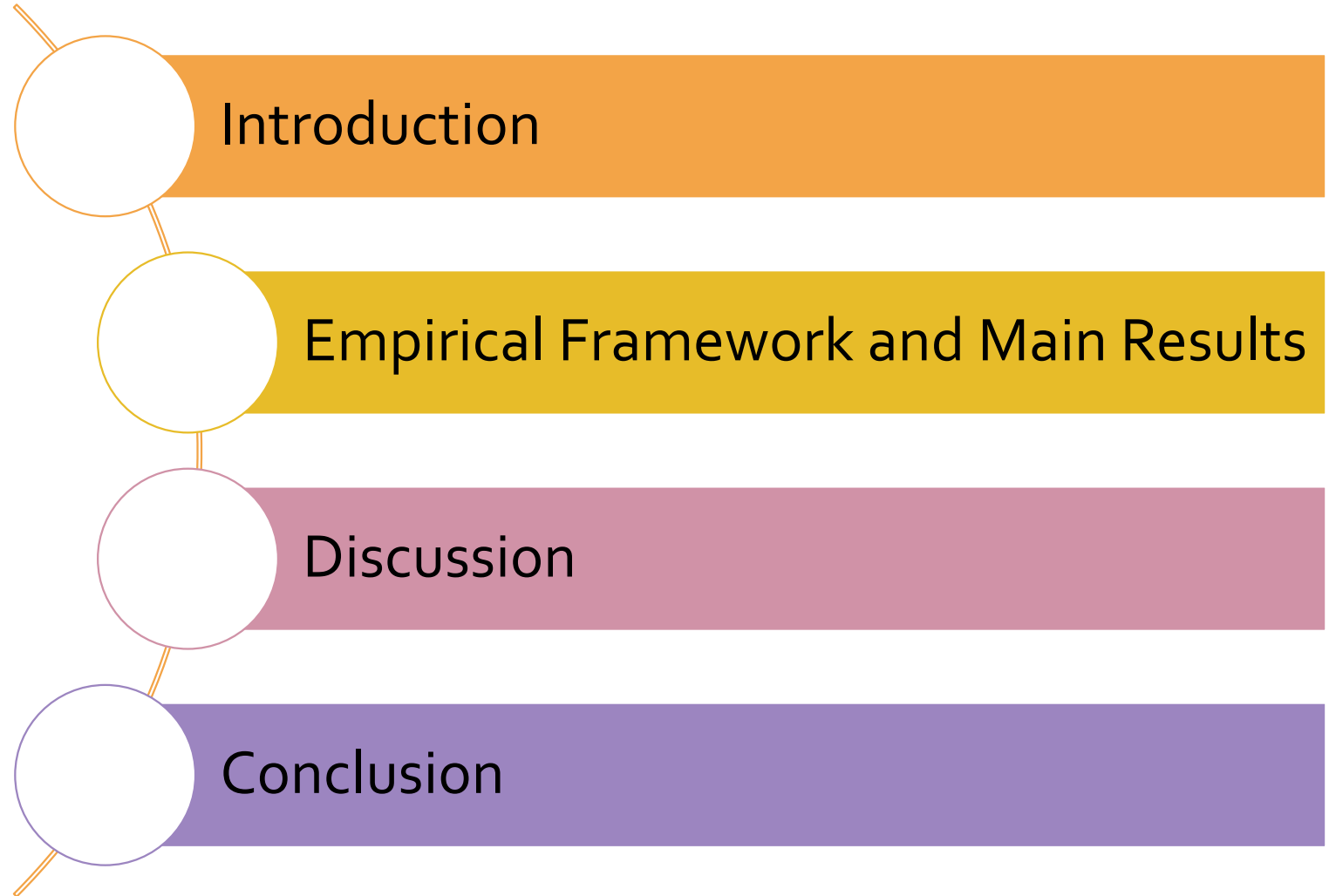


Measuring the Effect of the Zero Lower Bound on Medium- and Longer- Term Interest Rates

