

# Financial Intermediation and Monetary Policy in a Small Open Economy

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# Outline

- 1 Introduction
- 2 The Model
- 3 Calibration
- 4 Transmission mechanisms
- 5 Concluding remarks



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# Financial intermediation

- The financial system is important for a small open economy:
  - ▶ eases the transactions between economic agents (households, firms, banks, government, foreign sector)
  - ▶ allows the reduction of transaction costs and the exploitation of scale economies
  - ▶ intermediary between saving and investment
  - ▶ intermediation of foreign resources into the domestic economy
- Empirically it is known the relation between the domestic real cycle and the domestic and foreign financial cycles (Uribe, Yue (2003), Oviedo (2005)).



# Financial intermediation: monetary policy

- The transmission and effectivity of monetary policy is influenced by the optimal decisions of the banks to exogenous policy shocks.
- However, most of the DSGE models used for policy analysis and forecasting ignore any interactions between the financial markets and the real economy.
- A standard new-keynesian small open economy model can be easily extended to incorporate financial intermediation. We need to generate a demand for financial services.

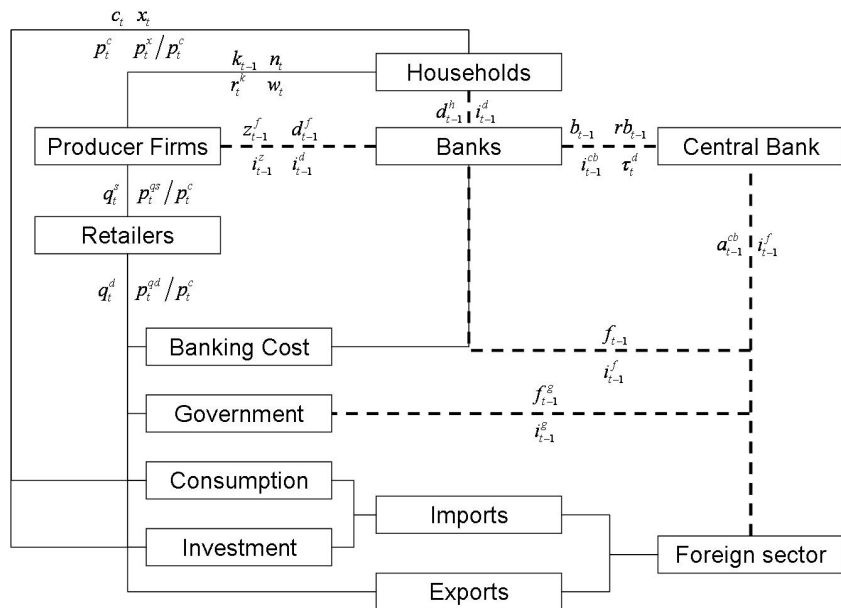


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# Model: Outline



# Households: TC approach

- We need to impose some kind of need for financial products (several shortcuts).
- Following Hamann and Oviedo (2006) there is a transaction cost. The exchange process requires the utilization of real resources, and this cost depends positively on the ratio between the value of private absorption and household's deposits

$$v_t(h) = \frac{c_t(h) + \frac{p_t^x}{p_t^c} x_t(h)}{d_{t-1}^h(h)} \frac{A_t N_t}{A_{t-1} N_{t-1}}$$

- The transaction cost for absorption unit is given by

$$\vartheta(v_t) = \vartheta_0 v_t^{\vartheta_1}$$

a positive, increasing, convex twice continuously differentiable function.



# Production firms

- Following Uribe and Yue (2003), the firm faces a *working capital constraint*. To pay a fraction of the wage bill the firm is required to hold deposits in the banks in order to satisfy the constraint

$$d_{t-1}^f \frac{A_{t-1}}{A_t} \frac{N_{t-1}}{N_t} \geq \varphi w_t (1 - TD_t) TBP_t n_t$$

where  $d_{t-1}^f$  are total deposits held by the firm in the banks and  $\varphi \geq 0$ .

- Firms demand credit as a production input

$$q_t^s = f(n_t, k_t^s, z_{t-1}^f)$$



## Financial sector: cost function

- The production technology for the bank  $j^b$  is given by the cost function  $\xi_t \eta(z_t(j^b), d_t(j^b))$  that represents the minimum quantity of real resources (final output) needed to produce financial services (deposits and credit).
- The production technology of the financial services is represented by the cost function

$$\eta(z_t(j^b), d_t(j^b)) = \left[ \nu_z (z_t(j^b))^\nu + \nu_d (d_t(j^b))^\nu \right]^{\frac{1}{\nu}}$$

where  $\nu > 1$ ,  $\nu_z, \nu_d > 0$ . Credit and deposits are **Edgeworth complements**.

