The Disturbing Interaction Between Countercyclical Capital Requirements and Systemic Risk

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Motivation

- Two dimensions of systemic risk
  - time dimension (procyclicality)
  - cross-sectional (due to common exposures or interconnectedness)
- Both dimensions are usually analyzed in isolation with consequences for policy formulation

This paper: study interaction among dimensions.

Specific question: how does policy intervention in one dimension of systemic risk affect systemic risk in the other dimension?

Main results

- Key insight from model: counter-cyclical macroprudential regulation can increase systemic risk in the cross-section
- Reason: Countercylical policies insulate banks from sector-wide fluctuations but not against bank-specific shocks $\Rightarrow$ relative cost of being exposed to idiosyncratic risk increases and leads to more systemic risk-taking
- The consequence is that macroprudential policies that improve systemic risk in one dimension (countercyclicality) worsen systemic risk in the other dimension (cross-sectional risk). Ultimately they can even lead to more procyclicality.
- The reverse problem does not arise: policies that reduce cross-sectional risk at the same time lower countercyclicality.

Literature

- Procyclicality
  - Procyclicality may arise from capital (Blum and Hellwig (1995) and others), haircuts and margining practices (CGFS (2010)), loan-loss provisioning (Borio et al. (2001))
  - Can make countercyclical capital requirements (CR) optimal (e.g., Kashyap and Stein (2004), Repullo and Suarez (2012), Malherbe (2013))
- Cross-sectional systemic risk
  - Common exposures on asset or liability side (Rajan (1994), Acharya and Yorulmazer (2007), Wagner (2010), Farhi and Tirole (2012))
  - Banks may correlate "too much", providing rationale for policy
- Martinez-Miera and Suarez (2012): in fully dynamic model, show that fixed CR lower incentives to take on aggregate risk
  - CR increase value of capital to surviving banks, thus incentive to take on less risk (last-bank standing effect)

Preview of model

- banks are subject to a moral hazard problem (akin to Holmstrom and Tirole, 1997) that can be addressed by requiring bankers to put capital into the bank
- banker's endowment with capital determined by prior returns on projects
  - if these returns are low it is more costly to put a certain amount of capital in the bank (banker has to give up consumption)
  - this creates scope for capital requirements that depend on state of the economy (project returns)
- systemic costs: if both banks fail, the economy has insufficient funds to undertake a worthwhile project.
- bankers can choose correlation of their projects, choice interacts with capital requirements

The model

- three dates (0,1,2), two bankers (A and B), a consumer and a producer
- bankers are impatient (time preference $\alpha > 1$), which makes (bank) capital costly

Date 0:

- each banker needs 1 unit of funds to start a project
- banker i determines amount of equity finance k_0^i, remainder $1 - k_0^i$ comes from consumer through (insured) one-period deposits
- bankers invest in a project
  - banker A can choose between common and alternative project, banker B can only invest in the common project
  - return on alternative project is uncorrelated to common project at later dates, but is otherwise identical

The model

Date 1:

- each project produces an amount of $\widetilde{x}$ (uniformly distributed on $[\underline{x},\overline{x}]$)
- each bank has to fulfill a regulatory capital requirement k (banker will never hold capital in excess of the requirement)
    - if $k_0 + x^i \geq k$, banker takes out funds of $k_0 + x^i - k$ and does not renew an amount $k - k_0$ of deposits
    - if $k_0 + x^i < k$, banker cannot fulfill capital requirement and bank is closed down
- each banker decides whether to exert effort at private cost $z > 0$

The model

Date 2:

- projects mature
  - with probability p_F a project fails and returns zero
  - no effort: with probability p_H project reaches high state and returns R_H; otherwise it reaches the low state and returns R_L ($R_L < R_H$)
  - effort: shifts probability mass of $\triangle p$ from low to high state
  - note:
    - in equilibrium, bank will default in low state which will produce inefficient effort
    - the role of capital is to induce effort
- producer: has no endowment but has technology that converts m units into $m + \kappa$ ($\kappa > 0$) units (technology can only be operated with exactly m units)
  - raises funds from consumer/bankers (surplus from production accrue to producer)
  - parameters in economy are such that there are sufficient funds to operate technology at date 2, unless both banks fail

Timing

$t = 0$	$t = 1$	$t = 2$
Regulator announces $k(x_C)$. Banker A chooses project. Bankers learn about x^i and invest k_0^i in the banks. Bankers and consumers consume.	Interim returns x^i realize. Bankers invest additional $k^i - k_0^i$. Bankers decide about monitoring. Bankers and consumers consume.	Returns R^i realize. Depositors are repaid. The producer raises funds. Production may take place. All agents consume.

Benchmark: Project choice is observable

Let us first assume that regulator can also determine the project choice. Regulator thus sets capital requirement $k(x_C)$ and decides whether bank A takes the common or the alternative project.

