

# Financial Intermediation and Credit Policy in Business Cycle Analysis

Mark Gertler and Nobuhiro Kiyotaki

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## Introduction

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Non Financial firms

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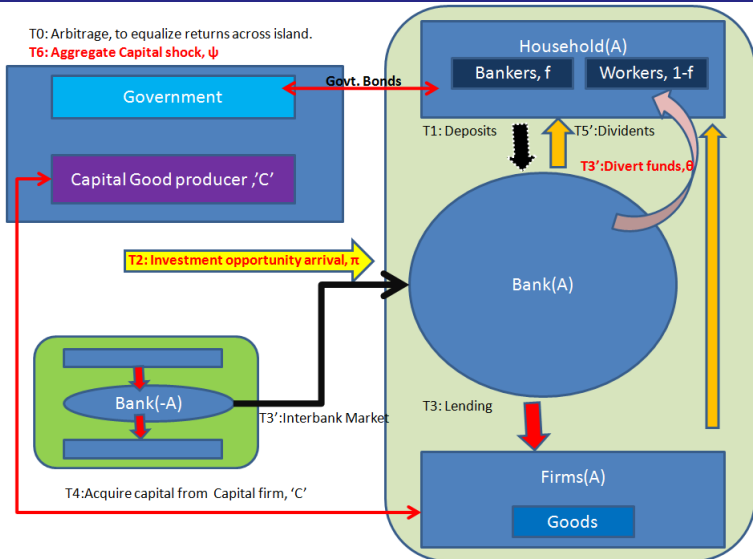
## Results



- ▶ Current crisis has been characterised by disruptions in financial intermediation and FED used unconventional MP to handle the crisis.
- ▶ Most of the previous literature focussed on models with frictionless capital markets or frictions on non financial firms.
- ▶ In this paper K&G focus on a real business cycle model with some frictions (financial intermediation and liquidity risk).
- ▶ How credit market frictions may affect real activity?
- ▶ How various credit policies may work given crisis scenario?



- ▶ Continuum of households, Continuum of firms, Continuum of bank (continuum of islands)
- ▶ Goods and Capital goods producers
- ▶ Government/Central Bank
- ▶ Two type of island: Investing and Non investing
- ▶ Capital is homogeneous
- ▶  $\psi_{t+1}$  capital quality shock(markov process),  $\pi$  investment opportunity arrival (i.i.d.)





- ▶ Each household has  $1 - f$  "workers" and  $f$  "bankers".
- ▶ Bankers exits next period with i.i.d prob  $1 - \sigma$ , the retained earnings is tranfered to the household.
- ▶ Same number of bankers (as exiting) are born out of worker force.
- ▶ Bank pays dividends only when it exits and becomes a worker



- ▶ Household chooses consumption, labor supply, and riskless debt  $(C_t, L_t, D_{ht+1})$  to maximize expected discounted utility

$$\text{Max } E_t \sum_{i=0}^{\infty} \beta^i \left[ \ln C_{t+i} - \gamma C_{t+i-1} \right] - \frac{\lambda}{1+\varepsilon} L_{t+i}^{1+\varepsilon}$$

$$\text{s.t. } C_t = W_t L_t + \Pi_t - T_t + R_t D_{ht} - D_{ht+1}$$

- ▶ Complete Consumption insurance: Workers and firms belong to the big group in household
- ▶ Workers and bankers return their wages and earnings, respectively, to the household



## Banks

Flow-of-funds constraint:  $Q_t^h s_t^h = n_t^h + b_t^h + d$

Expected present value of future dividends  $V_t = E_t \sum_{i=1}^{\infty} (1 - \sigma) \sigma^{i-1} \Lambda_{t,t+i} n_{t+i}^h$

Value of Bank satisfies the Bellman Equation:

$$V_{t-1}(s_{t-1}, b_{t-1}, d_{t-1}) = E_{t-1} \Lambda_{t-1,t} \sum_{h=i,n} \pi^h \left\{ (1 - \sigma) n_t^h + \sigma \underset{d_t}{\text{Max}} [\underset{s_t^h, b_t^h}{\text{Max}} V_t(s_t^h, b_t^h, d_t)] \right\}$$

Incentive Constraint:  $V_t(s_t^h, b_t^h, d_t) \geq \theta(Q_t^h s_t^h - \omega b_t^h)$

- ▶ Agency problem: Banker may divert a fraction,  $\theta$  of the total assets back to its family.
- ▶ The net worth of banks evolve as per the capital quality shock and fluctuation in the return of assets (magnified given high

leverage ratio)  $n_t^h = [Z_t + (1 - \delta) Q_t^h] \psi_t s_{t-1} - R_{bt} b_{t-1} - R_t d_{t-1}$



- ▶ It can be shown that the value function is linear:

$$V_t(s_t^h, b_t^h, d_t) = \mathcal{V}_{st} s_t^h - \mathcal{V}_{bt} b_t^h - \mathcal{V}_t d_t$$

- ▶ Case I: Frictionless interbank mkt: At aggregate level,  $Q_t S_t = \phi_t N_t$ , where  $\phi_t$  is the leverage ratio.

