9TH JACQUES POLAK ANNUAL RESEARCH CONFERENCE
NOVEMBER 13 - 14, 2008

The Procyclical Effects of Basel II

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Presented at the 9th Jacques Polak Annual Research Conference
Hosted by the International Monetary Fund
Washington, DC—November 13-14, 2008

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"Supervisors will assess the cyclicality of the Basel II framework and take additional measures as appropriate."

Financial Stability Forum, April 2008

"We should critically examine capital regulations, provisioning policies, and other rules applied to financial institutions to determine whether, collectively, they increase the procyclicality of credit extension."

Ben Bernanke, Jackson Hole, August 2008

"In implementing the new (Basel II) framework, banking supervisors will monitor the potential procyclical effects of the new regulation and asses whether remedial measures are needed."

Council of the European Union, October 2008

Purpose of this paper

- Assess the extent to which bank capital regulation can lead to amplification of business cycle fluctuations
- Assess the impact of the new risk-based capital requirements

  → Will Basel II make things worse?

  → What would be the appropriate policy response?

What is bank capital?

- (Equity) capital is a liability: funds provided by shareholders
- Sources of capital: equity issues + retained earnings
- Simplified balance sheet

assets	liabilities
loans $\rightarrow$ l	d $\leftarrow$ deposits
	k $\leftarrow$ capital

Capital requirements

- Minimum ratio γ of capital to risky assets

  → In Basel I: $\gamma = 8\%$

  → In Basel II: γ determined by value-at-risk calculation

- Given k, requirement sets upper limit on lending capacity

$$k \geq \gamma l \;\leftrightarrow\; l \leq \frac{k}{\gamma} \quad (= 12.5k \text{ in Basel I})$$

Bank capital amplification channel

- Contraction in loan supply in downturns due to
  - → Lower bank capital due to higher default rates
  - → Possibly higher capital requirements (Basel II)
- Two conditions are necessary for this effect
  - → Banks should find it difficult to issue equity in downturns
  - → Firms should find it difficult to switch financing source
- However, these conditions are not sufficient
  - → With high capital buffers constraint would not be binding

Key question

- Will endogenous capital buffers neutralize the procyclicality of bank capital regulation?

- Answer (under realistic parameterization)

  → With Basel I: YES

  → With Basel II: NO

Outline

- Model setup
- Analytical results
- Numerical results
- Policy analysis
- Concluding remarks
- Future research

Model setup

- Infinite horizon, discrete time, Markov switching model
- At each date t continuum of entrepreneurs enters the market
- They live for two periods → OLG structure
- Relationship banking

  → Entrepreneurs become dependent on initial lenders

  → Perfect competition ex-ante & monopoly rents ex-post
- Banks with ongoing relationships cannot issue equity

  → Banks can only raise capital every other date
- Loan losses as in single risk factor of Basel II

Notation (i)

- State of the economy $s_t \in \{h, l\}$ follows a Markov chain with

$$q_h = \Pr(s_t = h \,|\, s_{t-1} = h)$$

$$q_l = \Pr(s_t = h \,|\, s_{t-1} = l)$$

- State s_t determines probability of default

$$p_t = \begin{cases} p_h & \text{if } s_t = h \\ p_l & \text{if } s_t = l \end{cases} \quad \text{with } p_h > p_l$$

- Interpretation

  → State *h:* high business failure (recession)

  → State *l:* low business failure (expansion)

Notation (ii)

- Cost of (insured) deposits normalized to 0
- Cost of capital $\delta > 0$
- Initial loan rates r_l and r_h (depending on state)
- Initial capital (of banks that can issue equity) k_l and k_h
- Capital requirements
  - Basel I: $\gamma_l = \gamma_h = 8\%$
  - Basel II: $\gamma_l < \gamma_h$
- Capital buffers $\Delta_l = k_l - \gamma_l$ and $\Delta_h = k_h - \gamma_h$

Equilibrium

- State-contingent pair $(k_s^*, r_s^*)_{s=h,l}$ that satisfies
  - Banks' optimization

$$k_s^* = \arg\max_{k_s \in [\gamma_s, 1]} v_s(k_s, r_s^*)$$

  - Banks' zero net present value condition

$$v_s(k_s^*, r_s^*) = 0$$

Analytical results

- Banks' objective function is neither concave nor convex
  - There may be corner or interior solutions
  - We derive comparative statics for interior solutions
- Higher capital requirements → Higher equilibrium loan rates
- Higher capital requirements → Ambiguous effect on capital
  - Higher prospects of ending with insufficient capital
  - Lower profitability of future lending
- Focus on numerical solutions

Parameterization (i)

- Transition probabilities (for annual frequency)

$$q_h = \Pr(s_t = h \,|\, s_{t-1} = h) = 0.64$$

$$1 - q_l = \Pr(s_t = l \,|\, s_{t-1} = l) = 0.80$$

→ Expected duration of high default state: 2.8 years

→ Expected duration of low default state: 5 years

Parameterization (ii)

- State-contingent probabilities of default (PDs)

  → Focus presentation on medium volatility of PDs scenario

$$p_l = 1.1\% \quad \rightarrow \quad \text{Basel II} \quad \gamma_l = 6.6\%$$

$$p_h = 3.3\% \quad \rightarrow \quad \text{Basel II} \quad \gamma_l = 10.5\%$$

  → Paper also considers high and low volatility scenarios

  → PDs chosen so that average capital requirement is 8%

- Other parameters

  – Loss given default (LGD) $\lambda = 45\%$

  – Cost of bank capital $\delta = 4\%$

Initial loan rates and capital buffers

	Rates (%)		Capital (%)		Buffers (%)	
	r_l	r_h	k_l	k_h	Δ_l	Δ_h
Basel I	1.2	2.7	11.0	11.2	3.0	3.2
Basel II	1.2	2.8	11.7	12.5	5.1	1.9

