

THE GREAT RECESSION

Harvard Economics 1011B
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Spring 2020

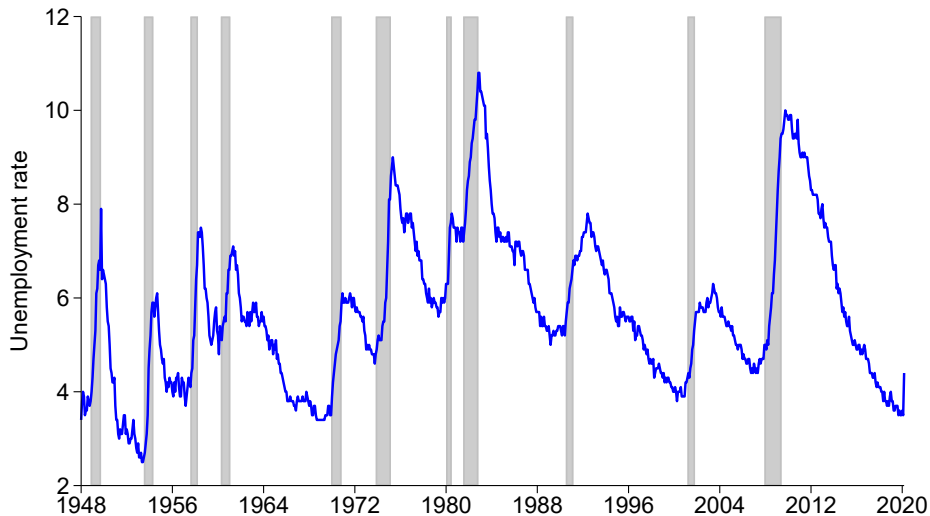
OUTLINE

- 1 COMMON BACKGROUND
- 2 NARRATIVE I: HOUSEHOLD SPENDING BOOM AND BUST
- 3 NARRATIVE II: FINANCIAL PANIC
- 4 POLICY RESPONSES AND RECOVERY

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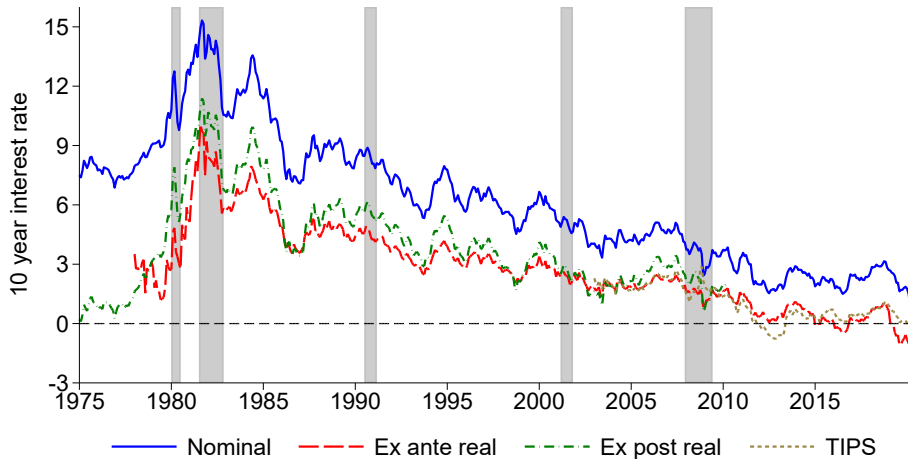
WORST DOWNTURN IN 60 YEARS



INTEREST RATES, HOUSE PRICES, AND MORTGAGES

- Real interest rates on downward trend since early 1980s.
 - ① Loose monetary policy during 2000s.
 - ② Productivity slow down.
 - ③ Global savings glut.
- House prices begin to rise in late 1990s.
 - ① Low interest rates.
 - ② Easier financing: NINJA loans.
 - ③ Bubble?
- Expansion of lending to previously excluded and riskier borrowers.
 - ① Subprime, Alt-A, ARMs, etc.

INTEREST RATE ON 10 YEAR TREASURY



MONETARY POLICY FEEDBACK RULE (TAYLOR RULE)

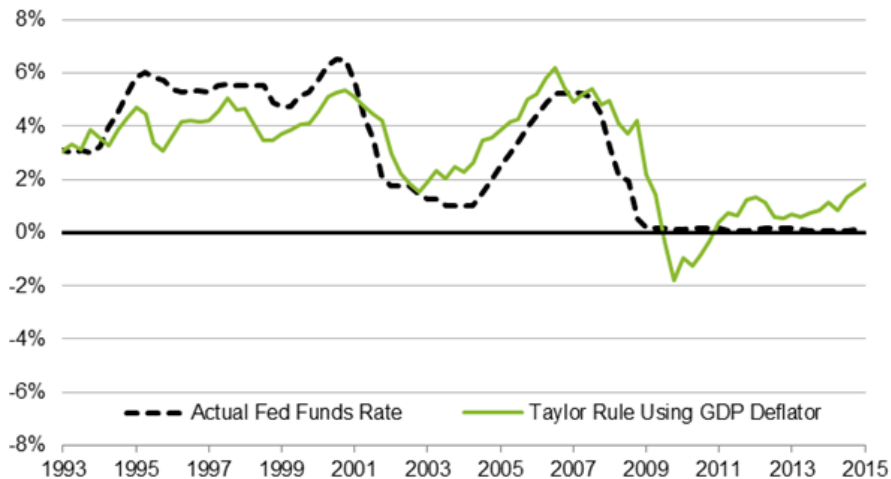
$$i_{t,t+1} = r_{t,t+1}^* + \pi_{t,t+1}^* + \phi_Y(Y_t - Y_t^*) + \phi_\pi(\pi_{t,t+1} - \pi_{t,t+1}^*).$$

- Y_t^* : Fed's target for (log) output; $\pi_{t,t+1}^*$: Fed's target for inflation (2%); $r_{t,t+1}^*$: real interest rate when $Y_t = Y_t^*$ and $\pi_{t,t+1} = \pi_{t,t+1}^*$.
- $\phi_Y > 0$: when output is below target, Fed lowers interest rates.
- $\phi_\pi > 0$: when inflation is above target, Fed raises interest rates.
- Assumption: ϕ_Y, ϕ_π large enough, and inflation sluggish enough, that Fed raises real interest rate. This is usually true.
- Original Taylor rule:

$$i_{t,t+1} = \underbrace{r_{t,t+1}^*}_2 + \underbrace{\pi_{t,t+1}^*}_2 + \underbrace{\phi_Y}_{0.5}(Y_t - Y_t^*) + \underbrace{\phi_\pi}_{1.5}(\pi_{t,t+1} - \pi_{t,t+1}^*).$$

MONETARY POLICY TOO LOOSE?

