Financial Fragility Modelling and Applications
Section V: Chilean Case Study[1]

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[1] DISCLAIMER: The views expressed here are my own and do not necessarily represent those of the St. Edmund Hall, U. of Oxford or the Saïd Business School. Based on "A Financial Stability Analysis for the Chilean Economy" (Kazakova, Martinez, Peiris, Tsomocos, 2019).

The paper in a nutshell

The question:

What is the impact of - real and nominal - shocks to financial stability of SOE commodity exporters? What is the role of the banking system IO?

What we do:

- We develop a comprehensive model of small open economy that allows us to study financial stability.
- The model incorporates banking system heterogeneity in a reduced fashion and reflects SOEs' banking industry IO.
- We provide evidence of the interplay of real and financial economies.

Financial (In)Stability in Chile

- Chile has experienced three relevant episodes in the last 40 years with different degrees of relevance and policy/regulatory environments.
- The current situation is the result of an evolution to an open economy with safer banking system. We have inflation targeting with free floating exchange rate, which acts as a natural stabilizer of international shocks.
- However, there is still dependence of copper prices that may feedback to the financial sector directly or **indirectly**.

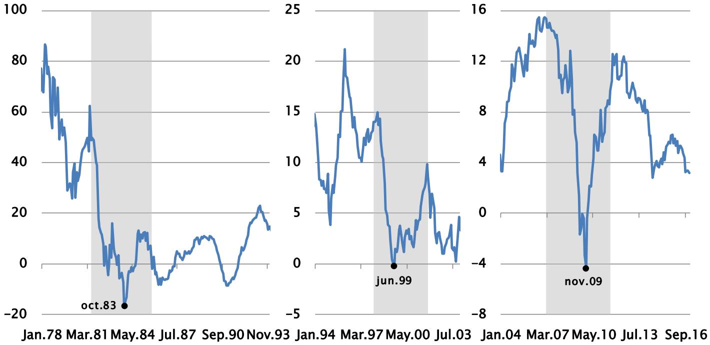
Period	Characteristics	Context
Local banking crisis (LBC) $\sim$ 1982	Insolvency of many institutions. Credit risk increase. Profitability reduction. Balance-sheet effects. Credit crunch.	Financial liberalization. Regulation failures. Credit boom. Current account deficit.
Asian crisis (AC) $\sim$1998	Credit risk increase. Profitability reduction. Merge/exit of small credit agencies. Credit crunch.	Current account deficit. Households' credit boom. Capital inflows.
Global financial crisis (GFC) $\sim$2008	Credit risk increase. Liquidity restrictions. Credit crunch.	Credit boom (lower intensity). Capital inflows.

Source: Martínez et al. (2018).

Chilean credit growth

- Consistent to Goodhart et al. (2006) description of financial fragility periods, past Chilean episodes of vulnerability include sharp contractions in credit...

Figure: Real annual credit growth (percentage).

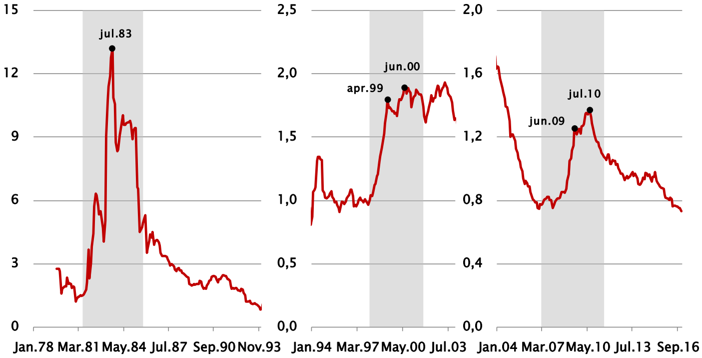


Source: Martínez et al. (2018).

Chilean past-due loans

...sizeable increases in default rates,...

Figure: Past due loans ratio (percentage of loans).



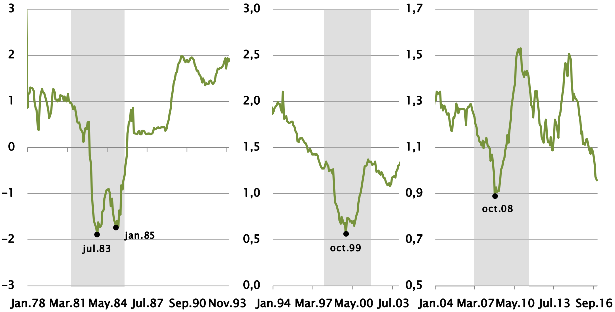
Source: Martínez et al. (2018).

Chilean ROA

...and, as a result, periods of considerably low profitability.

- So that it becomes relevant to progress in assessing the impact of several shocks in an integrated model to understand possible channels of shocks transmission and dynamics of key financial variables.

Figure: Return over assets (percentage).

