

Escaping the Great Recession¹

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¹The 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**
 - Standard new-Keynesian model would predict deflation (Bob Hall's puzzle)
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 reduction in the focus on inflation
 - Reluctance to explicitly abandon macroeconomic policies that have been successful in the past

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. The model accounts for the absence of deflation during the Great Recession as a result of policy uncertainty about how the rising stock of public debt will be stabilized
2. At the zero lower bound a **policy trade-off** arises...
 - Announcing that fiscal discipline will be abandoned greatly mitigates the recession, but...
 - ...it also jeopardizes long-run macroeconomic stability
3. Policymakers could **escape the Great Recession** by committing to **inflating away only the amount of debt that results from the recession itself**

Private sector

The representative household...

1. ...maximizes expected utility
2. ...is subject to a **discrete preference shock** $\bar{d}_{\zeta_t}^d$ (high or low).
The shock follows a two-state Markov-switching process with transition matrix H^d

The representative firm faces...

1. ...a downward sloping demand curve
2. ...price stickiness

Government: Monetary/fiscal policy mix

Monetary rule (linearized):

$$\begin{aligned} \tilde{R}_t = & \left[1 - Z_{\zeta_t^d} \right] \left[(1 - \rho_R) \left(\psi_{\pi, \zeta_t^p} \tilde{\pi}_t + \psi_{y, \zeta_t^p} [\hat{y}_t - \hat{y}_t^*] \right) + \right. \\ & \left. \rho_{R, \zeta_t^p} \tilde{R}_{t-1} + \sigma_R \epsilon_{R,t} \right] \\ & + Z_{\zeta_t^d} [\text{Zero Lower Bound}] \end{aligned}$$

Fiscal rule:

$$\tilde{\tau}_t = \rho_{\tau, \zeta_t^p} \tilde{\tau}_{t-1} + \left(1 - \rho_{\tau, \zeta_t^p} \right) \left[\delta_{b, \zeta_t^p} \tilde{b}_{t-1}^m + \dots \right] + \sigma_{\tau} \epsilon_{\tau,t}, \quad \epsilon_{\tau,t} \sim N(0, 1)$$

Government budget constraint + (simplified) fiscal rule:

$$\begin{aligned} \tilde{b}_t^m &= \beta^{-1} \tilde{b}_{t-1}^m + b^m \beta^{-1} \left(\hat{R}_{t-1,t}^m - \tilde{\pi}_t - \text{growth} \right) \\ &\quad - \tilde{\tau}_t + \text{spending} \\ \rightarrow \tilde{b}_t^m &= \left(\beta^{-1} - \delta_{b, \zeta_t^p} \right) \tilde{b}_{t-1}^m + \dots \end{aligned}$$

In and out of the zero lower bound

1. Out of the zero lower bound, two alternative policy regimes:

- **Monetary led policy mix** (AM/PF , $Z_{\zeta_t^d} = 0$):

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

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

- **Fiscally led policy mix** (PM/AF , $Z_{\zeta_t^d} = 0$):

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

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

2. Negative preference shock \rightarrow Zero lower bound policy mix :

$$Z_{\zeta_t^d} = 1 \rightarrow R_t \rightarrow \psi_z R^{-1}$$

$$\delta_b \left(\zeta_t^p = Z; \zeta_t^d = l \right) = \delta_{b, Z} = 0$$

Evolution of Policy Regimes In and Out the ZLB

- Out of the zero lower bound, policymakers' behavior evolves according to

$$H^P = \begin{bmatrix} p_{MM} & 1 - p_{FF} \\ 1 - p_{MM} & p_{FF} \end{bmatrix}$$

- Combine H^d with H^P to obtain evolution of policy regimes in and out the ZLB:

$$H = \begin{bmatrix} p_{hh} H^P & (1 - p_{ll}) \begin{bmatrix} p_{MZ} \\ 1 - p_{MZ} \end{bmatrix} \\ (1 - p_{hh}) [1, 1] & p_{ll} \end{bmatrix}$$

Estimation

- We solve the model with the method proposed by Farmer, Waggoner, and Zha (2009):

