

Financial Intermediation and International Business Cycle

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16 December 2010

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Motivation

- The last, or *great* recession has lent further weight to the argument that financial sector shocks are a driver of the business cycle.
- The great recession has been a largely global phenomenon.
- Synchronized downturns in many, but not all major economies.
- We want to understand how financial sector shocks are transmitted across countries.

Methodology

- We introduce financial intermediation into a canonical IRBC model.
- Early days in the literature - how does one model a bank in a DSGE sense?
- We analyse two approaches :
 - i Banks with a bank production function using labour and deposits (Benk *et al*, 2010, JEDC)
 - ii Banks that face quadratic costs of deviating from prescribed equity to loan ratio (Gerali *et al* 2010, JMCB).
- Consider different ownership structures in the banking sector.

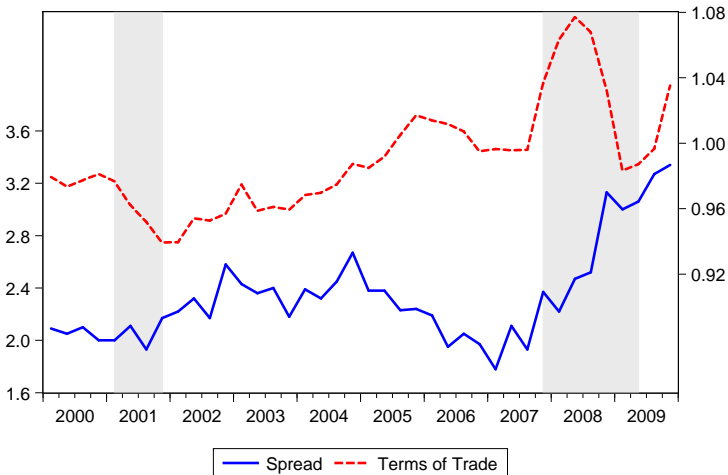
Questions

- Do banks matter for the transmission of real shocks across countries?
- How do shocks originating in the banking sector transmit across countries?
- As the answer to the first two questions is "not very much", we ask what does it take to get a synchronized down turn following a banking shock?

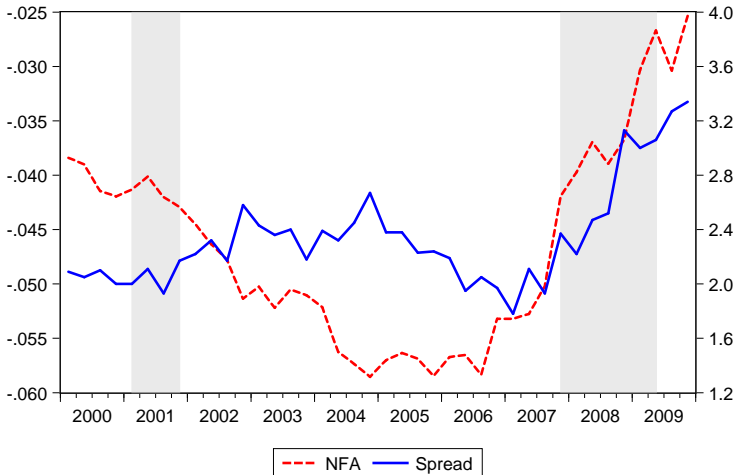
Answers

- Financial intermediation has little effect on the transmission of normal shocks.
- Weak international transmission of shocks arising from the banking sector.
- In our model economy, a contractionary banking shock :
 - i raises the interest rate spread
 - ii depreciates the terms of trade
 - iii improves net trade
- Ownership structure of banks matters for the international transmission mechanism.

US Spread and Terms of Trade



US Spread and NFA



What do banks do in our model ?

- Banks transform household deposits into loanable funds for capital producers
- Financial intermediation uses real resources - *i.e.* spread between interest rates on deposits and loans.
- As bank loans are costly relative to savings, we need a mechanism to motivate the existence of banks.
- Banks are useful ! (Olivero, 2010, JIE)
- Lending is proportional to the desired capital stock of the firm.

$$q_t = \chi k_{t+1}$$

Banks using labour

- Roughly following Benk *et al*, (2010, JEDC).
- Loans :

$$q_t \leq (A_{b,t} l_{b,t})^\gamma D_t^{1-\gamma}$$

subject to

$$q_t = D_t$$

- Spread :

$$\frac{\beta \lambda_{t+1}}{\lambda_t} \frac{P_{H,t+1}}{P_{t+1}} \frac{P_t}{P_{H,t}} \left[(1 + r_t^q) - (1 + r_t^d) \Psi(d_t - D_t) \right] = w_t \frac{1}{A_{b,t}}$$