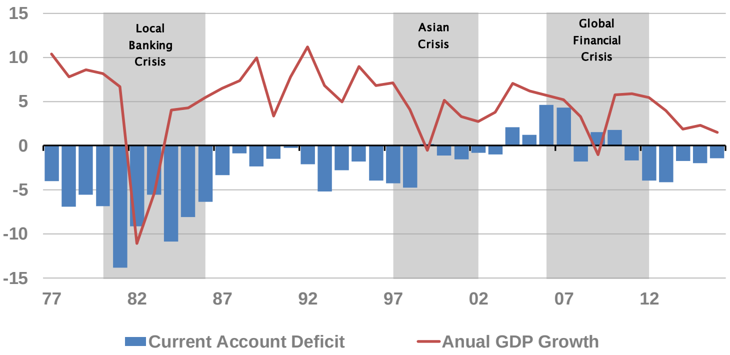


Source: Martínez et al. (2018).

Economic activity and country's external position

- As suggested by De Gregorio (2013), size of impacts depends also on the country's external position.

Figure: Financial Fragility and Current Account Deficit (percentage)

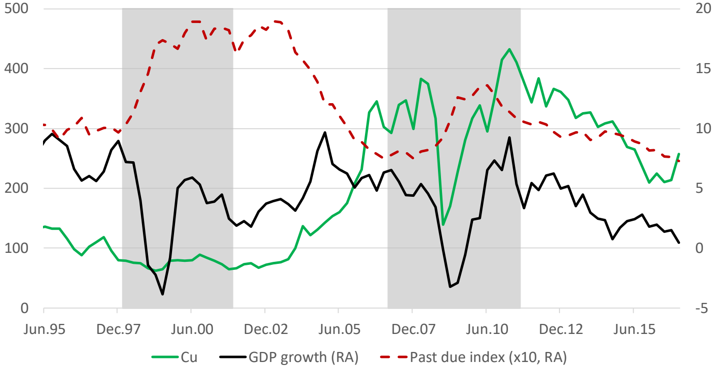


Source: Own elaboration. Grey areas based on Martínez et al. (2018).

Commodity price shocks' role

- In particular, recent periods of fragility seem related to commodity price fluctuations...

Figure: Financial Fragility and Economic Activity (percentage)



Source: Own elaboration. Grey areas based on Martínez et al. (2018).

Bank heterogeneity

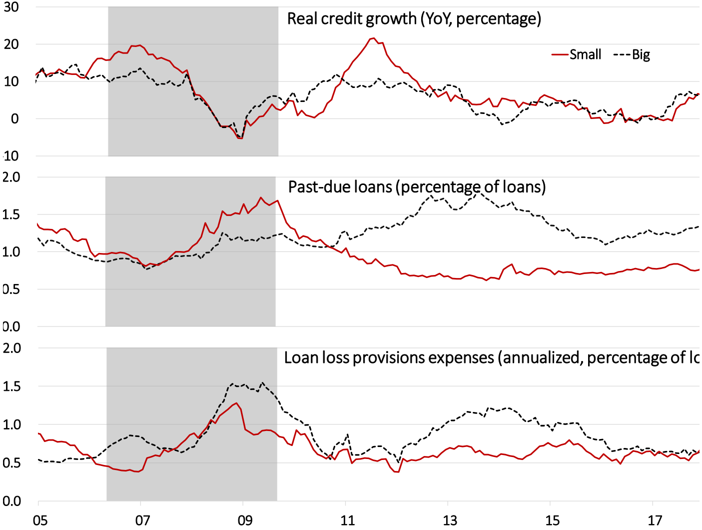


Figure: Commercial sector credit activity and risks by bank's size in Chile

Recent context

- In 2018 the Chilean economy is recovering after a period of slow macroeconomic activity in 2014-2016.
- The main global economic and geopolitical risks have materialized in volatile copper prices that could receive further shocks.
- Given its mandate of price and financial stability, the CBC may be interested in evaluating its potential financial stability effects.
- Furthermore, there is scope for discussing monetary policy in Chile in connection with the existence of macro-prudential regulation derived from the convergence to international standards, such as Basel III.
- In particular, there is need to explore in detail the channels of transmission.

Framework

- Medina & Soto (2007), present a small open economy setting for monetary policy analysis. This explains the business cycles that occurred in the Chilean economy from 1987 to 2005.
- Del Negro & Schorfheide (2008), perform a similar analysis, with some additional robustness checks, from 1999 to 2007.
- García-Cicco et al. (2014) have tested combinations of a simplified version of Medina & Soto (2007), with Gertler & Karadi (2011) and Bernanke et al. (BGG) (1999). These models include nominal rigidities and consider that the primary source of financial frictions is the presence of asymmetric information as it is manifested in costly state verification and moral hazard.
- We keep the financial acceleration mechanism and allow for endogenous (strategic) default is described in Dubey et al. (2005) and Goodhart et al. (2006a).
- We model the foreign economy by following Peiris & Tsomocos (2015) and Goodhart et al. (2013) and Walsh (2015 a, b).

Focus of Analysis

Our paper concerns **macroprudential regulation/monitoring** in **fragility times** with macroeconomic shocks being amplified due to the presence of **pecuniary externalities**. The two sources of the externalities are:

- Cost of default
- Collateral constraints dependent on market valuation of capital

Banking sector consists of big and small banks and is perfectly competitive, and there is ex post heterogeneity manifested in idiosyncratic shocks experienced by small banks.