Figure 1: The Original Taylor Rule, 1993-Present

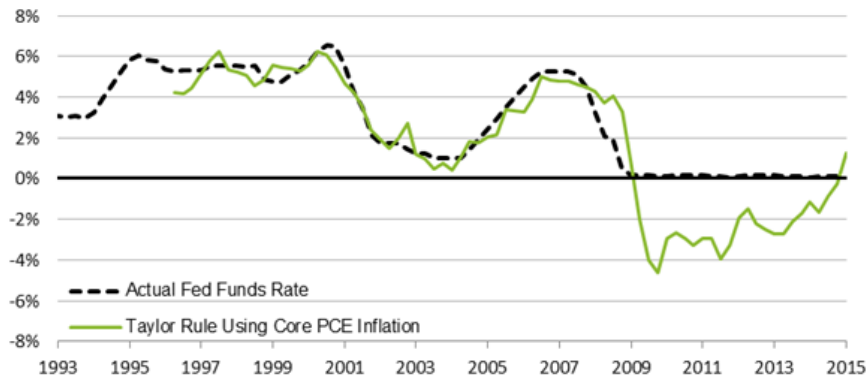


<http://www.brookings.edu/blogs/ben-bernanke/posts/2015/04/28-taylor-rule-monetary-policy>

BERNANKE DISAGREES

Figure 2: Predictions of a Modified Taylor Rule

(Core PCE inflation, weight of 1.0 on output gap)



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PRODUCTIVITY SLOWDOWN

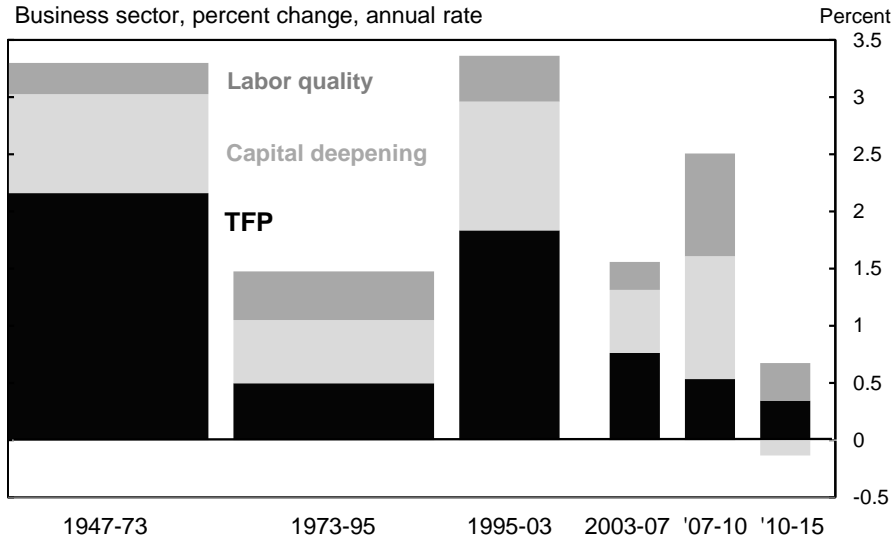
- Euler equation plus balanced growth:

$$\begin{aligned}\left(\frac{C_t}{N_t}\right)^{-\frac{1}{\sigma}} &= \beta(1+r_{t,t+1})\left(\frac{C_{t+1}}{N_{t+1}}\right)^{-\frac{1}{\sigma}} \\ \Rightarrow 1+r_{t,t+1} &= \beta^{-1}\left(\frac{C_{t+1}/N_{t+1}}{C_t/N_t}\right)^{\frac{1}{\sigma}} \\ \Rightarrow 1+r_{t,t+1} &= \beta^{-1}\left(\frac{Y_{t+1}/N_{t+1}}{Y_t/N_t}\right)^{\frac{1}{\sigma}} \\ \Rightarrow r_{t,t+1} &\approx -\ln \beta + \frac{1}{\sigma}g.\end{aligned}$$

- ▶ C_t, Y_t : aggregate consumption, output.
- ▶ N_t : population.
- ▶ g : growth rate of output per worker.

Contributions to growth in U.S. output per hour

Business sector, percent change, annual rate

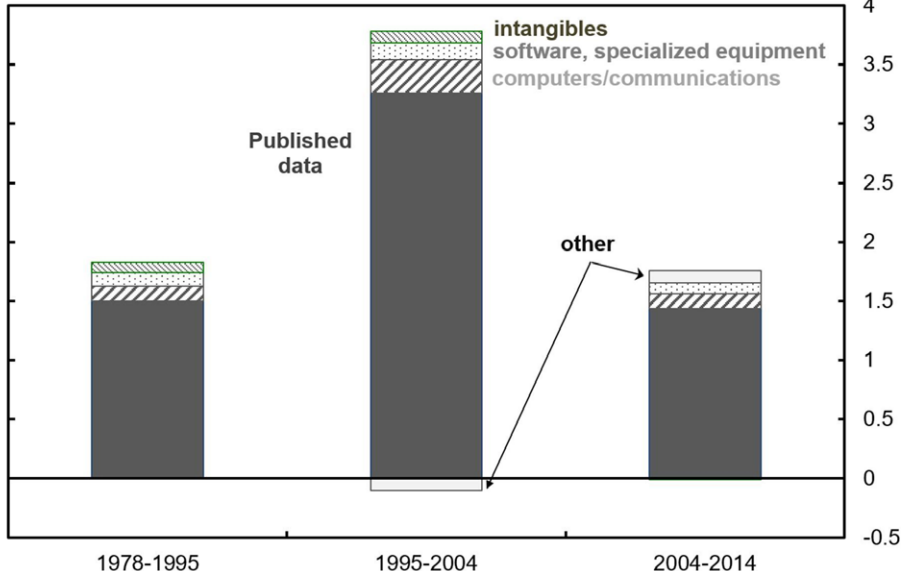


Source: Fernald (2014a). Quarterly; samples end in Q4 of years shown except 1973 (ends Q1). Capital deepening is contribution of capital relative to quality-adjusted hours. Total factor productivity measured as a residual.

Adjustments to growth in output per hour

Business sector, percentage points per year

Percentage points



Source: BLS, Fernald (2014a), and authors' calculations. Other comprises Internet, free digital services, globalization, and fracking.