- Small loan rate effects
- Sizable buffers

  → Slightly countercyclical in Basel I

  → Strongly procyclical in Basel II

Credit rationing

Expected % of second period projects not funded

(because of banks' insufficient lending capacity)

Credit rationing (%) in state s' conditional on $s \to s'$

	$l \to l$	$l \to h$	$h \to h$	$h \to l$
Basel I	1.4	1.4	2.7	2.7
Basel II	0.3	10.7	4.5	0.6

- Basel II is more procyclical

  → Increases rationing in state $s' = h$, especially after $s = l$

  → Reduces rationing in state $s' = l$, especially after $s = h$

Banks' solvency

	Probabilities of bank failure (%)			
	1st period banks		2nd period banks	
	$s = l$	$s = h$	$s = l$	$s = h$
Basel I	0.022	0.115	0.006	0.074
Basel II	0.014	0.054	0.014	0.019

- Basel II increases solvency (unconditionally)
- Risk of failure is much lower than 0.1% targeted by Basel II

  → Due to capital buffers and net interest income

Effect of parameter changes (i)

Higher loss given default (LGD)

Results under Basel II

	Rates (%)		Buffers (%)		Rationing (%)
	r_l	r_h	Δ_l	Δ_h	$l \to h$
$\lambda = 45\%$	1.2	2.8	5.1	1.9	10.7
$\lambda = 50\%$	1.4	3.2	4.1	1.4	20.7

$\to$ Higher rates, lower buffers, and much more credit rationing

Effect of parameter changes (ii)

Higher cost of bank capital

Results under Basel II

	Rates (%)		Buffers (%)		Rationing (%)
	r_l	r_h	Δ_l	Δ_h	$l \to h$
$\delta = 4\%$	1.2	2.8	5.1	1.9	10.7
$\delta = 5\%$	1.4	3.0	3.6	1.3	23.4

$\to$ Higher rates, lower buffers, and much more credit rationing

Effect of parameter changes (iii)

Longer expected duration of low default state (expansions)

Results under Basel II

	Rates (%)		Buffers (%)		Rationing (%)
	r_l	r_h	Δ_l	Δ_h	$l \to h$
$d_l = 5$ years	1.2	2.8	5.1	1.9	10.7
$d_l = 6$ years	1.1	2.8	4.4	1.9	18.0

$\to$ No change in rates and buffers in high default state h

$\to$ Lower rates and buffers in low default state l

$\to$ Much more rationing in state h after state l

Effect of parameter changes (iv)

Higher cyclical variation of PDs

From $p_l = 1.1\%$ and $p_h = 3.3\%$ to $p_l = 1.0\%$ and $p_h = 3.6\%$

Results under Basel II

	Rates (%)		Buffers (%)		Rationing (%)
	r_l	r_h	Δ_l	Δ_h	$l \to h$
Benchmark	1.2	2.8	5.1	1.9	10.7
Higher vol.	1.1	3.1	4.3	1.6	24.4

$\to$ Lower buffers and much more credit rationing

Summary of effects of parameter changes

- Qualitative results are robust to changes in parameters
- Rationing when entering recession is greater in economies with
  - Higher cost of bank capital
  - Lower probability of going into recession
  - Higher cyclical variation of PDs

Policy responses (i)

- Objective: Reduce incidence of credit rationing

  → without major costs in terms of banks' solvency

- Policy 1: Reduce confidence level to 99.8% in state *h*

  + Increase conf. level in state *l* to keep average at 99.9%

- Policy 2: Lower confidence level to 99.8% in state *h* after *l*

  + Increase conf. level in state *l* to keep average at 99.9%

Policy responses (ii)

Credit rationing (%) in state s' conditional on $s \to s'$

	$l \to l$	$l \to h$	$h \to h$	$h \to l$
Basel II	0.3	10.7	4.5	0.6
Policy 1	0.8	3.7	3.6	1.6
Policy 2	0.5	4.4	4.4	0.6

- Both policies achieve significant reductions in credit rationing
- Small effect on banks' solvency

  → Probability of failure below 0.08% in all sequences.

Concluding remarks (i)

- Two frequent misconceptions:
  - Buffers mean that capital requirements are “not binding”

    → Forward-looking banks take precautions!
  - Effect of Basel II can be predicted from Basel I evidence

    → Lucas’ critique!

Concluding remarks (ii)

- Paper evaluates potential procycliclity of capital requirements
- Focuses on supply side of bank lending market
  - Demand side and feedback effects ignored
  - How much procyclicality comes from the supply side?
  - How this will be affected by Basel II?
- Contribution is partly methodological and partly substantive

Concluding remarks (iii)

- Methodological contribution
  - → Fully-fledged dynamic model of the credit market with
    - – Relationship lending
    - – Frictions in banks' access to equity financing
  - → Endogenous capital buffers and loan rates
- Numerical results on Basel II
  - → Procyclical capital buffers
  - → Risk of credit crunch when economy goes into a recession
  - → Policy response: cyclical adjustment in cap. requirements

Future research

- How should the cyclical adjustment of Basel II be made?
  - → The devil is in the details
- Two basic alternatives
  - – Smooth the inputs of the Basel II formula
    - → Through-the-cycle ratings
  - – Smooth the output (with point-in-time ratings)
    - → Using aggregate information
    - → Using individual bank information
- Compare these alternatives with Spanish data