A Macroeconomic Model of Endogenous Systemic Risk Taking

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2nd MaRs Conference, ECB, 30-31 October 2012

Introduction

- The recent crisis has evidenced the need to incorporate banks & systemic risk in **macroeconomic analysis**

- Existing macroeconomic models explicit about banks do not yet share a clear notion of **endogenous systemic risk**

- In this paper, systemic risk results from banks' **voluntary exposure** to an **infrequent & large common shock**...

  which is attractive to them due to standard risk-shifting incentives of levered firms

  [$\Rightarrow$ link to microeconomic literature on bank risk-taking]

- Simple **dynamic equilibrium model** focused on the positive and normative analysis of the effects of **capital requirements** on systemic risk taking

  – Bank capital dynamics is modeled like in other recent papers (e.g. Gertler-Kiyotaki'10)

  [Limited wealth of bankers who retain earnings and/or suffer losses from prior investments]

  – Bank capital reduces **systemic gambling incentives**

  [A micro-banking classic not yet explored by macro papers:

  * Meh-Moran'10: monitoring incentives *a la* Holmström-Tirole'97
  * Gertler-Kiyotaki'10: fund diversion *a la* Hart-Moore'94]

- Simplifications: risk neutrality, no physical capital accumulation, inelastic labor supply, perfectly elastic deposit supply, DI, etc.

Our modeling of systemic risk taking

- Production technology subject to *failure risk*, which can be:
  - purely i.i.d. (*non-systemic firms*)
  - highly correlated across firms if a rare large negative shock occurs (*systemic firms*)
- Firms need bank loans:
  - Lending to systemic firms is *socially inefficient*
  - But banks may find systemic lending *privately profitable* due to the combination of high leverage and limited liability
- Systemic vs. non-systemic lending is not ex-ante distinguishable

  $\rightarrow$ Flat capital requirement γ
- Banks specialize in one type of lending (and bankers competitively allocate their wealth across bank types)

Key variables

- Capital requirements are satisfied with *inside equity*, i.e. wealth that so-called bankers accumulate via earnings retention

  [like in Gertler-Kiyotaki 2010]

  $\longrightarrow$ Single *state variable* is bankers' aggregate wealth e

  $*$ grows quickly if bank profits are high

  $*$ gets lost if invested systemically and shock realizes

- Two important endogenous variables

  $v(e)$: value of one unit of bankers' wealth

  $x(e)$: fraction of bankers' wealth invested in systemic banks

  [banks specialize as systemic or non-systemic]

Key insights

- Bankers' systemic gambling incentives are moderated by:
  - Leverage reduction achieved by rising γ
  - Incentives to preserve wealth when other bankers are losing wealth (i.e. when e is low & $v(e)$ is high)

    $\longrightarrow$ *Last bank standing effect* like in Perotti-Suarez (2002)
- Importantly, a higher capital requirement γ...
  - Reinforces the last bank standing effect [GOOD]
  - Makes bank capital effectively scarcer at all times

    $\Rightarrow$ less credit $\Rightarrow$ lower economic activity [BAD]
- We can explicitly analyze the implied welfare trade-offs