Banks with capital

- Roughly following Gerali *et al* (2010, JMCB)
- Costly to deviate from a target capital to equity ratio

$$\frac{\kappa}{2} \left(\frac{K_t^b}{q_t} - v_t \right)^2 K_t^b$$

- Balance sheet

$$q_t = D_t + K_t^b$$

- Bank capital accumulation

$$K_t^b = (1 - \delta^B) K_{t-1}^b + \omega \pi_t^B$$

Banks with capital

- The spread is then given by

$$\frac{\beta \lambda_{t+1}}{\lambda_t} \frac{P_{H,t+1}}{P_{t+1}} \frac{P_t}{P_{H,t}} \left((1 + r_t^q) - (1 + r_t^d) \Psi(B_t) \right) = -\kappa \left(\frac{K_t}{q_t} - v_t \right) \left(\frac{K_t}{q_t} \right)^2$$

Banks in the IRBC model

- Two identical countries.
- Agents in both countries (dis)save to smooth consumption.
- Agents hold deposits with a global bank.
- Banks in both countries borrow funds from the global bank.
- Bank liabilities are combined either with labour or bank capital to produce bank loans.
- A country's net foreign asset position is the difference between resident's assets and liabilities with the global bank.
- If banking is costless, model collapses to the IRBC model.

Structure of model

- Simple flex price IRBC model.
- Incomplete financial markets - just trade in deposits.
- Home bias both in consumption and investment.
- Model driven by three shocks :
 - i TFP shocks
 - ii IST shocks
 - iii Banking sector shocks

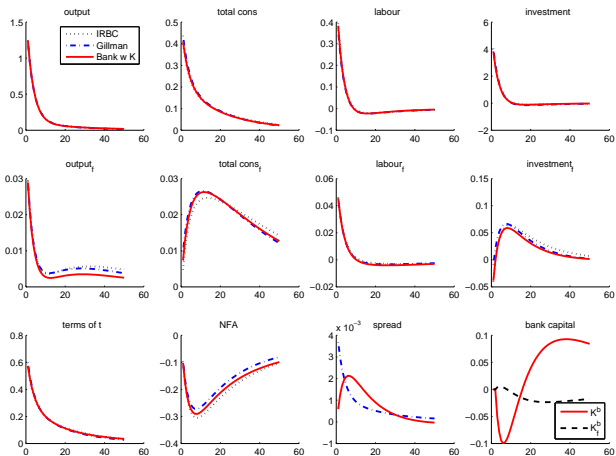
Calibration

Parameter	Description	Value
β	Discount Factor	0.99
σ	Elasticity of intertemp. substitution	1
η	Labour supply elasticity	1
θ	Elasticity of substitution btw. consumption goods	1
κ	Elasticity of spread to capital to loan ratio	10
γ	Home bias in consumption	0.88
η	Home bias in investment	0.88
v	Steady state capital to loan ratio	0.08
ω	Bank's dividend policy	0.9
δ_b	Bank capital depreciation rate	0.009
l_b	Share of steady state labour in the banking	1.9%
ρ_A	Persistence : Technology shock	0.7388
σ_A	Standard deviation : Technology shock	0.0056
ρ_i	Persistence : Relative price of investment shock	0.88
σ_i	Standard deviation : Relative price of investment shock	0.0062
ρ_{A_b}	Persistence : Banking labour productivity shock	0.9
σ_{A_b}	Standard deviation : Banking labour productivity shock	0.2
ρ_v	Persistence : Capital to loan ratio shock	0.9
σ_v	Standard deviation : Capital to loan ratio shock	0.2

Transmission of TFP shocks

	Data	IRBC	Labour Bank	Capital Bank
Standard deviations				
σ_y	1.15	0.81	0.80	0.81
σ_c/σ_y	0.82	0.33	0.36	0.34
σ_x/σ_y	4.35	3.11	3.30	3.07
σ_n/σ_y	1.59	0.32	0.30	0.31
σ_w/σ_y	0.89	0.63	0.65	0.64
σ_{tot}/σ_y	1.48	0.65	0.70	0.67
σ_{nx}/σ_y	0.24	0.32	0.29	0.31
σ_{sp}/σ_y	0.16	NaN	0.01	0.01
Correlations				
$Corr(c, y)$	0.90	0.97	0.98	0.97
$Corr(x, y)$	0.87	0.99	0.99	0.99
$Corr(n, y)$	0.89	0.99	0.98	0.98
$Corr(w, y)$	-0.17	1.00	1.00	1.00
$Corr(tot, y)$	0.38	0.68	0.68	0.67
$Corr(nx, y)$	-0.41	-0.23	-0.25	-0.24
$Corr(sp, y)$	-0.43	NaN	0.99	0.31
Cross Correlations				
$Corr(y, y^*)$	0.66	0.03	0.05	0.04
$Corr(c, c^*)$	0.51	0.05	0.05	0.05
$Corr(rs, c/c^*)$	-0.49	1.00	1.00	1.00

