

JOHNSON
Cornell University

NBA 5420: Investment and Portfolio Management

Class 10: Currencies

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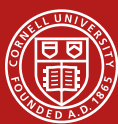


Topics

- Real and nominal exchange rates
 - Theory versus reality
- Forward premium puzzle and carry trades
- Capital flows
 - How do these work?
- Currency crises

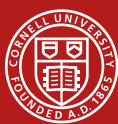


EXCHANGE RATE DEFINITIONS



Nominal Exchange Rate definition

- The Nominal Exchange Rate is the price of foreign currency in terms of the domestic currency
 - $E_{\text{€}/\$} = \text{€}0.88 \text{ per } \$$
 - $E_{\text{\$/€}} = 1/E_{\text{€}/\$} = \$1.14 \text{ per } \text{€}$
- Thus, from the U.S. point of view, a fall in $E_{\text{€}/\$}$ means a dollar can buy fewer imports
 - “a weaker dollar”, “a dollar depreciation”



Real Exchange Rate definition

- The Real Exchange Rate (RER) is the nominal exchange rate times the inverse of the relative price levels
 - $RER = E_{\$/\epsilon} * P_{\text{Eurozone}} / P_{\text{U.S.}}$
 - P can be the consumer price index (CPI)
- Measures the relative price (for U.S. versus Europe) of a broad basket of goods
 - When you go on vacation in Europe, does it feel like your dollar buys more or less than it does in the U.S.?



A U.S. dollar depreciation

- Makes U.S. residents relatively poorer
 - Bad for U.S. consumers
- Makes U.S. products cheaper to foreigners
 - Good for U.S. workers



A U.S. dollar depreciation

Foreign currency
baskets per
U.S. dollar
(Jan 2002 = 100)

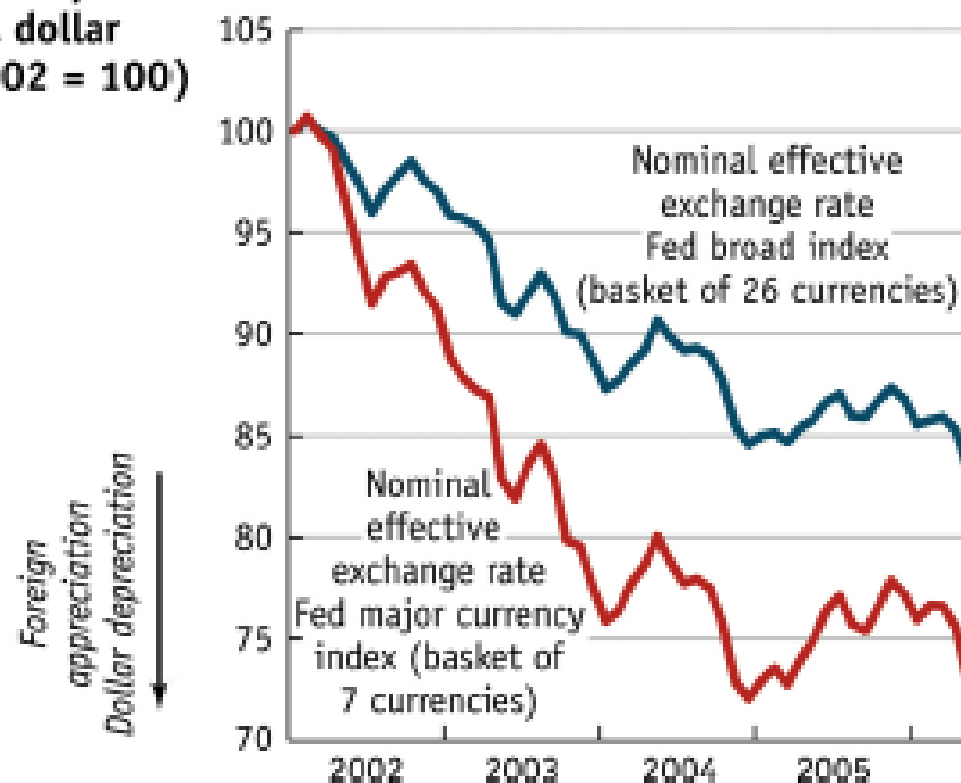


Figure: Source: Feenstra and Taylor 2010



A U.S. dollar depreciation





SOME SIMPLE THEORY

(THAT ONLY WORKS IN THE LONG-RUN)



Real exchange rates (in theory)

- Two countries: the U.S. and Japan.
 - 1000 hours of American labor builds 1 GM car
 - 1000 hours of Japanese labor builds 1 Toyota car
- Suppose:
 - The cars are identical
 - American and Japanese consumers are indifferent between the 2 cars
 - Both types of cars available for sale in both the U.S. and Japan.
- What is the real exchange rate?
 - Real FX rate = 1 GM car / 1 Toyota car



Real exchange rates (in theory)

- Real FX rate = 1 GM car / 1 Toyota car
 - For every GM car shipped to Japan, 1 Toyota is shipped here





Real exchange rates (in theory)

- Real FX rate = 1 GM car / 1 Toyota car
 - Equivalently, an American working 1000 hours can afford either a (domestic) GM car or an (imported) Toyota



Nominal exchange rates (in theory)

- Suppose also:
 - There are 1 million cars produced in each country each year (requiring 1 billion labor hours)
 - The money supply in Japan is ¥1 trillion.
 - The money supply in the US is \$10 billion.
- Therefore:
 - Price of GM car = Money Supply / GM cars
= \$10 billion / 1 million cars
= \$10,000 per car
 - Price of Toyota car = Money Supply / Toyota cars
= ¥1 trillion / 1 million cars
= ¥1 million per car



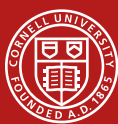
Nominal exchange rates (in theory)

- Therefore:
 - Price of GM car = Money Supply / GM cars
= \$10 billion / 1 million cars
= \$10,000 per car
 - Price of Toyota car = Money Supply / Toyota cars
= ¥1 trillion / 1 million cars
= ¥1 million per car
- So what's the nominal exchange rate?
 - \$10,000 = 1 GM car = 1 Toyota car = ¥1 million
 - So \$10,000 is equivalent to ¥1 million
 - Or \$1 buys you ¥100



How does inflation affect the nominal exchange rate?

- Suppose the money supply in Japan doubles from ¥1 trillion to ¥2 trillion.
 - Hyperinflation!
- What is now the price of a Toyota in yen?
 - Now ¥2 trillion / 1 million car
= ¥2 million per car
- What is now the nominal exchange rate?
 - \$10,000 = 1 GM car = 1 Toyota car = ¥2 million
 - So \$1 buys you ¥200



So in general...

- The real exchange rate:
 - Equals amount of Japanese goods that have to be exported in order to import one unit of U.S. goods
 - RER should be 1 for equivalent goods (Japanese cars vs. American cars)
 - “No arbitrage” in the goods market
- The nominal exchange rate
 - Adjusts the real exchange rate by the price level in each country
 - Inflation in one country should weaken its currency in nominal terms



THE GOOD NEWS:

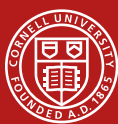
**THIS THEORY WORKS QUITE WELL
IN THE LONG-RUN**



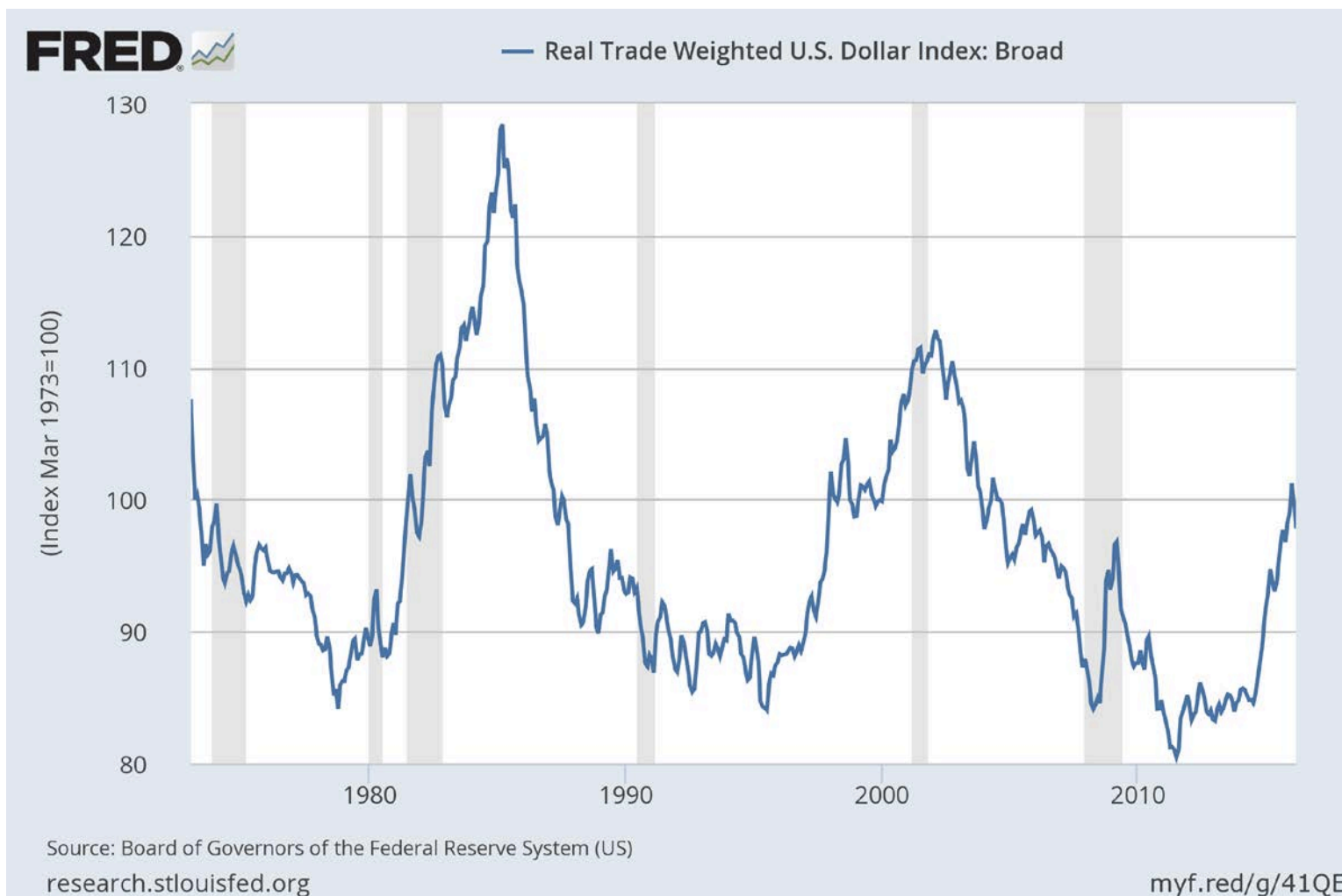
The long run

These relationships do hold in the long-run:

1. The real exchange rate mean-reverts to (approximately) one in the long run
 - “Purchasing power parity” (PPP)
2. The nominal exchange rate changes one-for-one with the price level in the long run



RERs mean-revert in the long-run

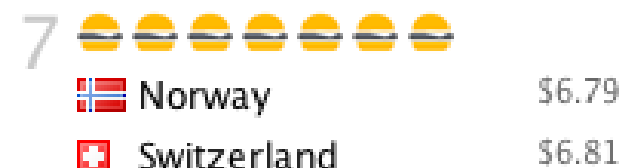
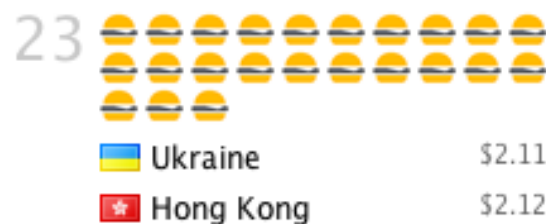
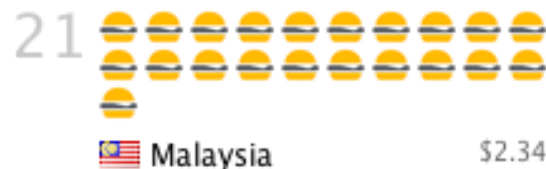
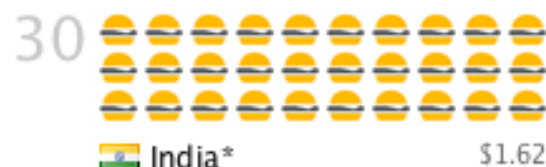




Well, not for everything...

THE BIG MAC INDEX

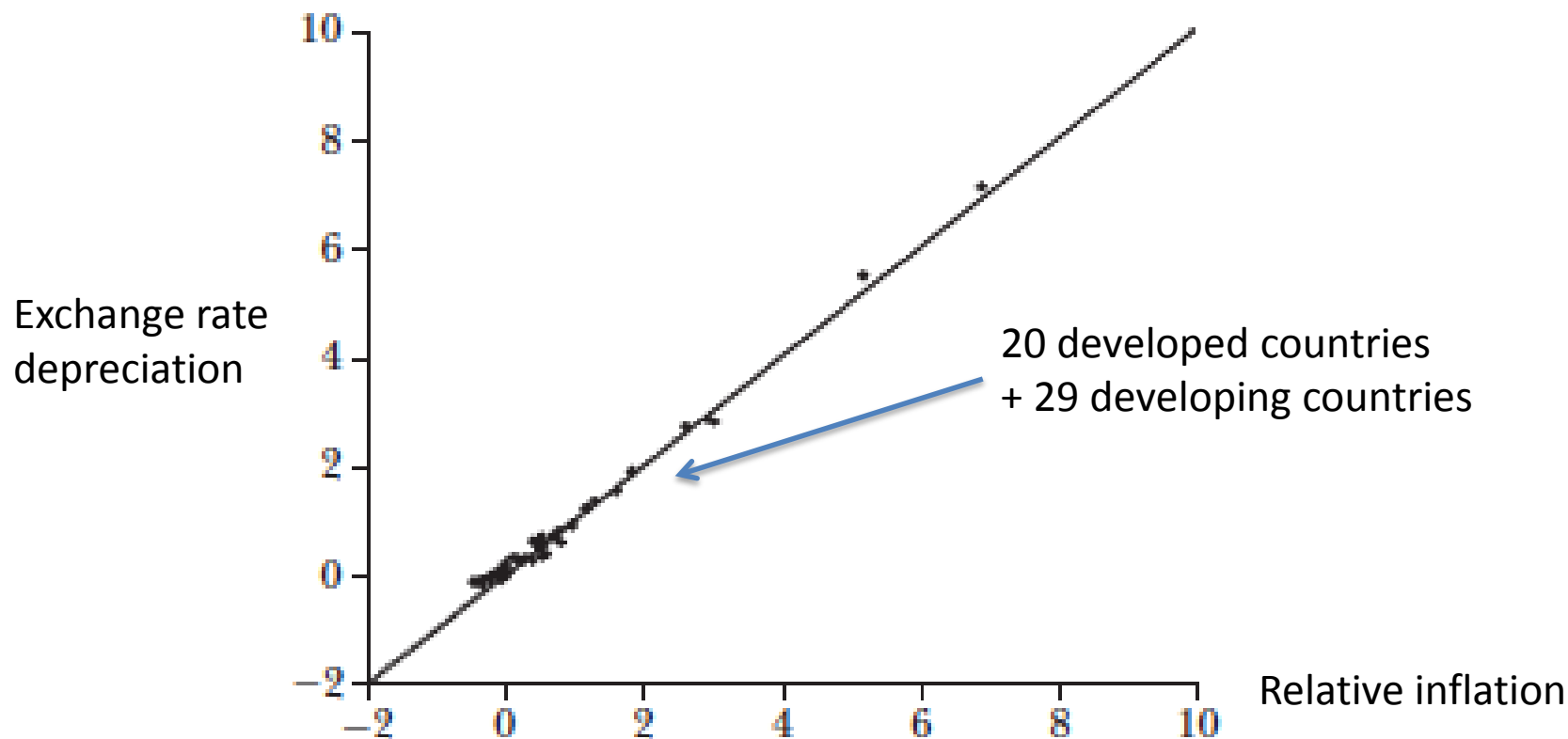
How many burgers you get for \$50 USD?