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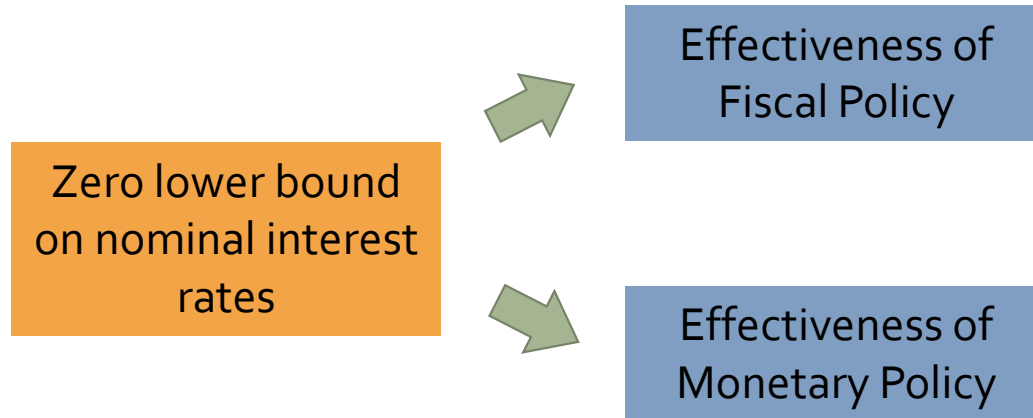
OUTLINE





Introduction

Introduction



- It is not clear whether the zero bound has substantially constrained the Fed's ability to affect longer term yields
- The entire path of expected future short-term interest rates, not just current level of the over night federal funds rate matters.

Introduction

- Purpose: to measure the extent to which interest rates of any maturity – and hence **monetary policy**, more broadly defined– are constrained by the **zero lower bound**
- The EFFECT/ CONSTRAIN is measured by the sensitivity of yield to macroeconomic news compared to the benchmark period (1990-2000)
 - Periods when yield is about as sensitive to the benchmark → UNCONSTRAINED
 - Periods when yield is less or not responsive to news at all → largely or completely CONSTRAINED

Introduction

FINDINGS

- Yields on Treasury securities with a year or more to maturity were surprisingly **responsive to news throughout 2008-10**, suggesting that MP and FP were likely to have been about as effective as usual during this period
- Not until the **late 2011, the sensitivity of those yields to news falls closer to zero**
- 2 explanations
 1. Until late 2011, market participants expected the funds rate to lift off from zero within about four quarters, minimizing the effect of zero bound on medium- and longer-term yields.
 2. The Fed's unconventional policy actions seem to have helped offset the effect of the zero bound on medium- and longer-term rates



Empirical Framework and Main Results

Empirical Framework

1. Identifying a surprise component of major US macroeconomic announcement



2. Estimate average sensitivity of Treasury yield of each maturity to the announcement over the sample 1990-2000



3. Estimate the relevant sensitivity of sample period 2001-2012 and compare to the benchmark

Hypothesis: periods that the zero bound was a significant constraint on a given Treasury yield should appear in the analysis as periods of unusually low sensitivity of that security to macroeconomic news

Empirical Framework

The Surprise Component

- Based on EMH and forward-looking model: the expected component of macroeconomic data releases should have no effect on interest rates
- To measure the effects of major macroeconomic news on interest rates, require the UNEXPECTED or SURPRISE component.

*surprise component = realized macro data –
financial markets' expectation for that realized value*

- Financial markets' expectations: Money Market Services (MMS) and Bloomberg Financial Services

Empirical Framework

The Sensitivity of Treasury Yields (1990-2000): the Benchmark model

- Model Specification: daily-frequency regression

$$\Delta y_t = \alpha + \beta X_t + \varepsilon_t$$

- t indexes days
- Δy_t is one-day change in the Treasury yield in basis points
- X_t is a vector of surprise components of macroeconomic data releases that took place that day – normalized by its historical standard deviation to facilitate the interpretation
- ε_t is residual i.e. the influence of other factors on the Treasury yield that day

Main Results

The Sensitivity of Treasury Yields (1999-2000)

	Treasury yield maturity					
	3-month		2-year		10-year	
Capacity Utilization	1.68	(2.93)	2.10	(4.23)	1.47	(2.51)
Consumer Confidence	0.29	(0.59)	2.67	(5.84)	2.69	(5.40)
Core CPI	0.79	(2.55)	2.33	(4.38)	1.71	(3.38)
GDP (advance)	0.33	(0.71)	-0.18	(-0.19)	-0.67	(-0.62)
Initial Claims	-0.29	(-1.36)	-0.63	(-2.42)	-0.39	(-1.43)
ISM Manufacturing	0.98	(1.47)	3.44	(7.23)	2.61	(4.99)
Leading Indicators	0.83	(1.58)	1.20	(2.36)	0.69	(1.09)
New Home Sales	1.46	(3.56)	1.98	(4.84)	2.04	(4.30)
Nonfarm Payrolls	2.44	(4.41)	4.56	(7.02)	2.86	(4.03)
Core PPI	0.52	(1.40)	0.87	(1.78)	1.33	(2.60)
Retail Sales ex. autos	1.19	(3.35)	1.83	(2.84)	1.18	(1.83)
Unemployment rate	-1.54	(-2.19)	-1.98	(-2.60)	-0.96	(-1.23)
# Observations	1303		1303		1303	
R^2	.07		.19		.09	
$H_0 : \beta = 0$, p -value	$< 10^{-8}$		$< 10^{-16}$		$< 10^{-16}$	

