Course 5: Financial Markets, Aggregate Demand and the Crisis

Intermediate Macroeconomics, Econ 102

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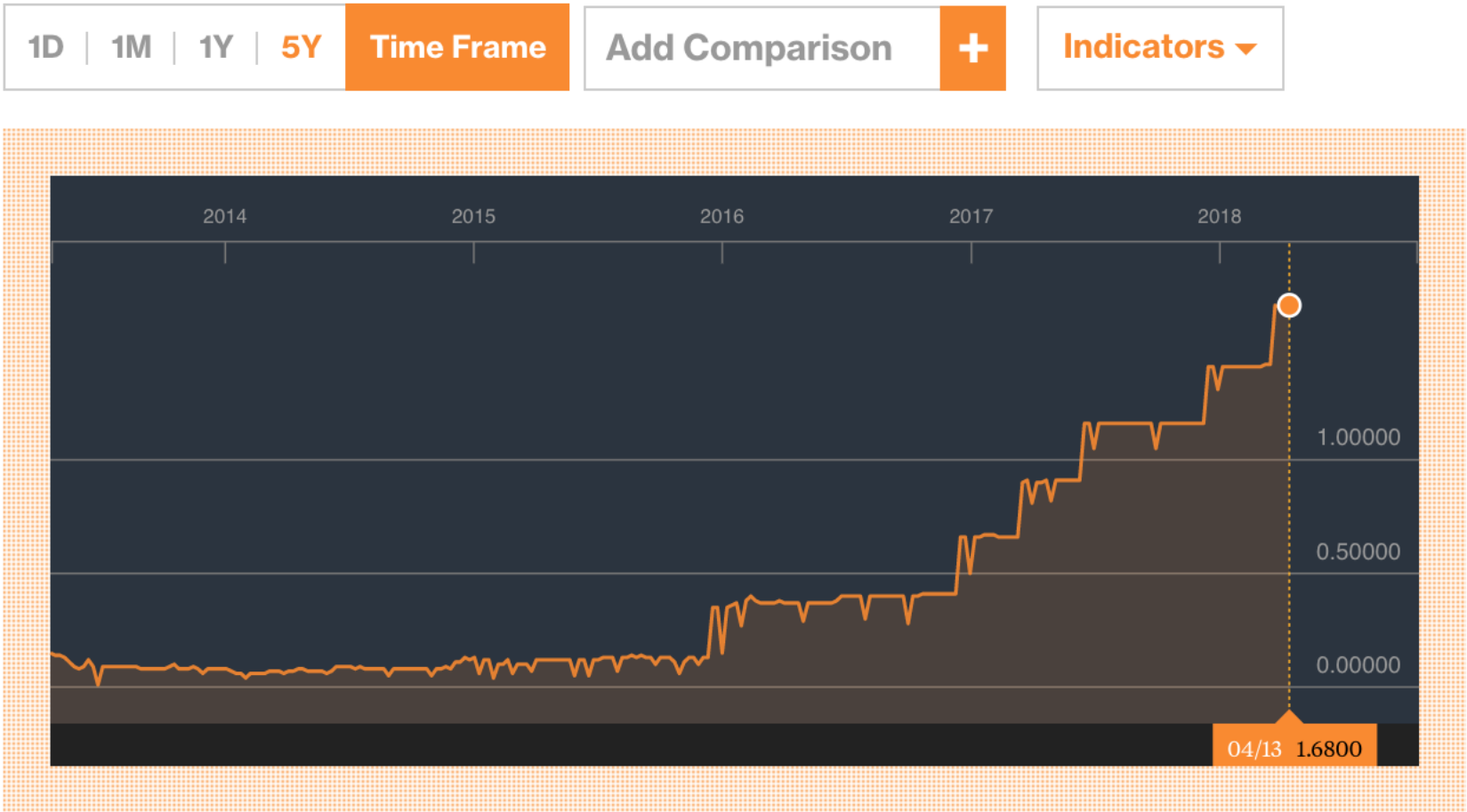
The Role of Finance

- In the preceding lectures we have assumed that there were only two assets:
  - money which does not pay interest, but allow for transactions.
  - bonds that pay interest i.
- We eluded to the fact that i should really thought of as the price of central bank reserves: the federal funds rate. Obviously, the financial world is **vastly more complex:**
  - there are many interest rates. (see next slides)
  - there are many financial institutions interacting with one another, borrowing at different interest rates.
- Crisis of 2007-2009 has shown that financial institutions are important:
  - can be a *source of crises*. e.g. subprime loans extended to low-income.
  - macroeconomically significant: financial system accounts as a whole for **7% of GDP**.
- This lecture intends to give you a birds' eye view of financial markets.

Federal Funds Rate

Source: Bloomberg, Screenshot, April 14, 2018. Link



Federal Funds Rate

Source: Bloomberg, Screenshot, April 14, 2018. Link

Federal Reserve Rates

RATE	CURRENT	1 YEAR PRIOR
FDFD:IND **Fed Funds Rate**	1.68	0.90
FDTR:IND **Fed Reserve Target**	1.75	1.00
PRIME:IND **Prime Rate**	4.75	4.00

US Treasury Yields

Source: Bloomberg, Screenshot, April 14, 2018. Link

Treasury Yields

NAME	COUPON	PRICE	YIELD	1 MONTH	1 YEAR	TIME (EDT)
GB3:GOV **3 Month**	0.00	1.72	1.75%	0	+95	4/13/2018
GB6:GOV **6 Month**	0.00	1.91	1.95%	+2	+103	4/13/2018
GB12:GOV **12 Month**	0.00	2.03	2.09%	+6	+108	4/13/2018
GT2:GOV **2 Year**	2.25	99.80	2.36%	+10	+115	4/13/2018
GT5:GOV **5 Year**	2.50	99.20	2.67%	+6	+90	4/13/2018
GT10:GOV **10 Year**	2.75	99.34	2.83%	+1	+59	4/13/2018
GT30:GOV **30 Year**	3.00	99.47	3.03%	-3	+14	4/13/2018

US TIPS

Source: Bloomberg, Screenshot, April 14, 2018. Link

Treasury Inflation Protected Securities (TIPS)

NAME	COUPON	PRICE	YIELD	1 MONTH	1 YEAR	TIME (EDT)
GTII5:GOV **5 Year**	0.13	98.45	0.52%	+6	+74	4/13/2018
GTII10:GOV **10 Year**	0.50	98.29	0.68%	-5	+37	4/13/2018
GTII20:GOV **20 Year**	3.38	134.75	0.75%	-12	+31	4/13/2018
GTII30:GOV **30 Year**	1.00	103.19	0.88%	-9	+2	4/13/2018

US TIPS

Source: Bloomberg, Screenshot, April 14, 2018. Link

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GTII30:GOV **30 Year**	1.00	103.19	0.88%	-9	+2	4/13/2018

Selected Rates (Federal Reserve)

Source: Selected Interest Rates (Daily) - H.15, April 14, 2018. Link

Federal funds (effective)	1.69	1.69	1.69	1.69	1.69	Bank prime loan	4.75	4.75	4.75	4.75	4.75
Commercial Paper						Discount window primary credit	2.25	2.25	2.25	2.25	2.25
Nonfinancial						U.S. government securities					
1-month	1.82	1.81	1.80	1.83	1.81	Treasury bills (secondary market)					
2-month	1.90	1.91	1.89	1.88	1.88	4-week	1.65	1.64	1.61	1.61	1.62
3-month	1.99	2.00	2.00	2.00	2.00	3-month	1.70	1.73	1.71	1.70	1.72
Financial						6-month	1.86	1.89	1.89	1.90	1.90
1-month	1.75	1.85	1.82	1.86	1.79	1-year	2.00	2.01	2.02	2.02	2.04
2-month	n.a.	2.06	2.00	2.01	1.90						
3-month	2.29	2.23	2.29	2.27	2.01						
						Treasury (Inflation indexed)					
Treasury (Nominal)						5-year	0.57	0.58	0.62	0.56	0.62
Nominal						7-year	0.66	0.67	0.70	0.63	0.69
1-month	1.68	1.67	1.63	1.64	1.65	10-year	0.70	0.71	0.72	0.68	0.70
3-month	1.73	1.76	1.74	1.73	1.75	20-year	0.83	0.83	0.84	0.80	0.82
6-month	1.91	1.93	1.93	1.95	1.95	30-year	0.92	0.92	0.92	0.88	0.90
1-year	2.06	2.08	2.09	2.09	2.11	Inflation-indexed long-term average	0.85	0.85	0.85	0.82	0.84
2-year	2.27	2.29	2.32	2.32	2.34						
3-year	2.40	2.43	2.45	2.45	2.49						
5-year	2.58	2.60	2.62	2.62	2.67						
7-year	2.70	2.72	2.74	2.72	2.78						
10-year	2.77	2.78	2.80	2.79	2.83						
20-year	2.89	2.89	2.89	2.87	2.92						
30-year	3.01	3.02	3.02	2.99	3.05						