Rest of the talk

1. Graphical presentation of key results
2. Quantitative results
3. Extensions / Applications
4. Conclusions

Social welfare W as a function of $\gamma \leftarrow$

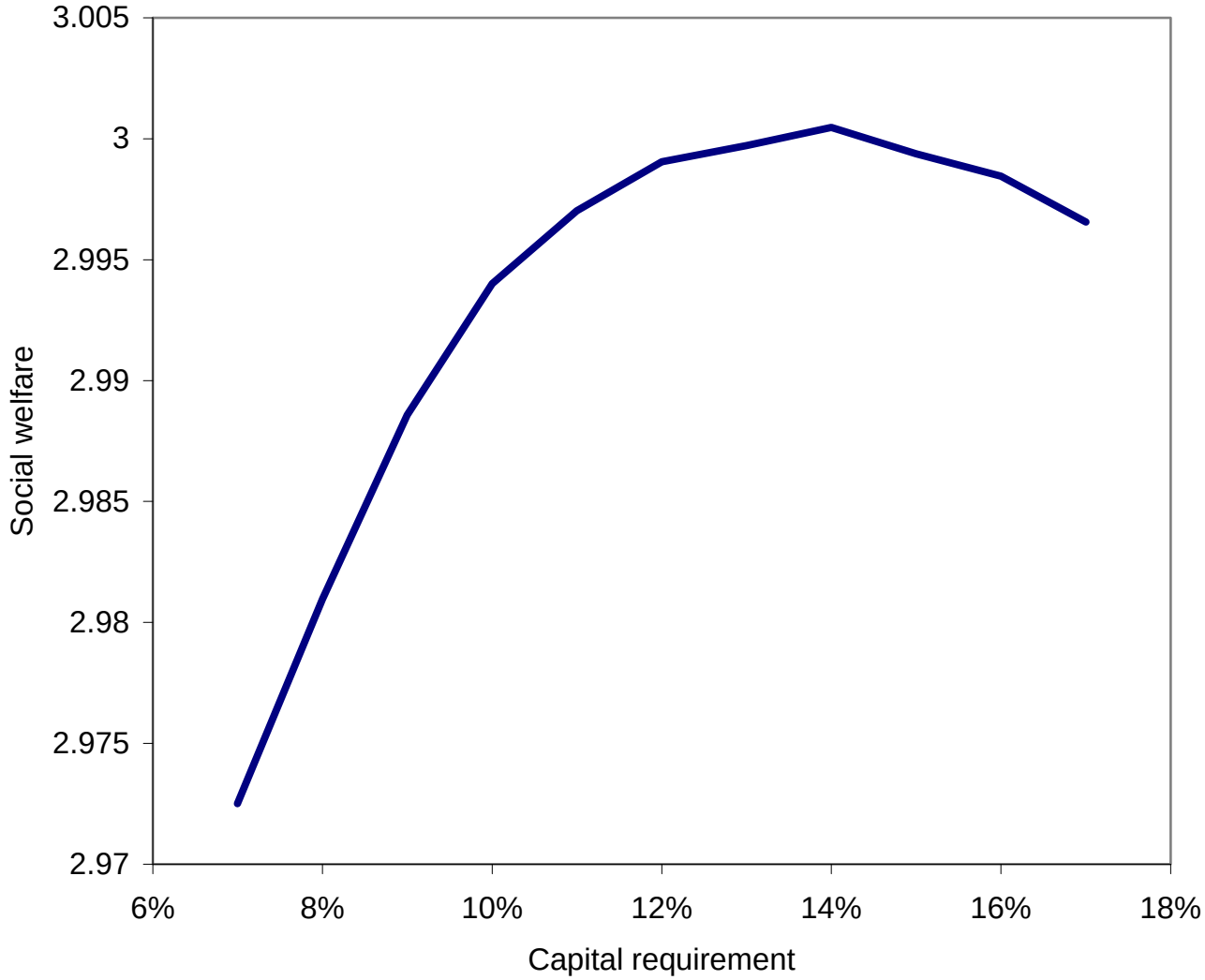


Figure 1: $W(\gamma)$ [we compare γ^*=14% with γ=7%]