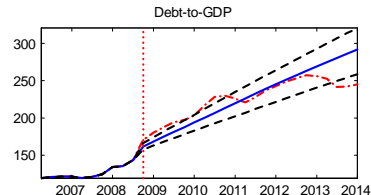
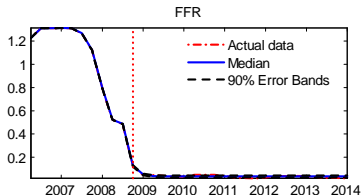
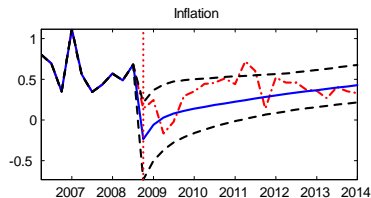
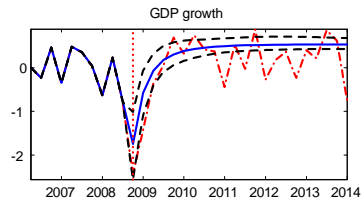
$$S_t = C(\zeta_t, \theta, H) + T(\zeta_t, \theta, H) S_{t-1} + R(\zeta_t, \theta, H) \varepsilon_t$$

- Agents take into account the possibility of regime changes \Rightarrow Their beliefs matter for the solution of the model.
- We estimate the model with Bayesian methods over the period 1954:Q4-2014:Q1.
- Regime sequence based on MS-VAR evidence ([▶ details](#)) and consistent with Bianchi and Ilut (2016):
 1. 1960s - 1970s \rightarrow Fiscally led policy mix
 2. 1980s - 2000s \rightarrow Monetary led policy mix
 3. Post-2008:Q4 \rightarrow Zero lower bound policy mix

Prior and Posterior Moments

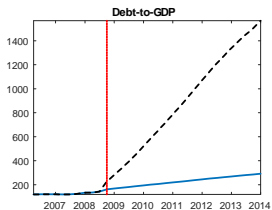
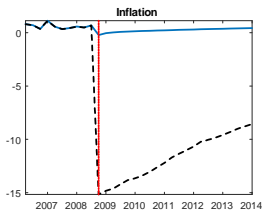
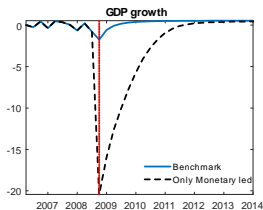
	Mean	5%	95%	Type	Mean	Std
$\psi_{\pi,M}$	1.6019	1.1758	2.0207	N	2.5	0.3
$\psi_{y,M}$	0.5065	0.2980	0.7688	G	0.4	0.2
$\delta_{b,M}$	0.0712	0.0457	0.1041	G	0.07	0.02
$\psi_{\pi,F}$	0.6356	0.5007	0.7546	G	0.8	0.3
$\psi_{y,F}$	0.2709	0.2005	0.3458	G	0.15	0.1
$\delta_{b,F}$	0	-	-	F	0	0
\bar{d}_I	-0.3662	-0.4827	-0.2789	N	-0.3	0.1
p_{hh}	0.9995	0.9984	0.9999	D	0.96	0.03
p_{ll}	0.9306	0.8936	0.9599	D	0.83	0.10
p_{MM}	0.9923	0.9872	0.9965	D	0.96	0.03
p_{FF}	0.9923	0.9888	0.9951	D	0.96	0.03
p_{MZ}	0.9225	0.8108	0.9861	D	0.50	0.22

Dynamics at the ZLB



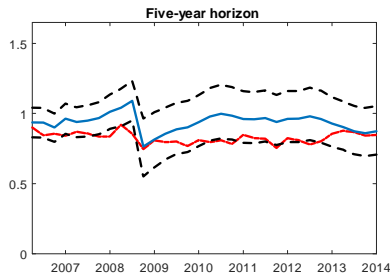
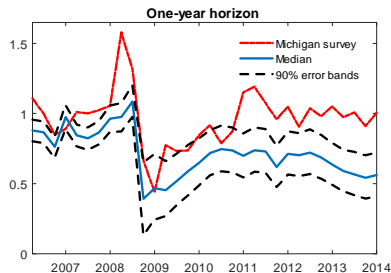
No Policy Uncertainty

Let us consider a counterfactual that removes policy uncertainty:
Only Monetary led regime out of the ZLB