10-Year Europe

Source: Bloomberg, Screenshot, April 14, 2018. Link

Europe, Middle East & Africa — 10-Year Government Bond Yields

COUNTRY	YIELD	1 DAY	1 MONTH	1 YEAR	TIME (EDT)
Germany »	0.51%	0	-8	+32	4/13/2018
United Kingdom »	1.43%	-2	0	+39	4/13/2018
France	0.74%	-1	-10	-17	4/13/2018
Italy	1.79%	-1	-22	-51	4/13/2018
Spain	1.22%	-2	-16	-46	4/13/2018
Netherlands	0.65%	-1	-11	+22	4/13/2018
Portugal	1.63%	-4	-15	-222	4/13/2018
Greece	4.04%	+6	-7	-250	4/13/2018
Switzerland	-0.04%	0	-8	+18	4/13/2018

10-Year Asia

Source: Bloomberg, Screenshot, April 14, 2018. Link

Asia Pacific 10-Year Government Bond Yields

COUNTRY	YIELD	1 DAY	1 MONTH	1 YEAR	TIME (EDT)
Japan »	0.03%	+0	-1	+3	4/13/2018
Australia »	2.73%	+7	0	+26	4/13/2018
New Zealand	2.81%	+4	-10	-11	4/13/2018
Hong Kong	1.83%	+3	-6	--	4/13/2018
Singapore	2.36%	+1	-2	+26	4/13/2018
South Korea	2.60%	+3	--	+42	4/13/2018
India	7.44%	-5	-24	+62	4/13/2018

Japan Government Bonds Yields

Source: Bloomberg, Screenshot, April 14, 2018. Link

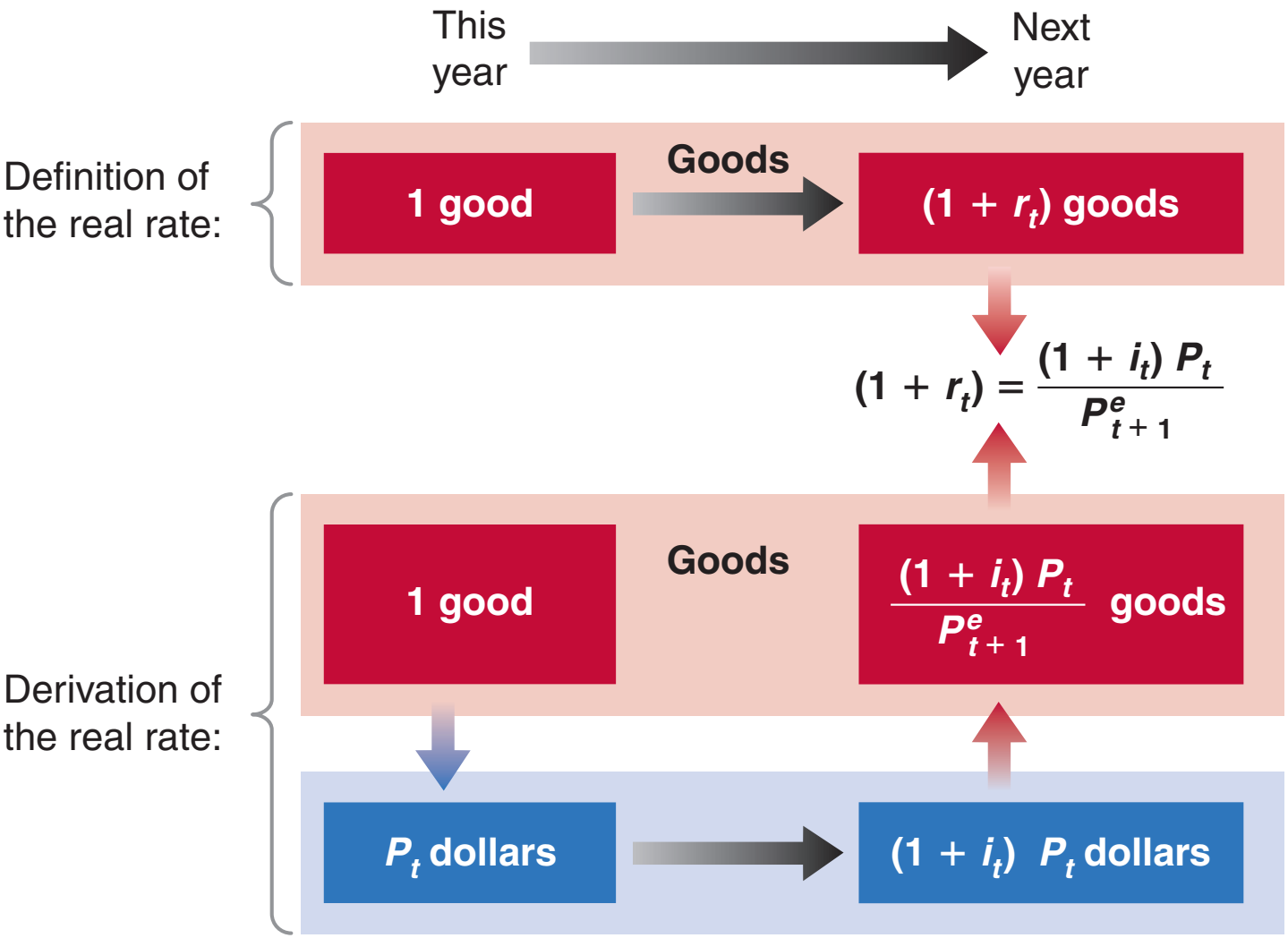
Government Bond Yields

NAME	COUPON	PRICE	YIELD	1 DAY	1 MONTH	1 YEAR	TIME (EDT)
GTJPY2Y:GOV **JGB 2 Year Yield**	0.10	100.52	-0.16%	0	-1	+7	4/13/2018
GTJPY5Y:GOV **JGB 5 Year Yield**	0.10	101.05	-0.12%	+0	-1	+7	4/13/2018
GTJPY10Y:GOV **JGB 10 Year Yield**	0.10	100.67	0.03%	+0	-1	+3	4/13/2018
GTJPY20Y:GOV **JGB 20 Year Yield**	0.50	100.05	0.49%	-1	-3	-6	4/13/2018
GTJPY30Y:GOV **JGB 30 Year Yield**	0.80	102.65	0.69%	-1	-6	-7	4/13/2018

Nominal or Real?

- Let's compare two numbers:
  - in January 1980: 1-year T-bill rate was **10.9%**.
  - in January 2006: 1-year T-bill rate was only **4.5%**.
  - as of April 14, 2018: 1- year T-bill returns **2.09%**.
- It is thus clearly much cheaper to borrow now than it used to be in 1980, is it not? No! What one needs to look at is real interest rates:
  - *Nominal interest rate* is the interest rate in terms of dollars.
  - *Real interest rate* is the interest rate in terms of a basket of goods.
- We must adjust the nominal interest rate to take into account **expected inflation:**
  - around 9.5% in January 1980: 1- year real T-bill rate was **1.4%**.
  - around 2.5% in January 2006: 1- year real T-bill was thus **2%**.
  - now: TIPS suggest 2.15% expected inflation (beakeven: 2.83 - 0.68 = 2.15%). Thus real interest rates are: -**0.04%**.

Definition and Derivation of the Real Interest Rate



Nominal or Real?

