The Global Economy

Government Debt & Deficits

NYU | STERN

Ride home revisited

- Has the US government issued too much debt?
- What's too much? How would we know? What are the consequences?

The idea

- Governments issue debt when spending exceeds revenue. When they issue too much debt, investors bail out, possibly triggering a crisis.
- Open question: how much is "too much"?

Roadmap

- Macroeconomic crises
- Words and pictures
- Debt arithmetic
- **Debt dynamics**
- What's missing?
- Is the US in trouble?

Macroeconomic crises

Macroeconomic crises

- New module
- The classic crisis triggers
    - Sovereign debt ("debt crisis")
    - Financial fragility ("financial crisis")
    - Fixed exchange rates ("exchange rate crisis")
- What was/is the trigger in
    - Japan in the 1990s?
    - Mexico in 1994?
    - The US in 2008?
    - Europe today? (Greece, Ireland, Portugal, Spain, Italy…)

Words & pictures

Words

- Alexander Hamilton, *Second Report on Public Credit*, 1795
  - Every system of Public Credit must assume as a fundamental principle the ability to pay the debt which it contracts. With the creation of debt should be incorporated the means of extinguishment.
- What is he saying? Do you agree?

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Words

- "Krugman declares bankruptcy," *Daily Currant*, March 2013
  - Economist and columnist Paul Krugman declared personal bankruptcy today following a failed attempt to spend his way out of debt. … Rather than tighten his belt, the economist decided to "stimulate" his way to a personal recovery by investing in expenses he hoped would one day boost his income.
- What are they saying? Do you agree?

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Words

- Thomas Sargent, October 2011
  - Here's a phrase that you hear. You hear that US fiscal policy is unsustainable. You hear it from both parties. What they mean is that certain promises people have made – taxes, entitlements, medicare, medicaid – those are incredible, they don't fit together. So US fiscal policy is very uncertain. It's uncertain because it's not clear which of these promises is going to be broken first.
- What is he saying? Do you agree?

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Words

- Walter Wriston, 1987
  - Countries don't go out of business. ... The infrastructure doesn't go away, the productivity of the people doesn't go away, the natural resources don't go away. And so their assets always exceed their liabilities, which is the technical reason for bankruptcy. That's very different from a company.
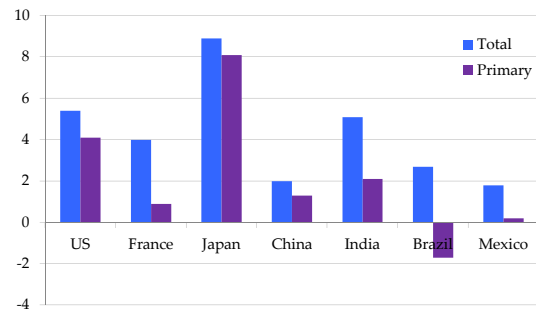- What is he saying? Do you agree?

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Words

- October 2012
  - The ARA Libertad, a training ship owned by the Argentine navy, was detained in Ghana at the request of Elliott Capital Management, a hedge fund run by Paul Singer.
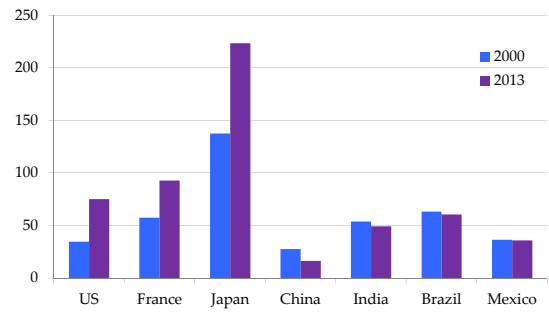- What's going on here?