- We may also consider a model without cost.



# Financial sector and monetary policy

- The financial system is the bridge between the monetary authorities and the private sector.
- There exists a compulsory requirement of reserves as a fixed proportion  $\tau_t^d > 0$  of the total deposits, so the reserves are given by

$$h_t(j^b) \geq \tau_t^d d_t(j^b)$$

- There is a repo market: banks can borrow at a nominal rate  $i_t^{cb}$  that is controlled by the central bank. The central bank follows a Taylor rule

$$(1 + i_t) = (1 + i_{t-1})^{\rho_i} \left( (1 + \bar{i}) \left( \frac{1 + \pi_t}{1 + \bar{\pi}} \right)^{\rho_\pi} \left( \frac{y_t}{y_{t-1}} \right)^{\rho_y} \right)^{1 - \rho_i} \epsilon_t^i$$



# Financial sector: profits

- The representative bank  $j^b$  seeks the maximization of the value of assets, the discounted sum of profits  $\Pi_t^b(j^b)$  that will be transferred to the households. This is a **dynamic** problem.
- The resource constraint of the bank  $j^b$  is given by:

$$\begin{aligned}
 \left( \frac{1 + i_{t-1}^z(j^b)}{1 + \pi_t^c} \right) z_{t-1}(j^b) \frac{A_{t-1}}{A_t} \frac{N_{t-1}}{N_t} &+ \left( \frac{1 + i_{t-1}^d(j^b)}{1 + \pi_t^c} \right) d_{t-1}(j^b) \frac{A_{t-1}}{A_t} \frac{N_{t-1}}{N_t} + z_t(j^b) \\
 + \frac{s_t p_t^*}{p_t^c} f_t(j^b) + d_t(j^b) &\geq + \left( \frac{1 + i_{t-1}^f}{1 + \pi_t^*} \right) \frac{s_t p_t^*}{p_t^c} f_{t-1}(j^b) \frac{A_{t-1}}{A_t} \frac{N_{t-1}}{N_t} + \Pi_t^b(j^b) \\
 + b_t(j^b) + r b_{t-1}(j^b) \frac{A_{t-1}}{A_t} \frac{N_{t-1}}{N_t} &+ \left( \frac{1 + i_{t-1}^{cb}}{1 + \pi_t^c} \right) b_{t-1}(j^b) \frac{A_{t-1}}{A_t} \frac{N_{t-1}}{N_t} + r b_t(j^b) \\
 &+ \frac{p_t^{gd}}{p_t^c} \xi_t \eta (z_t(j^b), d_t(j^b))
 \end{aligned}$$

- The first order conditions are dynamic as well.



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# Steady state ratios

Variable	Interpretation	Value
$gdp$	Real GDP level	0.982
$w$	Real wage level	3.616
$h$	Labour supply's share of time	0.298
$\frac{c}{y}$	Ratio consumption to GDP	0.640
$\frac{p^x x}{p^c gdp}$	Ratio investment to GDP	0.215
$\frac{p^{qd} g}{p^c gdp}$	Ratio government expenditures to GDP	0.178
$\frac{p^{qd} e}{p^c gdp}$	Ratio exports to GDP	0.163
$\frac{p^{mdock} m^{dock}}{p^c gdp}$	Ratio dock imports to GDP	0.196
$\frac{p^c c}{p^m c^m}$	Ratio imported consumption to total cons.	0.200
$\frac{p^m x^m}{p^x x}$	Ratio imported investment to total investment	0.500



# Steady state ratios

Variable	Interpretation	Value
$\frac{sp^* tr}{p^c gdp}$	Ratio net foreign transfers to GDP	0.035
$\frac{sp^* (f^g + fs)}{p^c gdp}$	Ratio total net foreign liabilities to GDP	1.20
$\frac{sp^* f^g}{p^c gdp}$	Ratio government's foreign debt to GDP	0.653
$\frac{sp^* a^{cb}}{p^c gdp}$	Ratio central bank's foreign assets to GDP	0.454
$\frac{sp^*}{p^c}$	Real exchange rate	1.191
$\left(\frac{1+j^d}{1+\pi^c}\right)^4 - 1$	Ann. real bank rate on deposits (per cent)	2.01%
$\left(\frac{1+j^z}{1+\pi^c}\right)^4 - 1$	Ann. real bank rate on credit (per cent)	7.92%
$\frac{d}{gdp}$	Ratio of deposits to GDP	1.123
$\frac{z}{gdp}$	Ratio of credit to GDP	2.100
$v$	Velocity of the deposits	0.983
$\vartheta_0 v^{\vartheta_1}$	Transaction cost (per cent)	9.77%



