

Measuring the Effect of the Zero Lower Bound on Yields and Exchange Rates in the U.K. and Germany

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Bank of England

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The views expressed in this presentation are solely those of the authors and do not necessarily represent the views of any other individual in the Federal Reserve System.

Three Motivating Observations

1 New Keynesian IS curve:

$$\begin{aligned}y_t &= E_t y_{t+1} - \alpha r_t + \varepsilon_t \\ &= -\alpha E_t \sum_{j=0}^{\infty} r_{t+j} + \varepsilon_t\end{aligned}$$

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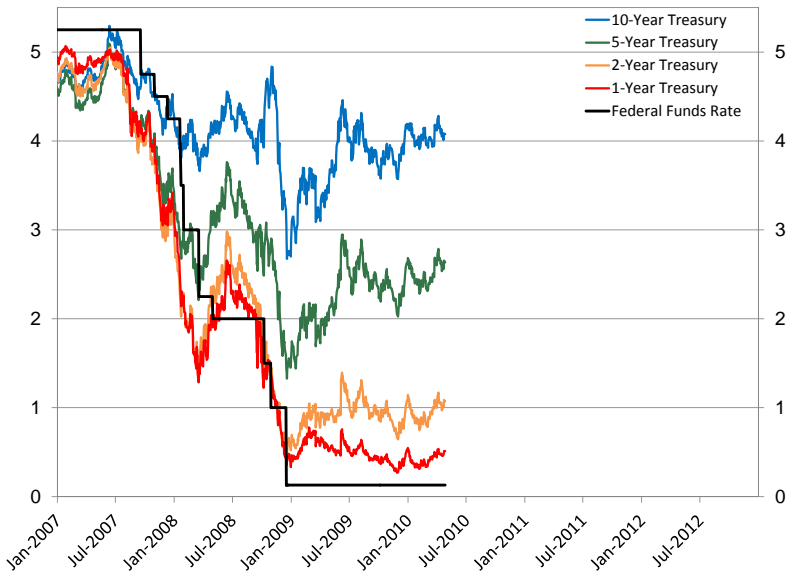
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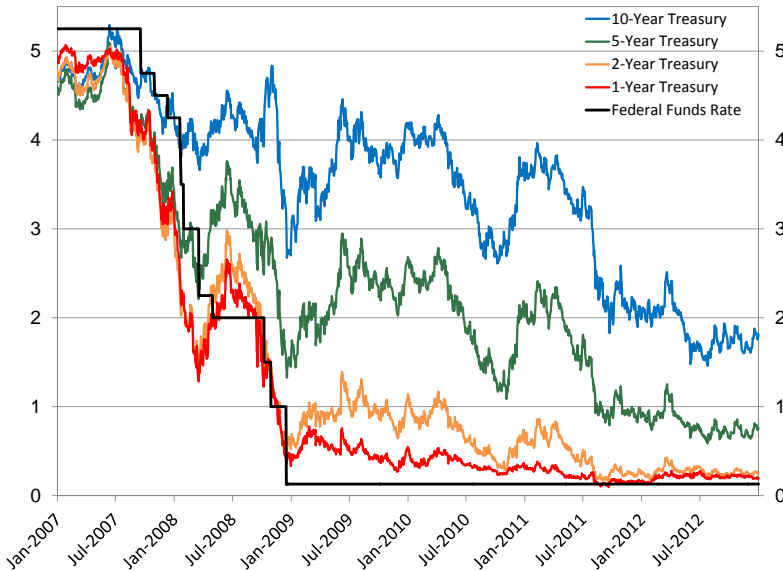
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- 3 The zero lower bound is not a substantial constraint on monetary policy if the central bank can affect longer-term interest rates:
 - Reifschneider-Williams (2000), Eggertsson-Woodford (2003)
 - Gürkaynak, Sack, and Swanson (2005):
60–90% of the response of 2- to 10-year Treasury yields to FOMC announcements is due to *statement*, not funds rate

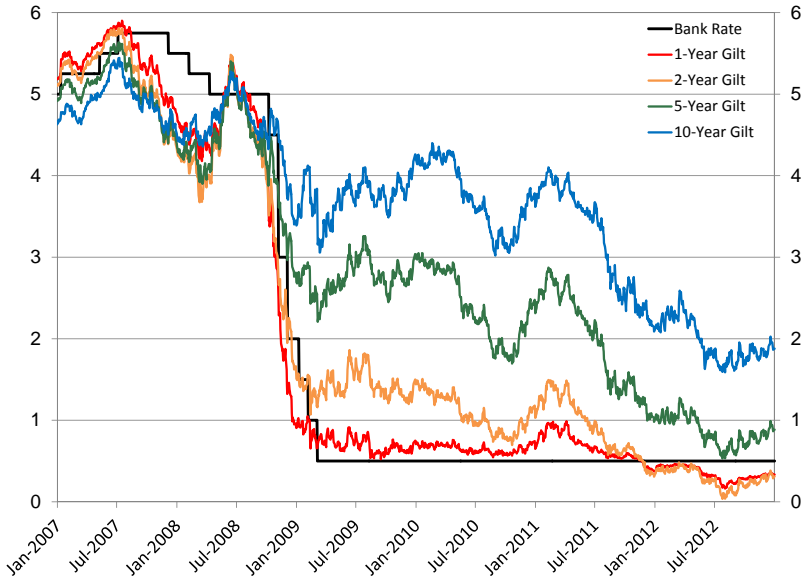
2-Year US Treasury Yield \gg 0 for Much of 2008–10



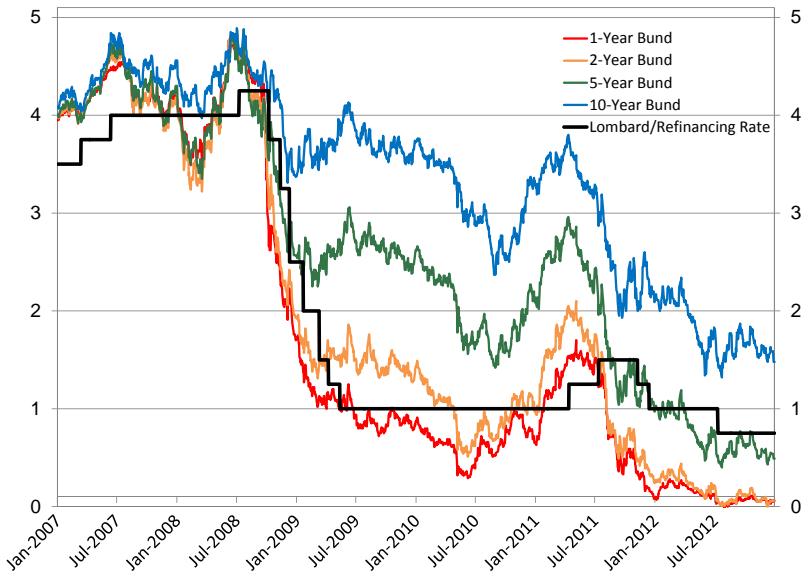
2-Year US Treasury Yield $\gg 0$ for Much of 2008–10