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Government deficits (% of GDP, 2013)

Legend: Total, Primary

Categories: US, France, Japan, China, India, Brazil, Mexico

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Government debt (% of GDP)

Legend: 2000, 2013

Categories: US, France, Japan, China, India, Brazil, Mexico

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Debt arithmetic

Government budget: Principle #1

- Principle #1 of fiscal policy
  - Government spending must be financed with tax revenue, either now or in the future

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Government budget: ingredients

- Government spending in year t

$$G_t + V_t + i_t B_{t-1}$$

  - G = government purchases of goods and services
  - V = government spending on transfers
  - i = interest rate on debt B
- Government tax revenue in year t: T_t
- Government debt at end of year t-1, start of year t: B_{t-1}

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Government budget: US, $b, 2012

Revenue	4,259
Tax revenue	3,041
Social insurance contributions	955
Expenses	**5,621**
Goods, services, and employee comp	2,548
Transfer payments	2,385
Interest on debt	632
Surplus	**−1,362**

For reference: GDP = 16,245

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Government budget

- Budget (cash flow out = cash flow in)

$$G_t + V_t + i_t B_{t-1} = T_t + B_t - B_{t-1}$$

  Spending = Tax Revenue + Change in Debt

- Government deficit

$$(G_t + V_t + i_t B_{t-1}) - T_t$$

- **Primary deficit** (excl interest)

$$D_t = G_t + V_t - T_t$$

  (replace three symbols with one)

Government budget arithmetic

- **Primary deficit** (excl interest)

$$D_t = (G_t + V_t) - T_t$$

- Budget becomes

$$G_t + V_t + i_t B_{t-1} - T_t = B_t - B_{t-1}$$

$$D_t + i_t B_{t-1} = B_t - B_{t-1}$$

- The point: this is how debt is connected to deficits
  - Past debt incurs interest expense
  - Current deficits lead to increases in debt

Government budget arithmetic

- Looking back in time
- Where does debt come from?

$$D_t + i_t B_{t-1} = B_t - B_{t-1}$$

$$\Rightarrow B_t = D_t + (1+i_t)B_{t-1}$$

$$= D_t + (1+i_t) D_{t-1} + (1+i_t)(1+i_{t-1})D_{t-2} \ldots$$

- Answer: debt = past primary deficits plus interest

Government budget arithmetic

- Looking forward in time
- Where does debt lead? [kill t on i_t for simplicity]

$$D_t + iB_{t-1} = B_t - B_{t-1}$$

$$\Rightarrow B_{t-1} = -D_t/(1+i) + B_{t-1}/(1+i)$$

$$= -D_t/(1+i) - D_{t+1}/(1+i)^2 - D_{t+2}/(1+i)^3 \ldots$$

- Answer: debt = present value of future primary surpluses
  - Debt today is a promise to run (primary) surpluses in the future

Government budget: Principle #1

- Principle #1 of fiscal policy
  - Government spending must be financed with tax revenue, either now or in the future.
- That's what the arithmetic says

Debt dynamics

Debt dynamics

- Focus: ratio of debt to GDP, B/Y
  - By convention, both are nominal
- What makes B/Y change over time?
- Two ways to reduce B/Y
  - Decrease debt
  - Increase output
- Here's how that works …

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Debt dynamics

- We usually look at debt and deficits as ratios to GDP
- How do they change over time?
- Growth of (nominal) debt

  $$[1] \quad B_t = (1+i_t)B_{t-1} + D_t$$
- Growth of (nominal) GDP

  $$[2] \quad Y_t = (1+g_t+\pi_t) \, Y_{t-1}$$

  g_t = real GDP growth, π_t = inflation
- Both numerator and denominator of B/Y change

