Non-linearities beyond the OBC: Financial frictions and the elasticity of banking sector leverage

Giosuè Cavagna[1] Felix Kuntz[2]

[1]European Central Bank

[2]University of Oxford and European Central Bank

Table of Contents

Motivation

- Gertler and Karadi (2011, 2013) became benchmark model for the study of macro-financial linkages
- It is frequently used to inform monetary policy-making
- However, the model exhibits a limited degree of pass-through from financial sector to the real economy under a reasonable set of parameters
- While the model illuminates financial sector dynamics, the moments of the financial variables are smaller than empirical evidence would suggest
- No substantial non-linearities beyond the occasionally binding leverage constraint

Table of Contents

Contribution

We propose a model ingredient which provides a versatile tool to:

1. Generate a stronger pass-through from financial sector to the real economy
2. Achieve higher volatility of the banking sector leverage
3. Calibrate the model closer to the data without relying on non-standard model parameters or steady state calibrations
4. Introduce non-linearities beyond the occasionally binding leverage constraint
5. Have control over the degree of non-linearity of the model

Table of Contents

Model

- Medium-scale New Keynesian model
- Standard household sector with habits in consumption
- Standard production sector with intermediate, final, and capital goods producers
- Government expenditures are financed through taxes and the issuance of government bonds
- Central bank sets nominal interest rate and conducts QE by purchasing government bonds

Banks

- Bank balance sheet

$$Q_tS_t + q_tB_{b,t} = N_t + D_t \tag{1}$$

  - S_t: corporate bonds with price Q_t
  - $B_{b,t}$: government bonds with price q_t
  - N_t: bank's net worth
  - D_t: deposits
- Banks acquire deposits subject to an incentive constraint

$$V_t(N_t) \geq \Theta_t(X_t) \underbrace{(Q_tS_t + \Gamma q_tB_{b,t})}_{\text{Assets}} \tag{2}$$

  - $V_t(N_t)$: Franchise value of the bank
  - $\Theta_t(X_t)$: Divertion rate

Divertion Rate

- Divertion rate pins down the fraction of assets which are divertable
- In a GK model, the diveration rate is a constant θ
- Similar to Akinci et al. (2023), we introduce an endogenous divertion rate as a decreasing function of the share of safe assets

$$\Theta_t(X_t) = \theta \left(1 - \frac{a}{b} {X_t}^b\right) \tag{3}$$

  - a and b are scaling parameters
  - $X_t = \frac{\Gamma q_t B_{b,t}}{Q_t S_t + \Gamma q_t B_{b,t}}$ is the share of safe assets

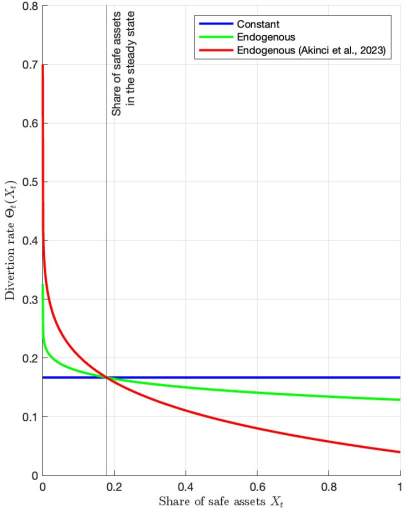
Divertion Rate

- Intuition of an endogenous divertion rate
  - Reflects depositor ability to monitor banks' portfolios
  - If the riskiness of the portfolio increases, it becomes harder for households to monitor
  - Banker ability to divert funds increases

$$\frac{\partial \Theta_t(X_t)}{\partial X_t} < 0$$

  - In order for the incentive constraint to be respected, the franchise value of bank has to increase with dimishing returns to riskiness

$$\frac{\partial^2 \Theta_t(X_t)}{\partial {X_t}^2} > 0$$



Banks

- Incentive constraint gives rise to an occasionally binding leverage constraint

$$\phi_t \leq \frac{\mu_{N,t}}{\Theta_t(X_t)(1-\lambda_t)} \equiv \bar{\phi}_t \tag{4}$$

