

Private and Government Banks: A DSGE Approach

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Overview

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Motivation

- Public and private banks are different according to the empirical literature. La Porta et al (2002), Levy-Yeyati et al (2004), Sapienza (2004), Micco and Panizza (2006), Micco et al (2007), Altavilla et al (2016)
- The main differences are: They react differently during recessions. They have a different mandate, operate in a different political environment, have different governance and have portfolios tied to government debt.
- At the same time, they are big enough, in aggregate (assets or loans) that they likely merit consideration when modeling economic fluctuations and crisis.

Motivation

Table: Government banks, share of assets of the top 10 banks. La Porta et al (2002).

Country	Share
Argentina	60.5
Belgium	27.6
Bolivia	18.5
Brazil	31.7
Chile	19.7
China	99.5
Colombia	53.9
Costa Rica	90.9
Ecuador	40.6
Egypt	88.6
El Salvador	26.4
France	17.3
Germany	36.4
Guatemala	22.2
Honduras	29.9
Israel	64.6
Italy	36
Nicaragua	63.4
Paraguay	48
Peru	26.5
Poland	84.3
Portugal	25.7
Taiwan	76.5
Thailand	17.1
Turkey	56.5
Uruguay	68.8

Motivation

- The literature has not provided an equilibrium model that addresses the effect of government banks in aggregate. Currently such effects are analyzed in partial equilibrium.
- I begin to address this gap by modeling a salient feature of government banks - they react differently during recessions by extending loans when non-government banks curtail lending.
- I develop a DSGE model that explores dynamics of the economy when we account for this behavior.

Introduction

- Until now public and government banks have been treated as the same agent in equilibrium models.
- However, the empirical literature shows important differences: La Porta et al (2002), Levy-Yeyati et al (2004), Sapienza (2004), Micco and Panizza (2006), Micco et al (2007), Altavilla et al (2016)
- Following Aliaga-Diaz and Olivero (2012) I develop a DSGE model with banks.
- In this model I differentiate between private and government banks, taking one of the major differences found in the empirical literature.
- Therefore, in this model, the government works through government banks during recessions by injecting capital that is used to make loans.

The Model

- The model is a DSGE economy which is characterized by six types of agents.
- Households with access to the financial market. They are λ percent of the total population.
- Households without access to the financial markets.
- Firms.
- Private banks. They are a ϕ percent of the total banks.
- Government banks.
- The government.

Ricardian Households

The households with access to the financial market solve:

$$\max_{c_{r,t}, l_{r,t}, D_{t+1}, s_{t+1}} E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(c_{r,t} - \frac{l_{r,t}^\omega}{\omega} \right)^{1-\theta}}{1-\theta} \quad (1)$$

s.t.

$$(1 + r_t)D_t + w_t l_{r,t} + \left[\frac{\text{div}_t^p}{s_t} + p_t \right] s_t \geq c_{r,t} + D_{t+1} + p_t s_{t+1}. \quad (2)$$

Ricardian Households

Therefore, the optimal equations for them are :

$$l_{r,t}^{\omega-1} = w_t, \quad (3)$$

$$\left(c_{r,t} - \frac{l_{r,t}^{\omega}}{\omega} \right)^{-\theta} = \beta E_t (1 + r_{t+1}) \left(c_{r,t+1} - \frac{l_{r,t+1}^{\omega}}{\omega} \right)^{-\theta}, \quad (4)$$

$$\left(c_{r,t} - \frac{l_{r,t}^{\omega}}{\omega} \right)^{-\theta} = \beta E_t \frac{1}{p_t} \left[\frac{\text{div}_{t+1}^p}{s_{t+1}} + p_{t+1} \right] \left(c_{r,t+1} - \frac{l_{r,t+1}^{\omega}}{\omega} \right)^{-\theta}. \quad (5)$$

Non-Ricardian Households

The households without access to the financial market solve:

$$\max_{l_{nr,t}} E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(c_{nr,t} - \frac{l_{nr,t}^{\omega}}{\omega} \right)^{1-\theta}}{1-\theta} \quad (6)$$

s.t.

$$w_t l_{nr,t} + tr_t = c_{nr,t}. \quad (7)$$

Non-Ricardian Households

So the optimal solution is:

$$w_t l_{nr,t} + tr_t = c_{nr,t}. \quad (8)$$

Firms

Firms maximize profits taken prices as given:

$$\max_{l_t, l_t, L_{t+1}} E_0 \sum_{t=0}^{\infty} \left[\prod_{j=0}^t \frac{1}{1+r_j} \right] [Y_t + L_{t+1} - w_t l_t - (1+i_t)L_t - l_t] \quad (9)$$

s.t.

