The Dire Effects of the Lack of Monetary and Fiscal Coordination[1]

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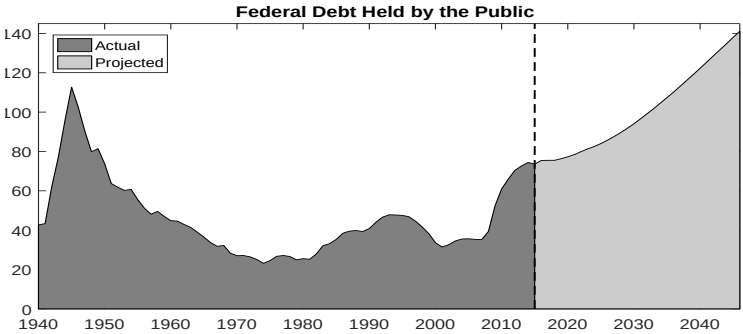
Recessions, Fiscal Imbalances, and Inflation

- Legacies of the Great Recession include a large public debt
- Some scholars have argued that fiscal imbalances have implications for price dynamics
  Sargent and Wallace (1981), Leeper (1991), Sims (1994), Woodford (1994), Cochrane (2001), Bassetto (2002)
- Emphasis on **monetary and fiscal coordination**
- This paper is mainly about the consequences of **lack of coordination**

Is Lack of Coordination a Possibility?



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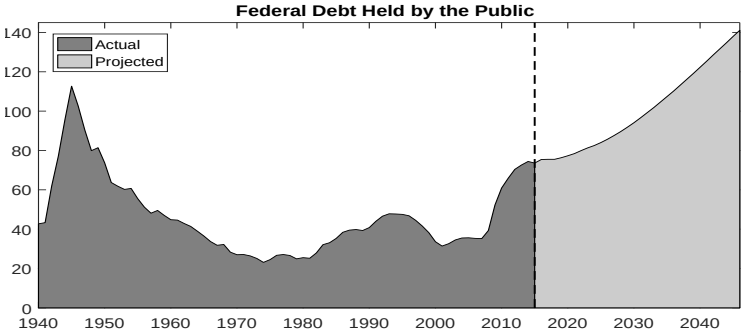

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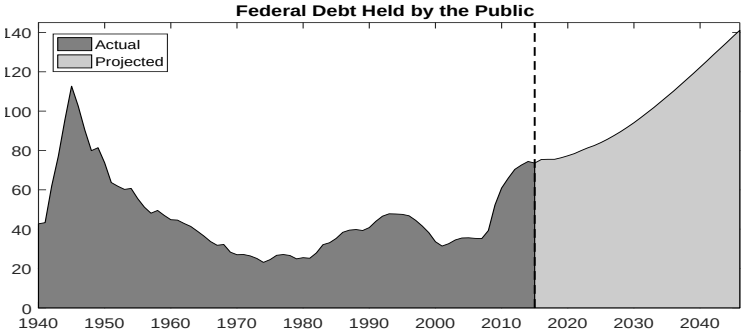

- CBO projections imply that debt is on an **unstable path**
- Fed ha insisted that **inflation stability** remains a central goal
- Suggestive of **possibility of conflict between the two authorities**: Ability of the Fed to control inflation requires fiscal backing

This Paper

We develop a NK model that features

- Large **contractionary shocks** that trigger large recessions and debt accumulation
- Agents understand that:
  1. Fiscal adjustments would be needed after the large recession
  2. Government might be unable or unwilling to make such adjustments
  3. Absent these fiscal adjustments, central bank could let inflation rise to stabilize debt
  4. Central bank might oppose such a change in policy

We use the model to study:

- The **consequences** of the **conflict** between the two authorities
- A policy proposal that resolves the conflict by separating **short-run** and **long-run** fiscal stabilizations

Main Results

- Lack of coordination has **dire effects**
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- This coordinated strategy also useful to **rule out liquidity traps**

A Simple Model of Inflation Determination

We extend the analysis of Leeper (1991), Leeper and Walker (2011), Sims (1994), and Woodford (2001) to study the effects of **lack of coordination**

- Fixed endowment economy populated by a continuum of infinitely many households:
  - have concave and twice continuously differentiable preferences over non-storable consumption goods
  - are endowed with a constant quantity of non-storable goods Y
- The fiscal authority
  - issues one-period bonds to households
  - raises real lump-sum taxes to repay its liabilities
  - does not consume
- The central bank controls the nominal interest rate

Household's Problem

- The representative household solves

$$\max_{C_t, B_t} E_0 \sum_{t=0}^{\infty} \beta^t \exp\left(\varepsilon_t^d\right) U(C_t)$$

where ε_t^d is an iid shock

- subject to the flow budget constraint

$$P_t C_t + Q_t B_t + P_t \tau_t = P_t Y + B_{t-1}$$

with $Q_t < 1$.