- ▶  $\mu_t \equiv \mathcal{V}_{bt} = \frac{\mathcal{V}_{st}}{Q_t} - \mathcal{V}_t > 0$

- ▶  $E_t \Lambda_{t,t+1} \Omega_{t+1} R_{kt+1} = E_t \Lambda_{t,t+1} \Omega_{t+1} R_{bt+1} > E_t \Lambda_{t,t+1} \Omega_{t+1} R_{t+1}$

- ▶ Case II: Frictional interbank mkt: At aggregate level,  $Q_t^h S_t^h \leq \phi_t^h N_t^h$ .

- ▶  $\mu_t^h \equiv \frac{\mathcal{V}_{st}^h}{Q_t^h} - \mathcal{V}_t^h = \frac{\mathcal{V}_{st}^h}{Q_t^h} - \mathcal{V}_t^h$  and  $\mu_t^i > \mu_t^h \geq 0$

- ▶  $E_t \Lambda_{t,t+1} \Omega_{t+1}^{h'} R_{kt+1}^{h'} > E_t \Lambda_{t,t+1} \Omega_{t+1}^{h'} R_{kt+1}^{h'}$   
 $\geq E_t \Lambda_{t,t+1} \Omega_{t+1}^{h'} R_{bt+1}^{h'} = E_t \Lambda_{t,t+1} \Omega_{t+1}^{h'} R_{t+1}^{h'}$



## Non Financial firms

- ▶ Goods producers: CRS (Cobb-Douglas) with mobile labour, aggregate productivity  $A_t$  is markov process, objective to maximise profits
- ▶ Capital goods producers: Aggregate production function is DRS in the SR, as are subjected to adjustment cost and is CRS in the LR.
- ▶ Goods producer borrows from the bank and buys new capital, at the price,  $Q_t^i$

$$\text{Law of Motion: } K_{t+1} = \psi_{t+1} [I_t + (1 - \delta)K_t]$$

$$\text{Capital good Producer: } \max E_t \sum_{\tau=t}^{\infty} \Lambda_{t,\tau} \left\{ Q_{\tau}^i I_{\tau} - \left[ 1 + f\left(\frac{I_{\tau}}{I_{\tau-1}}\right) \right] I_{\tau} \right\}$$

- ▶ Lump sum distribution of profits (capital good producers) to the households



## Equilibrium

- ▶ Households, Banks and Non financial firms maximise utility and profits, respectively.
- ▶ Markets clear in both type of islands (Securities, Labor, Goods, Interbank loans, riskless govt. bonds)
- ▶ If  $\omega$  indexes (inversly) the relative degree of frictions in interbank market.
  - ▶  $\omega = 1$ , Frictionless economy: Banks do not face any idiosyncratic liquidity risk (aggregate bank lending is constrained by the aggregate bank capital).
  - ▶  $\omega = 0$ , Frictional economy: Banks constrained balance sheet disrupts credit flows and thus depresses real activity

- ▶ The central bank is not 'balance sheet' constrained.
- ▶ Govt budget const:  $G_t + Q_t S_t = T_t + R_t S_{t-1}$
- ▶ 3 possible credit policies( $S_t$ )
  - ▶ Direct Lending (DL): Expansion of the supply of funds in the market at no subsidised rate.
  - ▶ Direct window lending (liquidity facility) (DWL): Expands total level of assets intermediated by banks on investing islands (CB can enforce repayment)
  - ▶ Equity injection (EI): Expands value of asset intermediated 1-1

High efficiency cost(evaluation and monitoring).

Lump sum taxes(distortionary) and net earning/profits through participation.



## Calibration

- ▶ Total 11 parameters (7 are standard preference and technology parameters:  $\beta, \gamma, \chi, \epsilon, \alpha, \delta, \eta$ )
- ▶ They consider both  $\omega = 0$  and  $\omega = 1$  case
- ▶ Crisis simulation
  - ▶ Initiation of crisis: Deterioration in value of intermediary portfolios. A 5% unanticipated decline in capital quality with an autoregressive factor of 0.66.
  - ▶ Magnification: Leverage ratio, decline in asset value and net worth, asset prices, balance sheet tightens

**Table 1** Parameter Values for Baseline Model**Households**

|               |       |   |
|---------------|-------|---|
| $\beta$       | 0.990 | Discount rate                             |
| $\gamma$      | 0.500 | Habit parameter                           |
| $\chi$        | 5.584 | Relative utility weight of labor          |
| $\varepsilon$ | 0.100 | Inverse Frisch elasticity of labor supply |

**Financial intermediaries**

|          |       |   |
|----------|-------|---|
| $\pi^I$  | 0.250 | Probability of new investment opportunities               |
| $\theta$ | 0.383 | Fraction of assets divertable: perfect interbank market   |
|          | 0.129 | Fraction of assets divertable: imperfect interbank market |
| $\xi$    | 0.003 | Transfer to entering bankers: perfect interbank market    |
|          | 0.002 | Transfer to entering bankers: imperfect interbank market  |
| $\sigma$ | 0.972 | Survival rate of the bankers                              |