2-Year UK Gilt Yield $\gg 0$ for Much of 2008–10



2-Year German Bund Yield \gg 0 for Much of 2008–10



Swanson-Williams (2013)

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The level of yields alone is not a good measure of ZLB constraint:

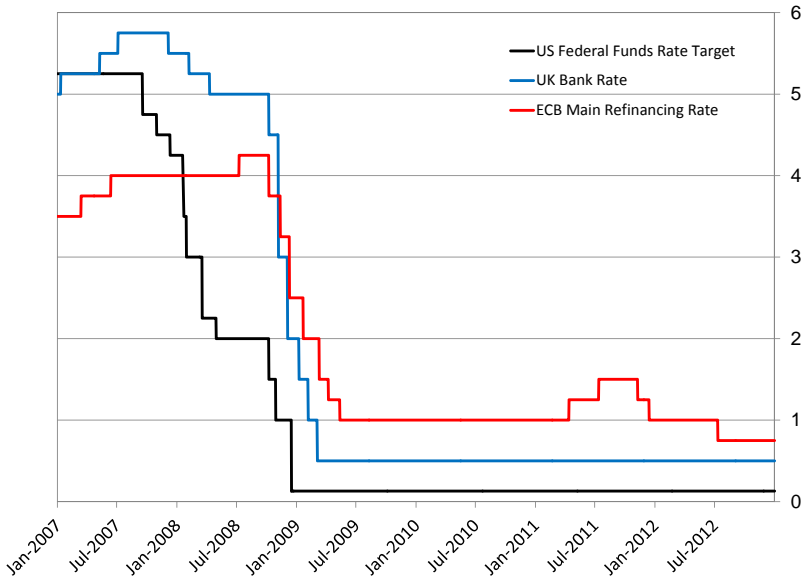
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The level of yields alone is not a good measure of ZLB constraint:

- 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

Monetary Policy Rates in U.S., U.K., Germany



Measuring Sensitivity of Yields, Exch. Rates to News

Measure sensitivity of a given yield (or exchange rate) to news in normal times using a high-frequency regression:

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- regression is at daily frequency
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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 δ^i scalar, $i \in 1993, 1994, \dots, 2012$.

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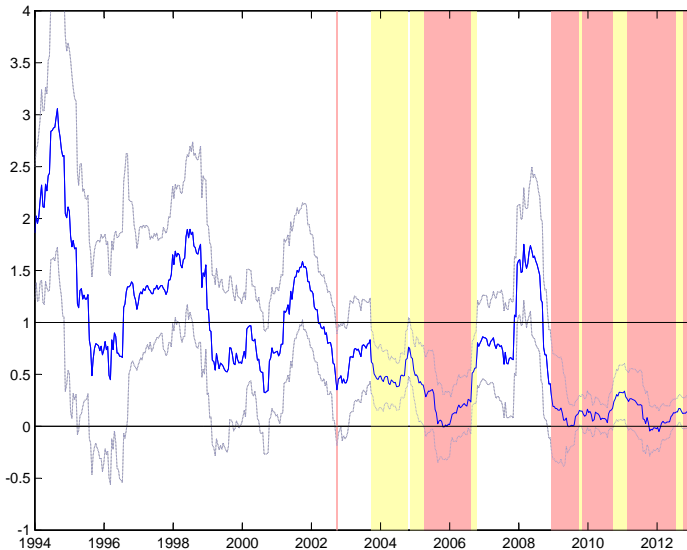
where δ^i scalar, $i \in 1993, 1994, \dots, 2012$.

- Assumption: *relative* responses β constant over time
- Estimate δ^i, β by nonlinear least squares
- Normalize δ^i so that average δ^i from 1993–2006 is 1

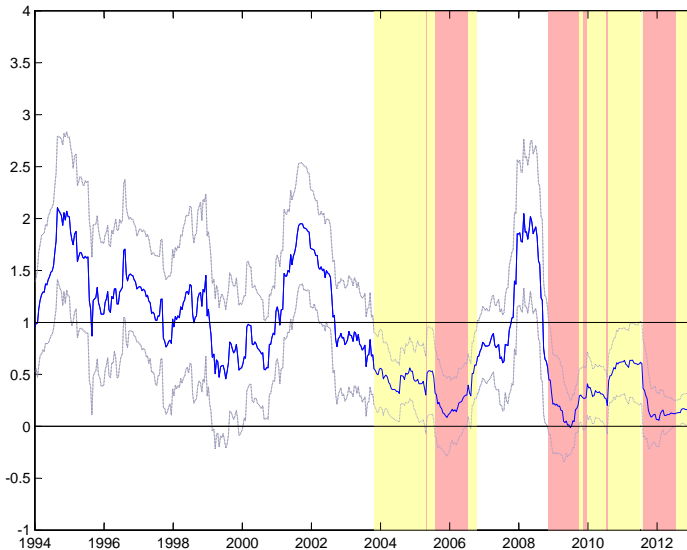
Nonlinear Regression Results for β , 1993–2012

