Traditional and matter-of-fact financial frictions in a DSGE model for Brazil: the role of macroprudential instruments and monetary policy

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The views expressed in this work do not necessarily represent those of the Central Bank of Brazil or its members
Purpose

- Investigate and assess the full-blown effects of macroprudential policies on the Brazilian economy
  - Reserve requirements
  - Capital requirement
  - Sectoral risk weights on banks’ assets for capital adequacy computation
  - Basel III (countercyclical buffer)
Motivation

– Banks are responsible for most of the financial intermediation in Brazil.
– Reserve Requirements have been actively used as a policy instrument in recent years
  • Existing studies based on partial-equilibrium analysis
– Brazilian agenda of convergence to Basel-3 regulation
– Mainstream literature focuses on advanced economies
  • Full collateralization of loans through capital or housing
  • Monopolistic competition in time deposits (GK)
  • Unremunerated reserve requirements
The theoretical model

- **Households (similar to Gerali et. al.)**
  - Savers
  - Borrowers

- **Entrepreneurs (as in BGG)**

- **Firms**
  - Intermediate goods
  - Retailers/Distributers
  - Final goods: private consumption, government consumption, investment, capital and housing

- **Government (monetary, fiscal and macroprudential policies)**

- **Investment fund**

- **Bank conglomerate**
  - Treasury department
  - Deposit branches (time deposits, savings accounts, demand deposits)
  - Lending branches (retail loans, investment loans, housing loans)
“Traditional” Features

– Habit formation in consumption.
– Prices and wages setting with Calvo rigidity.
– Corporate credit: Bernanke, Gertler and Gilchrist (BGG) financial accelerator, with slight modification (partial collateralization);
– As in Gerali et al., a representative bank collects deposits and lends to firms and households. Monopolistic competition in credit markets (staggered interest rates).
– One-period loans.
– Passive fiscal policy, with constant distortionary taxation.
– Closed economy (to keep things simple...)
– ESTIMATED model with Bayesian techniques.
“Matter-of-Fact” Features

- Households face debt-to-income credit constraint instead of LTV constraints with housing collateral. We implemented a variation of BGG financial accelerator associated do debt-to-income constraint to allow for endogenous default.
- Tight regulation on savings accounts and housing loans (very peculiar to Brazilian credit market)
- Ample and realistic set of reserve requirements on demand, saving and time deposits, which calls for:
  - Target for liquidity buffer
  - Targets and adjustment costs for time deposits
- Return on time deposits is equal to the policy interest rate (no Gertler and Karadi deposit spreads)
- Internal cost of bank capital as function of bank capital buffer (as in Van den Heuvel)
The bank’s program (simplified)

$$\max E_0 \left\{ \sum_{t \geq 0} \beta^t_{Bank} \left[ \frac{1}{1 - \sigma_B} \left( \frac{C_{B,j,t}}{\epsilon_t} \right)^{1-\sigma_B} \right] \varepsilon_t^{\beta,B} \right\}$$

Balance sheet:

$$L_{j,t} + Bonds_{j,t} + RR_{j,t} = D_{j,t} + Bankcap_{j,t}$$

Capital Accumulation:

$$Bankcap_{j,t} = Bankcap_{j,t-1} + FC^b_{j,t} - P_{C,t}C_{B,j,t} + Bankcap_{j,t} \varepsilon_t^{bankcap}$$

Reserve Requirement:

$$RR_{j,t} = \tau_{RR,R,T} D_{j,t}$$

Loan Demand (plus Calvo rigidity in interest rates):

$$L_{j,t} = \left( \frac{R^L_{j,t}}{R^L_{t}} \right)^{-\frac{\mu^R_{L-1}}{\mu^R_{L}}} L_t$$

Cash flow:

$$FC^b_{j,t} = R^L_{j,t-1}L_{j,t-1} - L_{j,t} + R_{RR,R,t-1}RR_{j,t-1} - RR_{j,t} + R_{t-1} Bonds_{j,t-1} - Bonds_{j,t} - R^T_{t-1}D_{j,t-1} + D_{j,t} - \Gamma_T \left( \frac{D_{j,t}}{D_{j,t-1}} \right) D_{j,t}$$

Bank Capital Cost

$$-\Gamma_{bankK} \left( \frac{BI_{j,t}}{\gamma_{bankK}} \right) Bankcap_{j,t}$$

Liquidity Preference

$$-\chi_{OM} \left( \frac{Bonds_{j,t}}{D_{j,t} + Bankcap_{j,t}} - \nu^OM_t \right)^2 (D_{j,t} + Bankcap_{j,t})$$

Leverage

$$-\chi_d \left( \frac{D_{j,t}}{D_{j,t} + Bankcap_{j,t}} - \nu^d_{t} \right)^2 (D_{j,t} + Bankcap_{j,t}) + \Pi_{L,j,t}^L + \Xi^b_{j,t}$$
IRFs to a 1p.p. Capital Requirement Shock

- GDP (% ss dev)
- Inflation (4-Q % ss dev)
- Interest rate (bp, yearly)
- R_B_c (% ss dev)
- Retail Lending Rate (bp, yearly)
- Retail Loans (% ss dev)
- Commercial Loans (% ss dev)
- Dividend distribution (% ss dev)
- Basel ratio (pp)