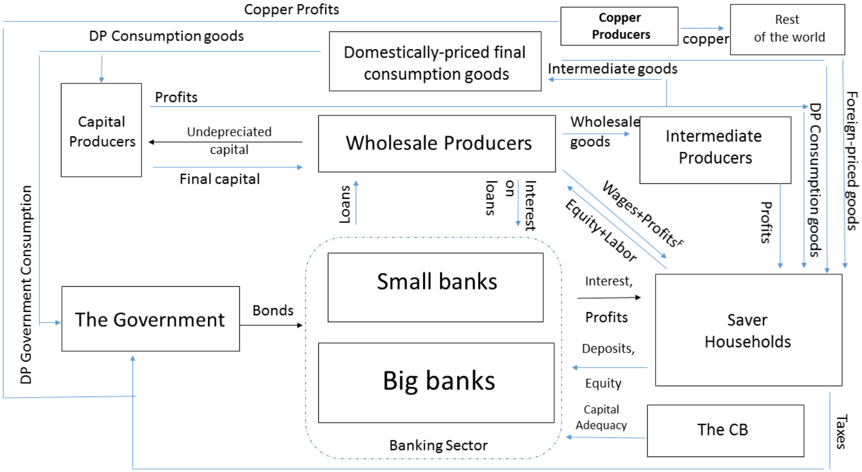
Frictions and assumptions

- New-Keynesian DSGE model with nominal rigidities.
- Considers a commodity exporter Small Open Economy.
- Assume that all goods are tradable and there are no barriers to trade.
- There is households, firms, external sector, Central Bank, Regulator and Government.
- Heterogenous 2-period lived Firms with idiosyncratic risk and default.
- Heterogenous 2-period lived banks, and capital requirements.
- Hence, there is default - for secured and collateralized loans - and capital requirements.
- Consider further bank heterogeneity in the form of systemic and small banks.

Implication

Bank´s, firm´s and household´s default is an equilibrium condition. Endogenous (strategic) default allows modeling risk taking behavior by firms, and justifies prudential regulation of banks and monetary policy.

Flow of funds



Formulation: firms (ex ante)

OLG structure

- Two period lived firms
- Secured vs unsecured borrowing
- **t=0**: Firms issue non-state-contingent nominal unsecured debt(credit)to banks.
- **t=1**: Firms liquidate assets, and pay dividends net of renegotiation costs depending on their default decisions and the business cycle fluctuations.

$$p_t^K k_{t+1}^w + T^w + 0.5a^{w,u}(\mu_{t+1}^{w,u} - \mu_{ss}^{w,u})^2 + 0.5a^{w,s}(\mu_{t+1}^{w,s} - \mu_{ss}^{w,s})^2 + 0.5a^{w,k}(k_{t+1}^w - k_{ss}^w)^2 = \mu_{t+1}^w + e_t^{w,total}, \quad (1)$$

where $\mu_{t+1}^w = \mu_{t+1}^{w,s} + \mu_{t+1}^{w,u}$ and $e_t^{w,total} = e_t^w + (1-\tau)p_t^K k_t^w$

$$\mathbb{E}(1 + r_{t+1}^{w,s})\mu_{t+1}^{w,s} \leq coll(1-\tau)k_{t+1}^w \, \mathbb{E}\, p_{t+1}^K \quad (2)$$

Formulation: firms (ex post)

- 'Lucky' vs 'unlucky' firms: probability of default θ^w is the prob. of $\underline{A_t}$
- δ_t^w - loss given default
- Cost of negotiating the debt $\frac{\Omega_{t+1}^w}{1+\psi}\left(\delta_{t+1}^w \mu_{t+1}^{w,u}(1+r_{t+1}^{w,u})\right)^{1+\psi}$

$$\Pi_{t+1}^w = p_{t+1}^w A_{t+1}^w (k_{t+1}^w)^\alpha (l_{t+1}^w)^{1-\alpha} - (1-\delta_{t+1}^w)\mu_{t+1}^{w,u}(1+r_{t+1}^{w,u}) - \mu_{t+1}^{w,s}(1+r_{t+1}^{w,s}) - w_{t+1} l_{t+1}^w - \frac{\Omega_{t+1}^w}{1+\psi}\left(\delta_{t+1}^w \mu_{t+1}^{w,u}(1+r_{t+1}^{w,u})\right)^{1+\psi} + p_{t+1}^K k_{t+1}^w (1-\tau) \quad (3)$$

- Firms'decision to default creates pecuniary externality
- Higher expected default rate raises the interest rate ax ante
- Macro variable:

$$\Omega_t^w = \Omega_{ss}^w \left(\frac{\mu_{ss}^{w,u}(1+r_{ss}^{w,u})}{GDP_{ss}}\right)^\omega (\delta_{ss}^w)^\gamma \left(\frac{GDP_t}{\mu_t^{w,u}(1+r_t^{w,u})}\right)^\omega \frac{1}{(\delta_t^w)^\gamma}. \quad (4)$$

Heterogeneous vs. homogeneous banking sector

- we estimate two models: with heterogeneous and homogeneous banking sectors in an economy
- for the homogeneous banking sector case we assume that the banking system is populated only by big, systemically important, banks
- for the heterogeneous banking sector case we assume that the banking system is populated by big, systemically important, banks and small banks
- small banks lend to one borrower, which makes them ex-post either "lucky" or "unlucky", depending on the state of a borrower, while big banks lend to a pull of "lucky" and "unlucky" firms

Systemically important banks

- New-born systemically important large banks are capitalised with equity of e_t^{big}.
- They accept deposits from households, extend secured and unsecured loans to firms.

