

# Escaping the Great Recession<sup>1</sup>

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<sup>1</sup>The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Federal Reserve Bank of Chicago or any other person associated with the Federal Reserve System. ▶ ☰ 🔍 ↺

# The Great Recession and policy interventions

The recent recession has induced:

- 1 Significant changes in the conduct of monetary policy, with interest rates stuck at the **zero lower bound**
- 2 A debate on the best way to mitigate the consequences of a recession when at the zero-lower-bound:
  - Robust fiscal intervention combined with a reduced emphasis on inflation stabilization
  - Reluctance to explicitly abandon macroeconomic policies that have been successful before the recession

# Model setup

We model an economy in which:

- 1 **Recurrent** large negative demand shocks can force the economy to the zero lower bound
- 2 Two policy combinations characterize policy makers' behavior:
  - **Monetary-led policy mix**: The fiscal authority strongly reacts to debt and the monetary policy rule satisfies the Taylor principle
  - **Fiscally-led policy mix**: The fiscal authority disregards the level of debt and the Taylor principle does not hold

Agents are aware of the possibility of...

- 1 ...zero lower bound episodes,
- 2 ...changes in policy makers' behavior,
- 3 ...and the link between the two

# Main results

- 1 Out of the zero bound the monetary-led regime leads to a stable macroeconomic environment
- 2 At the zero bound **the policy makers' dilemma** arises,
  - the monetary-led policy mix would exacerbate the recession while keeping the long-run macroeconomic volatility low
  - the fiscally-led policy mix would mitigate the recession while raising the long-run macroeconomic volatility
- 3 This dilemma could be **resolved** by committing to **inflate away only the portion of debt resulting from the recession itself**
- 4 **High uncertainty is an inherent implication of entering the zero lower bound, whereas deflation is not**

## Related literature

- Zero-Lower-Bound literature: Benhabib, Schmitt-Grohe, and Uribe (2001, 2002), Eggertsson and Woodford (2003), Eggertsson (2006), Eichenbaum *et al.* (2011), Correia *et al.* (2012), Farhi and Werning (2012)
- Zero-Lower-Bound in DSGE: Aruoba and Schorfheide (2013), Gust, Lopez-Salido, and Smith (2013)
- Monetary/fiscal policy interaction: Sargent and Wallace (1981), Leeper (1991), Sims (1994, 2011), Woodford (1994, 1995, 2001), Cochrane (1998, 2001), Schmitt-Grohe and Uribe (2000)

# Households and firms ▸ Details

- Linearized Euler Equation:

$$y_t = \tilde{E}_t(y_{t+1}) - (R_t - \tilde{E}_t(\pi_{t+1})) + d_t - \tilde{E}_t(d_{t+1}) \quad (1)$$

- Expectation augmented Phillips curve:

$$\pi_t = \beta \tilde{E}_t(\pi_{t+1}) + \kappa(y_t - z_t) \quad (2)$$

- Stochastic processes of the shocks:

$$d_t = \bar{d}_{\zeta_t^d} \quad (3)$$

$$z_t = \rho_z z_{t-1} + \sigma_z \epsilon_{z,t} \quad (4)$$

where  $\epsilon_{z,t} \sim N(0, 1)$ , and the preference shock  $\bar{d}_{\zeta_t^d}$  can assume two values, high or low ( $\bar{d}_h$  and  $\bar{d}_l$ ).