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Debt dynamics

- Reminder:

  $$[1] \quad B_t = (1+i_t)B_{t-1} + D_t$$
  $$[2] \quad Y_t = (1+g_t+\pi_t)Y_{t-1}$$
- Divide [1] by [2]:

  $$B_t/Y_t = [(1+i_t)/(1+g_t+\pi_t)] \, B_{t-1}/Y_{t-1} + D_t/Y_t$$
  $$\approx [1+i_t-(g_t+\pi_t)] \, B_{t-1}/Y_{t-1} + D_t/Y_t$$
  $$\approx B_{t-1}/Y_{t-1} + (i_t-\pi_t)B_{t-1}/Y_{t-1} - g_tB_{t-1}/Y_{t-1} + D_t/Y_t$$
  $$\Delta(B_t/Y_t) = (i_t-\pi_t)B_{t-1}/Y_{t-1} - g_tB_{t-1}/Y_{t-1} + D_t/Y_t$$

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Debt dynamics

- More on that last step
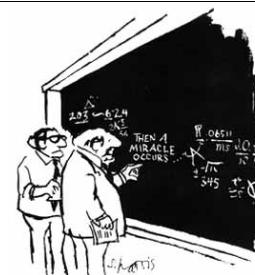
"I think you should be more explicit here in step two."

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Debt dynamics

- Ok, what are we left with?

  $$\boxed{\Delta(B_t/Y_t) = (i_t-\pi_t)B_{t-1}/Y_{t-1} - g_tB_{t-1}/Y_{t-1} + D_t/Y_t}$$
  $$\text{(A)} \qquad \text{(B)} \qquad \text{(C)}$$
  - (A): interest on debt at (real) interest rate $r = i-\pi$
  - (B): real GDP growth at rate g
  - (C): (primary) deficit D

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Debt dynamics

- In case you forgot

  $$\boxed{\Delta(B_t/Y_t) = (i_t-\pi_t)B_{t-1}/Y_{t-1} - g_tB_{t-1}/Y_{t-1} + D_t/Y_t}$$

- Dealing with percentages
  - We need to convert (i, π, g) to numbers: 0.05, not 5
  - But it's convenient to keep (B/Y) and (D/Y) as percentages: 50, not 0.50 (your choice, but that's what we'll do)

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Debt dynamics in Greece

Total deficit (% GDP)	2.4
Primary deficit (% GDP)	0.2
Interest rate paid on debt (%) (!)	1.34
Inflation rate (%)	−0.5
Real GDP growth rate (%)	−4.0
Public debt (% GDP, previous year end)	156.9

Is B/Y going up or down? Why?

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Debt dynamics in Greece

$$\Delta(B_t/Y_t) \ = \ (i_t - \pi_t)B_{t-1}/Y_{t-1} \ - \ g_t B_{t-1}/Y_{t-1} \ + \ D_t/Y_t$$

(A)   (B)   (C)

- Calculations
  - (A): (0.0134+0.005)*156.9 = +2.89
  - (B): +0.040*156.9 = +6.28
  - (C): +0.20
  - Total: +9.36 (B/Y rises to 166.3)

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What happened to Peru's debt?

- Debt-to-GDP fell from 47.1% to 25.0%
  [total change in B/Y = −22.1%]

- Why?

	Debt B_t/Y_t	Interest $(i_t - \pi_t)B_{t-1}/Y_{t-1}$	Growth $-g_t B_{t-1}/Y_{t-1}$	Deficit D_t/Y_t
2003	47.1			
2004	44.3	0.2	−2.4	−0.6
2005	37.7	1.1	−3.0	−4.6
2006	33.1	1.0	−2.9	−2.7
2007	20.9	1.1	−2.9	−0.4
2008	25.0	−0.3	−3.0	−2.5
Sum		3.1	−14.3	−10.9

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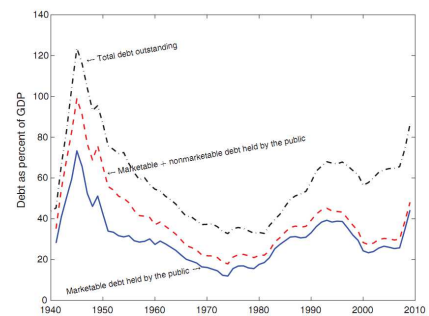
What happened to US WW II debt?

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What happened to US WW II debt?

