The Global Economy

Foreign Exchange

NYU STERN

Exam 2

- Exam: Saturday, December 17, 9am
  - Calculator
  - 1 page of notes
  - No books, cell phones, etc.
  - Focus study on post-midterm material
- How I would study
  - Problem sets and practice problems
  - Slides
  - Notes
  - Try the practice exam, timed
- Second half summary on Bb
- Drinks around 3:30pm: Amity Hall (3rd/Sullivan)

Today's Roadmap

- European Monetary Union (continued)
- Exchange Rates
  - Exchange rates and prices
  - Exchange rates and interest rates
  - Exchange rate regimes
- Review Session

European Union

- Emerged from post-WWII Europe
  - ECSC to foster peace between France and Germany
- Evolved into the EU and eventually the monetary union, the EMU (a subset of the EU)
  - 1 currency; 1 central bank; **1 monetary policy**
  - "one market, one law, one money" (maybe?)
- EMU challenge:
  - 1 monetary policy, 17 heterogeneous countries

Economic benefits and costs

- Benefits
  - Wide euro acceptance is a public good
  - Promotes international trade and finance
    - Lowers transaction costs
    - Makes pricing transparent
    - Expands size of market
  - Eliminates exchange rate risk within EMU
- Costs
  - Sacrifice local monetary policy and lender of last resort
  - Can't inflate away debt; increase risk of government default; diminish ability to recapitalize banks

Two monetary unions

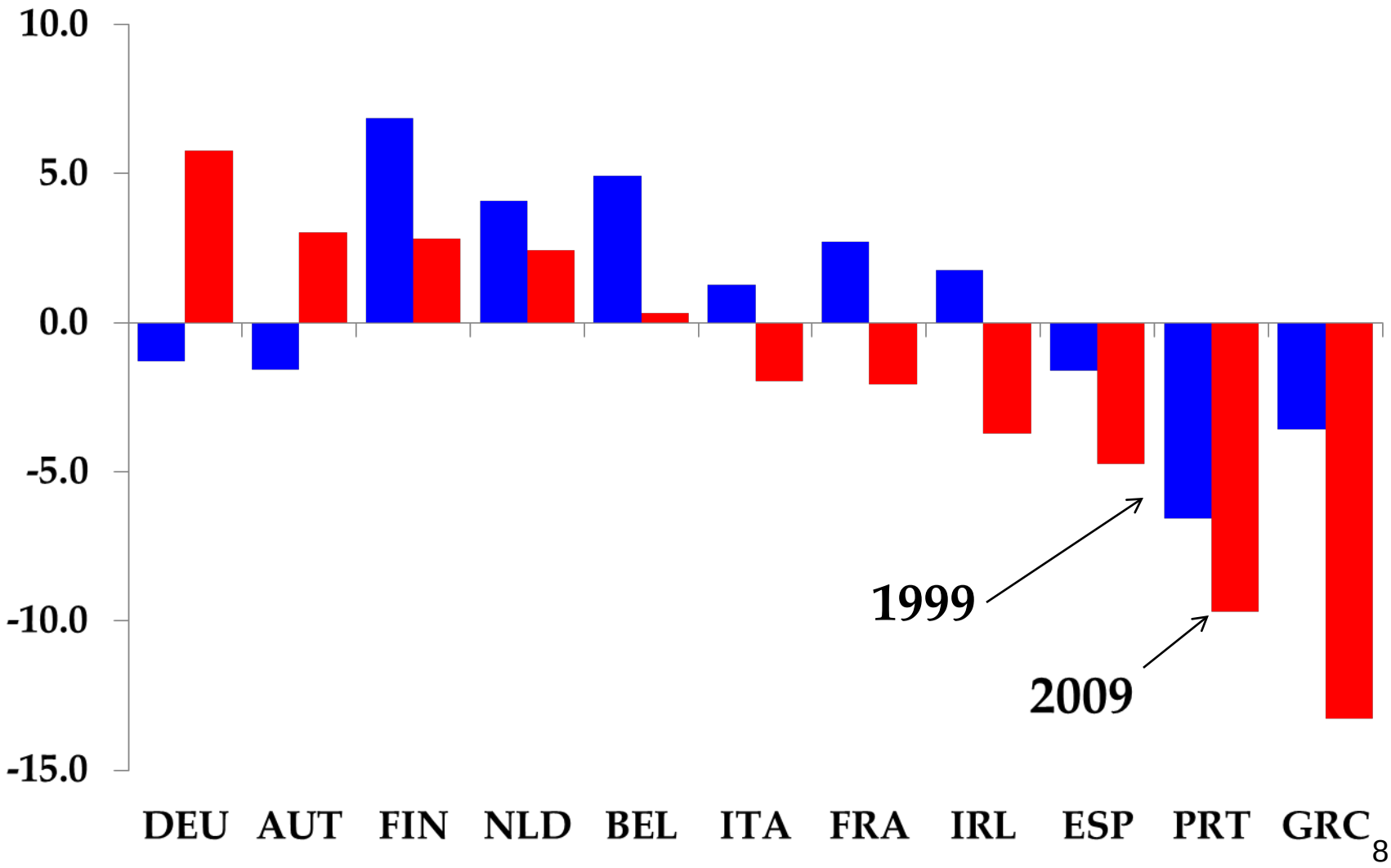
	US States	EMU Countries
Common monetary policy	Yes	Yes
Common fiscal policy	Yes	No
Fiscal burden sharing	Yes	No
Labor market mobility	High	Low
Official languages	1	23
Unemployment rate, average	9	10
Unemployment rate, high/low	NV=13.4, ND=3.5	ESP=22.6, NLD=4.5
Prices and wages	Flexible	Less flexible
Richest/Poorest	CT/MS=1.8	LUX/EST=7.2
Common: deposit insurance, bank regulator and backstop	Yes	No

Rules and time consistency

- Secure price stability
  - Independent ECB
  - "No bailout" clause
- Fiscal entry conditions in Treaty
  - Seek to contain fiscal moral hazard
  - Pressure to comply weakens after entry
  - Applied very flexibly even at start
- Stability and Growth Pact
  - Supplement to the Treaty
  - Excessive deficit procedure
  - Violated early by Germany, France and others