- $\zeta_t^d$  evolves according to the transition matrix  $H^d$ :

$$H^d = \begin{bmatrix} p_{hh} & 1 - p_{ll} \\ 1 - p_{hh} & p_{ll} \end{bmatrix}$$

# Policy makers

▸ Details

- Linearized government budget constraint:

$$b_t = \beta^{-1} b_{t-1} + b\beta^{-1} (R_{t-1} - \pi_t - \Delta y_t) - s_t$$

- Fiscal rule (net lump-sum taxes):

$$\begin{aligned} s_t &= \delta_{b, \zeta_t^p} b_{t-1} + \delta_y (y_t - z_t) + \sigma_x x_t \\ x_t &= \rho_x x_{t-1} + \epsilon_{x,t}, \quad \epsilon_{x,t} \sim N(0, 1) \end{aligned}$$

- Monetary rule:

- ① Out of the zero lower bound ( $\zeta_t^d = h$ ):

$$R_t = \rho_R R_{t-1} + (1 - \rho_R) \left( \psi_{\pi, \zeta_t^p} \pi_t + \psi_y [y_t - z_t] \right) + \sigma_R \epsilon_{R,t}$$

- ② At the zero lower bound ( $\zeta_t^d = l$ ):  $R_t = -\log(R)$

# Policy Regime Changes ▸ Back

- Monetary-led policy mix (*Ricardian*):

$$\psi_{\pi} \left( \zeta_t^p = M; \zeta_t^d = h \right) = \psi_{\pi}^M = 2 > 1$$

$$\delta_b \left( \zeta_t^p = M; \zeta_t^d = h \right) = \delta_b^M = .03 > \beta^{-1} - 1$$

- Fiscally-led policy mix (*NonRicardian*):

$$\psi_{\pi} \left( \zeta_t^p = F; \zeta_t^d = h \right) = \psi_{\pi}^F = .8 < 1$$

$$\delta_b \left( \zeta_t^p = F; \zeta_t^d = h \right) = \delta_b^F = 0 < \beta^{-1} - 1$$

- Zero-lower-bound (ZLB) Regime :

$$\zeta_t^d = l \longrightarrow R_t = -\log(R)$$
$$\delta_b \left( \zeta_t^d = l \right) = \delta_b^F = 0 < \beta^{-1} - 1$$

# Information Set

- Agents observe the history of endogenous variables and the history of shocks
- It is assumed that agents **do not directly observe the policy mix**  $\tilde{\zeta}_t^P \in \{M, F\}$

⇒ **Out of the ZLB**, agents **infer** the policy mix  $\tilde{\zeta}_t^P$

⇒ **At the ZLB**, agents **cannot observe** the policy mix  $\tilde{\zeta}_t^P$  that would have occurred if the demand shock was not realized

- In a sense, the central bank is **forced to the ZLB regime**, which looks like a radical fiscally-led policy mix

# Parameter Calibration

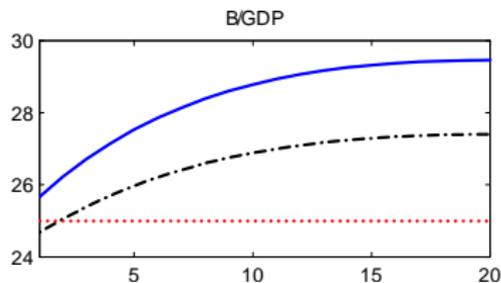
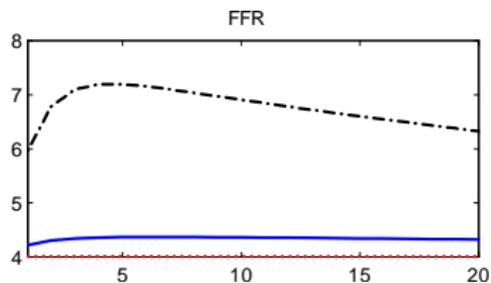
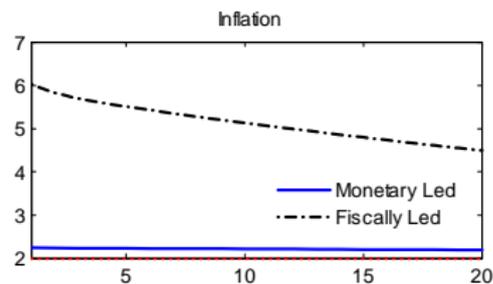
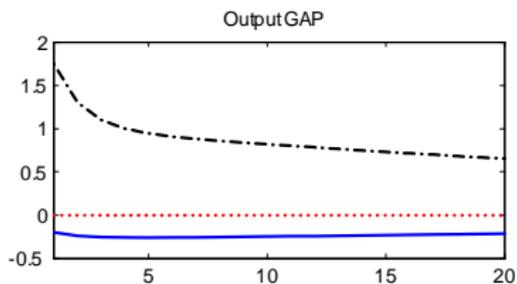
Parameter	Value	Parameter	Value	Parameter	Value
$\psi_{\pi}^M$	0.80	$\psi_y$	0.10	$100\sigma_R$	0.20
$\psi_{\pi}^F$	2.00	$\rho_R$	0.75	$100\sigma_x$	0.50
$\delta_b^M$	0.03	$\delta_y$	0.50	$100\sigma_z$	0.70
$\delta_b^F$	0	$\rho_z$	0.90	$100\sigma_d$	0
$Z_M, Z_F$	0	$\rho_x$	0.90	$\bar{d}_h$	0
$Z_Z$	1	$b$	1.00	$\bar{d}_l$	-.1
$p_{MM}$	99%	$\kappa$	0.035	$p_{hh}$	98%
$p_{FF}$	99%	$\beta$	0.995	$p_{ll}$	80%