Government Budget Constraint and the Fisher Equation

- The government budget constraint reads

$$P_t \tau_t + Q_t B_t = B_{t-1}$$

- Market clearing requires $C_t = Y$ for all t

- Households' optimal decisions lead to the *Fisher equation*

$$R_t = E_t \left(\beta^{-1} \frac{\exp \varepsilon_t^d}{\exp \varepsilon_{t+1}^d} \Pi_{t+1} \right)$$

where $R_t \equiv 1 / Q_t$.

Monetary and Fiscal Policy

- Monetary policy rule:

$$\frac{R_t}{R} = \left(\frac{\Pi_t}{\Pi}\right)^{\psi}$$

- Fiscal policy rule (in real terms):

$$\tau_t - \tau = \delta\left(b_{t-1} - b\right) + \varepsilon_t^{\tau}$$

The Linearized Equations

Linearizing the model, we obtain:

- Fisher equation

$$\tilde{R}_t = \varepsilon_t^d + E_t \hat{\pi}_{t+1}$$

- Government budget constraint

$$\hat{\tau}_t + \hat{b}_t = \beta^{-1} \hat{b}_{t-1} + b_* \tilde{R}_t - \beta^{-1} b_* \tilde{\pi}_t$$

- Monetary policy rule

$$\tilde{R}_t = \psi \tilde{\pi}_t$$

- Fiscal policy rule

$$\hat{\tau}_t = \delta \hat{b}_{t-1} + \varepsilon_t^\tau$$

Monetary and Fiscal Blocks

Replacing the two policy rules, we obtain:

- The monetary-block (MB) equation

$$\psi \tilde{\pi}_t = \varepsilon_t^d + E_t \tilde{\pi}_{t+1}$$

- The fiscal-block (FB) equation

$$\hat{b}_t = \left(\beta^{-1} - \delta\right) \hat{b}_{t-1} + b_* \left(\psi - \beta^{-1}\right) \tilde{\pi}_t - \varepsilon_t^\tau$$

- Two eigenvalues: ψ and $\left(\beta^{-1} - \delta\right)$; one non-predetermined variable

$\Longrightarrow$ **Joint behavior of monetary and fiscal policy key for existence and uniqueness of a stable rational expectations equilibrium**

Leeper's (1991) Partition

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

- Active Monetary: Taylor principle satisfied ($\psi > 1$)
- Passive Monetary: Taylor principle not satisfied ($\psi \leq 1$)
- Active Fiscal: fiscal policy does not stabilize debt ($\delta \leq \beta^{-1} - 1$)
- Passive Fiscal: fiscal policy stabilizes debt ($\delta > \beta^{-1} - 1$)

Monetary-Led Policy Mix (AM/PF)

In the **monetary-led policy mix**, monetary policy is active and fiscal policy is passive

- If $\psi > 1$ and $\delta > \beta^{-1} - 1$, the MB equation is explosive
- Inflation dynamics:

$$\tilde{\pi}_t = \psi^{-1} \varepsilon_t^d$$

- Real debt dynamics:

$$\hat{b}_t = \left(\beta^{-1} - \delta\right) \hat{b}_{t-1} + b_* \left(\psi - \beta^{-1}\right) \psi^{-1} \varepsilon_t^d - \varepsilon_t^\tau$$

- Monetary and Fiscal Dichotomy and inflation is iid

Fiscally-Led Policy Mix (PM/AF)

In the **fiscally-led policy mix**, monetary policy is passive and fiscal policy is active

- If $\psi \leq 1$ and $\delta \leq \beta^{-1} - 1$, the FB equation is unstable
- The unique stable equilibrium requires:

$$E_t \tilde{\pi}_{t+1} = \underbrace{\frac{1}{b_*}\left[1 - \frac{\delta}{\beta^{-1} - \psi}\right]}_{\xi} \hat{b}_t$$