Inflation Expectations

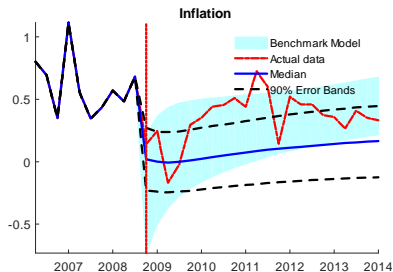
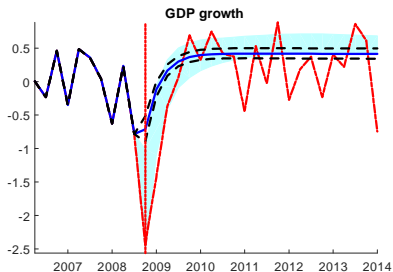
Corroborating evidence: Inflation expectations



No fiscal block: Explanatory power of discrete shock

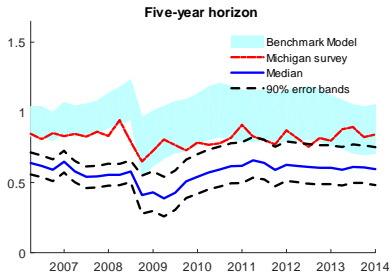
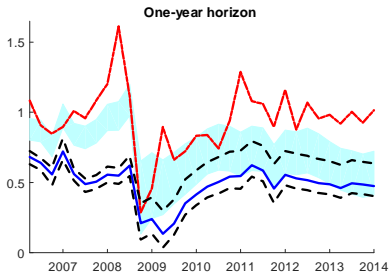
Suppose we estimate a nested model without the fiscal block:

→ It **cannot** account for the joint dynamics of growth and inflation with a single shock

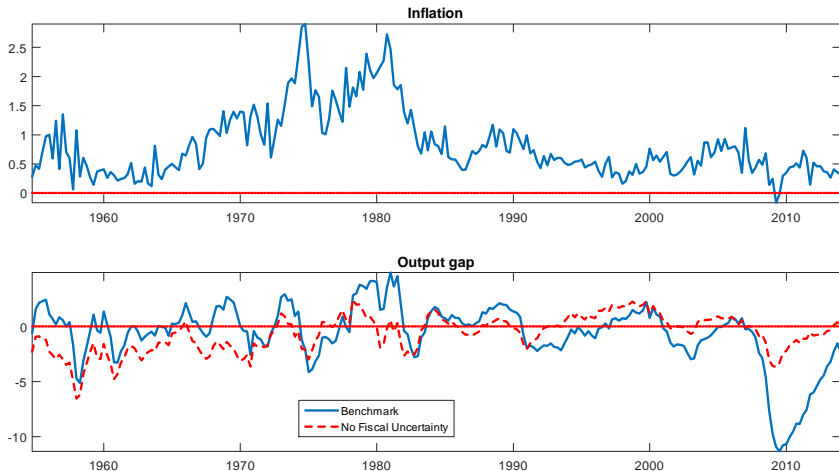


No fiscal block: Ability to match inflation expectations

Suppose we estimate a nested model without the fiscal block:
→ It cannot account for the behavior of inflation expectations



Inflation and Output gap



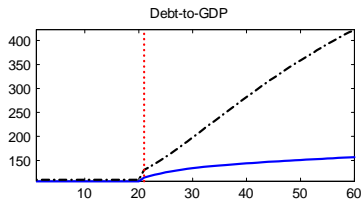
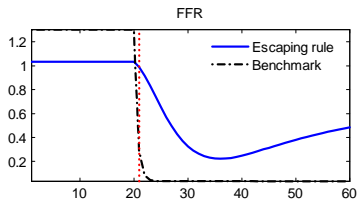
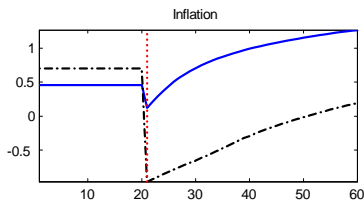
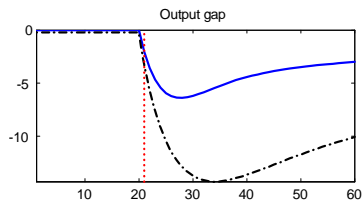
Policy Trade-Off

Why do not policy makers simply announce a switch to the fiscally led regime?