Empirical Framework and Results

Measuring the Time-Varying Sensitivity of Treasury Yields

$$\Delta y_t = \alpha + \beta X_t + \varepsilon_t$$



- Non-linear least square estimation of

$$\Delta y_t = \gamma^{\tau_i} + \delta^{\tau_i} \beta X_t + \varepsilon_t$$

- Where γ^{τ_i} and δ^{τ_i} are scalars that are allowed to take different values in each calendar year $i = 1990, 1991, \dots, 2012$
- δ^{τ_i} is normalized such that the average from year $i = 1990-2000$ is essentially 1

Main Results

Measuring the Time-Varying Sensitivity of Treasury Yields

	Treasury yield maturity					
	3-month		2-year		10-year	
Capacity Utilization	0.73	(1.56)	1.49	(2.89)	0.68	(2.02)
Consumer Confidence	0.75	(2.90)	1.37	(3.71)	0.84	(2.43)
Core CPI	0.39	(1.88)	1.89	(5.00)	1.17	(3.60)
GDP (advance)	0.92	(3.15)	1.42	(2.40)	0.95	(1.69)
Initial Claims	-0.30	(-1.82)	-1.10	(-5.35)	-0.95	(-5.02)
ISM Manufacturing	1.23	(3.24)	2.72	(7.09)	1.98	(5.96)
Leading Indicators	0.20	(0.62)	0.28	(0.85)	0.28	(1.01)
New Home Sales	0.83	(2.65)	0.65	(1.99)	0.50	(1.93)
Nonfarm Payrolls	3.03	(7.67)	4.79	(9.54)	2.95	(6.79)
Core PPI	0.22	(0.79)	0.52	(1.54)	0.85	(3.14)
Retail Sales ex. autos	0.83	(3.76)	1.86	(4.92)	1.62	(4.31)
Unemployment rate	-1.24	(-3.53)	-1.26	(-2.78)	-0.41	(-1.07)
# Observations	2829		2829		2829	
R^2	.08		.17		.10	
$H_0 : \beta$ constant, p -value	.598		.265		.630	
$H_0 : \delta$ symmetric, p -value	.095		.310		.319	
$H_0 : \delta$ constant, p -value	$< 10^{-16}$		$< 10^{-16}$.015	

Empirical Framework and Results

Measuring the Time-Varying Sensitivity of Treasury Yields

$$\Delta y_t = \alpha + \beta X_t + \varepsilon_t$$



- Non-linear least square estimation of

$$\Delta y_t = \gamma^{\tau i} + \delta^{\tau i} \beta X_t + \varepsilon_t$$

- Where $\gamma^{\tau i}$ and $\delta^{\tau i}$ are scalars that are allowed to take different values in each calendar year $i = 1990, 1991, \dots, 2012$
- $\delta^{\tau i}$ is normalized such that the average from year $i = 1990-2000$ is essentially 1