Long-run Nominal Exchange Rates

Consumer Price Inflation Relative to the U.S. versus
Dollar Exchange Rate Depreciation,
29-Year Average, 1970–1998





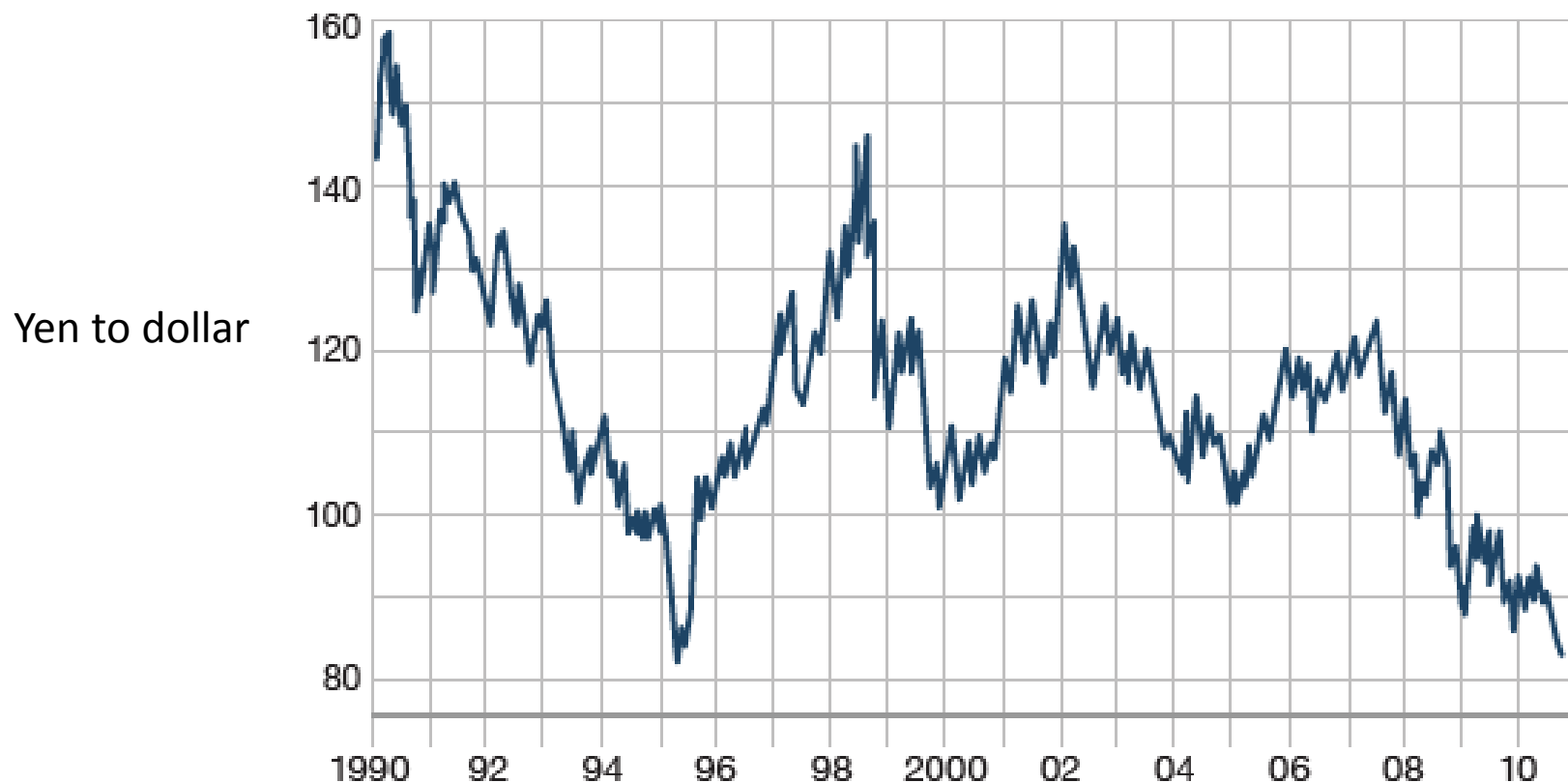
THE BAD NEWS:

**THE REAL WORLD IS NOT SO SIMPLE
IN THE SHORT-RUN...**



Nominal Exchange Rates

- Random walk (highly volatile & persistent)





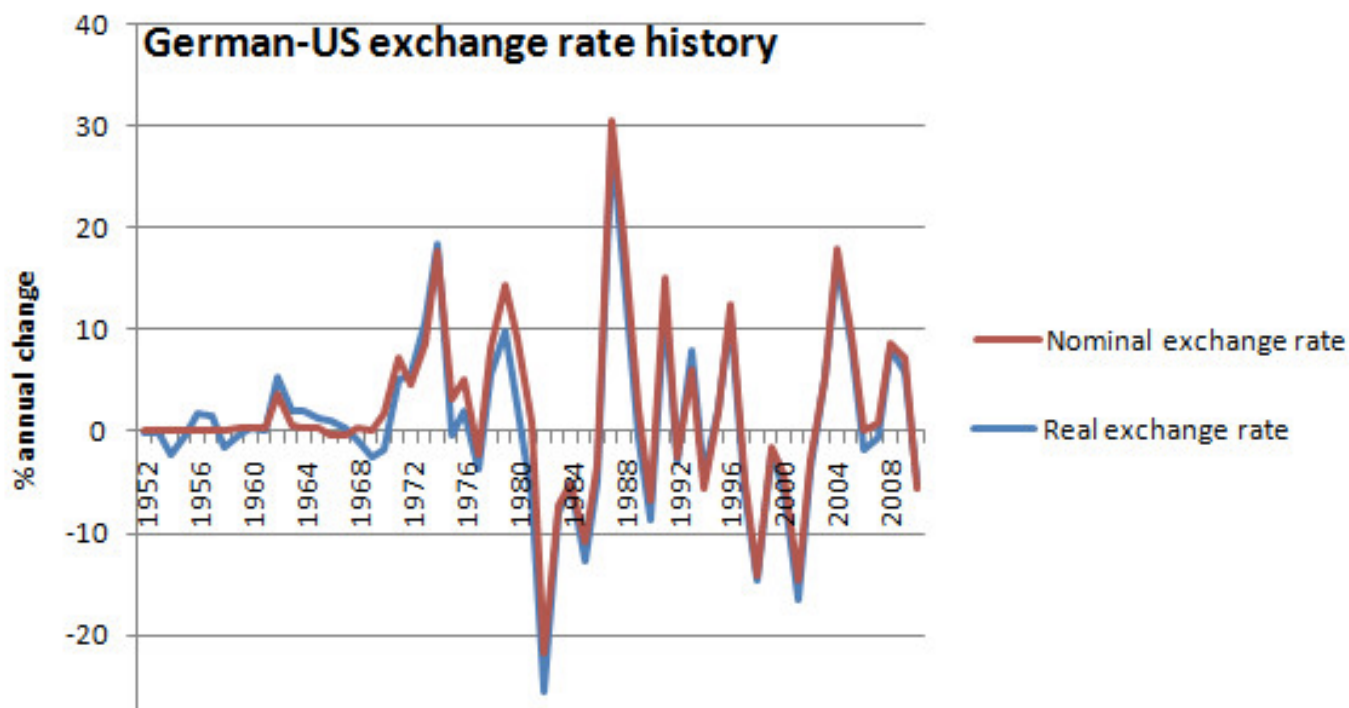
Why are exchange rates so volatile?

- And seemingly unconnected from fundamentals?
 - In general, we don't really know much about why currencies move as much as they do in the short-run
 - But the same can be said about most asset classes
 - Stocks
 - Commodities



Short-run Real Exchange Rates

- Real exchange rates move one-for-one with nominal rates in the short run



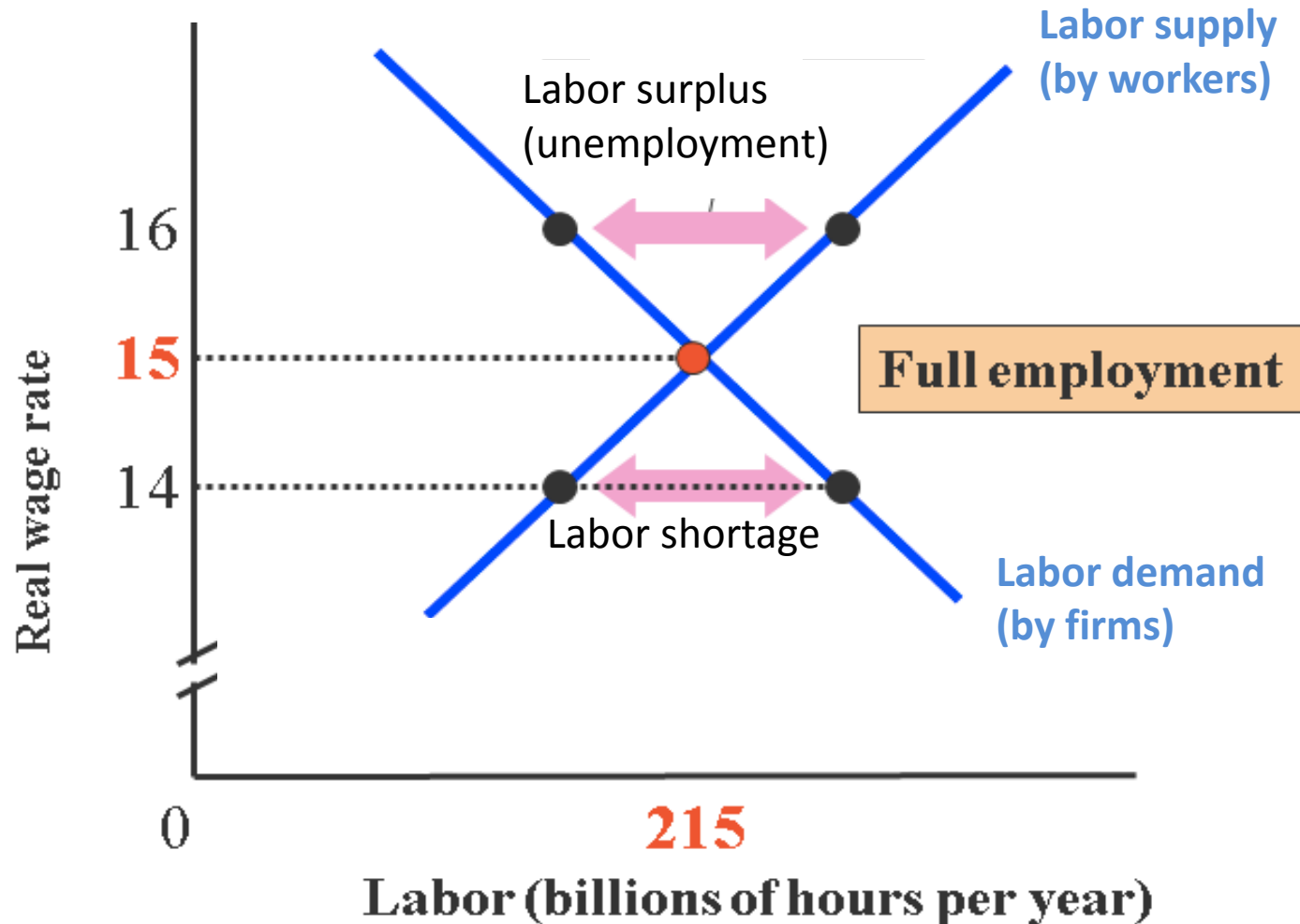


Short-run Real Exchange Rates

- Real exchange rates move one-for-one with nominal rates in the short run
 - Evidence for “price stickiness”
 - Hence, exchange rate adjustments can improve/worsen a country’s competitiveness



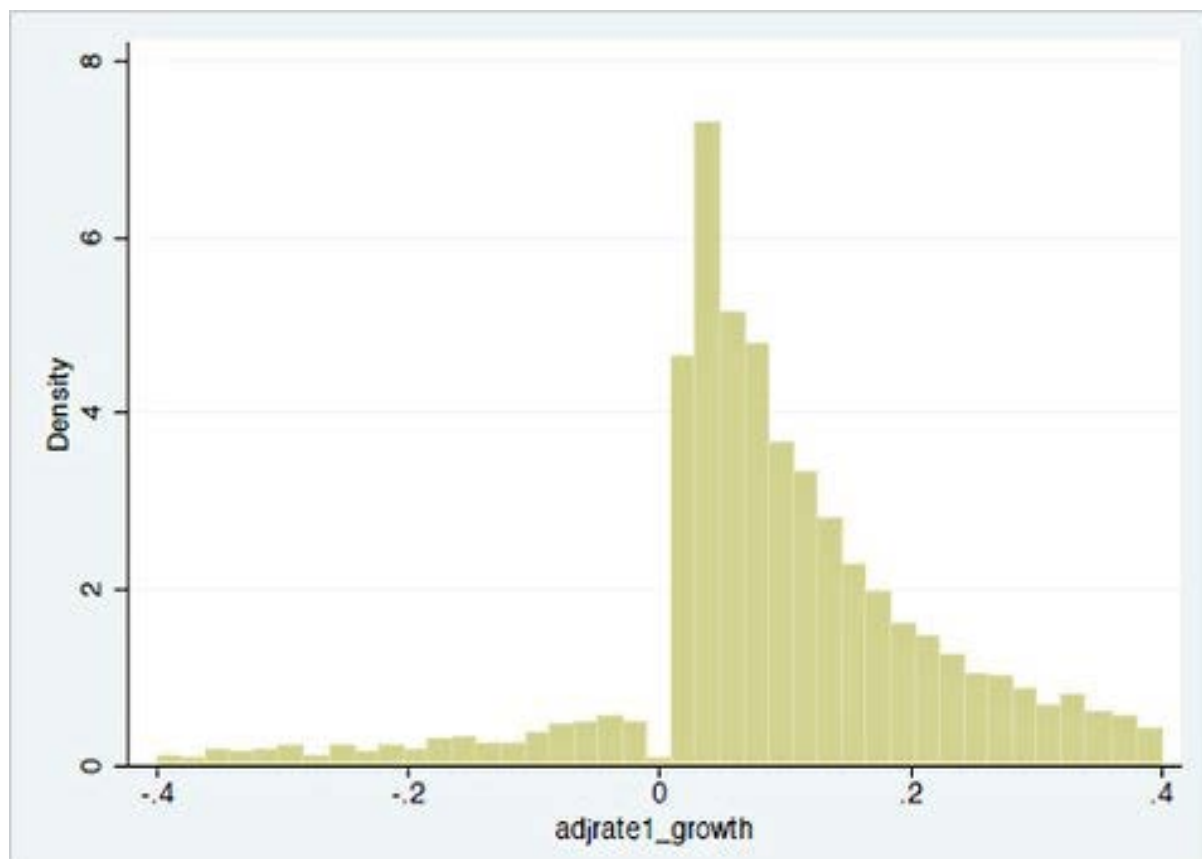
Supply and Demand for Wages





Downward Nominal Wage Rigidities

Distribution of non-zero wage changes, hourly workers in the U.S., 1996
(from Barattieri, Basu, and Gottschalk, 2010)



