Assessing Capital Regulation in a Macroeconomic Model with Three Layers of Defaults

MaRs Model Team

ESCB

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The Project

- **Cross-country project in MaRs WS1: Collective ESCB effort**
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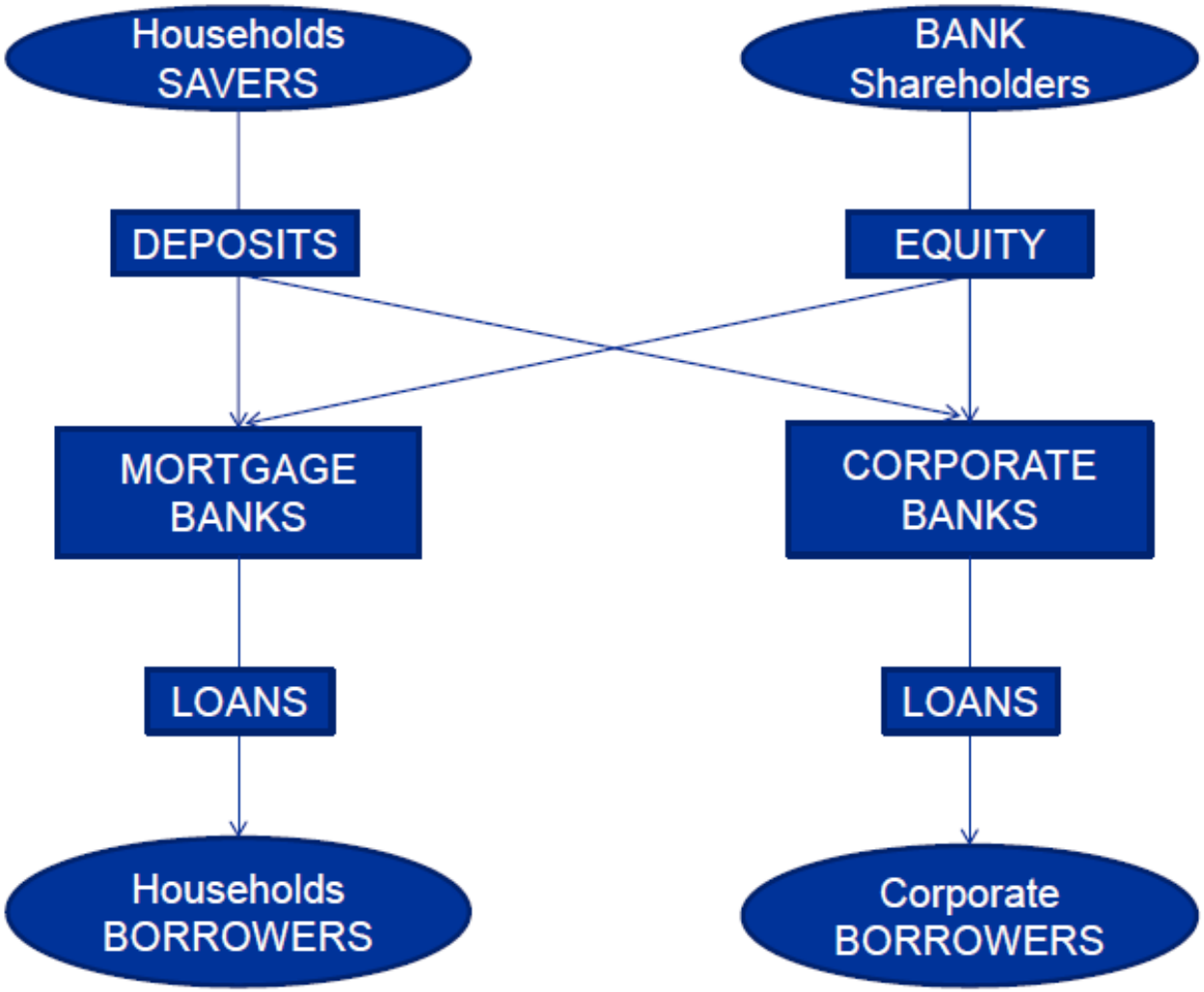
  - **Excellent research assistance:** Dominik Supera
- **Aim: Build a decision-support model to provide valuable feedback to policymakers**
  - state of the art research: dynamic stochastic general equilibrium
  - central role of default (Bank **d**efault, Firm **d**efault, Household **d**efault – **3D**)
  - policy analysis framework: welfare analysis + cost/benefits macroprudential policy
- **Project output**
  - Dynare code/User manual: distributed to the ESCB

Overview of policy conclusions

- **Initial efforts**: build the model and understand its main properties
  - Main policy results: capital requirements
- **Steady state capital requirements**
  - Large benefits from raising CRs when risk of bank failure is significant
  - Costs in terms of foregone lending when CRs are too high
- **Model dynamics (IRFs)**
  - Bank-related amplification channels are strong when risk of bank failure is high
  - CRs effective at shutting these amplification channels down
- **Countercyclical CR adjustments**
  - Mitigate the impact of negative shocks when low bank failure risk
  - Counterproductive otherwise

