Course in Heterogeneity: Econ 081

IV: Banking in Partial Equilibrium

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Based on joint work with Tamon Takamura and Yaz Terajima

Banking in Partial Equilibrium

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- We are not yet concerned with the determination of interest rates

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- Rationale is to Protect the Public Purse safe when there is Deposit Insurance in the presence of moral hazard on the part of the bank.

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  - How much extra banking loses?

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  - Nicely built on top of an infinitely lived RA business cycle model.
- Corbae et al. (2016) is quite similar except, single bank problem with market power, and constant interest borrowing and lending. Done to have structural models of stress testing. They miss the crucial ingredient of market discipline.

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- Assets are long term, liabilities are short term

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- Useful also for Shadow Banking

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- Note that in this version there is no interaction between banks. The distribution is not a state variable of the banks' problem.
- The state of the economy is a measure x of banks that evolves over time itself via banks decisions and shocks (an extension of Hopenhayn's classic)

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  - $\delta^*(z, \xi, \ell, n, b')$

The only relevant equilibrium condition is

1. Zero profit in the bonds markets:

$$q(z, \xi, \ell, n, b') = \frac{1 - \delta^*(z, \xi, \ell, n, b')}{1 + \bar{r}}$$

Model: Aggregate State, $\{z, x\}$

- The choices of the bank $\{n(z, \xi, a, \ell), b'(z, \xi, a, \ell), c(z, \xi, a, \ell)\}$ and the exogenous shocks $\{z', \xi', \delta'\}$ generate a transition for the state of each bank and in turn of the distribution of banks..

Definition
A, equilibrium is a function $x' = G(z, x)$, a price of bonds q, and decisions for $\{n, b', c\}$ such that banks maximize profits, lenders get the market return, and the measure is updated consistently with decisions and shocks.

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  2. No Countercyclical Capital Requirement and no adjustment in ω^r.

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- This is more like an example. We are now estimating the model to Replicate the Canadian Banking Industry with (6) Large and (40+) Small Banks.

Long Good Times Targets Capital Requirement: $\theta = .105$

- We have the following industry properties

	(Canadian) Data	Model
Bank failure rate	0.22%	0.26%
Capital ratio	14.4%	14.4%
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Normalized T-Account of Banking Industry

Canadian Data

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Existing Loans	4.87	Wholesale Funding	1.63
		Own Capital	1.00

Model

New Loans	1.26	Deposits	4.40
Existing Loans	5.69	Wholesale Funding	1.51
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The issue of Calibrating Risk Weights: Forward looking

How do regulators assess risks for the purposes of computing the capital requirement?

- By Revealed Preference (we implement what they seem to do not what they seem to say)
- For each group of banks, we calibrate the risk weight on risky loans to the implied average risk weight in the data:

$$\widehat{\omega}_r(z = g, \xi) = \frac{\text{total risk weighted assets in 2017Q1}}{\text{total risky assets in 2017Q1}}$$

  Both terms in RHS are published by regulators.

- We want to think of featuring two groups of banks:
  1. Canadian Big 6 banks
  2. Non-Big 6 banks
- The risk weight on safe assets, ω_s, is set to zero.

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- The size of bank is a determining factor among others, i.e., ξ.
- Currently, six largest banks are DSIBs in Canada, charged with the additional capital requirement of 1%.

- Given $\widehat{\omega}_r(\xi)$, we compute the implied probability of loan default, $\widehat{\delta}$, for each bank group, using the regulatory formula defining risk weights.

  Internal rating-based approach formula defines the risk weight on corporte loans as follows:

$$\widehat{\omega}_r(\xi) = 12.5 \text{ LGD } \left[\Phi\left(\frac{\Phi^{-1}(\widehat{\delta}) + \sqrt{R}\Phi^{-1}(0.999)}{\sqrt{1-R}}\right) - \widehat{\delta}\right] \frac{1+(M-2.5)b}{1-1.5b}$$

  where Φ is the standard normal distribution,

$$R = 0.12\frac{1-\exp(-50\widehat{\delta})}{1-\exp(-50)} + 0.24\left[1 - \frac{1-\exp(-50\widehat{\delta})}{1-\exp(-50)}\right],$$

$$b = \left[0.11852 - 0.05478\log(\widehat{\delta})\right]^2,$$

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- Then, we match the ratio of average loan failure rates across bank groups to the ratio of $\widehat{\delta}$ between Big 6 and Non-Big 6 in the data:

$$\frac{\mathbb{E}\ \delta'_{\text{big banks}}}{\mathbb{E}\ \delta'_{\text{small banks}}} = \frac{\widehat{\delta}_{\text{Big 6}}}{\widehat{\delta}_{\text{Non-Big 6}}}$$

Another what are Recessions, $z = b$

- First what is the tail distribution of bank failures. Perhaps we have to explore different scenarios

- How do regulators perceive those risks and get their

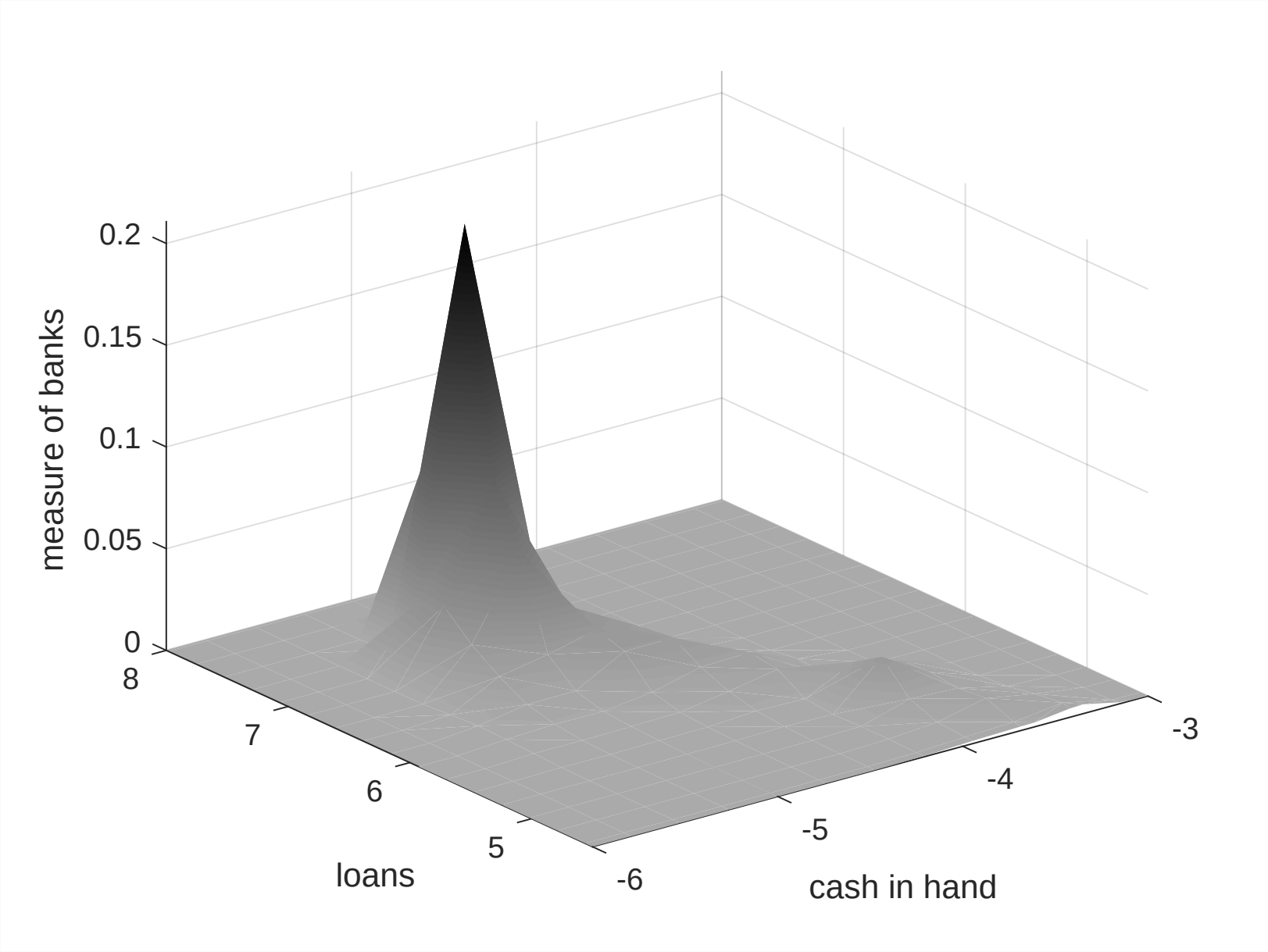
$$\widehat{\omega}(z = b, \xi)$$

We will have to explore various ones. So far this has not mattered much.