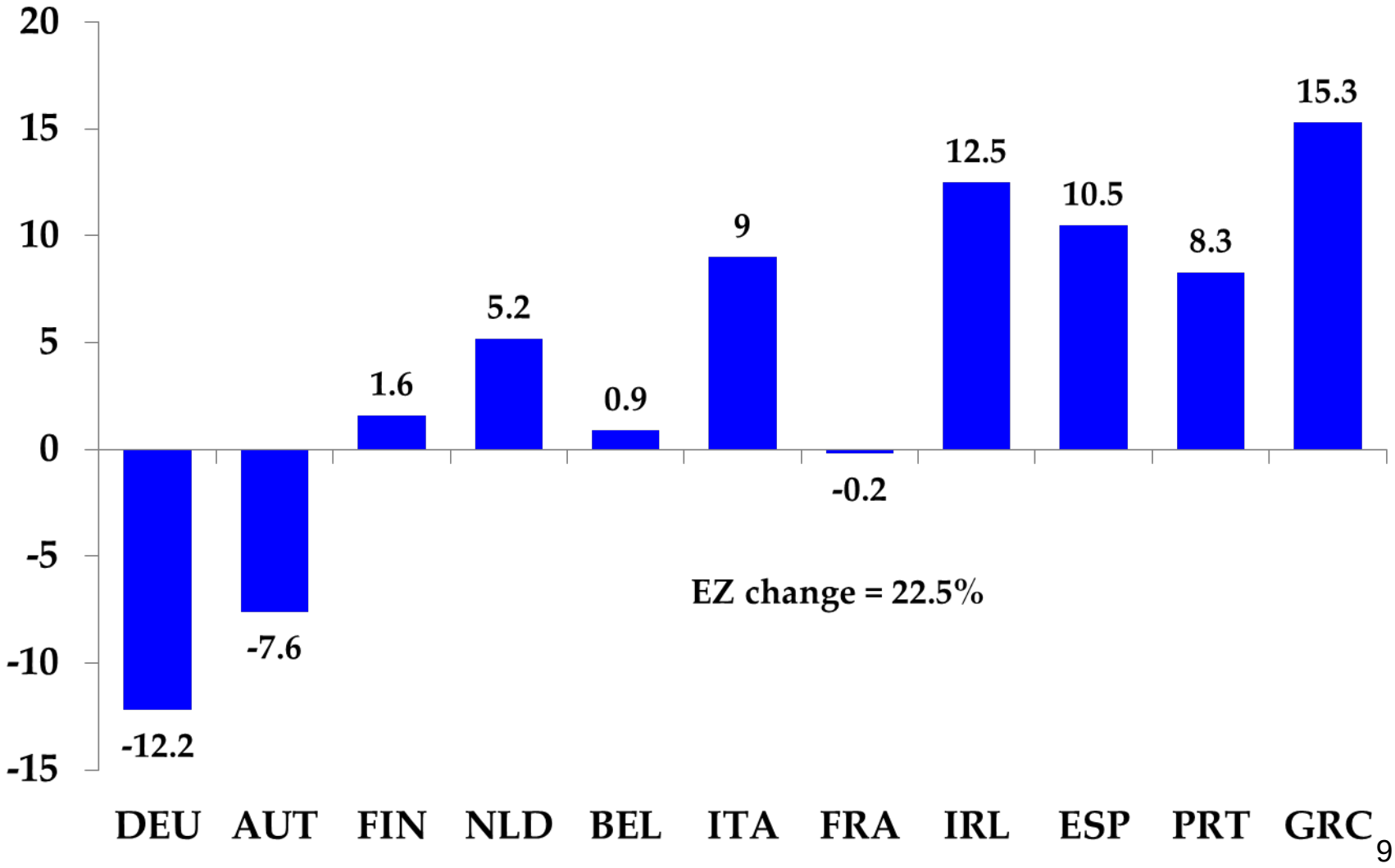
Current accounts

percent GDP

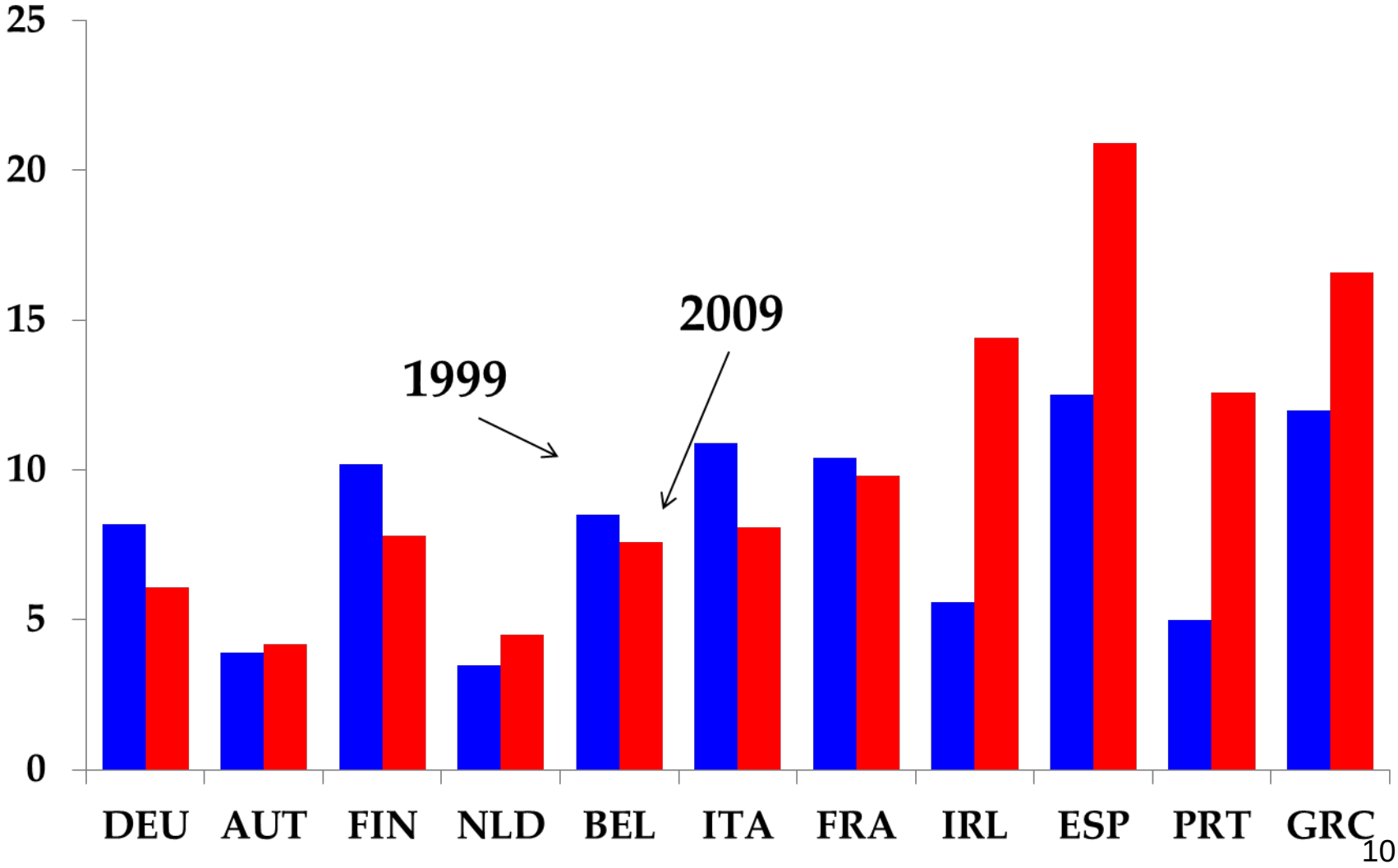


Unit labor costs

percent change 1999-2009, relative to EZ change



Unemployment rate

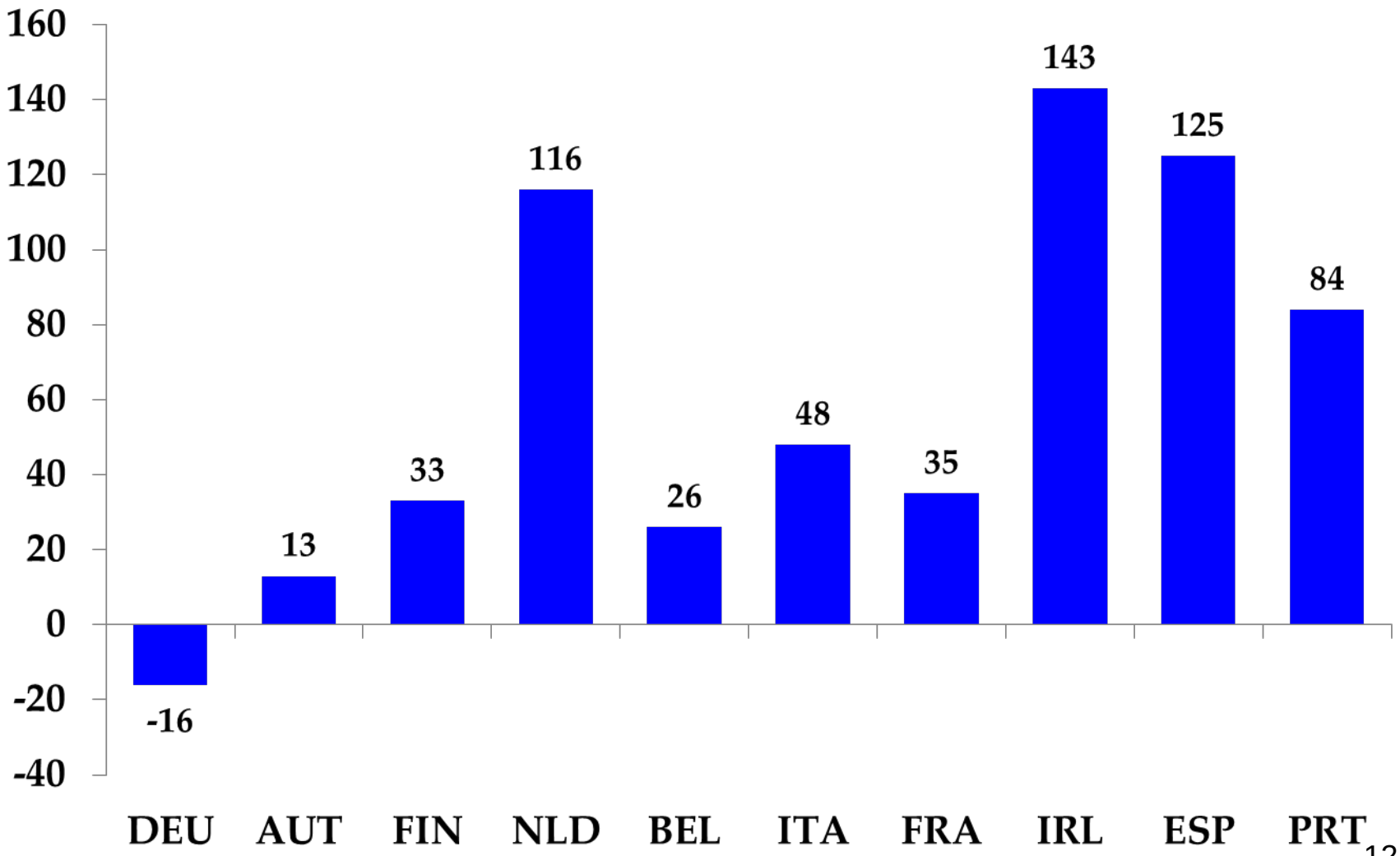


Spain, Greece, Ireland, Portugal, Italy

- Borrowing costs fall on joining EMU
  - "Inherit" central bank discipline
  - Can no longer inflate away debt (i vs. g)
- Portugal and Greece
  - Government debt grows: increase net spending
- Ireland and Spain
  - Private sector debt grows: housing, consumption
  - Private debt becomes public after bank bailouts
- Italy
  - Already had large debts, but runs primary surplus
  - Problem is slow growth (i vs. g, again!)
  - GDP/capita 1999-2011: avg 11.5%, Italy 1.8%

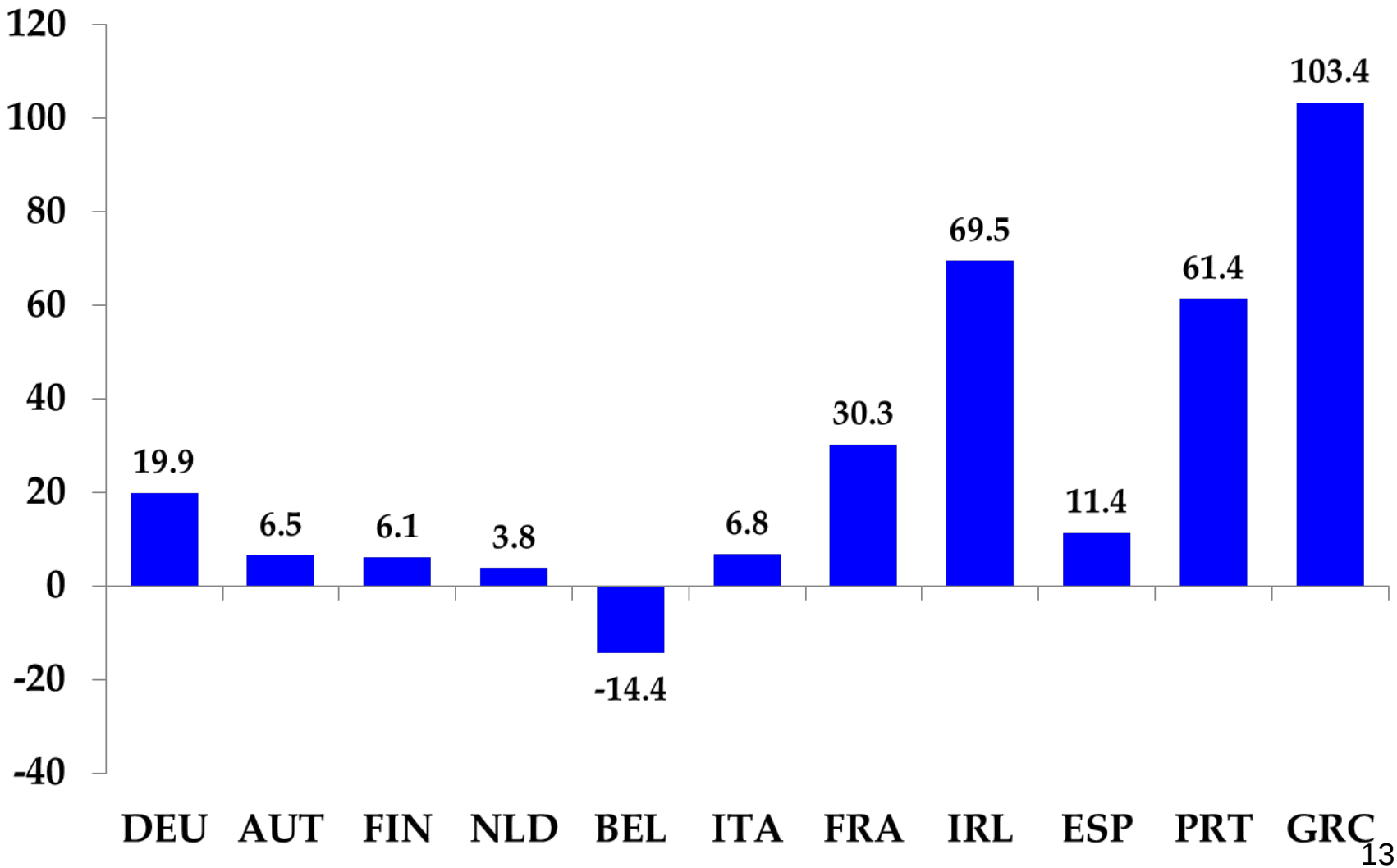
Private credit

change from 1999-2009, percent GDP



General government debt

percent GDP, change 1999-2012



What would happen with no EMU?

- Fixed exchange rate system (ERM in 1990s)
  - Capital flight out of Greece, etc
  - Fixed exchange rates are adjusted/abandoned
  - More on this next week
- Flexible exchange rate
  - Peripheral currencies would depreciate
  - Early adjustment likely
  - Capital inflows to the peripheral economies would have been smaller, less debt would have been possible

What are the options? I

- Abandon EMU?
  - Not an economic decision, a political one
    - Threatens the entire EU
  - The whole thing?
    - Germany leaves? Left with a "weak" EMU.
    - Greece, Italy leave? Left with a "Northern" EMU.
      - Need recapitalization of banks
      - Would France be next?
  - What happens during transition?
    - Cataclysm: banks runs, capital flight, sovereign default
  - Eventually settle on a system of fixed exchange rates?

What are the options? II

- Fiscal compact?
  - Anchor credible fiscal rules in new Treaty and/or state constitutions; require debt paydown over time
  - Transition: creditworthiness of Germany used to lower Italy's borrowing costs (reduce "i – g")?
- Inflate away debt?
  - Sacrifices credibility of ECB, perhaps irreversibly
  - Unacceptable in Germany

Today's Roadmap

- European Monetary Union (continued)
- Exchange Rates
  - Exchange rates and prices
  - Exchange rates and interest rates
  - Exchange rate regimes
- Review Session
  - Note handout on dating conventions for debt

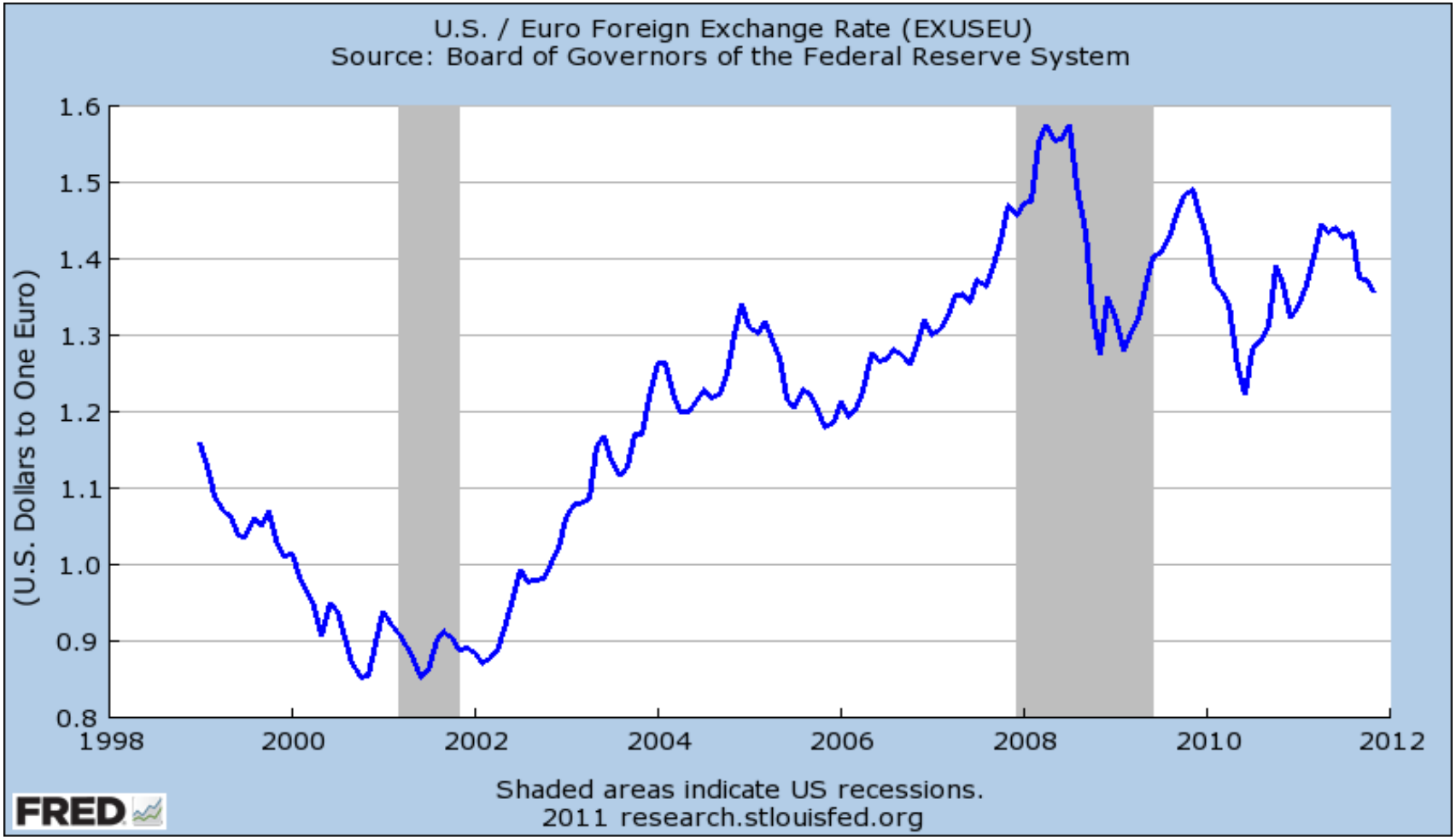
Bilateral exchange rate

- Price of one currency in terms of another
  - price of a Euro in terms of dollars:
  - Careful when reading data
    - $s_{\$/€} = 1.35$
    - $s_{€/\$} = 0.74$
- **Decrease** in $s_{\$/€}$ is a **depreciation of the Euro against the Dollar** and an **appreciation of the Dollar against the Euro.**