Overview of the 3D Model

3D Model Structure



Excessive bank leverage and risk-taking

- **Bank default risk arises from borrower default risk**: **banks fail when assets $<$ liabilities**
  - idiosyncratic risk: due to imperfect diversification
  - aggregate risk: due to aggregate (real and financial) shocks
- **Why are bank defaults excessive?**
  - bank funding costs unrelated to own risk-taking
- **Two key mechanisms**
  - Some costs of default covered by the financial safety net: implicit subsidies to risky banks
  - Other costs not covered (e.g. wholesale funding) but weak monitoring ability of depositors hence funding costs depend on **average** bank risk

  $\Longrightarrow$ undercapitalised banks do not fully internalise the costs of their risk-taking

  $\Longrightarrow$ too much risk from a social point of view
- **Defaults have resource costs $\Longrightarrow$ excessive burden on society**

Main Amplification Channels

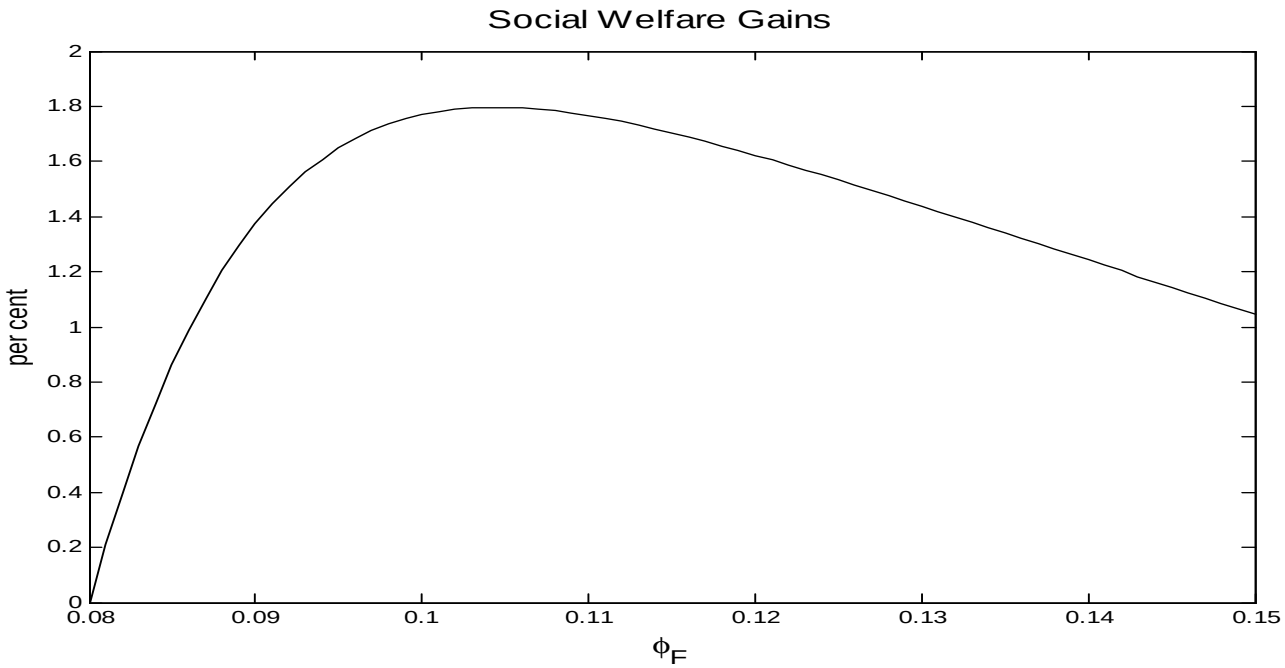
- **Model features two important bank-related shock amplification channels**
- **Bank capital channel**
  - Negative aggregate shocks hit bank borrowers, raising defaults and reducing bank capital
  - Bank capital reduction limits credit supply, adding to a further deterioration of the real economy and more defaults
  - Bank capital reduced further and so on
- **Bank funding cost channel**
  - Large negative aggregate shocks lead to a reduction of bank capital and some banks default
  - Fear of bank defaults raises bank funding costs, leading to a further deterioration in the real economy
  - More banks default and so on

Policy Exercise: Higher steady state capital requirements

Higher steady state capital requirements

- **Benefits of higher CR: reduce bank leverage and the risk of bank failure**
  - Reduce implicit subsidies to risk-taking
  - Reduce the intensity of the bank funding channel
- **Costs of higher CR**
  - Increase banks' weighted average cost of funding (except when CRs are very low)
  - Tighten credit supply and reduce borrowers' leverage