The first period budget constraint of a systemically important bank is given by

$$\mu_{t+1}^{big,s} + \mu_{t+1}^{big,u} = d_{t+1}^{big} + e_t^{big} - 0.5a^{b,s}(\mu_{t+1}^{big,s} - \mu_{ss}^{big,s})^2 - \\ - 0.5a^{b,u}(\mu_{t+1}^{big,u} - \mu_{ss}^{big,u})^2 - 0.5a^{b,d}(d_{t+1}^{big} - d_{ss}^{big})^2 \quad (5)$$

The capital adequacy ratio is defined as the ratio of bank capital to risk weighted assets net of reserves (rwa_t^{big}) :

$$k_t^{big} = \frac{e_t^{big}}{rwa_t^{big}} = \frac{e_t^{big}}{(\bar{rw}\mu_{t+1}^{big,u} + \bar{rw}\mu_{t+1}^{big,s})} \tag{6}$$

Big banks then choose how much of secured and unsecured debt to lend out to firms:

$$\Pi_{t+1}^{big} = \theta^w(1 + r_{t+1}^{w,u})(1 - \delta_{t+1}^w)\mu_{t+1}^{bank,u} + (1 - \theta^w)(1 + r_{t+1}^{w,u})\mu_{t+1}^{big,u} + \\ + (1 + r_{t+1}^{w,s})\mu_{t+1}^{big,s} - (1 + r_{t+1}^d)d_{t+1}^{big}, \tag{7}$$

Given $\left\{\delta_{t+1}^w, r_{t+1}^{w,u}, r_{t+1}^{w,s}, r_{t+1}^d\right\}$, banks maximize:

$$\max_{\mu_{t+1}^{big,u}, \mu_{t+1}^{bank,s}, d_{t+1}^{big}} \mathbb{E}_t \beta_t^h \frac{(\Pi_{t+1}^{big})^{1-\varsigma_{big}}}{1 - \varsigma_{big}} - a_{cap}0.5[k_t^{big} - \bar{k}^{big}]^2 \tag{8}$$

Small banks

Small banks have the following BC:

$$\mu_{t+1}^{small,s} + \mu_{t+1}^{small,u} = d_{t+1}^{small} + e_t^{small} - 0.5a^{b,s}(\mu_{t+1}^{small,s} - \mu_{ss}^{small,s})^2 - \\ - 0.5a^{b,u}(\mu_{t+1}^{small,u} - \mu_{ss}^{small,u})^2 - 0.5a^{b,d}(d_{t+1}^{small} - d_{ss}^{small})^2, \quad (9)$$

Lucky small bank receives a profit:

$$\bar{\Pi}_{t+1}^{small} = (1 + r_{t+1}^{w,u})\mu_{t+1}^{small,u} + (1 + r_{t+1}^{w,s})\mu_{t+1}^{small,s} - (1 + r_{t+1}^{d})d_{t+1}^{small}, \quad (10)$$

Unlucky small bank receives a profit:

$$\underline{\Pi}_{t+1}^{small} = (1 + r_{t+1}^{w,u})(1 - \delta_{t+1}^{w})\mu_{t+1}^{small,u} + (1 + r_{t+1}^{w,s})\mu_{t+1}^{small,s} - (1 + r_{t+1}^{d})d_{t+1}^{small}, \quad (11)$$

For a small bank capital adequacy ratio looks like:

$$k_t^{small} = \frac{e_t^{small}}{rwa_t^{small}} = \frac{e_t^{small}}{(\bar{rw}\mu_{t+1}^{small,u} + \bar{rw}\mu_{t+1}^{small,s})} \quad (12)$$

Given $\left\{\delta_{t+1}^{w}, r_{t+1}^{w,u}, r_{t+1}^{w,s}, r_{t+1}^{d}\right\}$**, banks maximize:**

$$\max_{\mu_{t+1}^{small,u}, \mu_{t+1}^{small,s}, d_{t+1}^{small}} \mathbb{E}_t \beta^{small}[(1 - \theta^w)\frac{(\bar{\Pi}_{t+1}^{small})^{1-\varsigma_{small}}}{1 - \varsigma_{small}} + \theta^w \frac{(\underline{\Pi}_{t+1}^{small})^{1-\varsigma_{small}}}{1 - \varsigma_{small}}] - \\ - a_{cap}0.5[k_t^{small} - \bar{k}^{small}]^2 + \lambda^{small,uns}\frac{\mu_{t+1}^{small,u}}{\mu_{ss}^{small,u}} \quad (13)$$

The CB and the Government

- The Central Bank controls the interest rate i_t^b according to the following rule:

$$\frac{1+i_t^b}{1+i_{ss}^b} = \Big(\frac{1+i_{t-1}^b}{1+i_{ss}^b}\Big)^{\rho_i} \Big(\frac{1+\pi_t^{cpi}}{1+\pi_{ss}^{cpi}}\Big)^{1+\rho_\pi} \Big(\frac{GDP_t}{GDP_{ss}}\Big)^{\rho_{gdp}} \varepsilon_t^i, \tag{14}$$