# Calibrated parameters

Parameter	Value	Parameter	Value
$\beta$	0.999	$b$	0.023
$a$	0.004	$\bar{\delta}$	0.003
$n$	0.003	$\nu_d$	$7.315 \times 10^{-5}$
$1 + \bar{\pi}$	$(1.03)^{\frac{1}{4}}$	$\nu_z$	$1.443 \times 10^{-4}$
$1 + \bar{\pi}^*$	$(1.0221)^{\frac{1}{4}}$	$\tau^d$	0.062
$\gamma$	0.791	$\gamma^x$	0.491
$\frac{(p^m)^*}{p^*}$	0.843	$\vartheta_0$	0.098
$tbp$	0.537	$\vartheta_1$	0.036
$td$	0.134	$c^*$	0.108
$\varphi$	0.48	$g$	0.183
$\bar{\chi}^{qs}$	0.493	$\bar{\chi}^h$	128.78
$\bar{a}^{cb}$	0.375	$\bar{fg}$	0.653



# Short-run parameters

Parameter	Value	Parameter	Value
$\alpha$	0.931	$\alpha_V$	0.525
$\rho$	0.75	$\rho_V$	0.838
$\omega$	1.247	$\omega^X$	1.158
$\sigma$	2	$\varsigma$	1.5
$\epsilon^q$	0.75	$\theta^q$	5
$\epsilon^m$	0.50	$\theta^m$	6
$\epsilon^w$	0.25	$\theta^w$	5
$\psi^X$	8	$\gamma$	1
$\phi$	0	$\nu$	2
$\psi^b$	0.001	$\psi^g$	0.001
$\mu$	2	$\rho_i$	0.40
$\rho_\pi$	1.50	$\rho_y$	0.50



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# Transmission mechanisms

- The dynamics of the log-linearized model are studied using impulse responses.
- The following shocks are considered:
  - ▶ Standard monetary policy shock to the repo rate (with and without financial costs ( $\eta \neq 0$  and  $\eta = 0$ )).
  - ▶ Shock to the rate of compulsory reserve requirement  $\tau^d$  (with and without systematic reaction of the Taylor rule).

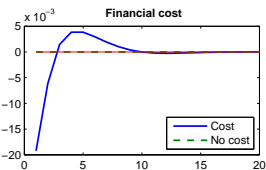
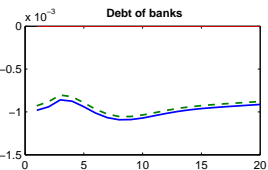
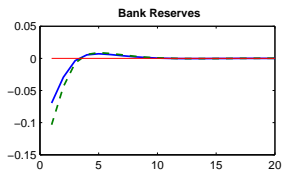
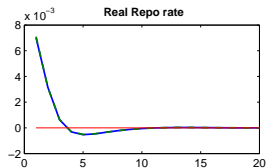
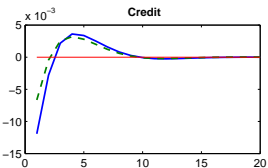
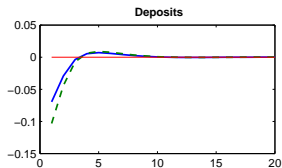
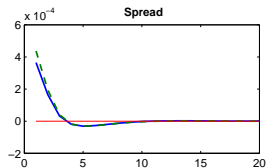
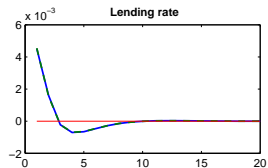
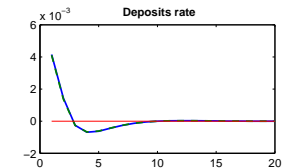