Social Welfare

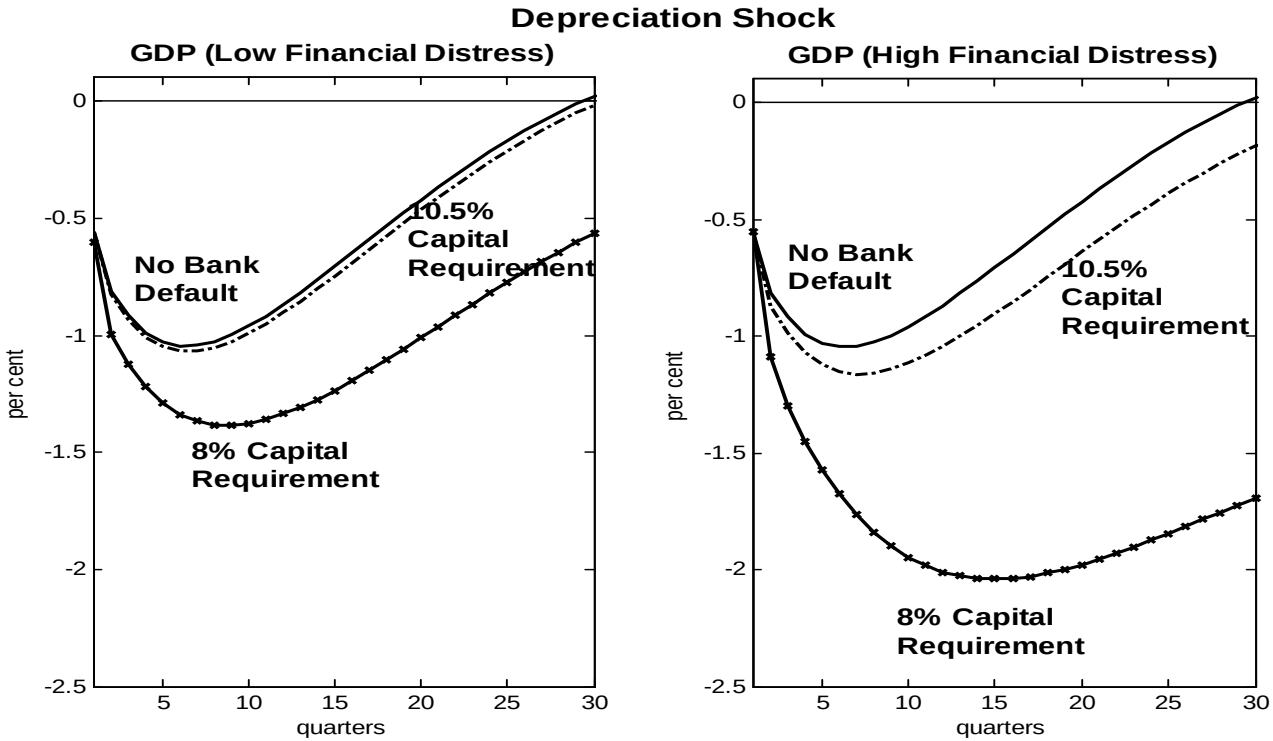


Policy exercise: Shock amplification under different capital ratios

How are shocks transmitted under alternative capital ratios?

- **Policy exercise**: hit the economy with one large shock
- **The shock**: a persistent collapse in asset prices (housing and capital prices)
- **Question**: how do capital ratios (high vs low) affect the transmission of shocks?

IRF to a 0.2% Depreciation shock (0.9 persistence)

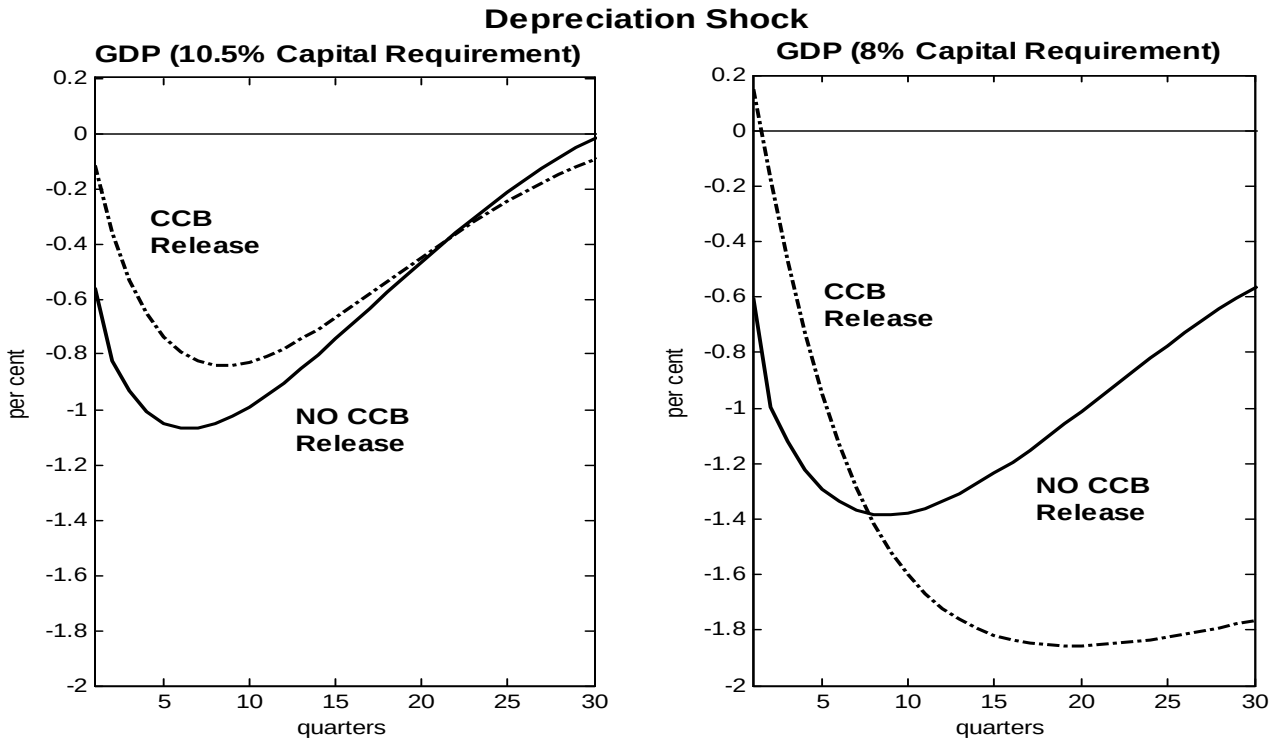


Policy exercise: the impact of the CCB release at different steady state capital ratios

Can a capital ratio reduction help in a crisis?