- The Government owns the copper endowment and receives all the copper profits
- The Government Budget Constraint:

$$G_t + p_t^{imp} G_t^{imp} + B_{t-1}^g \frac{(1+i_{t-1}^b)}{1+\pi_t} = B_t^g + p_t^{c,dom} C_t + T^w \tag{15}$$

Calibration: matching financial variables moments

Parameter	Value	Description	Source
β^h	0.9829	Household's time preference	Calibration
θ^h	1	Household's disutility from labor	Calibration
γ^h	0.84	Household's labor elasticity	Medina & Soto (2007)
σ^h	1.5	Household's risk aversion	Calibration
ϕ^h	0.65	Household's preference for domestic goods	Medina & Soto (2007)
ν^c	1.12	Elasticity of substitution between domestic and foreign consumption goods	Medina & Soto (2007)
ϕ^i	0.5	Share of domestic goods in investment	Medina & Soto (2007)
ν^i	1.04	Elasticity of substitution between domestic and foreign investment goods	Medina & Soto (2007)
β^{bank}	0.9829	Bank's time preference	Calibration
ξ_{bank}	1	Bank's risk aversion	De Walque et al. (2010)
δ^f	0.28	Loss given default	Calibration
k^{big}	0.105	Capital requirments for big banks	Calibration
k^{small}	0.13	Capital requirments for small banks	Calibration
$\bar{rw}$	1	Bank's risk weight	Basel III
τ	0.025	Depraciation rate	Calibration
α	0.33	Capital share in wholesaler's production	Medina & Soto (2007)
coll	0.5	Collateral value of capital	Calibration
θ^w	0.25	Fraction of firms defaulting	Calibration
θ^c	3	Elasticity of retailer's output	Calibration
ϵ_w	4	Elasticity of labor demand	Calibration

Calibration: matching financial variables moments

Calibrated ratios	Value	Description	Source
C/GDP	0.60	Aggregate Consumption to GDP	Calibration
$\frac{\mu^{big,u}}{\mu^{big}}$	0.19	Big bank unsecured lending to total lending in heterogeneous banking sector case	Calibration
$\frac{\mu^{small,u}}{\mu^{small}}$	0.34	Small bank unsecured lending to total lending in heterogeneous banking sector case	Calibration
$\frac{\mu^{big,u}}{\mu^{big}}$	0.21	Big bank unsecured lending to total lending in homogeneous banking sector case	Calibration

Estimation results: estimated parameters

		Homog. bank. sect.			Heterog. bank. sect.		
		Prior	Std	Post	Prior	Std	Post
Adjustment costs							
household's adj cost to foreign bonds	$a^{h,b,f}$	0.01	0.02	0.0027	0.01	0.02	0.0033
household's adj cost to firm's equity	$a^{h,f,e}$	0.01	0.02	0.0688	0.01	0.02	0.0226
firm's adj cost to capital	$a^{w,k}$	0.01	0.02	0.0130	0.01	0.02	0.0266
firm's adj cost to secured loans	$a^{w,s}$	0.01	0.02	0.0043	0.01	0.02	0.0047
firm's adj cost to unsecured loans	$a^{w,u}$	0.01	0.02	0.0045	0.01	0.02	0.0054
big bank's adj cost to secured loans	$a^{b,s}$	0.01	0.02	0.0061	0.01	0.02	0.0228
big bank's adj cost to unsecured loans	$a^{b,u}$	0.01	0.02	0.0046	0.01	0.02	0.0053
household's adj cost to big bank's equity	$a^{s,b,e}$	0.01	0.02	0.0049	0.01	0.02	0.0216
small bank's adj cost to secured loans	$a^{s,s}$	-	-	-	0.01	0.02	0.0052
small bank's adj cost to unsecured loans	$a^{s,u}$	-	-	-	0.01	0.02	0.0046
household's adj cost to small bank's equity	$a^{h,s,e}$	-	-	-	0.01	0.02	0.0045
cap prod adj cost to investment	$\varkappa$	0.3	0.2	0.1512	0.3	0.2	0.0945
Price and wage setting							
Wage stickiness	$\theta^{p,w}$	0.3	0.2	0.0525	0.3	0.2	0.3211
Price stickiness	$\theta^{p,s}$	0.3	0.2	0.0107	0.3	0.2	0.0095

