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

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Three Motivating Observations

1. New Keynesian IS curve:

\[ y_t = E_t y_{t+1} - \alpha r_t + \varepsilon_t \]

\[ = -\alpha E_t \sum_{j=0}^{\infty} r_{t+j} + \varepsilon_t \]
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2. Brian Sack: “The best measure of the stance of monetary policy is the 2-year Treasury yield.”

3. The zero lower bound is not a substantial constraint on monetary policy if the central bank can affect longer-term interest rates:
   - Gürkaynak, Sack, and Swanson (2005):
     60–90% of the response of 2- to 10-year Treasury yields to FOMC announcements is due to statement, not funds rate
2-Year Treasury Yield $\gg 0$ for Much of 2008–10
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Questions We Address

- Was the ZLB a substantial constraint on monetary policy? —e.g., was the 2-year Treasury yield constrained?
- If so, when?
- And how severely?
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Implications for fiscal as well as monetary policy:
- Several papers show fiscal multiplier larger when ZLB binds (Christiano-Eichenbaum-Rebelo 2011, Erceg-Lindé 2010, Eggertsson-Krugman 2011)
- But did ZLB constrain yields that matter for private-sector spending?
Empirical:
- We compute the sensitivity of interest rates of various maturities to macroeconomic news in normal times (1990–2000)
- And compare it to the sensitivity of those yields to news when the ZLB may have been a constraint.
What We Do

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The level of yields alone is not a good measure of ZLB constraint:
- No way to measure severity or statistical significance —e.g., is a 50 bp 2-year Treasury yield constrained or not?
- Crowding out, fiscal multiplier determined by *response* of yields to fiscal policy, not *level* of yields
- Effective lower bound may be $\gg 0$, e.g. 50bp in the UK
Measuring Treasury Yield Sensitivity to News

Measure Treasury yield sensitivity to news in normal times using a high-frequency regression:

\[ \Delta y_t = \alpha + \beta X_t + \varepsilon_t \]
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- Regression is at daily frequency.
- \( \Delta y_t \) denotes one-day change in Treasury yield on date \( t \).
- \( X_t \) is a vector of surprises in macroeconomic data releases (GDP, CPI, nonfarm payrolls, etc.) on date \( t \).
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Surprise component of data release: \( x_t - E_{t-1} x_t \).

Market expectation of macroeconomic data releases measured by Money Market Services, Bloomberg surveys.
Measuring Time-Varying Sensitivity to News

Time-varying sensitivity version:

$$\Delta y_t = \alpha^i + \delta^i \beta X_t + \varepsilon_t$$

where $\delta^i$ scalar, $i \in 1990, 1991, \ldots, 2012$. 
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where \( \delta^i \) scalar, \( i \in 1990, 1991, \ldots, 2012 \).

- Assumption: *relative* responses \( \beta \) constant over time
- Estimate \( \delta^i, \beta \) by nonlinear least squares
- Normalize \( \delta^i \) so that average \( \delta^i \) from 1990–2000 is 1
### Nonlinear Regression Results for $\beta$, 1990–2012

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Estimate:

\[
\Delta y_t = \alpha^i + \delta^i \beta X_t + \varepsilon_t
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(\*)
Motivation

Empirical Framework

Main Results

Discussion

Conclusions

Rolling Regressions

\[ \Delta y_t = \alpha_i + \delta^i \beta X_t + \varepsilon_t \]  \hspace{1cm} (*)

To study time-varying \( \delta \) in finer detail, run daily rolling regressions:

- Use \( \hat{\beta} \) from (*) to define “generic surprise” regressor \( \hat{\beta} X_t \)
- Estimate:
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  where sample is 1-year rolling window centered around date \( \tau \)
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Account for 2-stage sampling uncertainty in rolling regressions:

- Use standard errors for \( \delta^i \) in (*) as benchmarks
- Interpolate between them using estimates for \( \delta^\tau \)
Time-Varying Sensitivity $\delta^\tau$, 3-month Treasury

(a) 3-Month Treasury Yield Sensitivity to News
Time-Varying Sensitivity $\delta^\tau$, 6-month Treasury

(b) 6-Month Treasury Yield Sensitivity to News
Time-Varying Sensitivity $\delta^\tau$, 1-year Treasury
Time-Varying Sensitivity $\delta^\tau$, 2-year Treasury

(d) 2-Year Treasury Yield Sensitivity to News
Time-Varying Sensitivity $\delta^\tau$, 5-year Treasury
Time-Varying Sensitivity $\delta^\tau$, 10-year Treasury
Private-Sector Expectations of Funds Rate “Liftoff”

Why were 1- and 2-year Treasury yields so responsive to news from 2008–2010?
Private-Sector Expectations of Funds Rate “Liftoff”

Why were 1- and 2-year Treasury yields so responsive to news from 2008–2010?

Look at private sector expectations of funds rate “liftoff”:
- Blue Chip survey
- interest rate options
- Eurodollar futures
Private-Sector Expectations of Funds Rate “Liftoff”

Blue Chip Consensus expectation, time until first funds rate increase:

FOMC issues "mid-2013" guidance
Private-Sector Expectations of Funds Rate “Liftoff”

One-year-ahead implied probability distribution for federal funds rate, derived from options, on November 2, 2011:
Private-Sector Expectations of Funds Rate “Liftoff”

Probability of funds rate < 50bp in 5 quarters, from options:
Monetary Policy Expectations from Eurodollar Futures

(b) 2 to 3-Quarter-Ahead Eurodollar Future Sensitivity to News

(c) 3 to 4-Quarter-Ahead Eurodollar Future Sensitivity to News

(d) 4 to 5-Quarter-Ahead Eurodollar Future Sensitivity to News

(e) 5 to 6-Quarter-Ahead Eurodollar Future Sensitivity to News
Federal Reserve Long-Term Bond Purchases

Why are 5-, 10-year Treasuries so sensitive to news in 2010–12?
Federal Reserve Long-Term Bond Purchases

Why are 5-, 10-year Treasuries so sensitive to news in 2010–12?

(e) 5-Year Treasury Yield Sensitivity to News

(f) 10-Year Treasury Yield Sensitivity to News

In the illustrative model, all yields are attenuated by the ZLB (although longer-term yields are attenuated less)
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Forward Guidance:
- Eggertsson-Woodford (2003), Reifschneider-Williams (2000)
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Federal Reserve’s long-term bond purchases:
- 11/25/08: $500B MBS, $100B GSE
- 3/18/09: $750B MBS, $100B GSE, $300B Treasuries
- 11/3/10: $600B Treasuries
- 9/21/11: $400B “Operation Twist”
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Theoretical and empirical studies:
Implications for the Fiscal Multiplier

(A) Liftoff expected sooner
(B) Liftoff expected later

This paper: 2008–10 look like scenario A

\[ t_0, t_A, t_B \]
Implications for the Fiscal Multiplier

A) liftoff in 4 qtrs. $\implies$ multiplier same as normal (CER 2011)

B) liftoff in 8 qtrs. or more $\implies$ large multiplier (CER 2011)
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This paper: 2008–10 look like scenario A
Conclusions

What we do:

- **Test** whether interest rates are responding normally to news.
- Measure the **degree** to which interest rates are attenuated.

What we find:

- 1- and 2-year Treasury yields were surprisingly responsive to news throughout 2008–10.

What we conclude:

- Effectiveness of monetary and fiscal policy likely close to normal throughout 2008–10.
- Zero lower bound a more severe constraint since mid-2011.