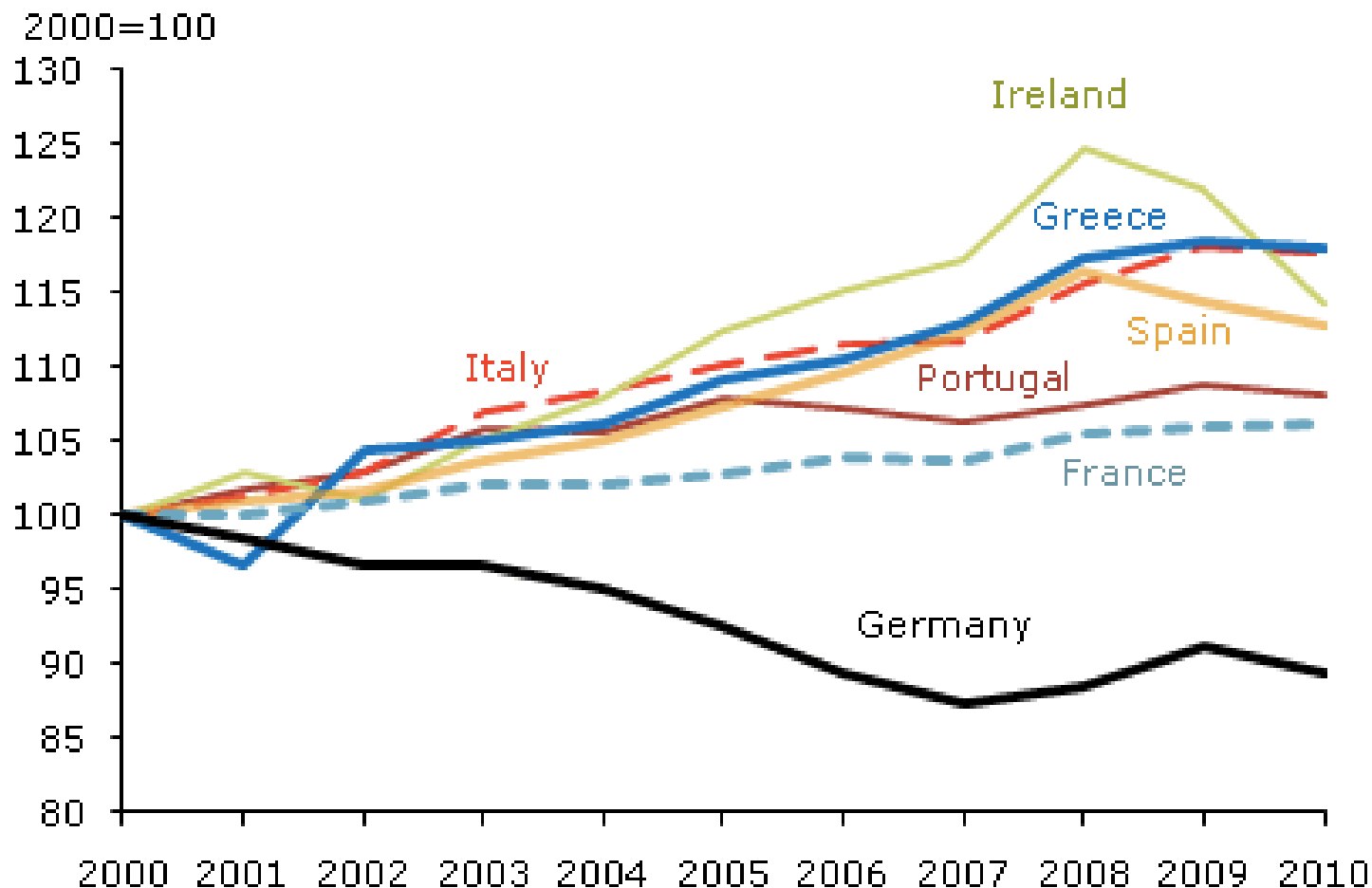


Exchange rate channel

- In “small-open economies” (think Korea, Canada or Switzerland), exchange rate devaluation makes exports more competitive
 - Similar to a fall in wages (in U.S. dollar terms)
 - Which stimulates demand and puts labor back to work
 - Not really relevant for the U.S. because exports only ~5% of GDP
- A fixed-exchange rate system (e.g., the gold standard or the Euro) creates a huge problem
 - Because there’s no mechanism for adjustment
 - Wages will have to fall to restore full-employment, which is very painful/impossible and slow



European Real Exchange Rates





Milton Friedman, *"The Case for Flexible Exchange Rates"*, 1953

"If internal prices were as flexible as exchange rates, it would make little economic difference whether adjustments were brought about by changes in exchange rates or equivalent changes in internal prices...

"At least in the modern world, internal prices are highly inflexible. They are more flexible upward than downward, but even on the upswing all prices are not equally flexible...

"Wage rates tend to be among the less flexible prices. In consequence, an incipient deficit that is countered by a policy of permitting or forcing prices to decline is likely to produce unemployment rather than, or in addition to, wage decreases...

"If the external changes are deep-seated and persistent, the unemployment produces steady downward pressure on prices and wages, and the adjustment will not have been completed until the deflation has run its sorry course.



Milton Friedman, *"The Case for Flexible Exchange Rates"*, 1953

“The argument for a flexible exchange rate is, strange to say, very nearly identical with the argument for daylight savings time. Isn't it absurd to change the clock in summer when exactly the same result could be achieved by having each individual change his habits?

“All that is required is that everyone decide to come to his office an hour earlier, have lunch an hour earlier, etc. But obviously it is much simpler to change the clock that guides all than to have each individual separately change his pattern of reaction to the clock, even though all want to do so.

“The situation is exactly the same in the exchange market. It is far simpler to allow one price to change, namely, the price of foreign exchange, than to rely upon changes in the multitude of prices that together constitute the internal price structure.”



COVERED AND UNCOVERED INTEREST RATE PARITY

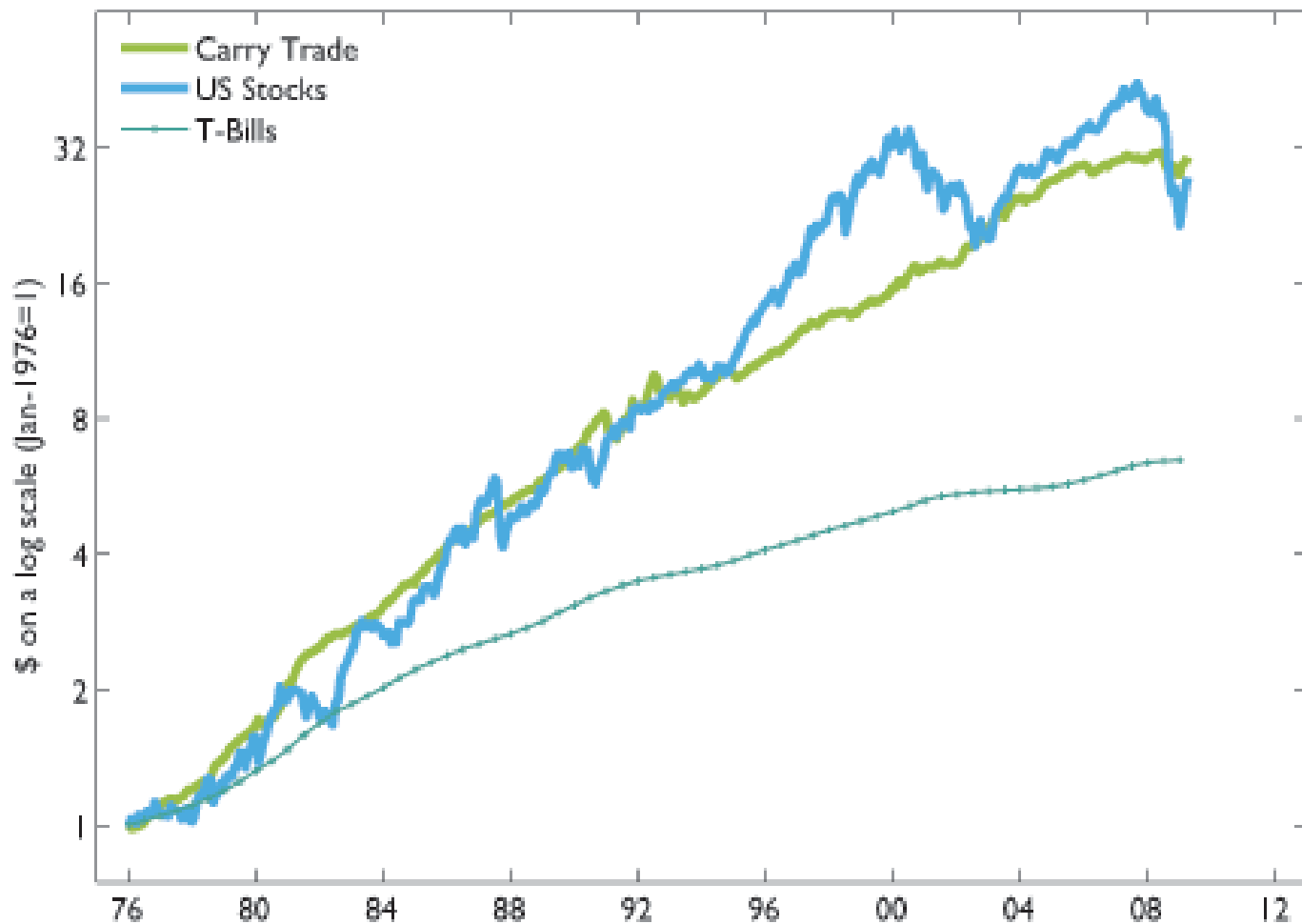


Carry trade

- Suppose:
 - U.S. interest rate = 3.2% (one-year bond)
 - Euro interest rate = 4.4% (one-year bond)
 - $E_{\$/\epsilon} = 1.273$ dollars per euro
- If the exchange rate doesn't change, you can make a lot of money
 - Borrow in dollars at 3.2%, convert to Euros
 - Invest in euros at 4.4%
 - Convert back after a year, earn profits of 1.2%

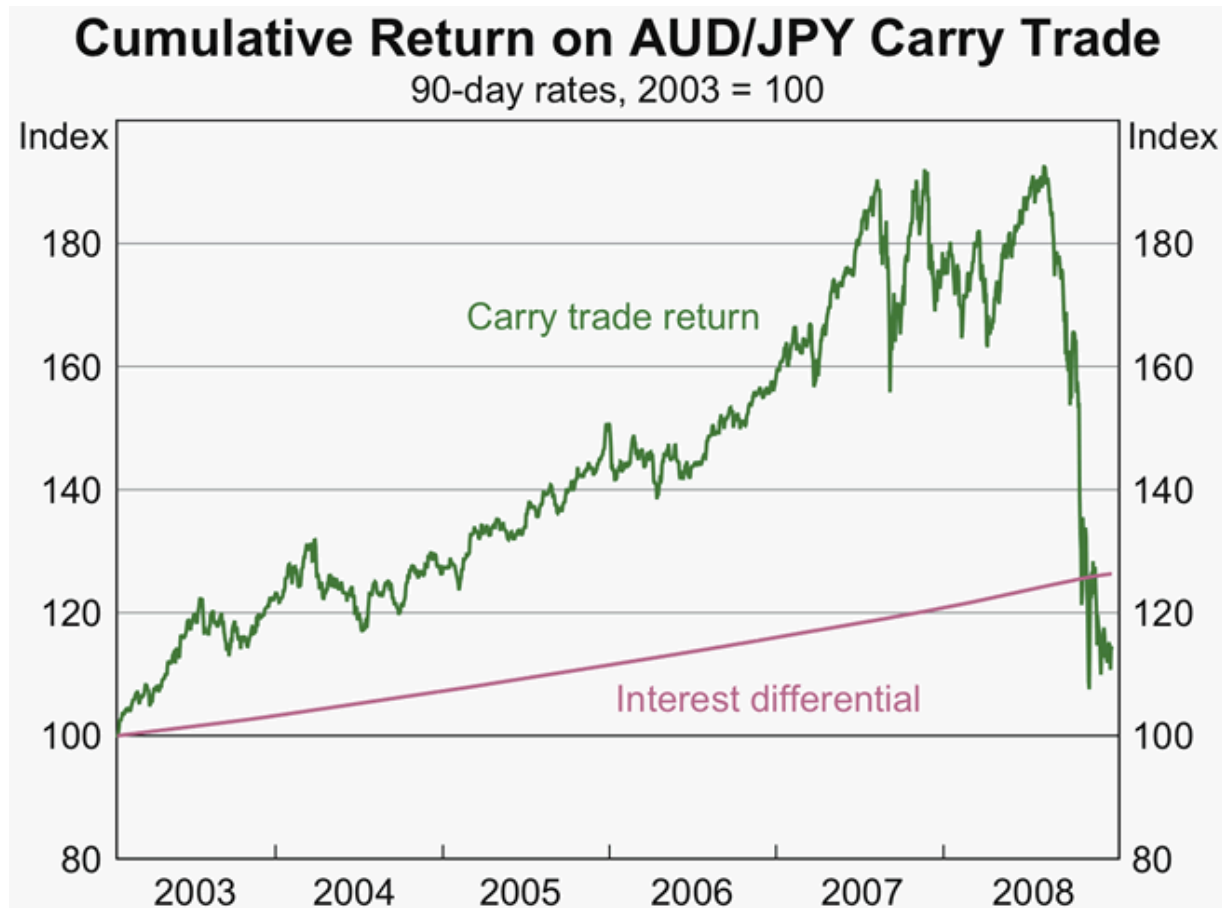


This strategy usually earns high returns with little volatility





But big crashes can occur

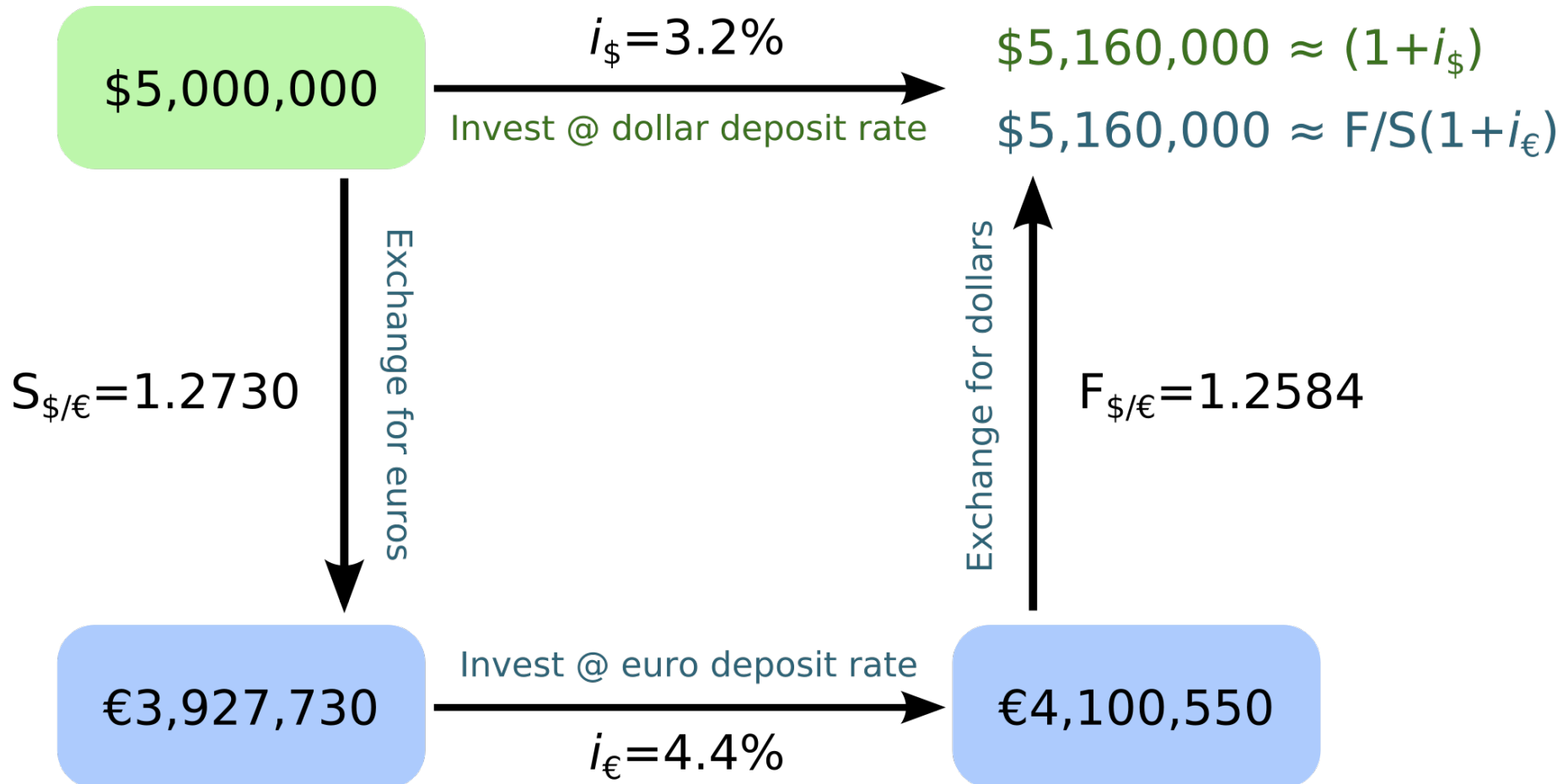


- Similarly, a Mexican Peso carry trade lost 50% on Sept 1, 1976



Interest Rate Parity

- Suppose:
 - U.S. interest rate = 3.2% (one-year bond)
 - Euro interest rate = 4.4% (one-year bond)
 - $E_{\$/\epsilon} = 1.273$ dollars per euro
 - You have up to \$5 million to invest in this arb strategy
- How should the exchange rate depreciate in order to give you zero profits in expectation?
 - uncovered interest rate parity
- If you had to lock in a forward-exchange-rate today (for one-year from now), what would that rate have to be, assuming no-arbitrage?
 - covered interest rate parity