$\Longrightarrow$ Monetary and fiscal dichotomy does not hold

- Equilibrium:

$$\begin{bmatrix} \tilde{\pi}_t \\ \hat{b}_t \end{bmatrix} = \begin{bmatrix} 0 & \xi \\ 0 & \psi \end{bmatrix} \begin{bmatrix} \tilde{\pi}_{t-1} \\ \hat{b}_{t-1} \end{bmatrix} + \begin{bmatrix} \frac{1}{\beta^{-1}-\delta} & -\frac{\xi}{\beta^{-1}-\delta} \\ -\frac{b_*(\beta^{-1}-\psi)}{\beta^{-1}-\delta} & -\frac{\psi}{\beta^{-1}-\delta} \end{bmatrix} \begin{bmatrix} \epsilon_t^d \\ \epsilon_t^\tau \end{bmatrix}$$

$\Longrightarrow$ inflation is not iid b/c debt is not (unless $\psi = 0$)

Lack of Coordination

So far monetary and fiscal policy have been **coordinated** to achieve a determinate rate of inflation. We now consider the case of **lack of coordination**:

1. Right after a preference shock, the govt starts disregarding debt stabilization...
2. ... while the central bank tries to keep inflation stable
3. This **conflict** lasts only one period, after which either the **monetary-led** or **fiscally-led** policies are in place forever

$\Rightarrow$ **Agents' beliefs about which authority will prevail in the conflict are key for macroeconomic outcomes**

Case 1: The Monetary Authority is Expected to Prevail

- Monetary-led is expected to be in place at time 2 $\Longrightarrow E_1 \hat{\pi}_2 = 0$
- Thus, inflation at time 1
$$\tilde{\pi}_1 = \psi_A^{-1} \varepsilon_1^d$$
- The stock of real debt is
$$\hat{b}_1 = b_* \left(1 - \frac{\beta^{-1}}{\psi_A}\right) \varepsilon_1^d$$
- The monetary and fiscal dichotomy holds
- The **more hawkish** the central bank is during the conflict, the **lower inflation** and the higher debt

Case 2: The Fiscal Authority is Expected to Prevail

- The unique equilibrium outcome at $t = 1$

$$\tilde{\pi}_1 = \frac{1}{\xi b_* \beta^{-1} + \psi_A (1 - \xi b_*)} \varepsilon_1^d$$

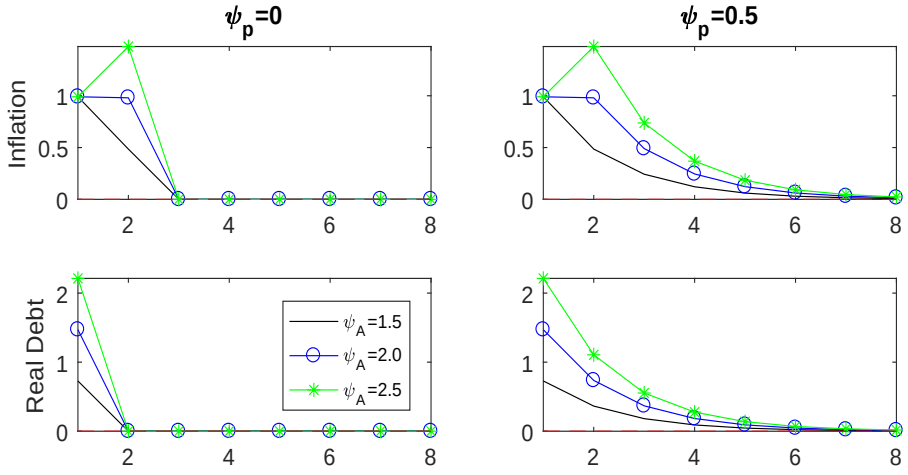
$$\hat{b}_1 = \frac{b_* (\psi_A - \beta^{-1})}{\xi b_* \beta^{-1} + \psi_A (1 - \xi b_*)} \varepsilon_1^d$$

where $\xi \equiv \frac{1}{b_*} \left[1 - \frac{\delta_A}{\beta^{-1} - \psi_P} \right]$.