- **Policy exercise**: hit the economy with one (or more) large shocks
- **The shock**: a persistent collapse in asset prices (housing and capital prices)
- **Question**: does a reduction in the capital ratio after a bad shock help to maintain economic activity?

Counter-cyclical Adjustment of CR



Summary

- **We have developed a macroeconomic model in which banks and borrower default take center stage**
- **Steady state effects of capital requirements**
  - eliminate bank default and the limited liability subsidy
  - eliminate bank funding related externalities
- **Capital requirements and shock propagation**
  - shock propagation is very powerful when bank risk is high and/or bank capital is low
  - high capital requirements eliminate the extra shock propagation coming from bank defaults
- **Countercyclical response**
  - only beneficial when high capital requirements!

3D Model details and parameterization

Households

- Grouped in two distinct dynasties which provide risk-sharing to their members: the saving dynasty (j=s) and the borrowing dynasty (j=m).

$$\max E_t \left[\sum_{i=0}^{\infty} \left(\beta^j\right)^{t+i} \left[\log\left(c^j_{t+i}\right) + v^j_{t+i} \log\left(h^j_{t+i}\right) - \frac{\varrho^j_{t+i}}{1+\eta} \left(l^j_{t+i}\right)^{1+\eta} \right] \right]$$

Patient Households (Savers)

- Intertemporal budget constraint

$$c_t^s + q_t^H h_t^s + d_t \leq w_t l_t^s + \left(1 - \delta^H\right) q_t^H h_{t-1}^s + \widetilde{R}_t^D d_{t-1} - T_t^s + \Pi_t + \Lambda_t$$

- where d_{t-1} are saving deposits whose (risky) return is given by

$$\widetilde{R}_t^D = \left(1 - \gamma PD_t^B\right) R_{t-1}^D$$

- where γ is a transaction cost incurred when banks default and Γ_t^B is the average bank failure rate $\Longrightarrow$ motivates depositors' aversion to bank default & a risk premium
- T_t^s is a lump-lum tax used by the DIA to ex-post balance its budget, Π_t profits from production sector and Λ_t are transfers from bankers and entrepreneurs

Impatient Households (Borrowers)

- Dynamic budget constraint

$$\begin{aligned} & c_t^m + q_t^H h_t^m - b_t^m \\ \leq \quad & w_t l_t^m + \int_0^\infty \max\left\{\omega_t^m q_t^H \left(1-\delta^H\right) h_{t-1}^m - R_{t-1}^m b_{t-1}^m, 0\right\} dF^m(\omega^m) \end{aligned}$$

  where b_t^m: conventional (uncontingent) debt

- **Default whenever house value is less than required repayment**

$$\omega_t^m q_t^H \left(1-\delta^H\right) h_{t-1}^m < R_{t-1}^m b_{t-1}^m$$

Banks

- One-period lived firms: raise equity from bankers and deposits from patient households
- specialize in either mortgage (j=H) or corporate loans (j=F).
- Profit

$$\pi^F_{t+1} = \max\left[\omega_{t+1}\tilde{R}^H_{t+1} b^m_t - R^D_t d^m_t, 0\right],$$

- their regulatory capital constraint is

$$e^H_t \geq \phi^H_t b^m_t,$$

- **the default threshold is**

$$\overline{\omega}^H_{t+1} = (1-\phi^H_t)\frac{R^D_t}{\tilde{R}^H_{t+1}}, \tag{1}$$

Bankers

- Risk neutral agents who live for 2 periods)
  - A banker born at time t receives a bequest from the previous generation of bankers.
  - t: decides how to allocate his wealth as inside equity into the 2 class of banks (mortgages & business loans)
  - $t+1$: values leaving gifts/ transfers to firms' owners (savers) and bequests
- Optimizing behavior at time $t+1$ yields

$$c^b_{t+1} = \chi^b W^b_{t+1}$$

and

$$n^b_{t+1} = (1-\chi^b) W^b_{t+1}.$$

- At time t solve optimal portfolio choice:

$$E_t \widetilde{\rho}^F_{t+1} = E_t \widetilde{\rho}^M_{t+1},$$

- Aggregate evolution of bankers' net worth:

Entrepreneurs

- Very similar to bankers: live for two periods and transmit net worth through bequests
- Own physical capital stock
- Capital financed partly with corporate loans and partly with inhereted net worth
- **Default when value of the firm less than debt repayment**

Credit Supply to Households

- Competitive banks supply loans to households, b_t^m, using deposit funding d_t and equity funding e^H as long as lending yields the market required expected return ρ_t on bank equity

$$E_t \max\left[\omega_{t+1}^H \widetilde{R}_{t+1}^H b_t^m - R_t^D d_t, 0\right] \geq \rho_t e^H.$$