- One-year real interest rate r_t is defined as follows:

$$1 + r_t = (1 + i_t)\frac{P_t}{P^e_{t+1}}$$

- Denote expected inflation between t and $t+1$ by:

$$\pi^e_{t+1} = \frac{P^e_{t+1} - P_t}{P_t} = \frac{P^e_{t+1}}{P_t} - 1$$

so that the previous equation becomes:

$$1 + r_t = \frac{1 + i_t}{1 + \pi^e_{t+1}}$$

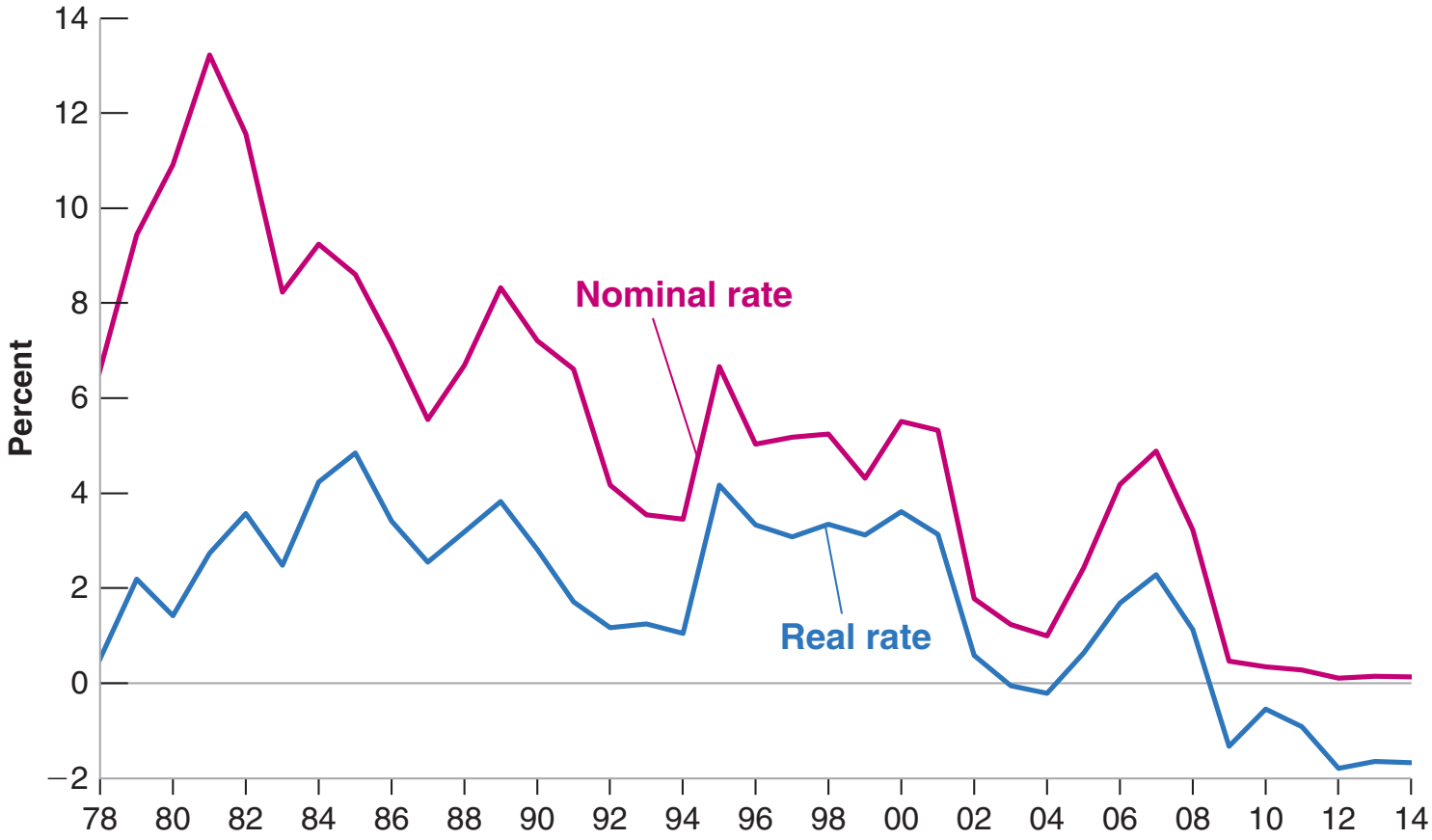
- If the nominal interest rate and expected inflation are not too large, then an approximation of the previous equation is:

$$1 + r_t \approx 1 + i_t - \pi^e_{t+1} - i_t\pi^e_{t+1} \quad \Rightarrow \quad r_t \approx i_t - \pi^e_{t+1}.$$

Nominal or Real?

- When expected inflation equals zero, the nominal interest rate and the real interest rate are equal.
- Because expected inflation is typically positive, the real interest rate is typically lower than the nominal interest rate.
- For a given nominal interest rate, the higher expected inflation, the lower the real interest rate.
- The real interest rate $i - \pi^e$ is based on expected inflation, so it is sometimes called the **ex-ante** (*before the fact*) real interest rate.
- The realized real interest rate $i - \pi$ is called the **ex-post** (*after the fact*) interest rate.
- The interest rate that enters the IS relation is the real interest rate.
- The zero lower bond of the nominal interest rate implies that the real interest rate cannot be lower than the negative of inflation.

Nominal and Real One-Year T-Bill Rates in the United States since 1978



Risk and Risk Premia

- Until now, we assumed that there was only one type of bond.
- Bonds however in practice differ in a number of ways, as we saw in the preceding examples:
  - in **maturity.**
  - in **risk**: some bonds have (quasi) certain cash flows: US Treasury bills, for example. Some don't: Greek sovereign debt, corporations.
- The risk premium compensates for both:
  - the probability of default: more detail on this on the next slide.
  - the degree of risk aversion: aversion to losses when there is a widespread economic crisis makes people ask for a risk premium.

Probability of default

- The higher is the probability of default, the higher the interest rate investors will ask for.
- Formally, let's denote:
  - i is the nominal interest rate on a riskless bond
  - $i + x$ is the nominal interest rate on a risky bond
  - p the probability of default of the bond
  - x the risk premium.
- Then the following relation must hold:

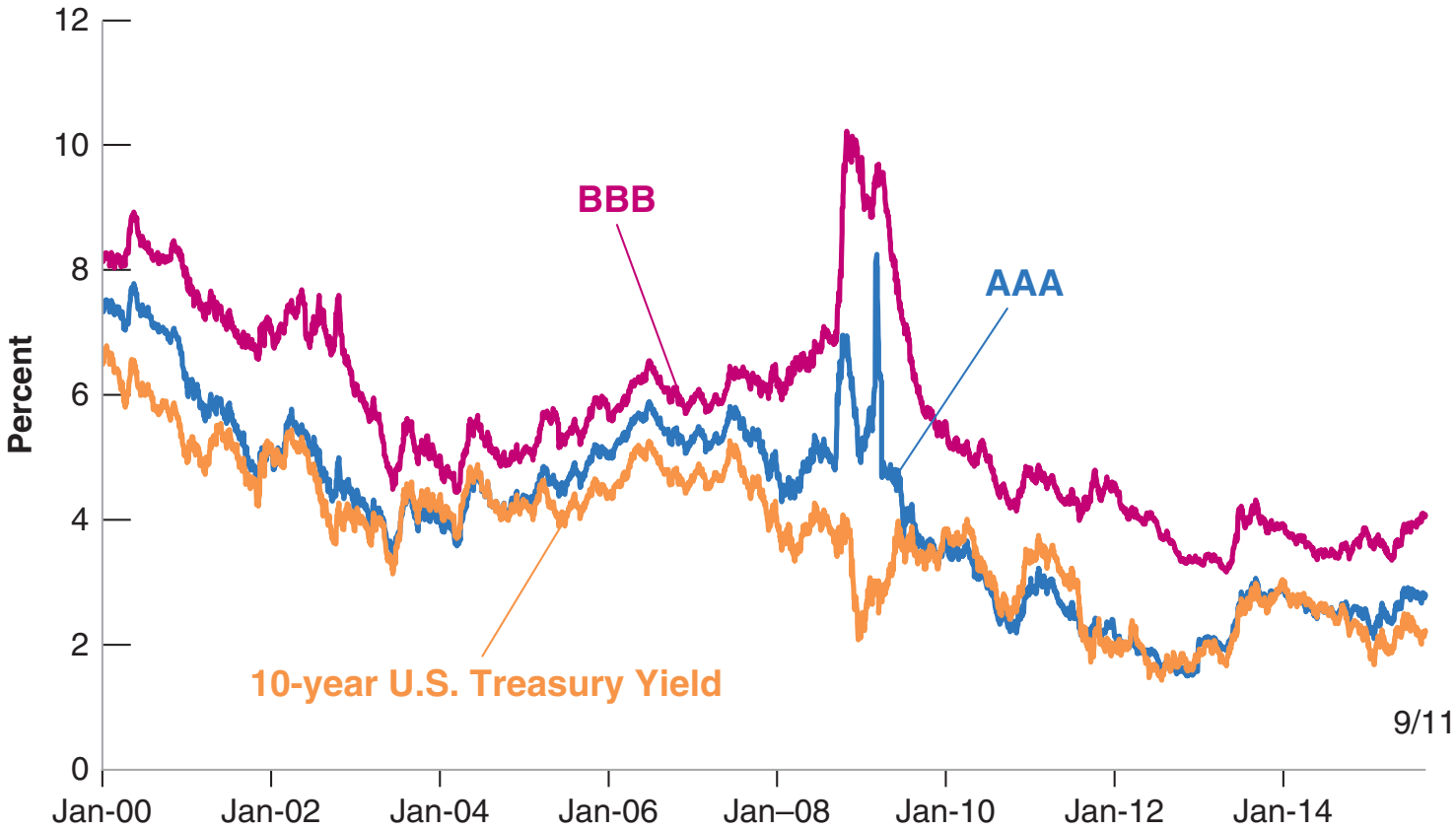
$$1 + i = (1 - p)(1 + i + x) + p * 0$$

- Therefore:

$$x = (1 + i)\frac{p}{1 - p}$$

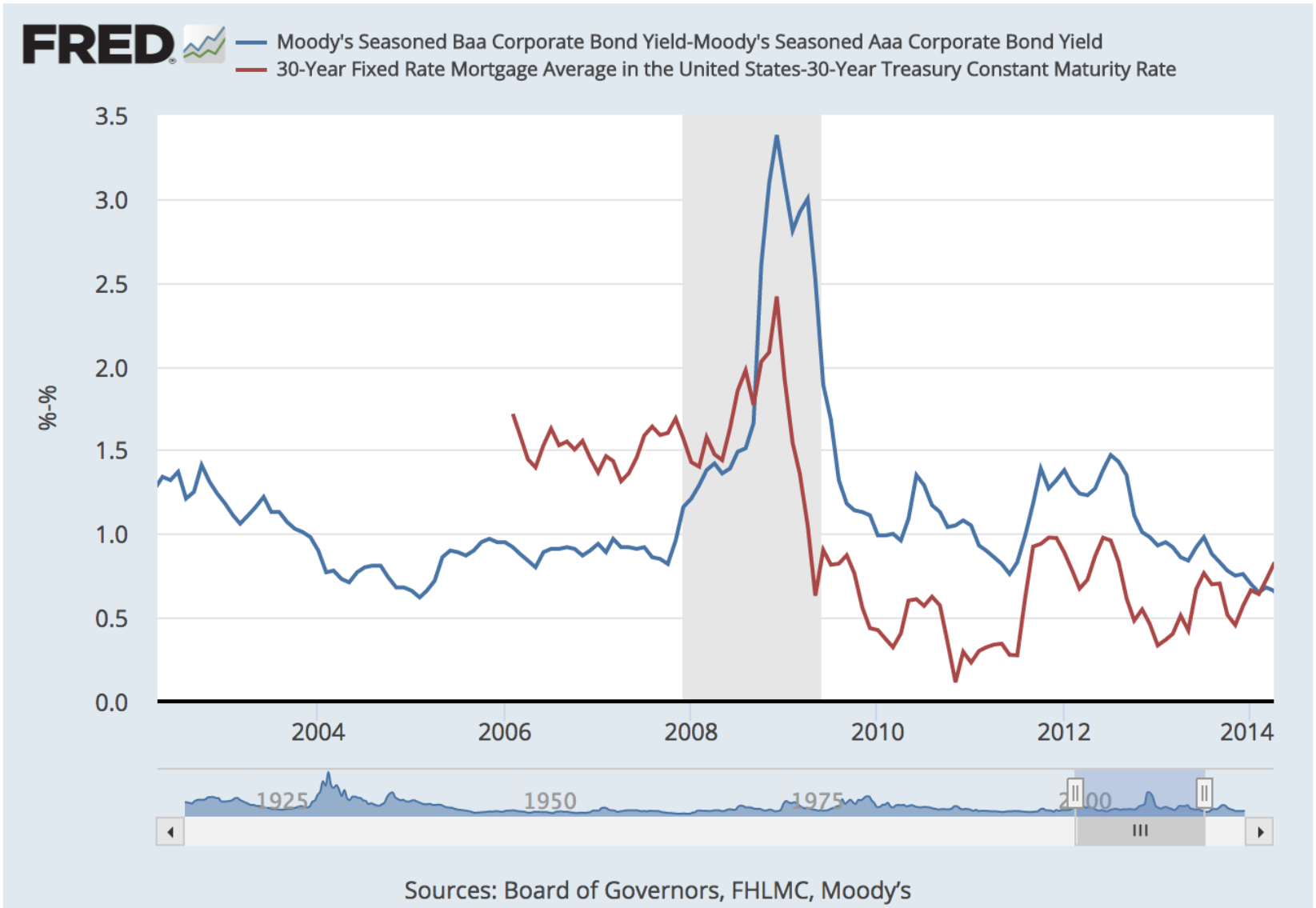
- For small values of i and p, an approximation is: $x \approx p$. Example: for $p = 2\%$, and $i = 4\%$, $x = 1.04 * 0.02/0.98 \approx 2.1\%$.

Nominal and Real One-Year T-Bill Rates in the United States since 1978



Increase in spreads

Crisis starts August, 2007 to June, 2009. Link Link



Direct versus Intermediated Finance

- To derive the IS model, we assumed that savings were flowing directly from ultimate borrowers to ultimate lenders.
- However, reality is more complex:
  - savers deposit their funds at commercial banks.
  - a veriety of banks and non-banks (money market funds, mortgage companies, hedge funds, venture capital funds, etc.) lend to corporations and to households.
  - These banks perform a variety of value-adding activities:
    - ★ allocating capital to more profitable projects,
    - ★ screening entrepreneurs' business plans, etc.
  - Most savers are instead "passive" and delegate these activities to banks.
- Thus, financial intermediation is important and perhaps even central to the functioning of the economy $\Rightarrow$ reason for bailouts? (even if "only" 7% of GDP)

An example of a bank's balance sheet

- Banks' balance sheets are important:
  1. Assets of a bank: reserves (central bank money), loans to consumers, loans to firms, loans to other banks, mortgages, government bonds, corporate bonds, etc.
  2. Liabilities of a bank: checkable depoits, interest-paying deposits, borrowing from investors by selling bank debt, corporate bonds, borrowing from other financial institutions (for example, through repurchase agreements with money-market funds).
  3. Capital of a bank: banks' shareholders.
- Imagine that a bank has $A = 100$ in assets, $L = 80$ in liabilities, and $E = 20$ in capital (equity).

Bank Balance Sheet

Assets 100	Liabilities 80
	Capital 20

Example

- The **capital ratio** (the ratio of capital to assets) is equal to E/A, or in this example $20/100 = 20\%$.
- The **leverage ratio** (the ratio of assets to capital) is equal to A/E, so in this example $100/20 = 5$.
- A higher leverage ratio implies a higher expected profit rate (return on equity):
  - Imagine the expected return on assets is $r_A = 5\%$, and the expected return on liabilities is $r_L = 4\%$. Then the expected return to capital r_E is given by:

$$r_E = \frac{A * r_A - L * r_L}{E}$$

    so in this example $r_E = 9\%$.
  - If instead $L = 90$, and $E = 10$, then $r_E = 14\%$.
- ... but also implies a higher risk of insolvency and bankruptcy... (if assets fall in value by 10 in the previous example, the bank is insolvent. they need to fall by 20 when $r_E = 9\%$) This is the reason for financial regulation.