GLOBAL SAVINGS GLUT

Figure 2. Saving and Investment, Industrial Countries
Excluding United States, 1960-2005

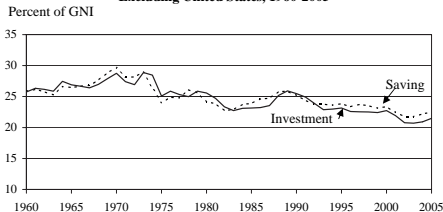
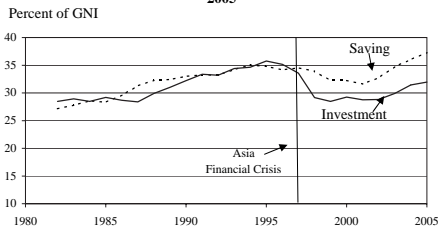
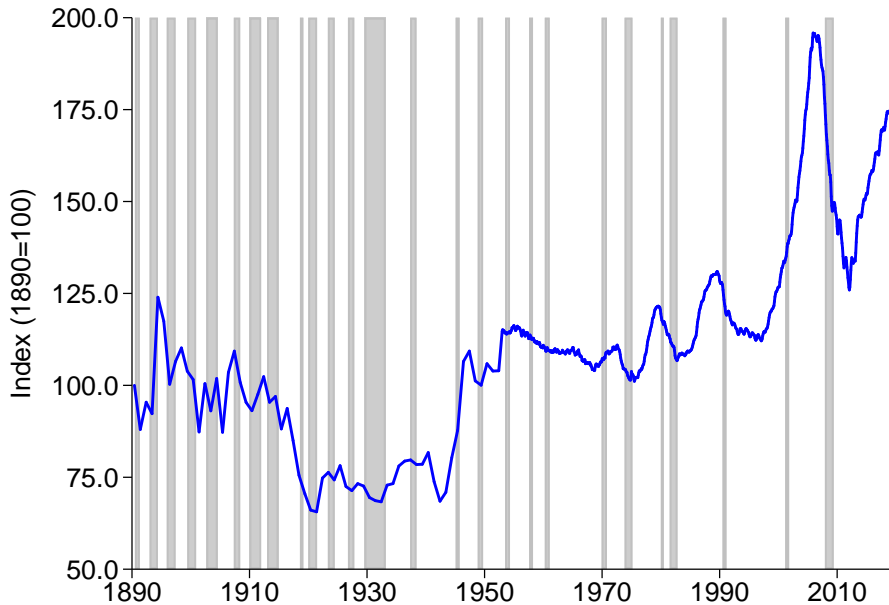


Figure 3. Saving and Investment, Emerging Asia, 1982-2005



- Foreign demand for safe assets increased, foreign investment fell following Asian financial crisis in 1997-98.
- Think of as $r^* \downarrow$.
- Model prediction: $i^* \downarrow \implies i \downarrow, \dot{e} < 0$.

NATIONAL HOUSE PRICES OVER THE LONG RUN



% of Originations by Product (except for Total Loans)

Year	FHA/VA	Conform- ing	Jumbo	Sub- prime	Alt-A	HEL	ARMs	Refinan- ces	Total Loans (\$Bn)
2001	7.9%	57.1%	20.1%	7.2%	2.5%	5.2%	16.0%	58.6%	2215
2002	6.1%	59.1%	19.8%	6.9%	2.3%	5.7%	23.5%	63.1%	2885
2003	5.6%	62.4%	16.5%	7.9%	2.2%	5.6%	26.2%	72.0%	3945
2004	4.5%	41.4%	17.5%	18.2%	6.3%	12.2%	50.1%	54.7%	2920
2005	2.9%	34.9%	18.3%	20.0%	12.2%	11.7%	47.8%	50.4%	3120
2006	2.7%	33.2%	16.1%	20.1%	13.4%	14.4%	45.0%	49.0%	2980
1Q06	2.7%	33.5%	14.6%	19.9%	14.9%	14.5%	42.1%	49.4%	705
2Q06	2.5%	34.4%	15.8%	20.6%	13.0%	13.8%	49.0%	47.8%	800
3Q06	2.9%	31.9%	17.0%	21.2%	12.1%	15.0%	44.0%	48.7%	755
4Q06	2.6%	33.1%	17.1%	18.8%	13.9%	14.6%	44.3%	50.3%	720
1Q07	2.8%	40.1%	14.7%	13.7%	14.4%	14.3%	35.3%	57.1%	680
2Q07	3.4%	44.9%	16.4%	7.7%	13.2%	14.4%	30.1%	51.6%	730
3Q07	4.6%	50.2%	14.6%	4.9%	9.5%	16.3%	29.1%	46.1%	570

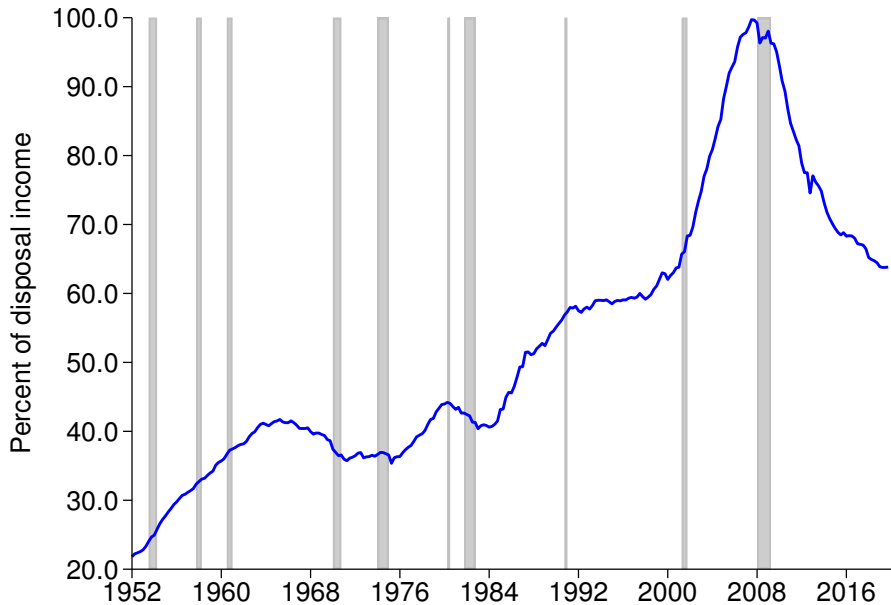
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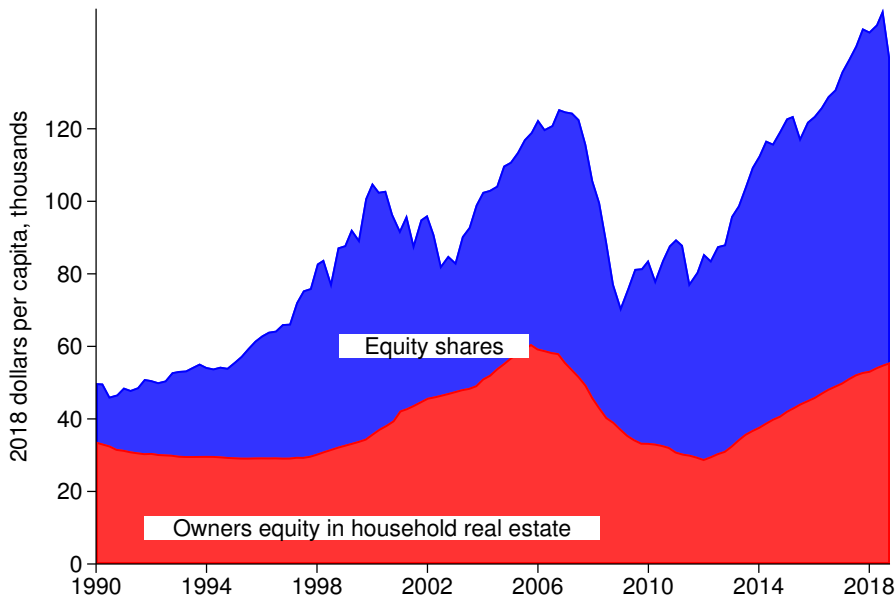
STORY