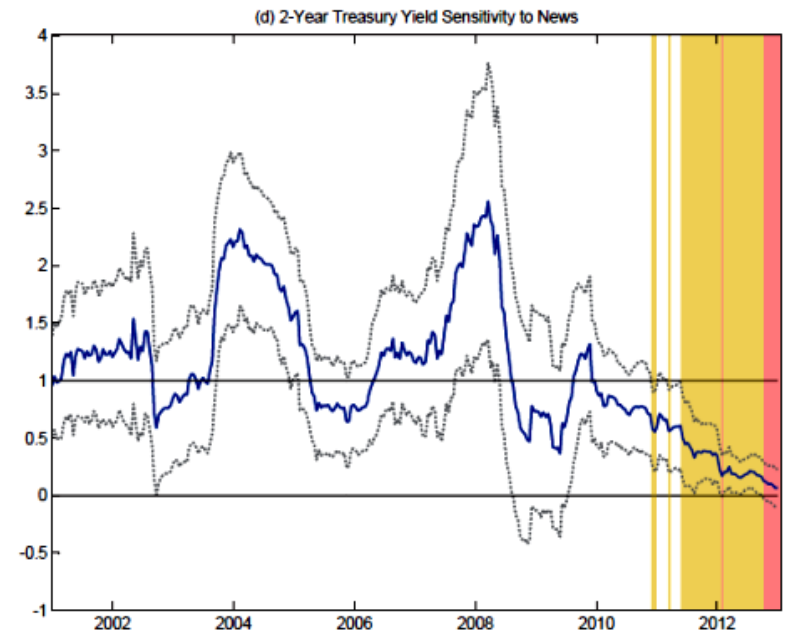
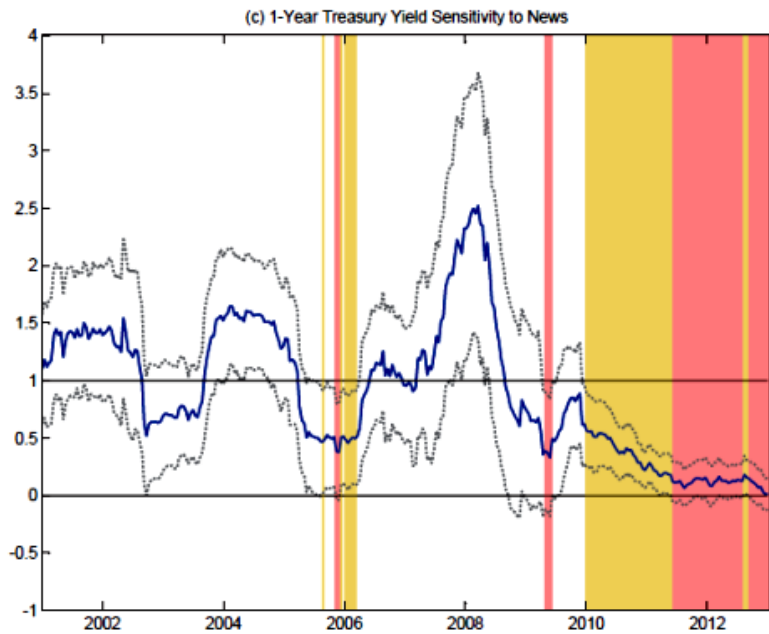
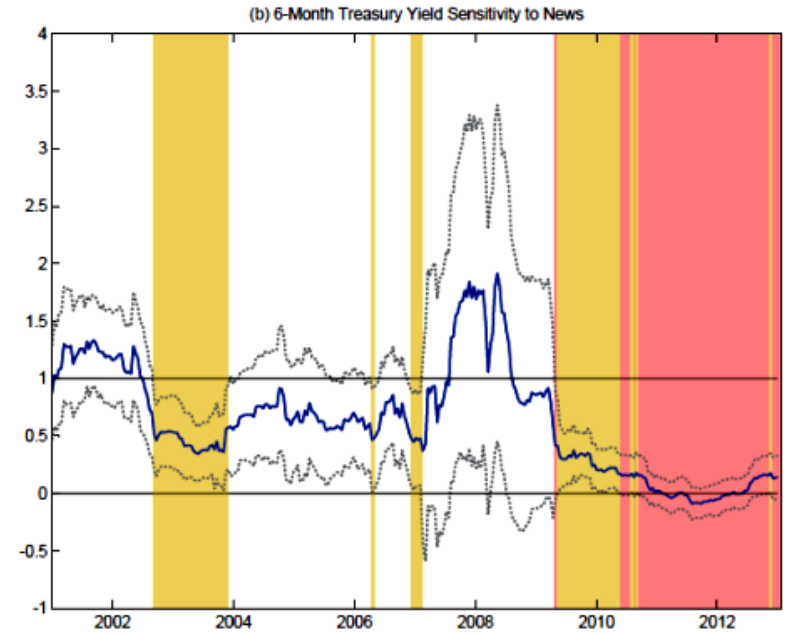
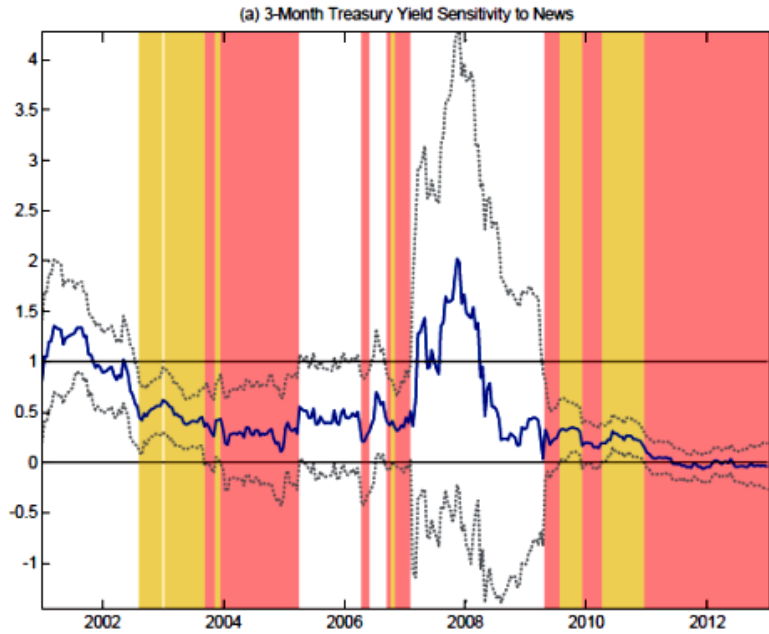
$$\Delta y_t = \gamma^{\tau} + \delta^{\tau} \hat{X}_t + \varepsilon_t^{\tau}$$