- Announcing the Fiscally led regime...
 1. ...mitigates the recession...
 2. ...at the cost of an increase in macroeconomic uncertainty
- The two results are the two sides of the same coin
- Announcement works only if it modifies long term expectations about future policy makers' behavior

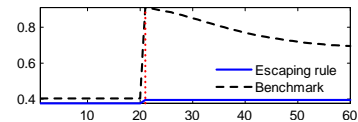
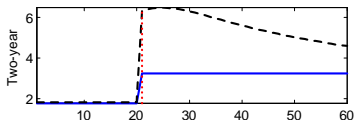
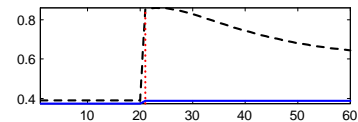
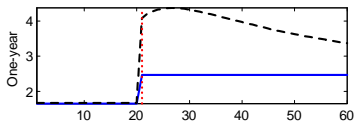
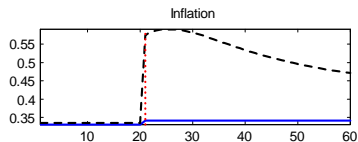
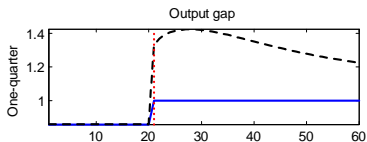
Escaping the Great Recession

Suppose policy makers commit to inflating away only the amount of debt resulting from the recession itself \Rightarrow No large recession



Escaping the Great Recession

Policy makers follow the Monetary led policy mix in response to all other shocks \Rightarrow No increase in uncertainty



Concluding Remarks

1. Recurrent ZLB events in a standard DSGE model
2. Absence of deflation explained by policy uncertainty in response to a **single shock**
3. The model highlights a **policy trade off** that can explain why policy makers...
 - are **reluctant to abandon fiscal discipline**
 - might be tempted to do so **to escape the Great Recession**
4. **Inflating away only the amount of debt accumulated because of the recession** would resolve the trade off

EXTRAS

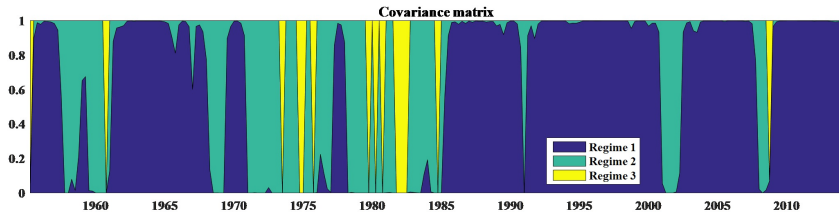
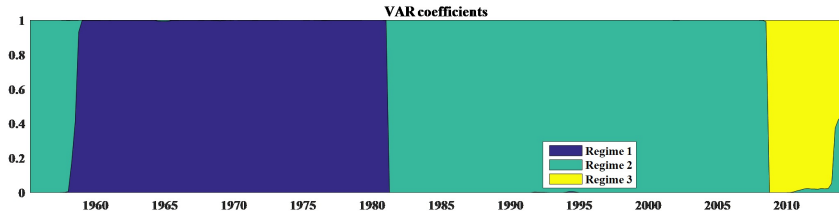
Motivating evidence [▶ Back](#)

- We use a MS-VAR to establish a series of stylized facts:

$$Z_t = c_{\zeta_t^\Phi} + A_{\zeta_t^\Phi,1} Z_{t-1} + A_{\zeta_t^\Phi,2} Z_{t-2} + \Sigma_{\zeta_t^\Phi}^{1/2} \omega_t$$
$$\Phi_{\zeta_t^\Phi} = \left[c_{\zeta_t^\Phi}, A_{\zeta_t^\Phi,1}, A_{\zeta_t^\Phi,2} \right], \omega_t \sim N(0, I)$$

- The model allows for three regimes for the VAR coefficients and three regimes for the covariance matrix
- We include four observables:
 1. Primary deficit-to-GDP ratio
 2. GDP growth
 3. Inflation
 4. Federal Funds Rate

Regime probabilities

[▶ Back](#)

Properties of the '1960-'1970s Vs. '1980s-2000s [▶ Back](#)