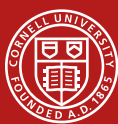


Interest Rate Parity

$$E_{t+k,\$/\epsilon} = E_{t,\$/\epsilon} * (1+i_{\$})^k / (1+i_{\epsilon})^k$$

where k is the investment horizon (e.g., one-year)

- If $E_{t+k,\$/\epsilon}$ is interpreted as the locked-in forward rate, this relationship must hold by no-arbitrage (since no FX risk)
 - Covered interest rate parity
- If $E_{t+k,\$/\epsilon}$ is interpreted as the expected future exchange rate, this relationship should hold on average (but there's risk, since future FX rate not guaranteed)
 - Uncovered interest rate parity



Uncovered interest rate parity

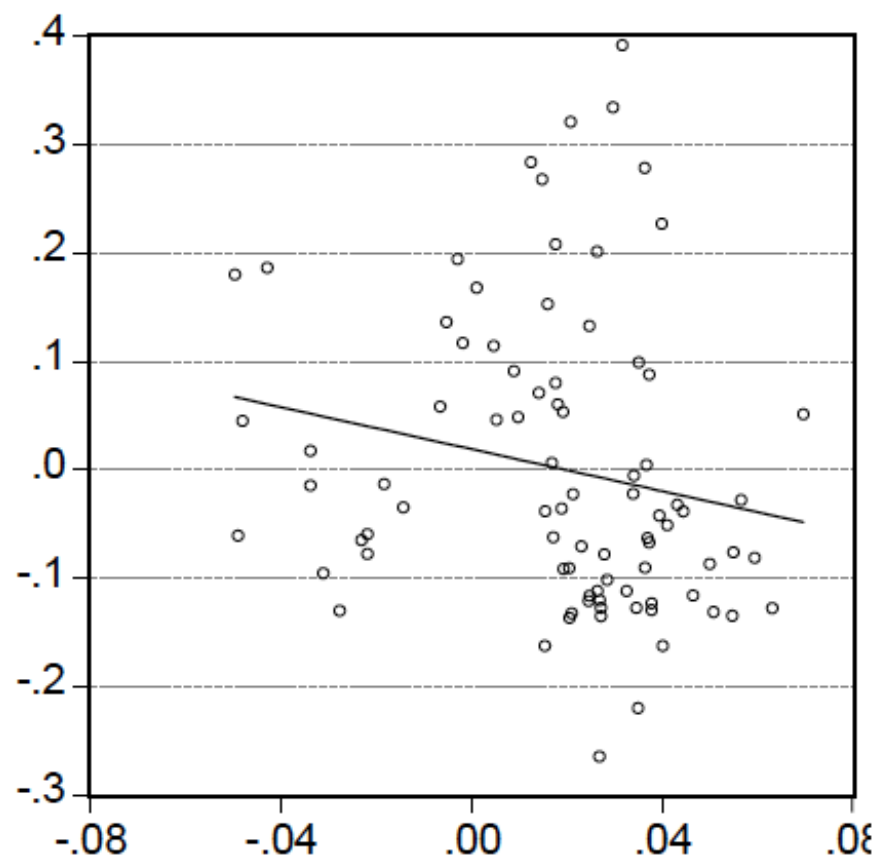
- But, in practice, it doesn't even hold in expectation
 - In fact the exchange rate tends to move in the wrong direction in the short-run
- If $i_{\text{U.S.}} = 1\%$ and $i_{\text{Euro}} = 2\%$, UIP says Euro should ...
 - Weaken in the future
 - But in fact the Euro will strengthen
- Hence why you can make a lot of money doing carry trades
 - Though keep in mind that the carry trade is not risk-free



Violation of UIP

Dollar versus Deutschmark, 1980-1999, one-year horizons

Subsequent exchange
rate change



Interest rate differential



HOW DO CAPITAL FLOWS HAPPEN?

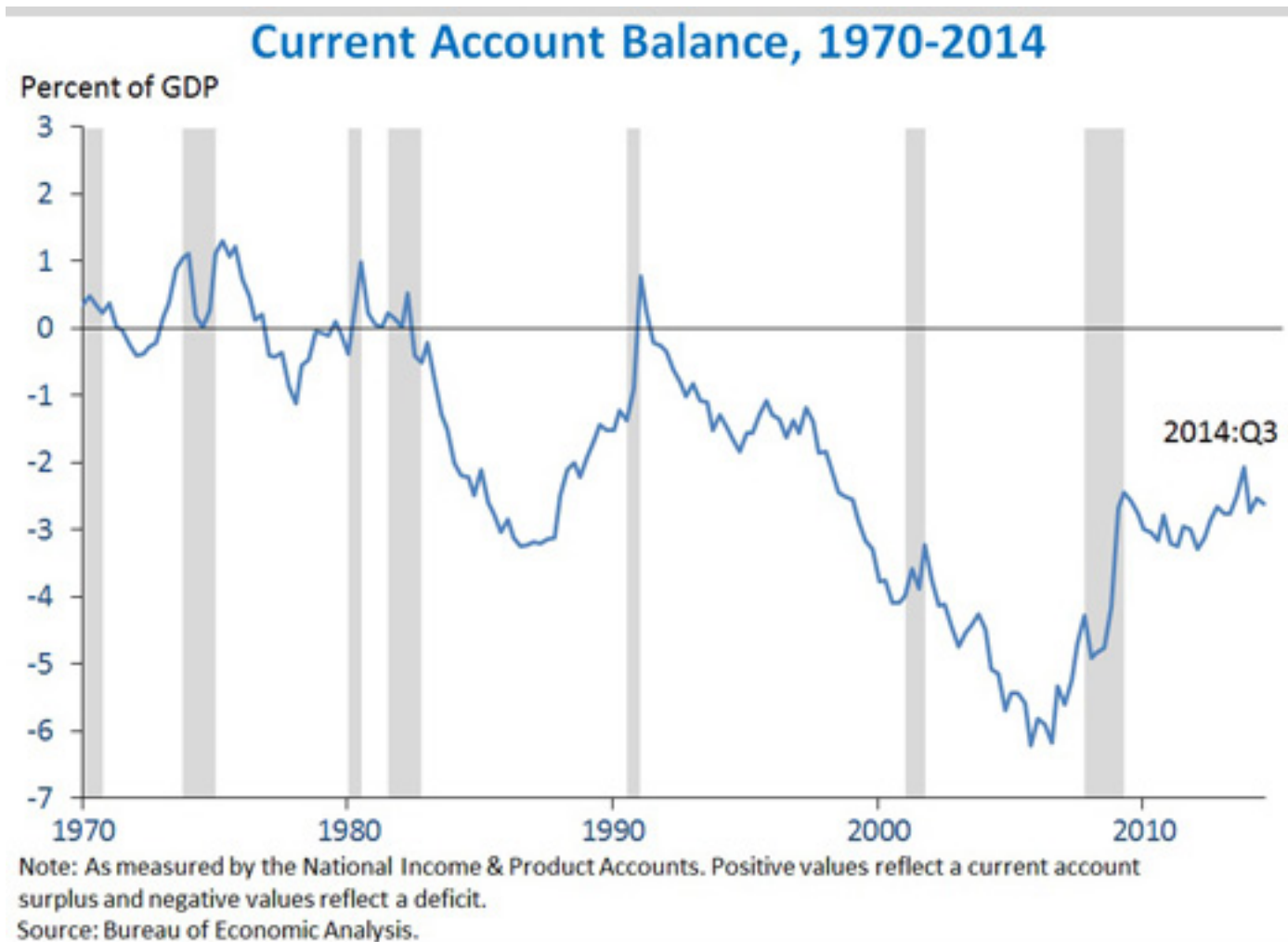


The balance of payments

- Current account
 - Approx. the trade balance = (exports – imports)
 - (plus overseas investment income & transfers)
- Capital account
 - The *negative* net foreign investment of a country
 - Investment minus savings
- They must balance:
$$\text{Current account} + \text{Capital account} = 0$$
- If you export more than you import, then you are giving the world more than you take, so you are, in effect, lending the world money
 - So you will own assets that entitle you to be paid back (via increased imports) in the future



The U.S. Current Account Deficit





How do capital flows happen?

- Assets don't actually get on a plane
- Two step process:
 1. Assets are traded (though they don't physically move)
 2. One party uses its assets to buy capital goods (which it then imports)



U.S.



U.S. investor

Brazil



Brazilian Company



U.S.

Brazil



U.S. investor

Brazilian Company



U.S.

Brazil



U.S. investor

Brazilian Company



U.S.

Brazil



U.S. investor

Brazilian Company



U.S.



U.S. investor

Brazil



Brazilian Company



CURRENCY CRISES



Recent examples

1. Europe 1992-93
2. Mexico 1994-95
3. East Asia 1997-98
4. Argentina 2001-02

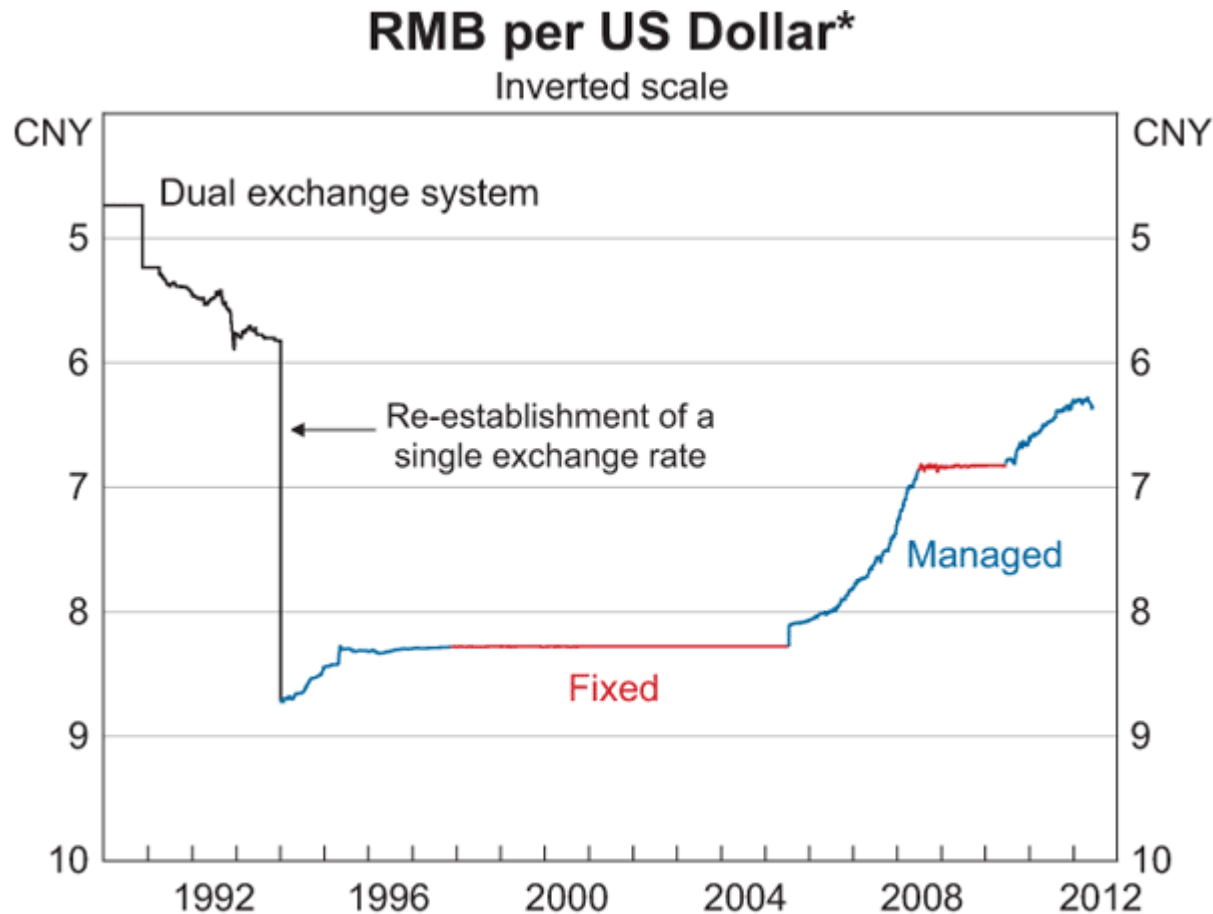


Readings

- We cannot go over all the details of currency crises, but **you will need to read these**:
 - Backus & Roubini: “Lectures in Macroeconomics, Chapter 8”
 - Krugman: “Currency Crises”
 - Moreno: “Models of Currency Speculation: Implications and East Asian Evidence”
- May be tested on the final exam



Fixed exchange rates

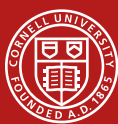


* Onshore exchange rates
Sources: Bloomberg; RBA



Fixed exchange rates

- The central bank stands ready to buy and sell the currency to maintain a fixed price
 - If the currency depreciates, CB will need to sell foreign reserves and **buy its currency**
 - If the currency appreciates, CB will need to buy foreign reserves and **sell its currency**



Fixed exchange rates

- Benefits
 - Good way to suddenly and credibly reduce inflation
 - Inflation will be pegged to U.S. inflation, govt can't monetize debt
 - Read Backus & Roubini (Chapter 8) for details
- Costs
 - Can lead to a real overvaluation (which reduces competitiveness and creates a drag on demand)
 - If there's residual "wage push" from past inflation
 - If a productivity boom or capital inflow comes to a halt
 - Overvalued currency leads to a current account deficit (debt owed to foreigners), because imports > exports
 - Can set country up for a speculative attack



Foreign Exchange intervention

- Suppose there's selling pressure on the currency. How does the CB defend the peg?