<u>Date 2</u>

- producer needs $m > 1$ funds to operate technology
- technology can be operated whenever at least one bank survives
- in this case, producer makes take-it-or leave it offer to consumers/bankers for funds, and operates technology (thus obtains the surplus κ from production)

Benchmark: Project choice is observable

Date 1

- At the end of date 1, each banker has to make the effort choice. Since a banker's pay-off is $R_H - (1-k)$ (recall that $d = 1-k$) in the high state and $\max\{R_L - (1-k), 0\}$ in the low state (as he possibly defaults), his expected gain from monitoring is

$$\triangle p(R_H - (1-k) - \max\{R_L - (1-k), 0\}) - z. \quad (1)$$

- Assuming default in low state (WLOG), we have from (1) that the expected benefit from monitoring is positive whenever capital exceeds a threshold $\bar{k}$, with

$$\bar{k} := \frac{z}{\triangle p} - (R_H - 1). \quad (2)$$

  Thus, for $k < \bar{k}$ banker does not monitor; for $k \geq \bar{k}$ he monitors.
- At the beginning of date 1, a banker has to fulfill capital requirements k. This means that he does not renew $k - k_0^i$ of the deposits. The cost of deposits is zero due to deposit insurance. Outstanding deposits are hence $d = 1-k$.

Benchmark: Project choice is observable

Date 0

- Banker (knowing future realization of x^i) will choose amount of own funds (capital) to put into bank. Cost of deposits are again zero. Given impatience of banker ($\alpha > 1$), banker will only use capital to the extent that it is required to fulfilled requirements at date 1.
  - if $k \geq x^i$, banker will use zero equity financing: $k_0^i = 0$
  - if $k < x^i$, banker will use amount of equity to just fulfill capital requirement at date 1: $k_0^i = k - x^i$

Benchmark: The regulator's problem

- The regulator maximizes welfare W, consisting of the utilities of bank owners, the consumer and the producer.
- welfare in the correlated and uncorrelated economy is given by

$$W_C(k(x_C)) = 2U_C^{-p}(k) + (1 - p_F)\kappa \quad (3)$$
$$W_U(k(x_C)) = U_C^{-p}(k) + U_U^{-p}(k) + (1 - p_F^2)\kappa. \quad (4)$$

where $U_t^{-p}(k(x_C))$ is the combined utility (for banker, consumer and deposit insurance fund) arising from pay-outs of a bank that is operating a project of type t

- Expression for $U_t^{-p}(k(x_C))$ is given by

$$U_t^{-p}(k(x_C)) = \mathrm{E}[\alpha^2 - (\alpha^2 - \alpha)\max(k - x_t, 0) - \alpha(k - x_t) + R_t + (k - 1) - \mathbf{M}z]. \quad (5)$$

where **M** denotes monitoring

Benchmark: Optimal capital requirements

Proposition 1

The welfare-maximing policy rule (for given correlation) is countercyclical: $\mathrm{Cov}(k^*, x_C) > 0$ *and takes the form:*

$$k^*(x_C) = \begin{cases} \bar{k} & \text{if } x_C \geq \widehat{x}_t^* \\ 0 & \text{otherwise} \end{cases}$$

The reason for countercyclicality: trade-off between benefits from monitoring and cost of capital. If capital at date 1 is sufficiently low ("bad" state in the cycle), the cost of incentivising banks to monitor using capital outweighs the benefits of it.

Benchmark: Optimal capital requirements

Corollary 2

The optimal degree of countercyclicality is lower in the uncorrelated economy

- Reason: in uncorrelated economy countercyclical CR only lower costs at one bank, hence lower benefits from countercyclicality.

Benchmark: Optimal correlation

- Suppose regulator imposes the same policy rule (characterized by a threshold $\widehat{x} \in (\underline{x}, \overline{x})$) irrespective of the correlation choice
- Then, correlated economy provides higher welfare than an uncorrelated economy if and only if

$$U_C^{-p}(k_{\widehat{x}}(x_C)) - U_U^{-p}(k_{\widehat{x}}(x_C)) > \left(p_F - p_F^2\right)\kappa, \tag{6}$$

- The RHS of (6) is the expected cost of choosing correlated projects arising from higher likelihood of joint failures
- The LHS of (6) represents the gains from correlation. These gains arise because in a correlated economy both banks can profit from countercyclical capital requirements (while in the uncorrelated economy only one bank can benefit)

Benchmark: Optimal correlation

- To see benefits, we can rearrange the LHS to

$$U_C^{-p}(k_{\widehat{x}}(x_C)) - U_U^{-p}(k_{\widehat{x}}(x_C)) = \frac{\alpha^2 - \alpha}{k}\mathrm{Cov}(k_{\widehat{x}}(x_C), x_C). \qquad (7)$$

- Expression is strictly positive whenever the policy rule is countercyclical ($\mathrm{Cov}(k_{\widehat{x}}(x_C), x_C) > 0$).
- The reason is that under countercyclical capital requirements common projects have lower costs as such capital requirements tend to be low when capital from common projects is scarce (additional effects occur when capital rule is different across economies)

Benchmark: Optimal correlation

Proposition 3

There is a critical value $\widehat{p}_F$, such that for $p_F \geq \widehat{p}_F$ uncorrelated investment maximizes welfare, while for $p_F < \widehat{p}_F$ correlated investment is welfare-maximizing.

