Endogenous Forward Guidance

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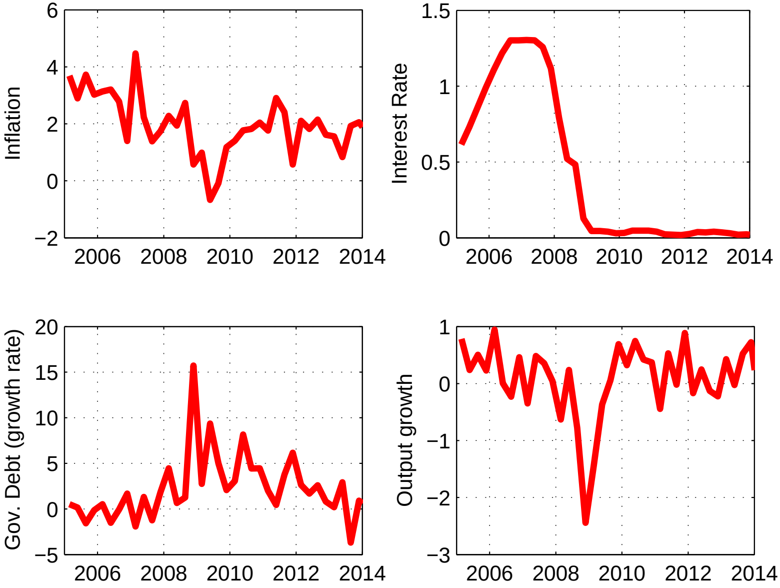
US Data Observations



Motivation: Interest Rate Policies in the Great Recession.

- What forces explain the Fed's policies during the Great Recession?
  - **Standard view:** A central bank that focuses on inflation + output stabilization should commit to keep interest rates low (Eggertsson and Woodford (2003)).
  - **Alternative view:** Keeping interest rates keeps debt refinancing costs low and helps with debt sustainability.
- Which is the most plausible?

Which is the most plausible?

- Can we answer this question with DSGE models?
  - **No!** In del Negro et al (2015), Bianchi and Melosi (2017) and others, interest rates follow **ad hoc rules**. To match interest rates, these papers add **exogenous shocks**. The shocks are (typically) interpreted as **model consistent Forward Guidance (FG).**

$$\hat{i}_t^{DSGE} = \max\{\mathcal{T}_t^{DSGE} + \sum_{l=0}^{M} \epsilon_{t-l}^{l,DSGE}, -\hat{i}^*\} \tag{1}$$

where $\mathcal{T}_t^{DSGE} = \phi_\pi \hat{\pi}_t + \phi_Y \Delta \hat{Y}_t + \phi_i \hat{i}_{t-1}$

$\epsilon_{t-l}^{l,DSGE}, l > 0$ is **FG.**

- Exogenous shocks cannot inform us about the driving forces of interests rates.

This paper...

- ...proposes a **novel framework of endogenous FG**, to answer this question.
  - The model endogenizes FG nesting the case where the Fed has **concerns over debt** and the case **where it does not**.
    - Policy under Commitment: The FED minimizes the variability of inflation, output gap and interest rates. Debt concerns in the case where optimization is subject to the 'consolidated budget constraint'.
  - The model is also tractable, it gives us **closed form solutions** (which enables us to derive new analytical insights) and simple to embed in **DSGE**.
  - We perform a quantitative evaluation of monetary policy in the Great recession.

Results

1. Interest rate rules are of the form (1).

   - In the case of debt concerns: Interest rates are a Taylor rule + **2 components**: i) a component that captures commitment to keep interests rate at the ZLB at the exit from the LT (e.g. Eggertsson and Woodford (2003) ii) a component which captures the planner's commitment to 'twist interest rates' in response to shocks to the consolidated budget.