- If policymakers coordinate on the **fiscally-led** policy mix thereafter

$$\begin{bmatrix} \hat{\pi}_t \\ \hat{b}_t \end{bmatrix} = \begin{bmatrix} 0 & \xi \\ 0 & \psi_P \end{bmatrix} \begin{bmatrix} \hat{\pi}_{t-1} \\ \hat{b}_{t-1} \end{bmatrix}, \quad t > 1$$

Case 2: The Fiscal Authority is Expected to Prevail



Case 2: The Fiscal Authority is Expected to Prevail

1. Fiscal authority affects equilibrium outcomes, including price dynamics

2. The **more hawkish** the central bank during the conflict period, the **larger real debt** at the end of period 1, the **higher inflation** in periods $t \geq 2$

   $\Rightarrow$ Hawkish Monetary Policy is not only **ineffective**, but also **counterproductive**.

3. The **more proactive** passive monetary policy in periods $t \geq 2$, the **more persistent** the dynamics of debt and inflation following the resolution of the conflict

Private Sector: Households

- The representative household maximizes expected utility

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t \exp\left(\bar{d}_{\zeta_t^d} \right) \left[\log C_t - h_t \right] \right]$$

subject to the budget constraint:

$$\begin{aligned} P_t C_t + P_t^m B_t^m + P_t^s B_t^s &= P_t W_t h_t + B_{t-1}^s + \left(1 + \rho P_t^m\right) B_{t-1}^m \\ &\quad + P_t D_t - T_t + TR_t \end{aligned}$$

- Discount factor shock, $\bar{d}_{\zeta_t^d}$, can assume two values, high or low ($\overline{d}_H$ or $\overline{d}_L$)

- ζ_t^d follows a Markov-switching process:

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

Private Sector: Firms

Representative firm faces:

- Monopolistic competition
- Sticky prices (Quadratic adjustment cost)
- TFP shocks
- Production function in which labor is the only input

The Government Budget Constraint

- The government budget constraint

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

  where all variables are normalized with nominal output

- Government expenditures: $e_t = g_t + tr_t$ with
  - Government purchases (exogenous) as a fraction of output: g_t
  - Transfers-to-output ratio: tr_t

$$\frac{tr_t}{tr_t^*} = \left(\frac{tr_{t-1}}{tr_{t-1}^*}\right)^{\rho_{tr}} \left(\frac{Y_t}{Y_t^*}\right)^{(1-\rho_{tr})\phi_y}$$

Policy Rules

- Fiscal Rule

$$\widetilde{\tau}_t = \rho_{\tau,\xi_t^p}\widetilde{\tau}_{t-1} + \left(1-\rho_{\tau,\xi_t^p}\right)\left[\delta_{b,\xi_t^p}\widetilde{b}_{t-1}^m + \delta_y\left(\widehat{y}_t - \widehat{y}_t^*\right)\right]$$

- Monetary Rule

$$R_t/R = \left(R_{t-1}/R\right)^{\rho_{R,\xi_t^p}}\left[\left(\Pi_t/\Pi\right)^{\psi_{\pi,\xi_t^p}}\left(Y_t/Y_t^*\right)^{\psi_{y,\xi_t^p}}\right]^{\left(1-\rho_{R,\xi_t^p}\right)}$$

- The Markov-switching process ξ_t^p determines the policy mix *conditional* on the state of demand ξ_t^d

Monetary/Fiscal Policy Mix

When policy regimes are taken in isolation, the two policy rules and the linearized budget constraint are key to determine existence and uniqueness of a REE:

$$\hat{R}_t = \psi_\pi \hat{\pi}_t + ...$$

$$\widetilde{\tau}_t = \delta_b \widetilde{b}^m_{t-1} + ...$$

$$\begin{aligned} \widetilde{b}^m_t &= \beta^{-1} \widetilde{b}^m_{t-1} + ... + b^m \beta^{-1} \left(\hat{R}_{t-1} - ... - \widetilde{\pi}_t \right) - \widetilde{\tau}_t \\ \rightarrow \quad \widetilde{b}^m_t &= \left(\beta^{-1} - \delta_b \right) \widetilde{b}^m_{t-1} + ... + b^m \beta^{-1} \left(\psi_\pi \hat{\pi}_{t-1} - ... - \widetilde{\pi}_t \right) \end{aligned}$$