- CB Balance sheet initially:

<u>Assets</u>	<u>Liabilities</u>
Treasury Bills 400	Currency 600
Forex Reserves 200	

- CB Balance sheet after:

<u>Assets</u>	<u>Liabilities</u>
Treasury Bills 400	Currency 550
Forex Reserves 150	



Fixed exchange rates

- The central bank stands ready to buy and sell the currency to maintain a fixed price
 - If the currency depreciates, CB will need to sell foreign reserves and **buy its currency**
 - Which is contractionary (by reducing the money supply), meaning it will reduce employment and raise interest rates
 - Plus the CB can run out of reserves!
 - If the currency appreciates, CB will need to buy foreign reserves and **sell its currency**
 - Which is inflationary (by increasing the money supply)



Fixed exchange rates

- Note that on a fixed exchange rate system, the central bank has no power to influence the interest rate
 - If it wants to maintain roughly stable reserves
- If there's sudden **buying** pressure on the currency,
 - The CB has to sell (newly-printed) currency & buy reserves to maintain peg
 - Which will increase the money supply
 - **Which will lead interest rates to fall** to induce people to stop buying the currency
 - And this will be expansionary (and could cause **inflation**!)
- If there's sudden **selling** pressure on the currency
 - The CB has to buy currency & sell reserves to maintain the peg
 - Which will decrease the money supply
 - **Which will lead interest rates to rise** to induce people to stop selling the currency
 - And this will be contractionary & will lead to a **recession**
 - Possibly a **fiscal or financial crisis** (if higher interest rates make debt service impossible)



Sterilization

- From before: If there's sudden **selling** pressure on the currency
 - The CB selling reserves is contractionary, raises interest rates
- But then, the CB can do a “sterilization”
 - Offsetting expansionary domestic open market operations
 - CB buys local bonds to expand the money supply
 - It will bring down interest rates and prevent a recession
 - But now it won't stop the selling pressure on the currency
 - And you will **lose** reserves indefinitely! (see Backus & Roubini for details)
- So you have a choice. You can either:
 - Continue to lose reserves indefinitely
 - Or you can let interest rates rise prevent the loss of reserves



Sterilization

- In the opposite case: if the currency is undervalued, then there's **buying** pressure on the currency
 - The CB then has to buy reserves, which is inflationary
- But then, the CB can do a “sterilization”
 - Offsetting contractionary domestic open market operations
 - CB sells local bonds to contract the money supply
 - It will bring interest rates back up to normal and contain inflation
 - But now it won't stop the buying pressure on the currency
 - And you will **gain** reserves indefinitely!
- This is what China did in the 2000s to keep its currency undervalued
 - And as a “side effect” build up large foreign reserves
 - But this policy loses a lot of money



A general principle

- A central bank can only hold fixed **two** of the following (and the other one will naturally adjust):
 1. The amount of reserves
 2. The foreign exchange rate
 3. The interest rate



THE CAUSES OF CURRENCY CRISES

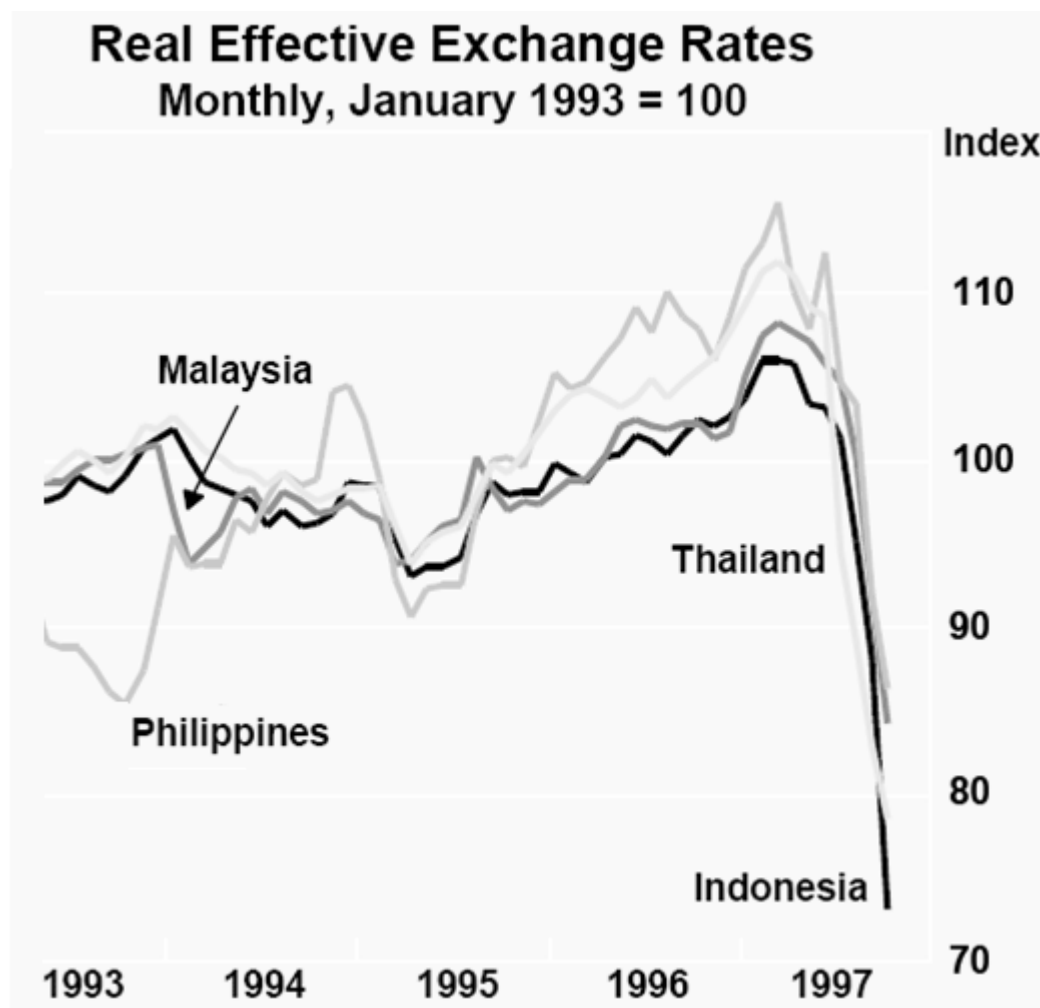


The Main Cause

- The government is defending an unsustainable fixed exchange-rate
 - Usually an overvalued currency
 - Which hurts competitiveness
 - Often accompanied by large capital inflows
 - Which can lead to bad lending quality and high leverage
 - Can also lead to high government and private debt levels, which can lead to a “debt-spiral” if interest rates rise
- Speculators know that the government has finite foreign reserves and limited willingness to raise interest rates
 - Can stage a speculative attack by selling currency

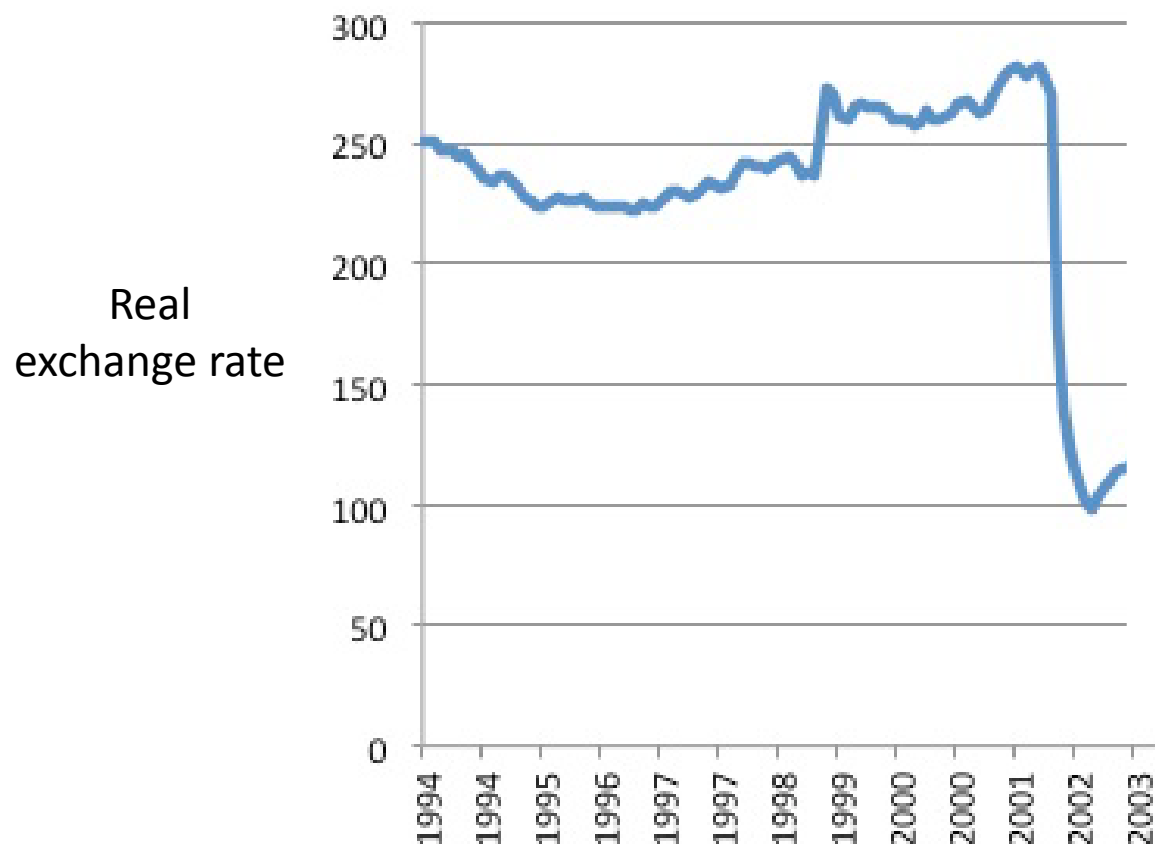


Overvalued East Asian currencies



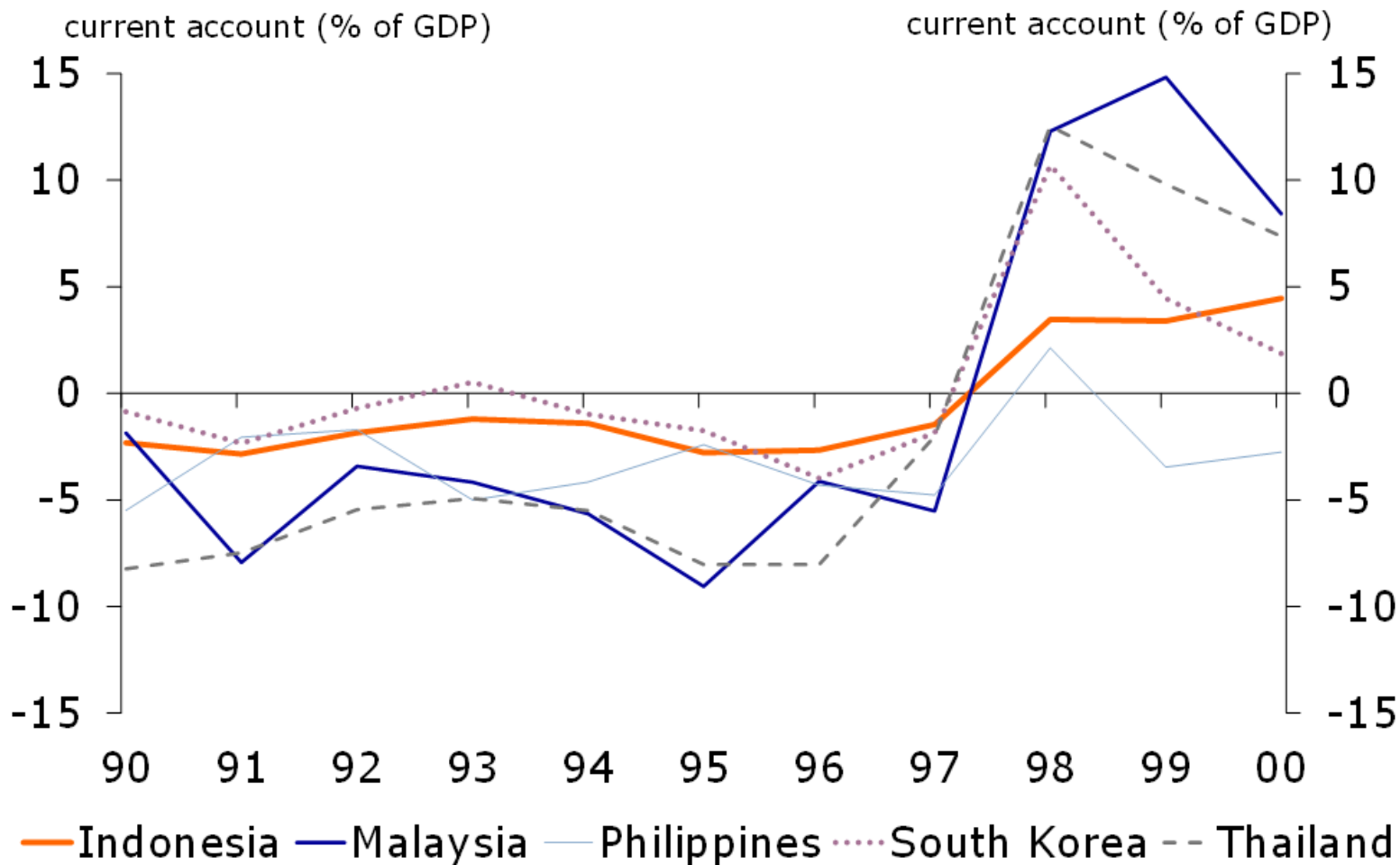


Overvalued Argentinian currency





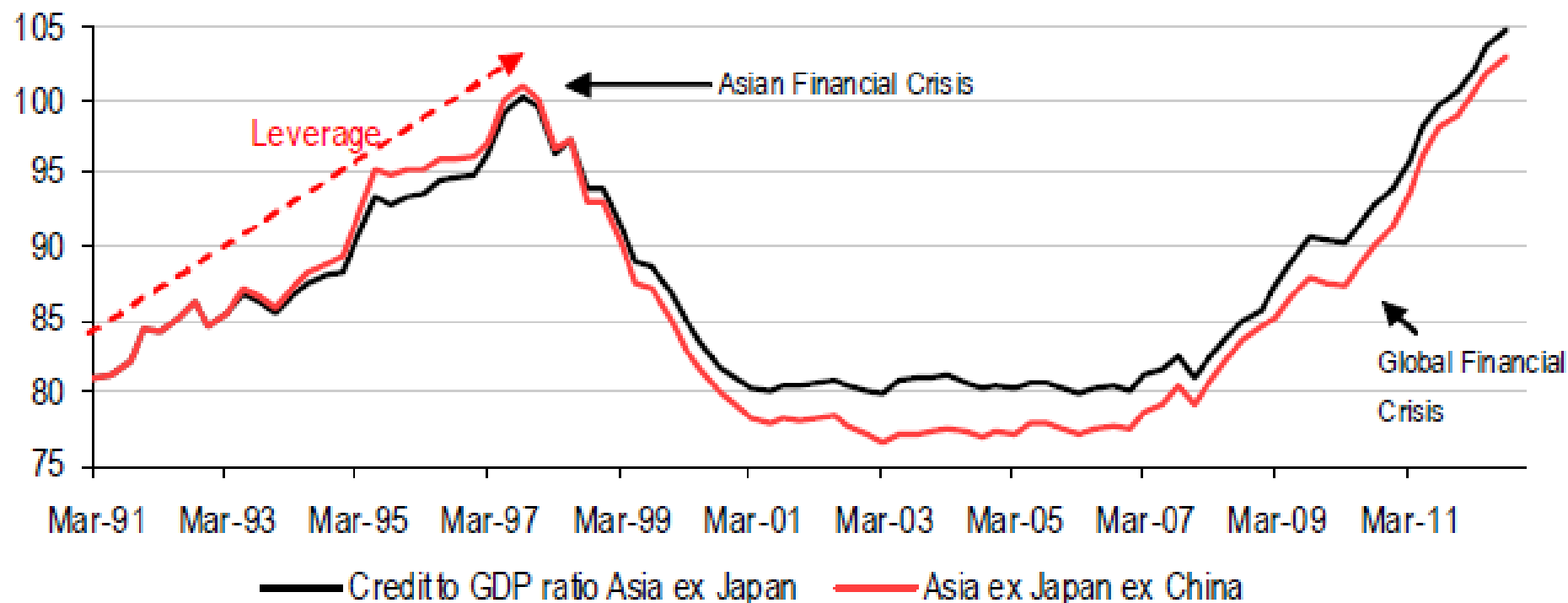
East Asian current account deficits





Which led to bank credit expansion

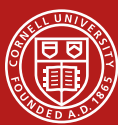
Chart 1: Bank lending to GDP ratio still on the rise (%)



