

AD-AS Analysis of Financial Crises, the ZLB, and Unconventional Policy

ECON 40364: Monetary Theory & Policy

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Spring 2022

Readings

- ▶ Text:
 - ▶ Mishkin Ch. 15 pg. 355-361; Ch. 23 pg. 572-578
- ▶ Other:
 - ▶ Yu (2016), "Did Quantitative Easing Work?"
 - ▶ Bernanke (2016), "What Tools Does the Fed Have Left? Part 2: Targeting Longer-Term Interest Rates"

Financial Crises

- ▶ Recall from earlier, that in a **financial crisis** credit markets stop working well, which impedes the funneling of savings into productive investment
- ▶ The tell-tale sign of a financial crisis is an increase in interest rate spreads (decrease in bond prices) for risky and long term debt
- ▶ There is a “flight to safety” – dumping risky and long maturity bonds in favor of shorter maturity government debt
- ▶ Results in higher borrowing costs for consumers and firms
- ▶ Resulting in a collapse in spending

Incorporating Financial Frictions into the AD-AS Model

- ▶ Recall earlier our investment demand function:

$$I = \bar{I} - dr$$

- ▶ The (real) interest rate in our basic AD-AS model is **short-term** and **riskless**
- ▶ In reality, the interest rates relevant for investment are **long-term** and **risky**
- ▶ From earlier, we know that interest rates tend to be higher the longer is the time to maturity (yield curves usually slope up) and are higher the higher is the risk of the loan
- ▶ In normal times, moving short term riskless interest rates moves other interest rates in the same direction, so thinking about there being one interest rate in the economy isn't a bad abstraction

Financial Frictions

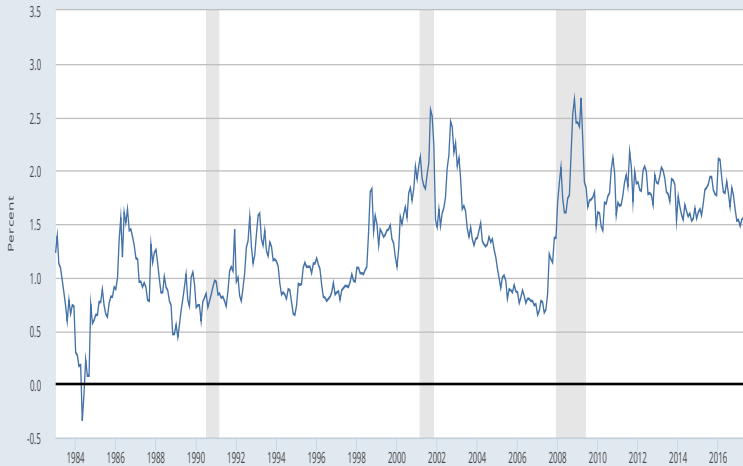
- ▶ A simple way to incorporate the risk and term structure of interest rates into our model is to assume that the interest rate relevant for investment differs from the short term riskless interest rate:

$$I = \bar{I} - dr_i$$
$$r_i = r + \bar{f}$$

- ▶ Here \bar{f} is an exogenous variable which we can think about as a credit spread (either a term premium or a risk premium)
- ▶ If \bar{f} is more or less constant, abstracting from it isn't a big deal
- ▶ But during financial crises, we see spreads rising
- ▶ A **worsening of financial frictions** can be thought of as an increase in \bar{f}



— Moody's Seasoned Aaa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity®



Source: Federal Reserve Bank of St. Louis
fred.stlouisfed.org

myf.red/g/dU3z



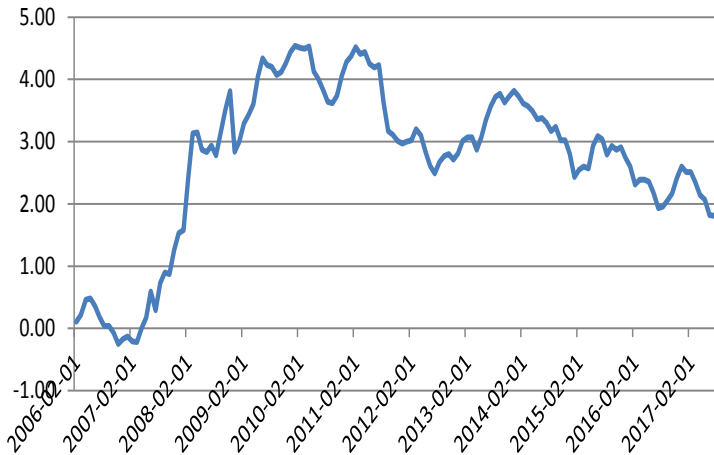
— Moody's Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity®