| | 6-month UK gilt | | 2-year UK gilt | | 10-year UK gilt | |
|--------------------------------|-----------------|---------|----------------|---------|-----------------|---------|
| UK Average Earnings | 2.28 | (5.73) | 2.90 | (5.79) | 0.71 | (1.59) |
| UK GDP (advance) | 0.69 | (1.39) | 3.17 | (3.44) | 1.21 | (2.38) |
| UK Manuf. Prod. | 0.42 | (1.14) | 1.10 | (3.87) | 0.60 | (1.24) |
| UK PPI | 1.00 | (2.98) | 1.40 | (2.48) | 1.28 | (2.63) |
| UK Retail Sales | 0.92 | (2.94) | 1.69 | (4.96) | 0.70 | (1.52) |
| UK RPIX | 1.48 | (5.20) | 2.23 | (4.33) | 1.71 | (4.30) |
| UK Unemployment | -0.23 | (-0.80) | -1.29 | (-2.76) | -0.16 | (-0.48) |
| US Capacity Util. | 0.29 | (1.02) | 1.51 | (3.32) | 0.90 | (1.93) |
| US Core CPI | 0.62 | (1.71) | 0.67 | (1.86) | 0.88 | (2.18) |
| US GDP (advance) | -0.68 | (-1.70) | 0.48 | (0.92) | -0.82 | (-0.97) |
| US Initial Claims | -0.08 | (-0.61) | -0.63 | (-3.79) | -0.64 | (-3.10) |
| US ISM Manufacturing | 1.04 | (3.98) | 1.57 | (5.27) | 2.52 | (5.92) |
| US Nonfarm Payrolls | 0.47 | (1.81) | 1.58 | (3.58) | 1.60 | (3.25) |
| US Core PPI | 0.31 | (1.40) | 0.77 | (2.19) | 0.56 | (1.43) |
| US Ret. Sales ex. autos | 0.58 | (2.56) | 0.96 | (2.28) | 1.34 | (2.62) |
| US Unempl. rate | 0.27 | (0.66) | 0.28 | (0.67) | 1.01 | (1.92) |
| # Observations | 2592 | | 2708 | | 2708 | |
| $H_0 : \beta = 0$, p -value | $< 10^{-13}$ | | $< 10^{-16}$ | | $< 10^{-15}$ | |

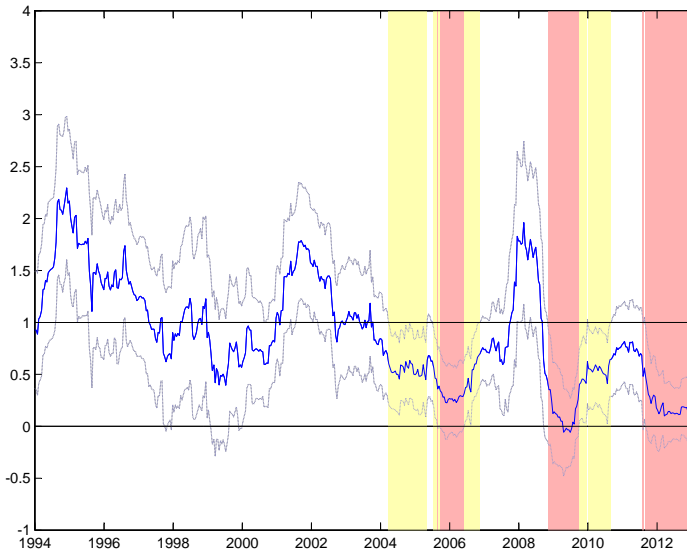
Time-Varying Sensitivity δ^τ , 6-month UK Gilt



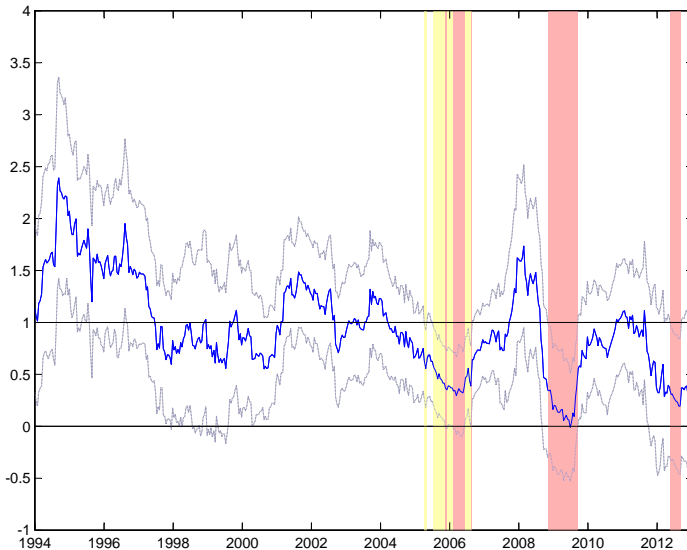
Time-Varying Sensitivity δ^τ , 1-year UK Gilt



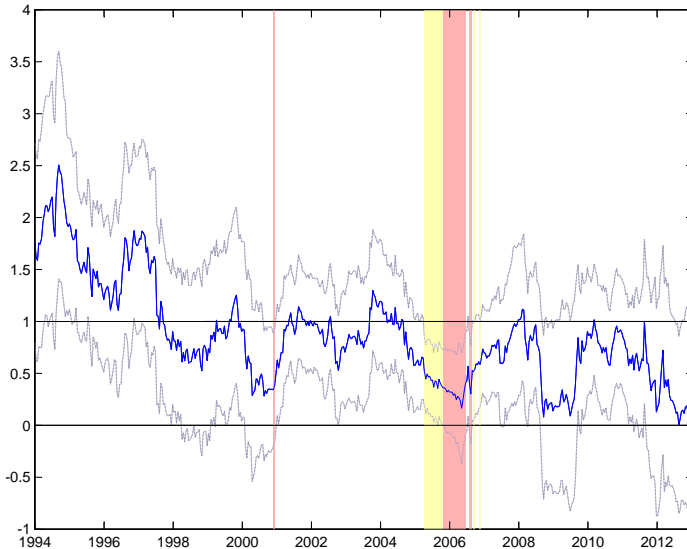
Time-Varying Sensitivity δ^τ , 2-year UK Gilt



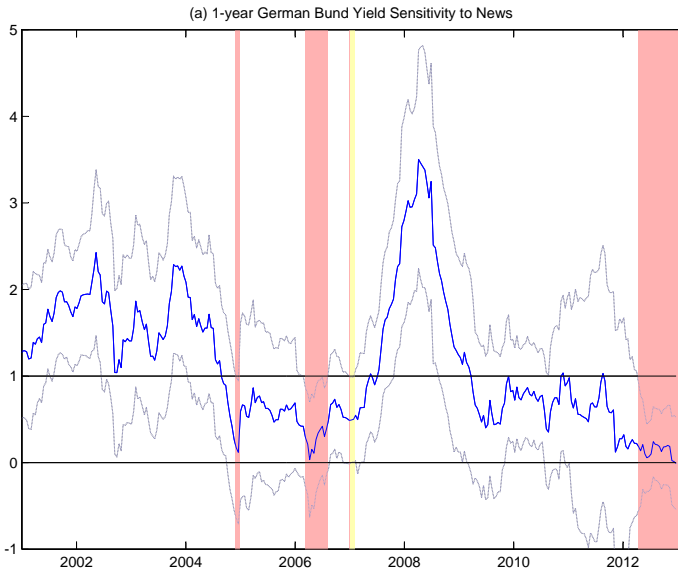
Time-Varying Sensitivity δ^τ , 5-year UK Gilt