# Repo rate

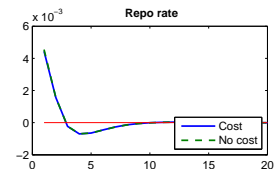
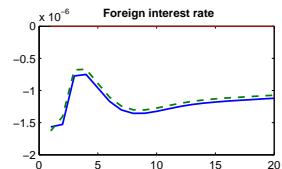
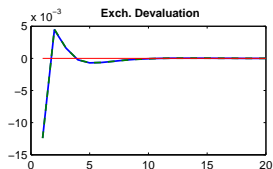
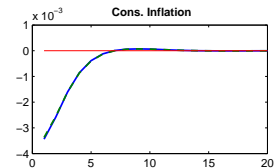
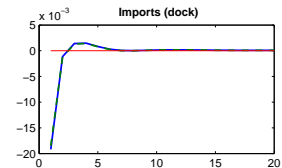
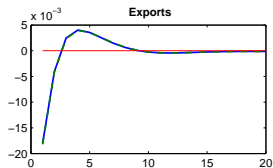
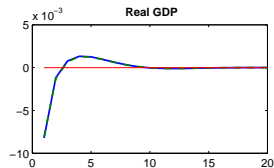
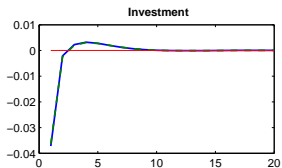
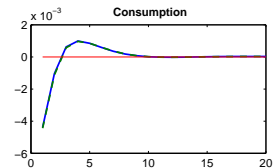
- Increase in deposits and lending rates and in spread.
- All the usual effect on real variables and inflation.
- No difference between Edwards and Vegh's costs and linear production (just as in Claus (2005)).



# Repo rate



# Repo rate

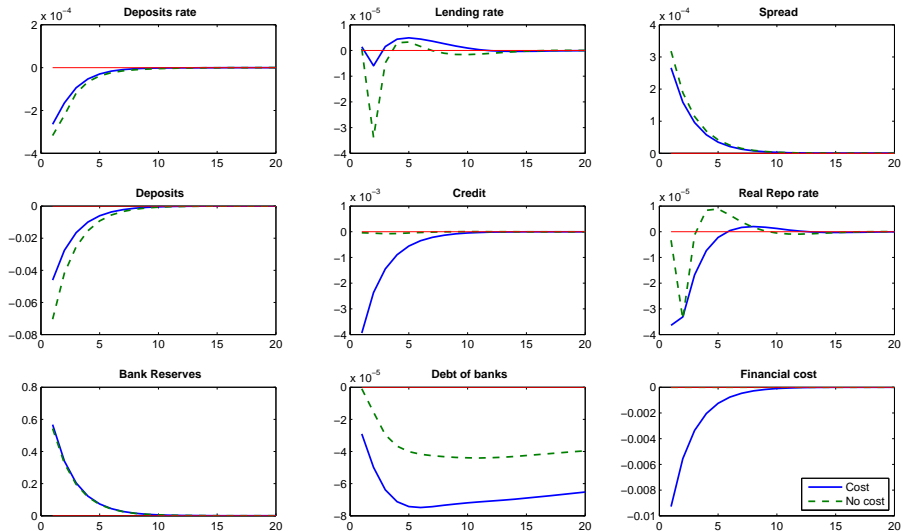


# Rate of compulsory reserve requirements

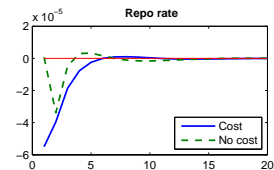
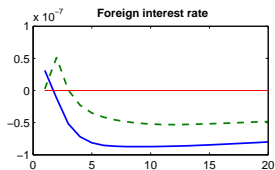
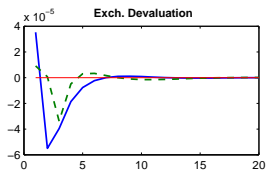
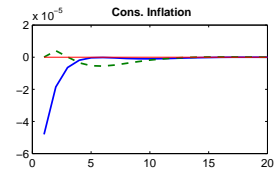
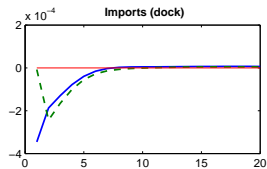
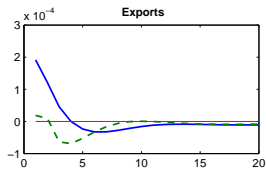
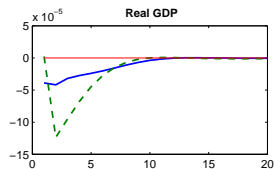
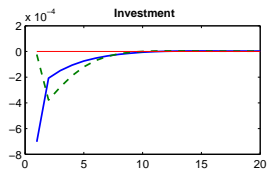
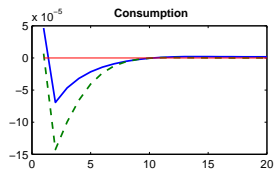
- Decrease in deposits rate. Increase in spread.
- No fall of aggregated demand (less savings).
- Model-dependent small effect on inflation rates.