Estimation results: estimated parameters and shocks

		Homog. bank. sect.			Heterog. bank. sect.		
		Prior	Std	Post	Prior	Std	Post
Taylor rule							
interest rate coefficient	ρ^{i}	1	0.2	0.8739	1	0.2	0.8633
inflation rate coefficient	ρ^{π}	1.5	0.2	1.9808	1.5	0.2	1.7812
GDP growth rate coefficient	ρ^{gdp}	0.3	0.2	0.1473	0.3	0.2	0.1277
Credit conditions							
default amplification in Ω	γ	1	0.1	1.2941	1	0.1	1.5172
credit to GDP amplification in Ω	ω	1	0.1	1.2363	1	0.05	1.2139
default cost parameter	ψ	1.9	0.01	1.8942	1.9	0.025	1.9188
Shocks' persistence							
AR(1) persistent oil price shock	$\rho^{p,o}$	0.9	0.02	0.9308	0.7	0.1	0.9080
AR(1) persistent TFP shock	ρ^{a}	0.9	0.01	0.9045	0.9	0.02	0.9453
AR(1) monetary policy shock	ρ^{mon}	0.8	0.1	0.8513	0.5	0.2	0.8206
AR(1) foreign interest rate shock	$\rho^{i,for}$	0.8	0.1	0.8496	0.7	0.1	0.8780
AR(1) saver's time-preference shock	$\rho^{\beta,sav}$	0.7	0.1	0.7040	0.5	0.2	0.7389
Shocks							
Std. oil price shock	$\epsilon^{p,o}$	0.15	0.01	0.1256	0.15	0.01	0.1214
Std. TFP shock	ϵ^{a}	0.01	0.01	0.0084	0.01	0.01	0.0093
Std. monetary policy shock	ϵ^{mon}	0.01	0.01	0.0054	0.01	0.01	0.0050
Std. foreign interest rate shock	$\epsilon^{i,for}$	0.01	0.01	0.0032	0.01	0.01	0.0027
Std. saver's time-preference shock	$\epsilon^{\beta,sav}$	0.01	0.01	0.0032	0.01	0.01	0.0033

Error variance decomposition: heterogeneous case

Heterogeneous banking sector case						
	$\epsilon^{p,c}$	ϵ^{a}	ϵ^{mon}	$\epsilon^{r,for}$	$\epsilon^{\beta,h}$	ε_i^{me}
GDP	74.6	21.9	0.04	0.39	0.26	2.79
$cons$	43.9	17.6	0.02	16.3	18.0	4.19
$Loans^{big}$	80.8	6.44	0.01	7.49	1.53	3.75
$\frac{NPL}{Loans}^{big}$	44.4	31.8	0.30	14.5	1.15	7.85
$Loans^{small}$	86.9	1.60	0.00	7.75	1.13	2.63
$\frac{NPL}{Loans}^{small}$	40.4	44.0	0.99	3.32	2.25	9.04
π^{cpi}	30.2	9.85	45.6	11.7	0.28	2.33
i^{b}	46.9	13.1	10.4	26.4	1.15	2.03
$p^{o,\star}$	91.9	0	0	0	0	8.10

Table: Error variance decomposition: heterogeneous banking sector case

Error variance decomposition: homogeneous case

Homogeneous banking sector case						
	$\epsilon^{p,c}$	ϵ^{a}	ϵ^{mon}	$\epsilon^{r,for}$	$\epsilon^{\beta,h}$	ε_i^{me}
GDP	65.8	25.3	0.00	1.98	0.97	5.99
$cons$	49.3	15.1	0.00	19.4	11.3	5.00
$Loans^{bank}$	91.8	0.42	0.00	3.07	0.60	4.14
$\frac{NPL}{Loans}^{bank}$	53.1	21.2	0.60	6.63	2.22	16.3
π^{cpi}	9.30	6.50	66.5	10.5	3.71	3.49
i^{b}	31.0	8.68	17.4	30.1	9.86	3.01
$p^{o,\star}$	92.3	0	0	0	0	7.70

Table: Error variance decomposition: homogeneous banking sector case

Shock to Copper Price

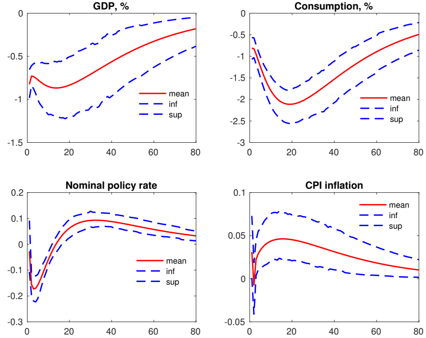
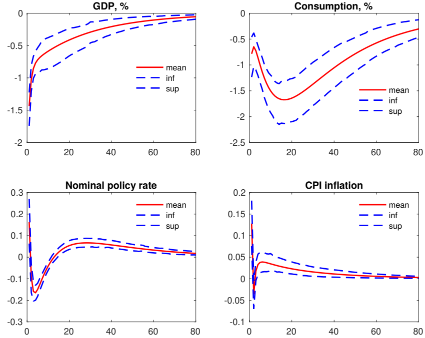


Figure: Bayesian IRFs to a negative 1 std copper price shock in homogeneous banking system case



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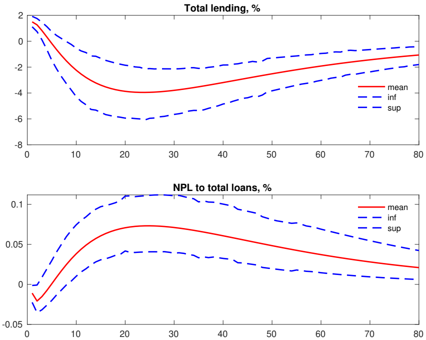
business cycle statistics