**Intermediate good firms**

|          |       |                                |
|----------|-------|--------------------------------|
| $\alpha$ | 0.330 | Effective capital share        |
| $\delta$ | 0.025 | Steady-state depreciation rate |

**Capital producing firms**

|              |       |  |
|--------------|-------|--|
| $I f'' / f'$ | 1.500 | Inverse elasticity of net investment to the price of capital |
|--------------|-------|--|

**Government**

|               |       |  |
|---------------|-------|--|
| $\frac{G}{Y}$ | 0.200 | Steady-state proportion of government expenditures |
|---------------|-------|--|



- ▶ With no credit policy:
  - ▶ RBC economy: Modest downturn in output and consumption, and high return to capital induces increase in investment and employment
  - ▶ Frictionless interbank: Output, investment and employment decline more than in the RBC case.
  - ▶ Frictional interbank: Overall deterioration is further magnified. Sharp rise in credit spread.
- ▶ With credit policy (DL):
  - ▶ Frictionless interbank: Dampening of overall decline in output, investment and rise in spread.
  - ▶ Frictional interbank: Policy effectively dampens the overall deterioration and is in fact much more effective as compared to the previous case

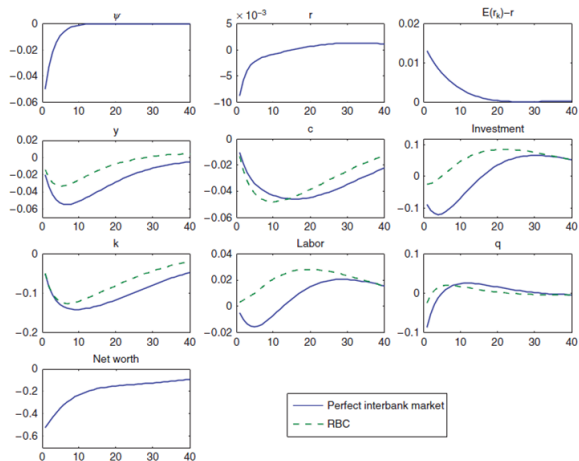


Figure 1 Crisis experiment: Perfect interbank market.

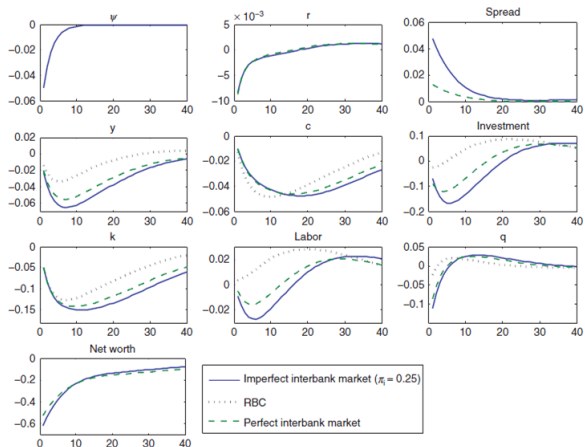


Figure 2 Crisis experiment: Imperfect interbank market.

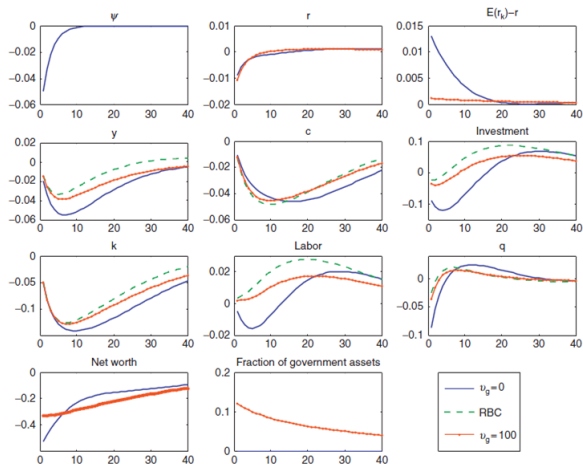


Figure 3 Lending facilities: Perfect interbank market.

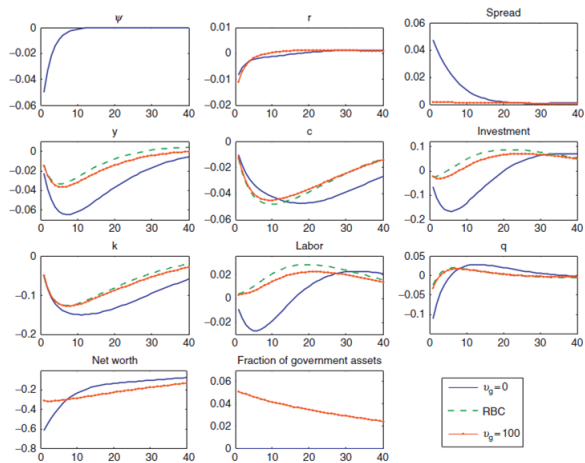


Figure 4 Lending facilities: Imperfect interbank market.