   - Under **no debt concerns...** Interest rates are a Taylor rule + i)

Results

1.
2. Monetary/Fiscal Policy mix:

   Under **debt concerns** fiscal policy is **active** (e.g. Leeper (1991)), taxes do not respond to debt (unbacked fiscal deficits).

   Under **no debt concerns** fiscal policy is **passive**, taxes respond strongly to debt.

Results

1.
2.
3. Properties at the ZLB:

   FG in the case of debt concerns (DC) is ineffective. The planner keeps interest rates low for a long period but inflation turns very negative at the onset of the LT episode (at odds with the US data).

   In the NDC case FG is very effective. Interest rates are at the ZLB for a long period and also inflation is positive (in line with the data).

Results

1.
2.
3.
4. Quantitative Evaluation of Monetary Policy in the Great Recession:
   Monetary policy in the Great recession has **focused mainly on stabilizing inflation and the output gap**. We find little evidence in favor of debt concerns.

A small scale version of the FED's program.

The FED maximizes

$$E_0 - \frac{1}{2}\sum_{t=0}^{\infty}\beta^t\left\{\hat{\pi}_t^2 + \lambda_Y \hat{Y}_t^2 + \lambda_i \hat{i}_t^2\right\} \tag{2}$$

subject to

$$\hat{\pi}_t = \kappa_1 \hat{Y}_t + \kappa_2 \hat{\tau}_t - \kappa_3 \hat{G}_t + \beta E_t \hat{\pi}_{t+1}, \tag{3}$$

$$\hat{i}_t = E_t\left(\hat{\pi}_{t+1} - \hat{\xi}_{t+1} + \hat{\xi}_t - \sigma\left[\frac{\overline{Y}}{\overline{C}}(\hat{Y}_t - \hat{Y}_{t+1}) - \frac{\overline{G}}{\overline{C}}(\hat{G}_t - \hat{G}_{t+1})\right]\right) \tag{4}$$

$$\hat{i}_t \geq -\frac{1}{\beta} + 1 \equiv -i^* \tag{5}$$

$+$ the consolidated budget (in the debt concerns model).

A small scale model version of the FED's program

Fiscal Policy follows:

$$\hat{\tau}_t = \rho_\tau \hat{\tau}_{t-1} + (1 - \rho_\tau)\phi_{\tau,b}\hat{b}_{t-1,\delta} + \hat{\epsilon}_{\tau,t} \tag{6}$$

A small scale version of the FED's program: Debt concerns

Proposition 1. *The optimal interest rate rule is:*

$$\hat{i}_t = \max\{\mathcal{T}_t + \mathcal{D}_t + \mathcal{Z}_t, -i^*\} \tag{7}$$

$$\mathcal{T}_t \equiv \phi_\pi \hat{\pi}_t + \phi_Y \Delta \hat{Y}_t + \phi_i \hat{i}_{t-1} + \frac{1}{\beta} \Delta \hat{i}_{t-1}$$

$$\mathcal{D}_t = -(\omega_1 + \omega_2) \sum_{l=0}^{\infty} \delta^l \Delta \psi_{gov,t-l} + \omega_2 \sum_{l=0}^{\infty} \delta^l \Delta \psi_{gov,t-l-1} - \omega_3 \Delta \psi_{gov,t}$$

and

$$\mathcal{Z}_t = -\omega_4 \psi_{ZLB,t-1} + \omega_5 \psi_{ZLB,t-2}.$$

A small scale version of the FED's program: No debt concerns

Proposition 2. *Assume that the planner does not account for the consolidated budget in optimization. The interest rate rule is*

$$\hat{i}_t^{NDC} = \max\{\mathcal{T}_t^{NDC} + \mathcal{Z}_t^{NDC}, -i^*\} \tag{8}$$

$$\mathcal{T}_t^{NDC} \equiv \phi_\pi \hat{\pi}_t^{NDC} + \phi_Y \Delta \hat{Y}_t^{NDC} + \phi_i \hat{i}_{t-1}^{NDC} + \frac{1}{\beta}\Delta \hat{i}_{t-1}^{NDC}$$