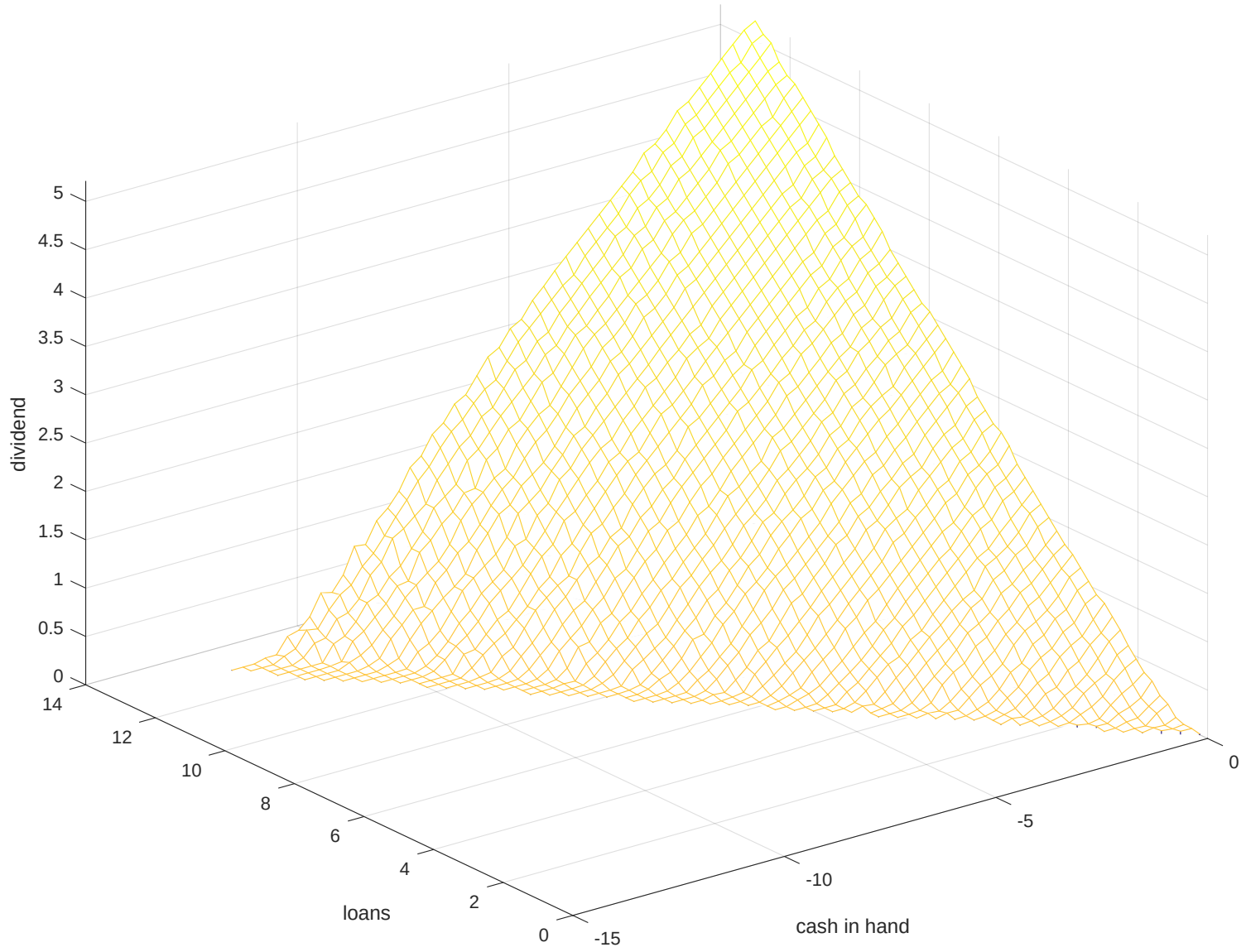
Model Parameters

Parameter	Value	Description
ξ_n^0	0.075	Loan issuance cost: $\chi(n, \xi_n) = \xi_n^0\, n + 0.5\, \xi_n^1\, n^2$
ξ_n^1	0.15	Loan issuance cost: $\chi(n, \xi_n) = \xi_n^0\, n + 0.5\, \xi_n^1\, n^2$
ξ_d	5	Deposits
β	0.95	Subjective discount factor
λ	0.2	Maturity rate of long-term loans
r	0.1	Bank lending rate
r_f	0.005	Risk-free rate
σ	0.9	$u(c) = c^\sigma$
ω_r	1	Risk weight on risky loans
ω_s	0	Risk weight on safe assets
$\Gamma_{z=G,z'=G}$	0.99	$\Pr(z' = G \mid z = G)$
$\Gamma_{z=B,z'=B}$	0.80	$\Pr(z' = B \mid z = B)$
$E(\delta \mid z = G)$	0.025	$\Sigma_\delta\ \delta \cdot \pi(\delta \mid z = G)$
$V(\delta, Z = G)$	0.0015	$\alpha(Z = G) = 0.3847$, $\beta(Z = G) = 15.0011$
$E(\delta \mid z = B)$	0.040	$\Sigma_\delta\ \delta \cdot \pi(\delta \mid z = B)$
$V(\delta, Z = B)$	0.0040	$\alpha(Z = B) = 0.3417$, $\beta(Z = B) = 8.2009$

