^{y_{t,t+1}} S_t / F_{t,t+1} \simeq (1 + y_{t,t+1})S_t / F_{t,t+1}$ U.S. dollars thanks to the forward contract. The arbitrageur reimburses her debt in U.S. dollars and is left with a profit equal to the negative of the cross-currency basis $x_{t,t+1}$. In essence, the arbitrageur is going long in the yen and short in the dollar, with the yen cash flow fully hedged by a forward contract.

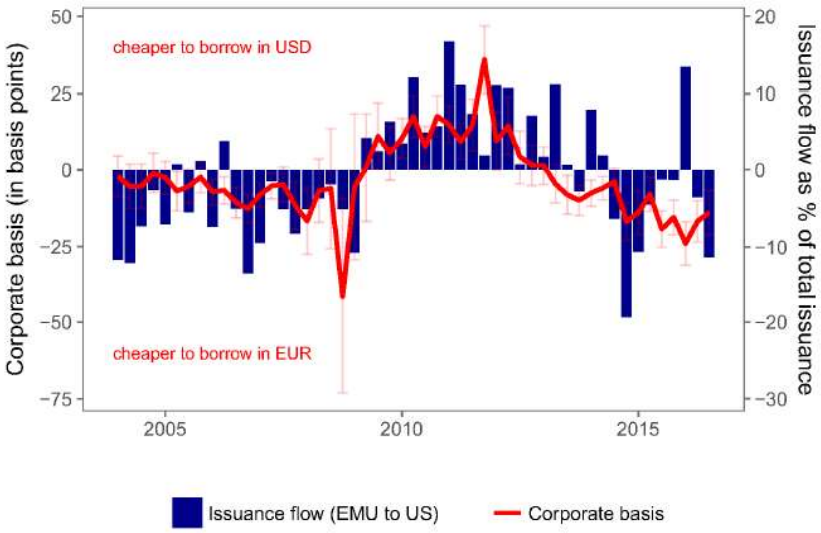
Demand for credit borrowing as a candidate for cross-currency basis



Main idea:
Credit spread is lower in Europe. This increase the demand for borrowing in EUR. More borrowing in EUR increase the demand for currency hedge.
Higher demand for currency hedge increases the balance sheet of forward contract issuers. And therefore, swapping to USD will be more costly.