Source: Federal Reserve Bank of St. Louis
fred.stlouisfed.org

myf.red/g/dTre

30 yr - 3 month spread



Financial Crisis

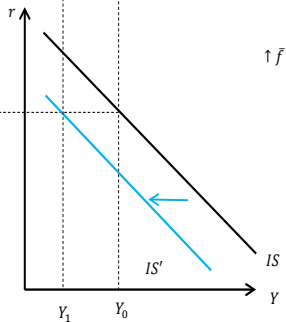
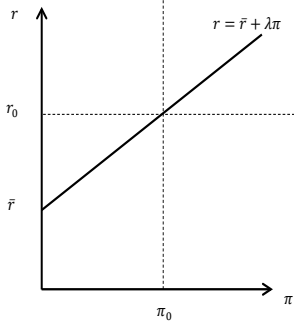
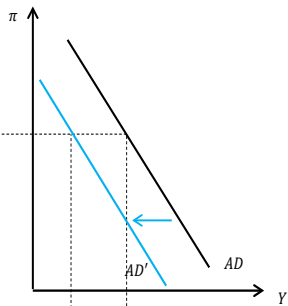
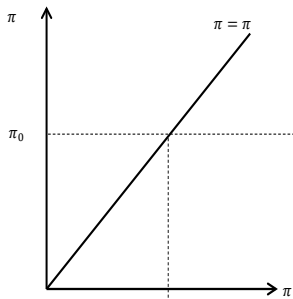
- ▶ Easiest way to think about a financial crisis is as a big increase in \bar{f} , which we clearly see either in term or risk premia during the Great Recession
- ▶ IS curve is now:

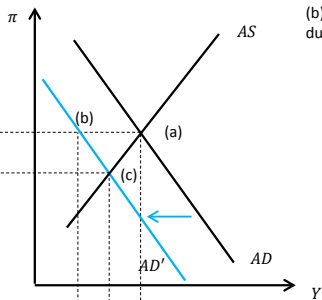
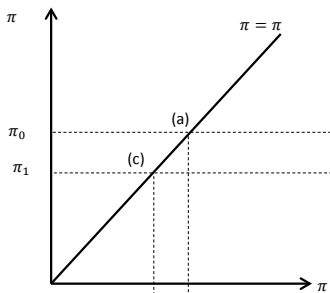
$$Y = \frac{1}{1 - mpc} \bar{A} - \frac{d + x}{1 - mpc} r$$

- ▶ Where:

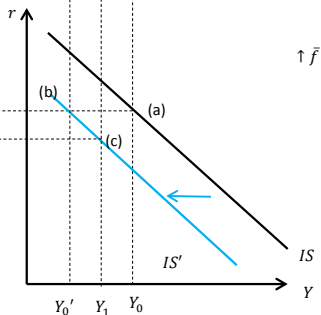
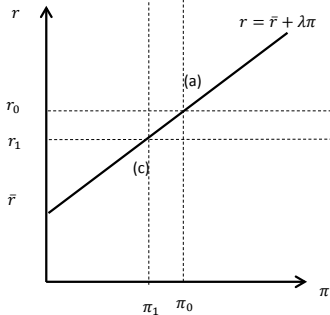
$$\bar{A} = \bar{C} - mpc \bar{T} + \bar{I} - d\bar{f} + \bar{G} + \bar{NX}$$

- ▶ Increase in \bar{f} : IS curve shifts in, causing AD curve to shift in





(a) to (b): direct effect
 (b) to (c): indirect effect
 due to lower π



$\uparrow \bar{f}$

Compared to the Data

- ▶ This is more or less what we see in the US data for 2007 into the first half of 2008
- ▶ Output contracts, although not enormously, in part because the Fed aggressively lowered short term interest rates
- ▶ Model predicts inflation should fall
- ▶ We don't really see this until the end of 2008 and into 2009
- ▶ Fairly easy to explain: big oil price increase from 2006-2008 which would have shifted the AS in, keeping inflation from falling too much
- ▶ In addition, there was significant monetary easing (can think about as a reduction in \bar{r}), which would shift the AD curve back out to prevent inflation from falling much

The ZLB

- ▶ The Great Recession wasn't "great" through the middle of 2008
- ▶ Confluence of events in fall of 2008 really made things worse: worsening financial conditions (e.g. failure of Lehman) plus the **zero lower bound** on interest rates
- ▶ Nominal interest rates cannot go below zero – that would imply lending money and getting less back in return
- ▶ The Fed Funds Rate formally hit ZLB in December of 2008, and didn't move away from zero until December of 2015
- ▶ What are implications of the ZLB for the AD-AS model?