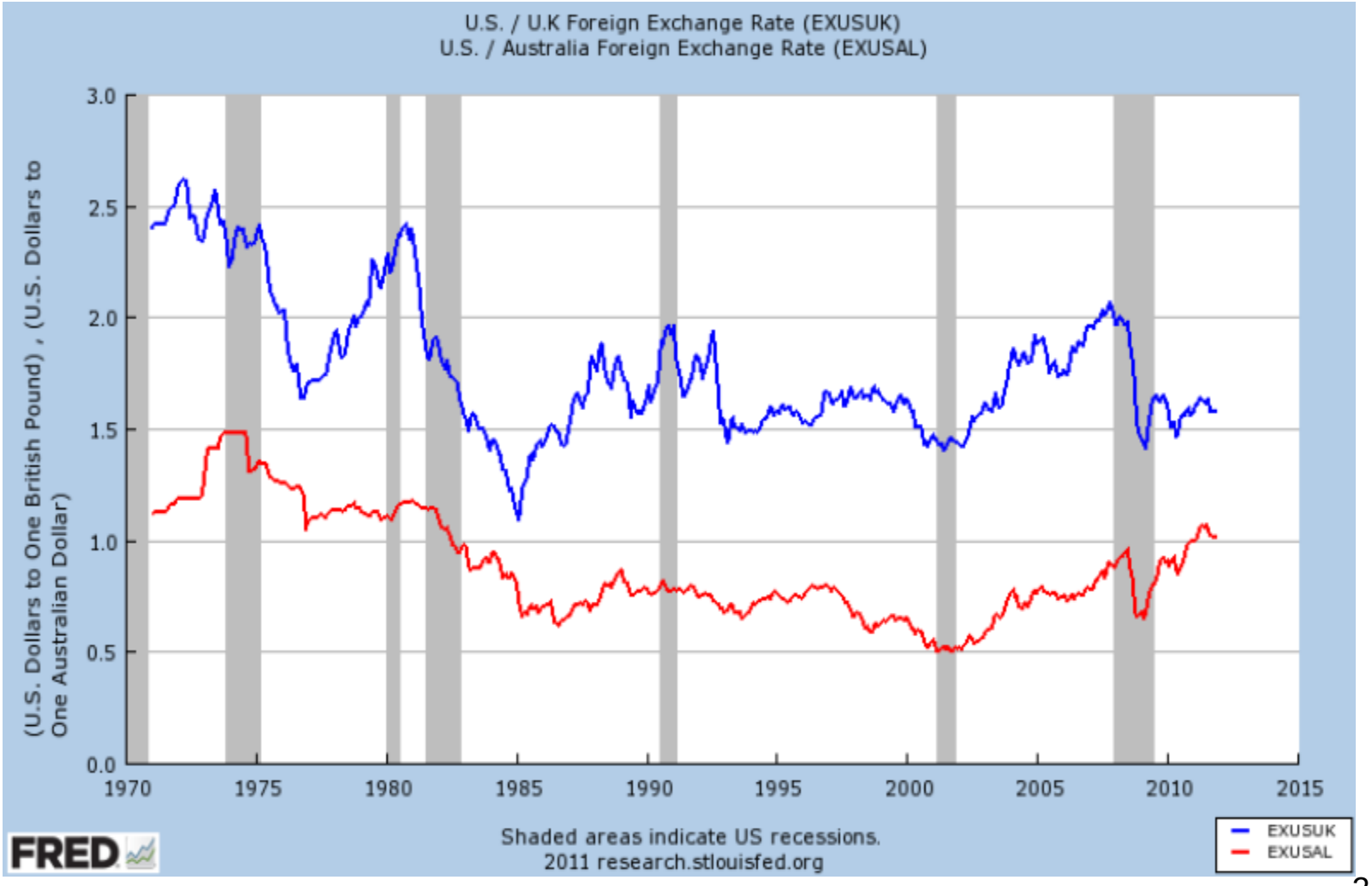
Bilateral exchange rates

- How are exchange rates determined?
- Currencies are like any other good
  - A demand and supply for currencies
- Let supply and demand determine prices
  - Floating exchange rate
- Governments can fix a price
  - Fixed or pegged exchange rate (more on this later)

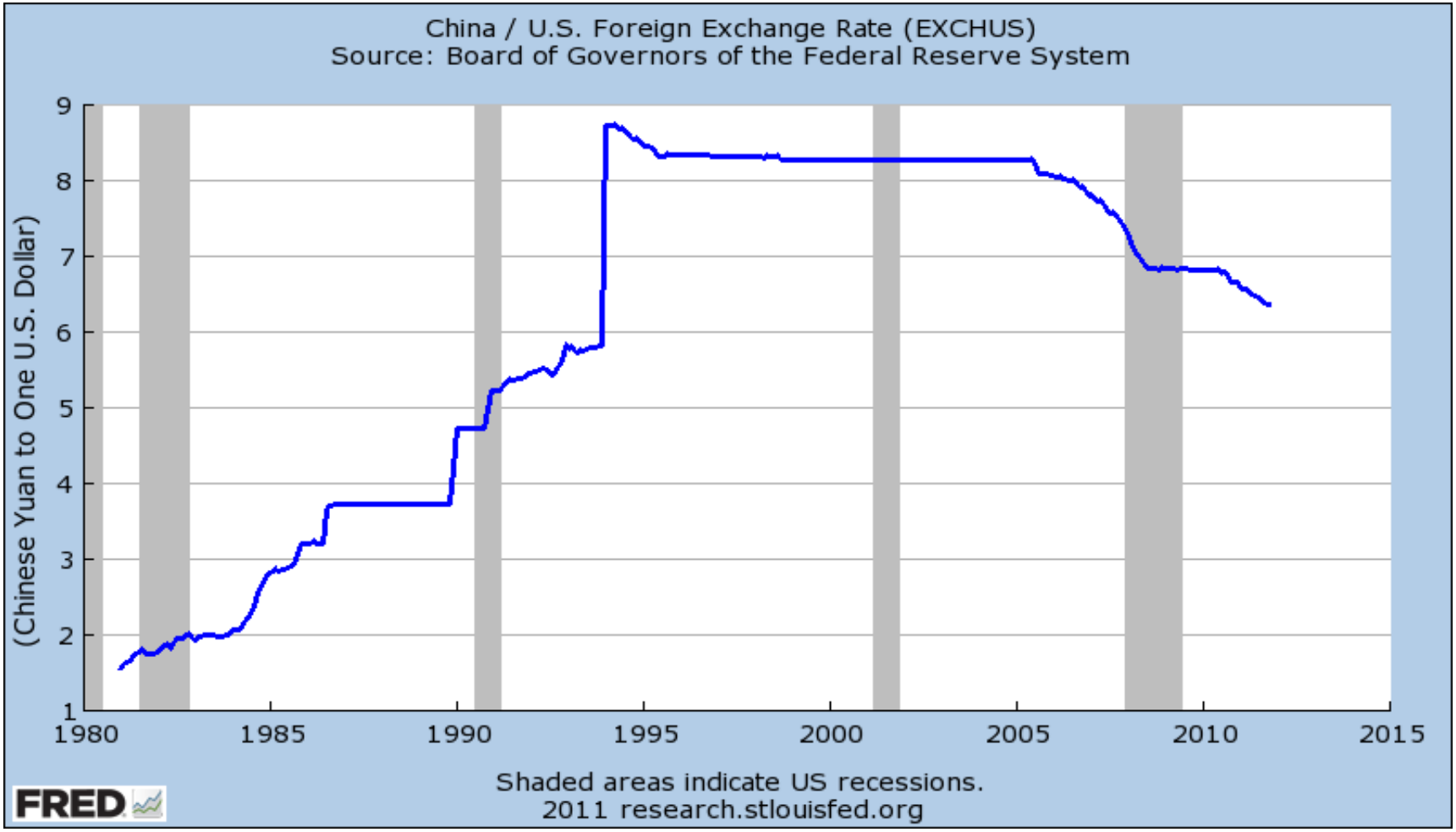
Floating exchange rates



Floating exchange rates



Fixed exchange rates



Explaining exchange rates

- What drives the demand and supply of a currency?
- Goods trade
  - Purchasing power parity
  - Exchange rate determined by cross-country *goods* prices
- Asset trade
  - Covered interest parity
  - Uncovered interest parity
  - Exchange rate determined by cross-country *interest rates*

The 'law' of one price

- The Dollar price of a good in the U.S., p_{US}
- The Euro price of the ***same*** good in Germany, p_{GER}
- Law of one price

$$p_{US} = s_{\$/€} p_{GER}$$

- What if this doesn't hold?
- What if there are transportation costs?
- Should this hold for haircuts?

The Big Mac index

	Local Currency Price	Exchange rate Dec-06-2011 (foreign cur/$)	Dollar price	Implied exchange rate (foreign cur/$)	Over/under valuation (%)
United States	4.07	1.00	4.07		
Argentina	20	4.29	4.66	4.66	15
China	14.7	6.36	2.31	3.60	-43
Norway	45	5.77	7.80	11.1	+92
Canada	4.73	1.02	4.65	1.16	14
Japan	320	77.95	4.11	78.7	1
Euro Area	3.44	0.74	4.62	1.18	+58

Source: The Economist July 28, 2011

Absolute purchasing power parity

- Generalize the law of one price
- The Dollar price of a basket of goods in the U.S., such as the CPI,

$$P_{US}$$

- The Euro price of the same basket of goods in Germany, such as the CPI,

$$P_{GER}$$

- **Absolute purchasing power parity**

$$P_{US} = s_{\$/€} P_{GER}$$

Absolute purchasing power parity

- What happens if the price level in Germany is greater than that in the US?

$$P_{US,t} < s_{\$/€,t} \times P_{GER,t}$$

- The Euro is too expensive (overvalued) when

$$\frac{P_{US,t}}{P_{GER,t}} < s_{\$/€,t}$$

- The Euro should **depreciate relative to the Dollar**, or the USD should **appreciate relative to the Euro**
- Works in growth rates, too

PPP in Growth Rates

- PPP says

$$P_{US,t} = s_{\$/€,t} P_{GER,t}$$

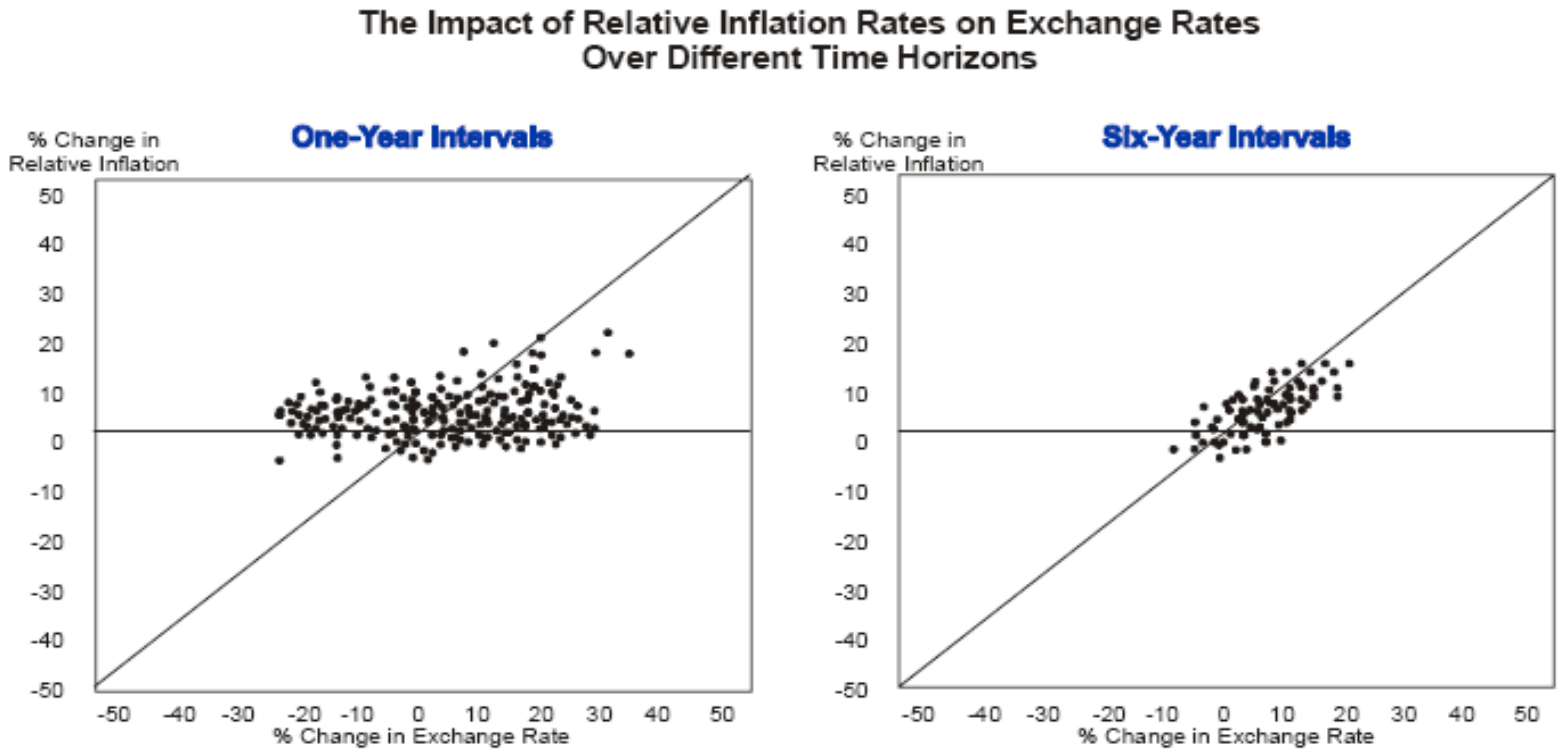
$$\frac{P_{US,t}}{P_{US,t-1}} = \frac{s_{\$/€,t}}{s_{\$/€,t-1}} \frac{P_{GER,t}}{P_{GER,t-1}}$$