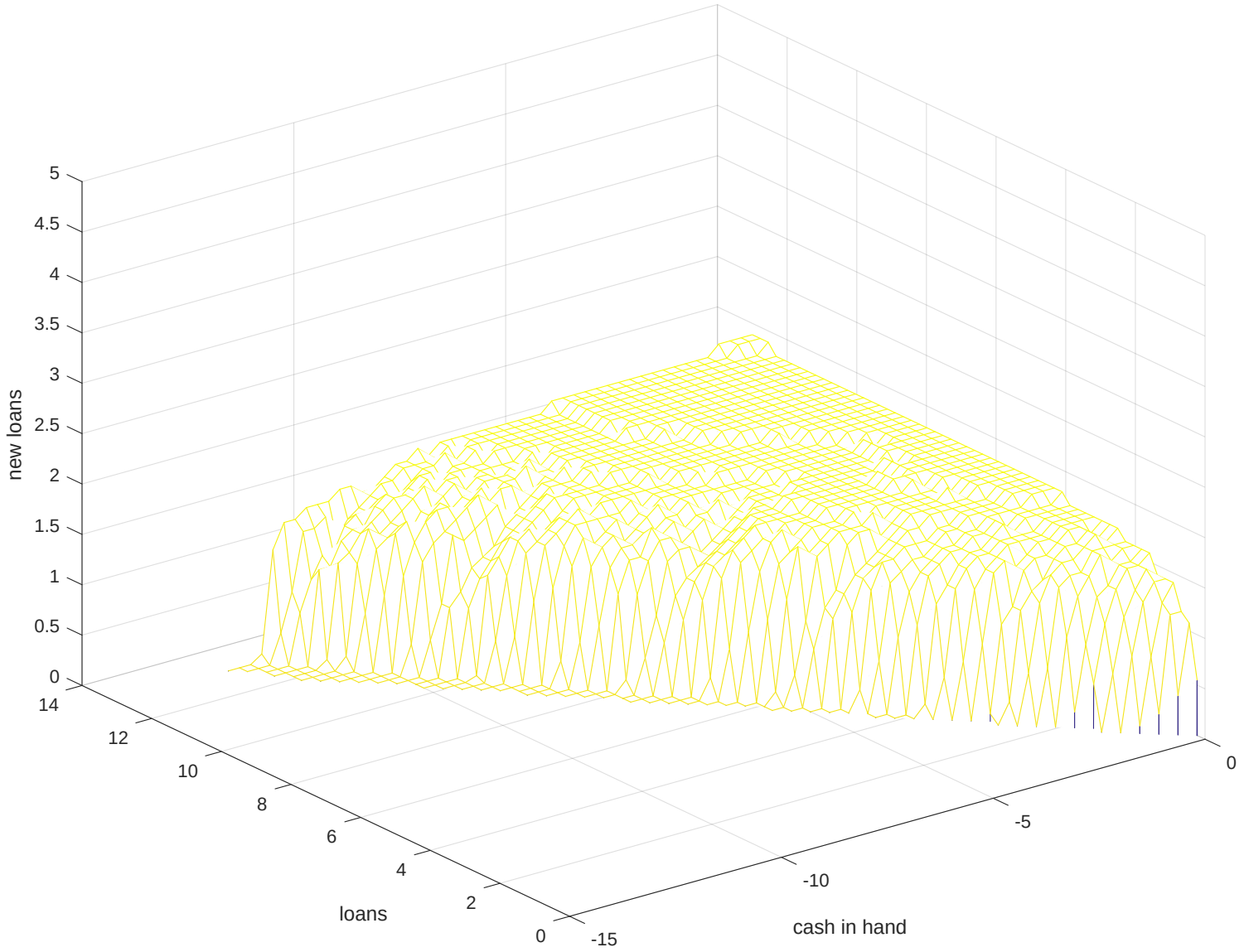
Distribution of Banks



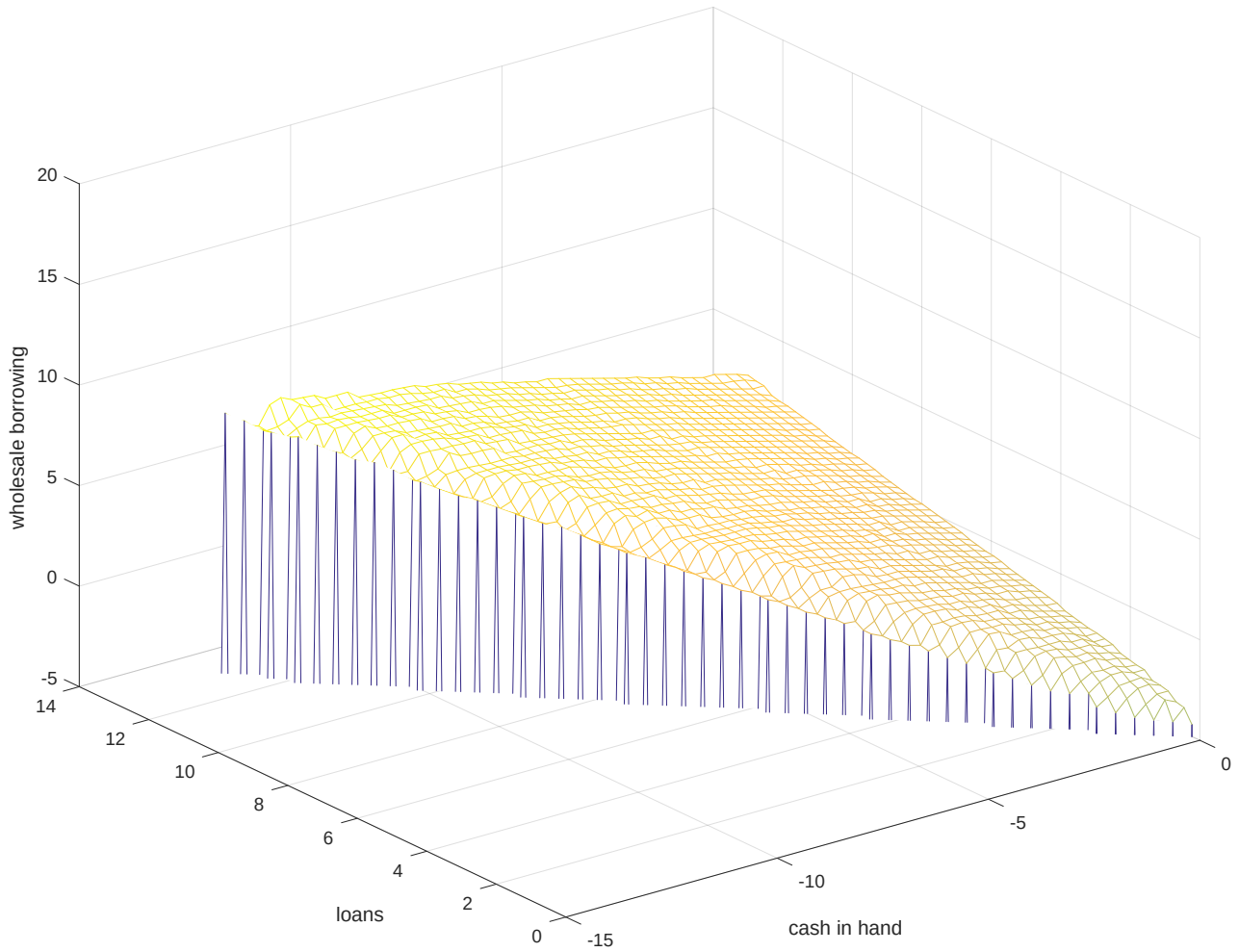
Banks Dividends



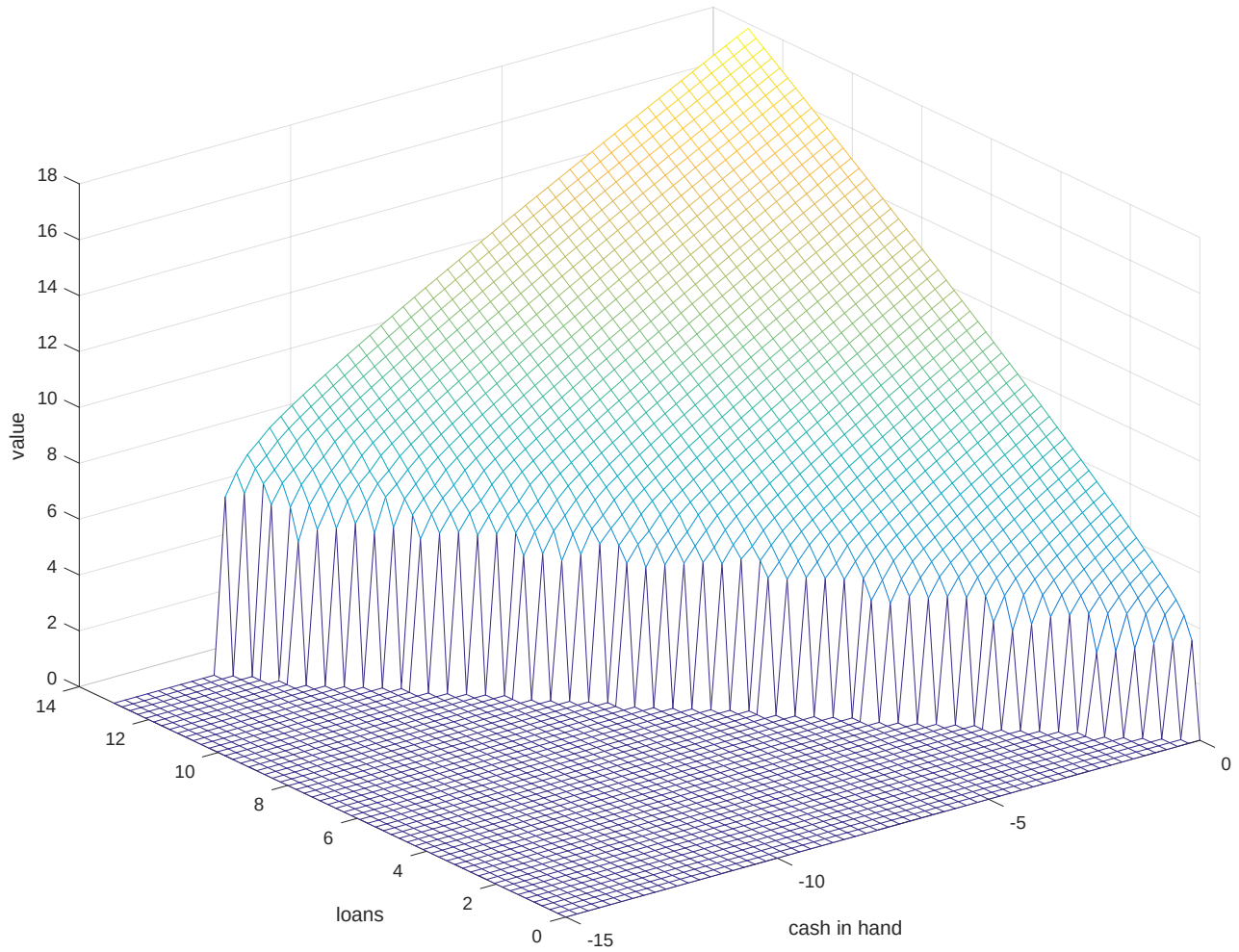
Banks New Loans Issue



Banks Wholesale Funding (Deposits plus Bonds)



Banks Value Function



Public Loses when Banks touch Intervention Threshold (2%)

Recovery Rate of Bank Assets at Default	Discount Rate of Regulator		
	0.5% (Risk-Free Rate)	2.0%	5.0% (Bank's Discount Rate)
0.3	23.01	7.92	3.43
0.6	9.84	3.40	1.49
1.0	-1.11	-0.94	-0.71