Bank Runs and Liquidity

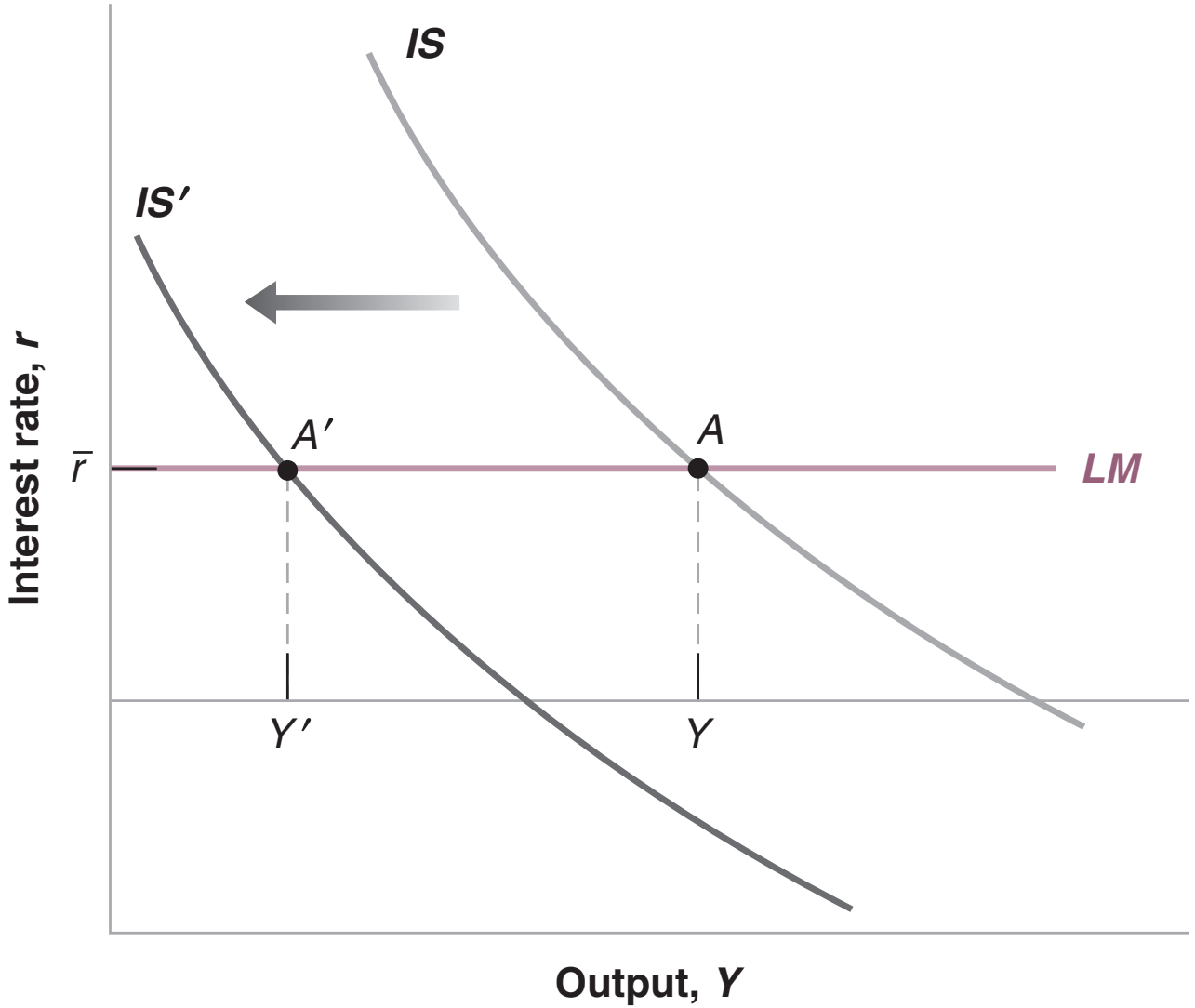
- The lower the liquidity of bank assets means the more difficult they are to sell, the higher the risk of being sold at fire sale prices (prices far below the true value) and the risk that the bank becomes insolvent.
- The higher the liquidity of the liabilities (e.g., checkable or demand deposits), the higher the risk of fire sales, and the risk that the bank becomes insolvent and thus faces bank runs.
- The U.S. financial history up to the 1930s is full of bank runs, as seen in the classic movie *It's a Wonderful Life*. Link. Link
- One potential solution to bank runs is narrow banking, which restricts banks from making loans, and to hold liquid and safe government bonds.
- To limit bank runs, the United States introduced federal deposit insurance in 1934.
- The Fed also implements liquidity provision so that banks could borrow overnight from other financial institutions, during crisis times.

Extending IS-LM to take Financial intermediation into account

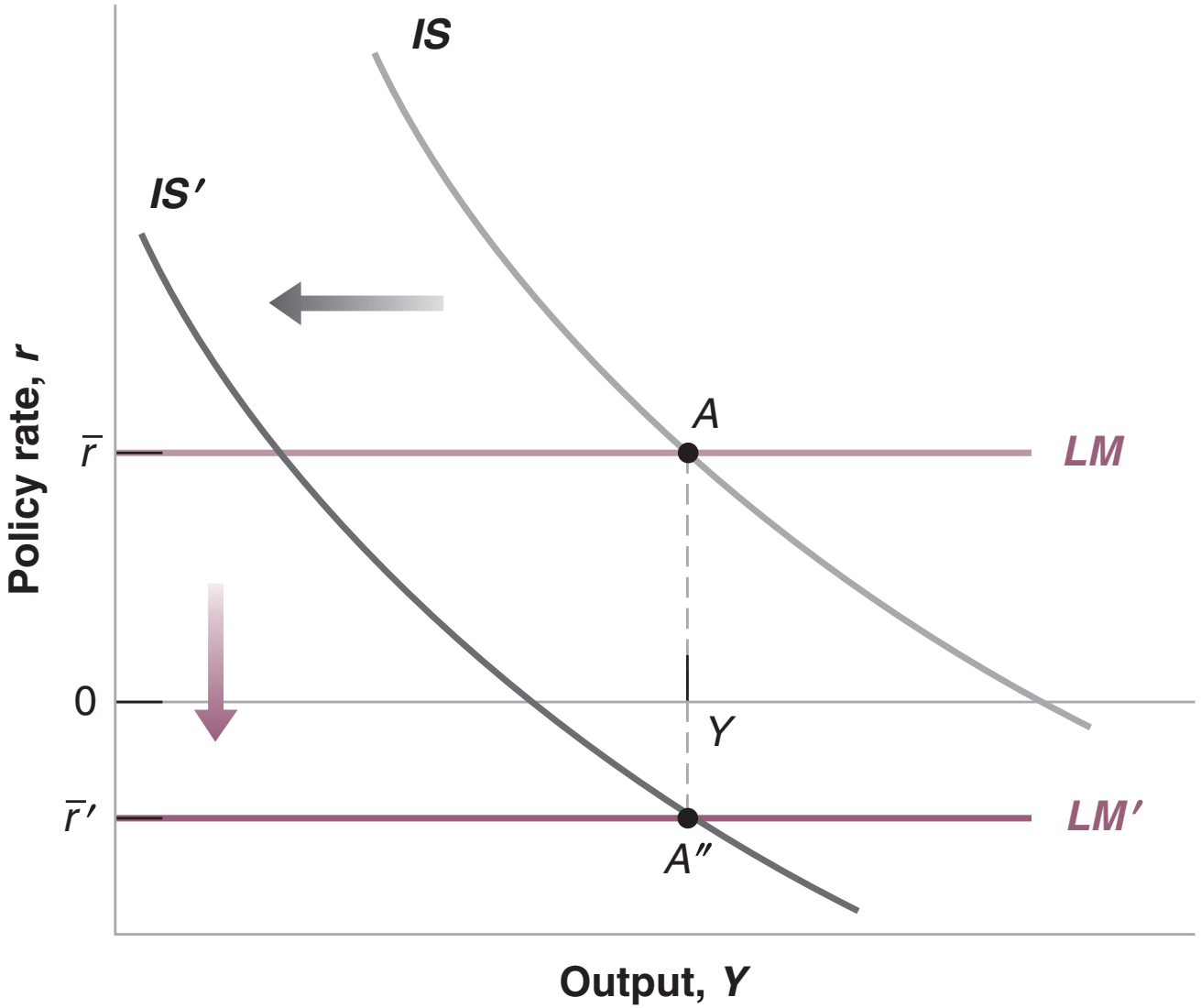
- The IS-LM we introduced in lecture 4 had only one interest rate. This interest rate was determined by the central bank.
- The previous sections should have convinced you that reality is more complex.
- Now we extend the IS-LM to reflect the distinction between:
  1. the nominal interest rate and the real interest rate: expected inflation π^e matters.
  2. the policy rate set by the central bank and the interest rates faced by borrowers: the risk premium x matters.
- The LM relation is unchanged but the IS relation now writes:

$$Y = C(Y - T) + I(Y, i - \pi^e + x) + G.$$

Financial Shocks and Output



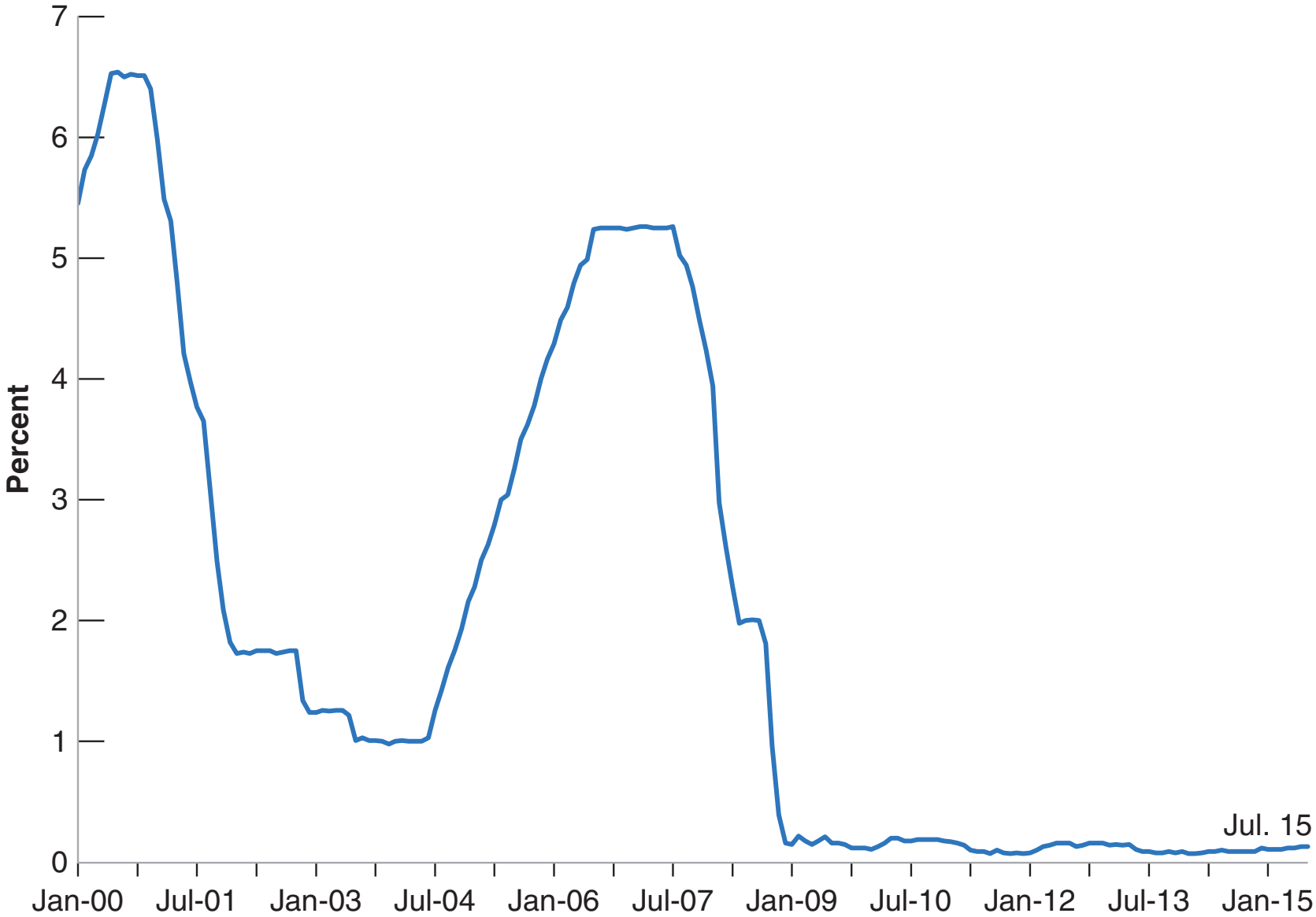
Financial Shocks, Monetary Policy, and Output



Run-up to the housing crisis

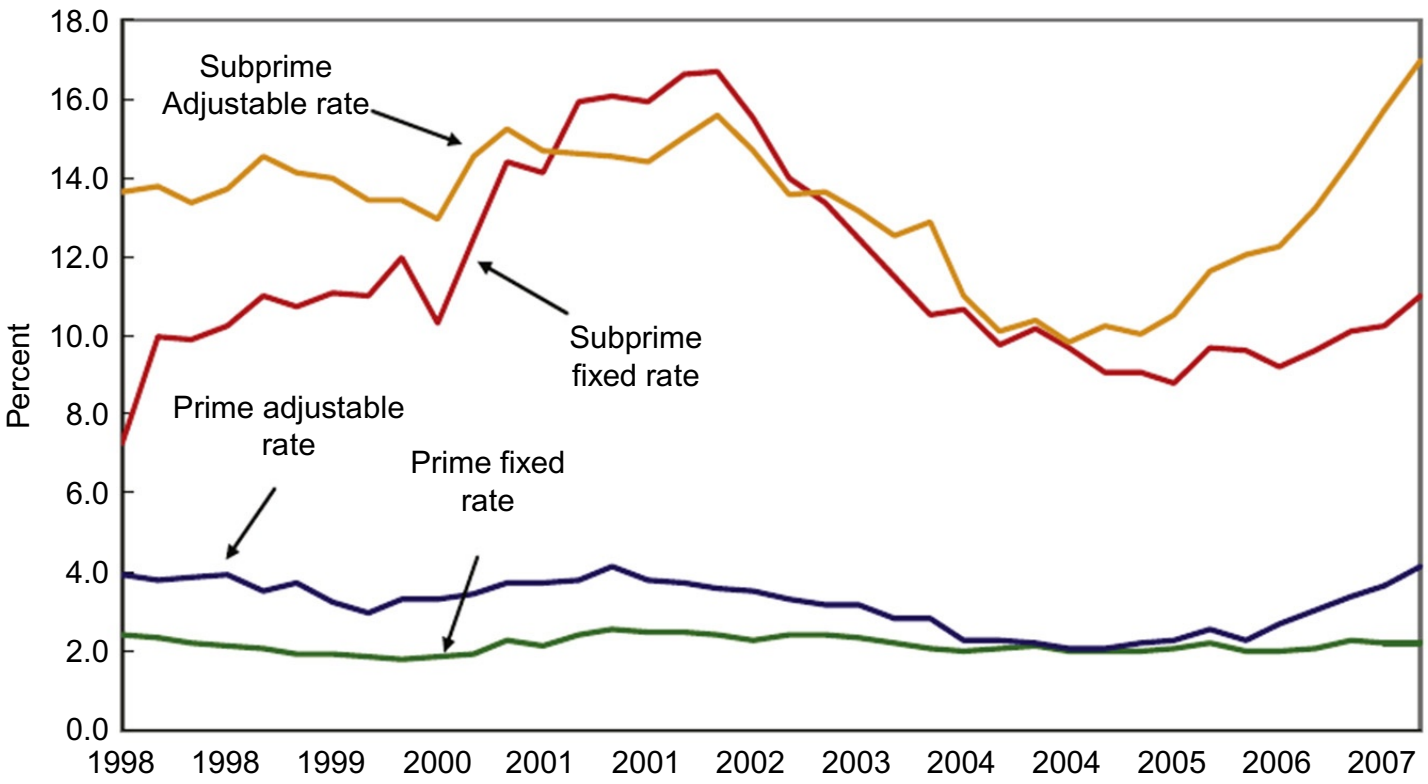
- The 2000s were a period of unusually low interest rates, which stimulated housing demand:
  - in the aftermath of the 2001 recession, accommodative monetary policy.
  - Bush tax cuts starting in 2001 = mostly in favor of high-income households, with limited effects on aggregate demand. (note: if high income households save the tax cuts, invest in the corresponding public debt, then they are just more "wealthy", but nothing happens in terms of output)
  - Low income gains of the lower/middle class led to a political response, encouraging "financial innovation" allowing low-income households to take on more debt. Various changes to financial regulation as well, encouraging banks to make loans.
- Mortgage lenders were increasingly willing to make loans to risky borrowers with **subprime mortgages**:
  - to low income households, backed by appreciating houses.
  - households thought they could always default if things turned bad.
  - "teaser" rates were appealing to some behavioral biases: mortgage payments were low at first, but rising after a few years.