Policy Regimes

- **High state of demand** ($\xi_t^d = H$):
  - Coordination: Monetary led policy mix (AM/PF):

$$\psi_\pi = \psi_\pi^M > 1 \qquad \delta_b = \delta_b^M > \beta^{-1} - 1$$

  - Coordination: Fiscally led policy mix (PM/AF):

$$\psi_\pi = \psi_\pi^F < 1 \qquad \delta_b = \delta_b^F = 0 < \beta^{-1} - 1$$

  - Non-Coordination: Conflict Regime (AM/AF):

$$\psi_\pi = \psi_\pi^C > 1 \qquad \delta_b = \delta_b^C = 0 < \beta^{-1} - 1$$

- **Low state of demand** ($\xi_t^d = L$): Fiscally-led policy mix (PM/AF)

Evolution of Regimes

The matrix Q^H controls the evolution of regimes in the high state of demand:

$$Q^H = \left[\begin{array}{cc|cc} p_{MM} & 1-p_{FF} & 1-p_{CC} & 0 \\ 1-p_{MM} & p_{FF} & 0 & 1-p_{CC} \\ \hline 0 & 0 & p_{CC} & 0 \\ 0 & 0 & 0 & p_{CC} \end{array}\right]$$

The matrix Q governs the overall evolution of regimes:

$$Q = \left[\begin{array}{cc} p_{hh}Q^H & (1-p_{ll}) \cdot I_4 \\ (1-p_{hh})\, 0.25 \cdot \mathbf{1}_{4\times 4} & p_{ll} \cdot I_4 \end{array}\right]$$

$\Rightarrow$ Agents take into account the possibility of large recessions and the consequent changes in policy makers' behavior

Back

Solution

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

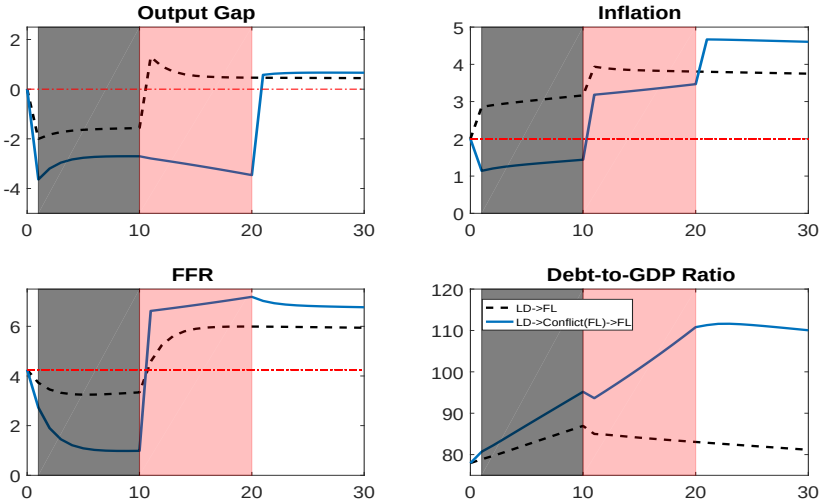
$$S_t = C\left(\xi_t, \theta, Q\right) + T\left(\xi_t, \theta, Q\right) S_{t-1} + R\left(\xi_t, \theta, Q\right) \varepsilon_t$$

- Agents are aware of regime changes and their beliefs matter for the solution of the model
- **Temporary explosive dynamics** are allowed, as long as the model is overall stationary
- This important feature allows us to study the properties of the conflict regime

Parameters (Bianchi and Melosi AER 2017)

Parameter	Value	Parameter	Value	Parameter	Value
$\psi_{\pi,M}$	1.7890	$\rho_{\tau,F}$	0.6501	p_{hh}	0.9999
$\psi_{y,M}$	0.4413	$\psi_{\pi,C}$	2.0000	p_{ll}	0.9465
$\rho_{R,M}$	0.8697	$\rho_{\tau,C}$	0.6501	p_{MM}	0.9902
$\delta_{b,M}$	0.0778	δ_y	0.2814	p_{FF}	0.9932
$\rho_{\tau,M}$	0.9666	ϕ_y	-2.0000	κ	0.0072
$\psi_{\pi,F}$	0.6903	ρ_{tr}	0.4620	$b_0^m/4$	0.7700
$\psi_{y,F}$	0.2655	$\overline{d}_h$	0.0429	100γ	0.4120
$\rho_{R,F}$	0.6576	$\overline{d}_l$	-0.1300	100π	0.5000