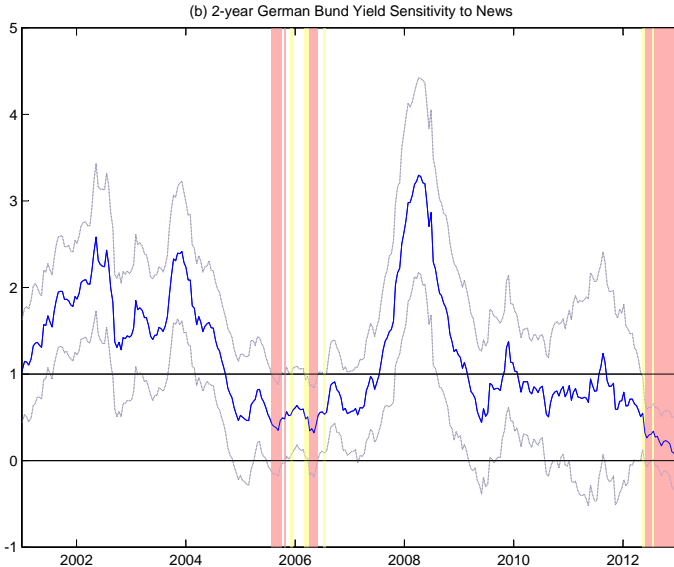
Time-Varying Sensitivity δ^τ , 10-year UK Gilt



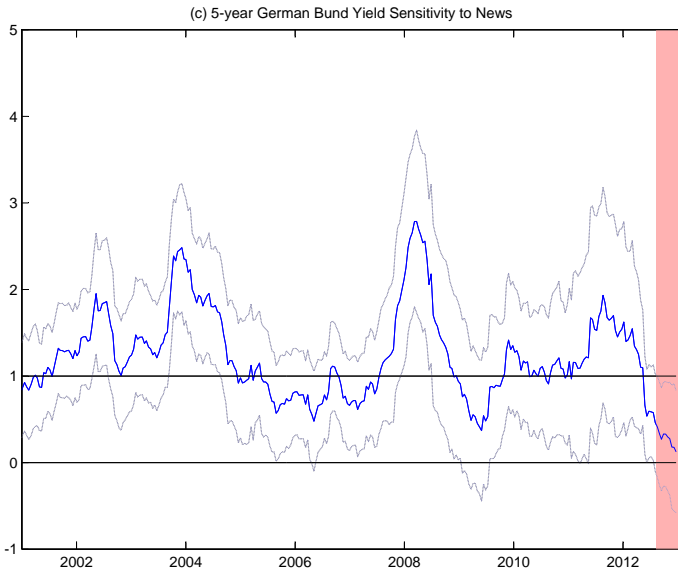
Time-Varying Sensitivity δ^τ , 1-year German Bund



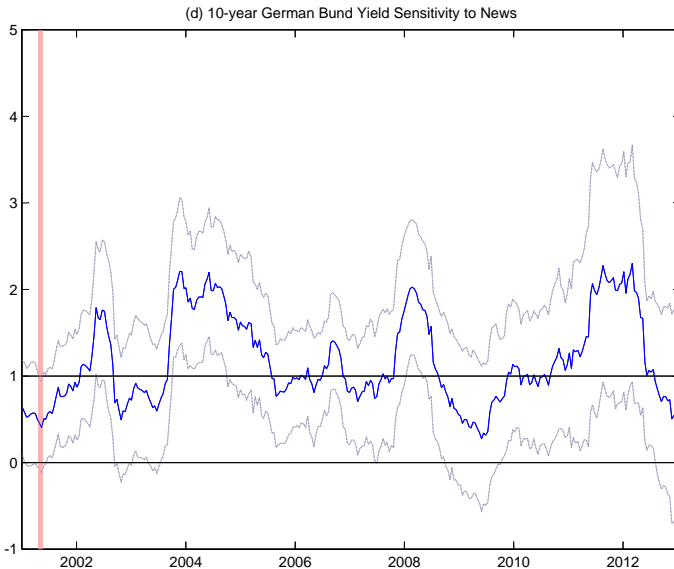
Time-Varying Sensitivity δ^τ , 2-year German Bund