- Rising house prices led to borrowing and consumption.
 - ① Wealth effects: Euler equation consumers experienced increase in lifetime resources.
 - ② Credit market: constrained consumers borrowed against their houses.
- Eventually, house prices crashed.
- Falling house prices led households to cut consumption.
 - ① Wealth effects: Euler equation consumers experienced decrease in lifetime resources, compounded by fall in stock market.
 - ② Credit market: constrained consumers forced to reduce borrowing.
- Much of the causal evidence for this story assembled by economists Atif Mian and Amir Sufi. Key insight: extent of house price boom and bust constrained by how easy it is to build new houses.

HOUSEHOLD MORTGAGE LIABILITIES



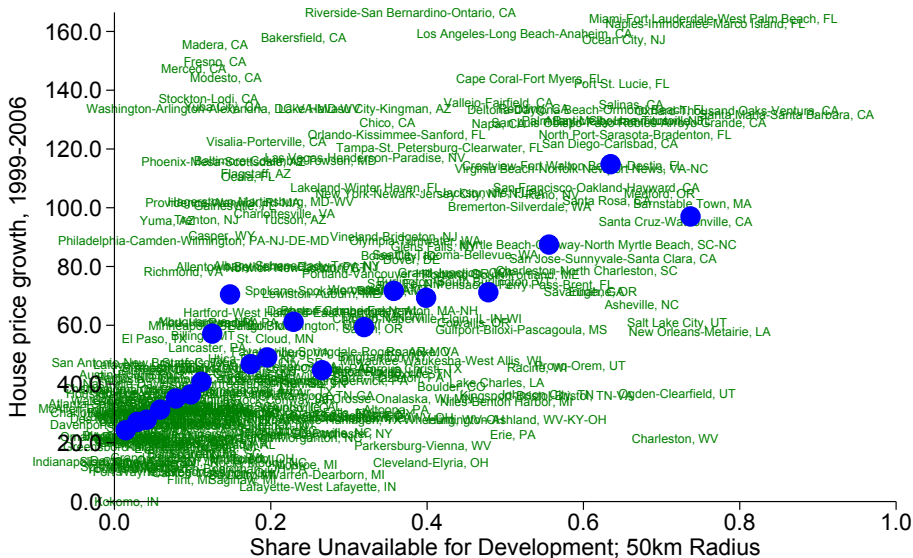
NET WORTH, REAL ESTATE AND EQUITIES



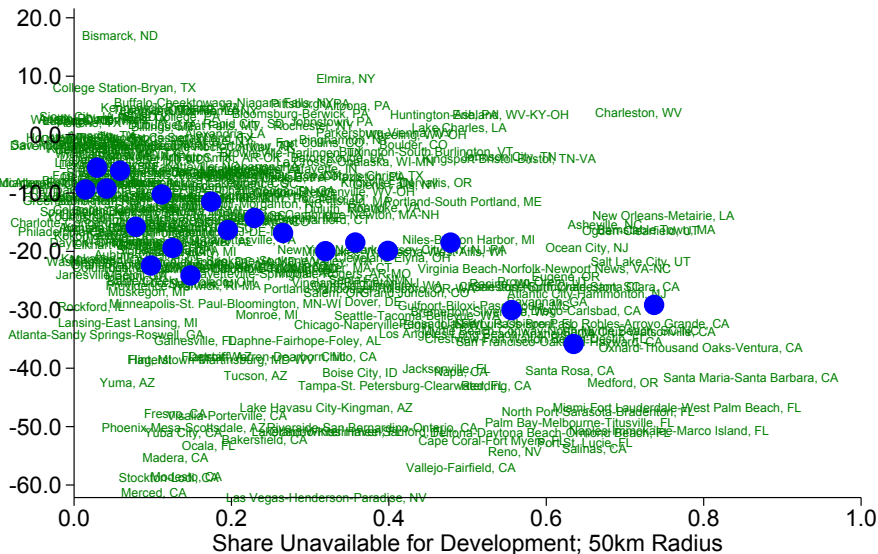
SAIZ (QJE 2010) LAND AVAILABILITY MEASURE

- Residential construction constrained in areas with slope above 15%.
 - ▶ Example: Steep slope encompasses 47.6% of land area within 50 km of L.A. center, but holds 3.7% of population.
- Residential construction impossible on water ways.
- GIS software to calculate fraction of land with slope above 15% or lost to water within 50 km radius of each metropolitan central city.
- Visual representation: sort Metropolitan Statistical Areas into 20 quantiles of land unavailability and plot average house price growth.