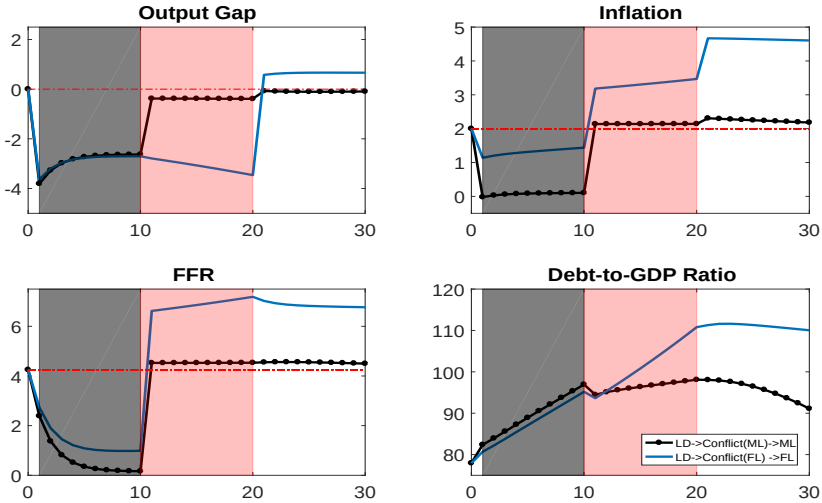
Conflict with Fiscally-led Resolution



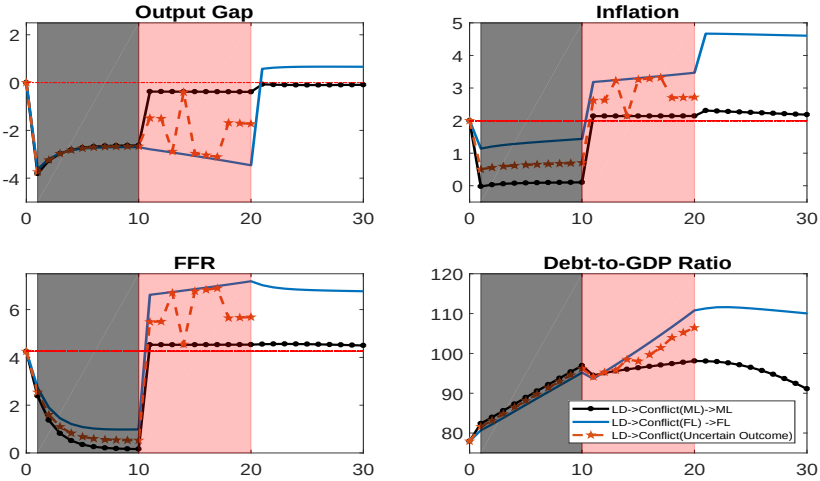
Vicious Circle

- Key mechanism:
  1. Large recession generates debt accumulation: $b \uparrow$
  2. Expectation that eventually debt will be inflated away: $\pi \uparrow$
  3. Central bank increases interest rate more than one-to-one: **Real interest rate** $\uparrow$
  4. Real activity goes down: $y \downarrow$
  5. Low real activity + high real interest rate induce further debt accumulation: $b \uparrow$
- Spiral of low growth, high(er) inflation, debt accumulation
- **Vicious Circle** ends when one of the two authorities gives up

Conflict with Monetary-led Resolution



Conflict with Uncertain Resolution



Take Away

If the fiscal authority is not **expected** to take the necessary fiscal adjustments

1. The central bank can accommodate these beliefs

   $\Longrightarrow$ persistently high inflation

2. The central bank can fight back

   - if the central bank is expected to eventually give up $\Longrightarrow$ spiral of low output, high inflation, and high debt
   - if the government is expected to eventually give up $\Longrightarrow$ recession coupled with persistently low inflation, and high debt

$\Longrightarrow$ CB cannot stabilize inflation without fiscal backing

$\Longrightarrow$ Institutional conflicts inevitably lead to **bad outcomes**: **Ineffective** or **detrimental** policy interventions