- The Public does well in closing the bank

A Nasty Crisis with and without CCyB

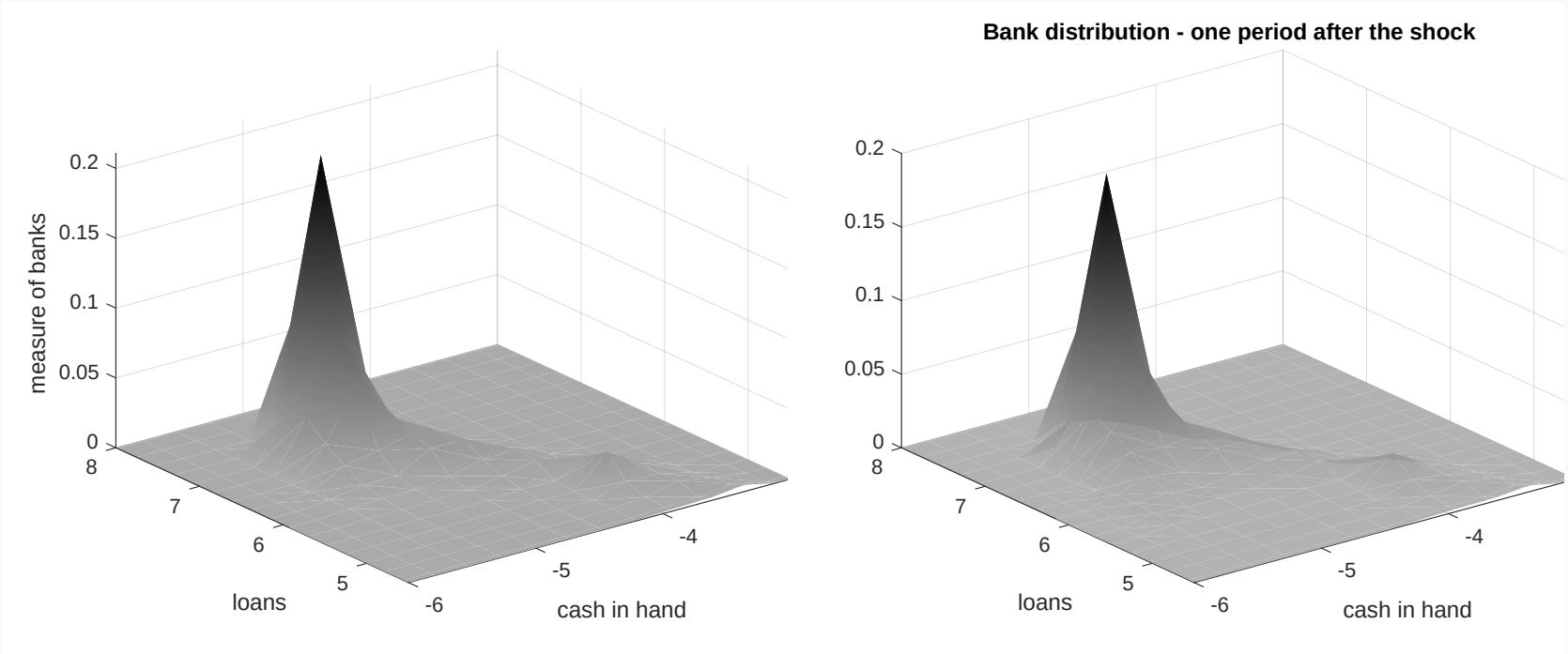
- Imagine the shock $\triangle E(\delta) = 0.015$ (from .025 to .04) hits all banks, which happens with a very small probability, 0.01. The crisis continues for two periods and ends to go back to the good aggregate state thereafter.

- Some banks are in better financial shape than others.

- We explore the recovery of the Banking sector under the four scenarios.