Time-Varying Sensitivity δ^τ , 5-year German Bund

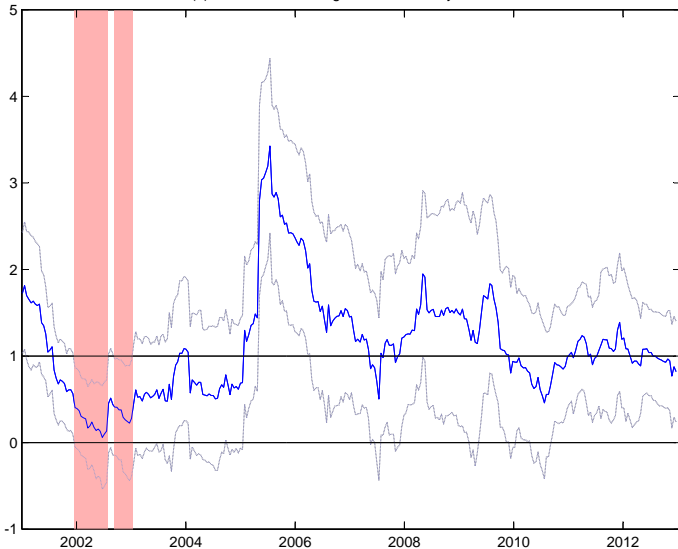


Time-Varying Sensitivity δ^τ , 10-year German Bund

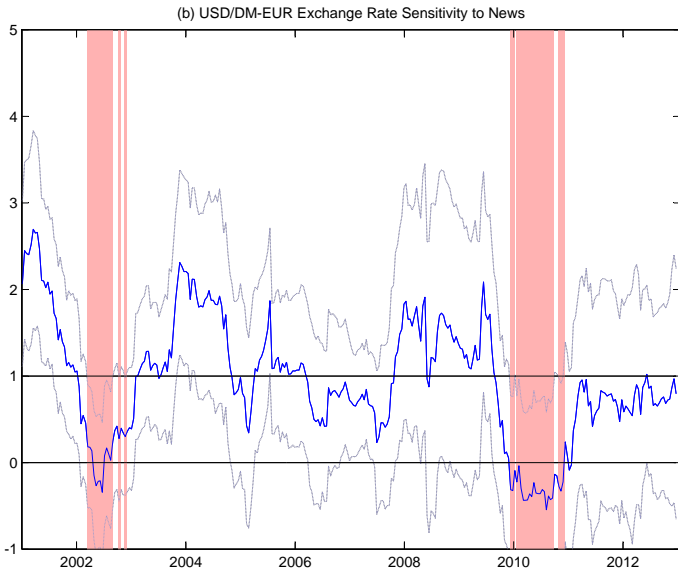


Time-Varying Sensitivity δ^τ , USD/GBP Exchange Rate

(a) USD/GBP Exchange Rate Sensitivity to News



Time-Varying Sensitivity δ^τ , USD/DM-EUR Exch. Rate



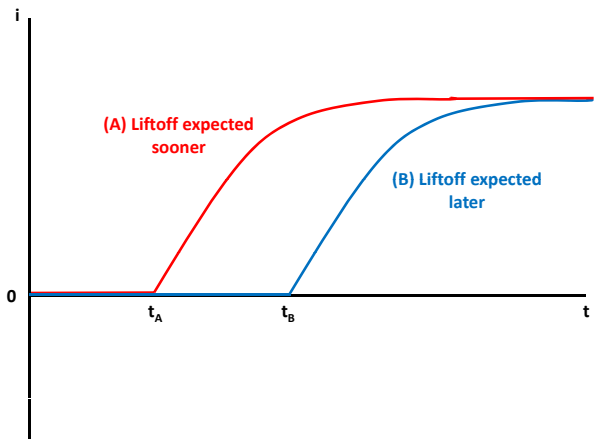
Summary of Results

- Exchange rates largely unaffected by the zero lower bound
- German bunds largely unaffected by zero bound until late 2012
- UK gilts behave in a constrained manner in 2009 and 2012, but largely unconstrained from 2010 to late 2011

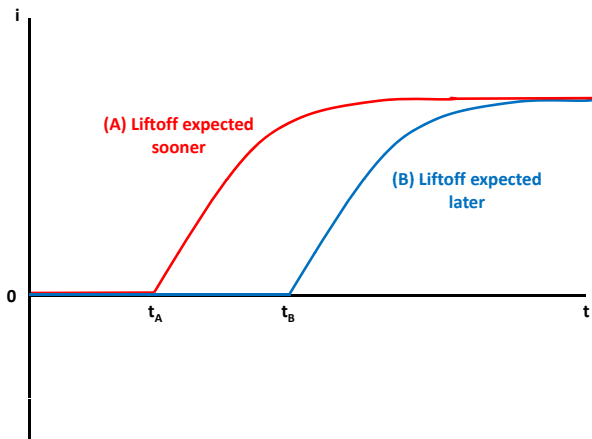
Discussion

- 1 Implications for the fiscal multiplier
- 2 Puzzling lack of gilt yield sensitivity in 2004–06
- 3 Private-sector expectations of UK monetary policy

Implications for the Fiscal Multiplier

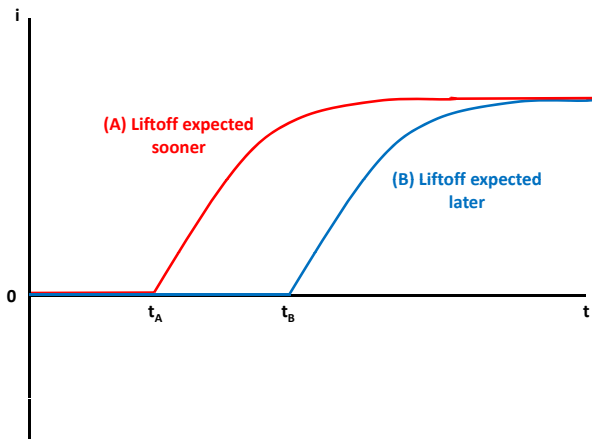


Implications for the Fiscal Multiplier



- 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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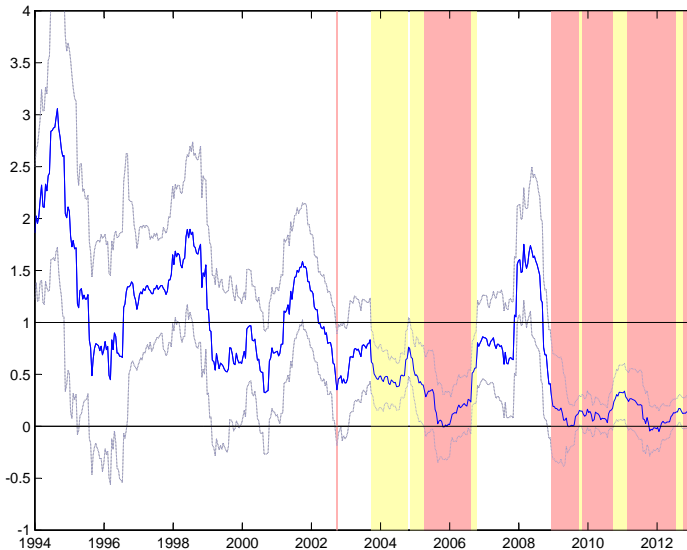


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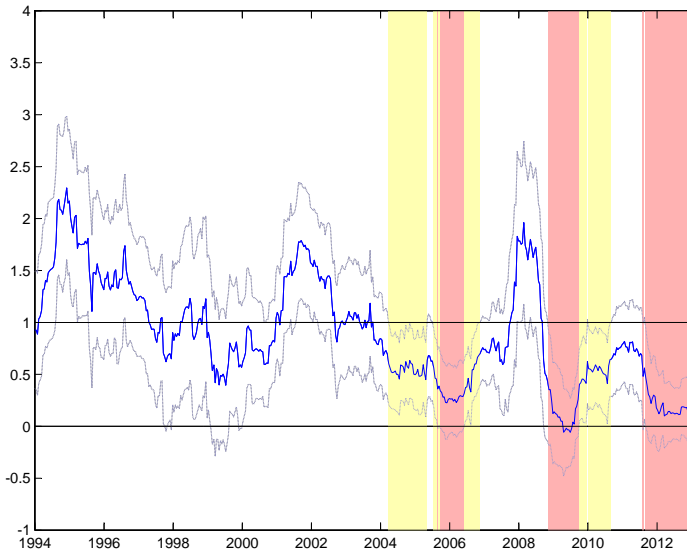
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This paper: much of pre-2012 period looks like scenario A