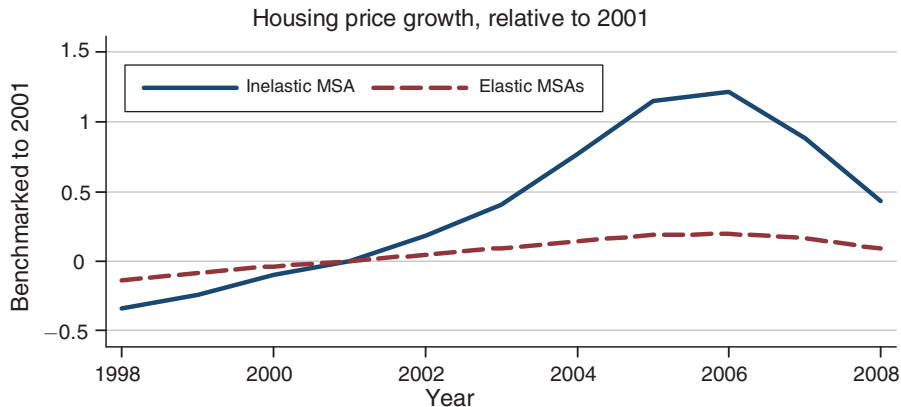
HOUSE PRICE GROWTH AND LAND AVAILABILITY



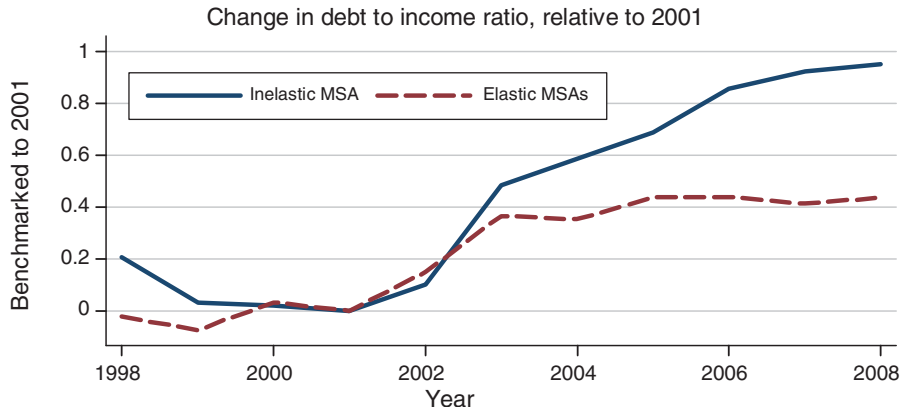
House price growth, 2006-2011



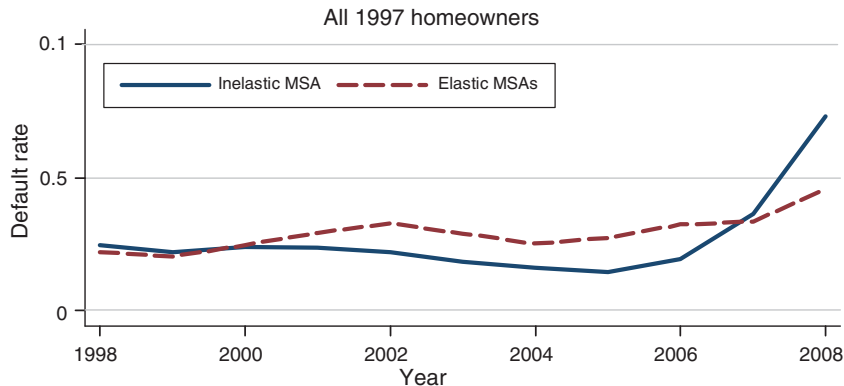
HOUSE PRICE GROWTH BY TOP AND BOTTOM QUARTILE OF SUPPLY ELASTICITY



DEBT TO INCOME RATIO BY TOP AND BOTTOM QUARTILE OF SUPPLY ELASTICITY



CONSEQUENCES



- Partial equilibrium aggregation exercise: \$1.25 trillion of additional borrowing during 2002-2006, 39% of new defaults 2006-2008.

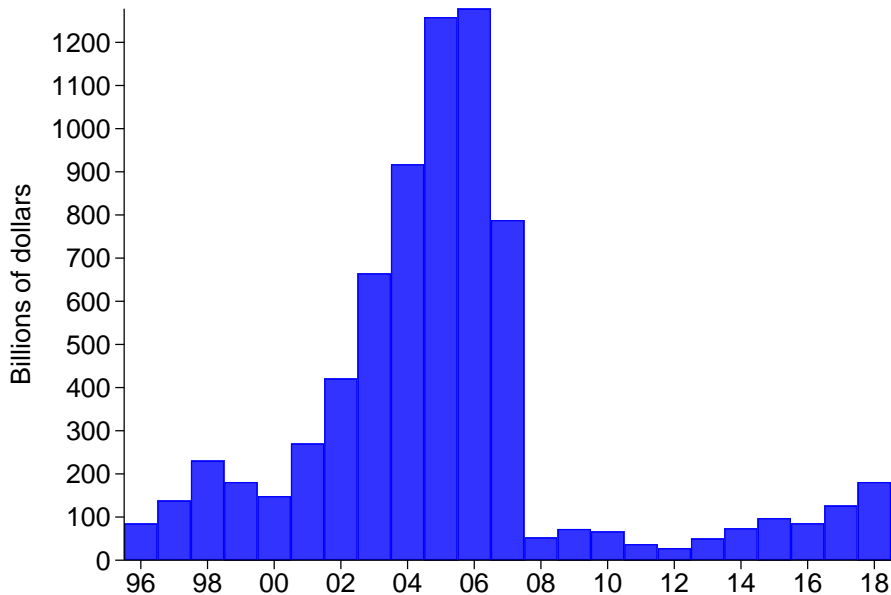
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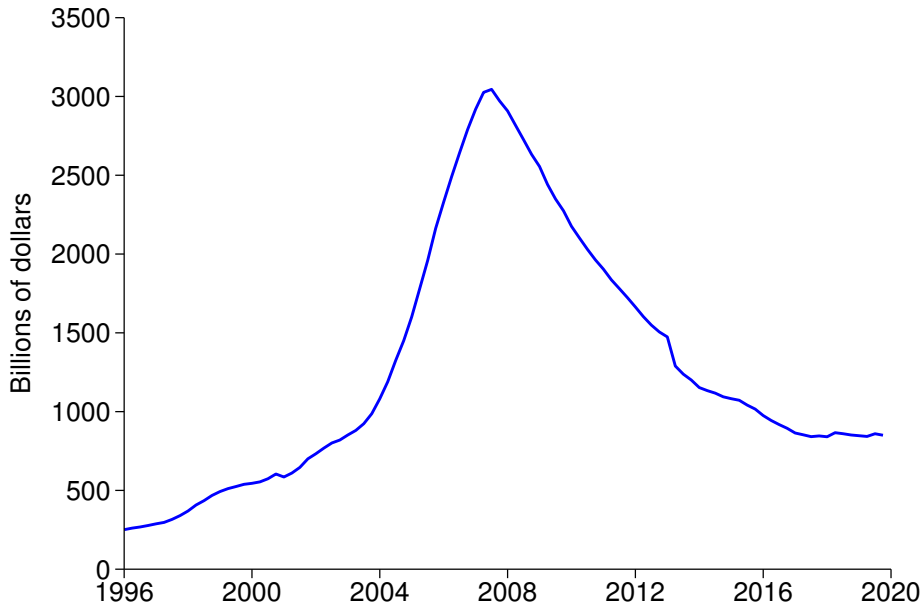
STORY

- Advent of securitization:
 - ① *Securitization* refers to the process of pooling multiple loans into a single debt security. By pooling many loans together, securitization reduces idiosyncratic (or geographic) risk.
 - ② Began in the 1980s but expanded in the 2000s.
 - ③ Aided by *tranching*, or the process of splitting a single security into multiple tranches with ordered priority for repayment.
 - ④ Demand from big banks for new mortgages to securitize.
 - ⑤ Moral hazard: without “skin in the game”, lenders made loans they probably shouldn’t have.
- When demand for new securities suddenly stopped, many banks held billions of dollars of mortgages or securities they had intended to sell.
- Resulting decline in capital led to reduced lending, and bank runs, which led to reduced lending.
- Sudden stop in lending made businesses which couldn’t borrow lay off workers, stop new investment, etc.