# Road map

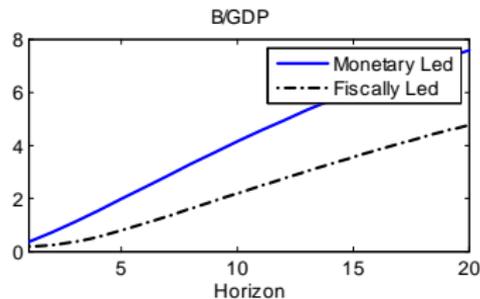
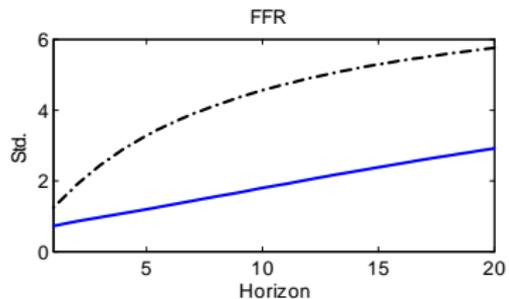
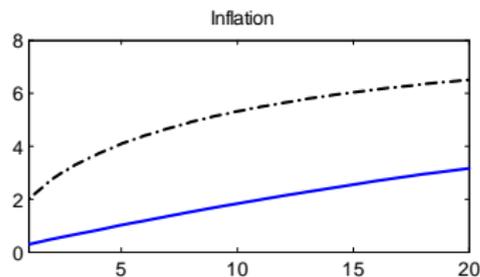
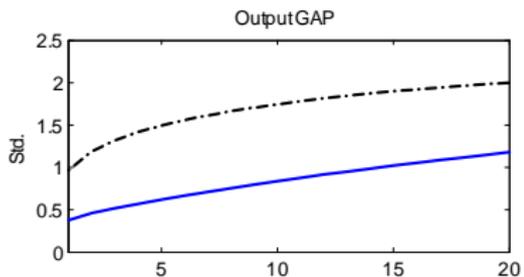
We will illustrate...