- Debt-to-GDP fell from 66% in 1945 to 11% in 1974
  [a change of −55%]

- Why?

	Interest $(i_t - \pi_t)B_{t-1}/Y_{t-1}$	Growth $-g_t B_{t-1}/Y_{t-1}$	Primary Deficit D_t/Y_t
1945-1974	−12.5	−21.6	−20.8

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What's missing?

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What's missing?

- Hidden liabilities
- Like what?
  - Financial bailouts
  - Unfunded pensions
  - Other entitlements
  - Implicit guarantees of businesses or regional governments
- Examples?

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What's missing?

- The impact of growth on tax revenue
- GDP growth
  - Affects B/Y directly
  - Also raises tax revenue, reduces primary deficit
  - Overall: the best cure for debt problems (also the converse)
- Examples?

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What's missing?

- The impact of debt on the interest rate
- Interest rate can rise sharply if investors become concerned with repayment
  - Direct impact on changes in debt through $r = i - \pi$
- When does it happen?
- Examples?

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What's missing?

- Maturity of debt
- Short debt needs to be rolled over
  - Interest rate could rise quickly
  - Or you could be shut out of markets altogether
- Examples?

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Is the US in trouble?

Is the US in trouble?

- What's the problem?
  - Large current deficits
  - Growing debt
  - **Significant increases in future spending in pipeline**
- Blinder (D) and Hubbard (R), WaPo, Sept 19, 2011
  - The (total) deficit is forecast by the CBO to reach 15.5% of GDP by 2035. By then, the national debt would be 187% of GDP. **The main culprit is increased health care spending**, which CBO projects to rise from 5.6% of GDP now to 10.4% by 2035.
- Comment: little of this stems from ACA/Obamacare

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Is the US in trouble?

- See link to CBO report on course outline

US government debt
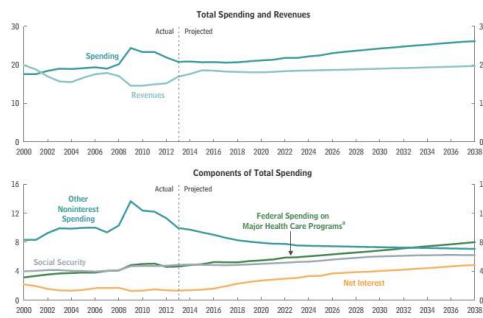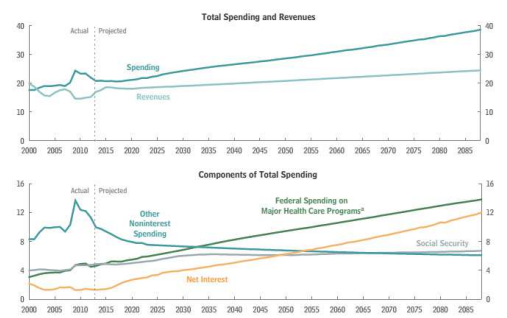

Figure 1-1.
Federal Debt Held by the Public

US government expenses & revenues

US government expenses & revenues

Social security spending

Figure 3-1.
Spending for Social Security

Demography

Social Security "fixes"

- Solutions
  - Increase the payroll tax – or other taxes
  - Reduce benefits
  - Raise retirement age
  - Reduce cost-of-living adjustments
- Congressional Budget Office analysis
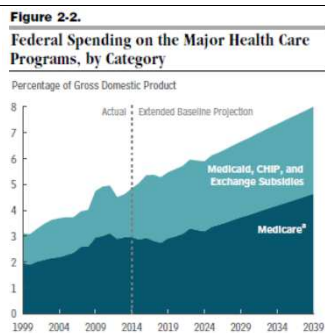 - http://www.cbo.gov/doc.cfm?index=11580

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Medicare and Medicaid

- Medicare: age 65 and older
  - Parts A&B cover hospital and physician care
  - Part D (2006) covers drugs
  - Funded by payroll tax and general revenues
- Medicaid: poor (joint state-federal program)
  - Federal government share >50%
  - States set rules subject to federal approval

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Federal healthcare spending

Figure 2-2.
Federal Spending on the Major Health Care Programs, by Category
Percentage of Gross Domestic Product

Source: CBO.