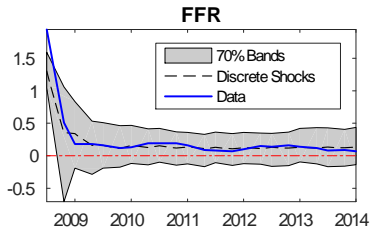
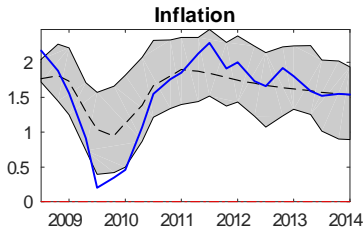
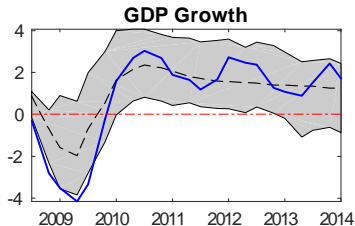
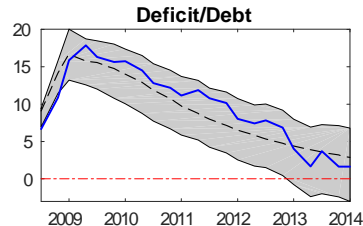
Conditional Steady-States

	Regime 1			Regime 2		
	Median	16%	84%	Median	16%	84%
Deficit/Debt	2.99	1.44	6.21	-3.63	-8.72	-0.49
GDP Growth	3.45	1.91	4.25	3.00	2.69	3.28
Inflation	5.11	3.45	8.61	2.48	2.06	2.81
Interest Rate	6.15	4.87	8.89	4.68	3.53	5.83
Real Int. Rate	1.07	0.23	1.48	2.21	1.27	3.21

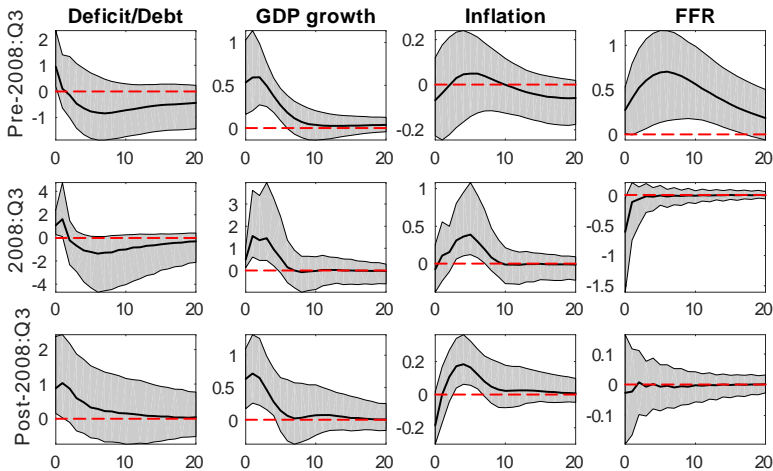
Stylized fact 1:

- 1960 - 1970s: High inflation, fiscal deficits, low real interest rates → Consistent with a fiscally led regime
- 1980 - 2000s: Low inflation, fiscal surpluses, higher real interest rates → Consistent with a monetary led regime

Properties of the zero lower bound regime [▶ Back](#)



Stylized fact 2: One single event is able to account for the zero lower bound dynamics

Fiscal shocks [▶ Back](#)

Stylized fact 3: Fiscal imbalances are important at the zero lower bound

Desirable properties

Desirable properties of a model aiming to explain the zero lower bound dynamics:

1. A single large initial shock should account for the dynamics of macro aggregates
2. The model should distinguish three periods in US economic history
3. The model should capture the inflationary consequences of fiscal imbalances during the zero lower bound

Comparison: Zero lower bound dynamics

Benchmark Model

Variable	<i>Median</i>	5%	95%	16%	84%
GDP growth	0.2997	0.2324	0.4172	0.2552	0.3595
Inflation	0.0638	0.0312	0.1897	0.0351	0.1338

Model without Fiscal Block

Variable	<i>Median</i>	5%	95%	16%	84%
GDP growth	0.4134	0.3607	0.4723	0.3807	0.4485
Inflation	0.1042	0.0331	0.3075	0.0461	0.2066