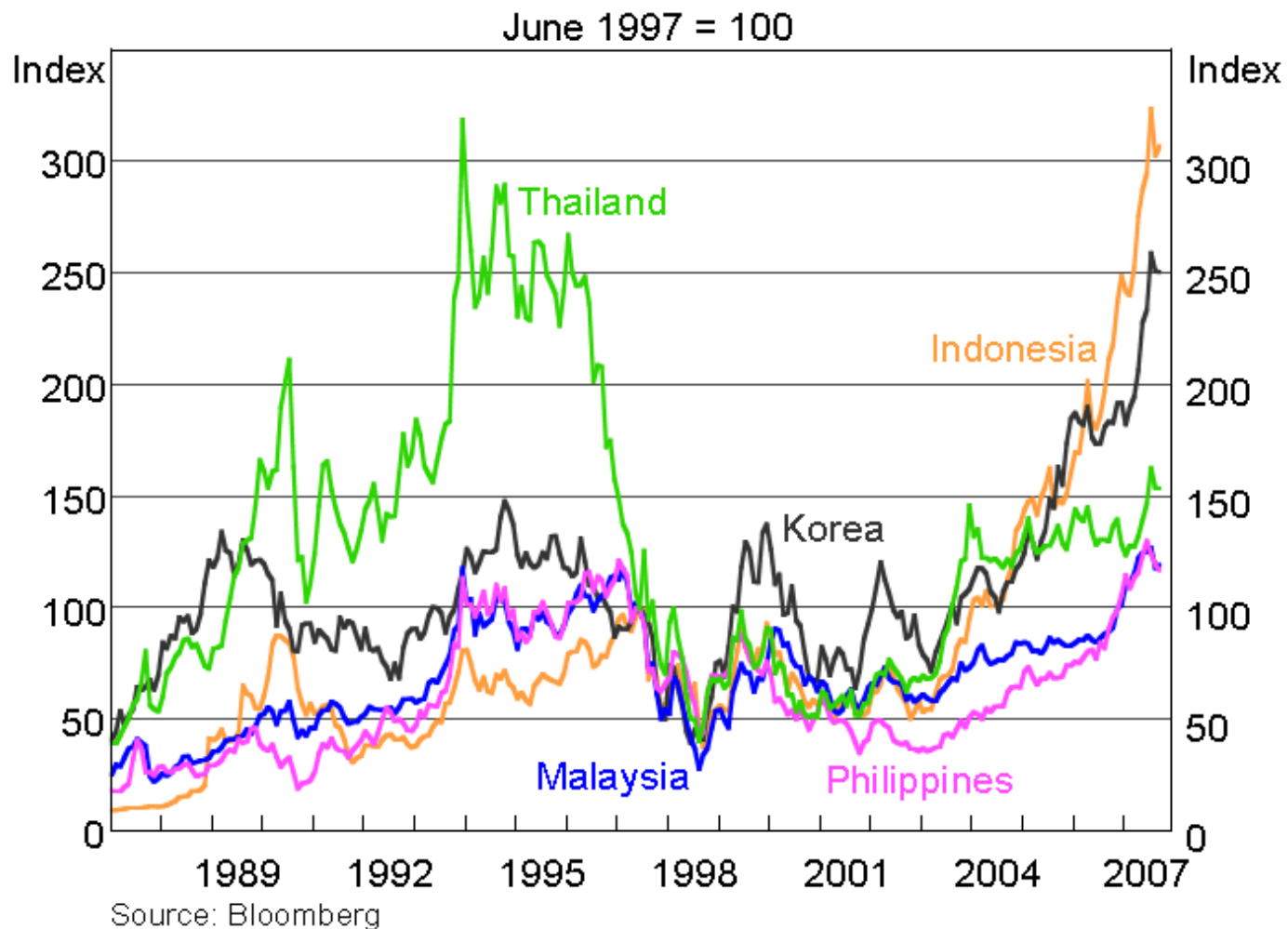


Capital inflows & credit expansion

- Investment boom chased bad projects in East Asia (1993-1997)
 - Asset price and real estate bubble
 - Lending to poor quality borrowers and non-profitable projects



High stock prices

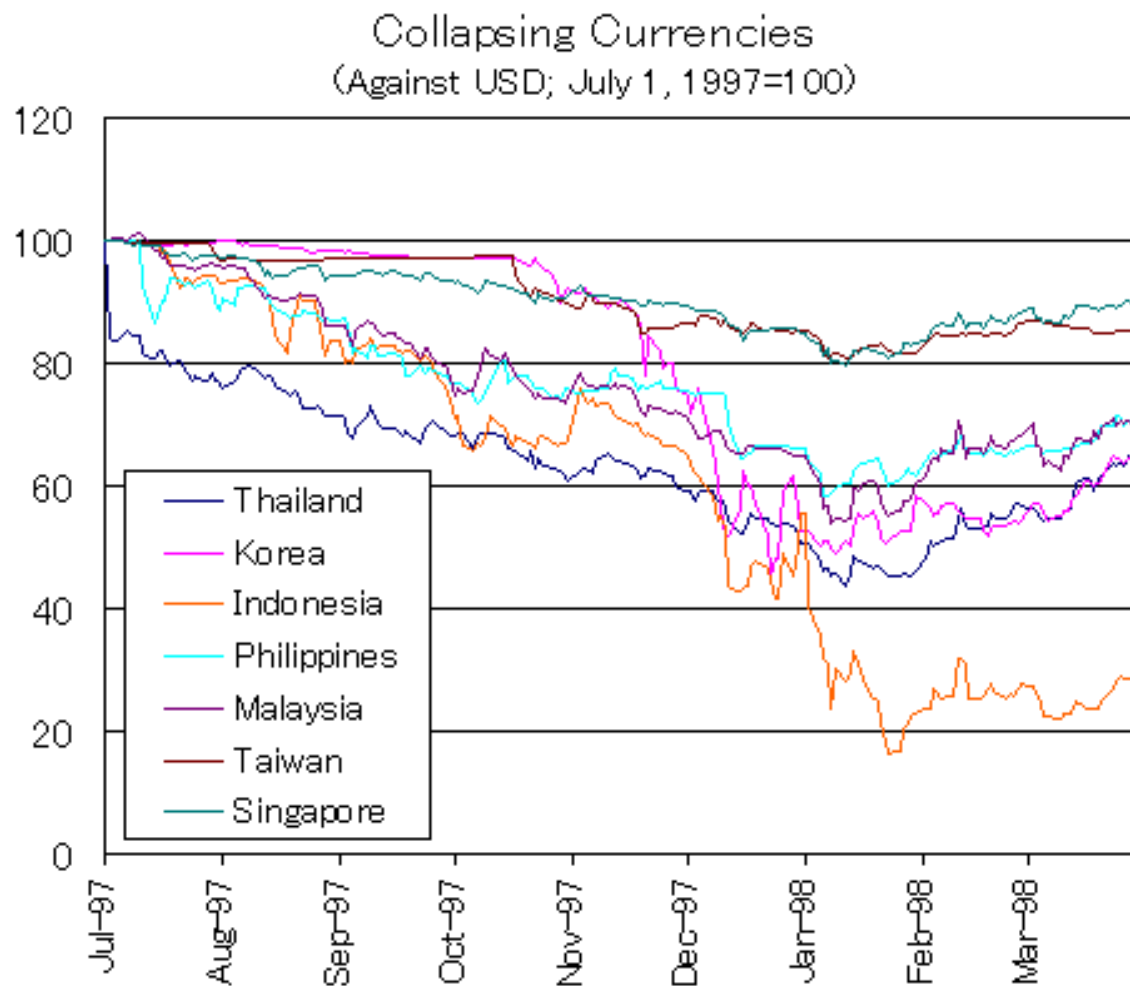




THE CONSEQUENCES OF CURRENCY CRISES

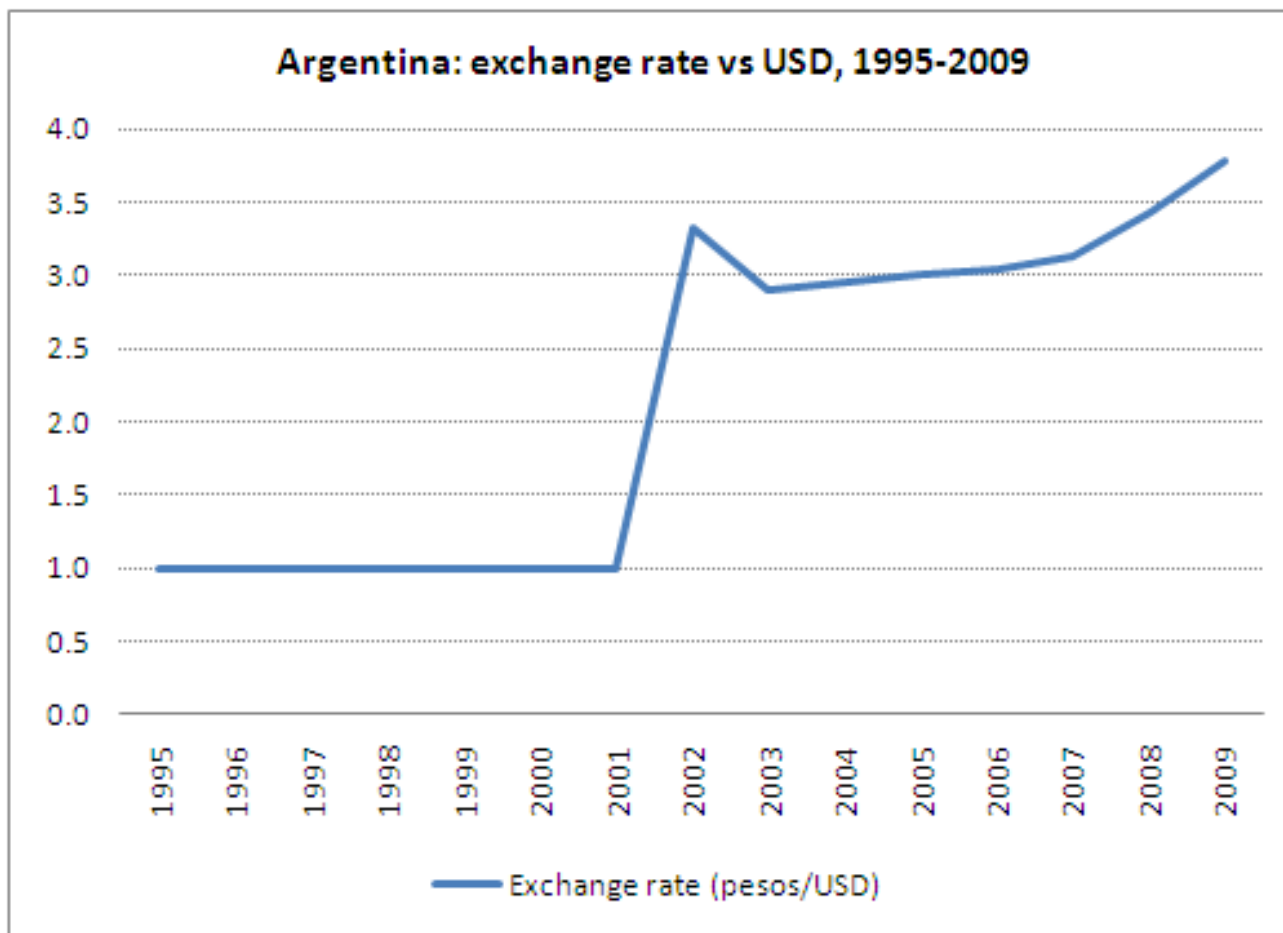


The collapse





The collapse





Argentina's Reserves Dwindle

BCRA International Reserves

Billions of US dollars, month-end, excluding Federal government securities





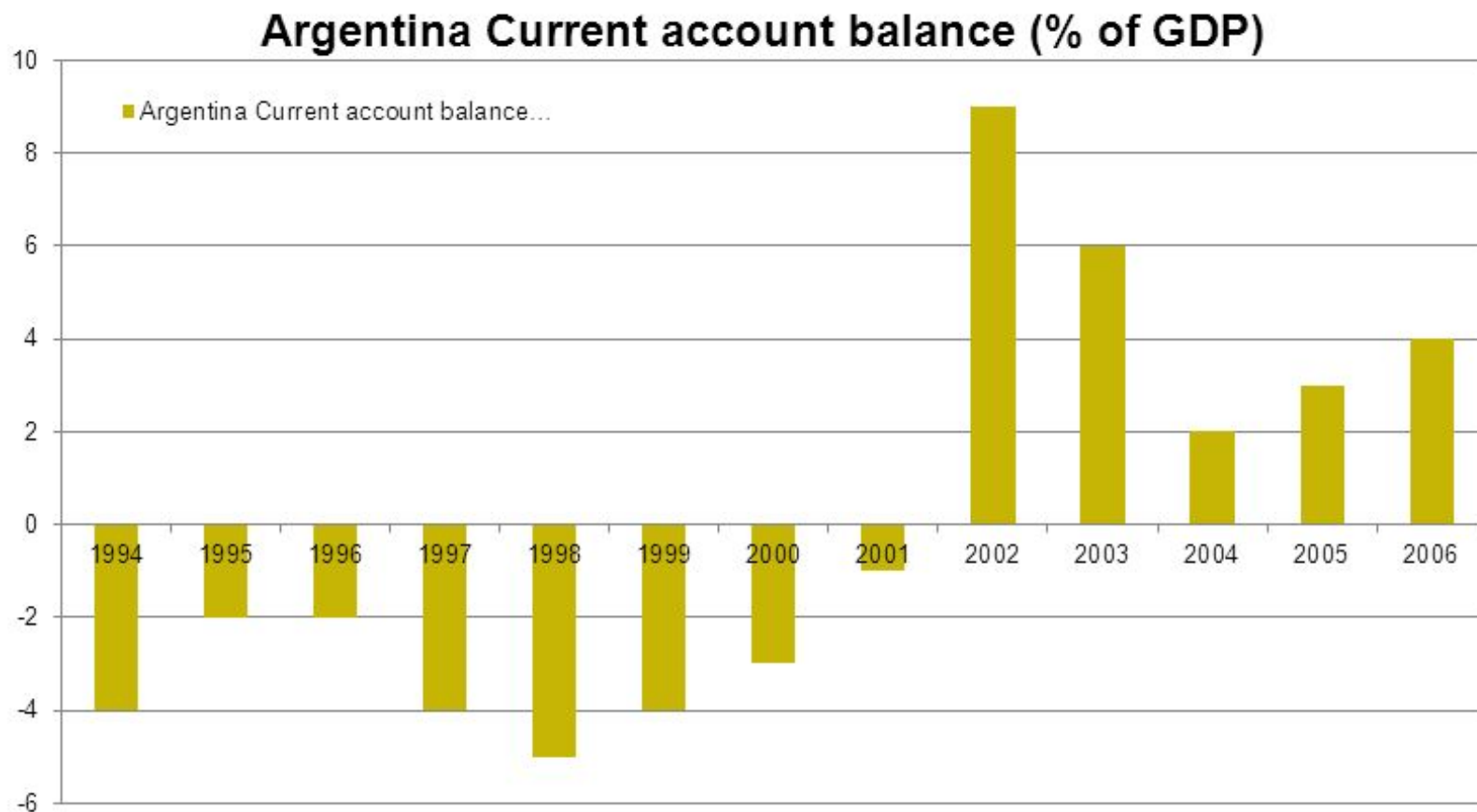
Direct consequences

A currency crash:

1. Make imports prohibitively expensive
 - Though makes exports cheap, which stimulates competitiveness in the long-run
2. Forces *high interest rates* to contain the outflows and resulting inflation
 - Which causes unemployment and output to drop
 - Through standard monetary channels
 - Think: IS-LM model
 - And alternative channels
 - Bank lending contraction