$v(e)$ and $x(e)$ under low and optimal γ $\leftarrow$

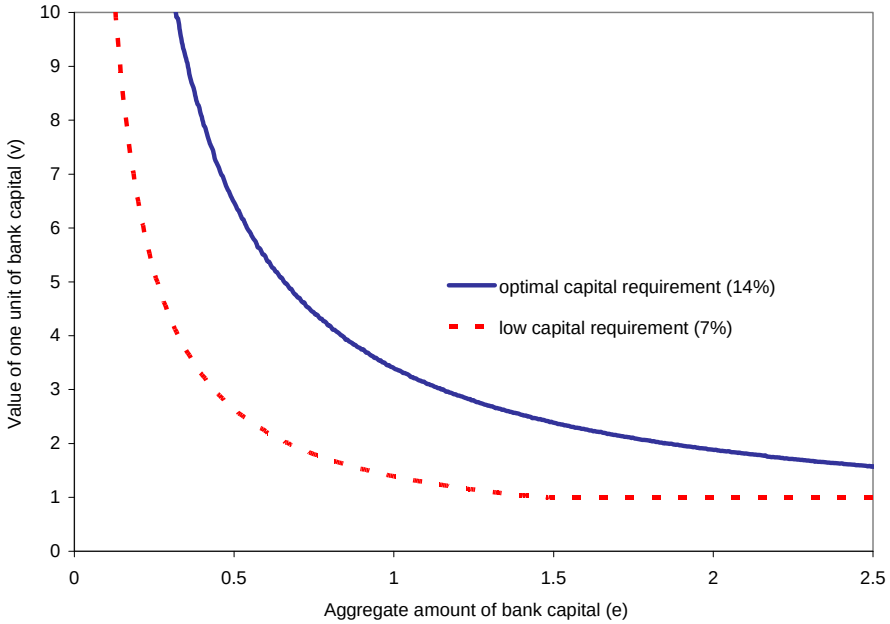


Figure 2a: $v(e)$

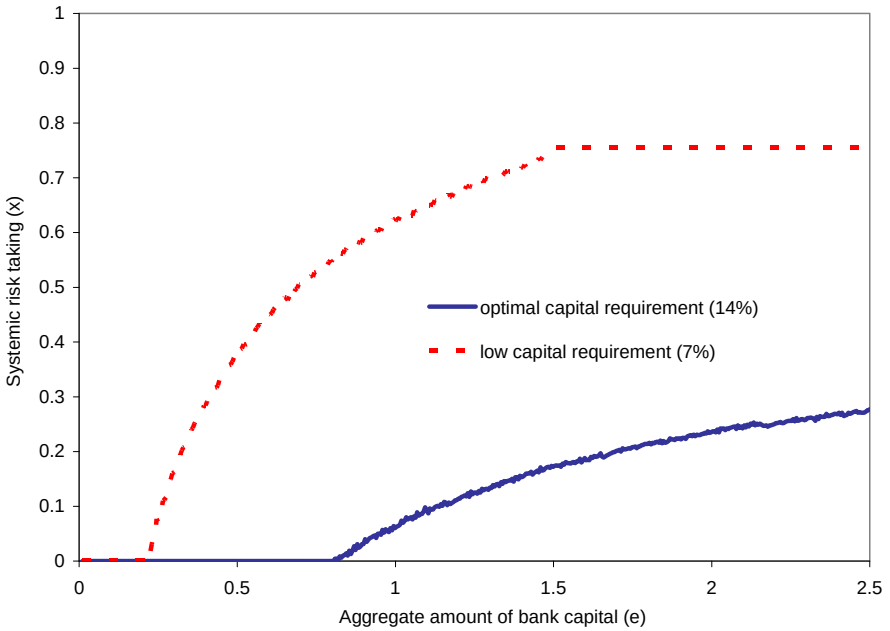


Figure 2b: $x(e)$

Equilibrium dynamics with low and optimal γ ←