$$Y_t = A_t K_t^\alpha l_t^{1-\alpha}, \quad (10)$$

$$K_{t+1} = (1-\delta)K_t + l_t, \quad (11)$$

$$L_{t+1} = K_{t+1}, \quad (12)$$

$$\log(A_{t+1}) = \rho \log(A_t) + \epsilon_{t+1}, \quad \epsilon_{t+1} \sim N(0, \sigma^2). \quad (13)$$

Firms

Their optimal plan is given by:

$$(1 - \alpha) \frac{Y_t}{l_t} = w_t, \quad (14)$$

$$E_t \left[\frac{1}{1 + r_{t+1}} \left(\alpha \frac{Y_{t+1}}{K_{t+1}} - (\delta + i_{t+1}) \right) \right] = 0. \quad (15)$$

Private Banks

Private banks solve:

$$\max_{D_{t+1}^P, L_{t+1}^P, RE_t^P} E_0 \sum_{t=0}^{\infty} \prod_{j=0}^t q_j \left[(1 - \tau)(i_t L_t^P + \phi \pi_t^f - r_t D_t^P) - RE_t^P \right] \quad (16)$$

s. t.

$$e_{t+1}^P = RE_t^P + e_t^P, \quad (17)$$

$$L_{t+1}^P = D_{t+1}^P + e_{t+1}^P, \quad (18)$$

$$e_{t+1}^P \geq \gamma^P L_{t+1}^P. \quad (19)$$

Private Banks

So their optimal solution is given by:

$$\gamma^P = E_t q_{t+1} (\gamma^P + (1 - \tau)[i_{t+1} - (1 - \gamma^P)r_{t+1}]). \quad (20)$$

Government Banks

Government banks solve:

$$\max_{D_{t+1}^g, L_{t+1}^g, RE_t^g} E_0 \sum_{t=0}^{\infty} \prod_{j=0}^t q_j \left[(1 - \tau)(i_t L_t^g + (1 - \phi)\pi_t^f - r_t D_t^g) - RE_t^g \right] \quad (21)$$

s.t.

$$e_{t+1}^g = RE_t^g + e_t^g + g_t, \quad (22)$$

$$L_{t+1}^g = D_{t+1}^g + e_{t+1}^g, \quad (23)$$

$$e_{t+1}^g \geq \gamma^g L_{t+1}^g. \quad (24)$$

Where g_t is an injection of capital coming from the government and is given by the following rule:

$$g_t = \chi(Y_{ss} - Y_t). \quad (25)$$

Government Banks

Hence, the optimal plan is given by:

$$\gamma^g = E_t q_{t+1} (\gamma^g + (1 - \tau)[i_{t+1} - (1 - \gamma^g)r_{t+1}]). \quad (26)$$

As we can see, government banks are very similar to private banks. They maximize the same objective function but differ in one constraint.

The Government

The government holds a zero budget balance every period.

$$g_t + tr_t = \tau(i_t L_t - r_t D_t + \pi_t^f) + div_t^g. \quad (27)$$

Aggregation

Finally, in equilibrium:

$$c_t = \lambda c_{r,t} + (1 - \lambda) c_{nr,t}, \quad (28)$$

$$l_t = \lambda l_{r,t} + (1 - \lambda) l_{nr,t}, \quad (29)$$

$$Y_t = c_t + l_t + g_t, \quad (30)$$

$$L_t = \phi L_t^p + (1 - \phi) L_t^g, \quad (31)$$

$$L_t = K_t; \quad (32)$$

$$D_t = \phi D_t^p + (1 - \phi) D_t^g. \quad (33)$$

Calibration

The parameters used in the paper are:

Table: Parameter values.

Parameter	Value
θ	3
β	0.98
ω	2
α	0.33
ρ	0.9
δ	0.1
γ^p	0.1
γ^g	0.1
τ	0.15
χ	0.125
λ	0.7