A Coordinated Strategy

- We propose a policy that separates the issue of **long-term fiscal sustainability** from the need of **short-run fiscal intervention**
- Policy makers commit to inflate away *just* the amount of debt resulting from the large recession itself....
- ... in response to private sector's loss of confidence that the necessary fiscal adjustments will ever be taken
- We model a shadow economy to keep track of the amount of debt deriving from the discrete demand shock. Policy makers...
  1. ...do not react to debt and inflation caused by the discrete demand shock, while...
  2. ...follow a monetary-led policy mix in response to all other shocks

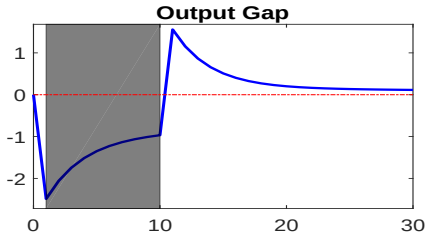
A Coordinated Monetary and Fiscal Rule

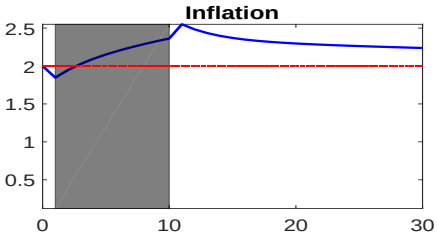
- Policymakers announce policies for regular debt and the **emergency budget** debt

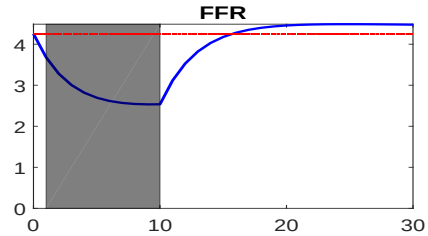
$$\begin{aligned}\widetilde{\tau}_t &= \left(1-\rho_\tau^M\right)\left[\delta_b^M \widetilde{b}_{t-1}^S + \tilde{\delta}_b^F\left(\widetilde{b}_{t-1}-\widetilde{b}_{t-1}^S\right)\right]+\ldots \\ \tilde{R}_t &= \left(1-\rho_R^M\right)\left[\psi_\pi^M \tilde{\pi}_t^S + \tilde{\psi}_\pi^F\left(\tilde{\pi}_t-\tilde{\pi}_t^S\right)\right]+\ldots\end{aligned}$$

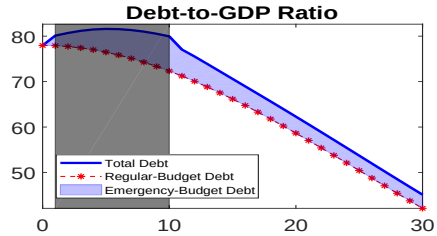
- The fiscal authority is not responsible for the **emergency budget** debt $\widetilde{b}_t - \widetilde{b}_t^S$: $\tilde{\delta}_b^F = \tilde{\psi}_\pi^F = 0$
- The central bank allows inflation to rise by $\tilde{\pi}_t - \tilde{\pi}_t^S$, which is the amount needed to stabilize the **emergency budget** $\widetilde{b}_t - \widetilde{b}_t^S$
- The targeted inflation and debt are determined in a shadow economy where
  1. There is no discrete demand shock
  2. Policymakers always follow the monetary-led policy mix