and

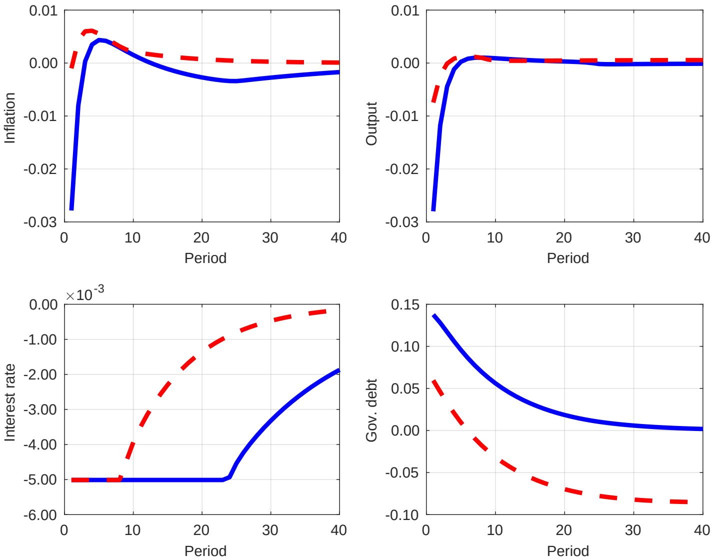
$$\mathcal{Z}_t^{NDC} = -\omega_4 \psi_{ZLB,t-1}^{NDC} + \omega_5 \psi_{ZLB,t-2}^{NDC}.$$

A small scale version of the FED's program: Monetary and Fiscal Interactions

In the case of debt concerns it must be $\phi_{\tau,b} \approx 0$. In other words taxes should not adjust to high debt levels.

In the case of no debt concerns it must be $\phi_{\tau,b} >> 0$. A strong response of taxes to debt is required.

Policy at the ZLB



Policy at the ZLB

Main takeaway: LTs last longer when monetary policy has debt sustainability concerns. 'Keeping interest rates low' for a long period does not lead to positive inflation.

In contrast, in the NDC case, monetary policy is very effective in stabilizing inflation.

Medium scale version of the FED's program.

We augment the model with habit formation, TFP shocks, markup shocks, shocks to the government budget constraint... We assume the following objective:

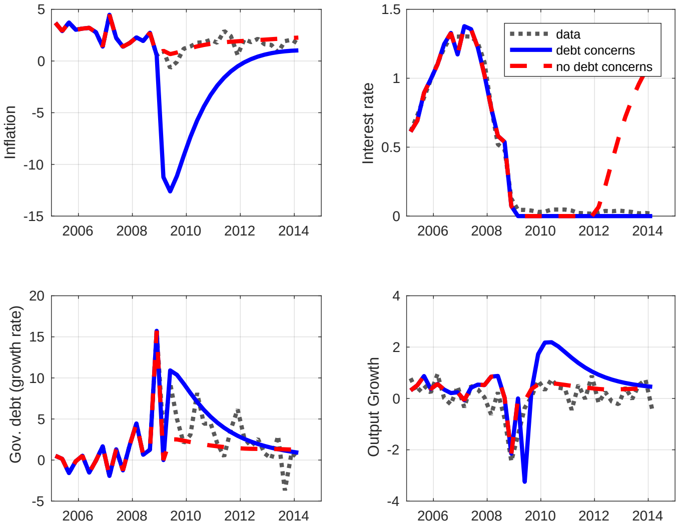
$$-\frac{1}{2}E_0\sum_{t=0}^{\infty}\left(\hat{\pi}_t^2+\lambda_Y\left(\hat{Y}_t-\hat{Y}_t^n\right)^2+\lambda_i\left(\hat{i}_t-\hat{i}_{t-1}\right)^2\right) \quad (9)$$

We estimate the model with Bayesian methods. Our sample is 1980:Q1 - 2008Q4.
We assume NDC throughout this period in line with the findings of Bianchi and Ilut (2018).