Shock to Copper Price



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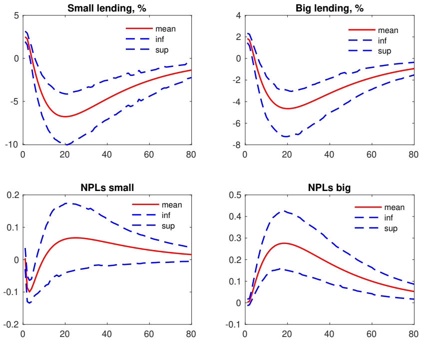


Figure: Bayesian IRFs to a negative 1 std copper price shock in heterogeneous banking system case

TFP shock

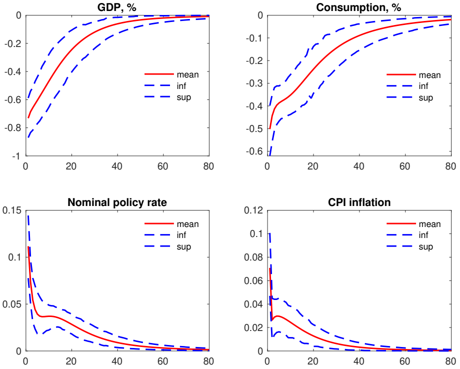
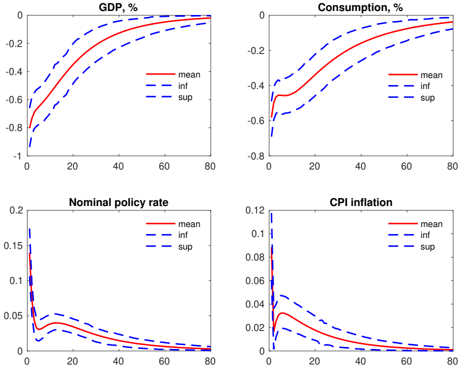


Figure: Bayesian IRFs to a negative 1 std TFP shock in homogeneous banking system case



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TFP shock

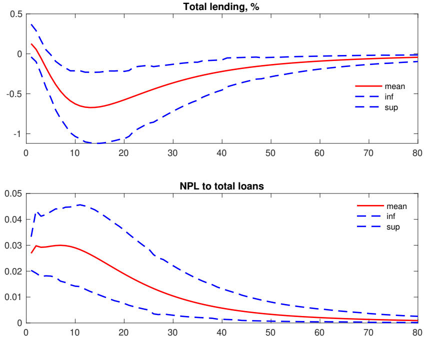

Figure: Bayesian IRFs to a negative 1 std TFP shock in homogeneous banking system case

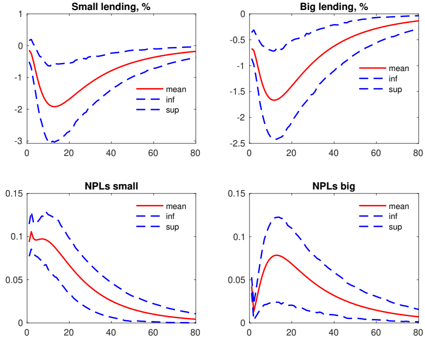

Figure: Bayesian IRFs to a negative 1 std TFP shock in heterogeneous banking system case

Regulation: Capital adequacy requirement

- fixed capital adequacy requirement over the business cycle:

$$k_t^{bank} = k_{ss}^{bank}, \tag{16}$$

where k^{bank} is different for small and big banks.

- credit-to-gdp ratio CCyB:

$$k_t^{bank} = k_{ss}^{bank} + \frac{\eta^{gdp}}{1 + exp(\zeta^{gdp} - 100 gap_t^{gdp})} - \frac{\eta^{gdp}}{1 + exp(\zeta^{gdp})}, \tag{17}$$

where $\eta^{gdp} = 2.5$, $\zeta^{gdp} = 6$ and gap_t^{gdp} is defined as:

$$gap_t^{gdp} = \frac{\mu_{t+1}^{w}}{GDP_t} - \frac{\mu_{ss}^{w}}{GDP_{ss}}. \tag{18}$$

- aggregate loan CCyB:

$$k_t^{bank} = k_{ss}^{bank} + \frac{\eta^{loan}}{1 + exp(\zeta^{loan} - 100 gap_t^{loan})} - \frac{\eta^{loan}}{1 + exp(\zeta^{loan})}, \tag{19}$$

where $\eta^{loan} = 2.5$, $\zeta^{loan} = 6$ and gap_t^{loan} is defined as:

$$gap_t^{loan} = log(\frac{\mu_{t+1}^{w}}{\mu_{ss}^{w}}). \tag{20}$$

Capital Adequacy requirement: copper price shock

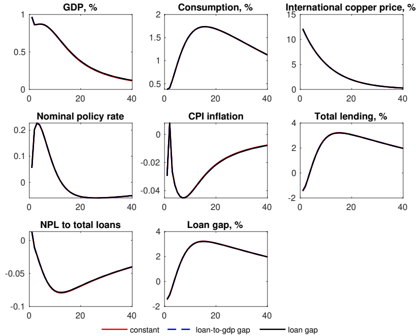

Figure: IRFs to a positive 1 std copper price shock in homogeneous banking system case