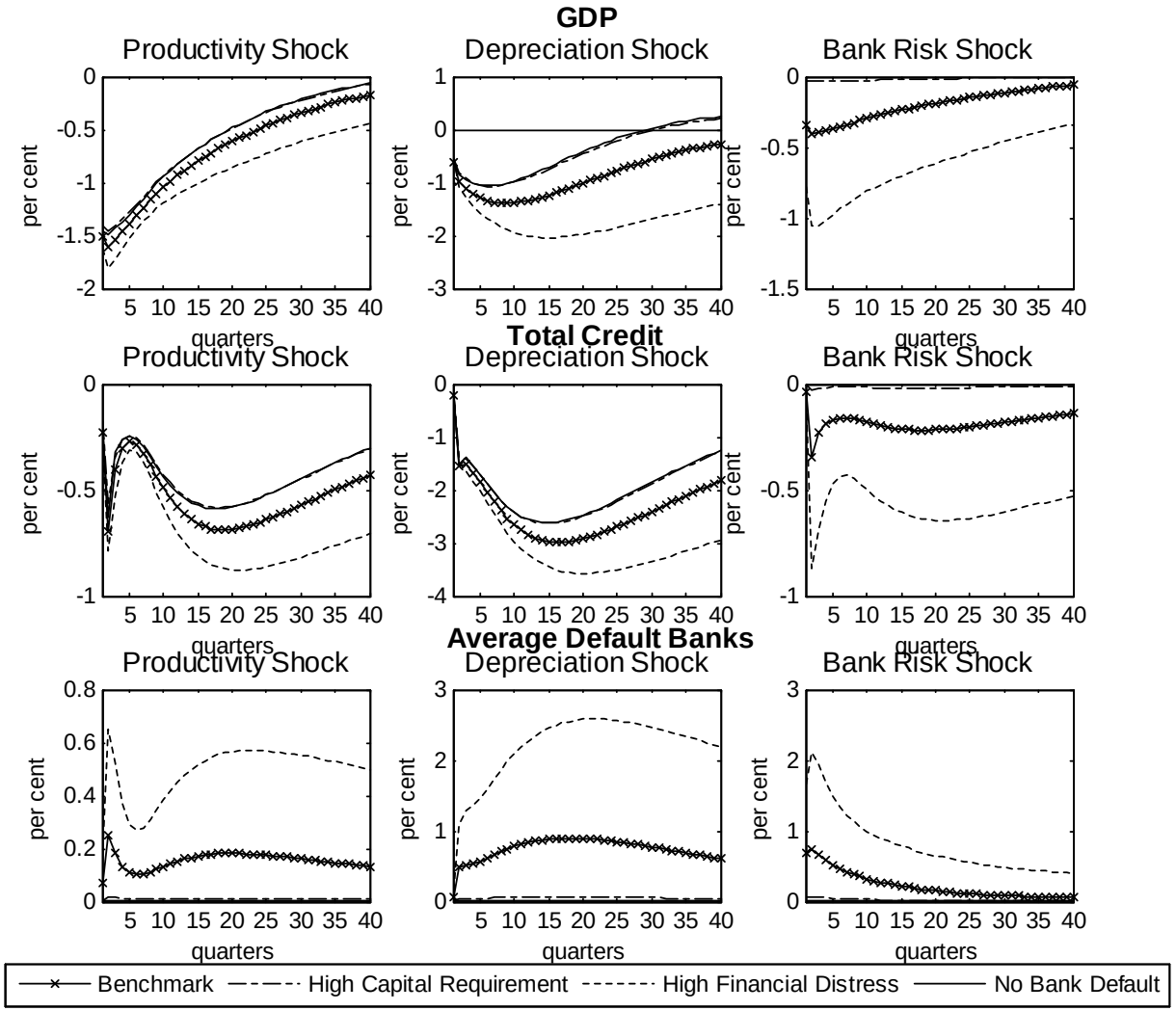
  where ω_{t+1}^H is a mortgage-bank-specific loan quality shock and $\widetilde{R}_{t+1}^H$ is the loan return (after loan losses).

- Several frictions:
  - $\rho_t \geq R_t$ due to scarcity of bank equity holder wealth
  - R_t^H includes compensation for HH default costs
  - DI subsidy reduces the necessary $E_t \widetilde{R}_{t+1}^H$ to achieve required equity return ρ_t
  - $R_t^D \geq R_t$ due to bank funding cost channel

