

Evaluating Central Banks' Tool Kit: Past, Present, and Future

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Monetary Policy

Before Great Recession

- ▶ Central banks focus on short term, interbank rates

ZLB

- ▶ Central banks resort to unconventional policies
 - ▶ Quantitative easing (QE)
 - ▶ Forward guidance (FG)
 - ▶ Negative interest rate policy (NIRP)

Our paper: compare all these policies and study their interactions in a unified framework

Contributions

Literature: mainly in piecemeal fashion

One main contribution: study all unconventional tools together

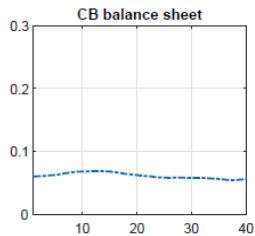
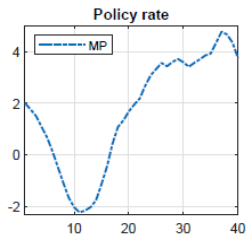
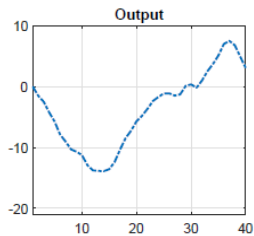
- ▶ Two channels for NIRP: forward guidance and banking
- ▶ New timing assumption for FG: no “puzzle”
- ▶ Novel endogenous rule for QE

Results

- ▶ In principal, all of QE, FG, NIRP can mimic a conventional rate cut
- ▶ The requisite FG and NIRP interventions are implausibly large
- ▶ QE seems the most promising tool

Main Takeaways

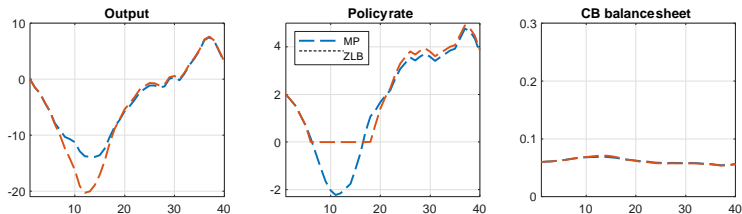
Simulation: Great Recession



- ▶ Output decreases by over 10%
- ▶ Lower policy rate to -2%

Main Takeaways

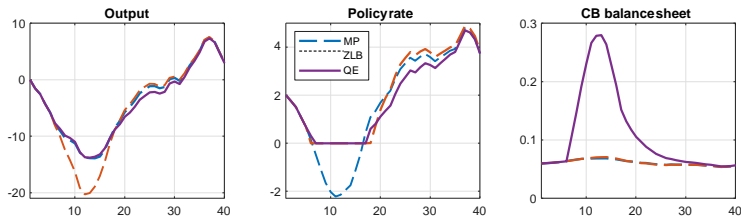
Simulation: Great Recession



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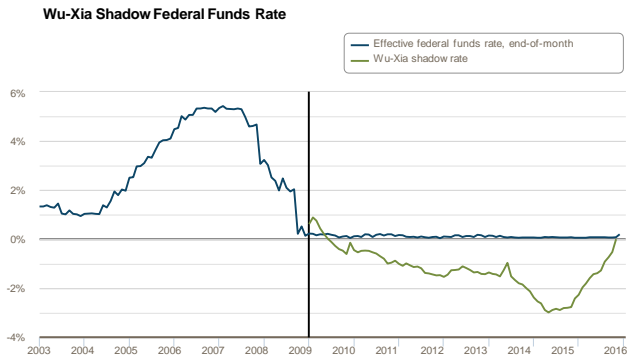
Main Takeaways

Simulation: Great Recession



- ▶ QE mitigates the effects of the binding ZLB
- ▶ QE1-QE3 is equivalent to 2% decline in the policy rate

Shadow Rate



Sources: Board of Governors of the Federal Reserve System and Wu and Xia (2015)

- ▶ Empirically, unconventional monetary policy has lowered the “shadow” fed funds rate by 3%.
- ▶ Our model implies 2/3 of the drop can be attributed to QE

Contributions: Future

But, large balance sheet has consequences

- ▶ Balance sheet normalization (QT): has impact for the efficacy of QE
- ▶ NIRP is less effective the larger the balance sheet
- ▶ First attempt at endogenizing an effective lower bound