- What happens upon

A Nasty Crisis with and without CCyB



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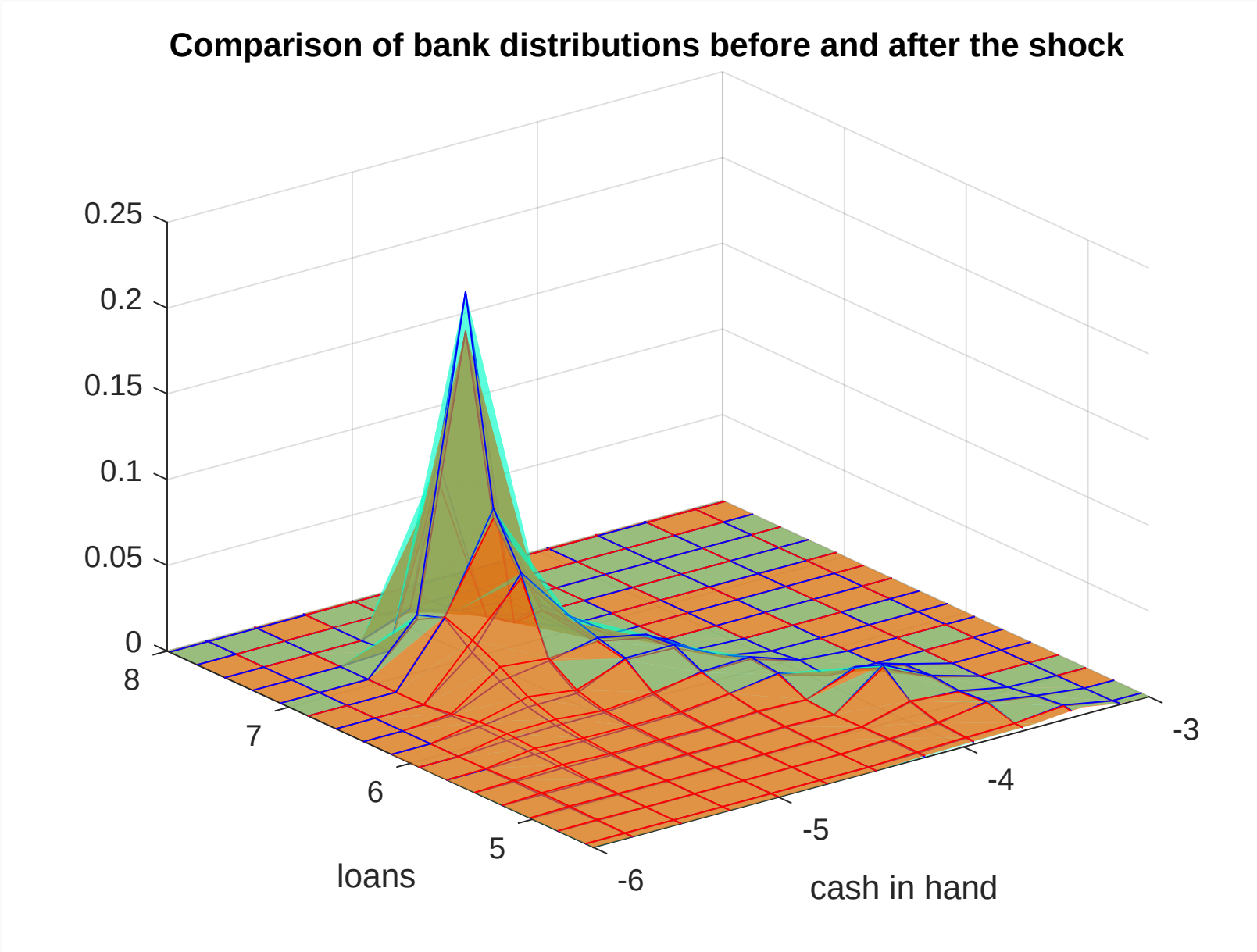
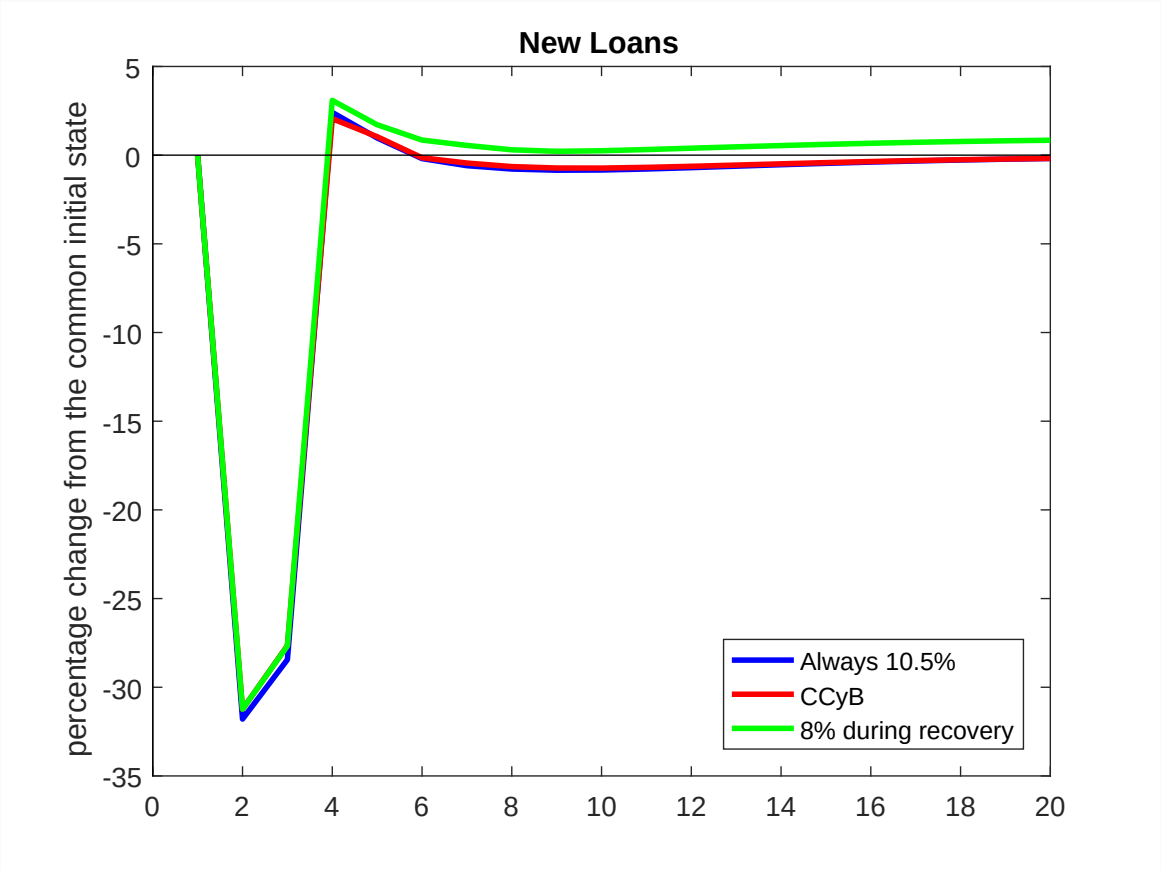


Ulterior Path of the Economies after the shock

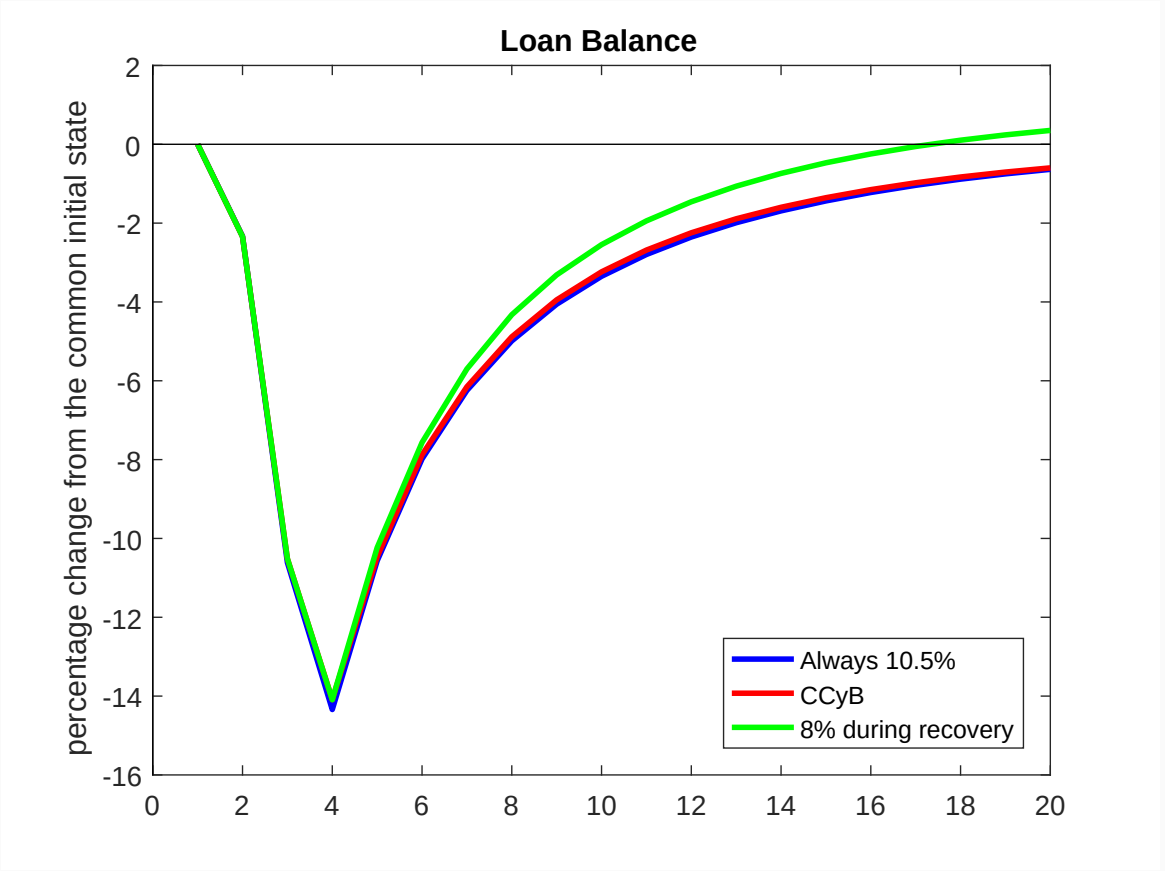
- Recall that it is a recession for two periods and then we have a recovery.
- We compare Countercyclical Capital Requirement with a constant weight to risk assests (left)and with a variable weight (right)
- We look at impulse responses