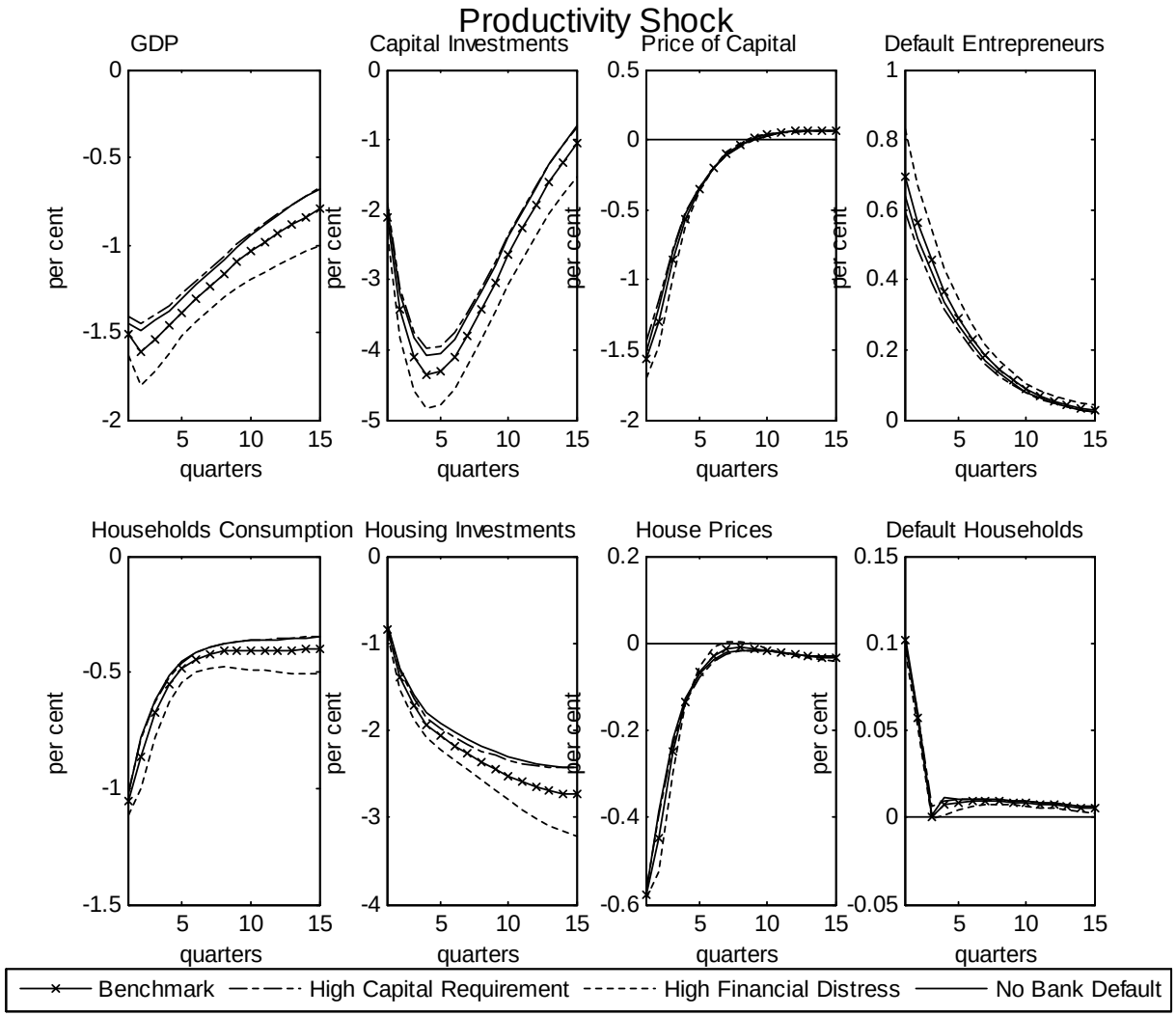
Baseline Parameters Setting

- Baseline capital requirements: $\left(\phi^M, \phi^F\right) = (0.04, 0.08)$
- Default (annualized):
  - Banks: 2%
  - Entrepreneurs: 3%
  - Households: 0.35%
- Leverage Entrepreneurs & Households: 75%
- Risk Weight: 50% on housing loans
- Transaction cost incurred when banks default (γ): 0.1
- Standard choices for other conventional parameters