Outline

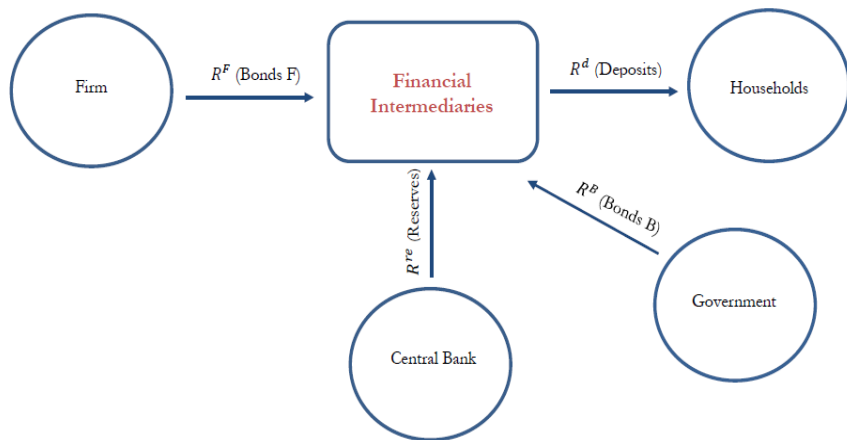
1. Model and (Un)conventional monetary policy tools
2. Comparing Alternative Policies
3. Endogenous QE and the Great Recession
4. Future Issues

Model

Medium-scale DSGE model

- (a) Households
- (b) *Financial Intermediaries*
- (c) *Production*
- (d) Fiscal authority
- (e) *Central Bank*: interest-bearing reserves

Debt Instruments and Market Segmentation



Four types of debt instruments in our model

- ▶ **Short term:** deposits (R^d) and reserves (R^{re})
- ▶ **Long term:** private (R^F) and government (R^B) perpetual bonds (Woodford, 2001)

Monetary Policy

Long rate = expectation + risk premium

Conventional Policy

$$\text{Long rate} = \underbrace{\text{expectation}}_{\text{Conventional}} + \text{risk premium}$$

Conventional: works on the short rate **today**

$$\ln R_t^{TR} = \rho_r \ln R_{t-1}^{TR} + \text{Taylor rule} + \varepsilon_{r,t}$$

Forward Guidance

$$\text{Long rate} = \underbrace{\text{expectation}}_{FG} + \text{risk premium}$$

FG: works on the expected future short rate

$$\ln R_t^{TR} = \rho_r \ln R_{t-1}^{TR} + \text{Taylor rule} + \gamma \varepsilon_{r,t}$$

▶ ZLB

$$\ln R_t^d = \ln R_t^{re} = \max \left\{ 0, \ln R_t^{TR} \right\}$$

▶ Timing assumption:

- ▶ facilitates comparison with NIRP
- ▶ mitigates “forward guidance puzzle”

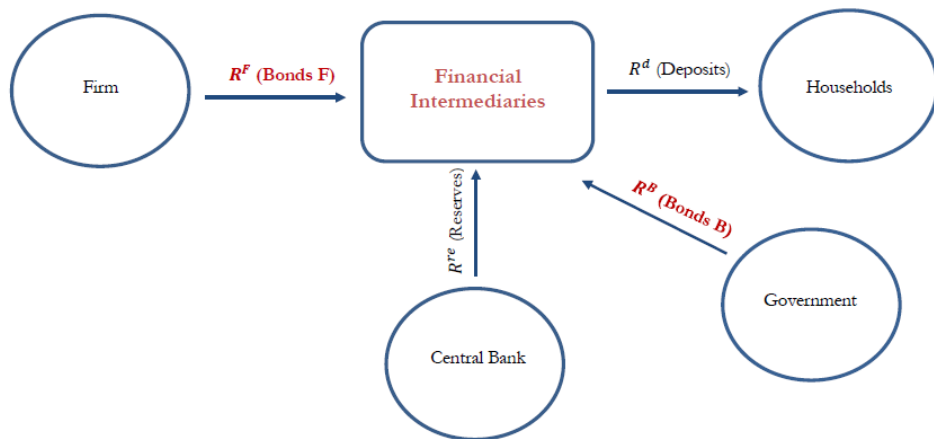
▶ $\gamma \in [0, 1]$: credibility

QE

“The problem with QE is it works in practice but it doesn't work in theory” - Bernanke