The Zero Lower Bound

- ▶ The zero lower bound (ZLB) requires that the nominal interest rate be non-negative
- ▶ We ignored this in our earlier analysis. In terms of the nominal rate, the MP rule can be written:

$$i = \bar{r} + (\lambda + 1)\pi$$

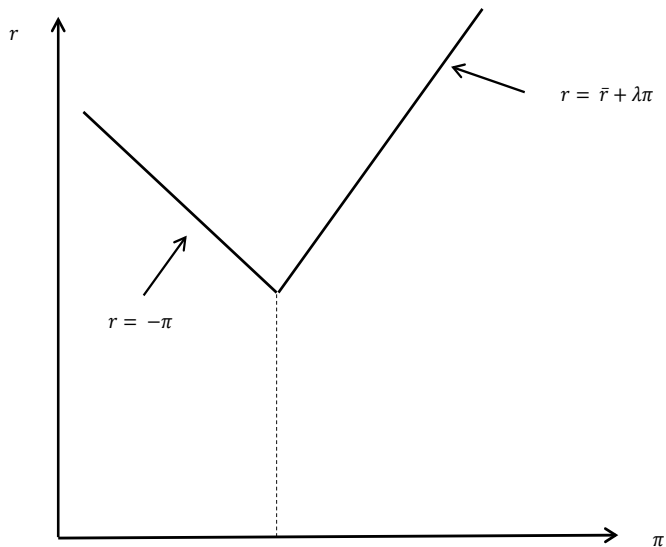
- ▶ $i \geq 0$ requires that inflation satisfy:

$$\pi \geq -\frac{\bar{r}}{\lambda + 1}$$

- ▶ For π less than this, the Fed would like a negative nominal interest rate. But the best it can do is $i = 0$, which means $r = -\pi$. MP rule is:

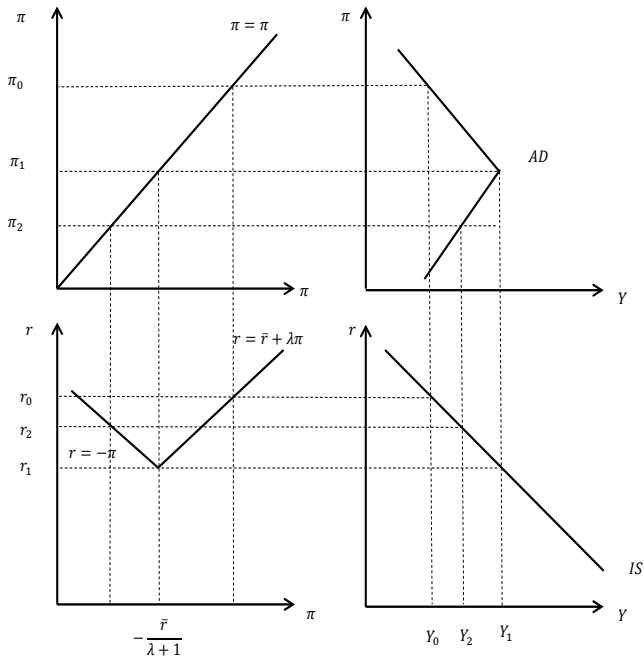
$$r = \begin{cases} \bar{r} + \lambda\pi & \text{if } \pi \geq -\frac{\bar{r}}{\lambda+1} \\ -\pi & \text{otherwise} \end{cases}$$