$$\ln\left[\frac{P_{US,t}}{P_{US,t-1}}\right] = \ln\left[\frac{s_{\$/€,t}}{s_{\$/€,t-1}}\right] + \ln\left[\frac{P_{GER,t}}{P_{GER,t-1}}\right]$$

$$\pi_{US,t} = d_{\$/€,t} + \pi_{GER,t}$$

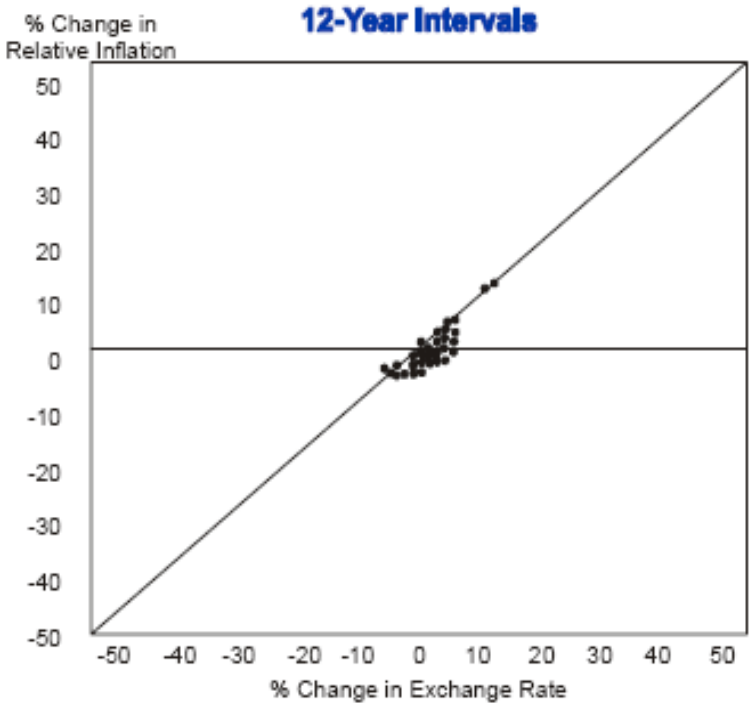
Where $d_{\$/€,t}$ is the rate of depreciation of the dollar versus the euro at time t.

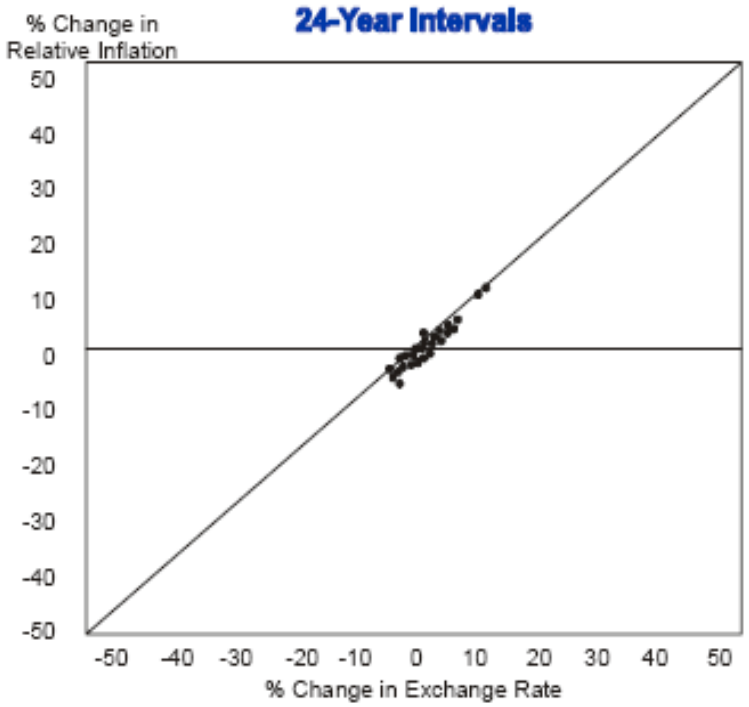
PPP: evidence



Source: Deutsche Bank FX Guide 2002

Relative PPP: evidence





Summary: goods trade

- Law of one price
  - Works well for some goods, not for others
  - Depends on how "tradable" the good
- Purchasing power parity
  - Works well over long time horizons
  - Adjustment is slow
    - Takes about 5 years to close the gap half way
  - Does not work well over short horizons

Explaining exchange rates

- What drives the demand and supply of a currency?
- Goods trade
  - Law of one price ✓
  - Purchasing power parity ✓
- Asset trade
  - **Covered interest parity**
  - Uncovered interest parity

Covered interest parity

- Want to save 1 dollar for 1 year: where to save?
- Asset returns quoted in domestic currency
  - U.S. T-bill pays in dollars: i_{US}
  - U.K. T-bill pays in pounds: i_{UK}
- Forward contracts are possible
  - Contract today for a pound to be delivered in 1 year
  - Forward price: price today of a forward contract: $f_{\$/£}$

Covered interest parity

- Two ways to earn dollars

1. Invest abroad and buy a forward contract
   - Exchange 1 dollar for pounds
   - Invest in pound assets **AND** contract to sell pounds in the forward market
   - One year later: receive returns in pounds, sell pounds according to forward contract
2. Invest domestically
   - No foreign exchange needed

- No arbitrage implies an investor should be indifferent between the two options

Return from investing abroad (covered)

- Buy pounds in the spot market, get $\frac{\$1}{s_{\$/£}}$ pounds

- Invest pounds, at the end of the year have

$$\frac{\$1}{s_{\$/£}}(1+i_{UK})\,\text{pounds}$$

- Sell the pounds according to the forward contract

$$\frac{\$1}{s_{\$/£}}(1+i_{UK})\times f_{\$/£}\,\text{dollars}$$

Covered interest parity

- Return on one dollar invested in US

$$\$1 \times (1 + i_{US}) \text{dollars}$$

- To eliminate arbitrage, we must have

$$\$1 \times (1 + i_{US}) = \frac{\$1}{s_{\$/£}} (1 + i_{UK}) \times f_{\$/£}$$

$$(1 + i_{US}) = (1 + i_{UK}) \times \frac{f_{\$/£}}{s_{\$/£}}$$

Covered interest parity

- Suppose i_{us} decreases (relative to i_{UK})

$$(1+i_{us}) < (1+i_{UK}) \times \frac{f_{\$/£}}{s_{\$/£}}$$

- Investors would want fewer US assets
  - Need fewer dollars today, depreciate dollar in spot market
  - Need more dollars in forward market: appreciate dollar in forward market
- CIP generally confirmed in the data

Explaining exchange rates

- What drives the demand and supply of a currency?
- Goods trade
  - Law of one price ✓
  - Purchasing power parity ✓
- Asset trade
  - Covered interest parity ✓
  - **Uncovered interest parity**

Uncovered interest parity

- Similar to covered interest parity, but *without* the forward contract.

1. Invest abroad
   - Exchange 1 dollar for pounds
   - Invest in pound assets (no forward contract)
   - One year later: receive returns in pounds, sell pounds in spot market for dollars
2. Invest domestically
3. Note: this is not an arbitrage.

Uncovered interest parity

- Expected return on 1 dollar invested in UK

$$\frac{\$1}{s_{\$/£,t}} \times \left(1+i_{UK}\right) \times E_t\left(s_{\$/£,t+1}\right) \text{ dollars}$$

- Return on dollar invest in US

$$\$1 \times \left(1+i_{US}\right) \text{dollars}$$

- Equating the returns

$$\left(1+i_{US}\right) = \left(1+i_{UK}\right) \times \frac{E_t\left(s_{\$/£,t+1}\right)}{s_{\$/£,t}}$$

Uncovered interest parity

- Taking LN

$$i_{US} - i_{UK} \approx \frac{E_t(s_{\$/£,t+1})}{s_{\$/£,t}} - 1$$

Expected depreciation rate of the dollar

- What happens if (all else constant)
  - i_{US} decreases?
- Investors would want fewer US assets
  - Need fewer dollars today, depreciate dollar in spot market
  - Need more dollars in a year: *expected* appreciation of dollar
- Bottom line: UIP says expect low interest rate currencies to appreciate and high interest rate currencies to depreciate

UIP and the carry trade

- UIP does not have to hold in the data
  - Not an arbitrage
- UIP doesn't hold in the data, especially for currencies of developed countries
- Opposite is often true: high interest rate countries often have appreciating currencies!!

Carry trade

- Borrow money in low interest currency (USD)
- Invest it in a high interest currency (Aust. $)

- If UIP held, dollar would appreciate in future to shrink gain
- Since UIP does not always hold, these trades can be profitable
- But risky!

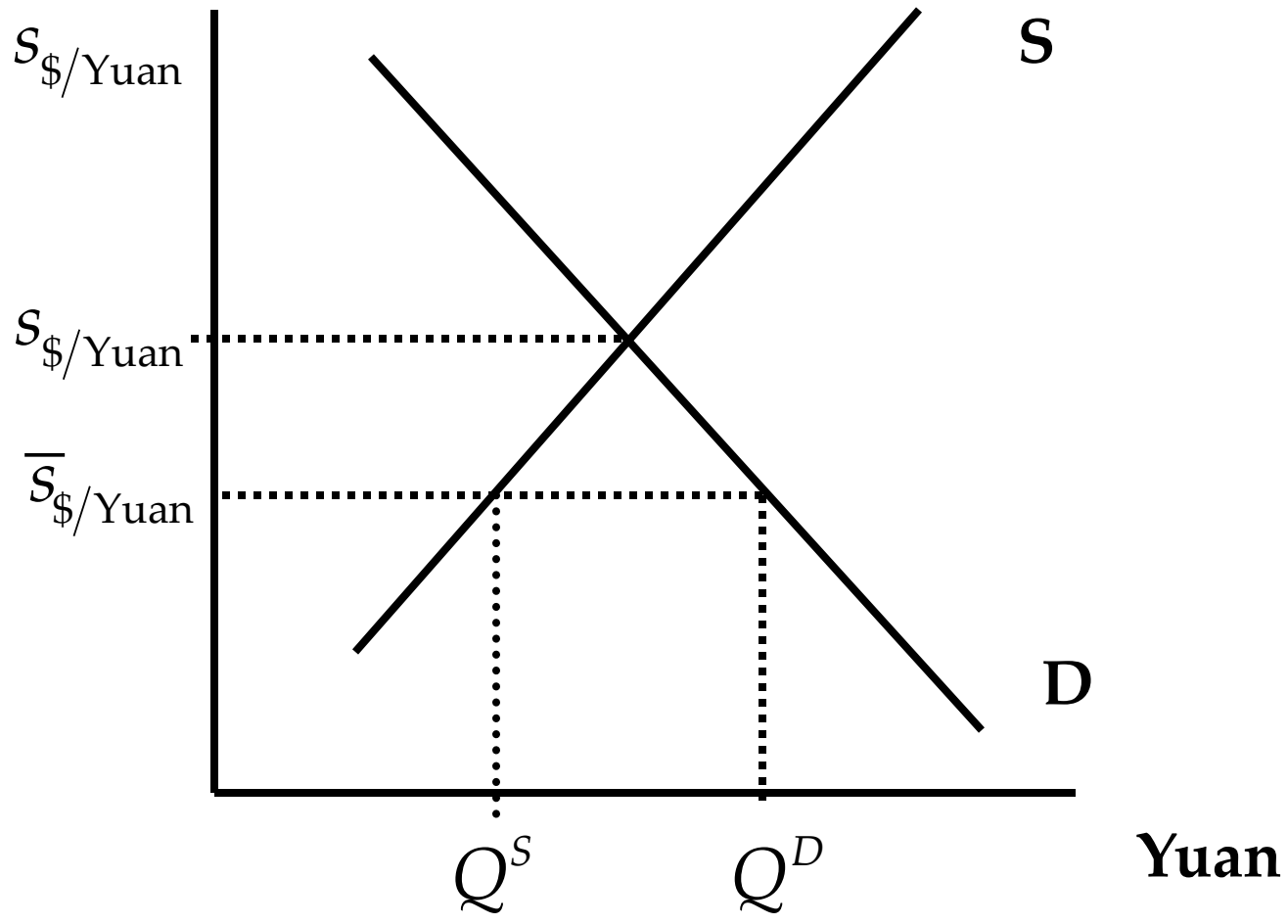
Asset trade summary

- Covered interest parity
  - Strong empirical support
- Uncovered interest parity
  - High interest rate currencies should depreciate
  - Tends to work in the opposite direction in the data for developed countries