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Medicare and Medicaid "fixes"

- Health care system as a whole is a mess
- What can be done for Medicare and Medicaid?
  - Spending needs to be paid for
  - Either raise tax revenue: by a lot!
  - Or reduce benefits: but how?
- The central budget issue of our time

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What have we learned?

- Government budgets: deficits are financed by
  - By issuing debt today
  - And promising to run (primary) surpluses in the future
- Standard tool
  - Debt dynamics equation (look for red box)
- Signs of trouble
  - Too much debt
  - Continuing and/or rising deficits
  - Weak political system
- US faces questions about future healthcare spending

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The Global Economy

Foreign Exchange

NYU STERN

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Announcement

- Special class meeting
  - Right after final exam
  - Malt House, 206 Thompson, just north of Bleecker
  - My treat

The ideas

- Exchange rates are …
  - Relative prices of currencies [dollar price of one euro]
  - Source of variation in costs, revenues, etc
  - Where sensible theories come to die

The question

- How can I predict the euro over the next six months?
- Answer: you can't, it's hard to beat a prediction of no change

Dollars per euro

Source: Ticker sense.

Roadmap

- Heineken USA
- Words and pictures
- Exchange rates and prices ("PPP anchor")
- Exchange rates and interest rates ("carry trade")

Heineken USA

- What's your margin (price minus cost per unit) at the current exchange rate?
- How likely is a rise in the euro of 12%? A fall?
- What happens to your margin if the euro rises 12%?
- What strategies would you recommend to deal with this currency risk?

Heineken USA

- Margin
  - Cost per unit: $1.35*2.50 + 2.00 = 5.38$
  - Margin in dollars = 1.62, margin in euros = 1.20
- How likely is a rise in the euro of 12%?
  - Roughly a one standard deviation move
  - Cost per unit: $1.12*1.35*2.50 + 2.00 = 5.78$
  - Margin in dollars = 1.22, margin in euros = 0.81
- What strategies would you recommend to deal with currency risk?

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Words & pictures

Words

- Alan Greenspan, "The euro as an international currency," November 2001
  - Having endeavored to forecast exchange rates for more than half a century, I have developed significant humility about my ability in this area, a sentiment I suspect many in this room share.
- What is he saying? Does it make sense?

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Words

- Warren Buffett, Letter to Shareholders, 2005
  - Berkshire owned about $21.4 billion of foreign exchange contracts at yearend, spread among 12 currencies. Holding of this kind are a change for us. But the evidence grows that our trade [deficit] will put unremitting pressure on the dollar for many years to come.
- Positions closed 2 years later at a loss.

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Words

- Jean-Paul Villain, head of strategy, ADIA, 2010
  - We came to a very firm conclusion: we simply don't know how to trade currencies.
- What is he saying? Does it make sense?

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Words

- Anonymous hedge fund trader, n+1, 2008:
  - From time to time, the dollar's been very weak; from time to time it's strong. … Over the very long term, currency prices tend to be fairly stable and mean reverting. So the dollar's weak today, but that's no reason to believe it's going to be weak forever. It's amazing how many brilliant investors have gotten egg on their faces trading G-7 crosses.
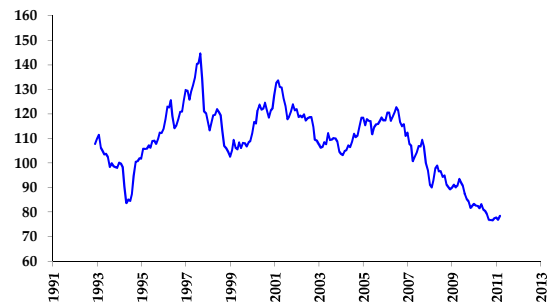- What is he saying? Does it make sense?