Transmission of TFP shocks



Transmission of TFP shocks

- Financial intermediation does not alter the transmission of TFP shocks.
- Same finding holds for IST shocks.
- No additional transmission of real shocks.

Transmission of banking shocks

- Do bank shocks have a greater effect?
- Two (not entirely comparable) banking sector shocks.
 - i Shocks to banking TFP

$$q_t \leq (A_{b,t} l_{b,t})^\gamma D_t^{1-\gamma}$$

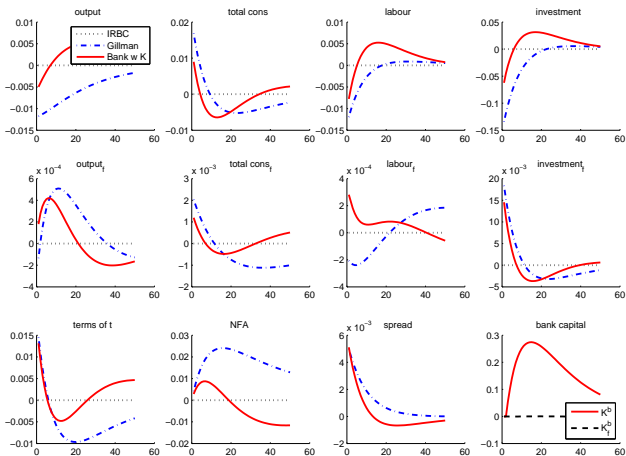
- ii Shocks to the equity-to-loan ratio

$$\frac{\kappa}{2} \left(\frac{K_t^b}{q_t} - v_t \right)^2 K_t^b$$

Transmission of banking shocks

	Data	IRBC	Labour Bank	Capital Bank
Standard deviations				
σ_y	1.15		0.31	0.15
σ_c/σ_y	0.82		1.45	1.90
σ_x/σ_y	4.35		11.16	11.81
σ_n/σ_y	1.59		0.99	1.54
σ_w/σ_y	0.89		0.52	0.53
σ_{tot}/σ_y	1.48		1.91	3.45
σ_{nx}/σ_y	0.24		1.59	2.34
σ_{sp}/σ_y	0.16		0.41	0.88
Correlations				
$Corr(c, y)$	0.90		-0.85	-0.85
$Corr(x, y)$	0.87		0.93	0.94
$Corr(n, y)$	0.89		0.93	0.93
$Corr(w, y)$	-0.17		-0.60	-0.32
$Corr(tot, y)$	0.38		-0.50	-0.64
$Corr(nx, y)$	-0.41		-0.39	-0.29
$Corr(sp, y)$	-0.43		-0.96	-0.98
Cross Correlations				
$Corr(y, y^*)$	0.66		0.24	0.22
$Corr(c, c^*)$	0.51		-0.01	-0.07
$Corr(rs, c/c^*)$	-0.49		0.98	0.98

Transmission of banking shocks



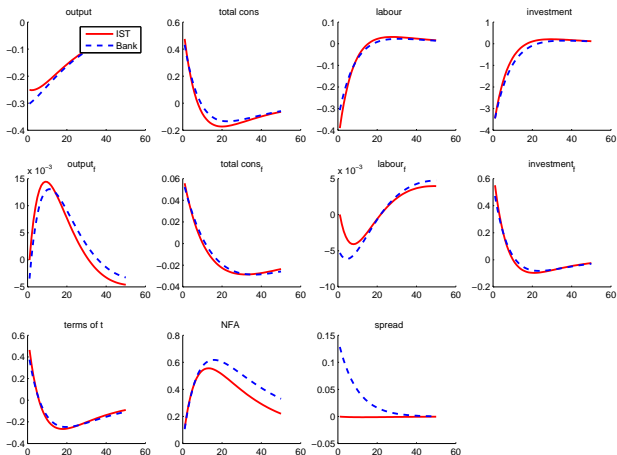
Transmission of banking shocks

- Bank shocks mainly affect investment.
- Counter-cyclical consumption - investment crash (boom) crowds in (out) consumption.
- Investment crash lowers relative demand for home-produced intermediate goods (via home bias in investment), causing the terms of trade to depreciate.
- Home bias in investment and investment crash leads to an improvement in net trade.
- In foreign economy spread falls and investment increases.
- Note that relative consumption rises and the terms of trade depreciate - consumption risk sharing.
- Does this shock look familiar? Yes, quite similar to IST shock, as suggested by Justiniano, Primiceri and Tambalotti (2010)
- BUT....