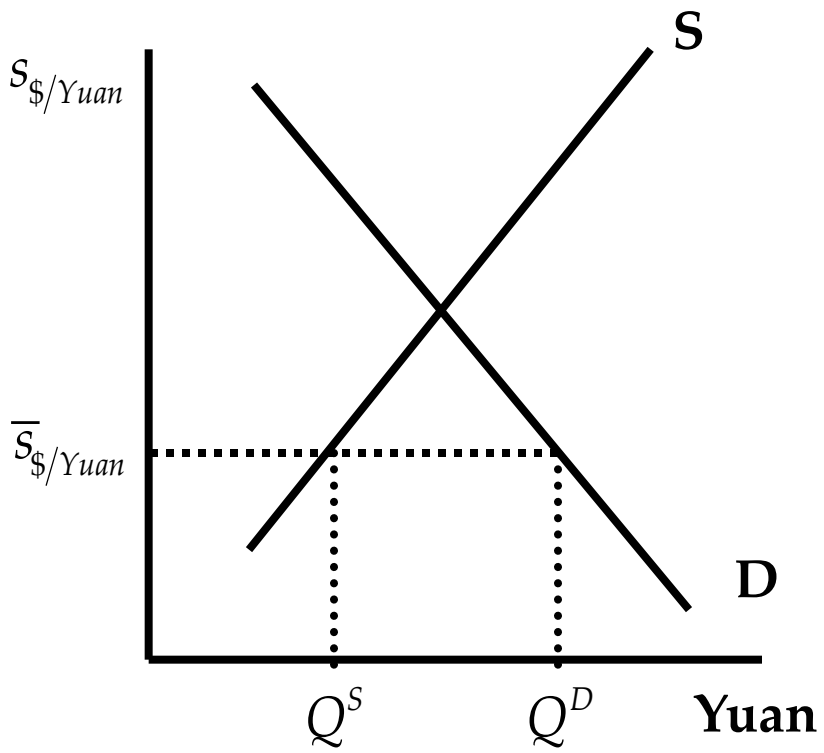
Exchange rate regimes

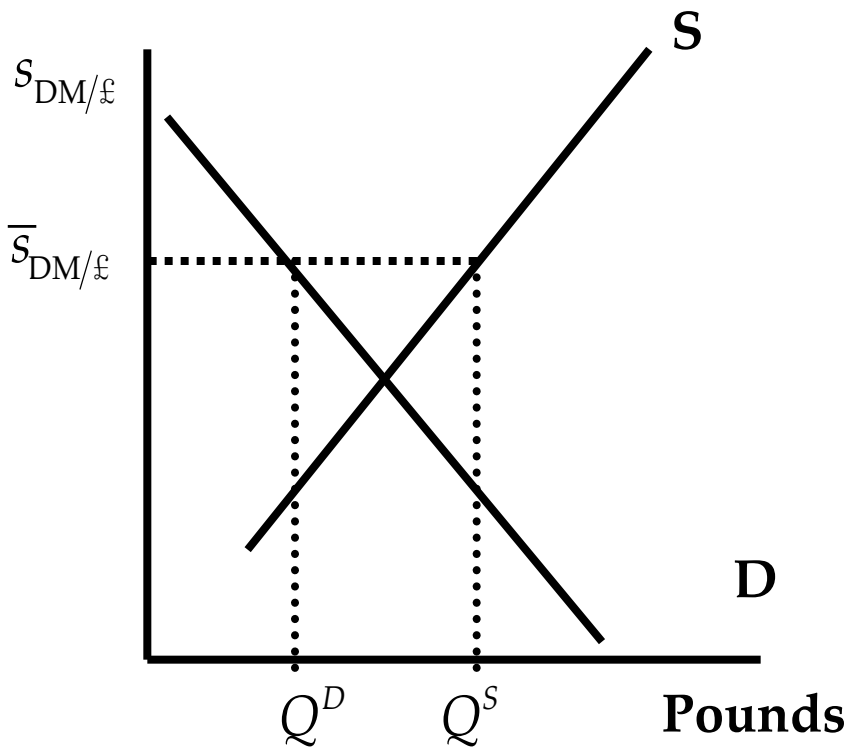
- Floating
  - Many countries with a float still intervene, (sometimes called “managed” or “dirty” floats)
- Fixed or pegged rate
  - Intervene to keep the exchange rate fixed in terms of another currency or basket of currencies
  - Variations on this allow the rate to float in a band
  - The peg may shift over time

How do you fix an exchange rate?



Fixed exchange rate mechanics





Assets	Liabilities
(+) dollars	(+) Yuan

Assets	Liabilities
(-) marks	(-) pounds

Why a fixed exchange rate?

- Pro: provides a *nominal anchor*
  - Helpful when monetary policy has lost credibility
  - Argentina 1991
- Pro: facilitates trade and investment
  - Lowers costs of doing business (think Euro)
  - Decreases uncertainty in foreign pricing

Why not a fixed exchange rate?

- The 'trilemma:' three options, pick only two
  - Fixed exchange rates
  - Free movement of international capital
  - Independent monetary policy

- Examples
  - U.K.(1992): fixed rate/free capital: no monetary policy discretion
  - China: fixed rate/independent monetary policy: no free movement of capital
  - U.S.: Free movement of capital/independent MP: no fixed exchange rate

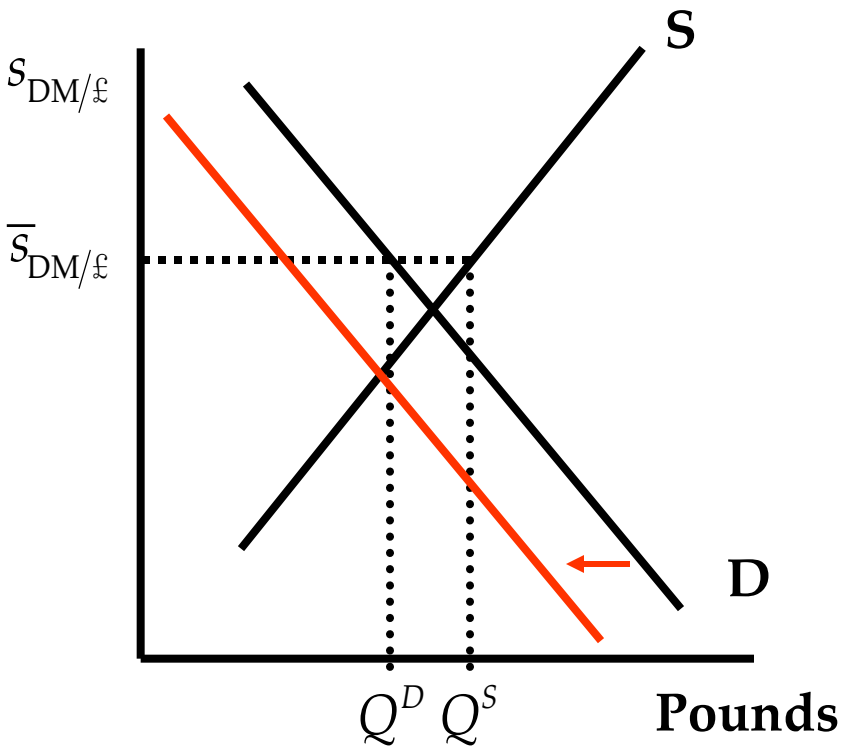
United Kingdom, 1992

- Fixed rate and free movement of capital

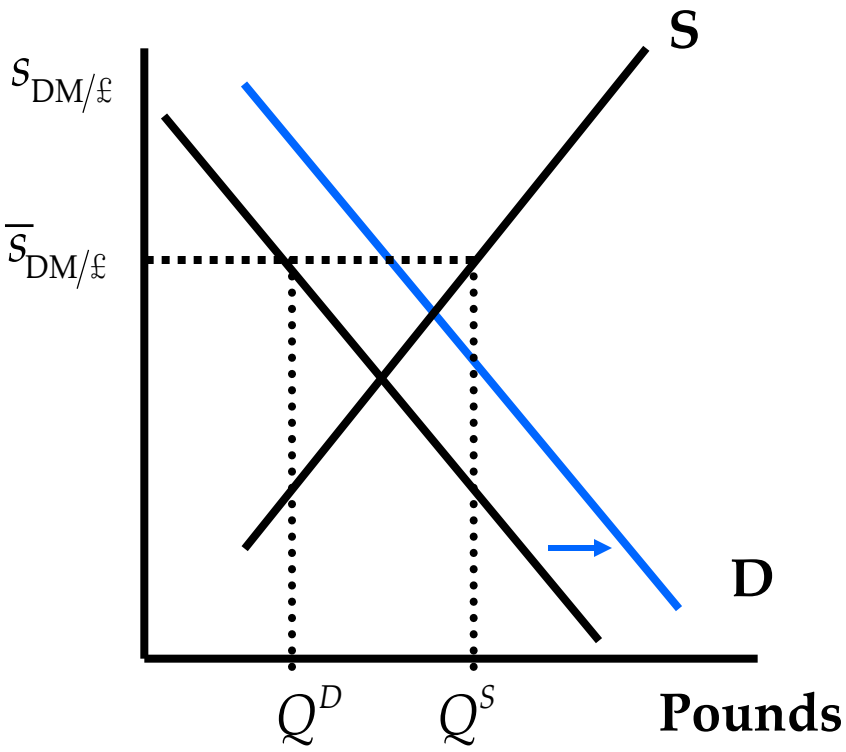
  → No monetary policy discretion

- U.K. and Germany had a fixed exchange rate as part of a system of European fixed exchange rates: the ERM
- High interest rates in Germany compel U.K. to adopt high interest rates to keep the exchange rate fixed
  - If not, free movement capital means demand for Pounds shifts left
- Weak U.K. economy means high interest rates are not desirable
- Lack of policy credibility invites speculation

Monetary policy is not independent!



Higher interest rates in Germany + free movement of capital. Capital flees U.K., decreasing demand for Pounds. **Losing reserves.**



Must increase interest rates to increase demand for Pounds. **Unwanted contractionary monetary policy!**

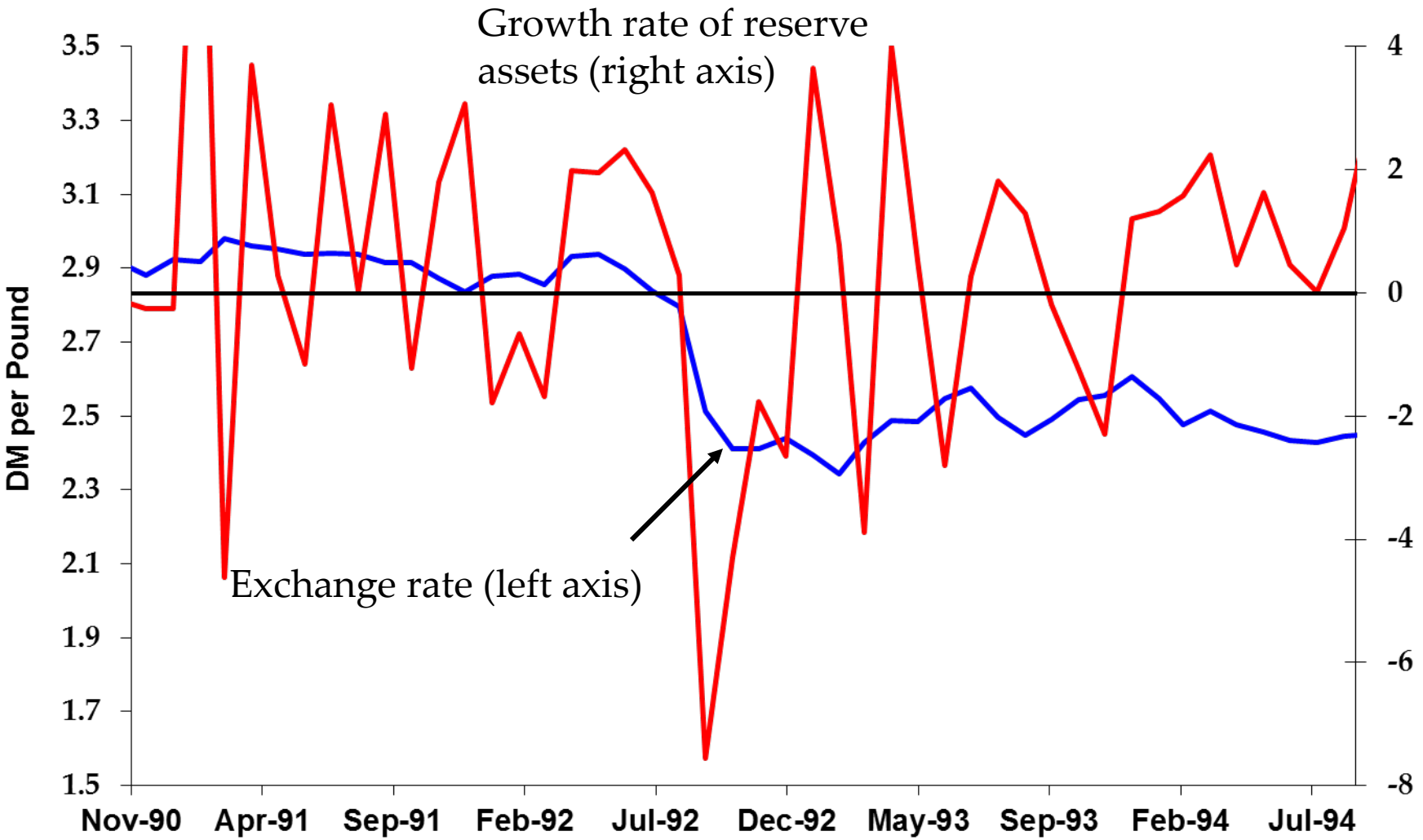
The end of UK fixed exchange rates

- Bank of England can
  - Keep interest rates high
  - Run down stock of reserves (can't do this for long)
  - Devalue the currency
- Investors speculate that BoE would rather devalue than keep interest rates high during a recession: policy commitment not credible
  - Borrow in Pounds, sell Pounds for Marks
  - BoE must raise interest rates or allow reserves to drain
  - Becomes a game of chicken

"Black Wednesday"

- On September 16, 1992
- U.K. raises interest rates from 10% to 12%
  - Promise to raise rate to 15% later that day
- Doesn't stop speculators from selling Pounds
  - Government abandons fixed rate regime
  - Soros reportedly makes about $1 billion
- Self-fulfilling prophecy
  - Fixed rate may have held if not attacked
  - Fixed rate failed when attacked

