

# Effects of Changing Monetary and Regulatory Policy on Money Markets

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# Motivation

- The financial crisis and the policy response changed the landscape for monetary policy implementation in the U.S.
- Money market rates at the Effective Lower Bound (ELB) for 7 years
- Fed expanded its toolkit to enhance monetary control
- Changing regulatory environment created new incentives money market participants

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- Traditional approach: Adjust reserve balances through OMOs and move the effective federal funds rate (FFR) toward the target
  - Worked seamlessly before the global financial crisis
- Reserve balances increased above \$800 billion by the end of 2008 from an average of \$10 billion in 2007
  - Reserves around \$2.5 trillion now

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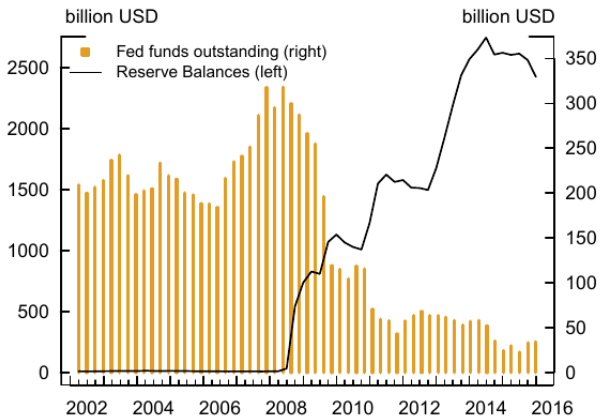
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# Bank Reserves and Federal Funds



## Changing Monetary Policy Framework

- The Fed introduced interest on reserves (IOR) as a new policy tool in 2008
- Incentives for banks to lend federal funds at rates below IOR were largely eliminated
  - Fed funds volume declined substantially
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- To enhance monetary control, the Fed introduced the ON RRP facility as a supplementary tool in September 2013
  - Fed borrows cash from eligible counterparties in exchange for Treasury securities in its portfolio
  - Daily offerings at a pre-announced rate to a broad set of institutions including MMFs



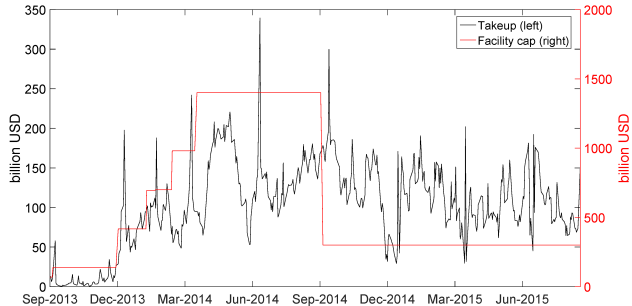
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# ON RRP Operations



## Changing Regulatory Landscape

- Declining leverage of securities broker-dealers and increased risk aversion (Adrian et al. (2013))
- Basel III capital and liquidity reforms
  - Liquidity Coverage Ratio (LCR) and Leverage Ratio requirements
- FDIC assessment base change
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- How are the new regulations affecting market dynamics, especially on financial reporting days?
- What are the effects of the ON RRP facility on comovement and volatility of rates?

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## Related Literature

- Afonso et al. (2011) on fed funds market; Copeland et al. (2014), Gorton and Metrick (2012) on repo market.
- Yoldas and Senyuz (2015) focus on a longer horizon including the crisis and identify funding pressure points.
- Spindt and Hoffmeister (1988), Griffiths and Winters (1995), Hamilton (1996), Carpenter and Demiralp (2006), Judson and Klee (2010) on effects of calendar days

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# Data

- Two sub-samples

- Pre-crisis: January 2, 2001 - July 31, 2007
- ELB: December 17, 2008 - August 28, 2015

