Optimal Severity of Stress-Test Scenarios

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Background: Bank Regulations over Time

Pre-2008: Minimum Equity-to-Asset Ratio

- Defines a minimum degree of equity financing of bank loans: $\frac{Equity}{Loans} \ge \chi$.
- Introduced to reduce the risk of bank default.

2008 and 2009: Dividend Smoothing

- Banks were reluctant to cut dividend payments.
- Financed by capital reserve depletion \rightarrow risk of capital depletion and asset shrinkage.



Optimal Stress-Test Scenario τ

Supervisory Objective: High and stable lending.

$$\max_{\tau} \quad \mathbb{E}_{0}[L_{1}^{*} \mid r_{l,0}, E_{0}] - \omega \mathbb{VAR}_{0}[L_{1}^{*} \mid r_{l,0}, E_{0}], \tag{1}$$
s.t.
$$\tau \ge 0 \tag{2}$$

Numerical Optimization:

- 1. Calibrate return process using balance sheet data of U.S. BHC s.t. stress tests.
- 2. Numerically find τ^* that maximizes the supervisor's utility function for different initial return states $r_{l,0}$ and different degrees of risk-aversion ω .
- 3. Translate τ^* into an stess-test implied equity-to asset ratio $\chi(\tau)$.

Post-2009: Introduction of regular stress tests (annual in the U.S.)

- Simulation of future equity, assuming severe losses on current assets.
- Restrict dividends **today**, if **future** minimum equity-to-asset ratio is violated.
- Ensure sufficient equity to maintain **current** lending even during **future** crisis.

Tension: Banks might preemptively shrink their balance sheet to pass stress-tests

This Paper: What is the optimal severity of stress-tests scenarios?

- Model banks' equity and lending choices when s.t. forward-looking stress tests.
- Taking this into account, what is the risk-averse supervisor's optimal stress-test severity?
- Investigate interplay between stress tests and other macro-prudential policies.

Optimal Stress-Test Implied Equity-to-Asset Ratio



Optimal stress-tests:

- increase capital buffers by 1% to 9% in the mean return state $\bar{\mu}$. This matches the Fed's 2021 of buffers between 2.5% and 7%,
- are more severe during bad times,
- but less so if the supervisor also considers investor utility.

3-Period Partial Equilibrium Model

Environment

- Investor and supervisor with mean-variance utility in dividends/loans, respectively.
- Loan returns $r_{l,t}$ evolve each period, following an AR(1)-process.

Period 0

- Investor is endowed with an equity stake E_0 in a representative bank.
- Supervisor sets stress-test scenario as τ standard deviations below mean-return on loans to simulate the bank's equity position in period t = 2.

Period 1

- **Bank** pays dividends and uses remaining equity plus deposits to invest in loans L_1^* .
- Lending is s.t. a minimum equity-to-asset ratio χ and a stress-test constraint:

(1) $\frac{Equity_t}{Loans_t} \ge \chi$ (2) $\frac{Equity_t + \hat{\mathbb{E}}(Losses_{t+1} \mid \tau)}{Loans_t} \ge$

Period 2

Investor consumes profits from loan investment as dividends.

Key Takeaways:

- Stress-tests are forward-looking minimum equity-to-asset ratios.
- Sufficiently severe stress-tests (i.e. large τ) bind before the min. equity-to-asset ratio.

Stress Tests in the Wider Regulatory Environment

1. Ban on dividends during crises:

- Prevents excessive equity withdrawal in bad times.
- Increases lending in low and medium loan return states relative to stress-tests.

2. Counter-cyclical capital buffer:

- Behaves very similar to a dividend ban.
- However, lowering buffers has no effect if introduced alongside a dividend ban.

3. Dividend prudential target (Muñoz, 2021).

- Quadratic punishment cost for deviating from steady state dividend level.
- Trades off lower lending in good states for higher lending in bad states.
- \rightarrow Supervisor Welfare maximised by combination of dividend ban & stress tests.

Conclusion

Simulated losses under

stress-test scenario

- We model the effect of stress-tests on bank balance sheet choices:
 - Stress tests curb overall lending levels, but reduce lending volatility.
 - Stress tests decrease pro-cyclicality of equity.
- Numerically derive optimal stress-test severity: Optimal stress-test capital buffers
 of 1% to 9%, matching the Fed's policy



--- Binding Stress-Test Constraint ($\tau >> 0$) – Binding Minimum Equity Constraint ($\tau = 0$)

- Stress-tests lead to overall lower, but less volatile lending.
- This generates a trade-off for a risk-averse supervisor seeking **stable** lending.

• Study several policy extensions on dividends and their impact on lending: Supervisor Welfare maximised by combination of dividend ban & stress tests.

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References

Muñoz, Manuel A. "Rethinking Capital Regulation: The Case for a Dividend Prudential Target". In: International Journal of Central Banking 17.3 (2021), pp. 271–336.