- Where $X_t \equiv \beta X_t$
- τ is the midpoint of a given calendar year or any business day in the sample

Main Results

Measuring the Time-Varying Sensitivity of Treasury Yields

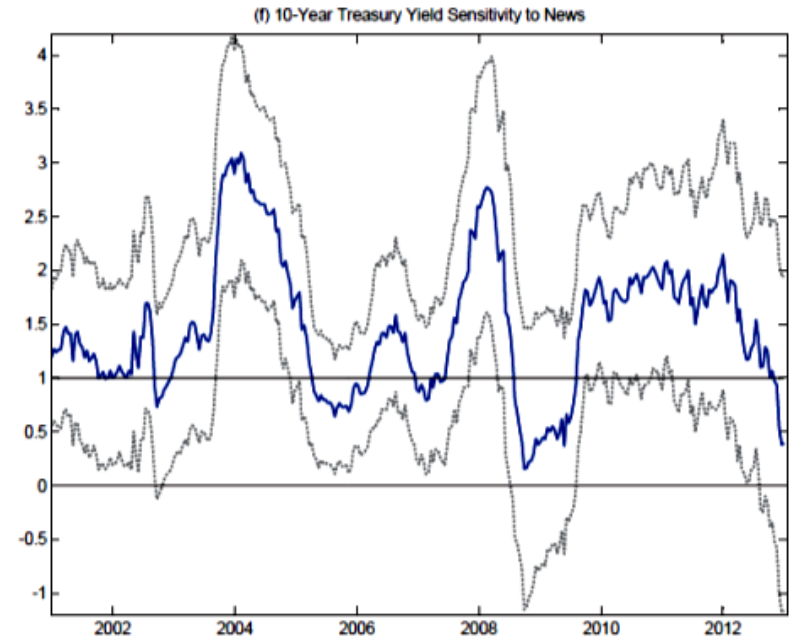
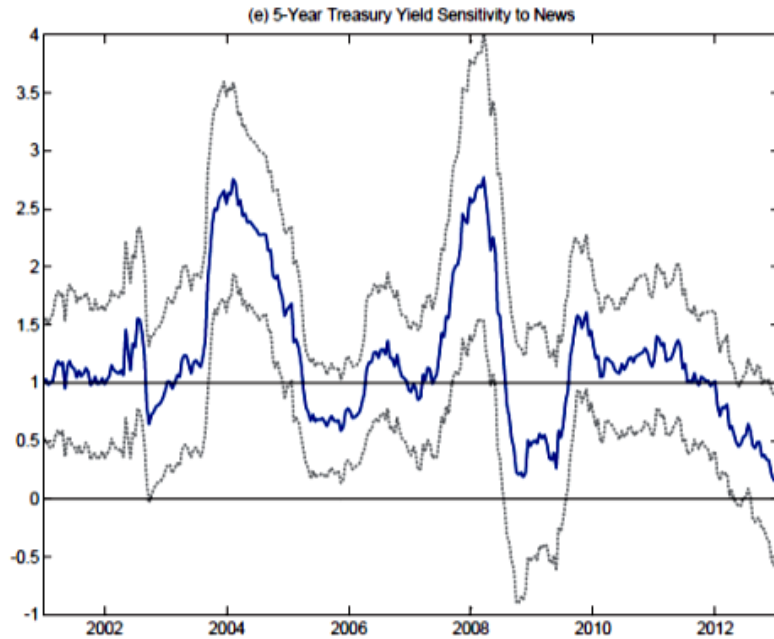
Time-varying sensitivity coefficient δ^τ from the last regression for different maturities



Main Results

Measuring the Time-Varying Sensitivity of Treasury Yields

Time-varying sensitivity coefficient δ^τ from the last regression for different maturities