New Lending

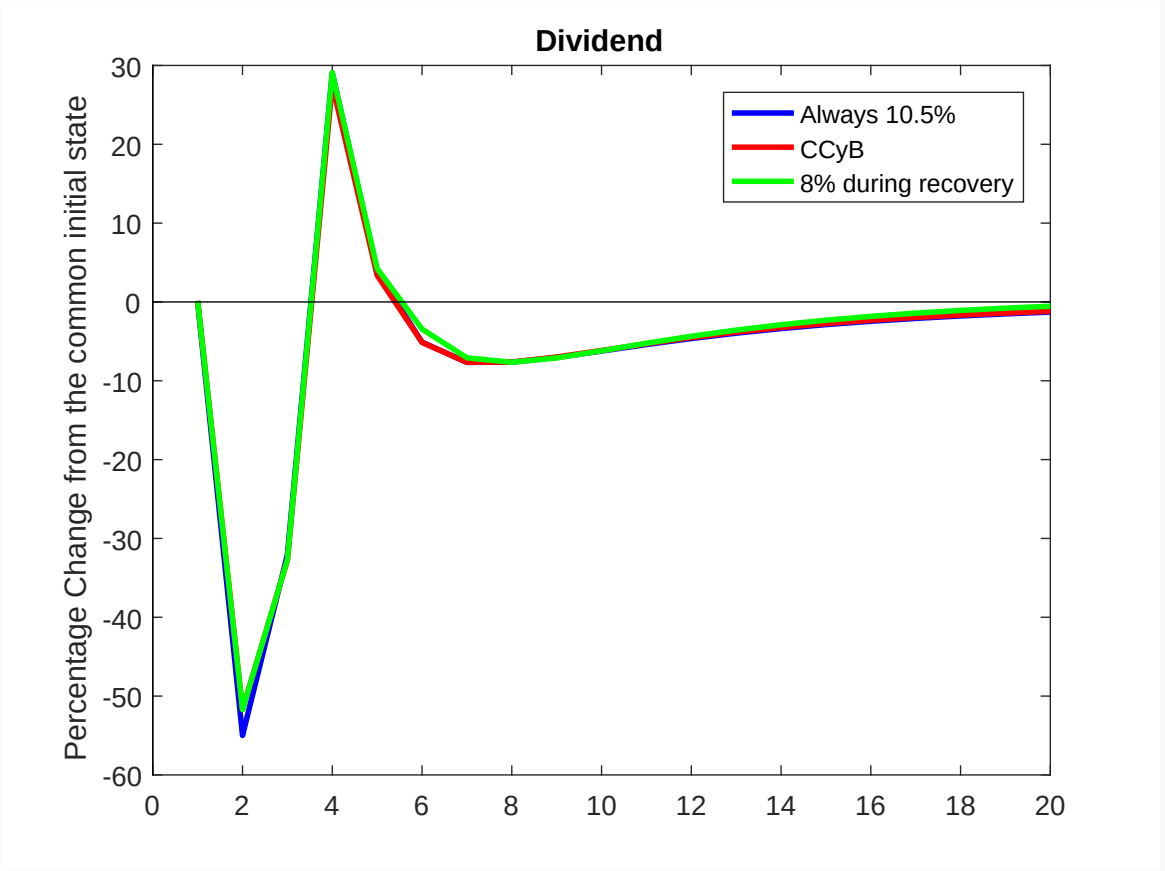
Small difference between non-contingent policy and CCyB during the downturn. CCyB (if low capital requirement extends for a longer period) provides some help during the recovery.