Reason: cost of correlated investment is increasing in p_F, while benefit is independent of it.

Optimal capital requirements when project choice is unobserveable

Now assume that regulator cannot control investment choice (the project choice has to be privately optimal).

Consider bank A' incentives to choose correlated investment:

- Private benefits from projects are identical to the benefits in the benchmark case ($\frac{\alpha^2-\alpha}{k} Cov(k^*, x_C)$)
- However, bank A does not perceive the cost of correlated investment (higher likelihood of joint bank failure in which case technology cannot be operated at date-2)
  - source of externality: bank cannot write ex-ante contracts with producer and hence does not capture surplus from operating technology

Proposition 4

For a given capital requirement rule, bank A may choose correlated investment even if the uncorrelated investment maximizes welfare.

Optimal capital requirements when project choice is unobserveable

Proposition 5

Compared to $k^*(x_C)$, the optimal policy rule now displays either the same or lower countercyclicality.

Intuition: Countercyclicality creates incentives to correlate (because of $U_C^{-p}(k) - U_U^{-p}(k) = \frac{\alpha^2 - \alpha}{k} Cov(k^*, x_C)$). If welfare-maximizing outcome in benchmark case was alternative investment, it may be optimal to lower countercyclicality in order to avoid correlated investment.

Discussion

- Countercyclical policies may increase "procyclicality": Countercyclicality may induce banks to choose correlated investments. Common shocks then have bigger implications (higher variance of interim returns and higher likelihood of joint failure).
- Cross-sectional policies are preferred. Suppose regulator has a policy tool that discourages banks from choosing correlated exposures. This will both reduce cross-sectional risk but also lower procyclicality as exposure to aggregate state declines. It will reduce need for countercyclical policies.
- Mechanism is not confined to capital regulation. The same intuition holds for other types of counter-cyclical bank regulation that is based on aggregate triggers.

Role of credibility

Note: we assumed that the regulator can commit.

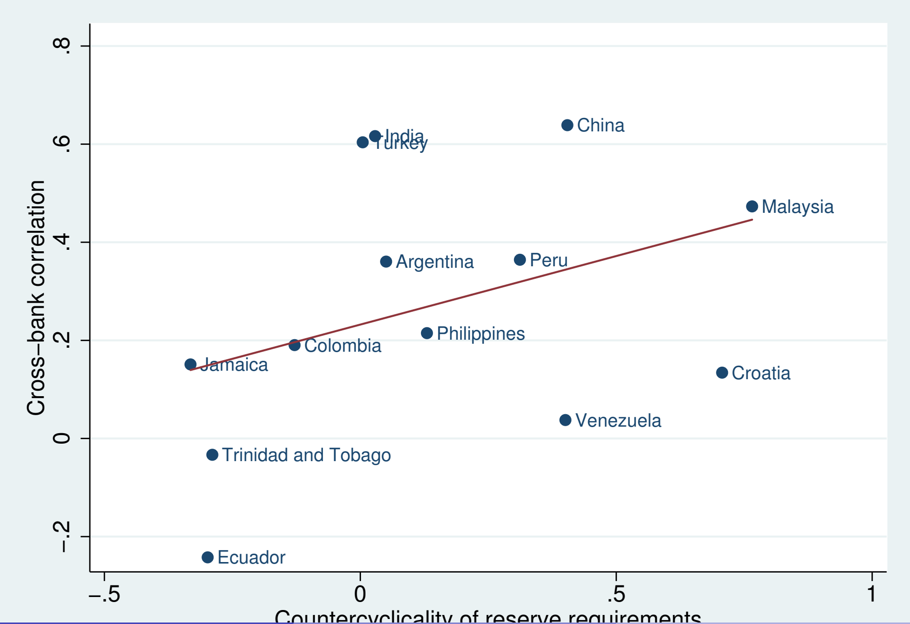
Proposition 6

If the regulator lacks commitment, the availability of a countercylical policy tool may reduce welfare (compared to situation where regulator can only set fixed capital requirements).

Reason: *ex post* (date 1) it is optimal to provide insurance against common fluctuations (shocks to x_C). Banks anticipate this and will choose correlated investment even if alternative investment is optimal. Availability of countercyclical policy tool may lead to lower welfare.

$\Rightarrow$ This provides a negative message for Basel III which envisages discretionary macro-prudential policies

Countercyclical Reserve Requirements in EM



Summary

- The two dimensions of systemic risk, procyclicality and cross-sectional risk, are inherently related.
- Policies that address one dimension of systemic risk will also affect the other dimension
- In particular, counter-cyclical bank regulation might increase cross-sectional risk. By contrast, policies that reduce cross-sectional risk reduce procyclicality.