Fed Funds Rate



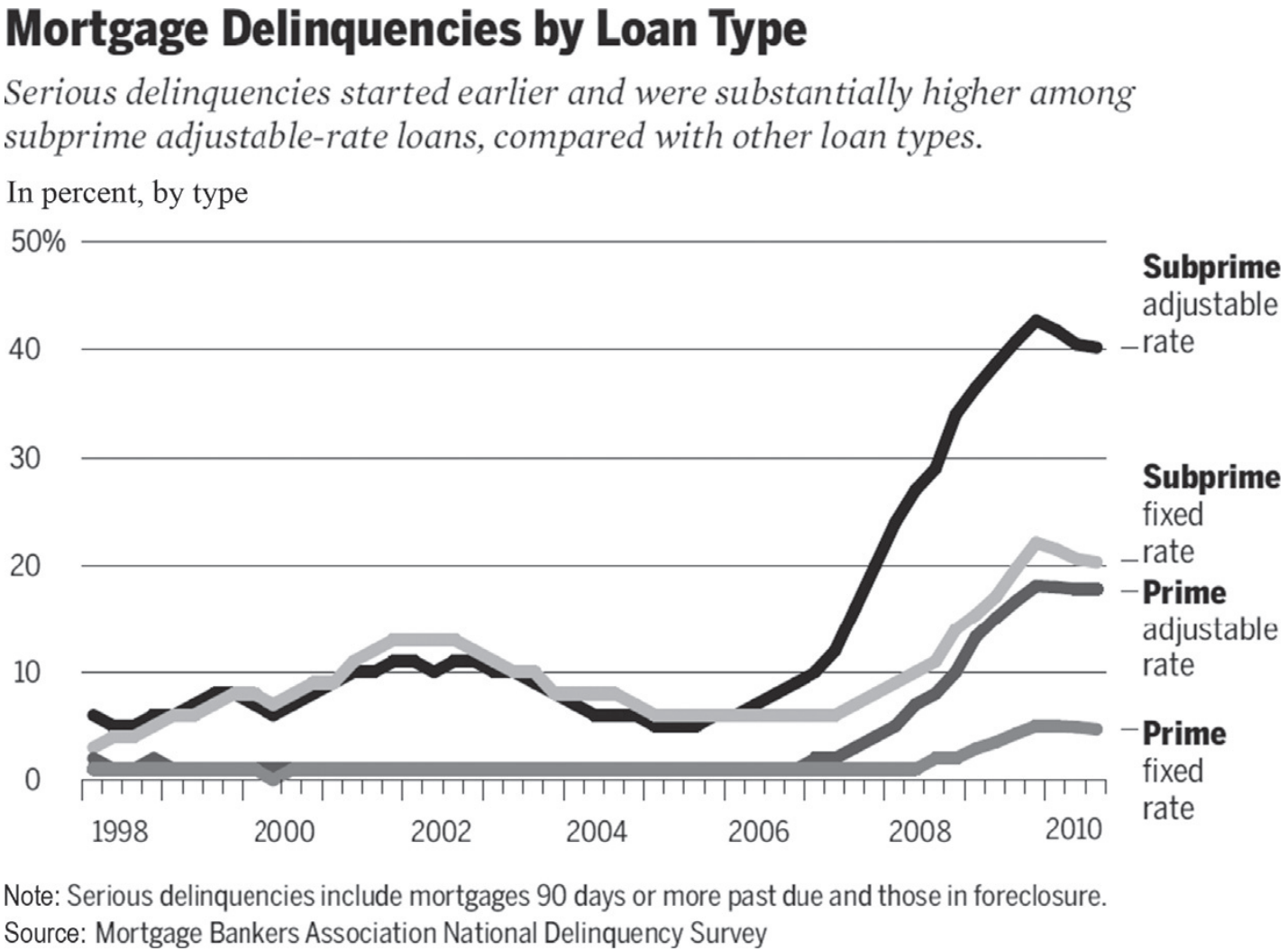
Prime and Subprime Adjustable Rate

Comparison of prime vs subprime delinquency rates, total US 1998–2007



Sources: Mortgage Bankers Association.

Mortgage Delinquencies



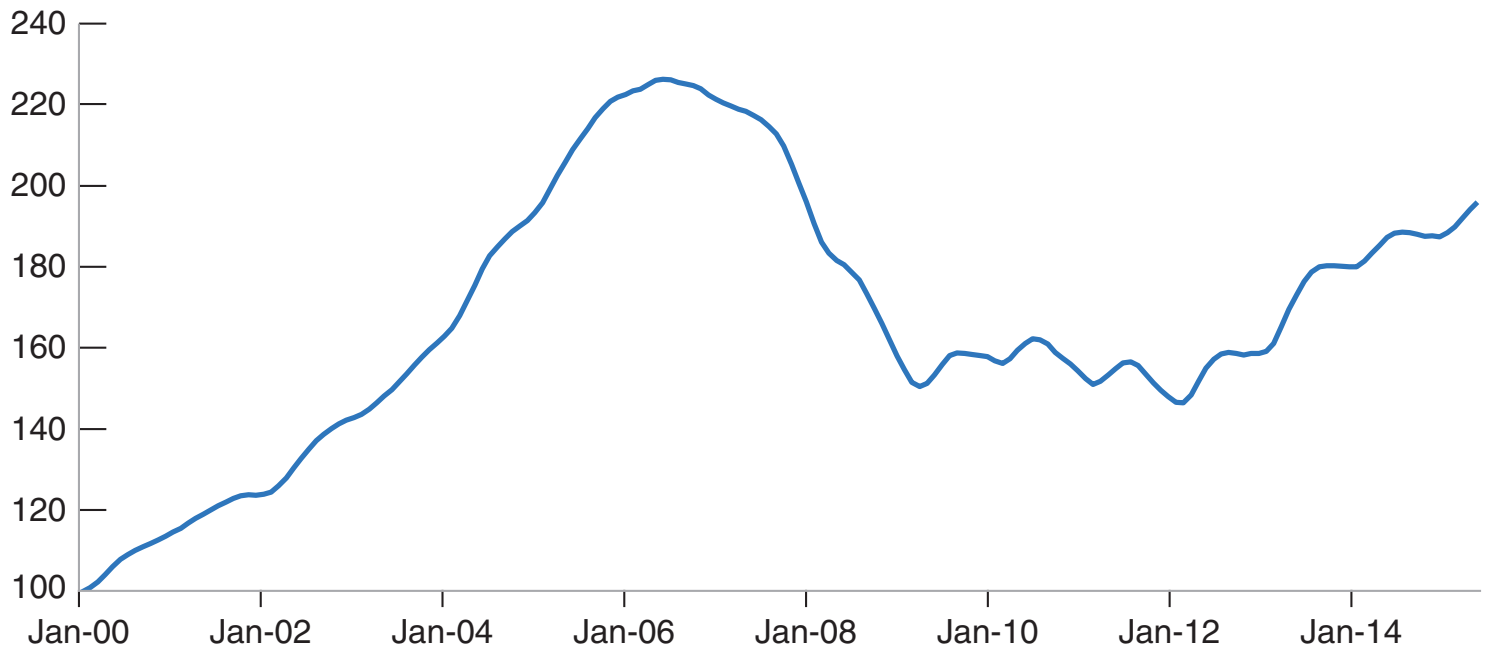
Some context on the 2007-2009 financial crisis

- From 2006 on, many home mortgages went "underwater" (when the value of the mortgage exceeded the value of the house):
  - Many defaults were not strategic, but triggered by rising mortgage payments which homeowners could not make.
  - Loans were backed by house prices.
  - Foreclosures led to declines in house prices, leading to more losses consecutive to default.
  - Aggregate demand decreased locally: restaurants, other non tradables.
  - People got unemployed, leading to another source of default, etc.
- Banks could not support these losses on their assets, because of leverage:
  - Banks probably genuinely underestimated the risk.
  - Many bank managers had incentives to go for high expected returns without fully taking the risk of bankruptcy. Some incentives were not well-aligned.
  - Banks avoided capital regulations using off-balance sheet lending, such as structured investment vehicles (SIVs).
  - Banks perhaps expected "too big to fail" problems and that there would be a bailout, in case a major problem happens.