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Words

- Michael Feroli, Chief US Economist, JP Morgan Chase
  - No framework works very well. Currency prices remain somewhat of a mystery.
- What is he saying? Does it make sense?
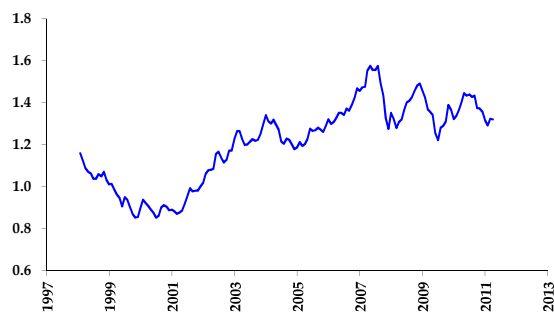
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Yen per dollar
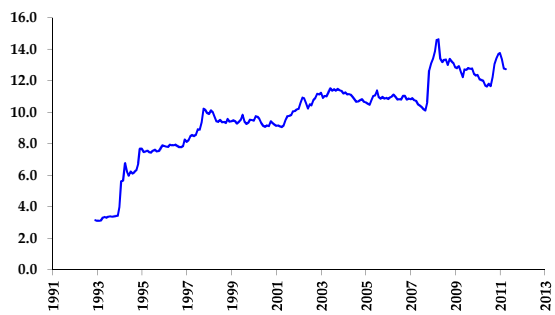

Source: Fed via FRED.

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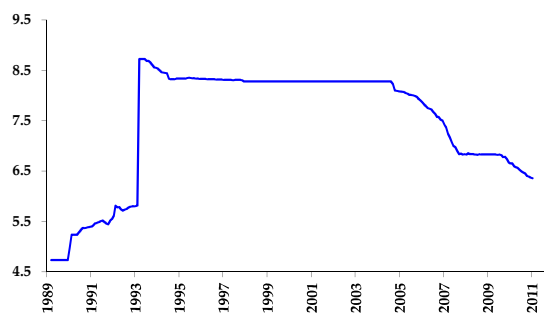## Dollars per euro

Source: Fed via FRED.

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Pesos per dollar

Source: Fed via FRED.

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Yuan per dollar

Source: Fed via FRED.

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Exchange rates & prices

Exchange rates

- Exchange rate terminology
  - e = **exchange rate** : dollar price of one unit of euro
  - If e rises, we say the dollar has **depreciated** (declined in value)
  - If e falls, we say the dollar has **appreciated** (increased in value)
  - The reverse, of course, for the euro
- The facts
  - e's for many currencies move around a lot
  - Annual std dev of stock market ~18%, dollar/euro ~12%
- Why?

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Exchange rates and prices

- The theory
  - Exchange rates reflect differences in prices of goods
  - Prices look high in Paris, but if we convert them to dollars using the exchange rate, they should be about the same as New York
  - We call this "purchasing power parity" (PPP)
- The reality
  - Crude approximation, but useful as long-term anchor
- What we say
  - If prices are high in Paris, we say the euro is **overvalued** [it's all relative: we also say dollar is **undervalued**]

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Exchange rates and prices

- Define
  - P = domestic price (measured in dollars)
  - P* = foreign price (measured in euros)
  - e = exchange rate (dollar price of one euro)
- Compare P with eP*

$$P \ ?=? \ e \ P^*$$
$$e \ ?=? \ P/P^*$$
$$RER = e \ P^*/P \ ?=? \ 1$$

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Exchange rates and prices

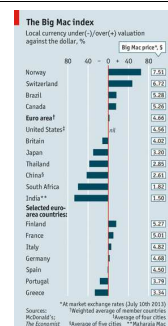| Region	USD Price of Big Mac (Jul 2013)
US	4.56
Euro area	4.66
Japan	3.20
China	2.61
India	1.50
Brazil	5.28
Mexico	2.86

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Exchange rates and prices

- Big Macs
  - Why are prices so low in China? India? Mexico?
  - Why so high in Brazil?
- How would you expect exchange rates to change?
- How fast?
- Are Big Macs typical?