Quantitative evaluation in the Great recession.

- What happens when monetary policy switches to the DC equilibrium in 2009 Q1?

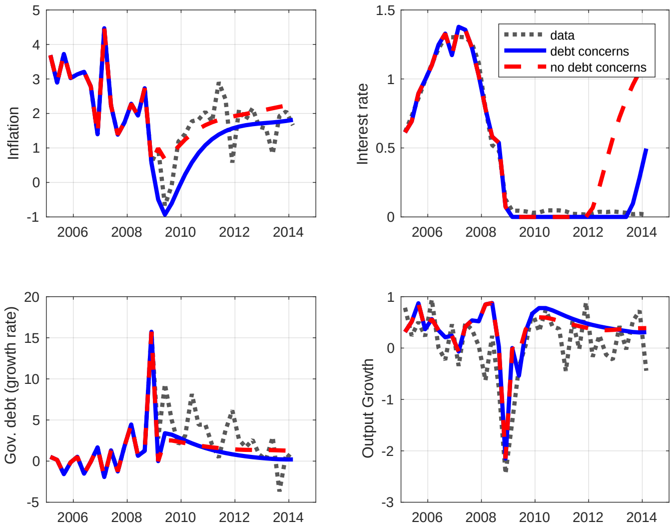
Quantitative evaluation in the Great recession.



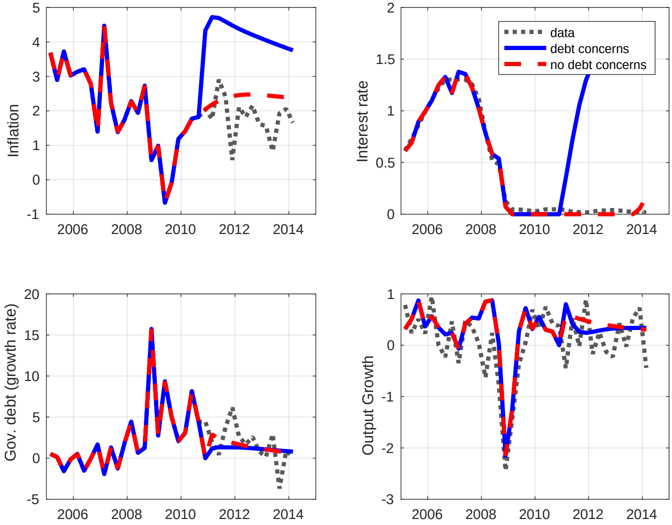
Quantitative evaluation in the Great recession.

NDC model predicts too high inflation. DC model too much deflation.
Both models can capture well the behavior of interest rates.

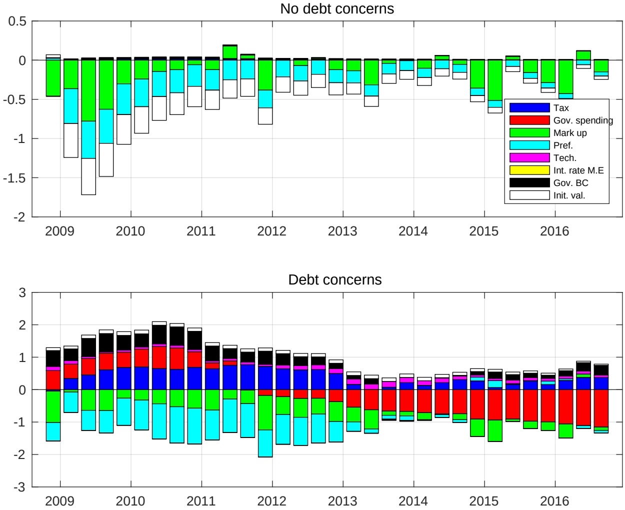
Temporary DC.