Legend:
- Unanticipated shock to capital requirement
- Anticipated shock to capital requirement
Reserve Requirement: scaling the size of the shocks
(nonresponsive MP)

Counter-cyclical capital buffer

IRFs to a 10% loss of bank capital

Bank capital (% ss dev)

Capital requirement (pp)

Credit for consumption (% ss dev)

Credit for investment (% ss dev)

Lending rate (retail) (bp, yearly)

Lending rate (investment) (bp, yearly)

Liquidity buffer (% ss dev)

GDP (% ss dev)

baseline
with countercyclical buffer
Concluding remarks

• Model with financial frictions both on the demand and the supply side of the banking sector
  – Theoretical set-up tailored to Brazil
  – Transmission mechanism of macroprudential policy
  – Endogenous lending spread: matter-of-fact decomposition

• Changes in reserve requirement ratios
  – Impact banks’ liquidity buffer, affecting lending rates and credit
  – Affect the real economy
  – Impact of remunerated RR (base-effect)
Concluding remarks

• Changes in capital requirement have a smaller yet more prolonged effect on credit-to-GDP with milder impact on output compared to MP shock

• Shocks on sectoral risk weight on CAR induce banks to reshuffle their credit portfolio towards less risky loans.
Caveats, Challenges and Next Steps

A considerable share of total credit consists of “earmaked credit”, with compulsory funding sources and government regulated interest rates:

• 60% of all bank saving deposits must be used to fund housing loans, at regulated low interest rates.
• 34% of all bank demand deposits must be channeled to farm loans, at regulated low interest rates.
• The Brazilian Development Bank (BNDES) provides loans to firms at low interest rates to finance investment projects.

As of dec/2012, these three credit categories accounted for 11%, 5% and 20% of total credit supply, respectively.

As their interest rates are not determined in a market equilibrium, they are not properly represented in the model.
Caveats, Challenges and Next Steps

• Sensitivity of internal cost of bank capital to capital requirement is hard to estimate (and subject to Lucas Critique).
• Short sample (jun/2000 onwards) with noticeable trends.
• Considerable bank heterogeneity (specially private vs. state-controlled banks) may render representative bank unrealistic.
• Still a closed economy model.

• Next steps:
  – Open economy
  – Phase-in implementation of Basle 3
  – Bank heterogeneity (public vs. private, small vs. big)
Trends in Credit Series

Credit as percentage of GDP

- Non-earmarked - Firms
- Non-earmarked - Households
- Earmarked - Other
- Earmarked - Dev. Bank
- Earmarked - Agribusiness
- Earmarked - Housing
Trends in Credit Series

Credit Interest Rates (yearly rates)

- Policy Rate (Selic)
- Nonearmarked funds - Households
- Nonearmarked funds - Firms
- CPI (12 months cum.)
Annex
Borrowing Constraint: Counterfactual Exercise

Comparing debt constraints dependent on wage income and housing.

- If housing stock is good as collateral, borrowers have an additional reason to own houses.
- If there is debt-to-income constraint, borrower will have more incentive to work.

Exercise: increasing risk weight of retail loans in the computation of Capital Adequacy Ratio (CAR)

\[ BI_t = \frac{BankCap_t}{\sum \tau_k B_{k,t}} \]
Borrowing Constraint: Counterfactual Exercise

IRFs to a 10p.p. increase in retail loans risk weight in CAR

- Risk Weight on Retail Loans in CAR (% ss dev)
- Borrower consumption (% ss dev)
- Borrower's housing stock (% ss dev)
- Relative housing price (% ss dev)
- Borrower hours (% ss dev)
- Housing investment (% ss dev)
- Consumption (% ss dev)
- Retail loans (% ss dev)
- GDP (% ss dev)
- Inflation (4-Q % ss dev)
- Interest rate (bp, yearly)

Legend:
- BGG debt-to-income borrowing constraint
- retail loans with housing collateral
Borrowing Constraint: Counterfactual Exercise

IRFs to a 1p.p. increase in total capital requirement

- Capital requirement (pp)
- Borrower consumption (% ss dev)
- Relative housing price (% ss dev)
- Inflation (4-Q % ss dev)
- Borrower hours (% ss dev)
- Housing investment (% ss dev)
- Retail loans (% ss dev)
- Consumption (% ss dev)
- Borrower’s housing stock (% ss dev)
- Housing investment (% ss dev)
- GDP (% ss dev)
- Interest rate (bp, yearly)

- BGG debt-to-income borrowing constraint
- retail loans with housing collateral
Borrowing Constraint: Counterfactual Exercise

IRFs to a 1p.p. monetary policy shock

- Interest rate (bp, yearly)
- Borrower hours (% ss dev)
- Borrower's housing stock (% ss dev)
- Borrower consumption (% ss dev)
- Housing investment (% ss dev)
- Consumption (% ss dev)
- Retail loans (% ss dev)
- Real wage (% ss dev)
- Relative housing price (% ss dev)
- GDP (% ss dev)
- Inflation (4-Q % ss dev)

- BGG debt-to-income borrowing constraint
- retail loans with housing collateral
IRFs of a 10 p.p. shock to Loan Risk Weights

• Shocks in risk weights spill over to the other credit segments