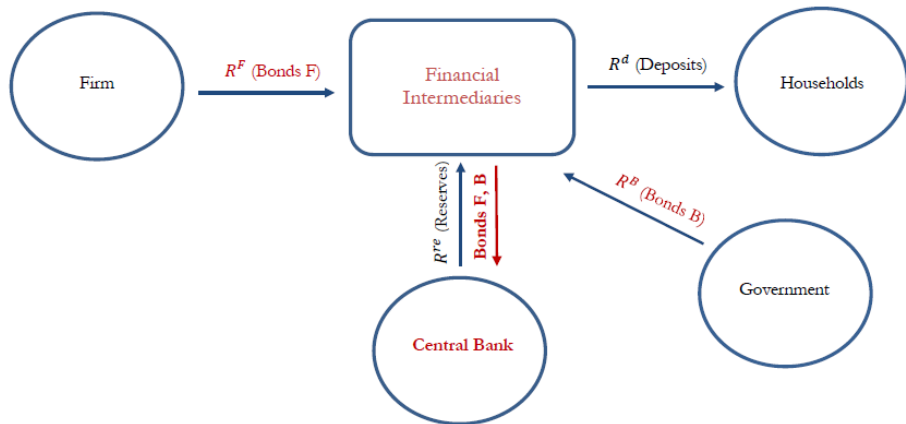
$$\text{Long rate} = \text{expectation} + \underbrace{\text{risk premium}}_{\text{QE}}$$

Constraints



- ▶ Leverage constraint (Gertler and Karadi 2011, 2013): $R^F, R^B > R^d$
- ▶ Loan in advance constraint (Carlstrom, Fuerst and Paustian 2017): real effect

QE



- ▶ Ease leverage constraint and lowers excess return
- ▶ Ease loan in advance constraint on firm: stimulate investment

NIRP

$$\text{Long rate} = \underbrace{\text{expectation}}_{FG} + \underbrace{\text{risk premium}}_{\text{Banking}}$$

NIRP

NIRP

$$\begin{aligned}R_t^{re} &= R_t^{TR} \\ \ln R_t^d &= \max \left\{ 0, \ln R_t^{TR} \right\}\end{aligned}$$

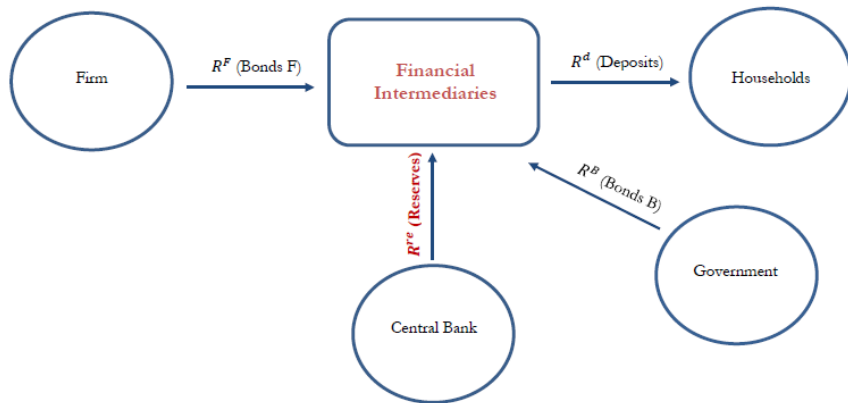
FG channel

- ▶ The same as FG: change **future** deposit rate

$$\ln R_t^{TR} = \rho_r \ln R_{t-1}^{TR} + \textit{Taylor rule} + \varepsilon_{r,t}$$