- ① why policy makers might favor the monetary-led regime when **out of the ZLB**
- ② why policy makers may be induced to abandon the monetary-led regime **at the ZLB**  $\Rightarrow$  Policy makers' dilemma
- ③ a possible **resolution of the policy makers' dilemma**

# Out of the ZLB - Primary Deficit Shocks



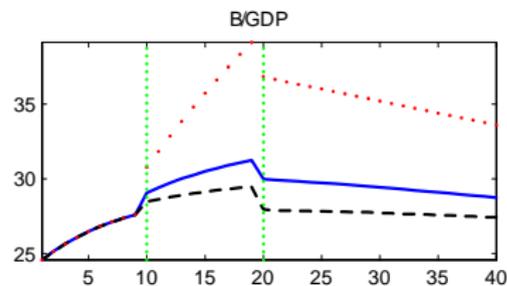
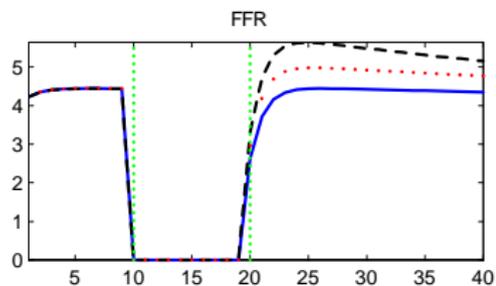
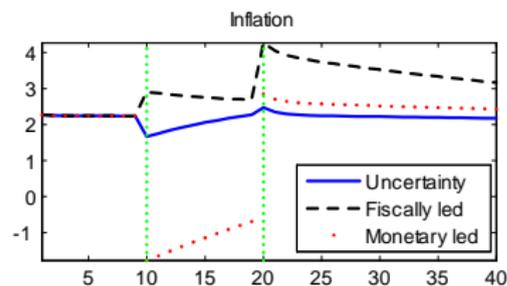
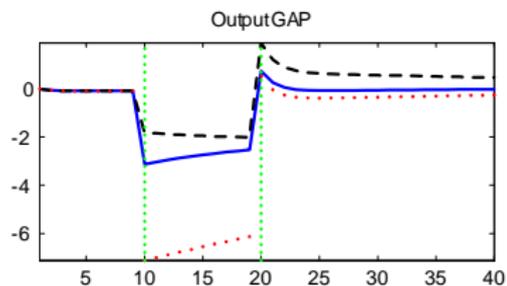
# Out of the ZLB - Macroeconomic Volatility



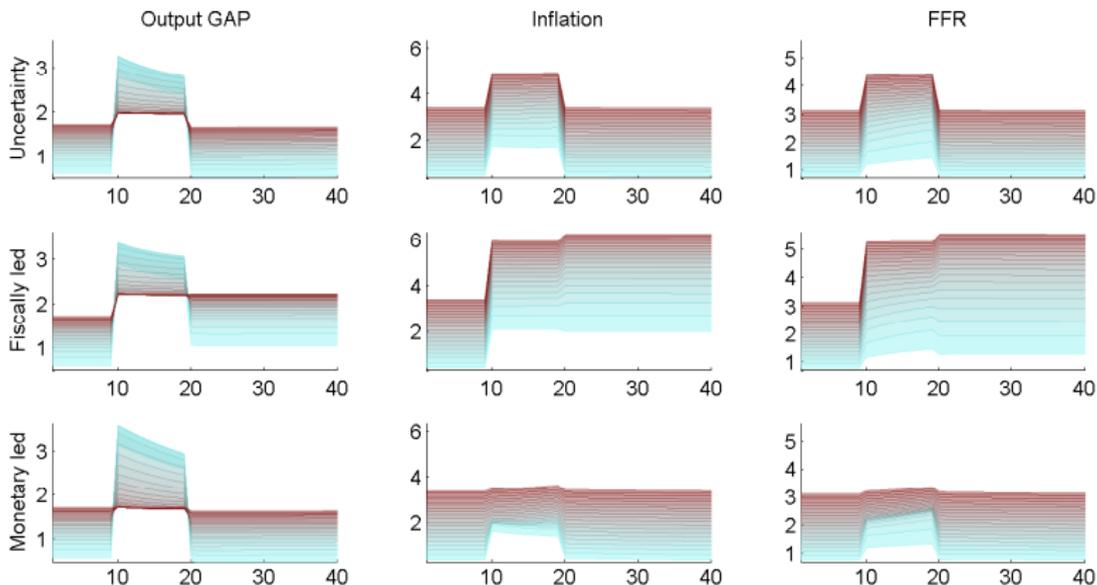
# Effects of Policies at the ZLB

- Assume that the economy enters the ZLB with an above-steady-state stock of debt and consider three strategies:
  - ① Announcing that the *monetary-led policy will be preserved*
  - ② Announcing that the *monetary-led policy will be abandoned*
  - ③ *No announcement* is made and *agents attach equal probabilities* to the two exit strategies above