PRIVATE LABEL RMBS ISSUANCE



PRIVATE LABEL MBS OUTSTANDING



DEFAULT LOSSES BY TRANCHE AND ISSUE PERIOD

	AAA	AA	A	BBB	BBB-
2005:H2	0.005	0.069	0.445	0.915	0.929
2006:H1	0.039	0.483	0.950	0.956	1
2006:H2	0.134	0.934	1	1	1
2007:H1	0.145	0.937	1	1	1

CDOs

Home Equity Bonds Placed into CDOs by Original Rating						
1998-2007						
Original Tranche Rating	Total # Issued	Total Placed in or Referenced in CDOs	% Placed or Referenced in CDOs	# Occurrences in CDOs	Share of Occurrences to Total Issued	Share of Occurrences to Total Placed in CDOs
AAA	12,948	1,463	11%	2,509	19%	171%
AA	5,486	3,893	71%	11,292	206%	290%
A	5,891	4,579	78%	14,714	250%	321%
BBB	6,993	5,496	79%	36,901	528%	671%
BB/B	1,976	899	45%	2,091	106%	233%

Amounts (\$ Millions)						
Original Tranche Rating	Total \$ Issued	Total Placed in or Referenced in CDOs	% Placed or Referenced in CDOs	\$ Occurrences in CDOs	Share of \$ Occurrences to Total Issued	Share of \$ Occurrences to Total Placed in CDOs
AAA	2,011,451	160,090	8%	25,897	1%	16%
AA	173,150	125,152	72%	80,449	46%	64%
A	100,183	82,916	83%	71,245	71%	86%
BBB	77,025	64,061	83%	140,046	182%	219%
BB/B	18,002	9,055	50%	7,981	44%	88%

- For every one BBB bond, created 5 synthetic bonds
- For every dollar of subprime BBB, nearly tv dollars of potential losses.
- Most of this is now AAA.

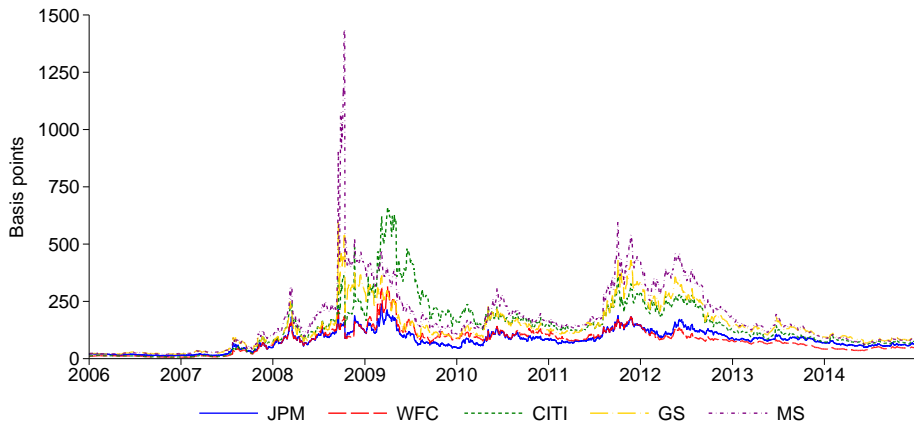
Summary Expected Losses for All SF ABS CDOs by Issuance Year				
Vintage	# Deals	Deal Balance (\$ million)	Deal Loss (\$ million)	Total Loss %
1999	1	304	60	20%
2000	19	6,991	1,847	26%
2001	34	14,891	3,132	21%
2002	37	17,456	3,604	21%
2003	45	25,561	7,481	29%
2004	81	58,558	25,822	44%
2005	124	108,877	61,627	57%
2006	223	231,711	167,402	72%
2007	163	176,759	148,836	84%
Grand Total	727	641,107	419,812	65%

- \$550 billion of AAA paper
- Lower rated stuff
 - Sold into other CDOs
 - Lehman sold to Merrill
 - Merrill sold to Lehman

CASE STUDY: LEHMAN BROTHERS

- Investment bank: traditionally in “movement” business.
 - ▶ Acquire mortgages to securitize and sell.
- 2006: decision to enter into “storage” business.
 - ▶ Hold assets such as mortgages on balance sheet as investment.
- Internal stress tests ignored own account real estate investments because they had historically been small part of portfolio.
- Countercyclical growth strategy (March 2007): “Current distressed environment provides substantial opportunities.”
 - ▶ Compare: December 2006 Goldman Sachs holds meeting of senior risk managers and MBS traders to review portfolio and decides to reduce exposure to real estate.
- September 15, 2008: Lehman files for bankruptcy.

IMMEDIATE FALLOUT I: CDS SPREADS

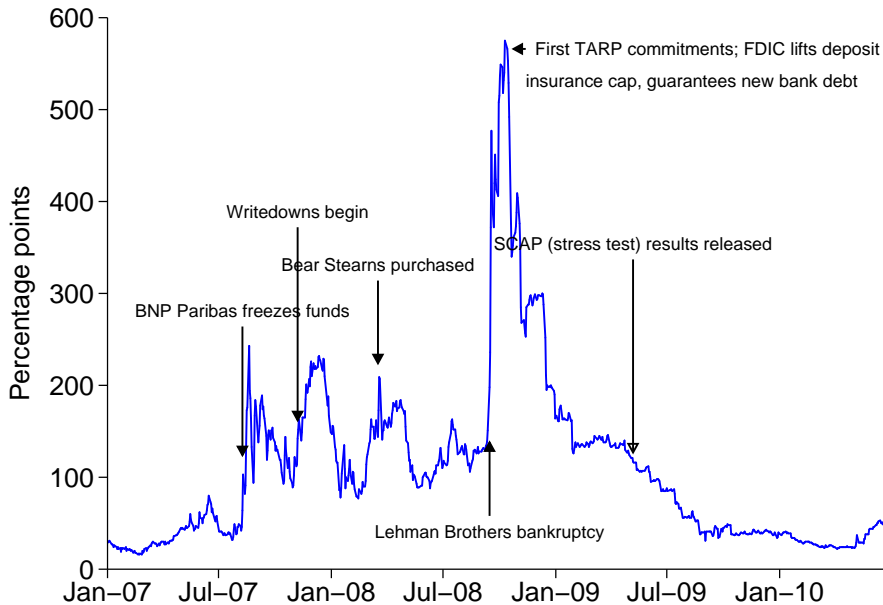


- CDS is the cost of buying insurance against a default. Pay *cds* per year, receive up to \$10,000 if entity defaults.
- After Lehman, run on other investment banks *a la* Diamond and Dybvig.