- ▶ Differently than FG: NIRP involves an observable action R_t^{re}

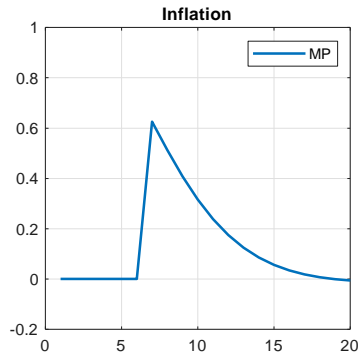
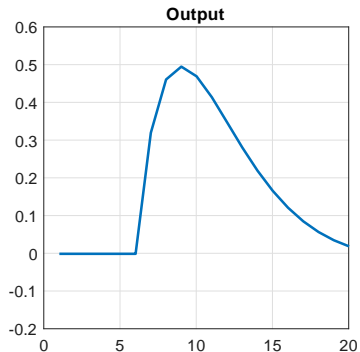
Banking Channel: Contractionary



Banking channel is like QE in reverse: it tightens FI's leverage constraint

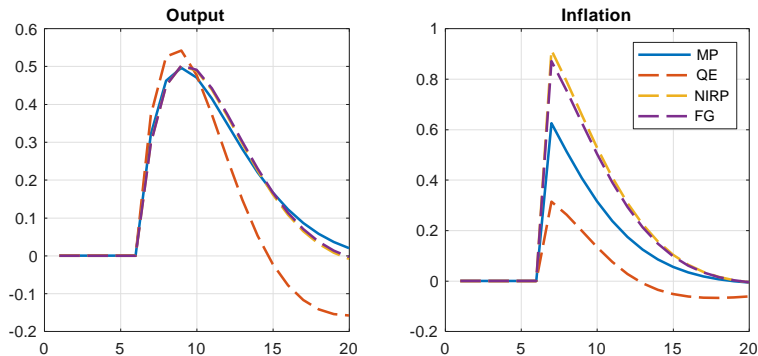
$$N_t = (R_{t-1}^{re} - R_{t-1}^d) RE_{t-1} + \dots$$

Conventional Monetary Policy



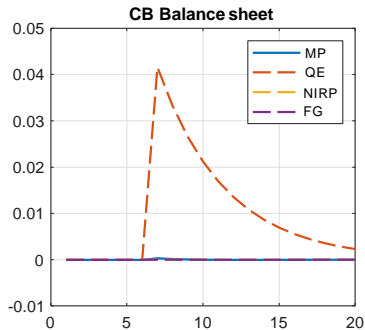
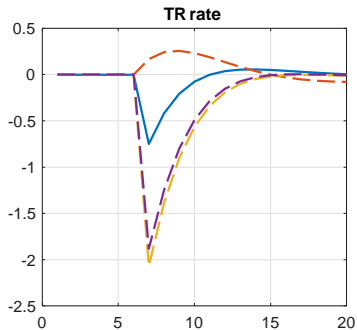
- ▶ 100 basis point conventional shock

Unconventional Monetary Policy



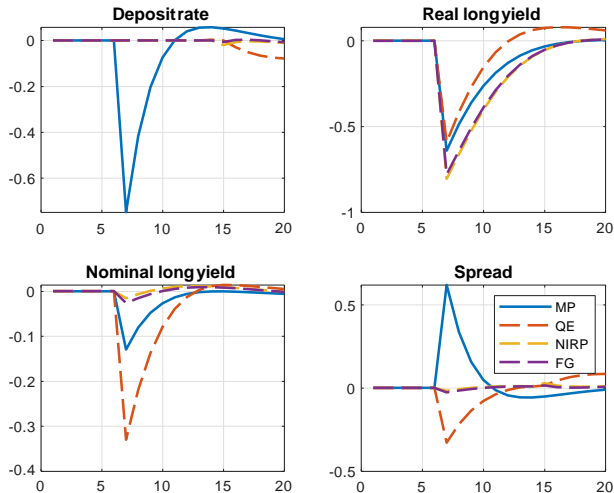
- ▶ Unconventional policies at the ZLB
- ▶ Choose shocks to match output responses

Shock Sizes



- ▶ FG and NIRP: require shock about twice the size of conventional policy shock
- ▶ QE: 4 percent increase in balance sheet

Yield Curve



- ▶ MP: increase spread; QE: decrease spread
- ▶ Real long yield similar across policies

Summary

- ▶ All of QE, FG, NIRP can mimic a conventional rate cut
- ▶ The requisite FG and NIRP interventions are large
- ▶ FG depends on a central bank's credibility
- ▶ Implementing large NIRP implausible in practice