# Recession and Zero Lower Bound



# Macroeconomic Volatility at the Zero Lower Bound



# Addressing the Policymaker's Dilemma

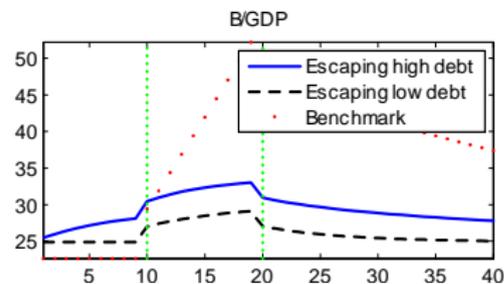
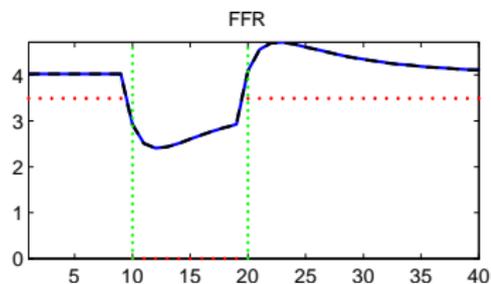
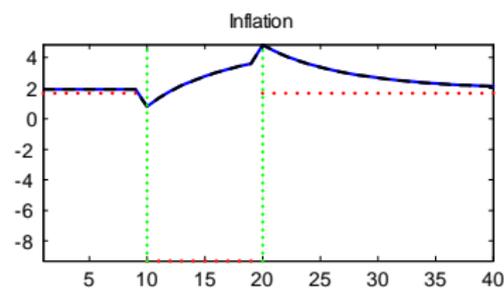
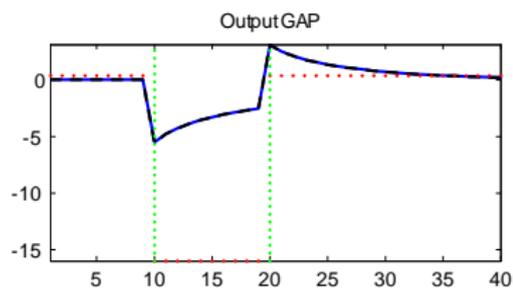
- Commitment to inflate away only the portion of debt resulting from demand shocks that lead to large recessions
  - Denote the debt and inflation of a **shadow economy** in which demand shocks are shut down as  $b_t^c$  and  $\pi_t^c$
  - Write the policy rules as

$$s_t = \delta_b^M b_{t-1}^c + \delta_b^F (b_{t-1} - b_{t-1}^c) + \delta_y (y_t - y_t^n) + x_t$$