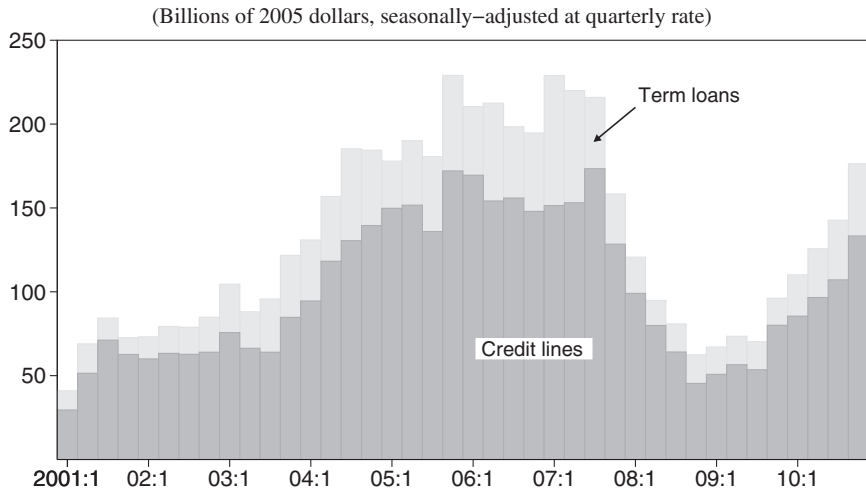
IMMEDIATE FALLOUT II: MMF FLOWS

- Money market fund: like bank checking account, except no deposit insurance.
- Reserve Primary Fund held \$775 million in Lehman unsecured debt and “broke the buck.”
- Run on other money market funds *a la* Diamond and Dybvig.
- Concern of whether nonfinancial corporations could roll over debt normally bought by money market funds.

TREASURY-EURODOLLAR (TED) SPREAD



NEW LENDING BY 43 LARGE BANKS



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CREDIT POLICY

- “Alphabet soup” of programs: TAF, TALF, CPFF, ABCP MMFLF, MMIFF, Maiden Lane I,II,III, TARP.
 - ▶ Stand alone investment banks acquire access to discount window.
 - ▶ Deposit cap lifted.
 - ▶ Money market funds guaranteed.
- Stress tests.
- Purpose I: stop runs.
- Purpose II: keep credit spreads from rising.
- Many of these being recycled for COVID-19.

MONETARY AND FISCAL POLICY

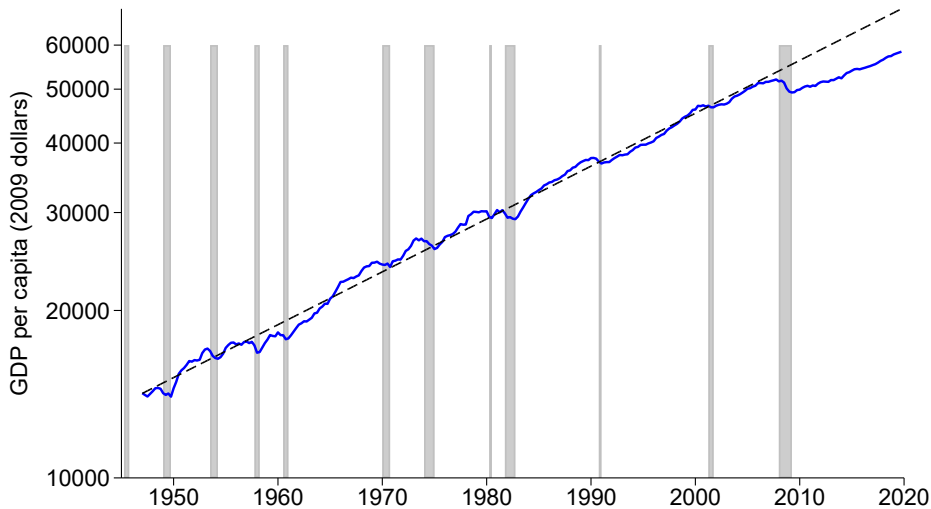
- Monetary policy:

- ① Short term interest rate to 0-25 basis points.
- ② Central bank liquidity swaps: keep dollar from appreciating too quickly due to “flight to quality.”
- ③ Quantitative easing: purchases of long-term Treasury bonds and Government Sponsored Agency bonds (Fannie Mae and Freddie Mac) to reduce risk premium.
- ④ Forward guidance.

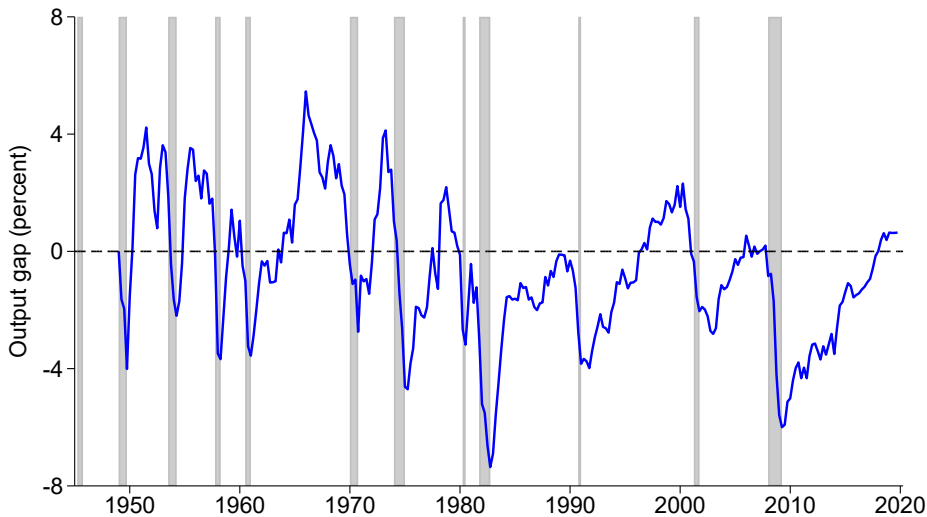
- Fiscal policy:

- ① American Recovery and Reinvestment Act.