MP Curve Taking the ZLB into Account



The AD Curve with the ZLB

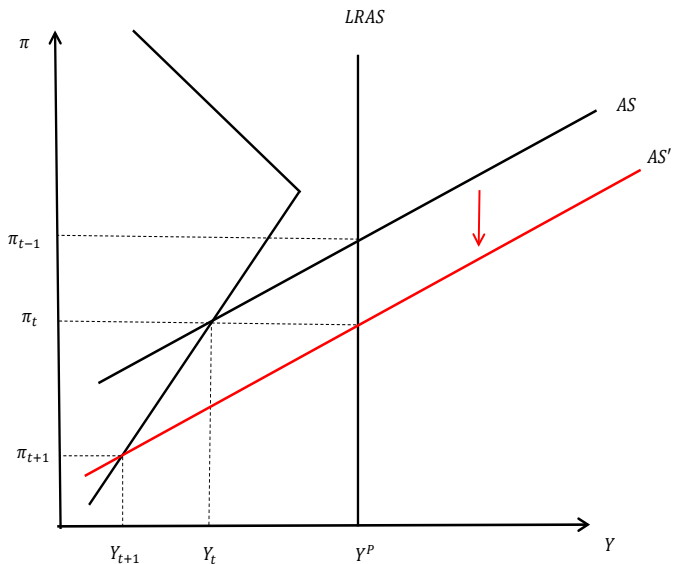
- ▶ Away from the ZLB (i.e. π sufficiently high), the AD curve is the same as above
- ▶ But in the ZLB region, the AD curve becomes upward-sloping
- ▶ Why? In the ZLB region, the real interest rate is decreasing (rather than increasing) in the inflation rate
- ▶ Higher inflation means a lower real interest rate, which means higher output, not lower
- ▶ In this way, being at the ZLB is similar to the Taylor principle not being satisfied



Why is the ZLB Costly

- ▶ The ZLB is problematic chiefly for two reasons:
 1. Economy much more susceptible to negative IS shocks. The Fed can't lower interest rates, so negative IS shocks have bigger effect than in normal times
 2. Self-correcting mechanism doesn't work
 - ▶ Suppose economy finds itself at ZLB with negative output gap
 - ▶ Rightward shift of AS (assuming AD is steeper than AS) results in inflation falling but output **falling**
 - ▶ The output gap **widens**
 - ▶ Mechanism: falling inflation plus fixed nominal rate means rising real rate

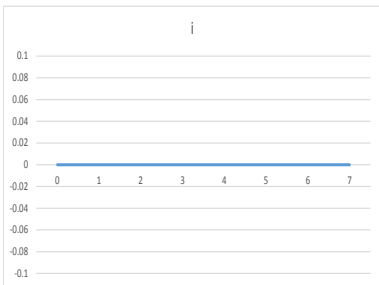
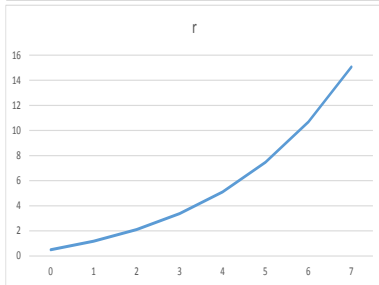
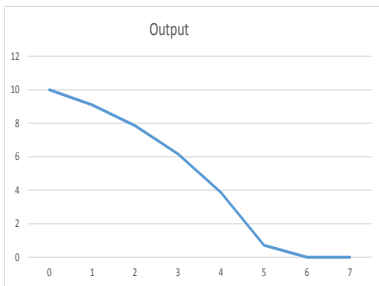
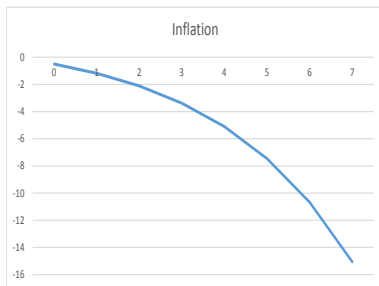
Failure of the Self-Correcting Mechanism



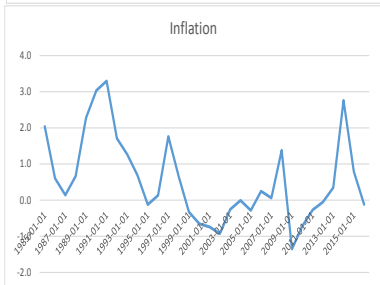
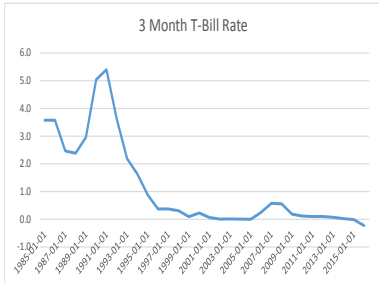
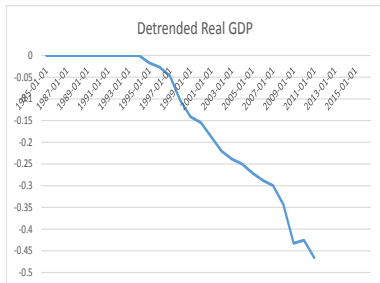
Deflationary Spiral