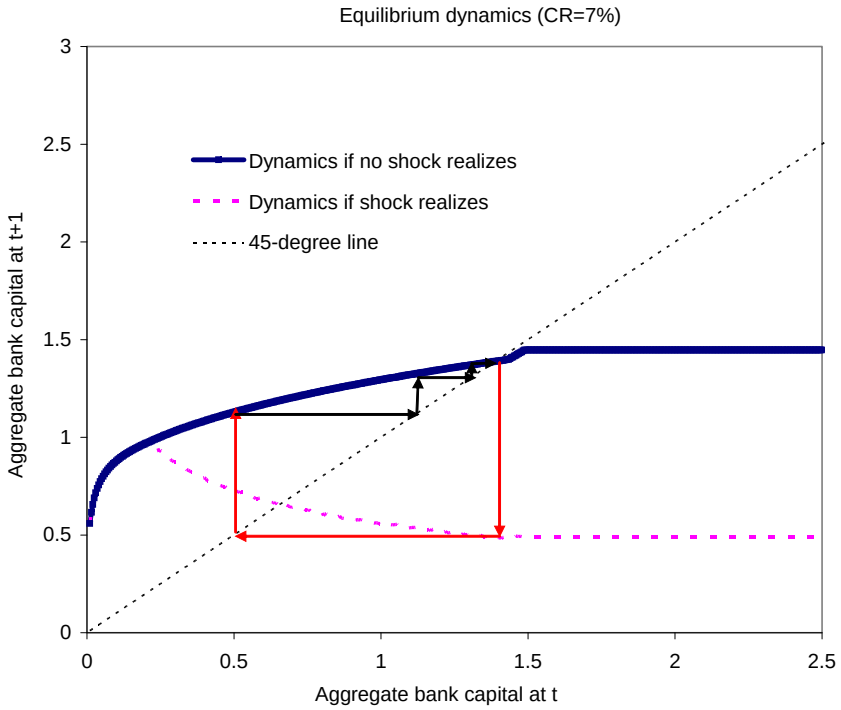


Figure 3a (γ =7%)

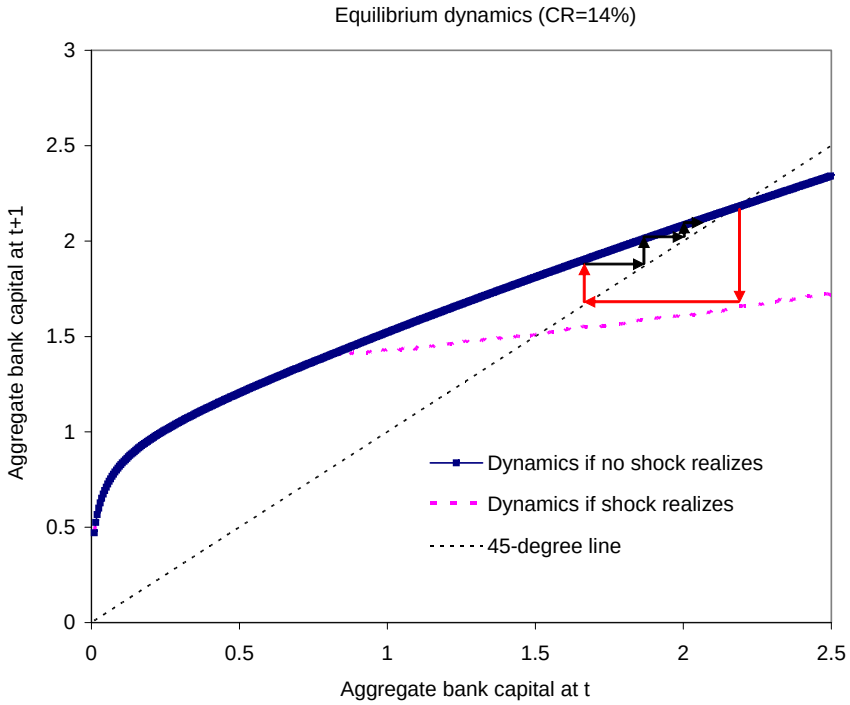


Figure 3b (γ =14%)

Equilibrium dynamics with low and optimal $\gamma \leftarrow$

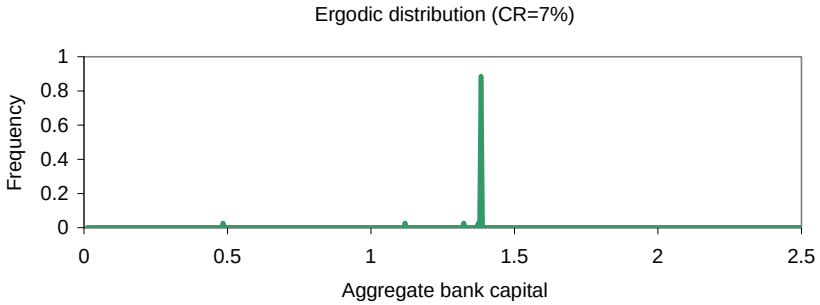


Figure 3c (γ =7%)