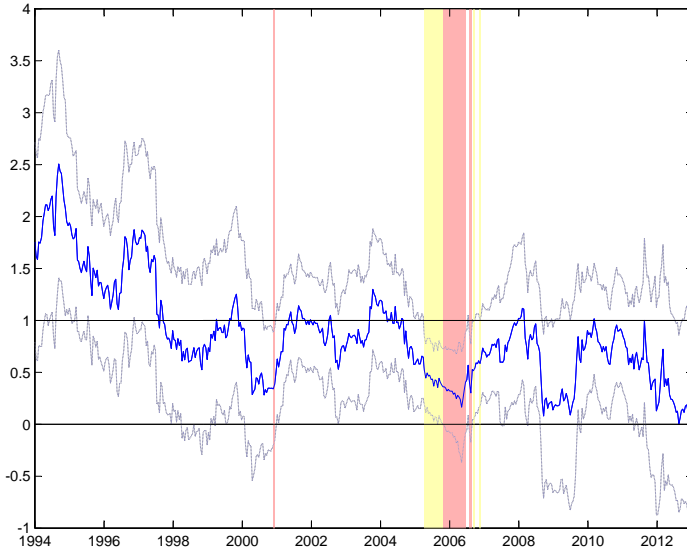
Puzzling Lack of 6-month Gilt Sensitivity in 2004–06



Puzzling Lack of 2-year Gilt Sensitivity in 2004–06

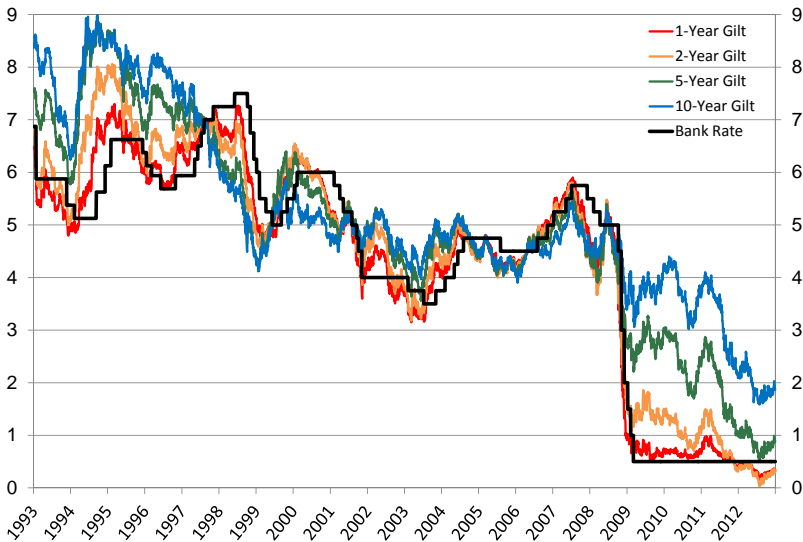


Puzzling Lack of 10-year Gilt Sensitivity in 2004–06

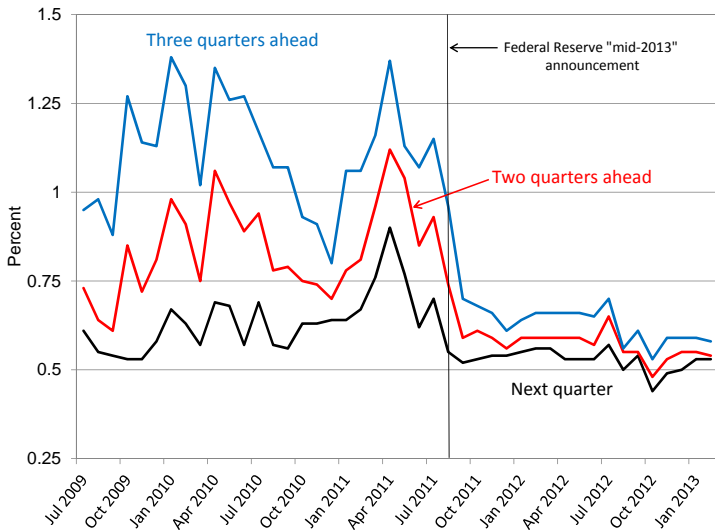


UK Gilt Yields, 1993–2012

(a) U.K. Bank Rate and Zero-Coupon Gilt Yields

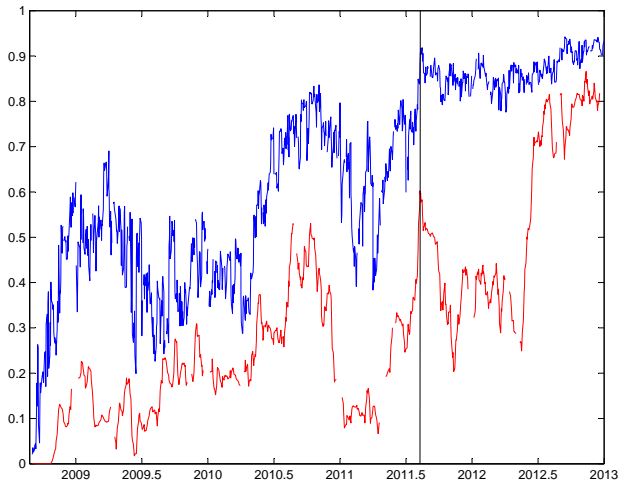


Private-Sector Expectations of UK Bank Rate



Private-Sector Expectations of UK Libor Rate

Probability of sterling Libor < 75bp in 4 quarters, from options:



Conclusions

What we do:

- **Test** whether ZLB is a **significant** constraint on yields, ex. rates
- Measure the **degree** to which yields, ex. rates are constrained

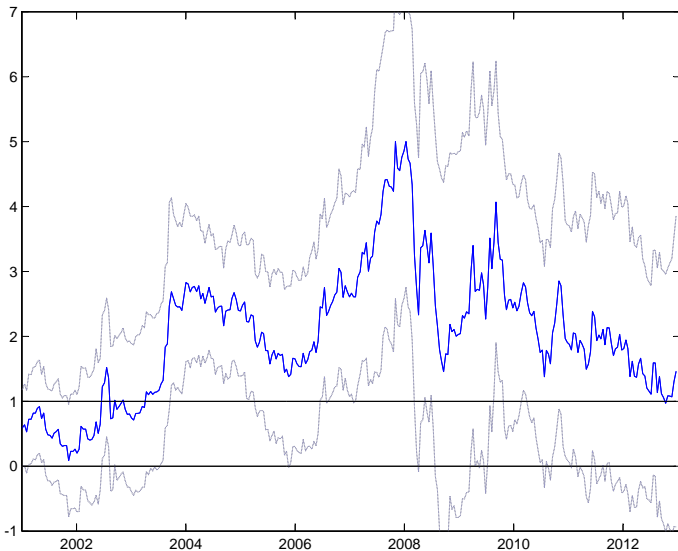
What we find:

- Exchange rates unaffected by the zero lower bound
- German bunds unaffected by the zero bound until late 2012
- UK gilts constrained in 2009, 2012, but largely unconstrained in 2010–11

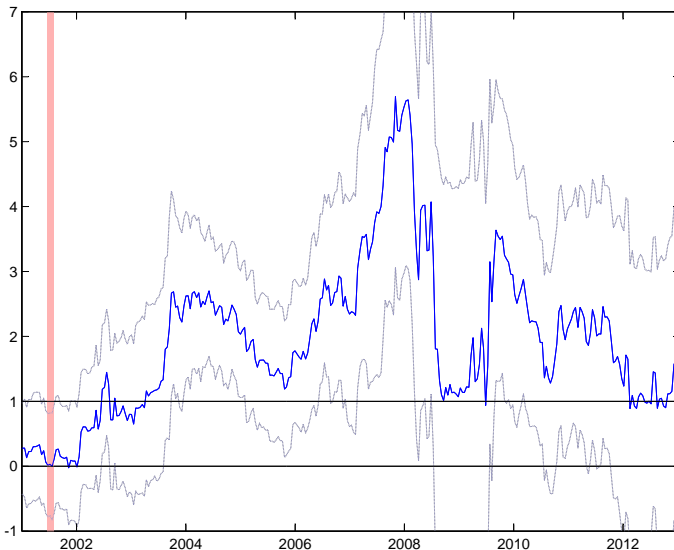
What we conclude:

- Effectiveness of monetary and fiscal policy in Germany likely close to normal until late 2012
- Effectiveness of monetary and fiscal policy in UK likely close to normal in 2010–11 (but not 2009 or 2012)

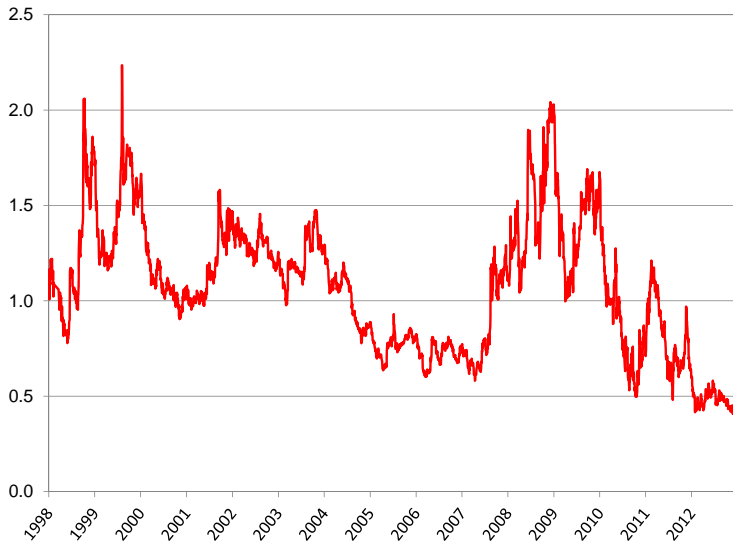
Time-Varying Sensitivity, 10-year UK Indexed Gilt



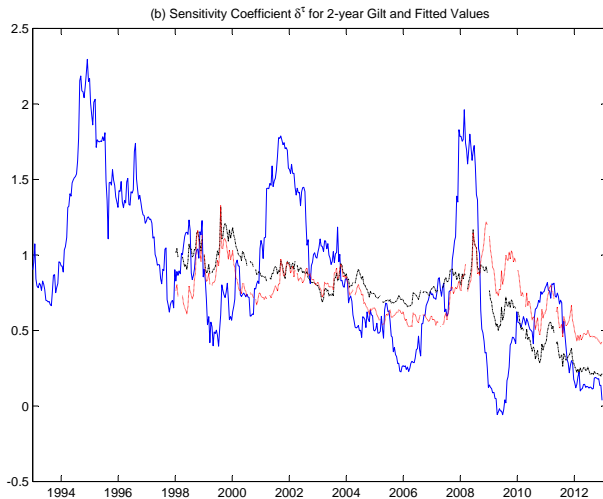
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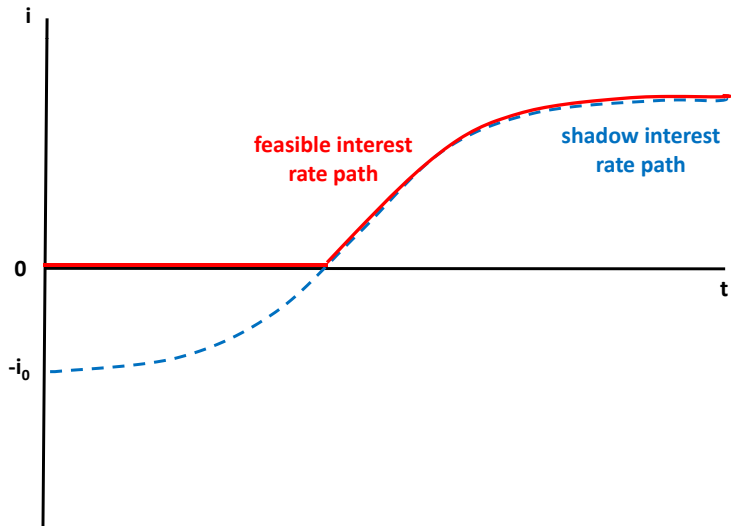
Monetary Policy Uncertainty