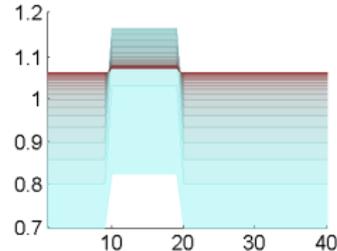
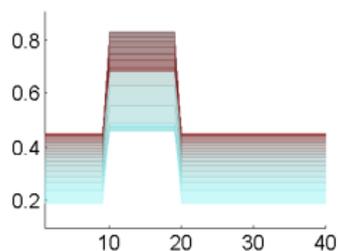
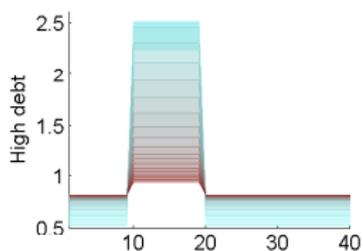
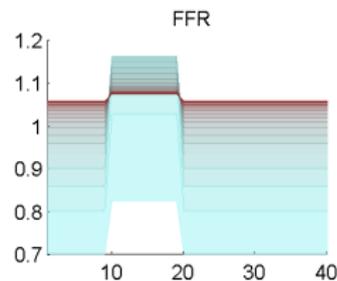
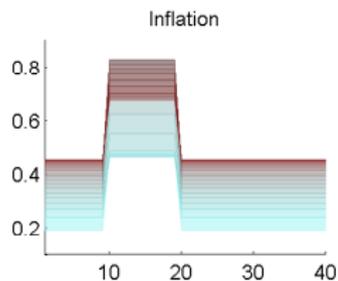
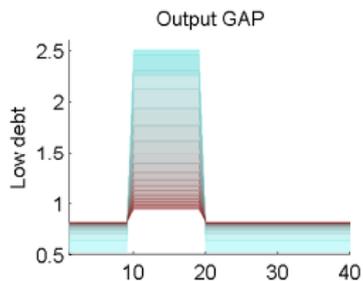
$$R_t = (1 - \rho_R) \left( \psi_\pi^M \pi_t^c + \psi_\pi^F (\pi_t - \pi_t^c) \right) + \dots$$

- Compare with outcomes when policymakers **always behave according to the monetary-led regime out of the ZLB**

## Alternative Strategy ▶ IRF learning ▶ IRF Perf Info



## Escaping the Great Recession ▶ IRF learning ▶ IRF Perf Info



# Why Does This Strategy Work?

- 1 *Automatic stabilizer*: This behavior determines an increase in short run expected inflation exactly when necessary
  - i.e., when the negative demand shock hits the economy
  
- 2 *Macroeconomic stability is retained after the recession*
  - Agents understand that the fiscally-led policy mix occurs only in response to shocks leading to *extraordinary recessions*

# Summary of the results

- 1 A DSGE model with **recurrent ZLB events**
- 2 The model highlights why policy makers...
  - are **reluctant to abandon fiscal discipline**
  - might be tempted to do so **to escape deep recessions**
- 3 Possible resolution of this policy dilemma:  
→ **Inflate away only debt accumulated *because* of the recession**
- 4 **Uncertainty is an implication of entering the ZLB; deflation is not**
- 5 **Methodological contribution:**  
→ **Modeling the ZLB while keeping the DSGE model tractable**

## Details about linearization [▶ Back](#)

Markov switching process for  $d_t$  represents a non-Gaussian shock

- 1 Compute the ergodic steady state  $d_{ss}$  for the demand shock  $d_t$
- 2 Verify that the ZLB is not binding at  $d_{ss}$
- 3 Linearize/loglinearize around the steady state
- 4 Use a VAR and a vector of dummy variables to model the Markov-switching process:

$$\begin{bmatrix} e_{1,t} \\ e_{2,t} \end{bmatrix} = \begin{bmatrix} p_{hh} & 1 - p_{ll} \\ 1 - p_{hh} & p_{ll} \end{bmatrix} \begin{bmatrix} e_{1,t-1} \\ e_{2,t-1} \end{bmatrix} + \begin{bmatrix} v_{1,t} \\ v_{2,t} \end{bmatrix}$$

where

$$e_t \in \{[1; 0], [0; 1]\}$$

$$v_t \in \{[1 - p_{hh}; p_{hh} - 1], [-p_{hh}; p_{hh}], [p_{ll}; -p_{ll}], [p_{ll} - 1; 1 - p_{ll}]\}$$

# Shock-Specific Policy Rules

## Problem

- Suppose the fiscal authority does not commit to repay the fraction of public debt resulting from preference shocks
- We would like to write the Taylor Rule as follows:

$$s_t = \delta_b^M b_{t-1}^c + \delta_b^F b_{t-1}^{nc} + \delta_y (y_t - y_t^n) + x_t$$

where  $b_t^c$  denotes debt due to all shocks but preference shocks and  $b_t^{nc}$  is debt only due to preference shocks

- **BUT** what is the law of motion for the two targets  $b_t^c$  and  $b_t^{nc}$ ?