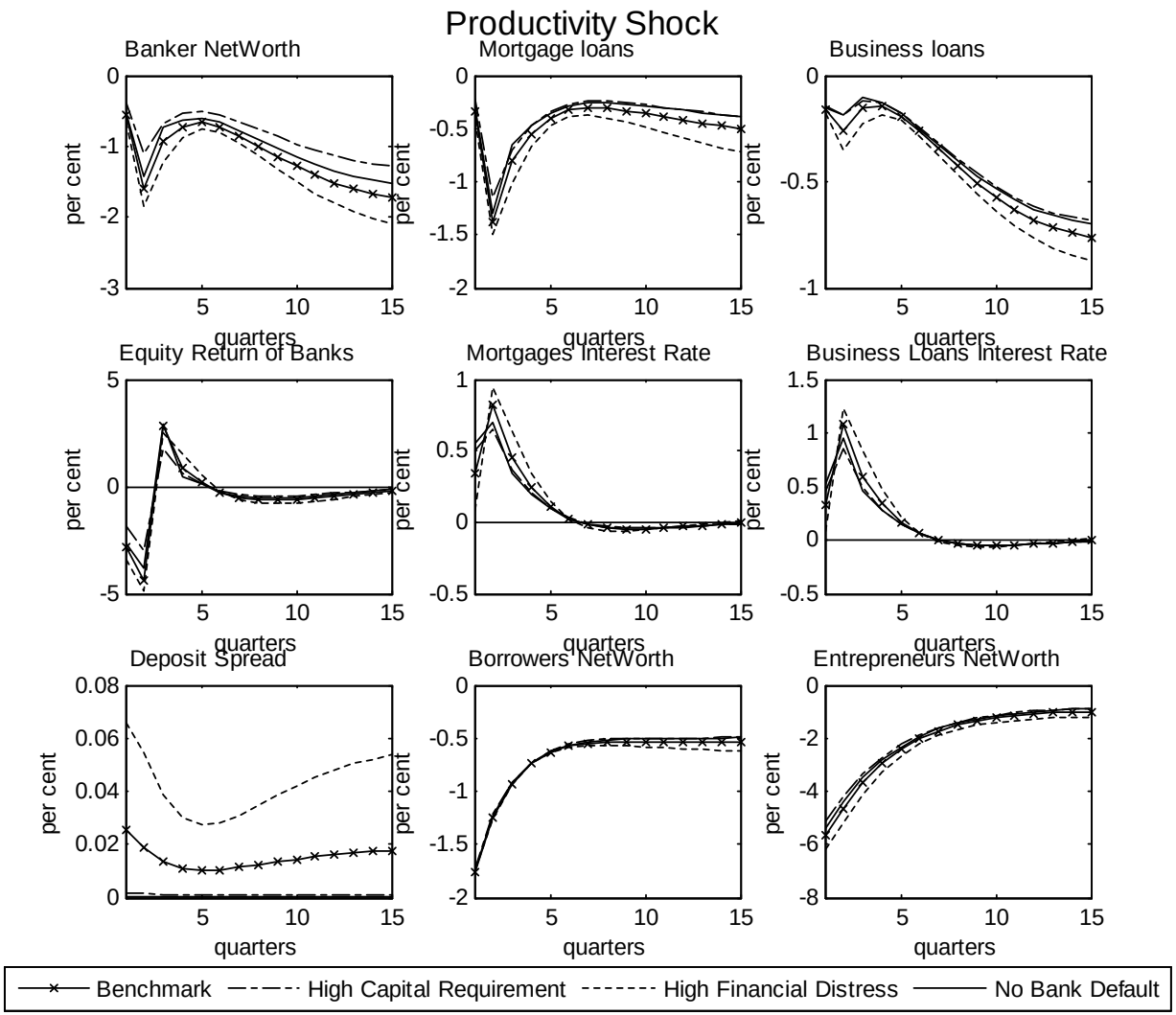
IRFs to Other shocks



IRFs: Productivity Shock



- Reduction in spending and production

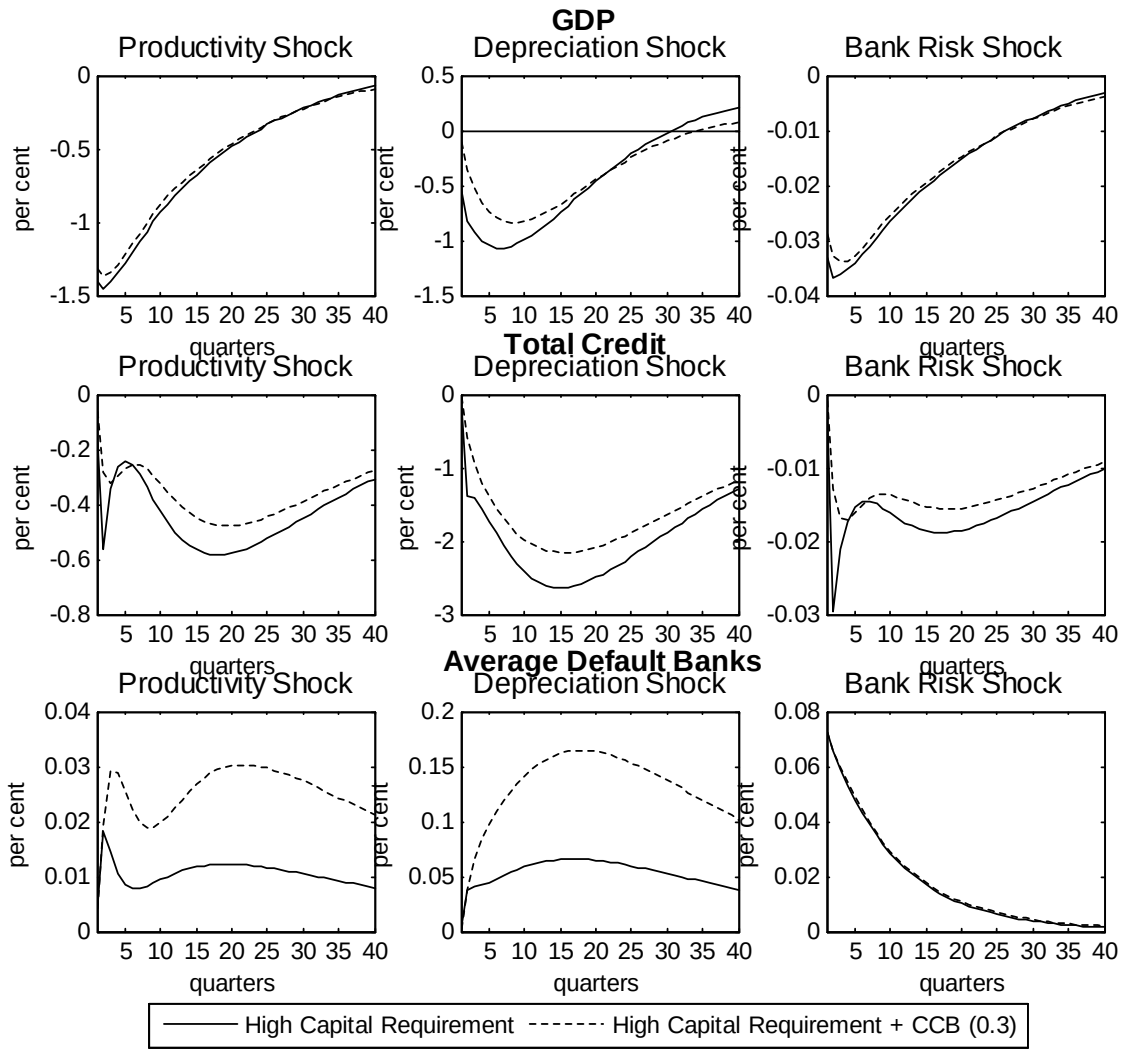


- $\uparrow$ Borrowers Default $\Longrightarrow$ $\downarrow$ Bank Capital$\Longrightarrow$

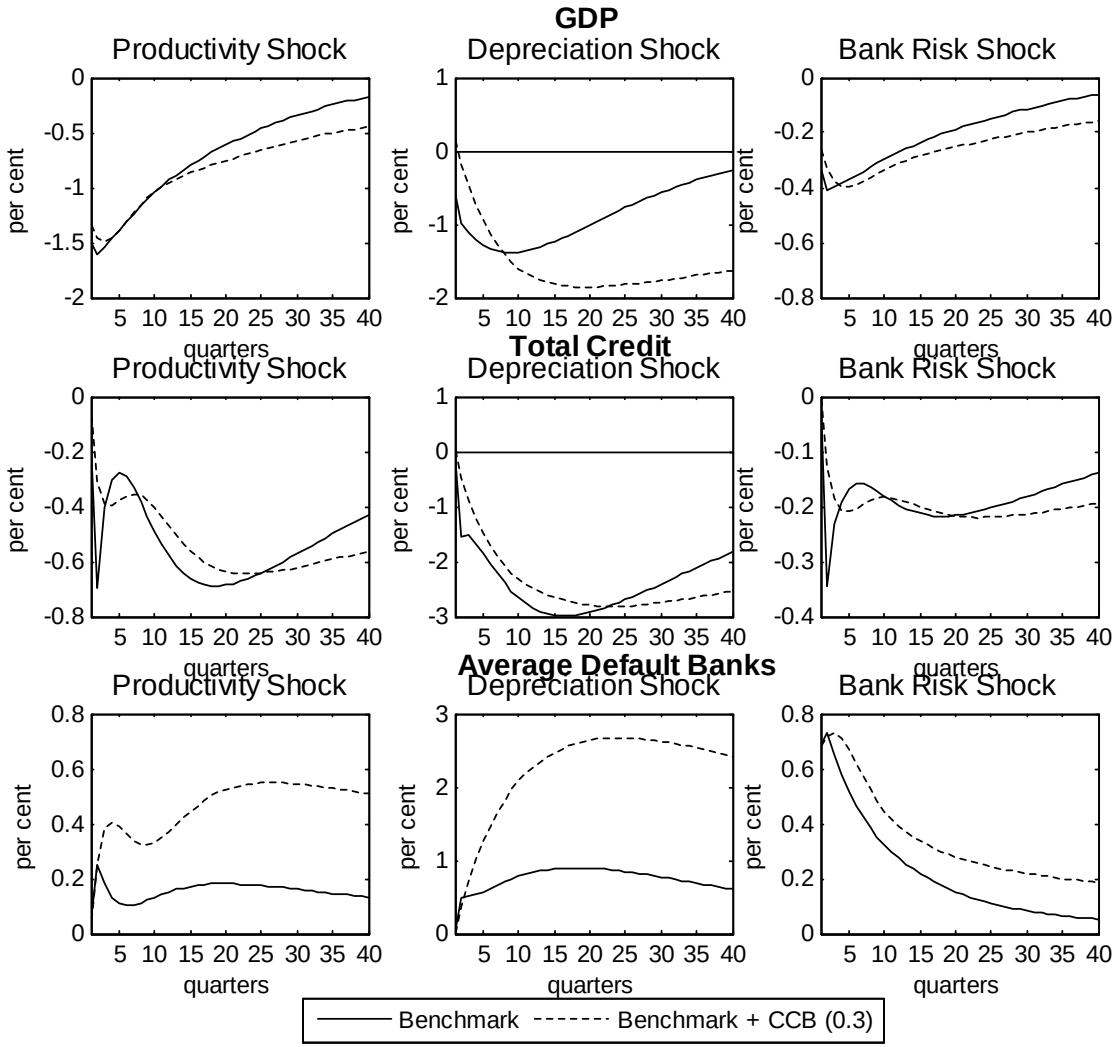
  A. Bank Capital Channel: $\downarrow$ Credit Supply

  B. Bank Funding Channel: $\uparrow$ Bank Default$\Longrightarrow$ $\uparrow$ Banks' funding cost$\Longrightarrow$ $\Uparrow$ loans rates

Counter-cyclical Adjustment of High Capital Requirements



Counter-cyclical Adjustment of Low Capital Requirements



Shocks hit economy with Poorly Capitalized Banks: small (+) effect in short run BUT