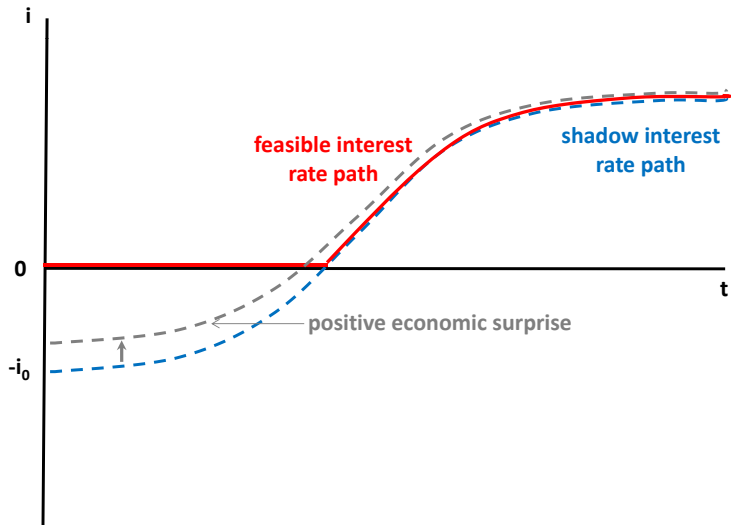
Regressions of $\delta\tau$ on Level, Mon. Pol. Uncertainty



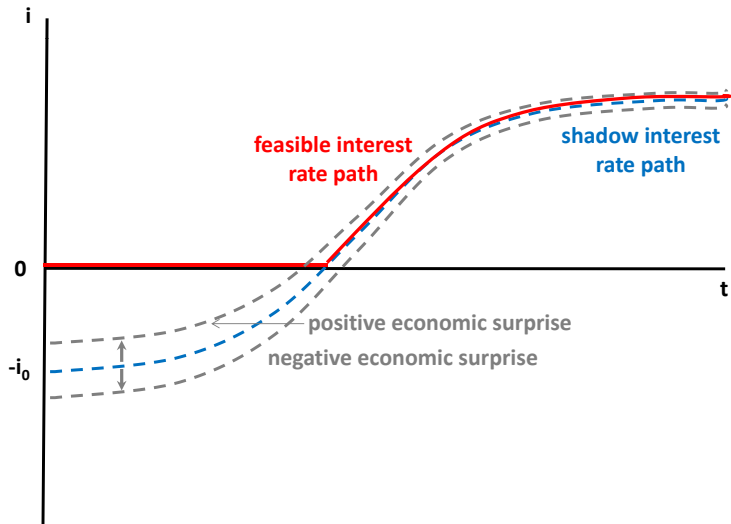
Symmetric Response to Positive, Negative Shocks



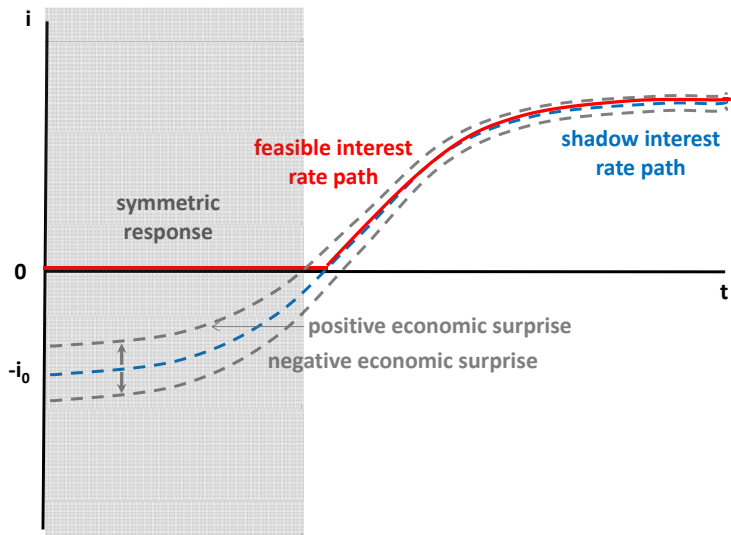
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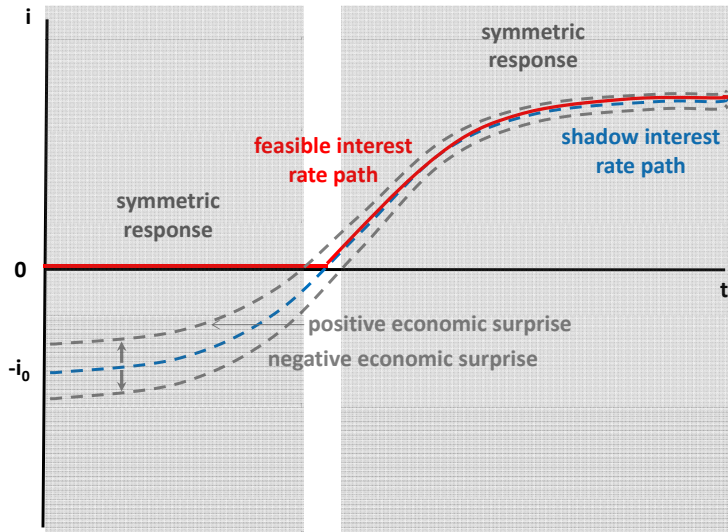
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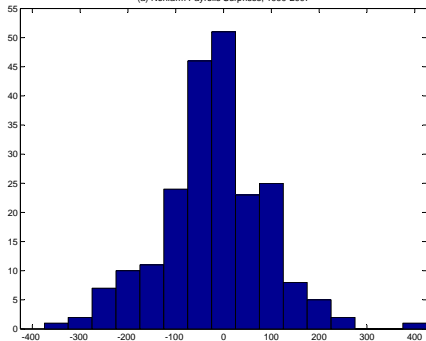


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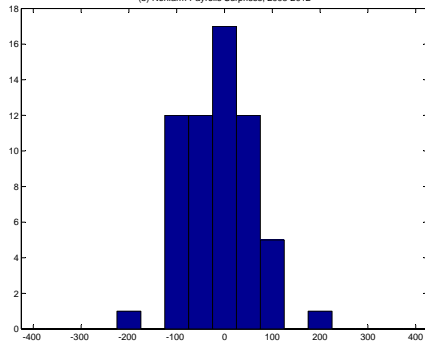


Macro Data Surprises Pre- and Post-2008

(a) Nonfarm Payrolls Surprises, 1990-2007



(b) Nonfarm Payrolls Surprises, 2008-2012



Exchange Rate

Cross-currency arbitrage:

$$s_t = -(i_t - i_t^*) + E_t s_{t+1} + \psi_t,$$

$$q_t \equiv s_t + p_t^* - p_t$$

$$q_t = -(i_t - i_t^*) + E_t(\pi_{t+1} - \pi_{t+1}^*) + E_t q_{t+1} + \psi_t.$$

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Solving forward gives:

$$q_t = E_t \sum_{j=0}^{\infty} \left[-(i_{t+j} - i_{t+j}^*) + (\pi_{t+j+1} - \pi_{t+j+1}^*) + \psi_{t+j} \right] + \bar{q}.$$