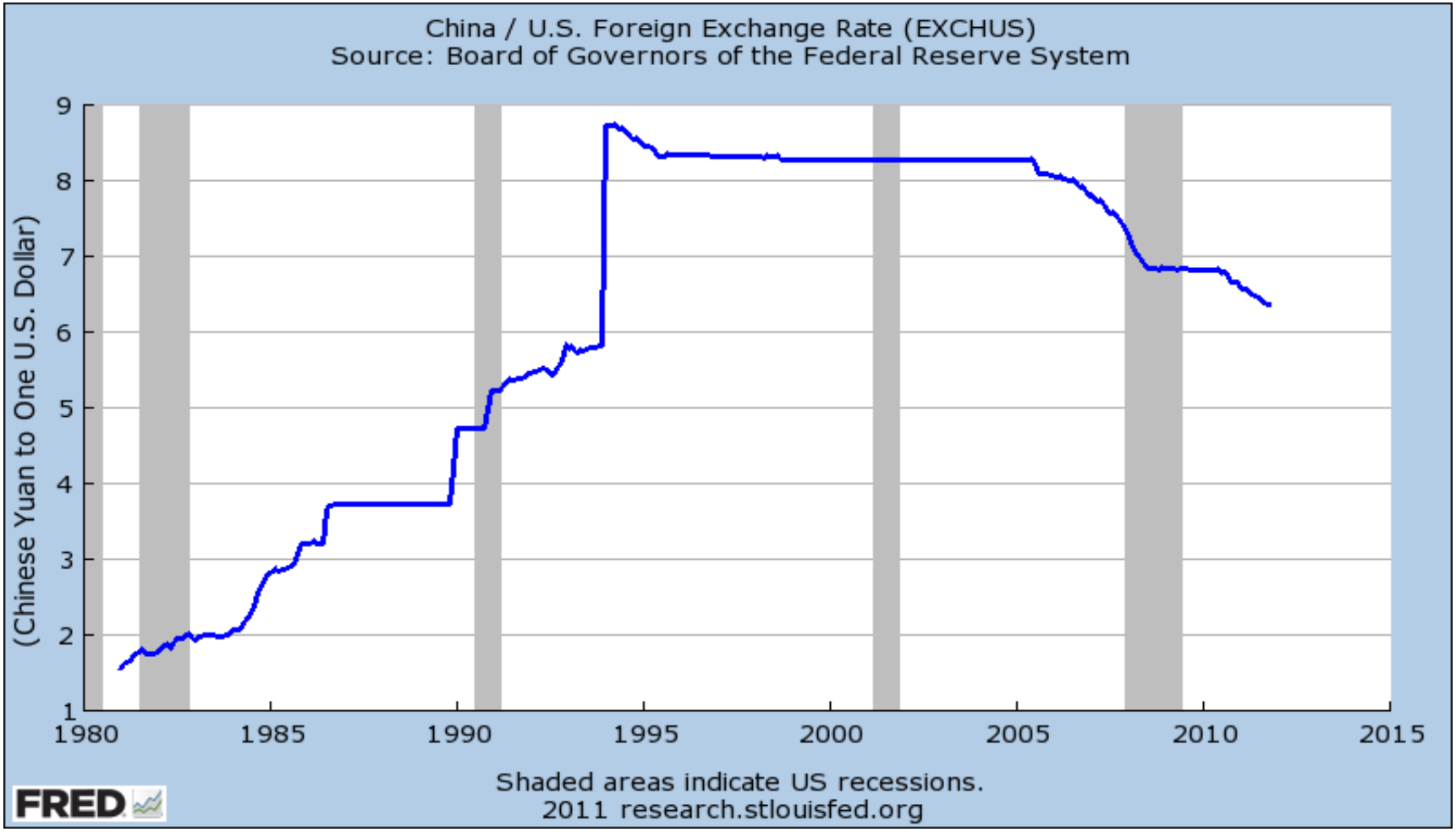
Deutschmark-Pound exchange rates



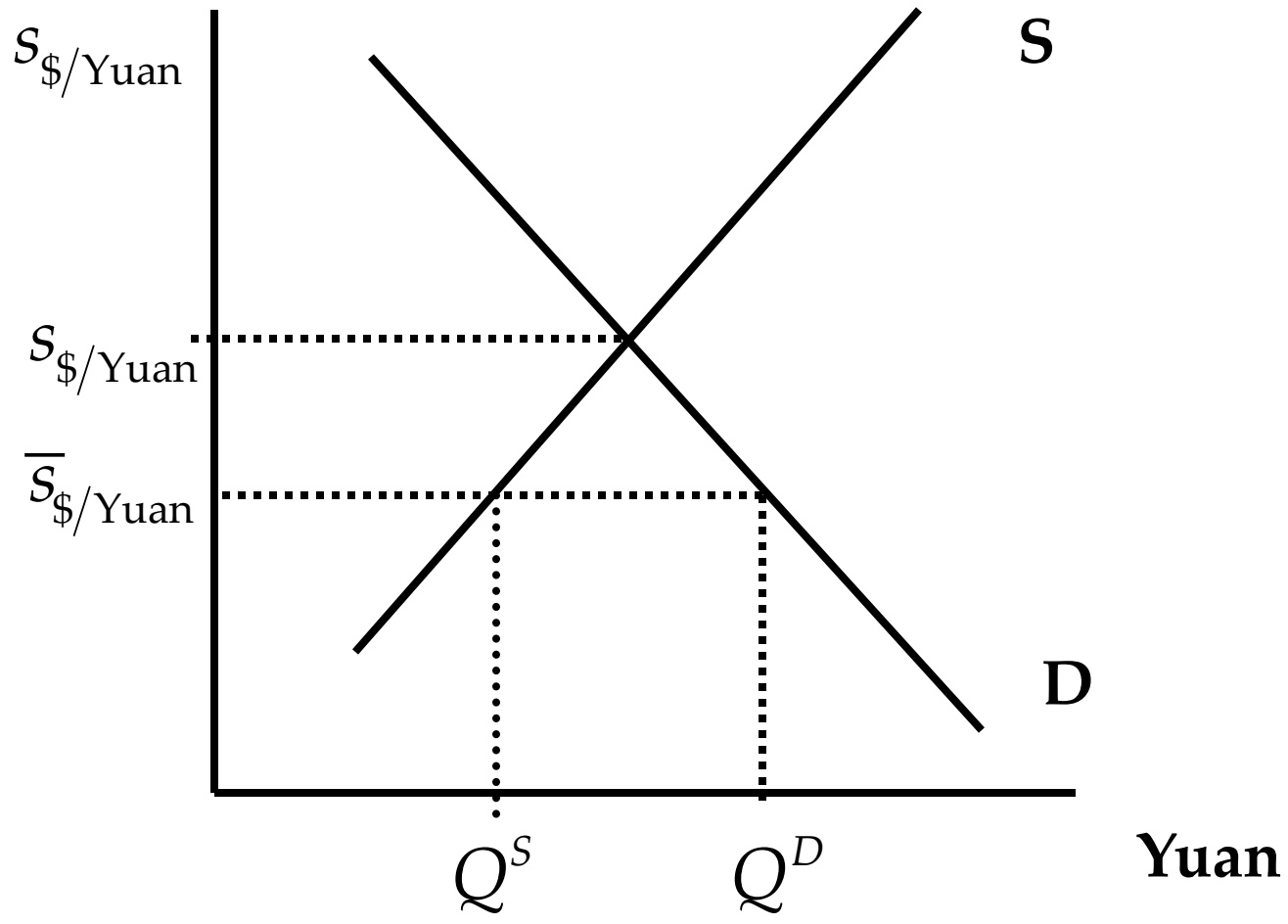
China, present

- Fixed rate and flexibility of monetary policy:
  - No free movement of capital (lack of convertibility)
- China fixes exchange rate against dollar
  - Yuan appears undervalued relative to dollar
- People's Bank can alter monetary policy to some extent
  - Raising interest rates to battle inflation shifts yuan demand right…
  - …but capital controls partly mitigate this shift
  - Like "throwing a wrench in the gears"
- Costs of capital controls?
  - Hinders efficient use of capital and limits financial development
  - Overvaluation can lead to black market for currency
  - Can discourage foreign investment
- Works … for now

Fixed exchange rates



How do you fix an exchange rate?



How do you fix an exchange rate?

- The government buys and sells the domestic currency
- People's Bank of China balance sheet

	Assets	Liabilities
International Reserve Assets	Dollars	Domestic Currency
	Dollar Assets	
	Yuan Assets	

How do you fix an exchange rate?

- People's bank must supply the excess Yuan
  - Buy Dollars with Yuan: "print money"
- People's Bank of China balance sheet

Assets	Liabilities
(+) Dollars	Domestic Currency (+)
Dollar Assets	
Yuan Assets	

- Accumulate foreign reserves
- Capital controls (lack of convertibility) limit flows

How do you fix an exchange rate?

- The people's bank accumulates Dollars
- Dollars have poor rates of return
- Buy dollar assets, leaving the money supply unchanged

Assets	Liabilities
(-) Dollars	Domestic Currency
(+) Dollar Assets	
Yuan Assets	

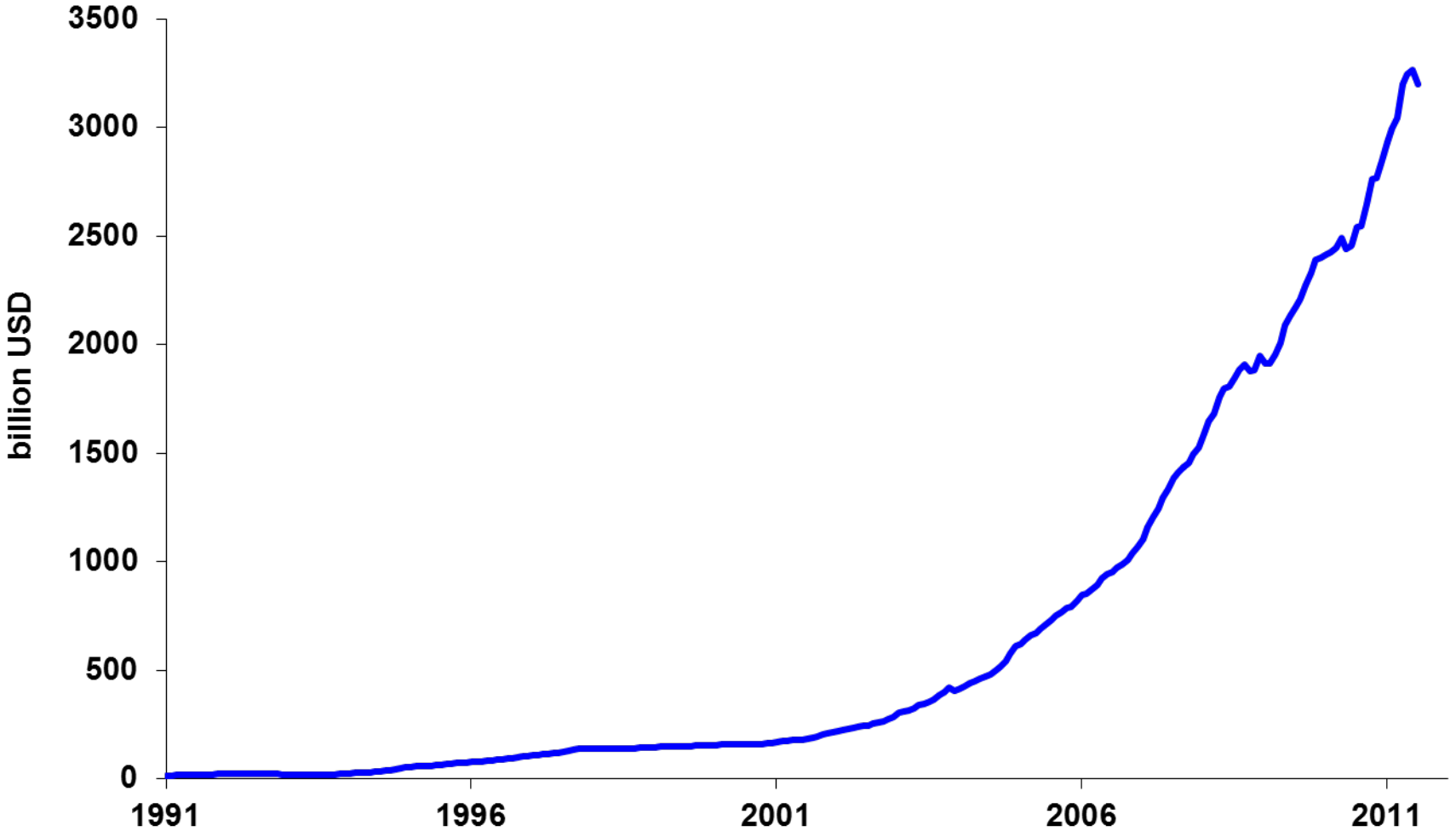
- Dollars go back to the U.S.

"Sterilized" Intervention

- Can the PBoC buy dollar assets without expanding its balance sheet (or the supply of money)? Answer: If it has yuan assets to sell.
  - Method: Sell yuan assets to "sterilize" the $ purchase

Assets	Liabilities
Dollars	Domestic Currency
(+) Dollar Assets	
(–) Yuan Assets	

Foreign reserve assets, China



Foreign holdings of U.S. securities

Billions of US$, as of 6-30-2010

(Billions of dollars)	Total debt	Long term Treas. debt	Long term agency debt	Short term debt	Equity
China	1484	1108	360	5	127
Japan	1169	737	234	69	224
United Kingdom	474	72	10	22	324
Cayman Is.	453	36	32	82	290
Middle East oil-exporter	222	107	16	73	128
Total	7877	3343	1085	956	2814
Of which: held by foreign official institutions	3920	2617	721	484	426

Source: US Treasury.

US, present

- Free movement of capital and ind. monetary policy:
  - No fixed exchange rate
- Federal Reserve's mandate
  - Low and stable inflation
  - Maximum sustainable employment
  - Nothing about exchange rates
- Monetary policy based on domestic conditions
- Free movement of capital into/out of country
  - Changes in interest rates shift demand for currency, and change the exchange rate
  - Changes in expected inflation do, too

Exchange rate variation (1999-Nov 2011)

	Floating exchange rate			Fixed exchange rate		
	Euro-USD	Yen-USD	Pound-USD	Yuan-USD	HKD-USD	D.Krone-Euro
Mean	0.85	107.97	0.60	7.74	7.78	7.45
Std	0.15	13.43	0.06	0.68	0.02	0.01
Std/mean	0.18	0.12	0.11	0.09	0.003	0.001

- Far more variation in floating exchange rates
- Foreign trade pricing decision more difficult
  - Argument for the Euro area (Euro area std=0)
- Variation in Yuan-USD relatively "forecastable"

Why a fixed exchange rate?