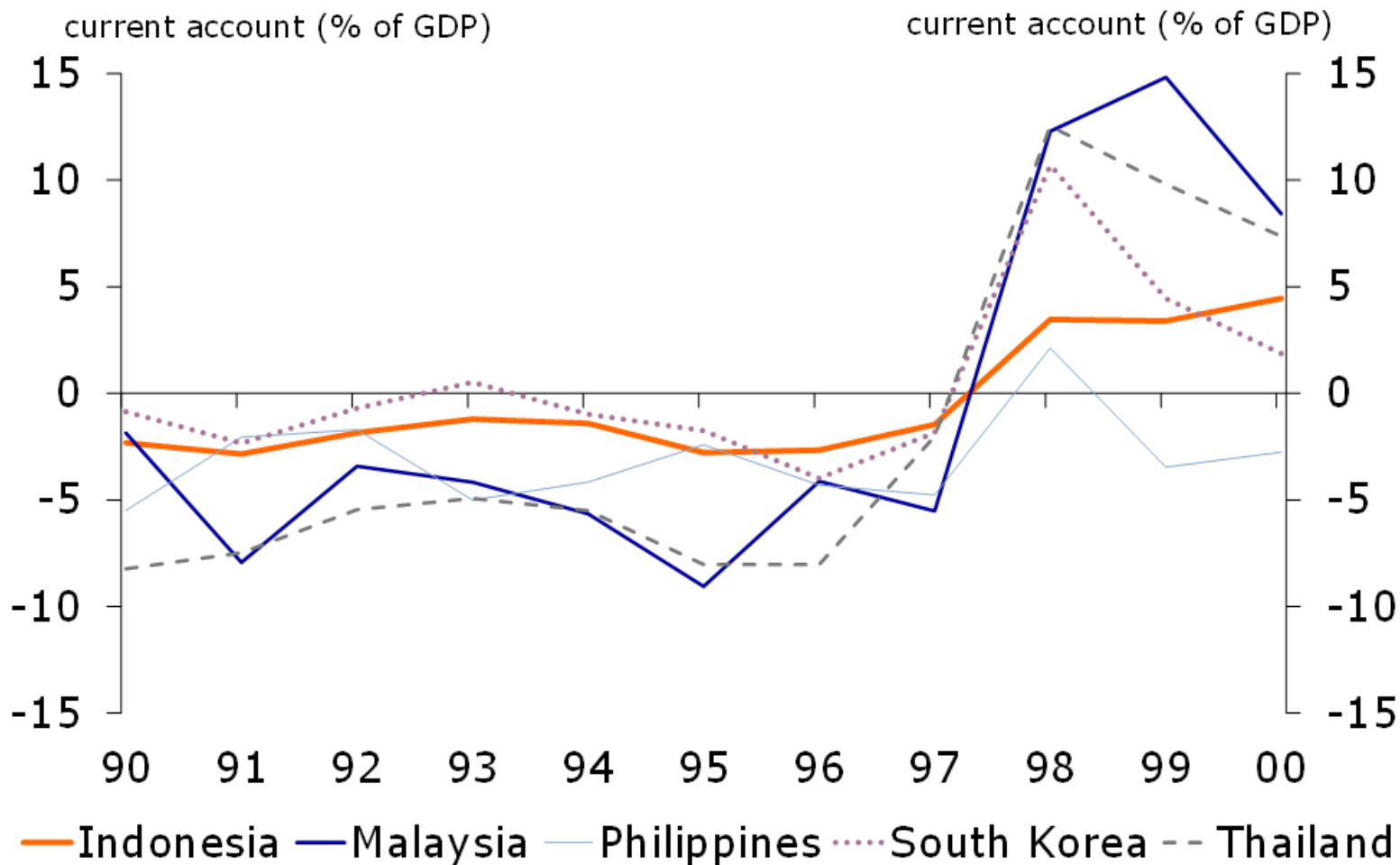


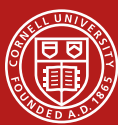
Sharp current account reversal





Sharp current account reversal



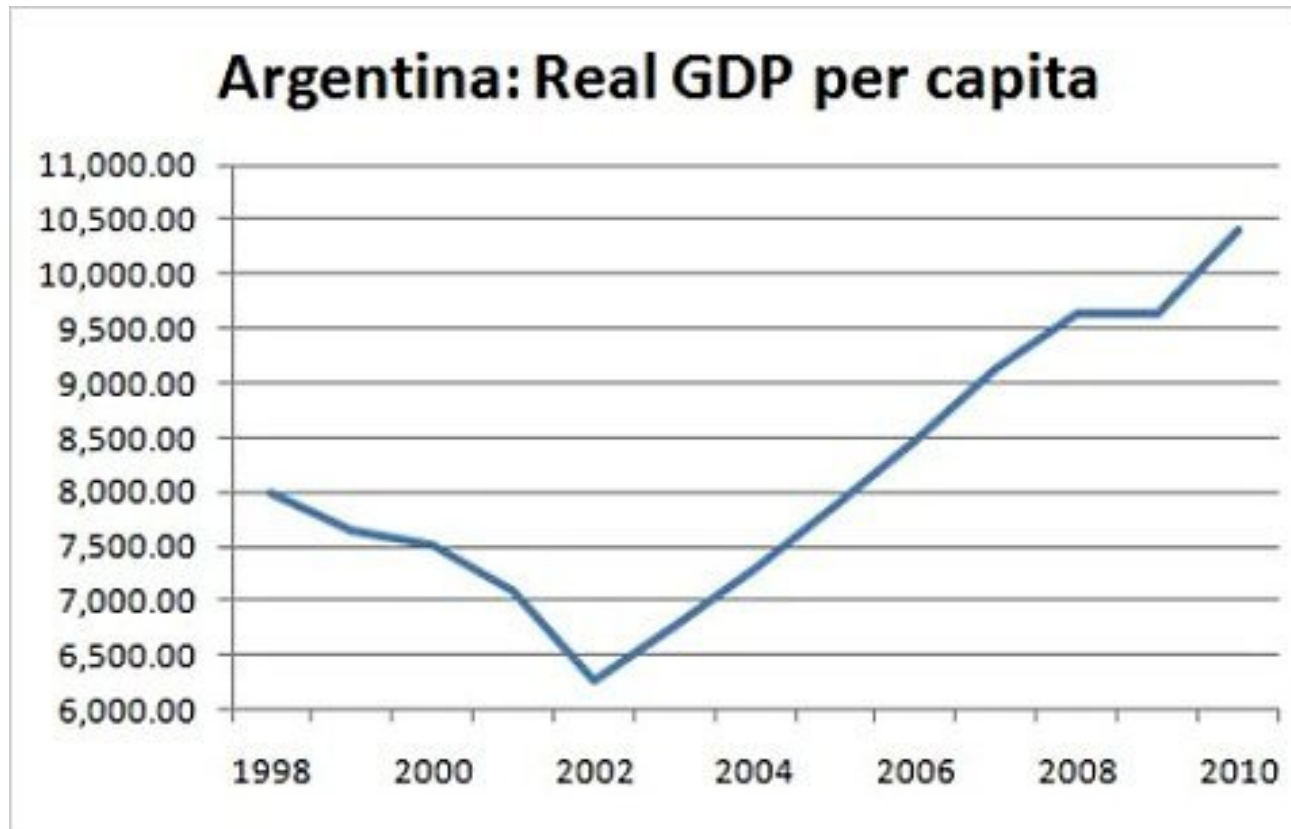


Output collapse



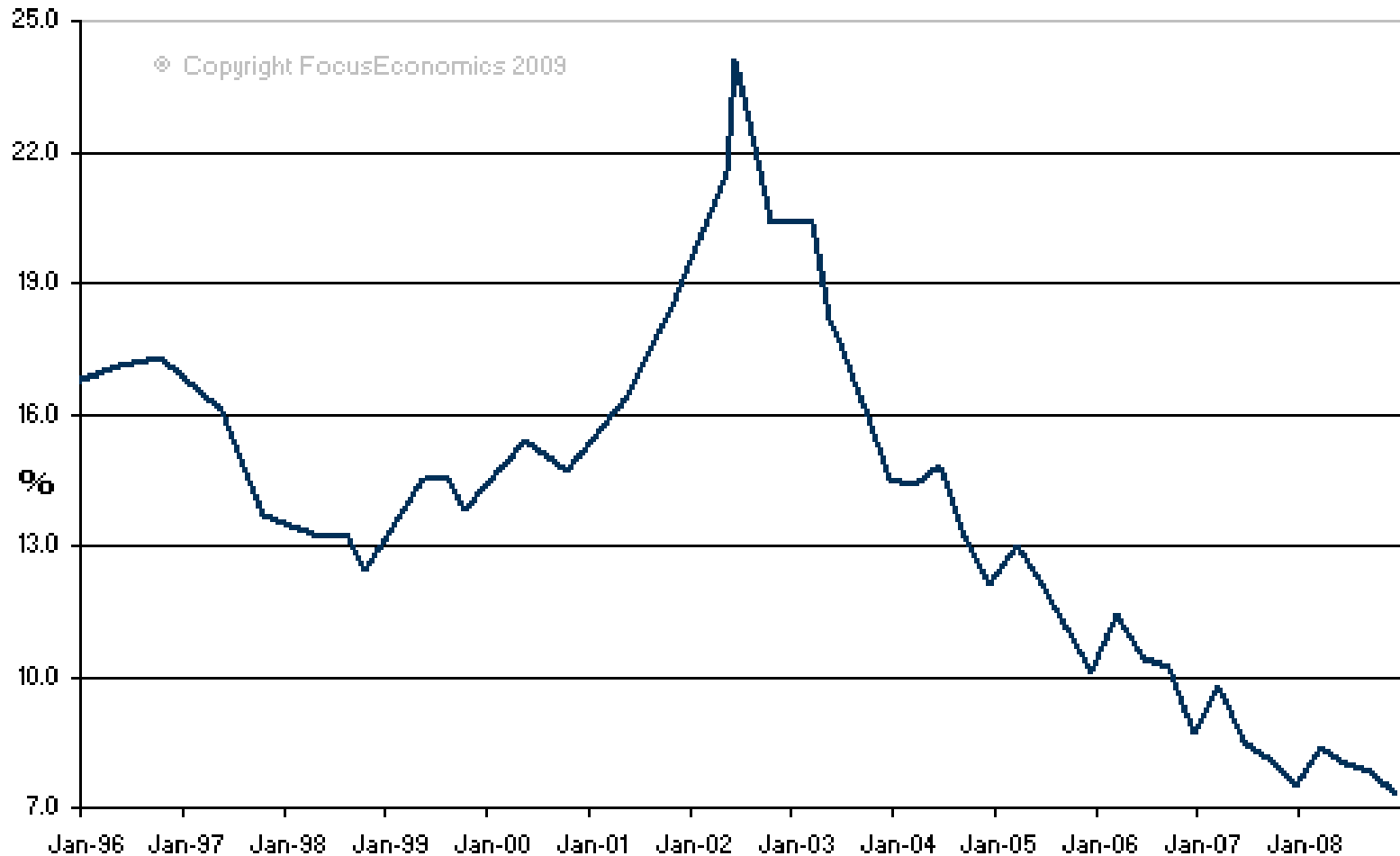


Output collapse





Unemployment in Argentina





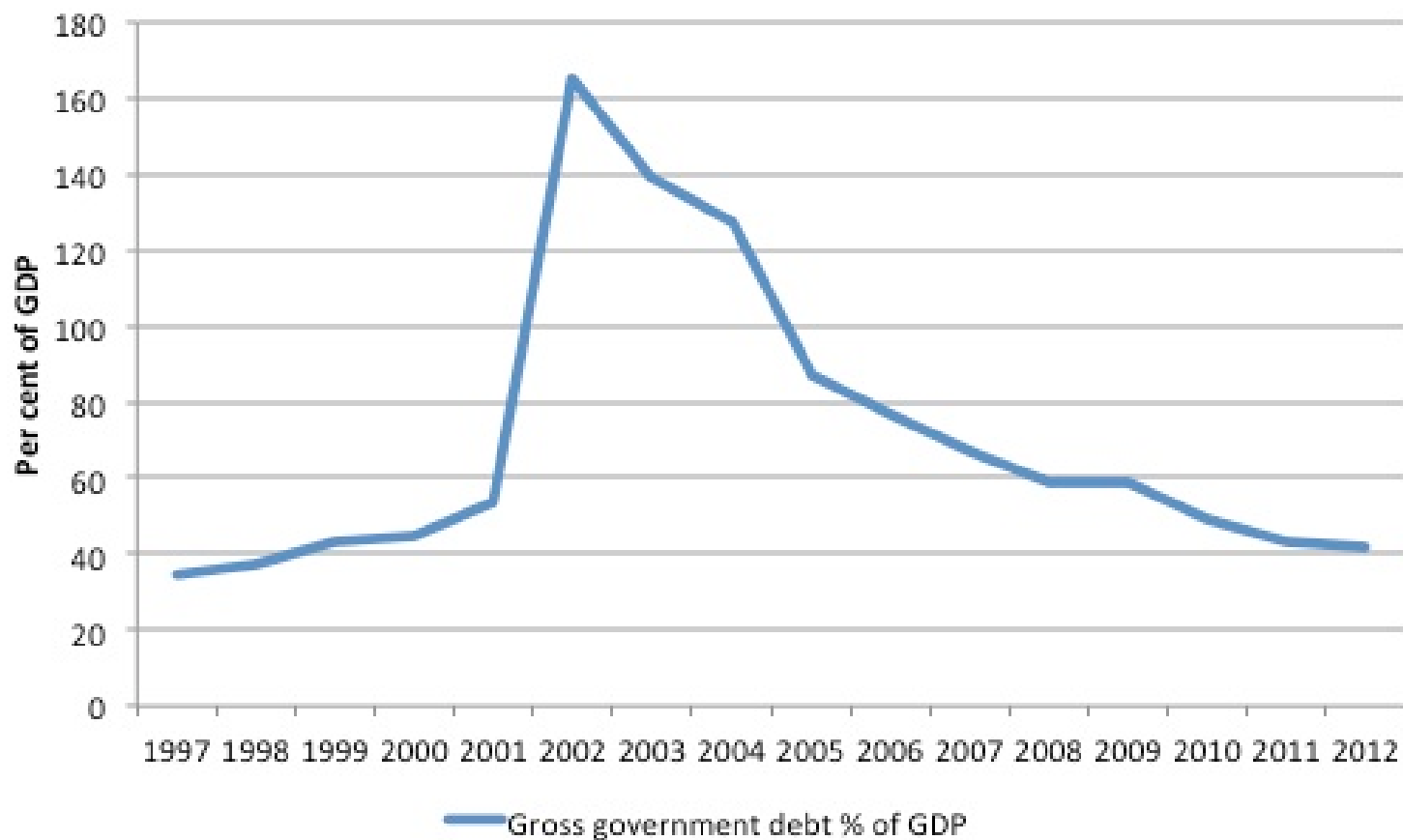
Amplifying factors

A currency collapse:

1. Magnified government debt burden
 - Large cuts in spending → depresses demand
 - Or government must monetize debt → inflation
2. Magnified debt burden of firms and banks
 - Households and firms hit borrowing constraints
 - Reduced consumption & investment → depresses demand
 - Corporate bankruptcies
 - Bank runs as foreign depositors withdraw