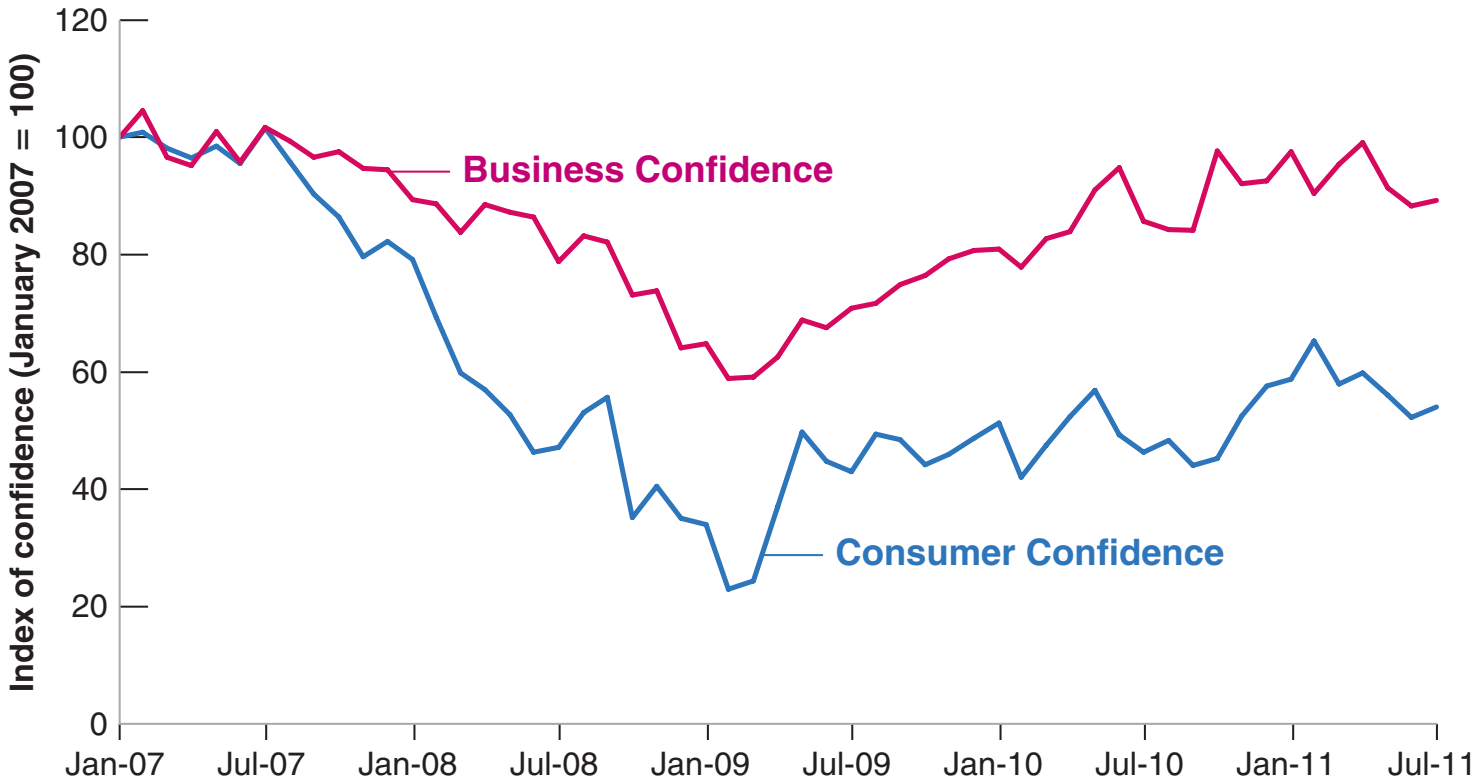
The Big Short

- One "remarkable" feature of the housing crisis is some people, such as Michael Burry (UCLA alumni), saw it coming, and were able to benefit from it by shorting the housing market.
- This was enabled by securitization:
  - Securitization is the creation of securities based on a bundle of assets, such as mortgage-based securities (MBS).
  - Senior securities have first claims on the return from the bundle of assets; junior securities, such as collateralized debt obligations (CDOs), come after.
- Houses cannot typically be "shorted".
- But MBS could, whose value at some point depended on the housing market.
- This short-selling perhaps amplified the bust

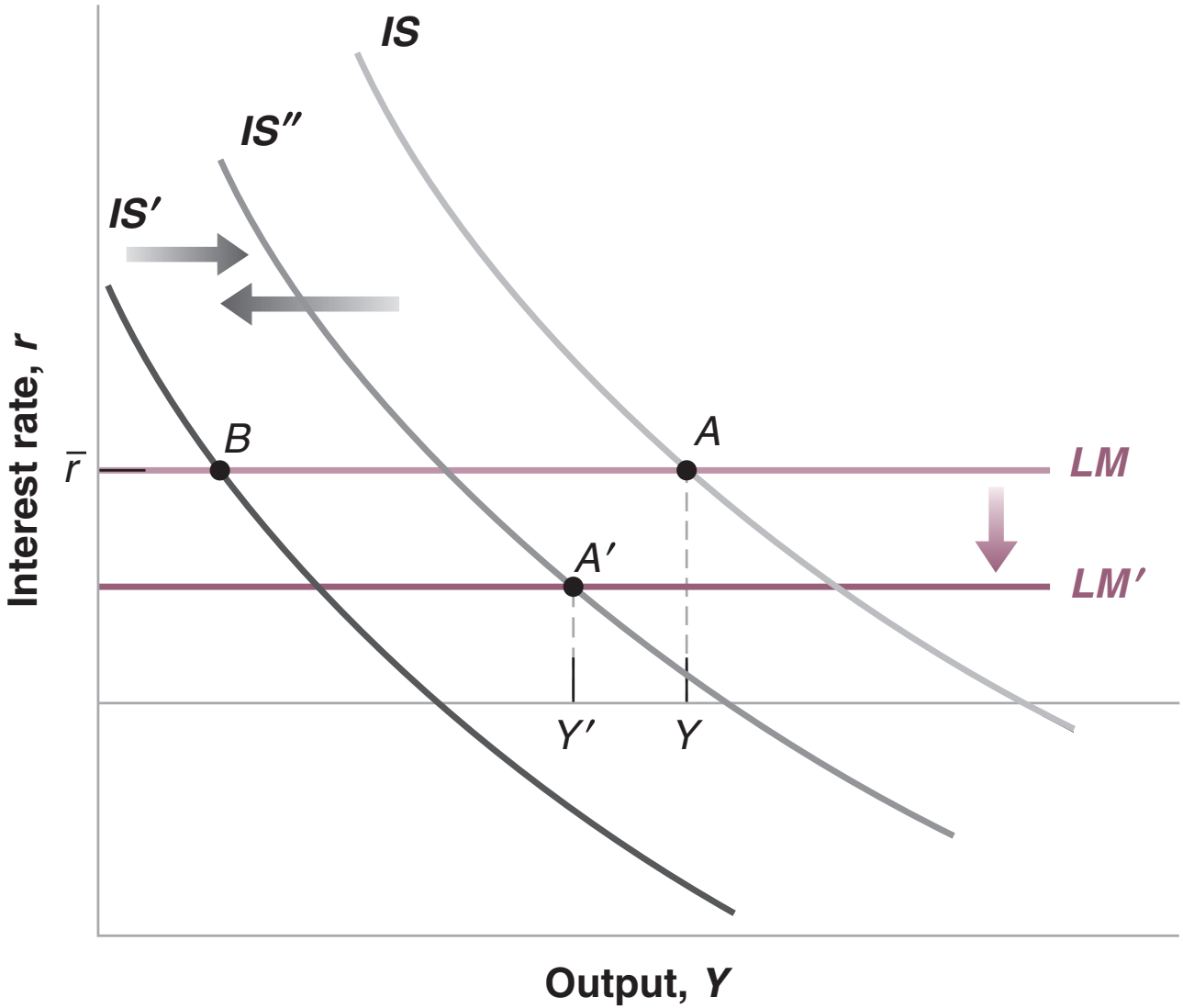
U.S. Housing Prices since 2000



U.S. Consumer and Business Confidence, 2007–2011



The Financial Crisis, and the Use of Financial, Fiscal, and Monetary Policies



The crisis through IS-LM

- The demand for goods decreased due to the high cost of borrowing, lower stock prices, and lower confidence. The IS curve shift to the left. Policy makers responded to this large decrease in demand in 2 ways:
  1. **Financial Policies**. Federal deposit insurance was raised from $100,000 to $250,000, The Fed provided widespread liquidity to the financial system through liquidity facilities, and increased the number the assets that could serve as collateral, The government introduced the Troubled Asset Relief Program (TARP).
  2. **Monetary Policy.** The federal funds rate was down to zero by December 2008. The Fed also used unconventional monetary policy, which involved buying other assets as to directly affect the rate faced by borrowers. Fiscal Policy: The American Recovery and Reinvestment Act was passed in February 2009, calling for $780 billion in tax reductions and spending increases.
- The crisis is perhaps one of the best possible application of the IS-LM framework. In particular, the multiplier effect through aggregate demand and income was probably compounded by multiplier effects working through the housing market.

Suggested Readings / Exercises

☞ Chapter 6, *Macroeconomics*, 7th Edition, Olivier Blanchard.
☆☆ Exercise 7, Chapter 6, page 132, *Macroeconomics*, 7th Edition, Olivier Blanchard.
☆ Exercise 8, Chapter 6, page 132, *Macroeconomics*, 7th Edition, Olivier Blanchard.
The Big Short: Inside the Doomsday Machine, Michael Lewis, W. W. Norton & Company, March 15, 2010. Link
The Big Short, Adam McKay, 2015. Link Excerpts: Link 1, Link 2. Michael Burry's UCLA Economics Commencement 2012. Link
I Saw the Crisis Coming. Why Didn't the Fed?, Michael J. Burry, *The New York Times*, April 3, 2010. Link
✎ The Financial Crisis Inquiry Report, January 2011. Link