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Exchange rates and prices

http://www.economist.com/content/big-mac-index

- Which currencies are "overvalued"?

- Which currencies are "undervalued"?

- Why?

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Exchange rates and prices

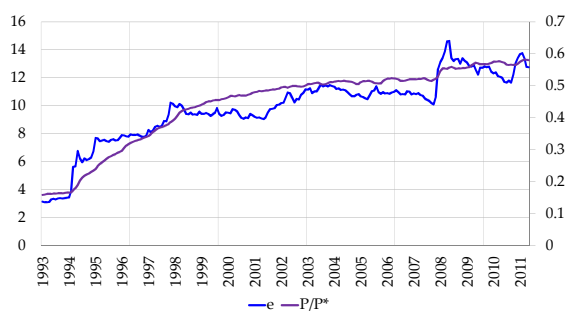- Suppose we used price indexes instead of Big Macs
- Do we see e = P/P*?

Exchange rates and prices

- Let's check
- Convention: home = country exchange rate is quoted in
  - Dollars per pound: home=US, foreign=UK
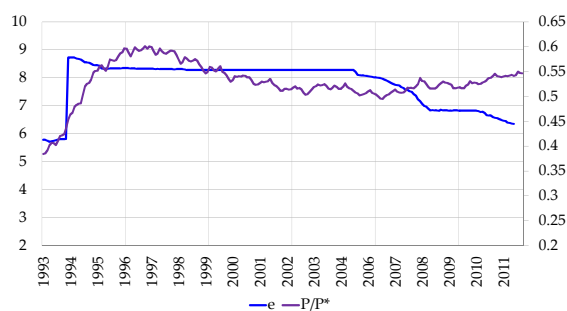 - Yen per dollar: home=Japan, foreign=US

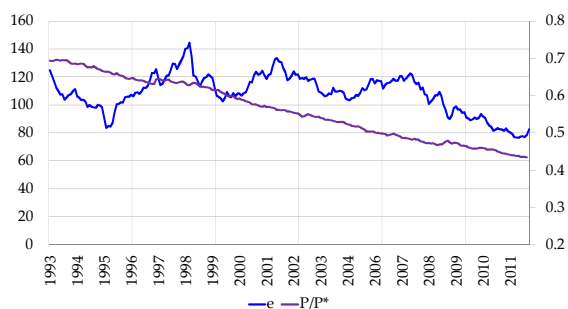## Pesos per dollar

—e —P/P*

Source: Fed via FRED.

Yuan per dollar
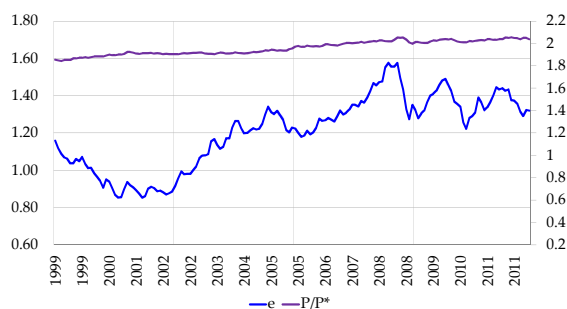
—e —P/P*

Source: Fed via FRED.

Yen per dollar

—e —P/P*

Source: Fed via FRED.

Dollars per euro

—e —P/P*

Source: Fed via FRED.