  - $\phi_t = \frac{Q_t S_t + \Gamma q_t B_{b,t}}{N_t}$: leverage ratio
  - $\bar{\phi}_t$: maximum leverage
  - $\mu_{N,t}$: Marginal value of banks' net worth
  - λ_t: Lagrange multiplier on the incentive constraint

- Relationship between the lending spread and the leverage
  - Zero lending spread $\rightarrow$ non-binding leverage constraint: $\phi_t \leq \bar{\phi}_t$
  - Positive lending spread $\rightarrow$ binding leverage constraint: $\phi_t = \bar{\phi}_t$

Set of modified equations

Divertion rate

$$\Theta_t(X_t) = \theta\left(1 - \frac{a}{b}{X_t}^b\right) \tag{5}$$

Incentive constraint

$$\lambda_t = \max\{0, 1 - \frac{\mu_{N,t}}{\Theta_t(X_t)\phi_t}\} \tag{6}$$

Marginal value of lending

$$\mathbb{E}_t\Lambda_{t,t+1}\Omega_{t+1}\left[R_{k,t+1} - R_{t+1}\right] = \lambda_t\left[\Theta_t(X_t) + \theta a X_t^b\right] \tag{7}$$

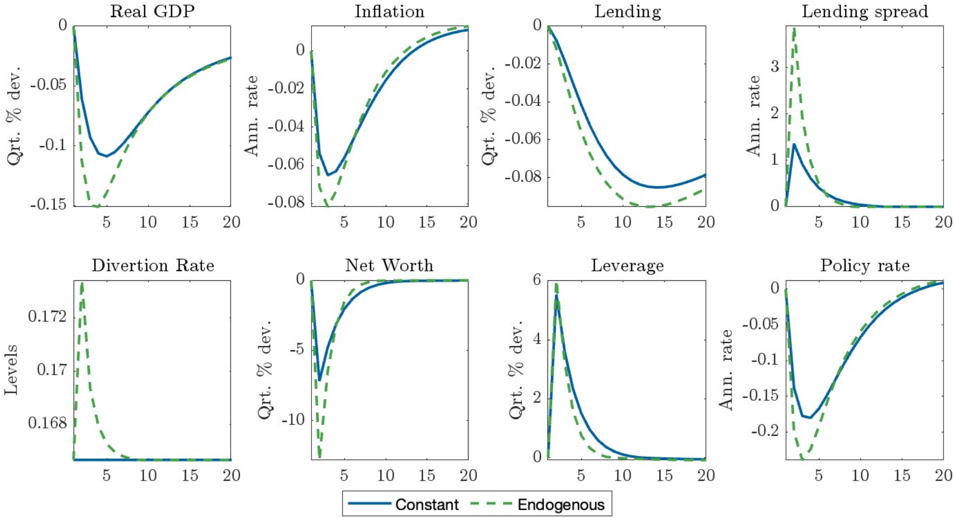
Marginal value of government bonds

$$\mathbb{E}_t\Lambda_{t,t+1}\Omega_{t+1}\left[R_{b,t+1} - R_{t+1}\right] = \lambda_t\Gamma\left[\Theta_t(X_t) + \theta a(1 - X_t)X_t^{b-1}\right] \tag{8}$$