Implementation of Coordinated Policies







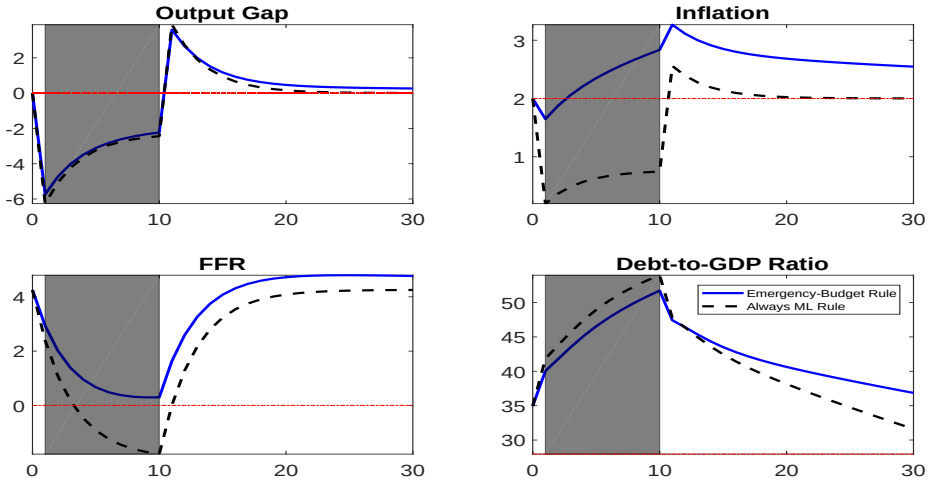


Avoiding Liquidity Traps

- The **zero lower bound** can be a significant constraint on the ability of a central bank to combat deflation
- Krugman (1998) and Eggertsson and Woodford (2003) suggest to use forward guidance to promise that monetary policy will drive a boom when the central bank will have again room to maneuver
- Our coordinated strategy can also be used to promise a boom at the end of large recessions
- Policymakers can adopt this strategy to rule out liquidity traps (Benhabib, Schmitt-Grohe, Uribe (2002) and Woodford (2003))
- Possible advantage: Easier to convince public if fiscal policy involved
- Historical relevance: Roosevelt's **emergency budgets**

Avoiding Liquidity Traps

- Our proposed policy makes a liquidity trap **fiscally unsustainable**



Conclusions

- Non-coordinated policies inevitably lead to bad outcomes
- The central bank cannot stabilize inflation if the govt is expected to withdraw its backing
- Not only hawkish monetary policy is **ineffective**, but it can also **backfire**
- A coordinated strategy to inflate away just a fraction of debt:
  1. mitigates the recession and stabilizes price dynamics
  2. can be useful to prevent monetary policy from hitting the ZLB

Private Sector: Households

- The representative household maximizes expected utility

$$E_0 \left[\sum_{s=0}^{\infty} \beta^t \exp\left(\zeta_t^d\right) \left[\log C_t - h_t \right] \right]$$

subject to the budget constraint:

$$\begin{aligned} P_t C_t + P_t^m B_t^m + P_t^s B_t^s &= P_t W_t h_t + B_{t-1}^s + \left(1 + \rho P_t^m\right) B_{t-1}^m \\ &\quad + P_t D_t - T_t + TR_t \end{aligned}$$

- Shocks to the discount factor: $\zeta_t^d = \bar{d}_{\zeta_t^d}$, which can assume two values, high or low ($\bar{d}_H$ or $\bar{d}_L$)
- ζ_t^d follows a Markov-switching process:

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

Back Woodford Bonds

Private Sector: Firms

- Firms choose their price $P_t(j)$ so to maximize the PV of future profits subject to
  1. A downward-sloping demand curve:
  $$Y_t(j) = \left(P_t(j)/P_t\right)^{-1/v} Y_t$$
  2. Quadratic price adjustment cost:
  $$AC_t(j) = .5\varphi \left(P_t(j)/P_{t-1}(j) - \Pi\right)^2 Y_t(j) P_t(j)/P_t$$
  3. The production function
  $$Y_t(j) = h_t^{1-\alpha}(j)$$

Back

Woodford's (2001) Bonds

- Govt bonds B_t^m: perpetuity with coupons that decay exponentially
- A bond issued in period t pays ρ^j dollars $t+j$ periods later with $0 \leq \rho < \beta^{-1}$
- It can be shown that: $P_{t-j}^m = \rho^j P_t^m$ for any $j > 0$

$\Longrightarrow$ The equilibrium prices of the (infinitely) many perpetuities are function of the price of the current bond

$\Longrightarrow$ A bond of this type issued k periods ago is equivalent to ρ^k current bonds

$\Longrightarrow$ Do not need to keep track of infinitely many perpetuities

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Policy Regimes

- **High state of demand** ($\xi_t^d = H$):
  - Monetary led policy mix (AM/PF):

$$\psi_\pi = \psi_\pi^M > 1 \qquad \delta_b = \delta_b^M > \beta^{-1} - 1$$

  - Fiscally led policy mix (PM/AF):

$$\psi_\pi = \psi_\pi^F < 1 \qquad \delta_b = \delta_b^F = 0 < \beta^{-1} - 1$$

  - Two Fight Regimes (AM/AF):

$$\psi_\pi = \psi_\pi^C > 1 \qquad \delta_b = \delta_b^C = 0 < \beta^{-1} - 1$$

- **Low state of demand** ($\xi_t^d = L$):
  - Four FL regimes that differ on beliefs about the post-recession policy mix

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