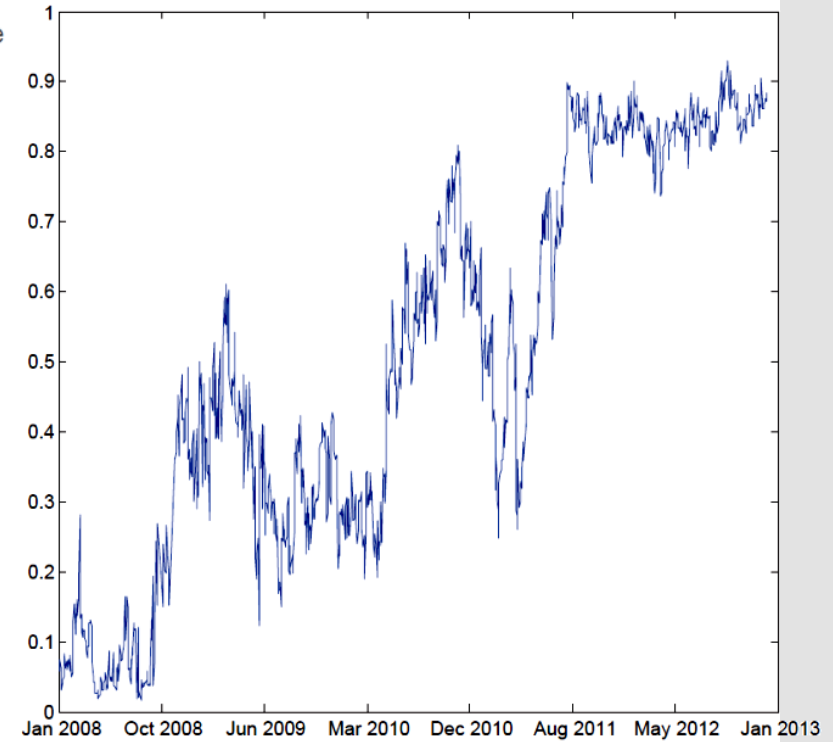
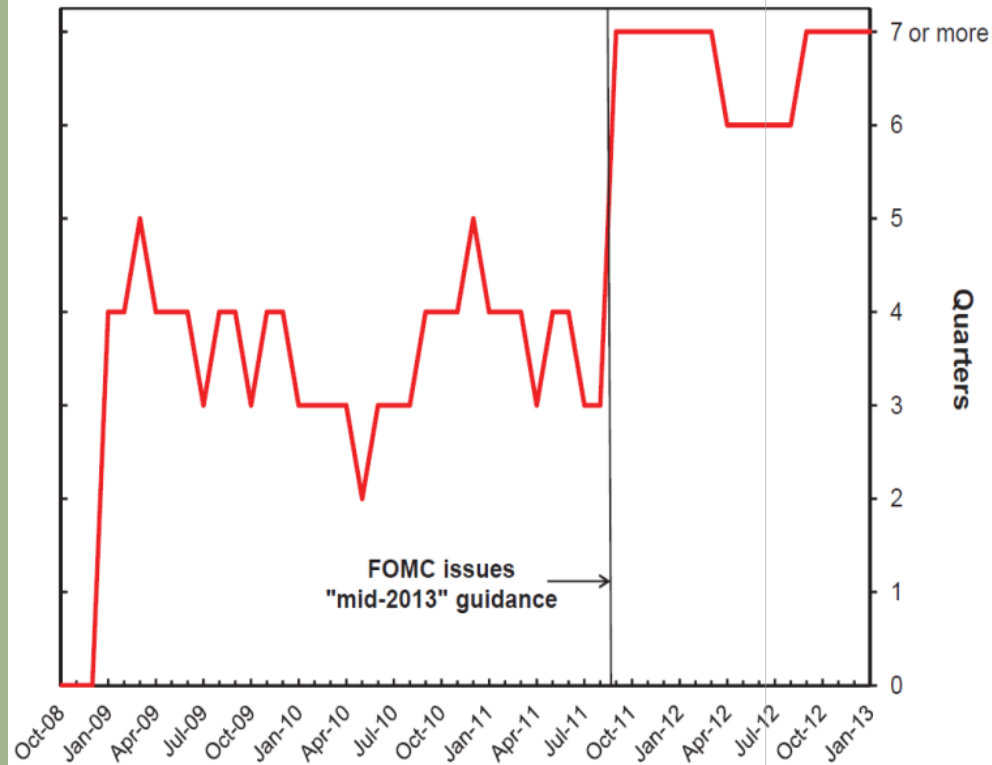