- Pro: provides a *nominal anchor*
  - Helpful when monetary policy has lost credibility
- Pro: facilitates trade and investment
  - Lowers costs of doing business (think Euro)
- Con: lose control of monetary policy or lose capital mobility
  - Cannot respond to domestic conditions: Greece, Ireland, etc
  - Capital flows restricted: China
- Con: Subject to speculative attacks
- Bottom line: most exchange rates were fixed after WWII, most no longer are.
  - Evidence that the cons outweigh the pros in most cases.

Exchange rate regime summary

- Variety of exchange rate regimes: most variations on floating or fixed rates
- A fixed rate (almost) always has to be defended
  - Sell domestic currency if rate is too "low"
  - Buy domestic currency if rate is too "high"
- Fixed rates have pros…
  - Nominal anchor, increase trade
- …and significant cons
  - Speculative attacks, loss of monetary policy

Today's Roadmap

- European Monetary Union (continued)
- Exchange Rates
  - Exchange rates and prices
  - Exchange rates and interest rates
  - Exchange rate regimes
- Review Session

Investment Under Uncertainty

- Formula for discounting future income stream

$$\sum_{t=1}^{\infty}\left(\frac{1}{x}\right)^{t}=\sum_{t=0}^{\infty}\left(\frac{1}{x}\right)^{t}-1=\frac{x}{x-1}-1=\frac{1}{x-1}$$

- So, if x=1.1, then

$$\sum_{t=1}^{\infty}\left(\frac{1}{x}\right)^{t}=\sum_{t=0}^{\infty}\left(\frac{1}{1.1}\right)^{t}-1=\frac{1.1}{1.1-1}-1=11-1=10$$

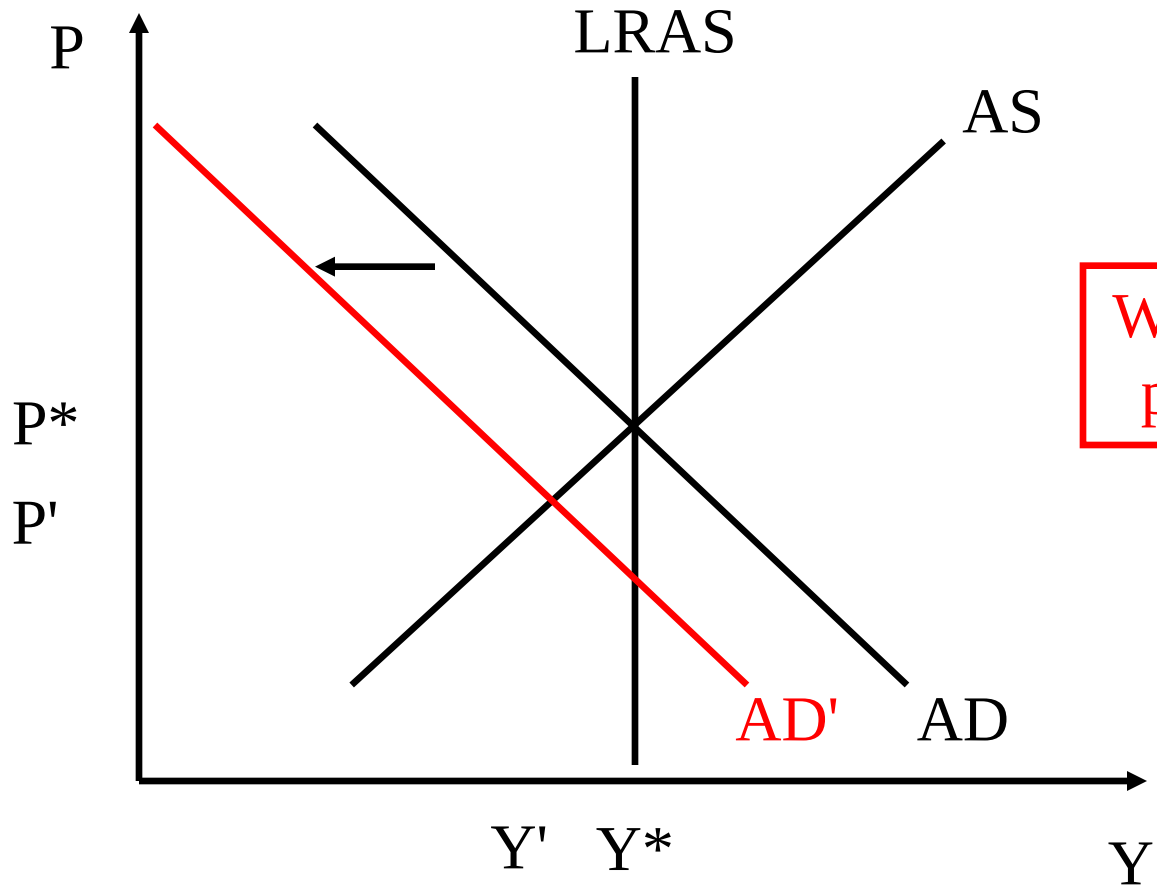
AS/AD Shocks (PS#4 Q4)

- AD
  - Equity
  - Fear of Job Losses
  - Tax holiday
  - Fed raises interest rate
  - Fed boosts QE
- AS
  - Oil Price Surge
  - Deregulation
  - Improved inventory control
  - Govt limits working hours
  - New IT

AS/AD Shocks (PS#4 Q4)

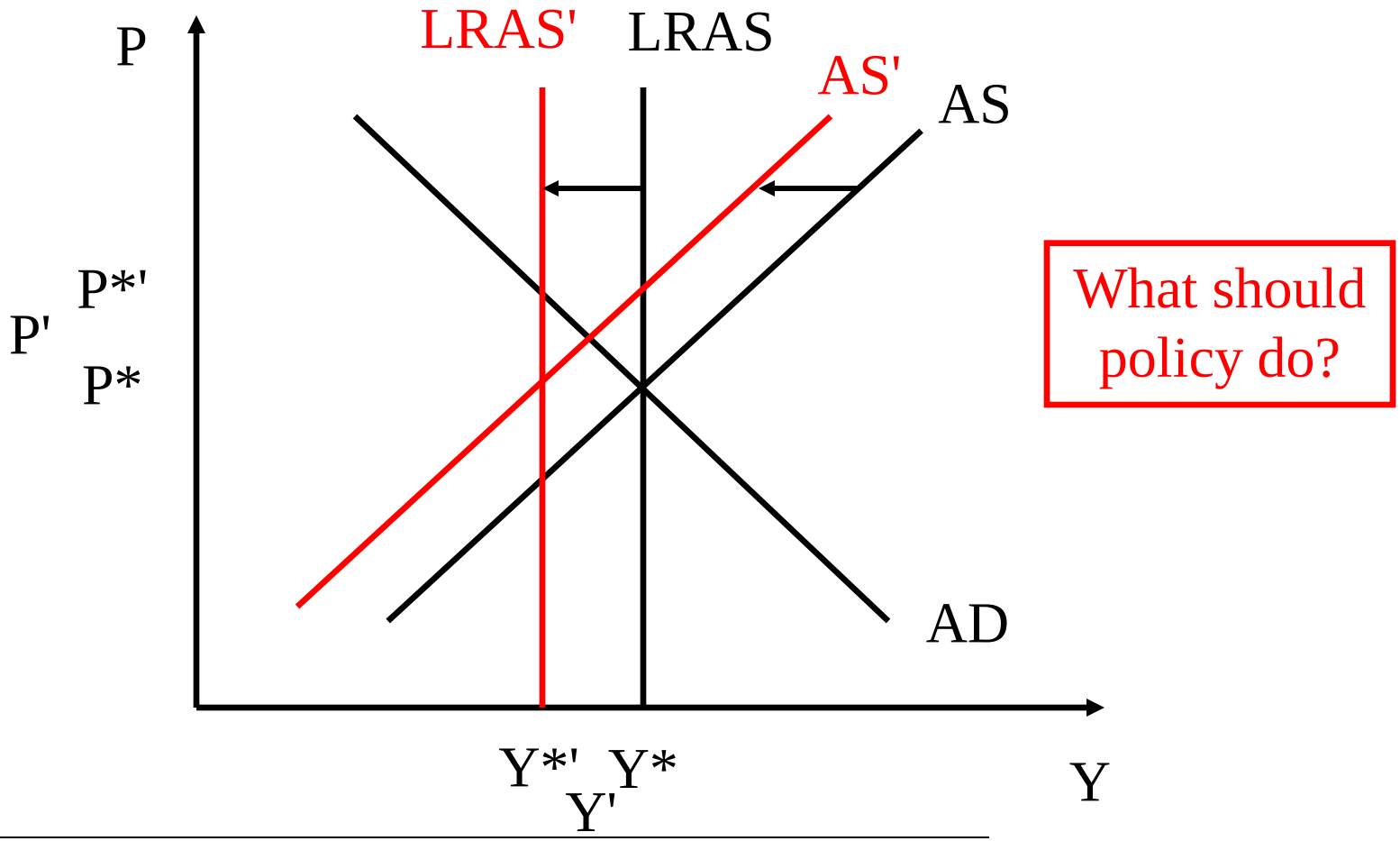
- AD
  - Consumption
  - Investment
  - Government Spending
  - Net Exports
- AS
  - Factors affecting:
    - A
    - K
    - L

Adverse demand shock



What should policy do?

Adverse supply shock



What should policy do?

The market for *bank reserves*

- Fed buys and sells securities to provide *reserves* to the banking system
  - Fed is *monopoly supplier* of aggregate reserves to banks
  - Banks hold reserves with the Fed (the Fed is the bank for banks); reserves are the banks' most liquid assets
  - At the end of the day, if a bank is low on reserves, it borrows from a bank with excess reserves.
  - This interbank market keeps banks from having to hold a lot of reserves to guard against a shortfall
  - The rate at which these overnight loans are made is the *federal funds rate*

Open market operations

Treasury

Assets		Liabilities	
		Bills	200

Central bank

Assets		Liabilities	
Bills	20	Money	20

Households and firms

Assets		Liabilities
Money	20	
Bills	180	

- The FED wants to increase the money supply by 40
- How does it work?

Open market operations

Treasury

Assets		Liabilities	
		Bills	200

Central bank

Assets		Liabilities	
Bills	20	Money	20
	+40		+40

Households and firms

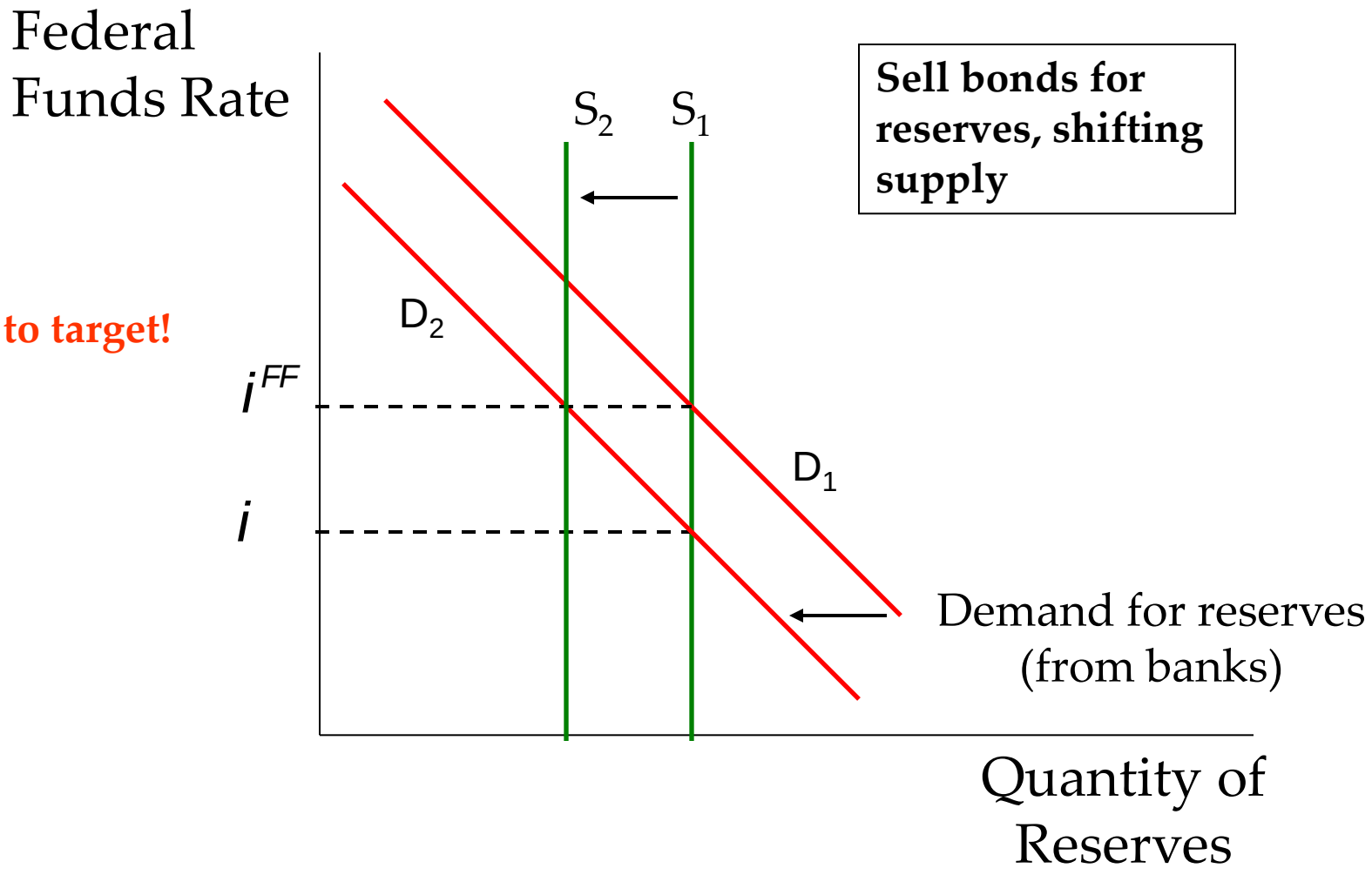
Assets		Liabilities	
Money	20		
Bills	180		
Money	+40		
Bills	-40		