Fiscal crisis in Argentina

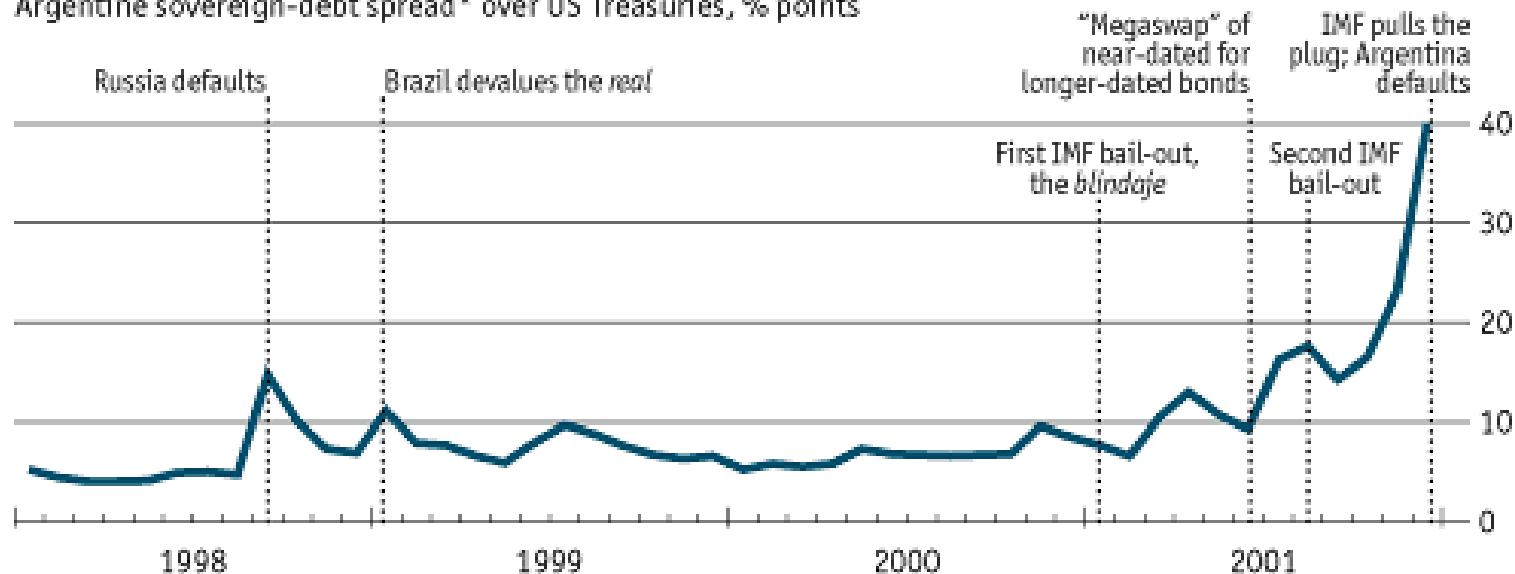


Fiscal crisis in Argentina

2

Yielding to the inevitable

Argentine sovereign-debt spread* over US Treasuries, % points



Source: Thomson Datastream

*Derived from J.P. Morgan EMBI+ Argentina index



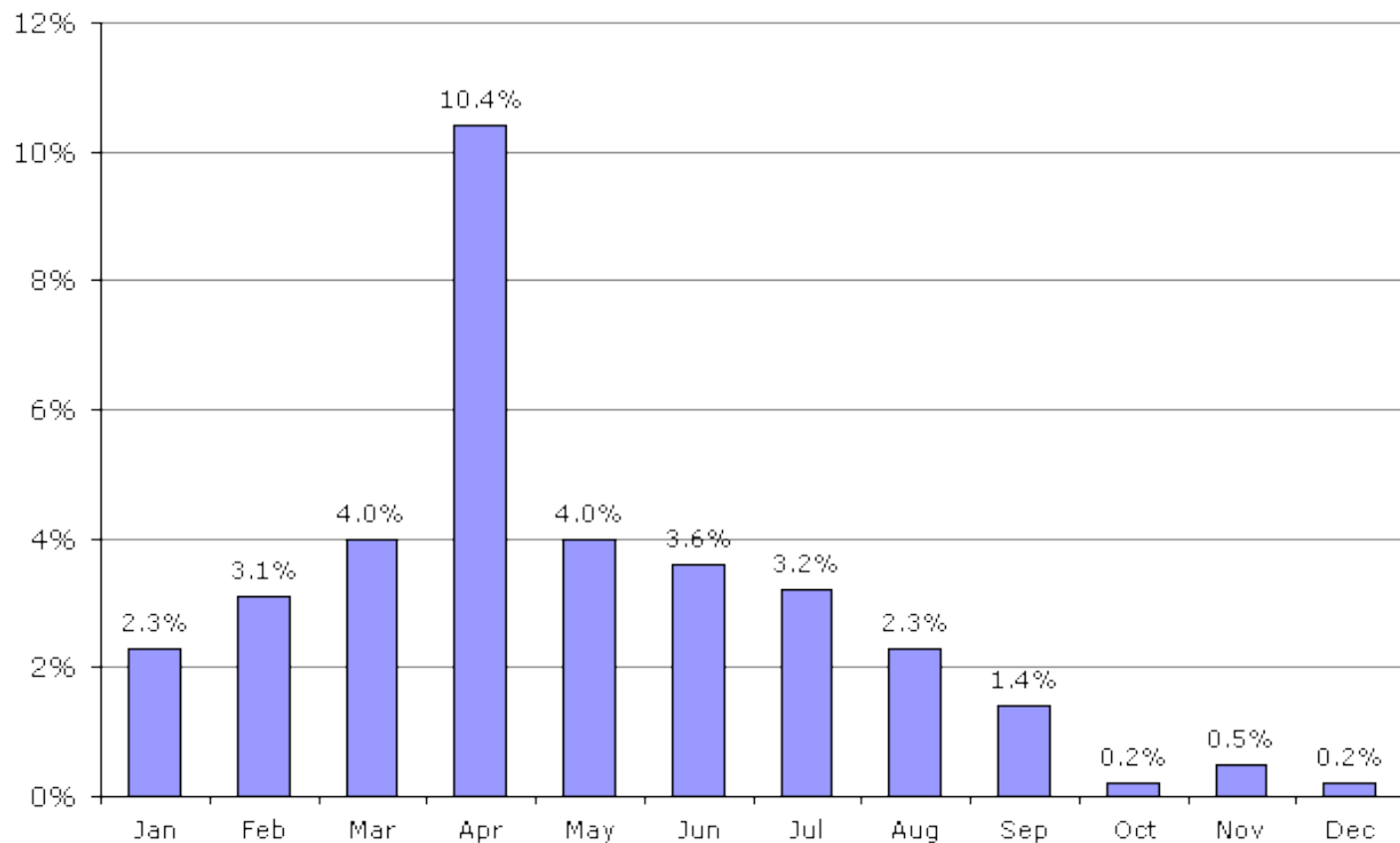
While interest rates spike

- Argentina can't meet debt payments
 - Defaults on its international debt
- Locked out of bond markets, Argentina has to monetize its deficit
 - High inflation



Inflation

Monthly inflation in Argentina, 2002





Financial crises





International responses

- IMF Bailouts in East Asia:
 - Both to the government
 - To help it finance its deficit
 - And to the banking sector
 - To stop the runs when the foreign deposits fled

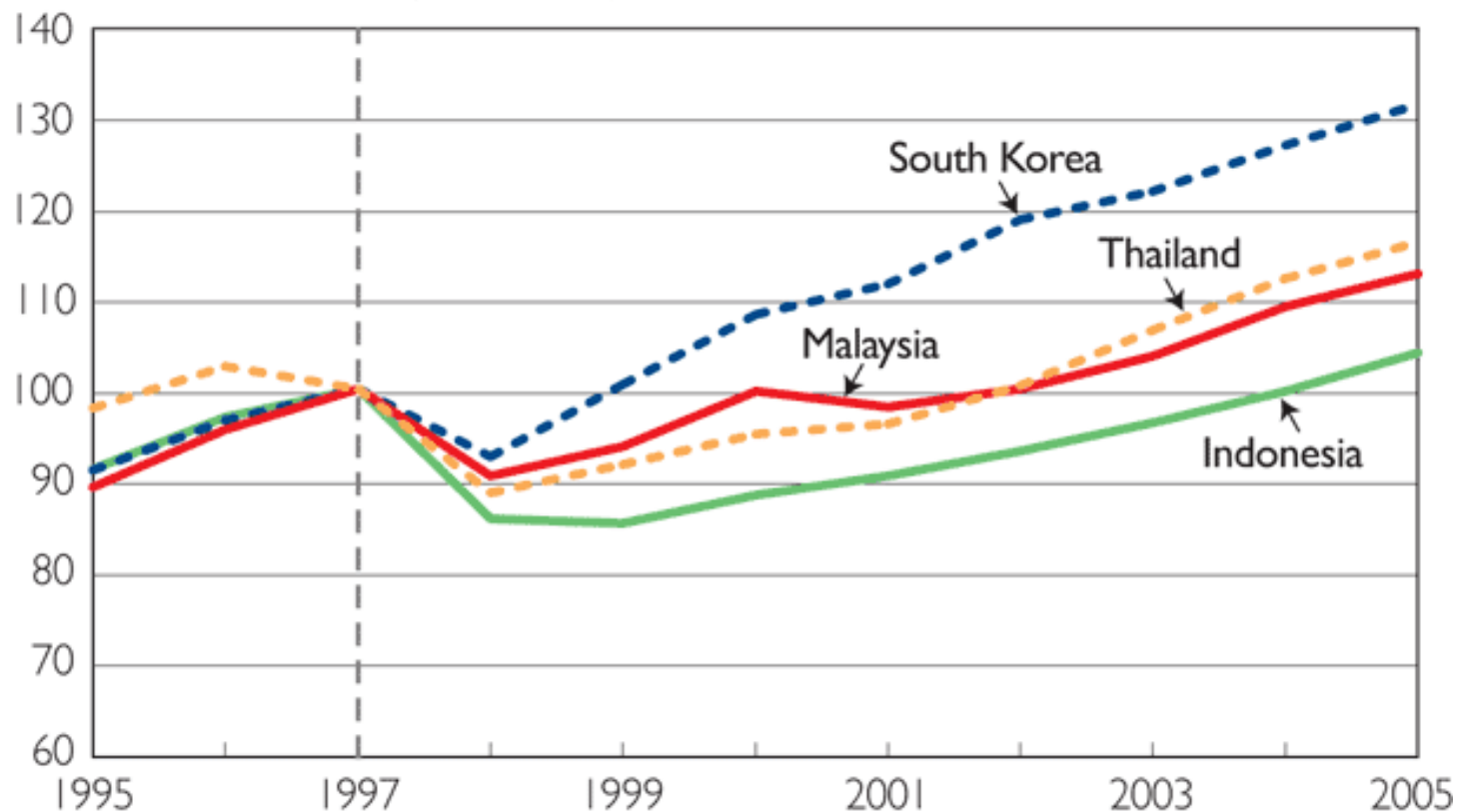


BUT THINGS BOUNCED BACK



Economic Recovery After the Setback

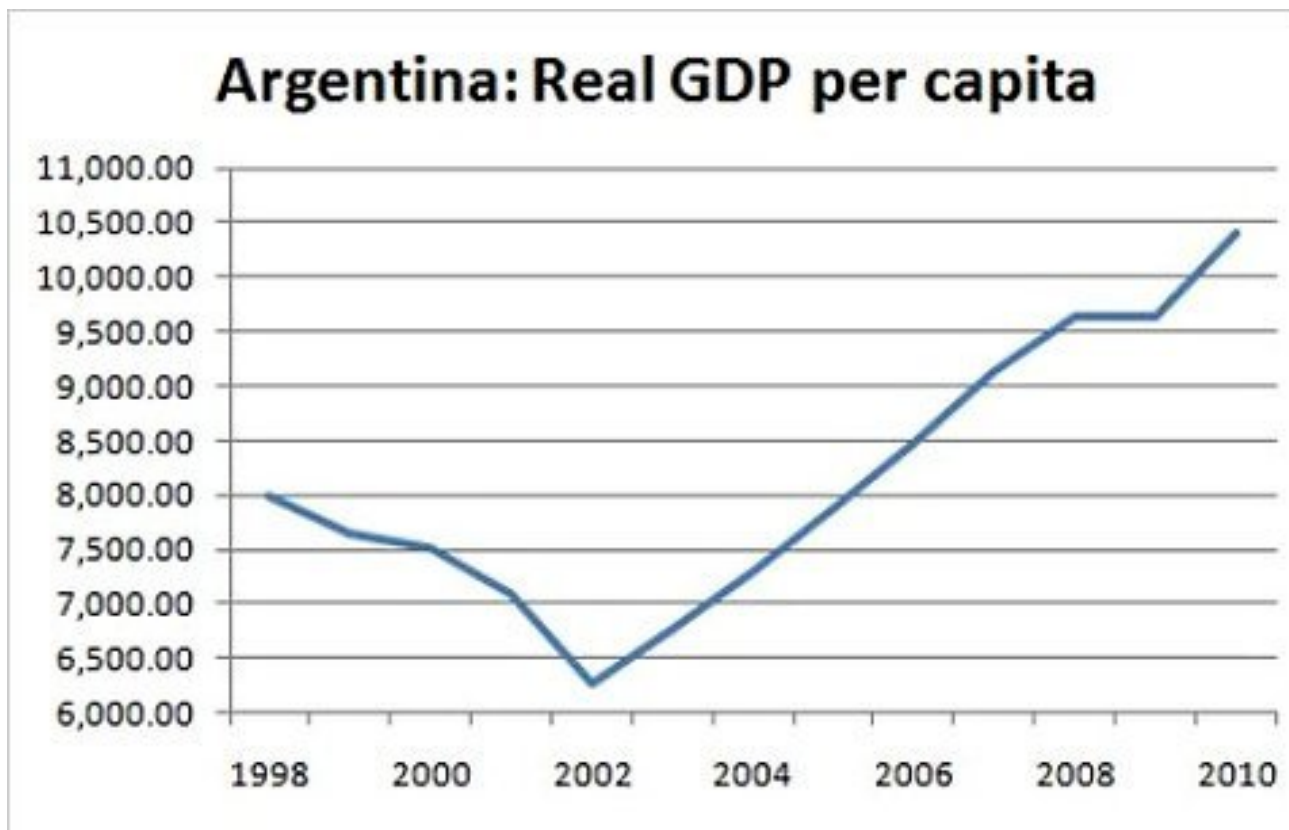
GDP per Capita Index (1997 = 100)



Source: World Bank, World Development Indicators Online, at go.worldbank.org/



The Recovery





THE EUROPEAN ERM CRISES OF 1992-93



What is the ERM?

- A fixed exchange rate system known as the Exchange Rate Mechanism (ERM)
 - Used by some members of the EU
 - Late 1970s to early 1990s
- Technically, a managed float exchange rate system
 - Currencies of participating countries allowed to fluctuate within pre-specified bands.



Centrality of the Deutsche Mark

- Effectively a system where the bands were maintained relative to the **Deutsche Mark**
 - The most stable currency of the group
- The Deutsche Mark became the unofficial reserve currency
 - So the ERM had a built-in lending mechanism to prevent crises from happening.
 - The German Central Bank (Bundesbank) was suppose to lend DM to the member country if the country needed support for its currency.



Factors behind the ERM's collapse

1. German Reunification
2. Self-Fulfilling Speculative Attacks



German reunification

- Catalyst for the ERM crisis was the reunification of Germany in 1990
- In order to make the assimilation work, the West German government spend an enormous amount of money.
- Almost half of all West German savings were transferred to the East and the government budget deficit rose from 5% to 13.2%.



German reunification

- By 1991, the Bundesbank was becoming nervous about the prospects of high inflation in Germany
 - Started pursuing contractionary monetary policy.
- The combination of expansionary fiscal and contractionary monetary policy caused German interest rates to rise dramatically
 - About 3% in 1991 and 1992
- High interest rates of Germany made the situation for Britain, France, Italy, and other European countries worse
 - Because they were restrained from taking corrective monetary policy actions
 - Had to “import” Germany’s contractionary monetary policy



Initial Speculations

- Led to high unemployment
 - Pressures for the politicians in upcoming elections in Britain, France, and Italy to offer some policy solution
- Some analysts speculated that these countries might soon give up their support for the exchange rate peg against the German Mark
- A currency devaluation would help the devaluing country boost exports
 - Also allow the country to cut interest rates



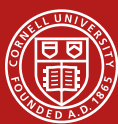
“Black Wednesday”

- September 16, 1992
 - The sell-off begins!
- UK's prime minister and cabinet members tried all day to prop up the sinking pound and avoid withdrawal from the ERM
 - The British government raised the base interest rate from a high 10% to 12% in order to tempt speculators to buy pounds.
 - During that same day, it promised to re-raise the interest rates to 15%, but investors kept selling the pounds.



“Black Wednesday”

- The UK Treasury spent approximately £27 billion of reserves in trying to defend the pound by selling Deutsche Mark and buying pounds.
 - The market knew that the UK could not afford to keep interest rates high for long.
 - The UK was not prepared to lose all of its currency reserves to simply stay in a seriously flawed ERM.
- One of the most high profile currency market investors, George Soros, made over \$1 billion in profit by betting against the pound.
- Britain was eventually forced to withdraw from the ERM
 - Because they were unable to keep the sterling above its agreed lower limit.



Speculative Attacks Continue

- A similar situation in Italy
 - Eventually, Italy also pulled the Italian Lira out of the ERM
 - Spain and Portugal, afraid of being attacked next, exit the ERM and devalue their currencies against the DM.
- Next target for speculative attacks: the French Franc.
 - Elections for France were coming soon, and political pressure was mounting for a cut in the French interest rates
 - As with the other currencies, speculators were betting that France would devalue the franc or withdraw from the ERM
 - Rather than maintain a high interest rate with slow growth and rising unemployment.



Fall of the French Franc

- As part of the core currency link under the ERM, France and Germany would try to defend the franc.
 - The central banks of France and Germany intervened aggressively to hold their exchange rate link by buying Francs and selling DM.
 - The countries succeeded, but it was only momentarily, since France's foreign currency reserves were nearly depleted.
- As expected, speculative attacks continued to hit the Franc because speculators knew France needed lower interest rates to help stimulate the economy and reduce unemployment.
- Bank of France raised interest rates to defend the Franc, and both France's and Germany's central bank continued to intervene directly to support the Franc.



Fall of the French Franc

- Rising interest rates continue to hurt the French economy
 - German interest rates were too high, and only a cut in German interest rates could save the Franc.
- Continued speculative attacks against the Franc proved to be impossible to beat, so Germany and France gave up defending the exchange rate link.
 - The EU finance ministers and central bankers decided to allow the widening of the currency trading bands to fluctuate within 15% around a central rate.
- Once again the speculators won and locked in their profits by buying back the devalued Franc.
 - The German central bank spent about 60 billion Mark (\$35 billion) trying to prop up the French currency.