Discussion

Discussion

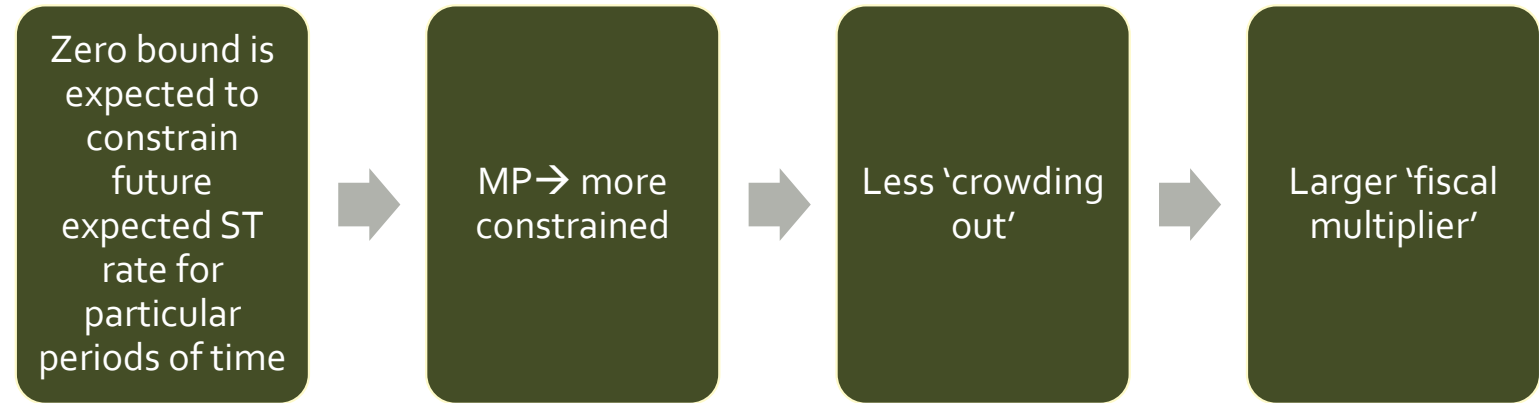
1. Private-Sector Expectations of Federal Funds Rate "liftoff" from zero



- Expected number of quarters until the Federal funds rates increased above 25 bps
- Probability of Fed Funds rate being less than 50 bps in five quarters

Discussion

2. Implications for the Fiscal Multiplier



- Periods when fiscal multiplier is larger are also periods when intermediate maturity bond yields are less sensitive to news
- This is consistent with standard IS-LM intuition of a smaller crowding-out effect

Discussion

3. Other Explanations for Time-Varying Treasury Yield Sensitivity

- Insensitivity of Treasury yields might occur due to reasons other than the zero lower bound:
 1. Decline in Treasury yields over that period (trend)
 2. Reduction in uncertainty about future short-term interest rates

- A more structural specification

$$\Delta y_t = \gamma + f(Z_t)\beta X_t + \varepsilon_t$$

- Where $f(Z_t) = \theta + \phi Z_t$
- Z_t is vector of explanatory variables for Treasury yield sensitivity, in this case, includes 'level of the same yield' or 'monetary policy uncertainty' or both
- θ is a constant normalized so that the average sensitivity of $f(Z_t)$ equal to unity over the benchmark sample (1990-2000)