- The FED wants to increase the money supply by 40
- How does it work?
- No change in anyone's net worth

Hitting the target federal funds rate

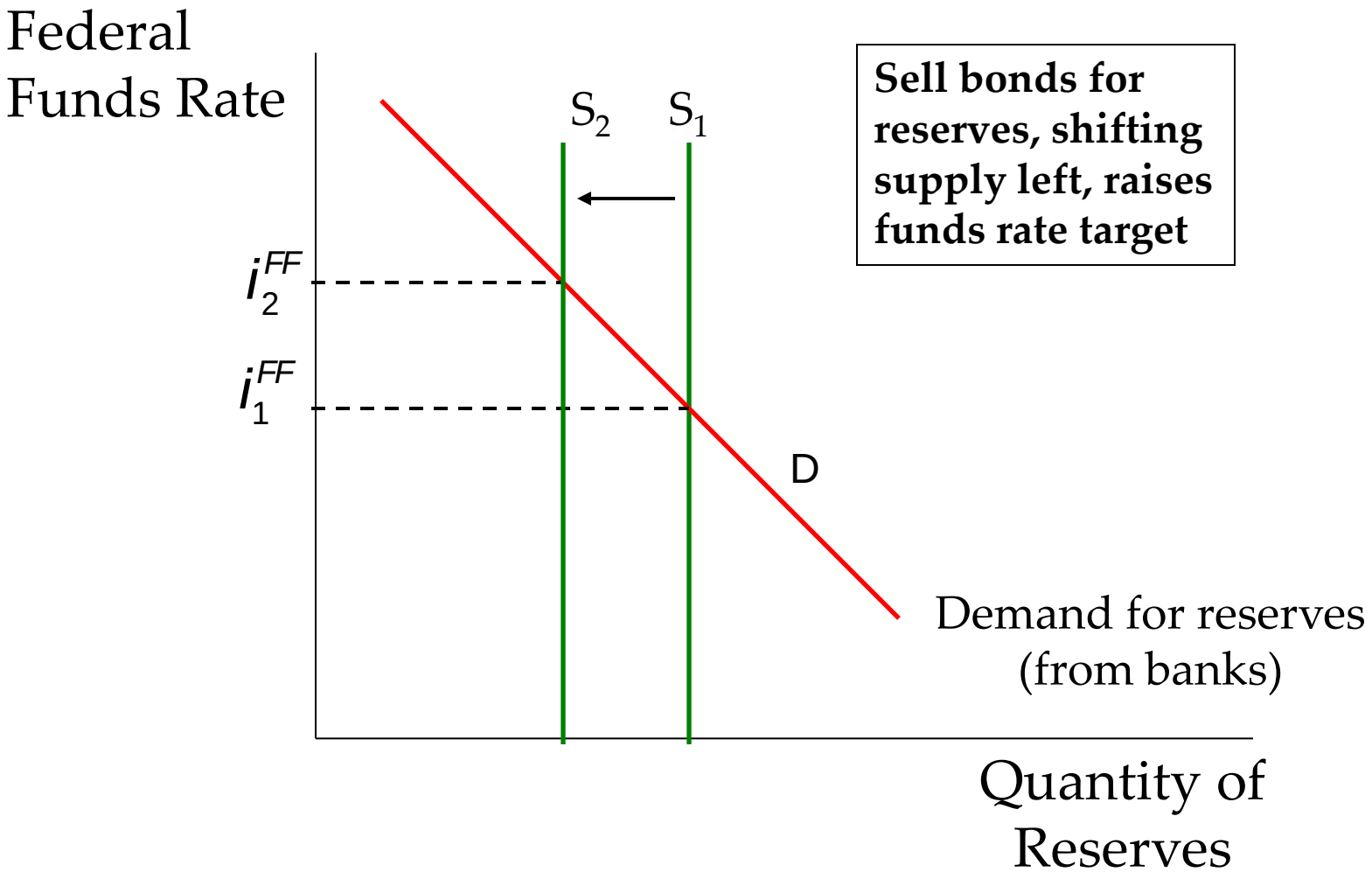
- Open market operations change the supply of reserves to banks to keep the market federal funds rate close to the target
- Decreasing the supply of reserves raises interest rates, lowers the money supply
- Increasing the supply of reserves lowers interest rates, increases the money supply
- Demand for reserves is constantly fluctuating
  - How easy is it to hit the target?

Movements in reserve demand



Back to target!

Raising the Federal Funds Rate



Sell bonds for reserves, shifting supply left, raises funds rate target

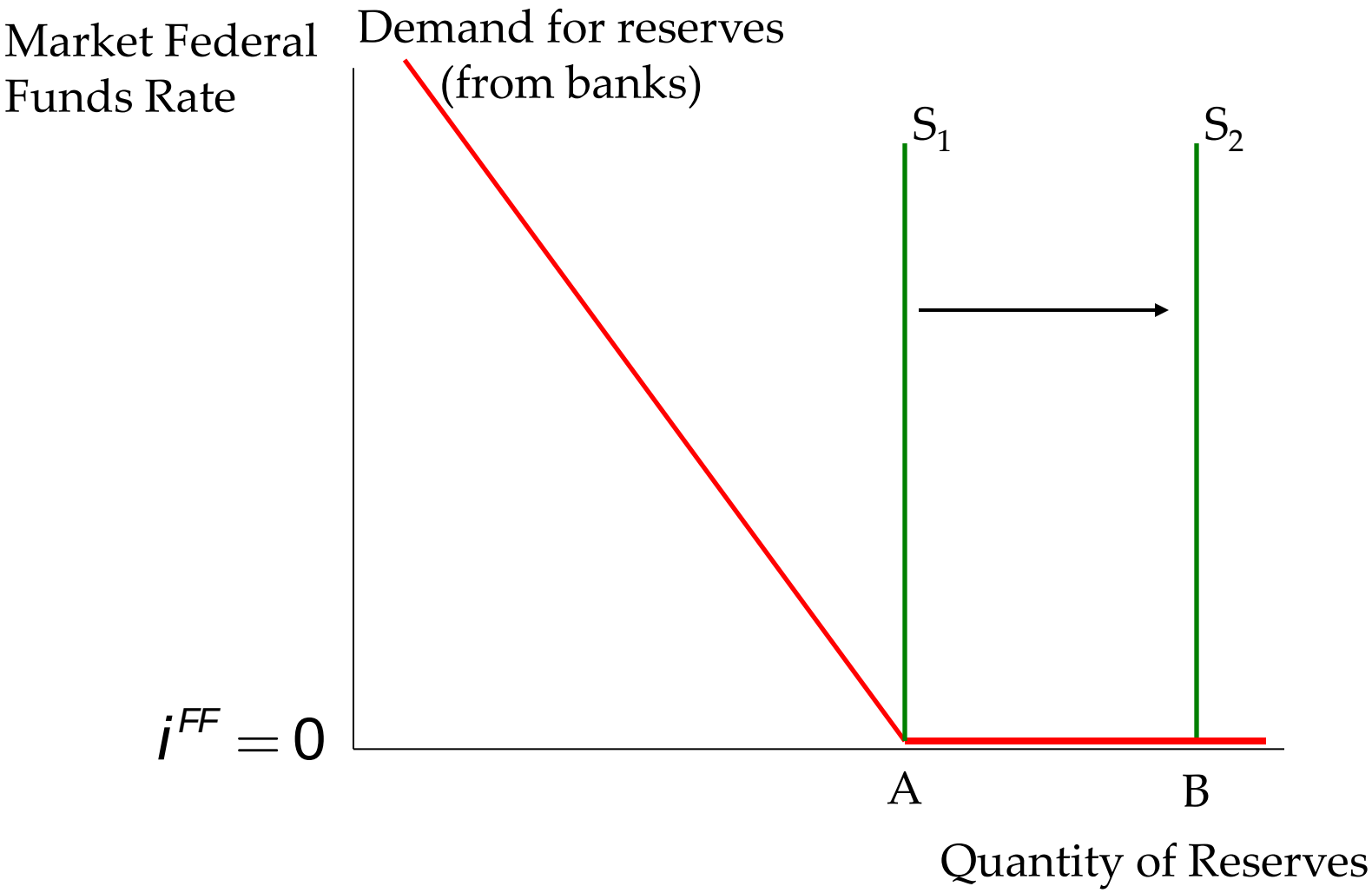
How Does the Fed Steady Inflation?

- Taylor Rule relates inflation and output to CB policy

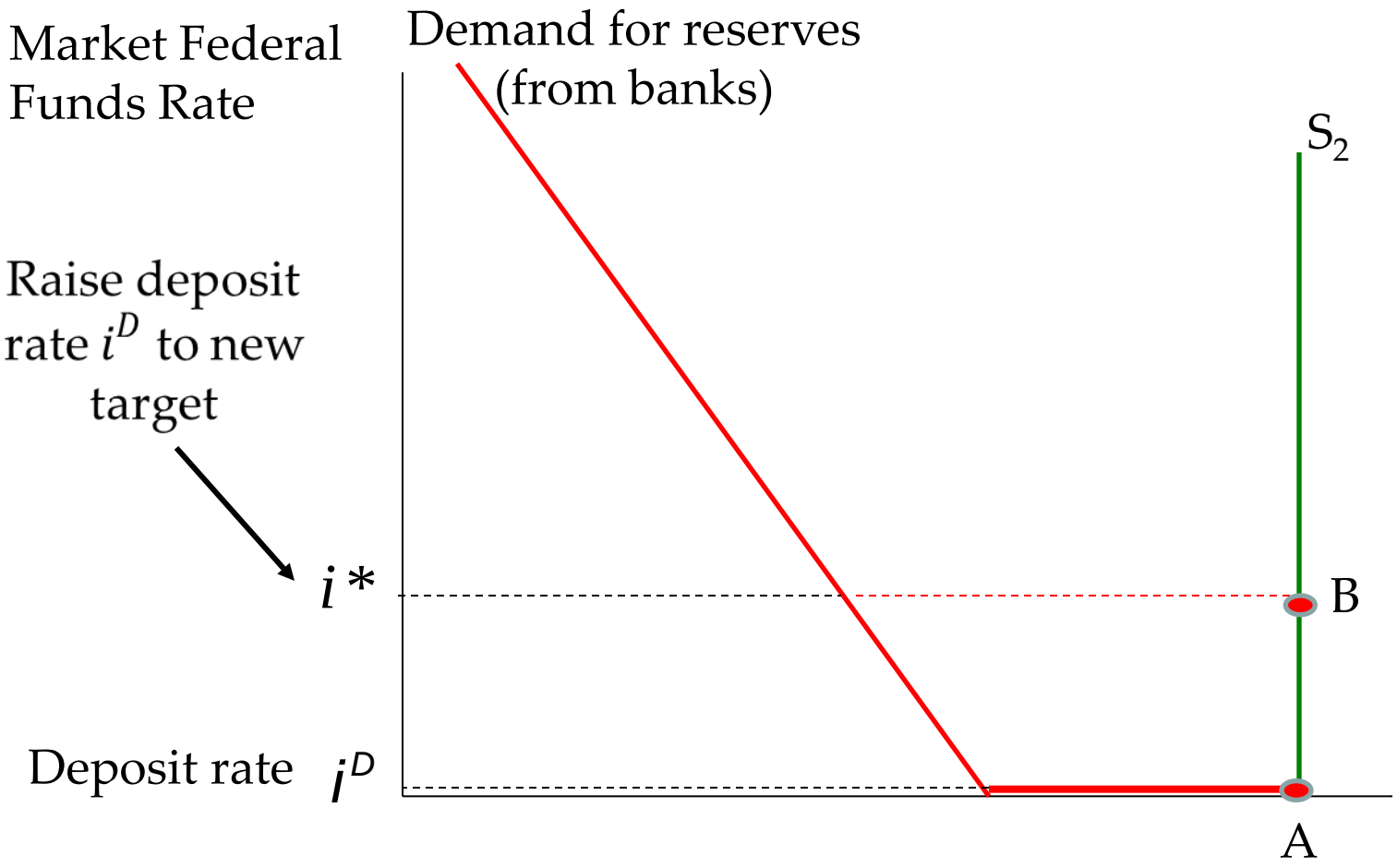
$$i_t^{FF} = r^{FF} + \pi_t + a_1(\pi_t - \tilde{\pi}) + a_2(y_t - y_t^*)$$

- i_t^{FF} is the federal funds rate set by the Fed
- r^{FF} is the real interest rate consistent with long run
- π_t is the current inflation rate
- $\tilde{\pi}$ is the target inflation rate
- y_t is current output
- y_t^* is long-run output

Quantitative easing



Exiting quantitative easing



Using and Interpreting Regressions

- R^2 – "goodness of fit" measure
  - Share of variance of dependent variable explained by regression
- Standard error of regression
  - If errors are normally distributed, provides a confidence interval around fitted or forecast value (one-SD bandwidth = 68%; two-SD bandwidth = 95%)
- Coefficients
  - Sensitivity of dependent variable to independent variables; used in calculating forecast based on observed independent variables
- Standard error of coefficient
  - If errors are normally distributed, provides a confidence interval around coefficient (one-SD bandwidth = 68%; two-SD bandwidth = 95%)
- t-statistic
  - Measures ratio of coefficient to its standard error; tests hypothesis that coefficient is different from zero (95% confidence interval when t>1.96)