Comparison: Ability to match inflation expectations

Benchmark Model

Variable	<i>Median</i>	5%	95%	16%	84%
Whole sample: 1-year	0.0569	0.0374	0.0857	0.0440	0.0733
Whole sample: 5-year	0.0451	0.0345	0.0641	0.0378	0.0557
Pre-ZLB: 1-year	0.0424	0.0317	0.0615	0.0349	0.0529
Pre-ZLB: 5-year	0.0493	0.0383	0.0734	0.0415	0.0625
Post-ZLB: 1-year	0.1001	0.0368	0.2067	0.0551	0.1595
Post-ZLB: 5-year	0.0181	0.0037	0.0958	0.0066	0.0532

Model without Fiscal Block

Variable	<i>Median</i>	5%	95%	16%	84%
Whole sample: 1-year	0.1675	0.1399	0.1955	0.1510	0.1840
Whole sample: 5-year	0.1563	0.1106	0.2141	0.1307	0.1894
Pre-ZLB: 1-year	0.1496	0.1241	0.1880	0.1349	0.1696
Pre-ZLB: 5-year	0.1836	0.1281	0.2557	0.1510	0.2229
Post-ZLB: 1-year	0.2309	0.1005	0.3008	0.1577	0.2778
Post-ZLB: 5-year	0.0656	0.0139	0.1369	0.0298	0.1058

Dynamics at the ZLB

- Impulse response to a discrete negative preference shock \bar{d}_t
- We consider the economy as it was in 2008Q3
- A negative discrete preference shock occurs in 2008:Q4
- Objectives:
 1. A stylized NK model can replicate the key post-2008Q3 macroeconomic facts as a result of only one shock
 2. The impulse response is *not* invariant with respect to the state of the economy; in particular the fiscal situation
 - b/c the negative preference shock implies a change in expectations about future policymakers' behavior

Primary deficit and debt

- The government budget constraint is given by:

$$b_t^m = (b_{t-1}^m R_{t-1,t}^m) / (\Pi_t Y_t / Y_{t-1}) + pd_t$$

where $b_t^m = (P_t^m B_t^m) / (P_t Y_t)$ and all variables are expressed as a fraction of GDP

- In steady state:

$$b^m = (b^m R^m) / (\Pi M) + pd$$

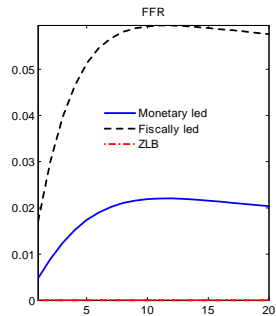
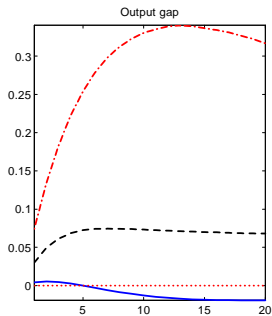
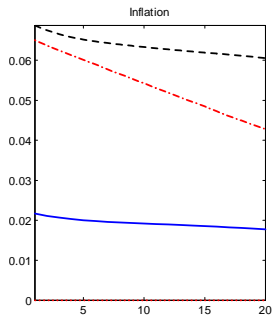
$$b^m = \frac{pd}{1 - (1+r) / (1+\gamma)}$$

$$b^m = \frac{pd}{1 - 1/\beta} > 0 \text{ if } pd < 0$$

- Also:

$$\frac{pd}{b^m} = 1 - 1/\beta < 0$$

Shock to government spending



Monetary/Fiscal Policy Mix

Leeper (1991) shows that two determinacy regions exist:

	ψ_{π, ζ_t^P}	δ_{b, ζ_t^P}
Active Monetary, Passive Fiscal	> 1	$> \beta^{-1} - 1$
Passive Monetary, Active Fiscal	< 1	$< \beta^{-1} - 1$

- AM/PF → Taylor principle is satisfied, fiscal policy accommodates behavior of monetary authority
→ **Macroeconomy is insulated (Ricardian regime)**
- PM/AF → Taylor principle is **not** satisfied, inflation is free to move to keep debt on a stable path
→ **Macroeconomy is not insulated (non-Ricardian regime)**

Why does this approach work?

- Policy makers are influencing agents' beliefs about their **long run** behavior in response to a **specific** shock
 - **Automatic stabilizer**: This behavior determines an increase in **short run** expected inflation exactly when necessary
- Policy makers are committed to raise taxes to repay the preexisting amount of debt and all future fiscal imbalances
 - **Macroeconomic stability is retained after the recession**