Discussion

3. Other Explanations for Time-Varying Treasury Yield Sensitivity

Regressions with Treasury Yield Sensitivity a Function of Explanatory Variables

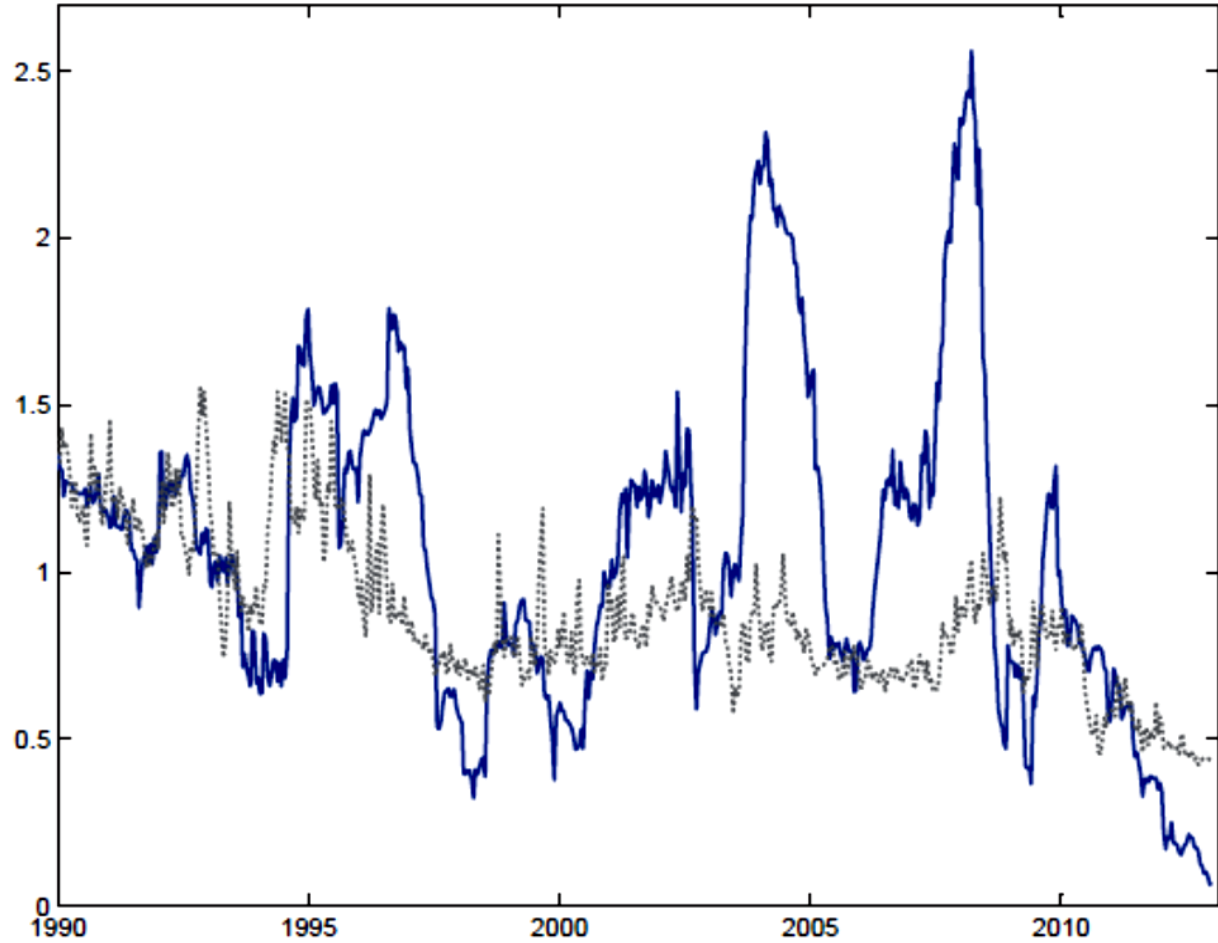
	(1)	(2)	(3)
(A) 3-month Treasury Yield			
own interest rate level	.130 (3.49)		.051 (0.93)
monetary policy uncertainty		.526 (4.73)	.433 (2.58)
time trend			
R^2	.11	.11	.11
(B) 2-year Treasury Yield			
own interest rate level	.048 (2.09)		-.023 (-0.72)
monetary policy uncertainty		.292 (5.90)	.332 (4.58)
time trend			
R^2	.19	.19	.19
(C) 10-year Treasury Yield			
own interest rate level	-.020 (-0.38)		-.120 (-1.32)
monetary policy uncertainty		.074 (0.81)	.248 (1.51)
time trend			
R^2	.11	.11	.11

Table 3. Coefficient estimate ϕ from nonlinear regression $\Delta y_t = \gamma + (\theta + \phi Z_t)\beta X_t + \varepsilon_t$ at daily frequency from Jan. 1990 to Dec. 2012. Heteroskedasticity-consistent t -statistics in parentheses.

Discussion

3. Other Explanations for Time-Varying Treasury Yield Sensitivity

(b) Sensitivity Coefficient δ^T vs. $f(Z_t)$ for 2-year Treasury Yield





Conclusion

Conclusion

FINDINGS

- Interest rates with a year or more to maturity were surprisingly responsive to news throughout 2008-10. Only in the late 2011 – around the time of the FOMC’s forward guidance – did the sensitivity of intermediate Treasury yields fall closer to zero.
- 2 main explanations for the finding
 1. Up until late 2011, financial markets consistently expected the federal funds rate to liftoff from zero within about four quarters
 2. The FOMC’s forward guidance and large-scale asset purchases continued to move medium- and longer- term interest rates even when short-term rates were stuck at zero

Conclusion

Policy implications

- MP: with substantial room to affect interest rates until late 2011. Nevertheless, managing expectations of future MP and conducting large scale purchases of long-term bonds also allow the Fed directly affected the longer-term yields.
- FP: Fiscal Multiplier was probably close to normal during 2008-10 but turned larger afterward as the expected time until the first rise in fed funds rate was lengthened

Q&A