From Liao (2020): Credit Migration and Covered Interest Rate Parity

Demand for credit borrowing as a candidate for cross-currency basis



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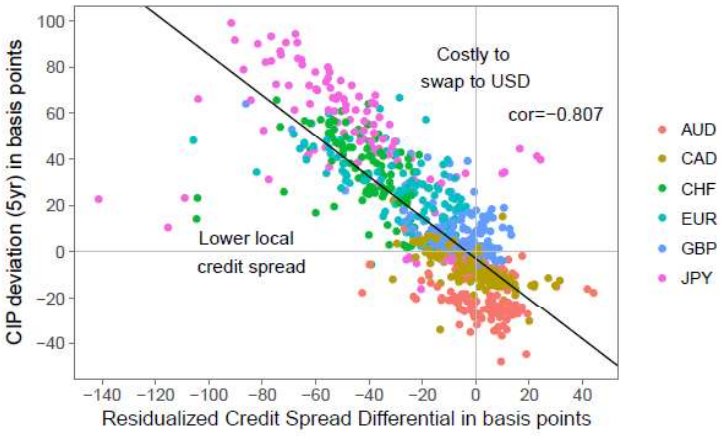
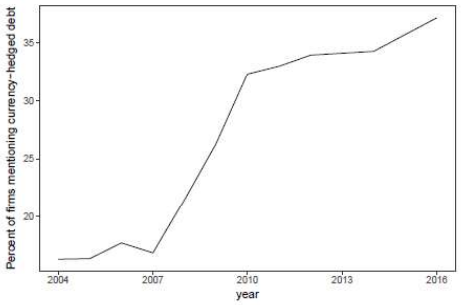
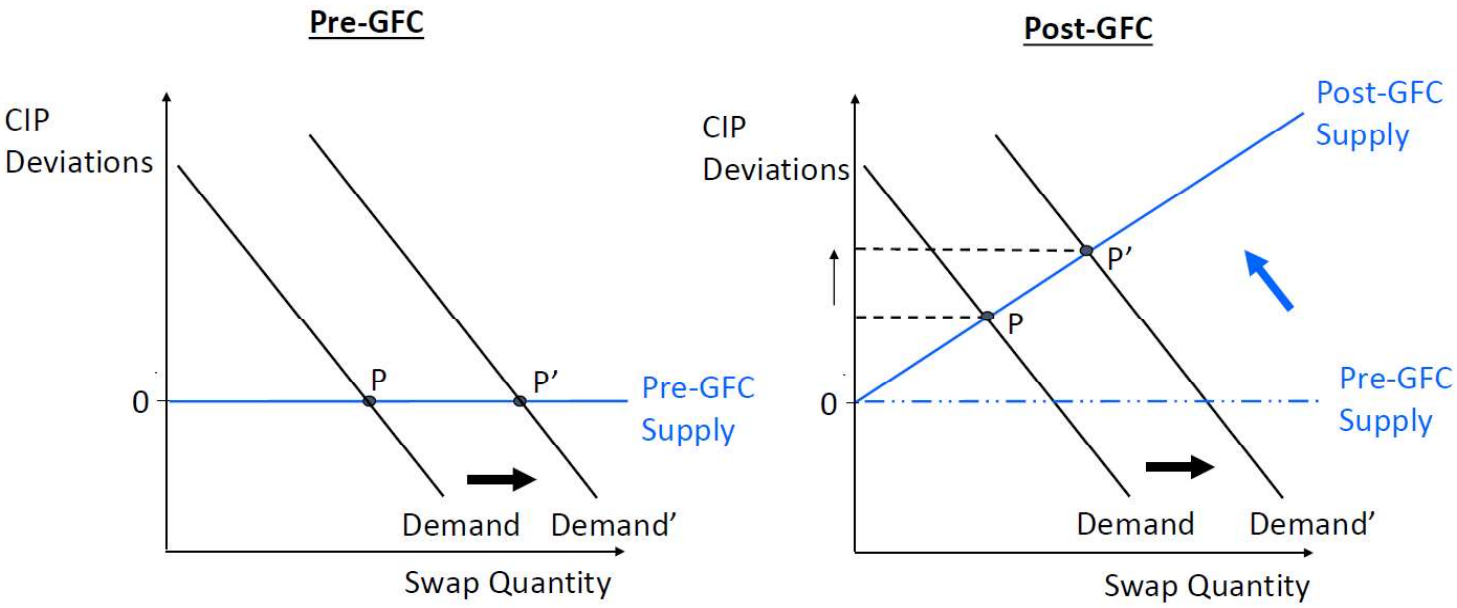
Demand for credit borrowing as a candidate for cross-currency basis



B. Percentage of 10K filings with mentions of currency-hedged debt issuance



Demand for swaps affect the cross-currency basis.



Hedging Transaction Risk in the Money Market

- When Interest Rate Parity holds, there are two ways to hedge a transaction (either a liability or a receivable)
  - Forward contract – use the appropriate forward contract to buy or sell the foreign currency
  - Synthetic forward – borrowing / lending the foreign currency and making a transaction in the spot market

Hedging Transaction Risk in the Money Market

- Shetlant: Receive ¥500M in 30 days
  - S: ¥179.5/£; F(t+30): ¥180/£; i(£, t+30): 2.70% p.a; i(¥, t+30): 6.01% p.a.
  - Choice #1: Sell yen forward
    - Earn: $¥500M \times (¥180/€) = \$2{,}777{,}778$
  - Choice #2: Money Market hedge
    - Borrow PV of ¥500M, and sell at spot
      - $PV = ¥500M/[1 + (\frac{6.01}{100})(\frac{30}{360})] = ¥497{,}508{,}313$
      - $£\,revenue = ¥497{,}508{,}313/(¥179.5/£) = £2{,}771{,}634$
    - FV of forward hedge
      - $£2{,}771{,}634 \times \left[1 + \left(\frac{2.70}{100}\right)\left(\frac{30}{360}\right)\right] = £2{,}777{,}785$
    - Forward contract is more expensive by £6,151