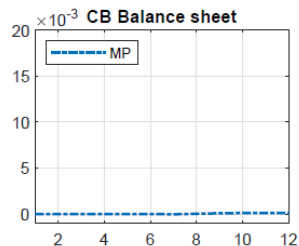
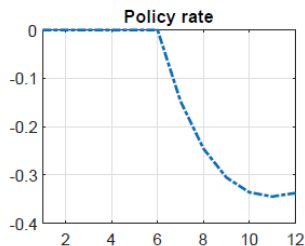
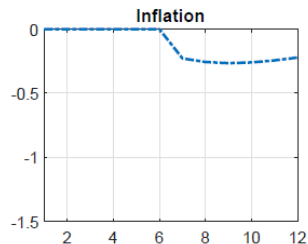
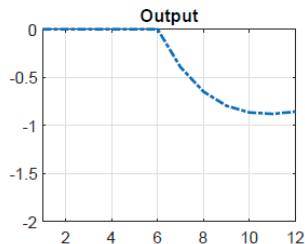
QE seems the most promising tool in our model as well as in real world

Endogenous QE

Propose Taylor type rule for QE

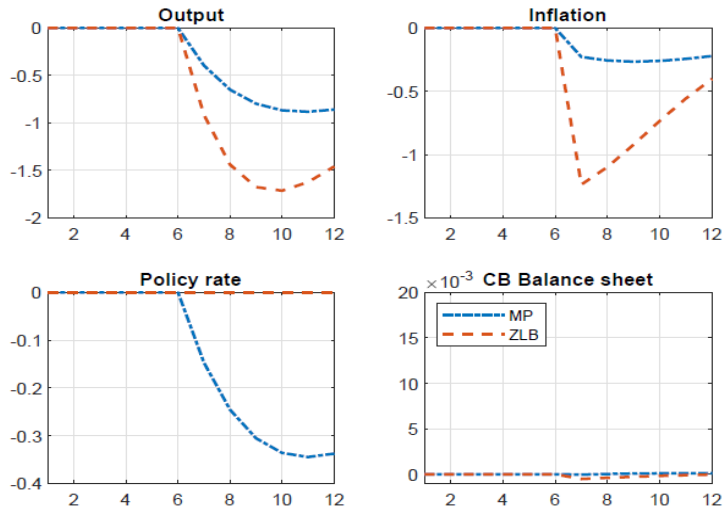
- ▶ endogenous response at the ZLB
- ▶ exogenous otherwise

Liquidity Shock



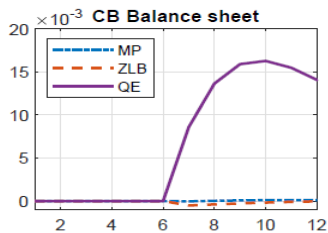
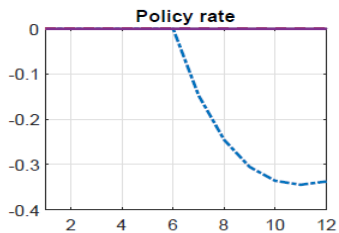
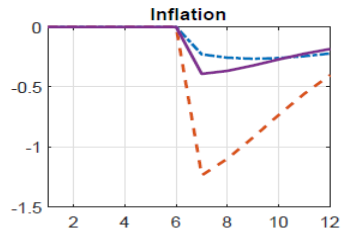
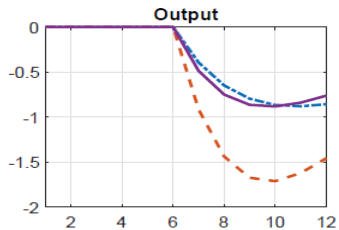
- ▶ MP: lower output and inflation, lower policy rate