# Shock-Specific Policy Rules

## Solution

- Conjecture that the ZLB is not binding  $\implies$  the model is linear
- Model linearity leads to three useful results:
  - 1 In equilibrium,  $b_t = \sum_{s=0}^{\infty} \phi_s L^s \varepsilon_t$  and  $b_t^c = \sum_{s=0}^{\infty} \tilde{\phi}_s L^s \varepsilon_t$ , where  $\phi_s(i_d) = 0$  for all  $s$
  - 2  $\phi_s(j) = \tilde{\phi}_s(i)$  if  $j = i$  and  $j \neq i_d$
  - 3  $b_t^{nc} = \sum_{s=0}^{\infty} (\phi_s - \tilde{\phi}_s) L^s \varepsilon_t = b_t - b_t^c$
- It follows that
  - $b_t^c$  is the public debt of a **shadow economy** in which preference shocks are shut down
  - The fiscal rule in the actual economy

$$s_t = \delta_b^M b_{t-1}^c + \delta_b^F (b_{t-1} - b_{t-1}^c) + \delta_y (y_t - y_t^n) + x_t$$

$$R_t = (1 - \rho_R) \left( \psi_{\pi}^M \pi_t^c + \psi_{\pi}^F (\pi_t - \pi_t^c) \right) + \dots$$

# Monetary/Fiscal Policy Mix [▸ Back](#)

Following Leeper (1991) we can distinguish four cases:

	Active Fiscal (AF)	Passive Fiscal (PF)
Active Monetary (AM)	No Solution	Determinacy
Passive Monetary (PM)	Determinacy	Indeterminacy

- Active Monetary Policy: Taylor principle is satisfied  
( $\psi_{\pi, \zeta_t^p} > 1$ )
- Passive Fiscal Policy: Taxes react strongly to debt  
( $\delta_{b, \zeta_t^p} > \beta^{-1} - 1 \rightarrow \beta^{-1} - \delta_{b, \zeta_t^p} < 1$ )

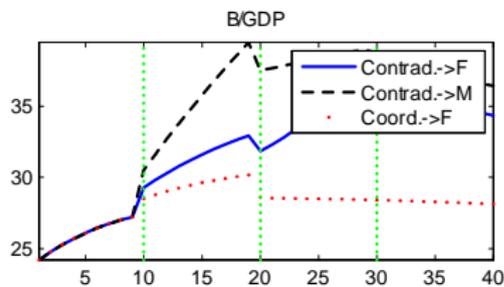
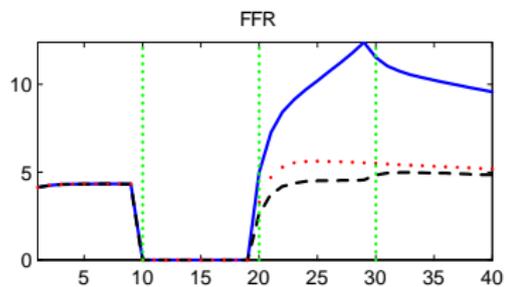
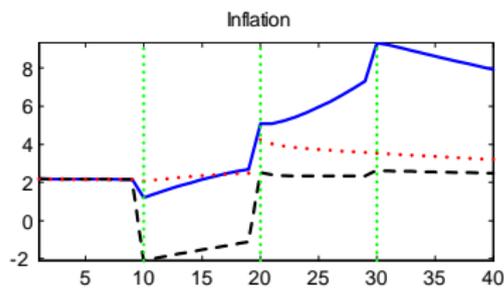
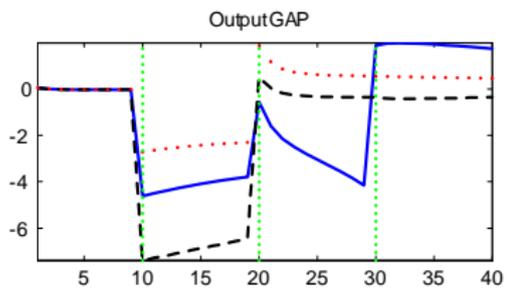
# Contradictory announcements