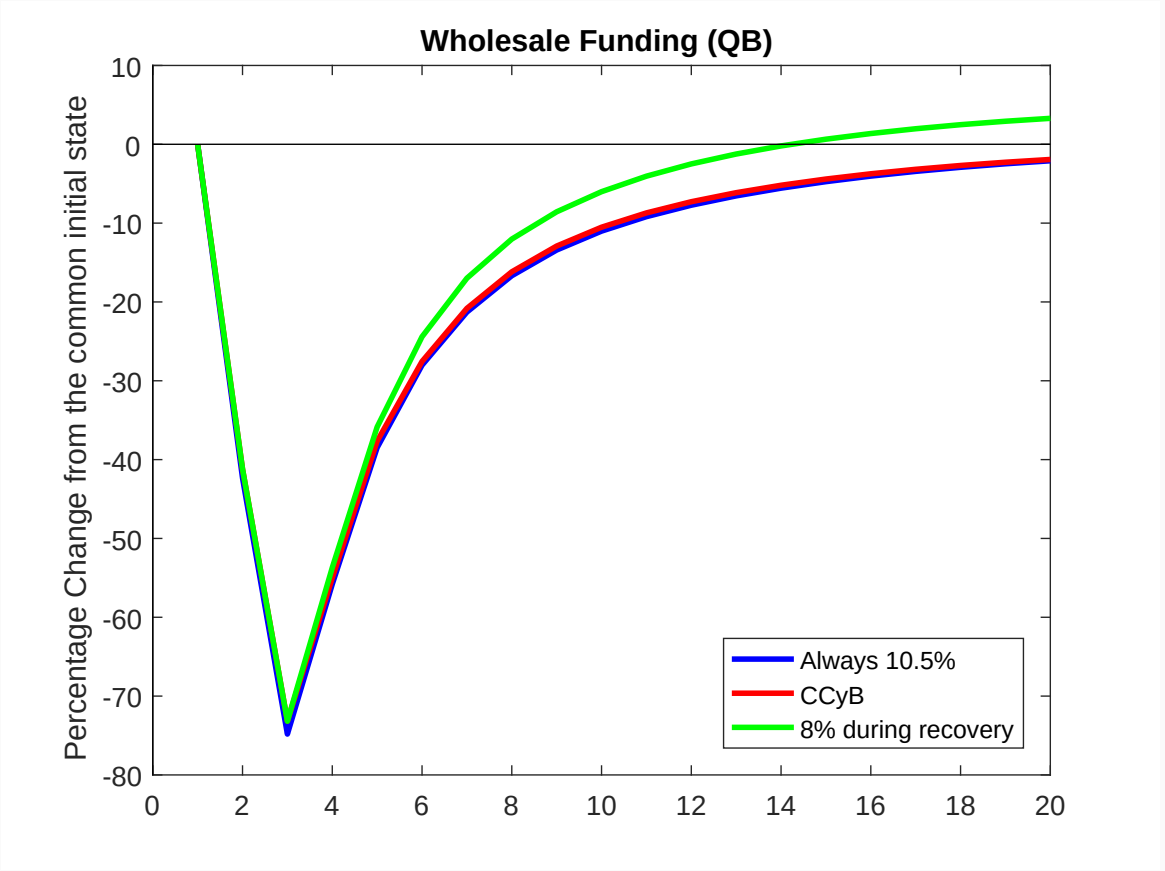
Stock of Loans



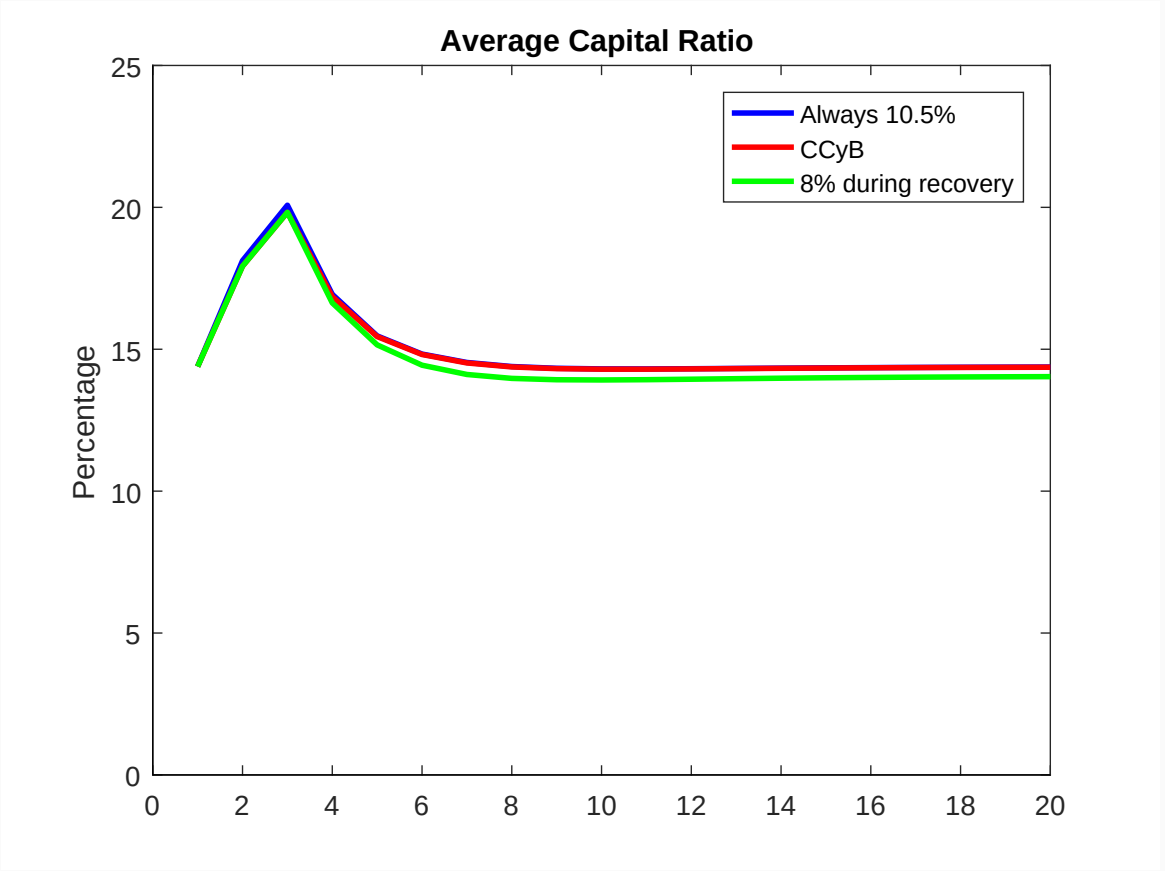
Dividends


Dividend
Always 10.5%
CCyB
8% during recovery
Percentage Change from the common initial state
30
20
10
0
-10
-20
-30
-40
-50
-60
0
2
4
6
8
10
12
14
16
18
20