Liquidity Shock



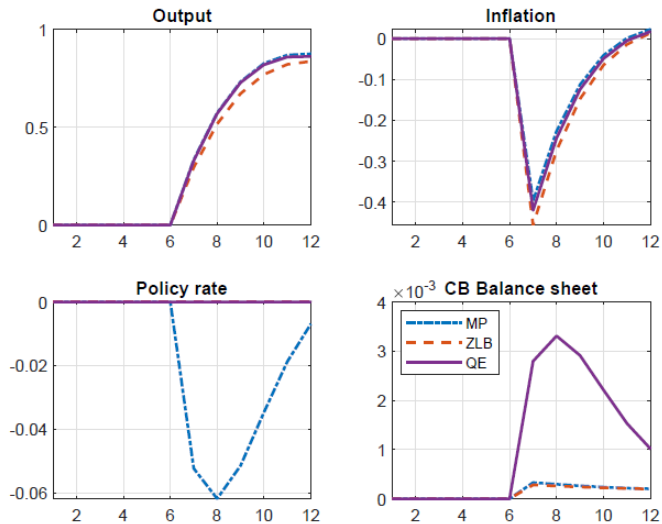
► ZLB: exacerbates these effects

Liquidity Shock



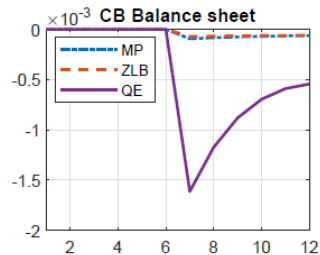
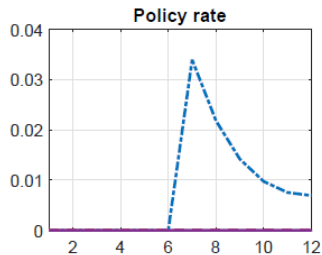
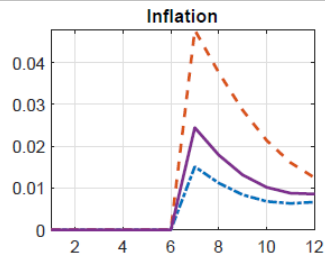
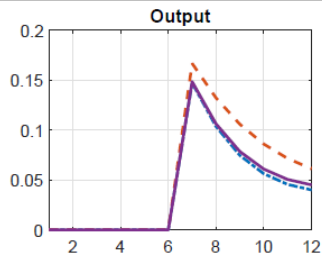
► Endogenous QE: similar to MP

Productivity Shock



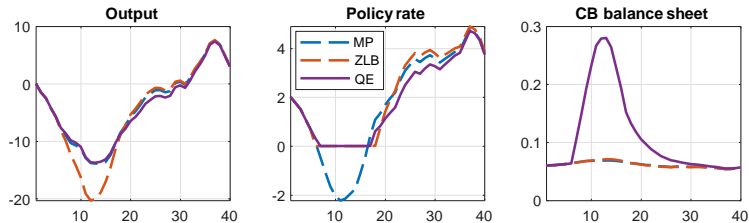
► Endogenous QE: similar to MP

Government Spending Shock



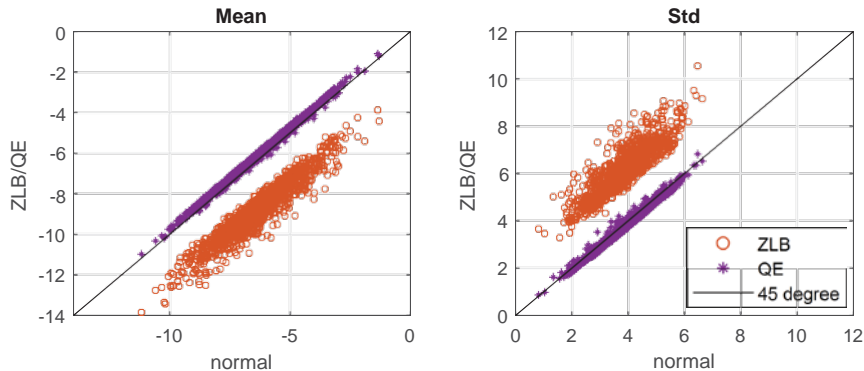
► Endogenous QE: similar to MP

Great Recession



- ▶ Endogenous QE mitigates the effects of the binding ZLB
- ▶ QT is contractionary
- ▶ policy rate: -2%, 2/3 of Wu and Xia's (2016) shadow rate.
- ▶ Balance sheet: 25% of GDP, about post-QE3