- ▶ Suppose that the ZLB binds when $Y < Y^P$ (e.g. because of a negative IS shock that lowers inflation to the point where nominal rate hits zero)
- ▶ Failure of self-correcting mechanism: not only will economy not transition back to potential, things will get worse
- ▶ Normal dynamics: AS curve will shift down, which causes inflation to fall
- ▶ But falling inflation causes the real interest rate to rise, which causes output to fall, which generates even more deflation (from the AS curve)
- ▶ Sometimes called a “deflationary spiral”

Deflationary Spiral: Quantitative



Application: Japanese Experience



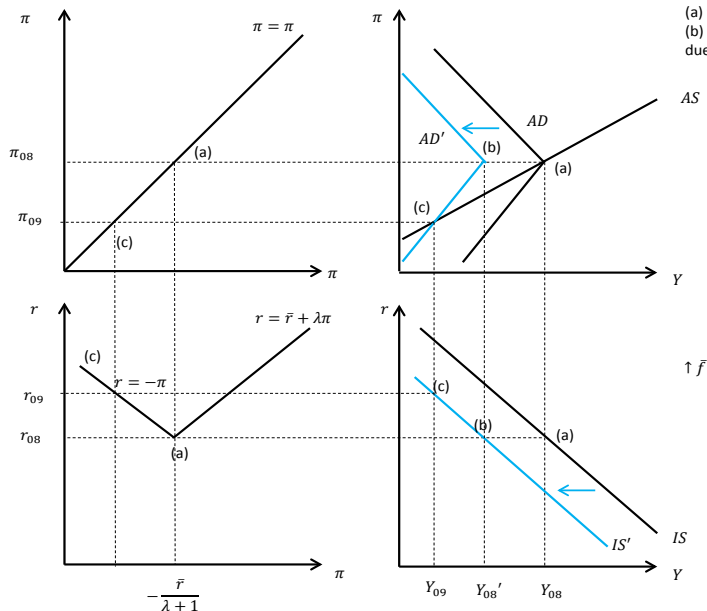
The Height of the Financial Crisis

- ▶ From late summer of 2007 until early fall of 2008, the Fed had lowered the Fed Funds Rate from 5 percent to nearly zero
- ▶ Then the worst of the financial crisis hit:
 1. Failure of Lehman Brothers on Sept. 15
 2. Failure and ensuing engineered rescue of AIG on Sept. 16
 - ▶ AIG had written over \$400 billion in **credit default swaps** on mortgage-related securities, which are essentially insurance contracts (hedges) on declining value of those securities. With mortgage markets collapsing and Lehman failing, AIG's short term financing dried up
 3. Run on the Reserve Primary Fund **"breaking the buck"**
 - ▶ **Money market mutual fund** offers checking-like services to depositors and invests in short term commercial paper and government securities. It seeks to always maintain a net asset value of \$1 (total equity divided by shares) by paying dividends daily. Value below \$1 is "breaking the buck"
 4. Political uncertainty from Troubled Asset Relief Program **(TARP)**

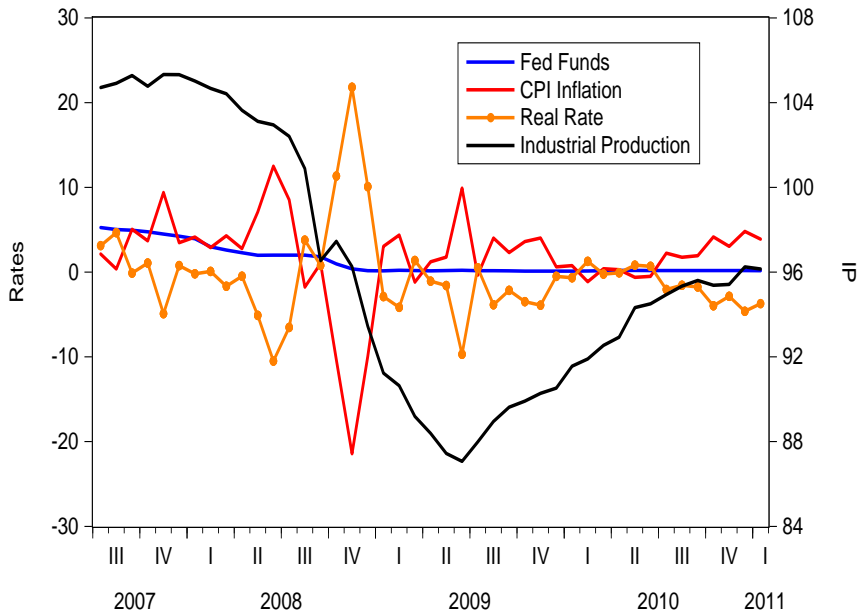
The Height of the Financial Crisis and the AD-AS Model