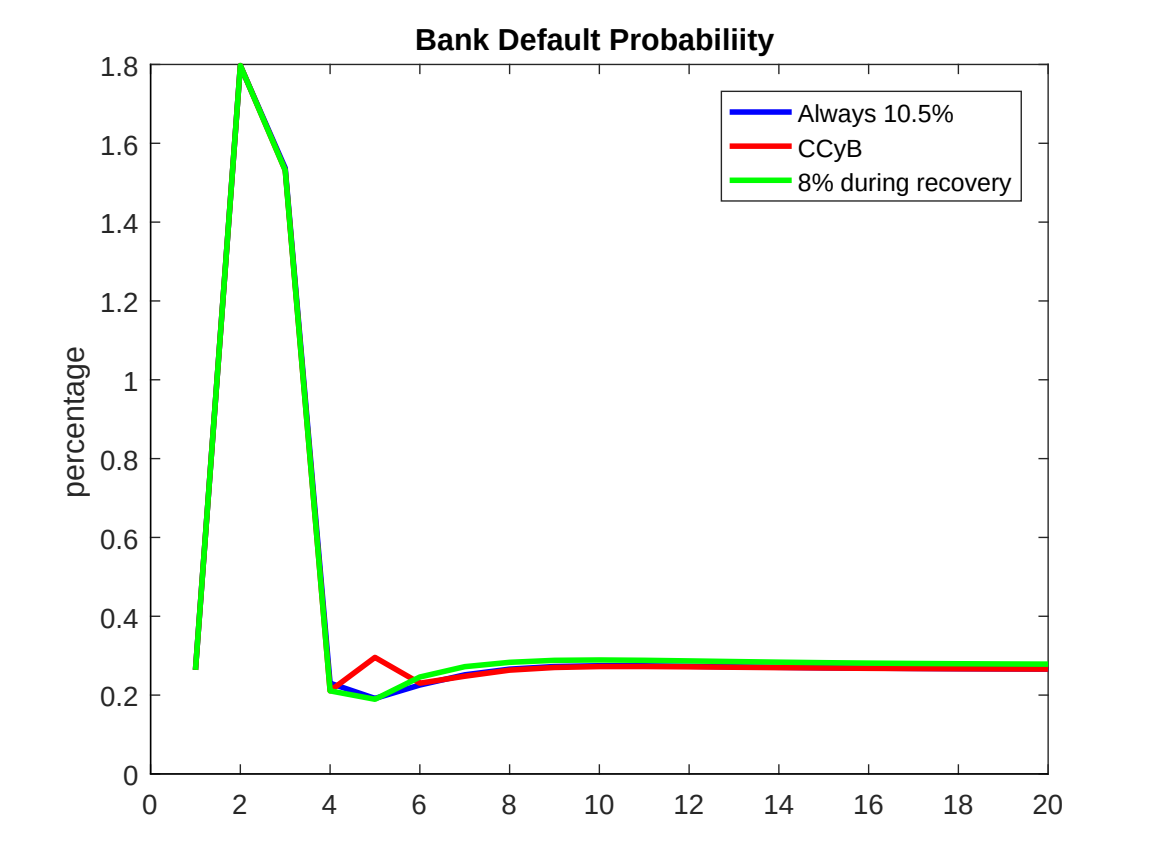
Wholesale Funding



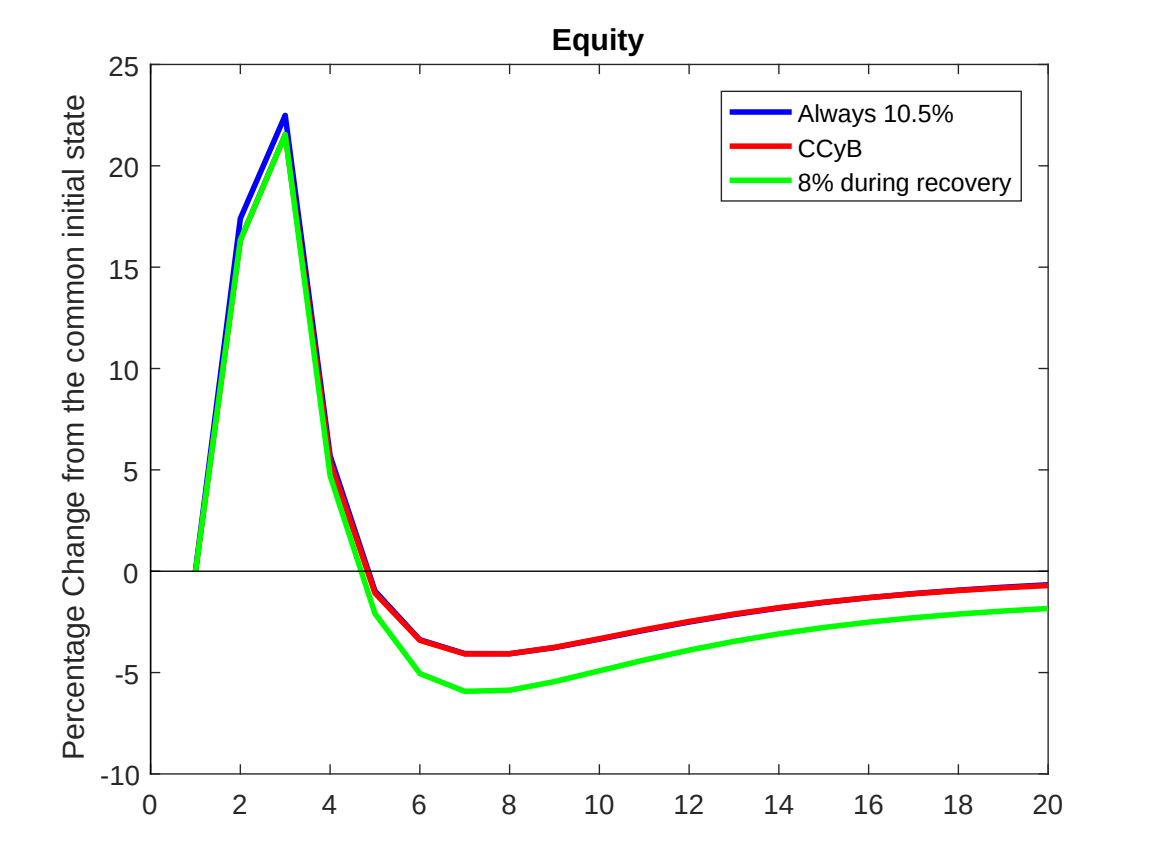
Capital Ratio



Bank Failure Rates



Bank Equity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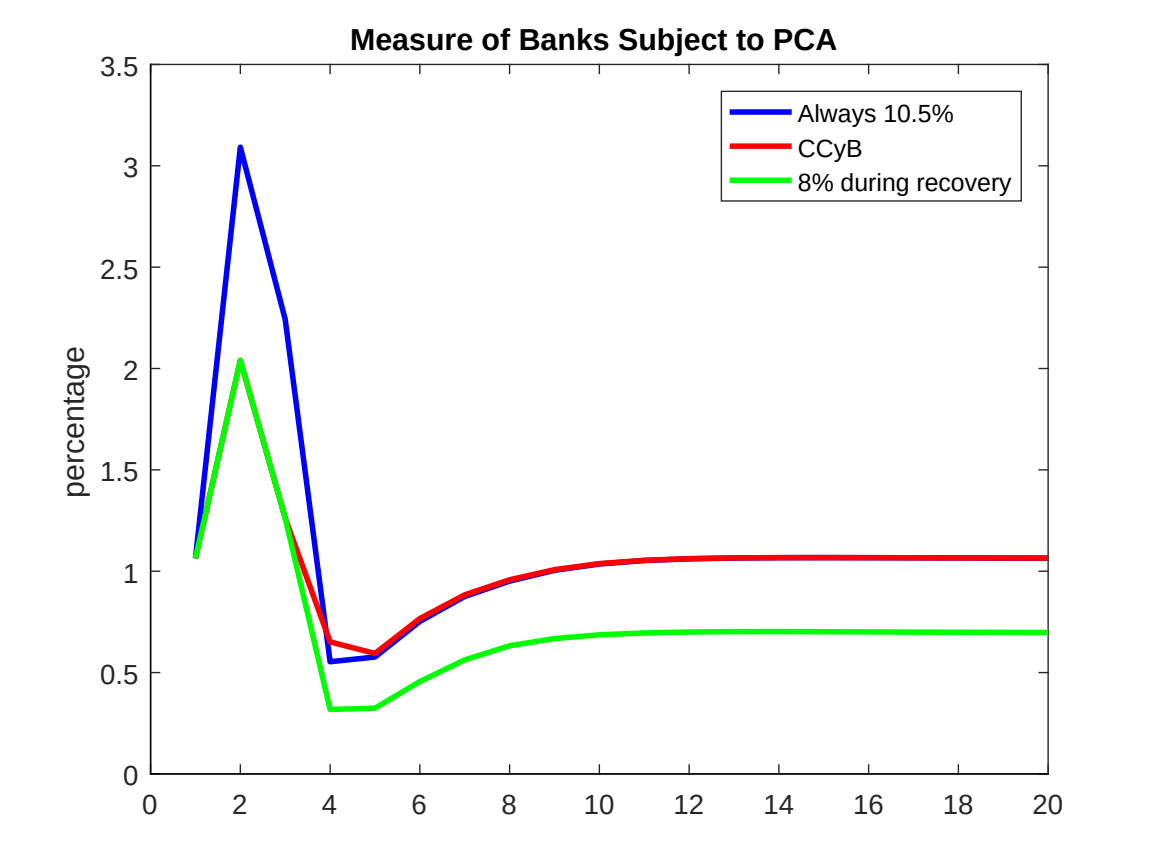
Fraction of Capital Requirement Violation



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- Contagion, financial crisis. This needs serious thinking.

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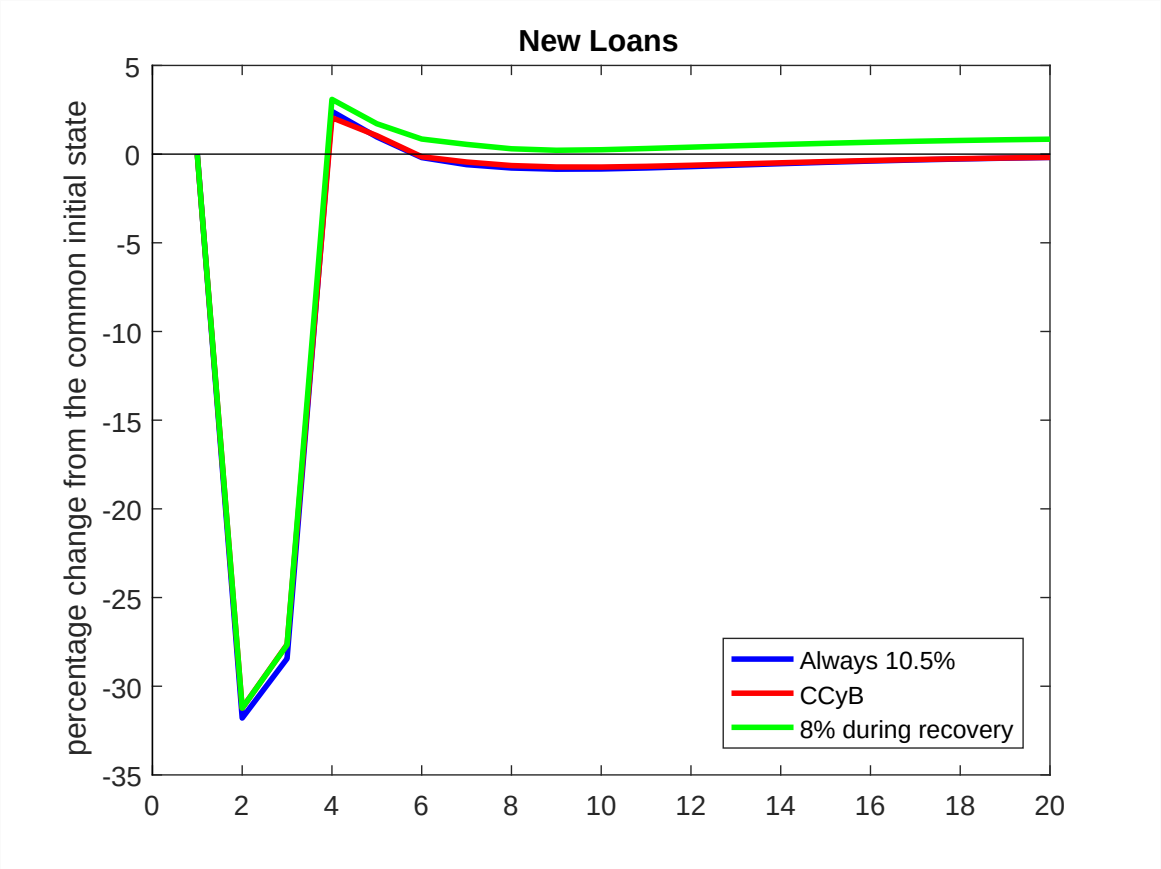
- Lowering capital requirements has little effect because banks are already concerned.
- Perhaps our findings will change when we fine tune the calibration so that banks' capital shrinks.

New Lending by Banks: with 8% Capital Requirement during Recovery



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- Households own shares of a mutual fund

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  - Still need a theory of why are they trouble.

Return

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