- Four overnight money market interest rates

- Effective Federal Funds Rate (EFFR) - FRBNY
- Eurodollar Rate (EDR) - FRBNY and Wrightson ICAP
  - Data provided with Libor for the pre-crisis period - Bloomberg
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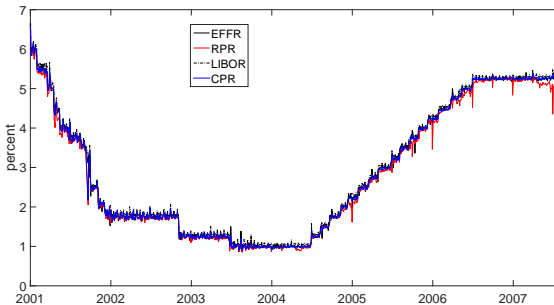
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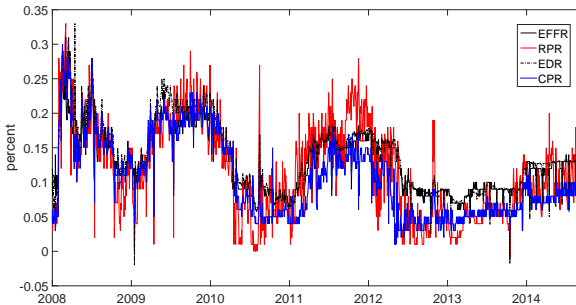
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# Overnight Money Market Interest Rates: 2001-2007





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# The Models

- Pre-crisis VEC Model:

$$\Delta y_t = A d_t + \beta \Delta TFFR_t + \sum_{j=1}^p \Phi_j \Delta y_{t-j} + \Theta z_{t-1} + \epsilon_t, \quad (1)$$

- $d_t$  is a vector of calendar effects
- $z_t$  is a vector of error correction terms
- $\epsilon_t$  is a zero-mean martingale difference vector process
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## Modeling Volatility and Correlation

- Let  $E(\epsilon_t \epsilon_t' | \Omega_{t-1}) = H_t$

$$H_t = D_t R_t D_t, \quad (3)$$

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$$h_{it} = \omega_i + \tau_i \epsilon_{i,t-1}^2 + \delta_i h_{i,t-1} + \lambda_{i,1} I_{m,t} + \lambda_{i,2} I_{q,t}, i = 1, \dots, 4, \quad (4)$$

- The correlation matrix  $R_t$

$$R_t = I_{m,t} R_m + I_{q,t} R_q + (1 - I_{m,t} - I_{q,t}) R_n, \quad (5)$$

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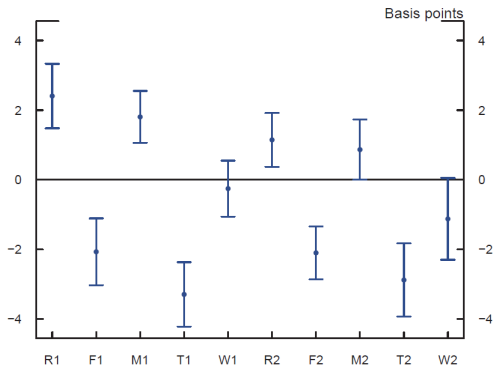
## VEC: Precrisis

	EFFR	RPR	LIBOR	CPR
Autoregressive terms (sum)				
EFFR	0.947 (0.00)	0.449 (0.00)	0.345 (0.00)	0.521 (0.00)
RPR	0.033 (0.39)	0.694 (0.00)	0.010 (0.72)	0.001 (0.98)
LIBOR	0.016 (0.91)	-0.125 (0.41)	0.546 (0.00)	-0.091 (0.43)
CPR	0.005 (0.97)	-0.021 (0.92)	0.099 (0.21)	0.570 (0.00)

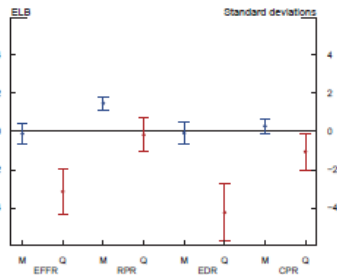
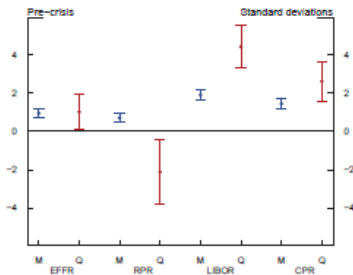
# VAR: ELB

	EFFR	RPR	EDR	CPR
Autoregressive terms (sum)				
EFFR	0.911 (0.00)	0.107 (0.21)	0.223 (0.00)	0.153 (0.02)
RPR	0.032 (0.00)	0.809 (0.00)	0.014 (0.29)	-0.011 (0.47)
EDR	-0.024 (0.53)	0.048 (0.50)	0.705 (0.00)	0.000 (1.00)
CPR	0.036 (0.01)	0.054 (0.14)	0.069 (0.00)	0.881 (0.00)