- ▶ Can think about the height of the financial crisis in terms of the AD-AS model as a further increase in \bar{f}
- ▶ This widening of credit spreads in the last quarter of 2008 and into 2009 is exactly what we observe in the data
- ▶ Think about the economy as being effectively at the ZLB during the period in which this increase in \bar{f} hits
- ▶ This results in output declining **much more** than it would have had the ZLB not been binding and the Fed had been able to lower interest rates

The ZLB and the US Financial Crisis



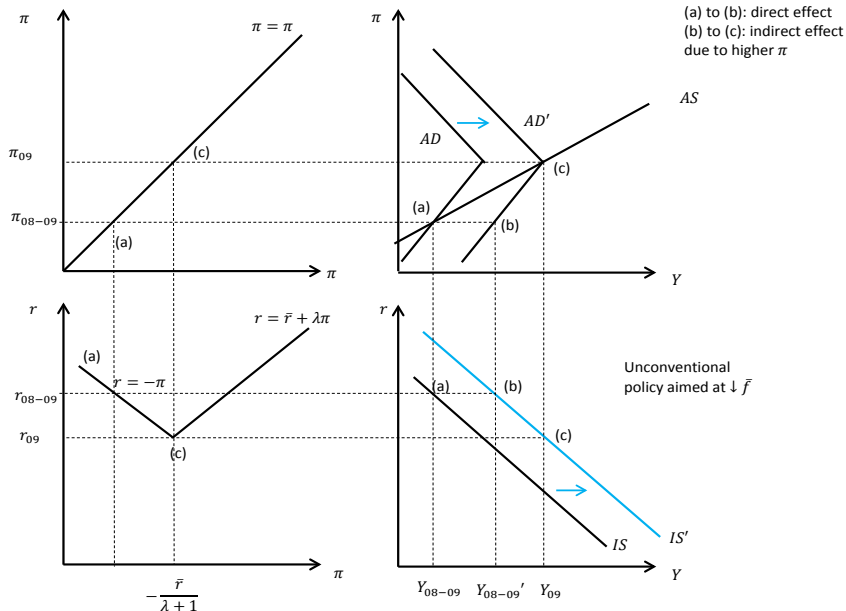
US Economy in the Financial Crisis



Unconventional Monetary Policy

- ▶ We've already mentioned several of the Fed's unconventional policies
- ▶ The ones we've mentioned have dealt with the Fed's role as **lender of last resort**: TAF, TSLF, AIG, Bear Stearns, TALF, etc
- ▶ We can think about all of these as the Fed trying to reduce \bar{f} in the model – i.e. to arrest the increase in credit spreads

Unconventional Policy and Desired Effects in AD-AS Model



Other Forms of Unconventional Policy

- ▶ In addition to the lender of last resort type of actions, the Fed engaged in two other forms of unconventional policy:
 1. Quantitative Easing
 2. Forward Guidance
- ▶ Both types of policies are unconventional in the sense of trying to impact longer term and/or riskier interest rates
- ▶ Easy way to think about this in terms of term structure:
 - ▶ Conventional policy aims to indirectly affect the “long end” of the yield curve (longer maturity rates) by adjusting the “short end” (adjusting short term interest rates)
 - ▶ Unconventional policy rather aims to directly impact “long end” of the yield curve
 - ▶ Quantitative easing by buying longer maturity bonds hoping to lower yields (relies on some failure of expectations hypothesis)
 - ▶ Forward guidance by promising to keep short term rates low for a long time (relies on expectations hypothesis)
- ▶ QE and forward guidance were generally tried after the immediate lender of last resort activities and should be thought of as conceptually distinct. These were trying to provide stimulus in spite of the ZLB, not trying to provide liquidity to stem a run

Forward Guidance

- ▶ Forward guidance involves either the explicit (Odyssean) or implicit (Delphic) signaling from a central bank about its intentions about the path of **future** short term interest rates
- ▶ August 9, 2011 FOMC statement: “Economic conditions . . . are likely to warrant exceptionally low levels of the federal funds rate at least through mid-2013.”
- ▶ This is essentially an expectations hypothesis channel: if the current long term interest rate is an average of expected future short term rates, promising low future short term rates ought to lower current long term interest rates
- ▶ Some evidence suggests that forward guidance works to affect yields on longer maturity and riskier debt

Table 6. Regressions Estimating Asset Price Responses to Target and Path Factors, August 2007–December 2011^a