Exchange rates and prices

- Summary
- Dollar v peso
  - Large movements in P/P* reflected in e
  - Still lots of variation in RER
- Dollar v euro
  - Lots of variation in e
  - Little variation in P/P*
  - Therefore: movements in RER = eP*/P mirror those in e
  - PPP fails miserably

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Exchange rates and prices
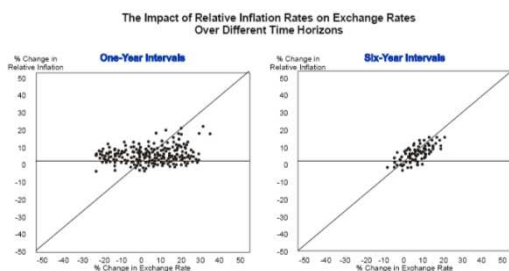
- One last try
- PPP says

$$e = P/P^*$$
$$\text{Rate of Change of } e = \text{Rate of Change of } P/P^*$$

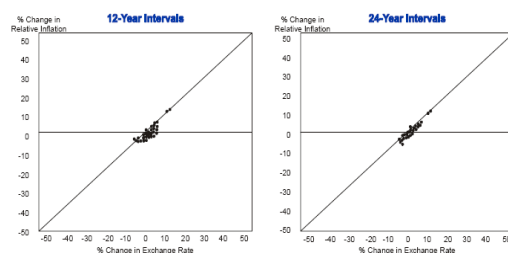- Let's look at this over different time intervals

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Exchange rates and prices

Source: Deutsche Bank FX Guide.

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Exchange rates and prices

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Exchange rates and prices

- Summary of PPP
- An approximation that works best
  - When there are large differences in inflation rates
  - And over long periods of time
- Otherwise variations in exchange rates mirror variations of relative prices and costs (think Heineken)

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Exchange rates & interest rates

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Exchange rates and interest rates

- If two countries have different interest rates, the one with the higher rate will tend to appreciate
- R^2 small (<0.05) but that's enough to make money
- More coming …

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Exchange rates and interest rates

Region	Money market rate (local currency)
US	0.24
Euro area	0.74
Japan	0.44
China	3.40
India	8.14
Brazil	12.00
Mexico	5.75

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Exchange rates and interest rates

- Why do interest rates differ across countries/currencies?
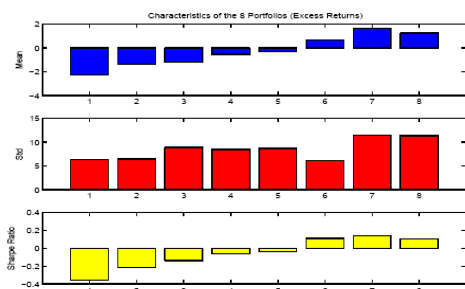- Do global capital markets equate expected returns?

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Exchange rates and interest rates

- The "carry trade"
  - Long position in high interest rate currency
  - Short position in low interest rate currency
  - Carry: collect difference in interest rates
  - Risk: the low-rate currency rises
- Does it work?
  - Most of the time, yes
  - Why?

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Exchange rates and interest rates

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Exchange rates and interest rates

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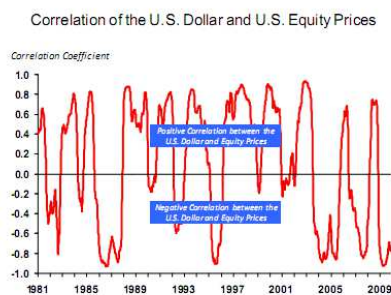*Exchange rates & anything else?*

Exchange rates and …

- Trade balance?
- GDP growth?
- Stock market?

Exchange rates and stock prices

Correlation of the U.S. Dollar and U.S. Equity Prices

What have we learned?

- Exchange rates are variable, affect costs, revenues, etc, in international transactions
- In the short run, most of this variation is unpredictable, even inexplicable
- In the long run, exchange rates roughly mirror ratios of prices (PPP)

For the ride home

- Is China's currency "too cheap"?
- What does that mean?
- What evidence would tell us one way or the other?

Reminders

- Problem Set #4 due next week
  - Last one!
  - Post questions on discussion board – or email me
- Final exam the week after
  - Similar to midterm
  - Practice exams are posted
  - Post questions on discussion board – or email me