Output reaction

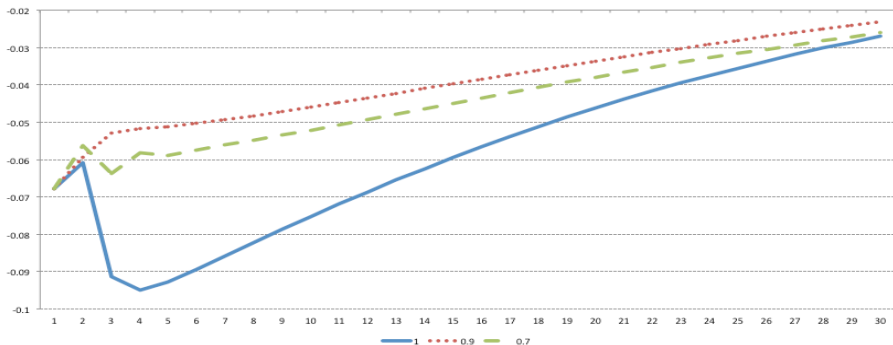


Figure: Output reaction to a TFP shock for different values for ϕ

Consumption reaction

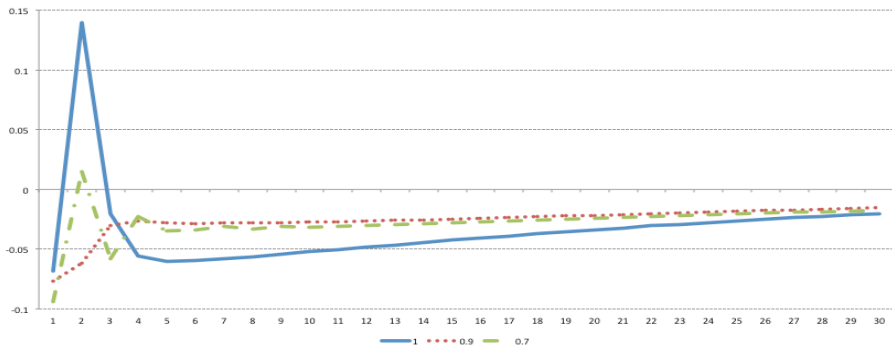


Figure: Consumption reaction to a TFP shock for different values for ϕ

Investment reaction

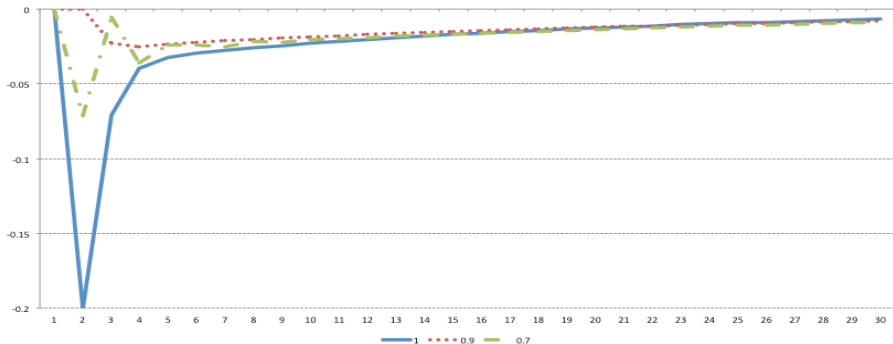


Figure: Investment reaction to a TFP shock for different values for ϕ

Labor reaction

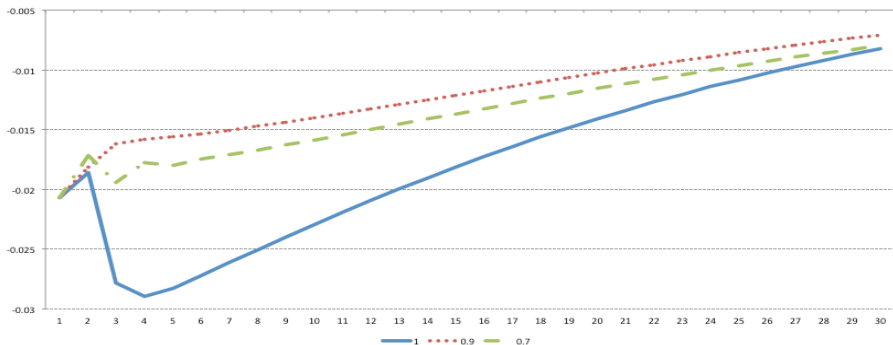


Figure: Labor reaction to a TFP shock for different values for ϕ

Further Research

- The next step is to extend the model to endogenously determine g and tr by using an objective function for the government.
- It is also worth noting that here the government does not care about its debt capacity - this is an immediate extension.
- It is important to include the more negative aspects of government banks (e.g. agency and political problems). This would allow us to observe, in a more thorough way, the merits of having stated-owned banks.

Conclusions

- We have seen the importance of including public and private banks as two different agents in an equilibrium model. As a matter of fact with a small percentage of public banks, the responses regarding macroeconomic variables are very different in magnitude.
- The reaction of the economy differs from the canonical DSGE with banks when we account for this heterogeneity.
- Modeling the observed behavior of government banks during recessions allows us to see that the recovery of the economy might be less severe depending on the characteristics of the economy.
- The results depends on how big the government banks are in the aggregate.

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