Quantitative evaluation in the Great recession. QE 2



Shock decompositions.



Conclusion

Several papers explain the lack of deflation in US data during the Great recession.

- In some of these papers monetary policy is not impacted by debt aggregates (e.g. Del Negro (2015), Fratto and Uhlig (2014), Kollmann et al (2015) etc
- in others it is (e.g. Bianchi and Melosi (2017)).

We propose a **novel theoretical model of endogenous FG** which **microfounds** the ad hoc interest rate rules assumed in the DSGE literature.

We find that when monetary policy is **overridden by debt sustainability concerns** it cannot stabilize inflation in LTs. Keeping interest rates low for a long period does not lead to positive inflation rates.

In the absence of debt concerns, monetary policy can stabilize inflation. We find strong evidence in favor of this model.

Literature

1. Several papers on monetary policy taking into account debt aggregates in the Great recession. (del Negro and Sims (2015), Cochrane (2017), Eggertsson et al (2015), Bianchi and Melosi (2017)
2. Optimal Monetary/ Policy models (e.g. Eggertsson and Woodford (2003, 6), Jung et al (2005), Adam and Billi (2006, 8), Bouakez et al (2018)...)
    - These models should give endogenous FG. But highly nonlinear and disconnected from DSGE. Our model is tractable, it enables us to develop analytical insights....
3. More broadly on Ramsey policy, Aiyagari et al (2002), SGU (2004), Lustig et al (2008), FMOS (2016).
4. Considerable literature on monetary/fiscal policy mix (Leeper (1991), Sims (2004), Bianchi and Ilut (2018), Bianchi and Melosi (2017)...)

Medium scale version of the FED's program.

	Parameter	Posteriors	
	Quarterly trends		
100γ	growth rate	0.4152	[0.337 ; 0.489]
$100(\beta^{-1} - 1)$	discount rate	0.1767	[0.065 ; 0.288]
$100 \ln \overline{\Pi}$	inflation	0.5706	[0.478 ; 0.658]
	HH and firms		
Ω	habit formation	0.4757	[0.378 ; 0.574]
κ	slope Phillips curve	0.0086	[0.003 ; 0.014]
ζ	price indexation	0.2031	[0.076 ; 0.328]
	CB preferences		
λ_i	interest rate smoothing	1.1302	[0.768 ; 1.446]
λ_Y	output smoothing	0.2053	[0.097 ; 0.310]
	Fiscal policy		
ρ_τ	tax smoothing	0.958	[0.924 ; 0.993]
$\phi_{\tau,b}$	tax response to debt	0.066	[0.036 ; 0.092]
$\phi_{\tau,Y}$	tax response to output	0.400	[0.099 ; 0.718]
$\phi_{\tau,G}$	tax response to G	0.071	[-0.025 ; 0.187]

	Parameter	Posteriors	
	Shock processes		
ρ_a	technology	0.428	[0.327 ; 0.535]
ρ_g	gov. spending	0.989	[0.980 ; 0.998]
ρ_ξ	preference	0.982	[0.972 ; 0.994]
ρ_λ	gov b.c	0.199	[0.062 ; 0.344]
ρ_p	price mark-up	0.980	[0.964 ; 0.997]
μ_p	price moving average	0.870	[0.779 ; 0.958]
	Shocks, Std		
σ_a	technology	0.553	[0.467 ; 0.642]
σ_g	gov. spending	1.780	[1.581 ; 1.968]
σ_ξ	preference	5.78	[2.686 ; 9.131]
σ_λ	gov b.c	3.259	[2.841 ; 3.665]
σ_p	price mark-up	0.117	[0.084 ; 0.149]
σ_τ	labor tax	0.303	[0.266 ; 0.339]
σ_r	interest rate, m.e.	0.036	[0.030 ; 0.042]

Table : Posterior statistics