# Rate of compulsory reserve requirements



# Rate of compulsory reserve requirements

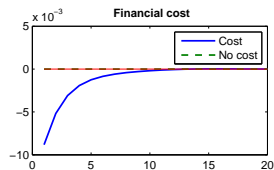
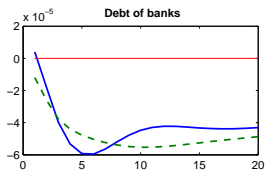
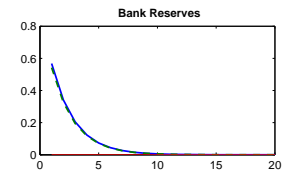
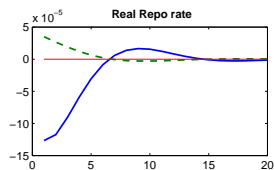
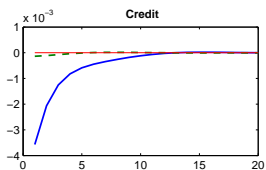
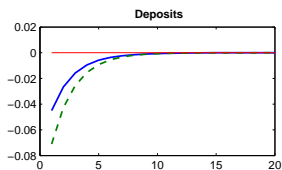
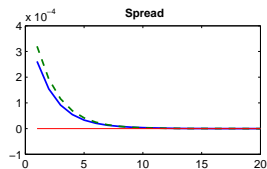
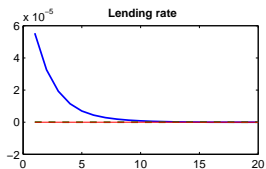
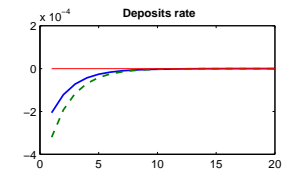


# Rate of reserve requirements: alternative

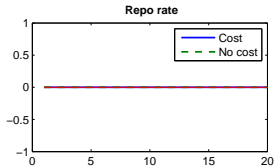
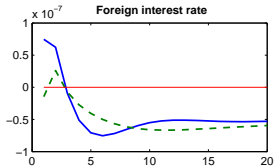
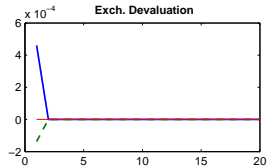
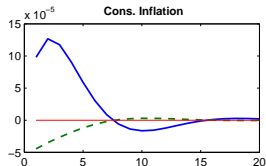
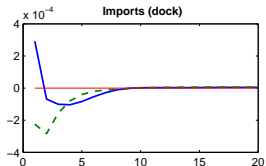
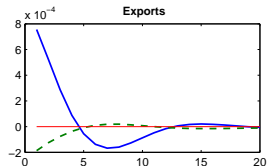
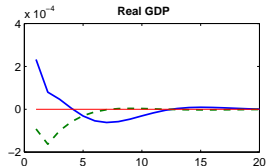
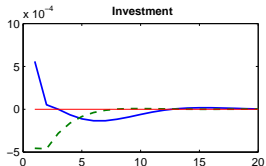
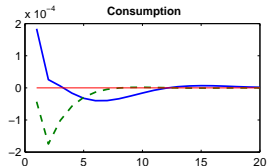
- The standard shock to the rate of compulsory requirement is influenced by the systematic response of Taylor's rule to inflation and output.
- A “fair” shock should leave the repo rate unchanged.
- By adequately shocking Taylor rule we can fix the repo rate and analyse the response to a reserve requirement shock.



# Rate of reserve requirements: alternative



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# Concluding remarks

- The financial system plays a key role in the transmission mechanism of the monetary policy:
  - ▶ Repo rates have in this model the standard effect.
  - ▶ Changes in the compulsory reserve requirement rate may generate, under different scenarios, totally different reactions on economic activity, and little quantitative effects on inflation rates and aggregate demand.
- Small quantitative effects of reserve requirement shock and financial shock cost: lack of accelerator mechanisms.



Thank you!

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