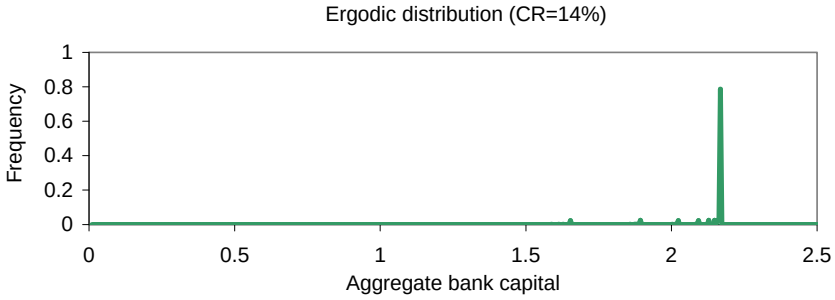


Figure 3d (γ =14%)

Quantitative results

- Optimal capital requirements: positive and large (14%)
- Comparison CR=7% $\rightarrow$ CR=14% (unconditional means)
  - Lower fraction of systemic loans: 71% $\rightarrow$ 24%
  - Higher loan rates: 4.1% $\rightarrow$ 5.6%
  - Lower macro aggregates: bank credit (–21%), GDP (–7%)
  - Higher social welfare: $\simeq$ +0.9% permanent consumption
- Variation in year-after-shock aggregates:
  - CR=7%: loan rate (+11.6pp), bank credit (-65%), GDP (-32%)
  - CR=14%: loan rate (+2.5pp), bank credit (-24%), GDP (-10%)

Quantitative results (details, 1/3)

T2. Main unconditional means	$\gamma = 7\%$	$\gamma = 14\%$	$\Delta\%$
Welfare (equivalent consumption flow)	2.97	3.00	0.9
GDP	4.40	4.12	-6.5
Bank credit (l)	19.24	15.25	-20.7
Bank equity (e)	1.35	2.14	58.5
Loan rate (r_L) (in %)	4.1	5.6	1.5pp
Deposit insurance costs	0.16	0.04	-76.5
Value of one unit of bank capital (v)	1.12	1.79	61.3
Fraction of equity in systemic banks (x)	0.71	0.24	-65.4

Quantitative results (details, 2/3)

T3. % Change in after-shock period (from PSS)	γ=7%	γ=14%
Aggregate net consumption	-17.3	-4.6
GDP	-31.7	-9.5
Bank credit (l)	-65.3	-24.0
Loan rate (r_L)	11.6pp	2.5pp
Value of one unit of bank capital (v)	160	26
Fraction of equity in systemic banks (x)	-50	-20

Quantitative results (details, 3/3)

T4. Other macro & financial ratios	$\gamma = 7\%$	$\gamma = 14\%$
Labor income/GDP	0.69	0.68
Physical capital/GDP	3.68	3.03
Bank credit/GDP*	4.37	3.71
Deposit insurance costs/GDP	0.036	0.009
ROE at non-systemic banks	0.10	0.17
ROE at systemic banks if no shock realizes	0.19	0.21

[*: suggests *exuberance* due to lax regulation]

Extensions / Applications

- Transitional dynamics from moving γ and impact on welfare**:**

  There is value (and limits to the value) of
  applying gradualism in rising γ

  [Best: moving from 7% to 13% in 10 years]