Banking vs Investment Technology shocks

- Compare IST and banking shocks generating the same initial impact on investment.
- Very similar dynamics, but different behaviour of the spread.
- IST shocks imply a pro-cyclical spread, whereas banking TFP shocks imply a counter-cyclical spread.

Banking vs Investment Technology shocks



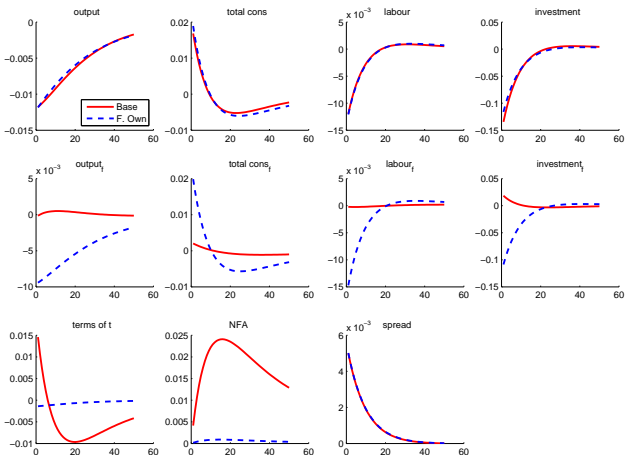
Ownership of Banks

- Role of globalized banking system
- Two forms of ownership :
 - Local incorporations - foreign owned (profits discounted by foreign owner's discount factor), but drawing on local labour and capital to produce loans
 - Branches - local bank receives bank liabilities from foreign owner.

Second Moments : Bank ownership

	Bank with Labour			Bank with capital	
	Baseline	Local Incorporation	Foreign ownership	Baseline	Foreign Ownership
Standard deviations					
σ_y	0.31	0.31	0.31	0.15	0.15
σ_c/σ_y	1.45	1.45	1.63	1.90	2.17
σ_x/σ_y	11.16	11.17	9.61	11.81	9.21
σ_n/σ_y	0.99	0.99	1.01	1.54	1.55
σ_w/σ_y	0.52	0.52	0.66	0.53	0.66
σ_{tot}/σ_y	1.91	1.91	0.12	3.45	0.12
σ_{nx}/σ_y	1.59	1.60	0.04	2.34	0.11
σ_{sp}/σ_y	0.41	0.41	0.41	0.88	0.90
Correlations					
$Corr(c, y)$	-0.85	-0.85	-0.88	-0.85	-0.91
$Corr(x, y)$	0.93	0.93	0.96	0.94	0.97
$Corr(n, y)$	0.93	0.93	0.95	0.93	0.96
$Corr(w, y)$	-0.60	-0.60	-0.74	-0.32	-0.75
$Corr(tot, y)$	-0.50	-0.50	1.00	-0.64	0.41
$Corr(nx, y)$	-0.39	-0.39	-0.50	-0.29	-0.14
$Corr(sp, y)$	-0.96	-0.96	-0.97	-0.98	-0.97
Cross Correlations					
$Corr(y, y^*)$	0.24	0.24	0.99	0.22	0.99
$Corr(c, c^*)$	-0.01	-0.01	0.99	-0.07	0.99
$Corr(rs, c/c^*)$	0.98	0.98	0.99	0.98	0.99

Transmission of banking shocks : Foreign Ownership



Transmission of banking shocks : Foreign Ownership

- Local incorporation type foreign ownership does not affect the transmission of banking shocks
- When banks are foreign owned and capitalized, there is a near perfect correlation between the components of home and foreign GDP following a TFP shock.
- Foreign ownership is observationally equivalent to perfectly correlated banking sector shocks.

Conclusion

- Introducing a banking sector into a two country business cycle model weakly alters the transmission of real shocks
- Shocks arising from the financial sector have strong domestic effects but weak cross-country impact
- The global integration of the banking seems key to understand the propagation of financial shocks