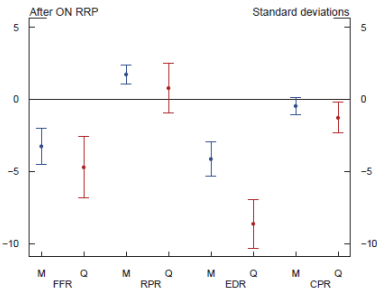
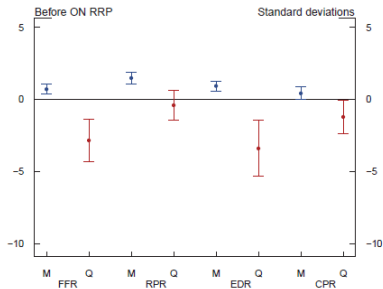
# Reserve Maintenance Effects on EFFR:Pre-Crisis



# Calendar Day Effects on Money Market Rates

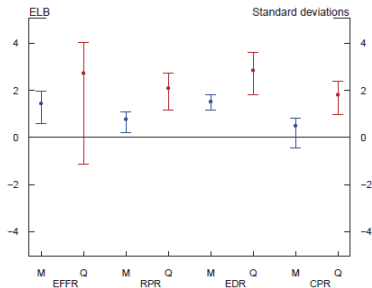
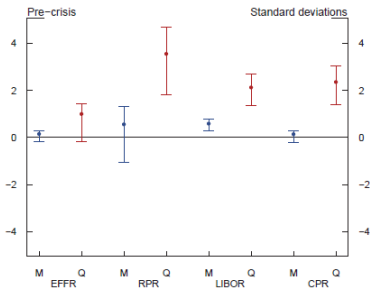


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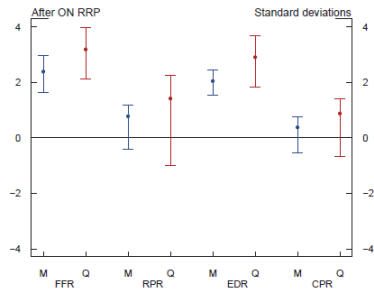
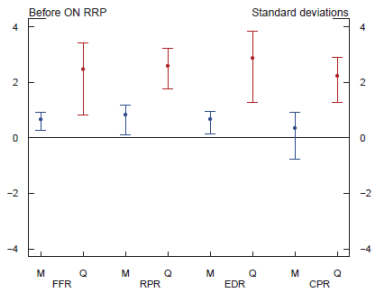




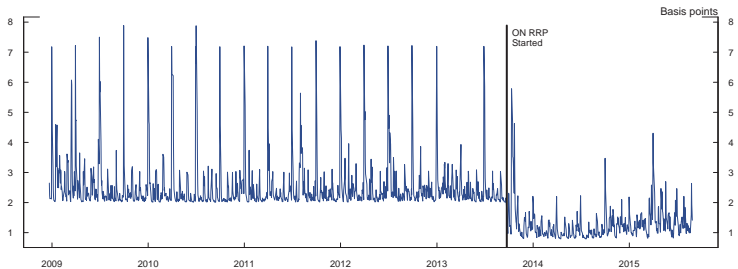
# Calendar Day Effects on Rate Volatility



# Calendar Day Effects on Rate Volatility: ELB



# RP Volatility and ON RRP



## Correlations of VAR Residuals

	Pre-crisis			ELB		
	RPR	LIBOR	CPR	RPR	EDR	CPR
Normal times	0.490 (0.00)	0.586 (0.00)	0.614 (0.00)	0.457 (0.00)	0.545 (0.00)	0.373 (0.00)
Month-end	0.421 (0.04)	0.246 (0.47)	0.341 (0.22)	0.301 (0.19)	0.879 (0.00)	0.395 (0.37)
Quarter-end	0.348 (0.30)	0.334 (0.23)	0.362 (0.32)	-0.056 (1.00)	0.564 (0.03)	0.360 (0.29)

## Concluding remarks

- At the ELB, FFR continued to be an anchor for the unsecured rates but transmission to RPR is hampered
  - Weaker co-movement of EFFR with other rates
  - Day-of-maintenance-period effects on the FFR have largely disappeared
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