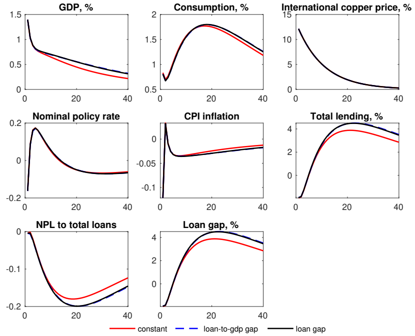

Figure: IRFs to a positive 1 std copper price shock in heterogeneous banking system case

Capital Adequacy requirement: copper price shock

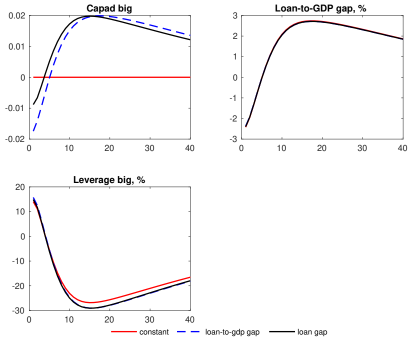

Figure: IRFs to a positive 1 std copper price shock in homogeneous banking system case

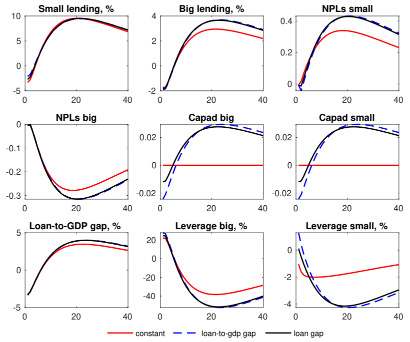

Figure: IRFs to a positive 1 std copper price shock in heterogeneous banking system case

Capital Adequacy requirement: TFP shock

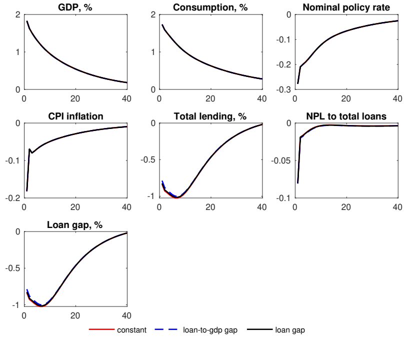

Figure: IRFs to a positive 3 std TFP shock in homogeneous banking system case

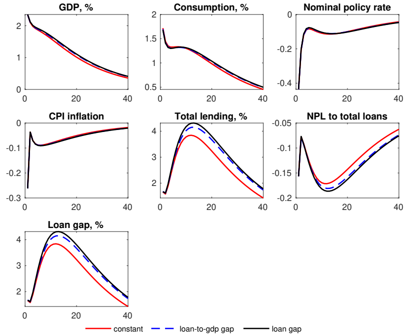

Figure: IRFs to a positive 3 std TFP shock in heterogeneous banking system case

Capital Adequacy requirement: TFP shock

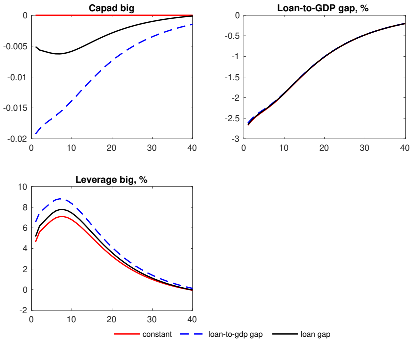

Figure: IRFs to a positive 3 std TFP shock in homogeneous banking system case

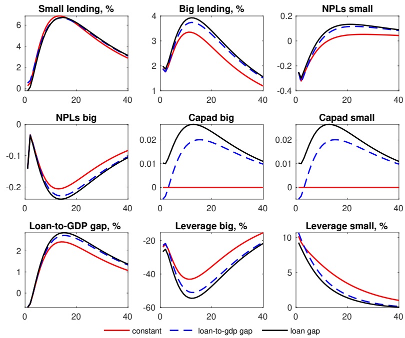

Figure: IRFs to a positive 3 std TFP shock in heterogeneous banking system case

Conclusions

- The model demonstrates that adverse shock to copper price significantly has both real and financial effects that reinforce each other.
- In a stylized fashion, we capture the effects of copper prices on repayment rates of the real sector.
- Hence, default rates transmit to interest on unsecured borrowing and reduces investment.
- We also study the effect of shocks on monetary policy to financial stability. We find that default may help to boost the response of real and financial variables in case of monetary expansions.
- We are now studying to what extent prudential regulation (e.g. CCyB) would help to further stabilize the economy.
- Additionally, we are dissecting the model, building core and periphery blocks in order to organize the assessment of transmission channels.

Business cycle statistics

Variable	Std	
	Homogeneous case	Heterogeneous case
GDP growth	0.0118	0.0167
consumption growth	0.0111	0.0137
Loans growth	0.0219	0.0281
π^{cpi}	0.0027	0.0036
i^b	0.0033	0.0045
$\frac{NPL}{Loans}$	0.0006	0.0009

Table: Business cycle statistics for homogeneous and heterogeneous banking sector cases

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