<i>Asset</i>	<i>Target factor</i>	<i>Path factor</i>	<i>Adjusted R²</i>
<i>Treasuries</i>			
2 years to maturity	0.592*** (0.096)	0.716*** (0.160)	0.79
5 years to maturity	0.404*** (0.143)	0.898*** (0.165)	0.66
10 years to maturity	0.250* (0.131)	0.877*** (0.103)	0.58
<i>Corporate bonds^b</i>			
Aaa/AAA-rated	0.058 (0.079)	0.631*** (0.085)	0.45
Baa/BBB-rated	0.065 (0.085)	0.556*** (0.117)	0.34

Source: Authors' calculations.

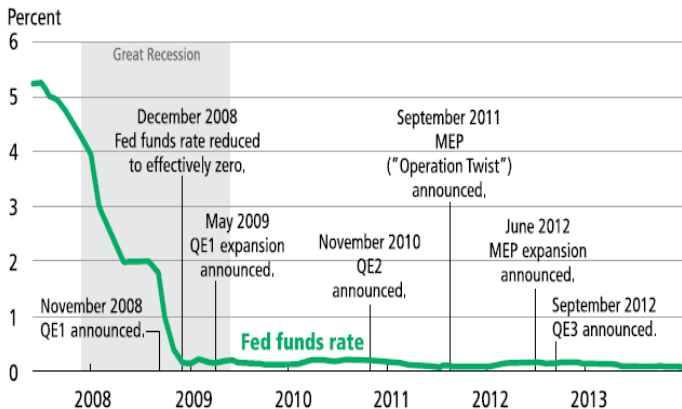
Source: Campbell, Jeffrey, Charles Evans, Jonas Fisher, and Alejandro Justiniano. 2016. "Macroeconomic Effects of Federal Reserve Forward Guidance" *Brookings Papers on Economic Activity*, 1-63.

Quantitative Easing

- ▶ QE (or LSAPs) involves purchasing longer maturity debt to push down yields on the longer end of the yield curve
- ▶ Under the expectations hypothesis, this shouldn't work: you cannot impact longer term yields without affecting path of short term yields
- ▶ Ben Bernanke: "The problem with QE is it works in practice, but it doesn't work in theory."
- ▶ What about the liquidity premium theory? Can QE affect the term premium? Not obvious – term premium depends on covariances
- ▶ Why might QE work?
 1. Markets may be segmented
 2. It may make forward guidance more credible
 3. Portfolio effect: by removing riskier long term debt, reduced liquidity premium

FIGURE 2

Timeline of the Fed's Quantitative Easing Program



Source: Yu, Edison. 2016. "Did Quantitative Easing Work?" *Federal Reserve Bank of Philadelphia Economic Insights*, 5-13.

Table 1
Changes in Asset Prices Around QE1, QE2, MEP, QE3 and
Exit Event Dates^a

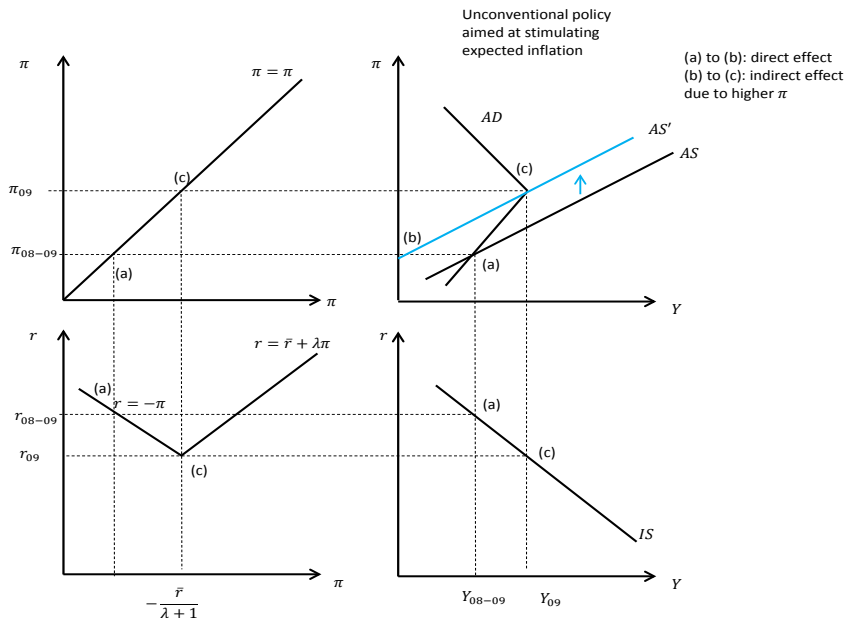
	Events				Exit
	QE1	QE2	MEP	QE3	
Asset Purchase News	MBS & Treasury	Treasury only	MBS & Treasury	MBS only	MBS & Treasury
<i>Treasury Yields (CMT)</i>	Basis points				
5-year	-74	-17	3	-6	24
10-year	-107	-18	-7	-3	21
30-year	-73	-9	-17	1	15
<i>Inflation Swaps</i>					
10-year	96	5	-4	4	-9
<i>Corporate Bonds^b</i>					
Aaa	-77	-9	-16	4	23
Baa	-81	-7	-15	0	28
Aaa CDS	-7	2			
Baa CDS	-40	2			
IG CDS 10-year			9	0	12
<i>Agency MBS^c</i>					
15-year	-88	-9	-7	-16	26
30-year	-107	-12	-23	-15	30