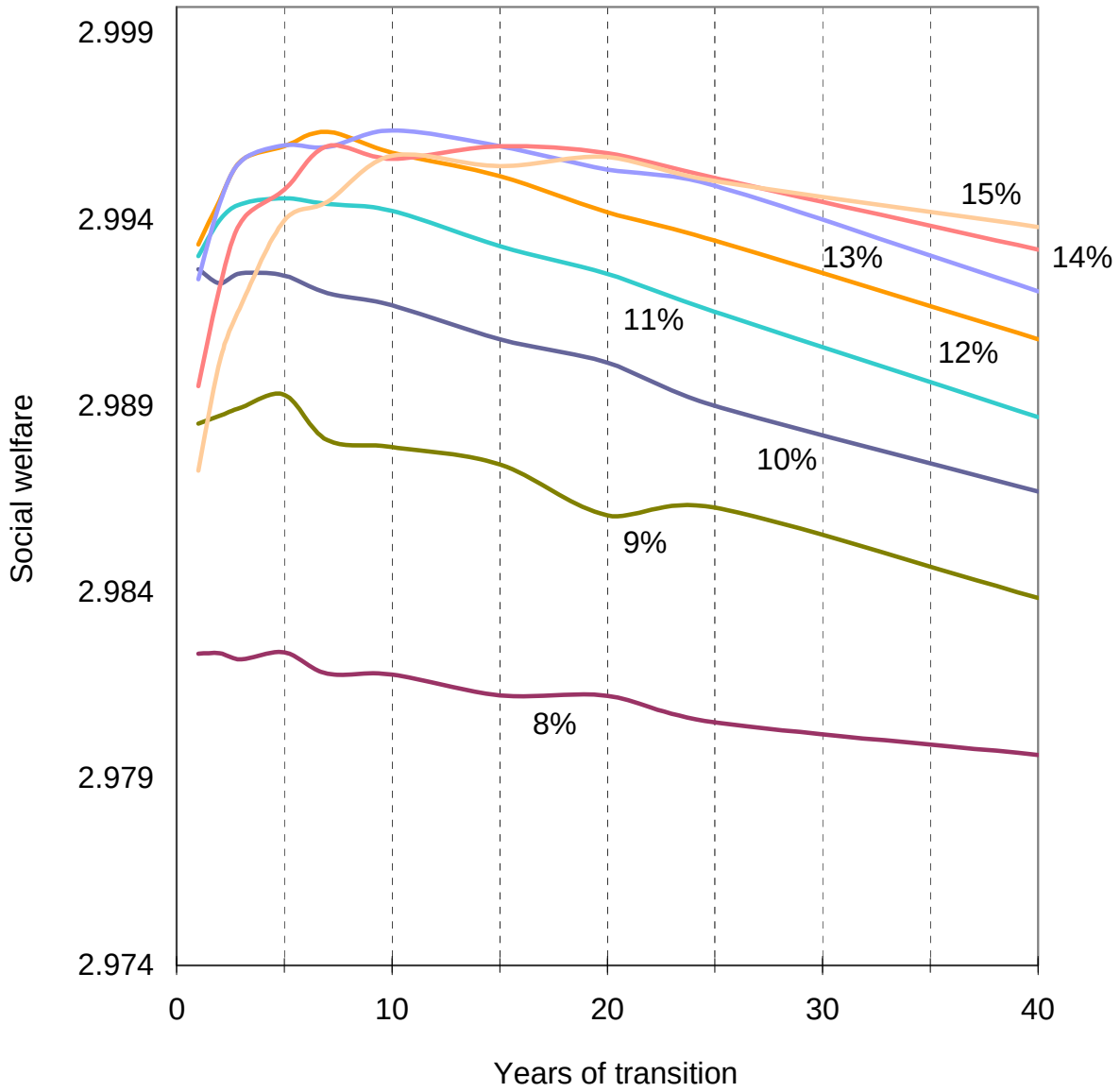
- Assessment of countercyclical capital requirements

  No net gain from making them countercyclical:
  bad effect on incentives

- Assessment of recapitalization programs

  $\uparrow e \Longrightarrow \downarrow v(e) \Longrightarrow \downarrow$ last bank standing effect

  [Best: as wealth transfers to solvent bankers]


2.999
2.994
2.989
2.984
2.979
2.974
Social welfare
0
10
20
30
40
Years of transition
15%
14%
13%
12%
11%
10%
9%
8%

Conclusions

- Dynamic equilibrium model of endogenous systemic risk-taking that
  - allows for a formal assessment of the macroprudential role of capital requirements
  - using an internally consistent welfare metrics
- Results suggest significant effects of capital requirements on systemic risk-taking, macroeconomic & banking indicators, and welfare
- Socially optimal capital requirements are quite high, have a sizeable negative impact on GDP, should be gradually introduced, and should not be lowered after a crisis