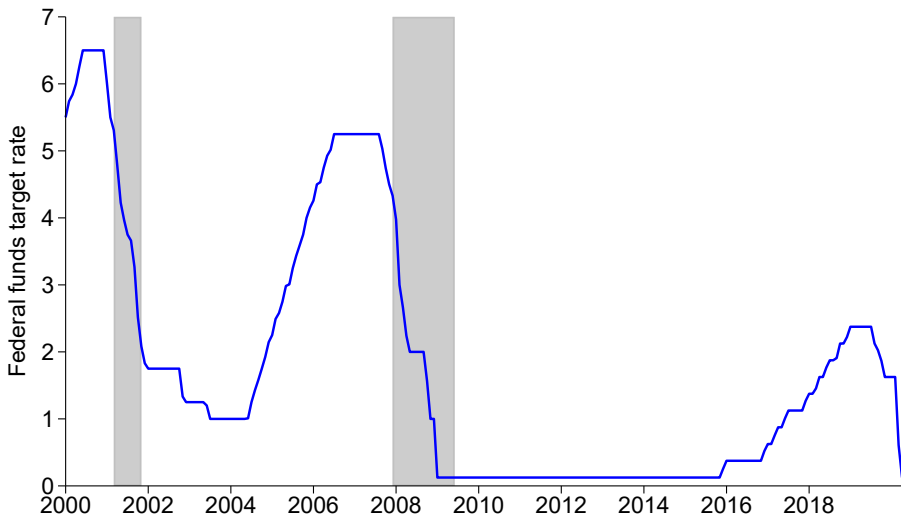
RECOVERY?



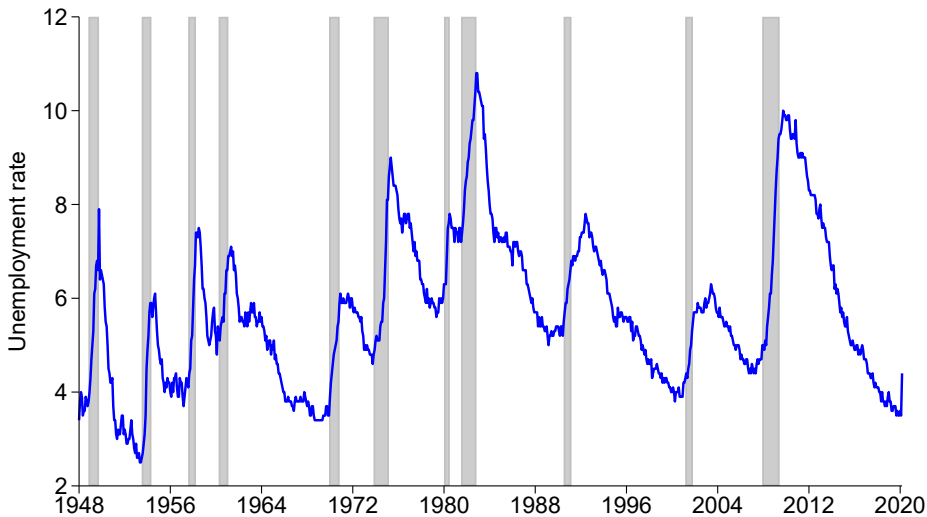
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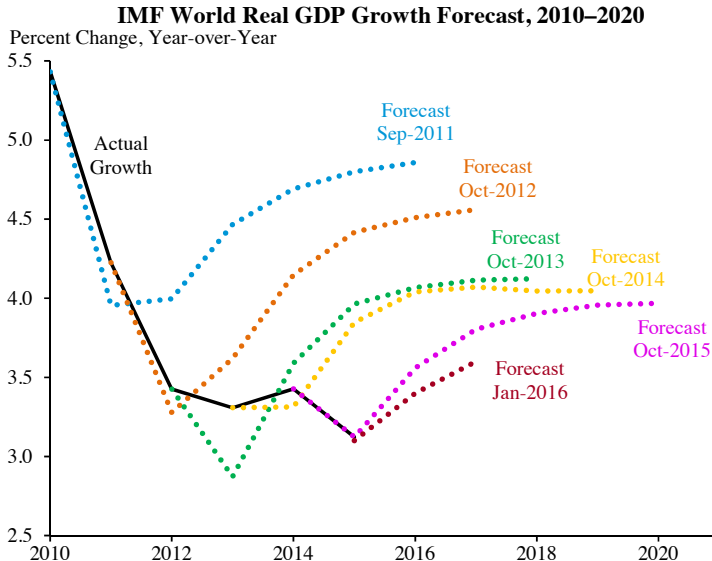
RECOVERY?



RECOVERY?



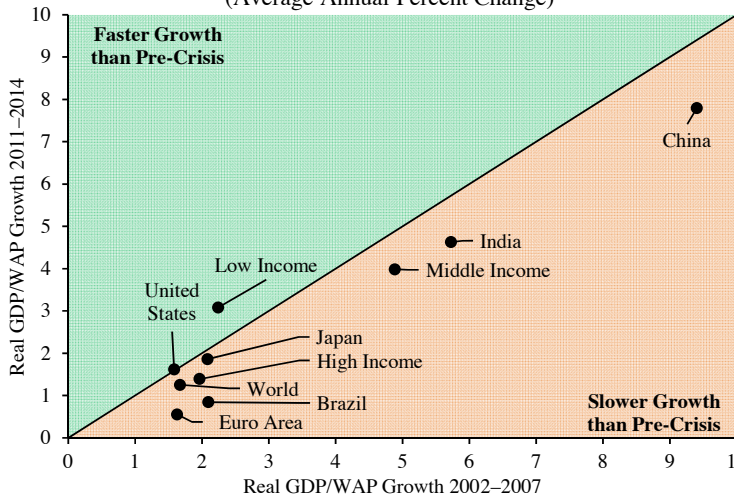
RECOVERY?



Source: International Monetary Fund (IMF).

RECOVERY?

**Real GDP per Working Age Population (WAP), Pre- vs. Post-Crisis
(Average Annual Percent Change)**

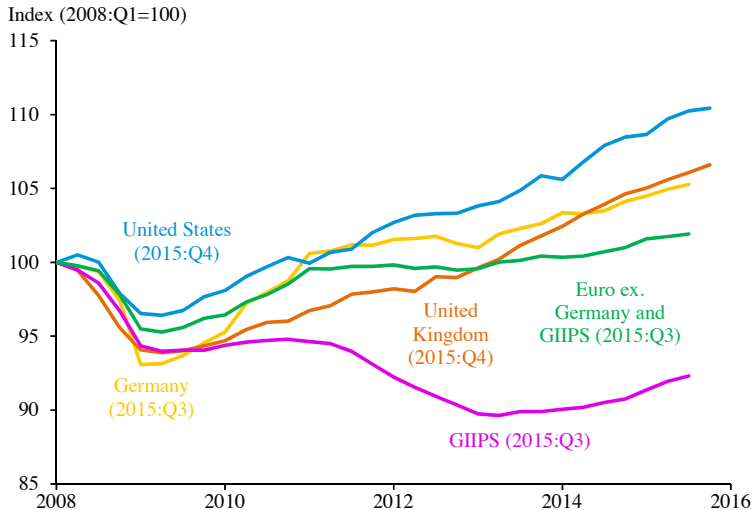


Note: Working age population is aged 15-64.

Source: World Bank; CEA calculations.

RECOVERY?

Real GDP, 2008–2015



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