Source: Krishnamurthy, Arvind and Annette Vissing-Jorgensen. 2013. "The Ins and Outs of LSAPs." *Economic Policy Symposium - Jackson Hole*, 57-111.

Mechanics of Unconventional Monetary Policy

- ▶ Unconventional monetary policy aims to lower the credit spread, \bar{f} , through different means
- ▶ If it can do this, it can also lower short term real interest rates, even though it can't lower short term nominal interest rates
- ▶ What is the mechanism? Lowering the credit spread stimulates demand, which creates inflation
- ▶ In normal times, Fed would respond to more inflation by raising short term real rates
- ▶ But at ZLB, more inflation lowers real rate, which provides further stimulus
- ▶ At the ZLB, the Fed **wants** to create inflation. Makes sense – create inflation to avoid the deflationary spiral
- ▶ Alternative channel of unconventional policy: raise **expected inflation**, which could shift AS up. Normal times this would be bad, but at ZLB could be expansionary

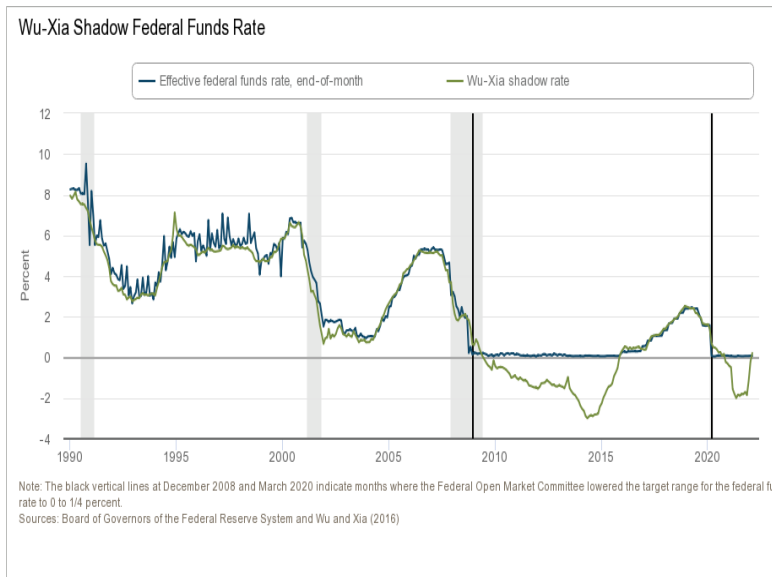
Expected Inflation Channel of Unconventional Policy



Is Monetary Policy and the Macro Economy So Different at the ZLB?

- ▶ Conventional wisdom is that the economy behaves very differently when monetary policy is constrained by the ZLB:
 - ▶ Self-correcting mechanism fails: deflationary spiral
 - ▶ Positive supply shocks can lower output
 - ▶ Non-monetary demand shocks (e.g. fiscal shocks) can have much larger effects than in normal times
- ▶ In a series of papers, Cynthia Wu and co-authors ([Wu and Xia, JMCB 2016](#), [Wu and Zhang working paper 2016](#)) have argued that monetary policy and the economy are not so different at the ZLB
- ▶ Fed just uses unconventional tools to move relevant rates in (more or less) the same way it did pre-ZLB
- ▶ Construct “shadow rate”: the FFR the Fed’s unconventional policies would imply absent a ZLB constraint. Looks similar to pre-ZLB behavior

The Shadow Rate and the FFR



Source: Wu and Zhang, (2016): "A Shadow Rate New Keynesian Model" (working paper)