## Policy makers' signals can be contradictory

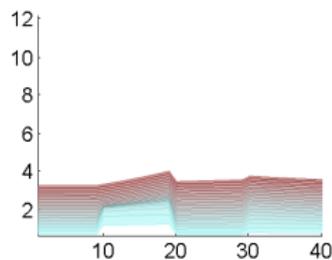
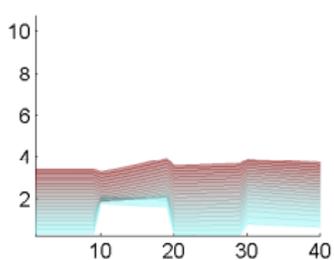
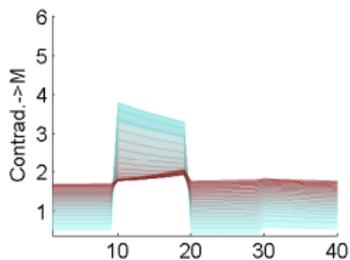
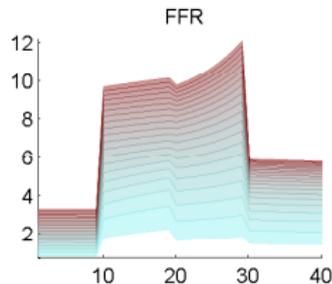
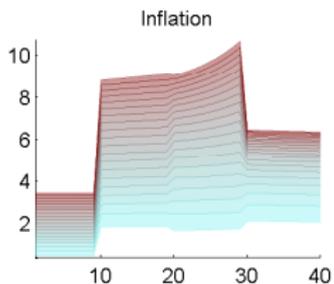
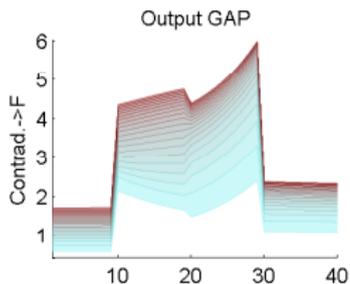
We assume that the economy enters the ZLB with an above steady state stock of debt and we consider three different scenarios:

- 1 Policy makers announce that the monetary-led regime will be abandoned
- 2 Fiscal authority → fiscal discipline will be abandoned  
Monetary authority → inflation stability will be preserved
  - 1 Conflict and agents expect fiscal authority to prevail
  - 2 Conflict and agents expect monetary authority to prevail

# Contradictory announcements



# Contradictory announcements



# Policymakers' Dilemma and Volatility at the ZLB

- 1 Announcing that monetary-led regime will prevail
  - 1 Recession and deflation in line with traditional view of the ZLB
  - 2 Post-crisis volatility goes back to the pre-crisis levels
- 2 Announcing that fiscally-led regime will prevail
  - 1 Inflation goes up and mitigates the recession
    - Debt accumulated during the crisis likely to be inflated away
  - 2 Post-crisis level of volatility rises as
    - As the recession is over, Taylor principle not satisfied and macroeconomy not insulated from fiscal shocks
- 3 Uncertainty regime leads to predictions in line with the data
  - Still no deflation at the ZLB
  - Higher volatility due to policy uncertainty and large macroeconomic effects of fiscal shocks

Backer, Bloom, and Davis (2013) and Kitsul and Wright (2013)