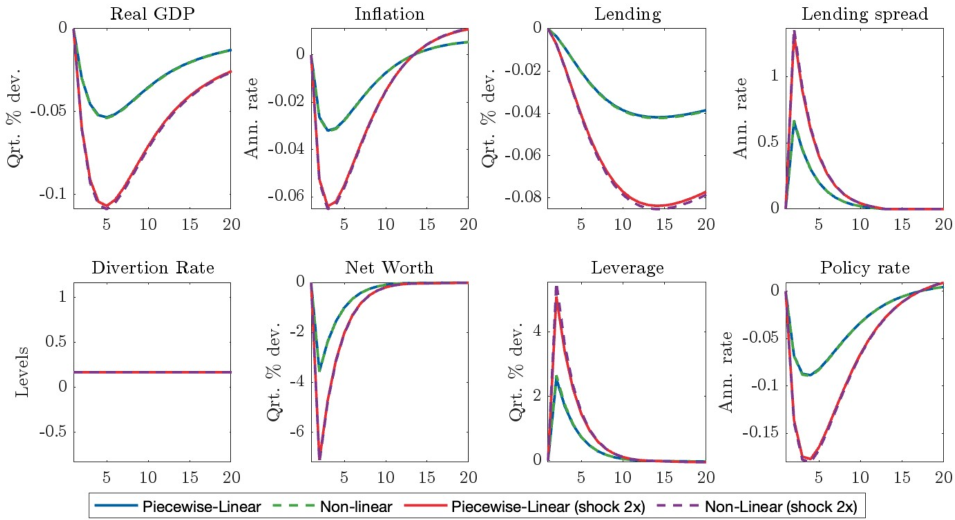
For $a = 0$, the model reduces to a benchmark GK model.

Table of Contents

Financial shock



Non-linearities in the benchmark model ($\alpha = 0$)



Non-linearities with endogenous divertion rate ($\alpha = 0.075$)

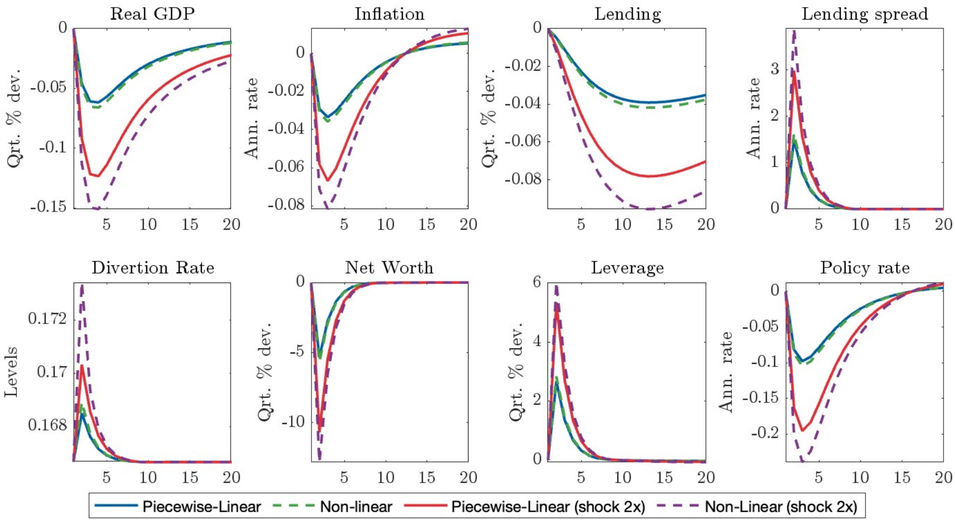


Table of Contents

Conclusion and Work in Progress

We propose a model ingredient which provides a versatile tool to:

- Generate a stronger pass-through from financial sector to the real economy
- Achieve higher volatility of the banking sector leverage
- Calibrate the model closer to the data without relying on non-standard model parameters or steady state calibrations
- Introduce non-linearities beyond the occasionally binding leverage constraint
- Have control over the degree of non-linearity of the model

Work in progress

1. Implement a simulation method that preserves non-linearities
2. Compare simulated moments with data and alternative models
3. Perform estimation of the model

References

Akinci, O., Benigno, G., Del Negro, M., and Queralto, A. (2023). The Financial (In)Stability Real Interest Rate, r**. *Federal Reserve Bank Staff Reports*.

Gertler, M. and Karadi, P. (2011). A model of unconventional monetary policy. *Journal of Monetary Economics*, 58(1):17–34.

Gertler, M. and Karadi, P. (2013). QE 1 vs. 2 vs. 3...: A Framework for Analyzing Large-Scale Asset Purchases as a Monetary Policy Tool. *International Journal of Central Banking*, (1):5–53.