Simulation

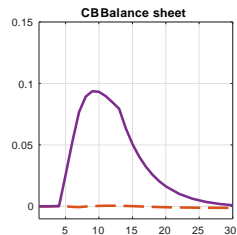
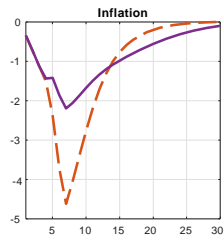
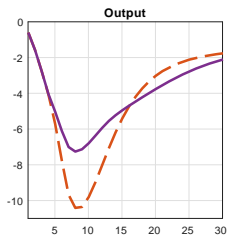


1000 draws

- ▶ endogenous QE is highly effective

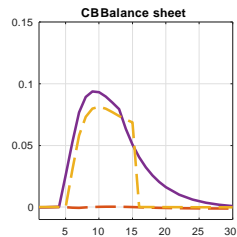
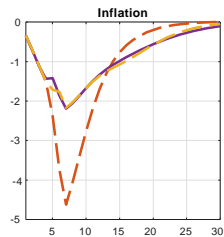
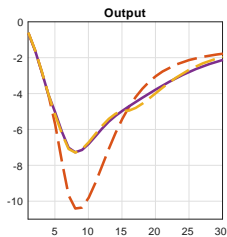
Quantitative Tightening

Benchmark



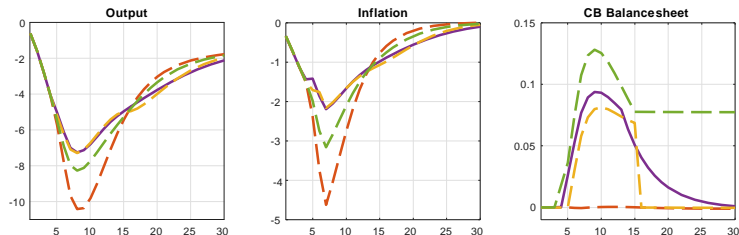
Quantitative Tightening

Immediate selloff after the ZLB



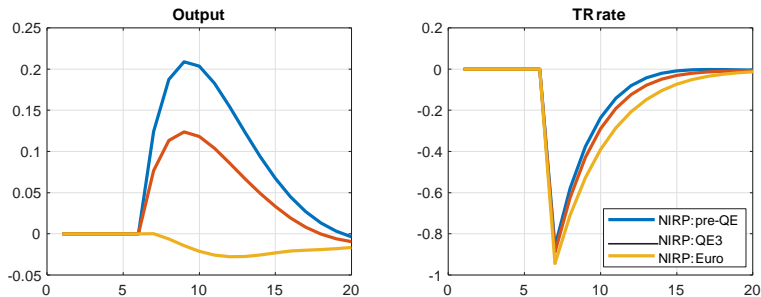
Quantitative Tightening

Carry large balance sheet forward



QT has an important impact for the economy during the ZLB.

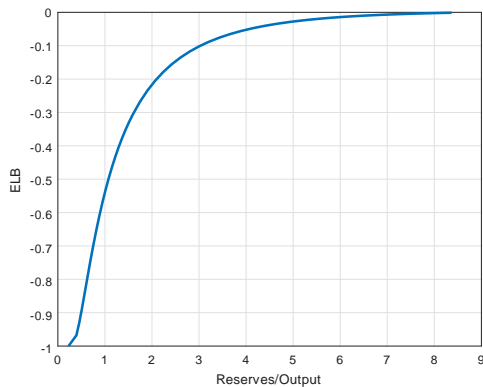
NIRP and the Balance Sheet



- ▶ Banking channel: NIRP less effective the larger the balance sheet
- ▶ Timing of unconventional policy interventions matters

ELB on Policy Rate

What is the lowest policy rate that the constraint FIs don't want to voluntarily shut down?



We provide a useful first benchmark to endogenize ELB

Conclusion

We develop quantitative DSGE model to study all three types of unconventional policies and interactions

- ▶ Two channels for NIRP: forward guidance and banking channel
- ▶ New timing assumption on FG: no puzzle
- ▶ Endogenous rule for QE neutralizes effects of ZLB

Issues going forward

- ▶ QT has an important impact for the economy during the ZLB
- ▶ NIRP: size of balance sheet matters
- ▶ The order of different policies matter
- ▶ Larger balance sheet implies a tighter ELB