Stress Testing and Bank Lending

Joel Shapiro[1]   Jing Zeng[2,3]

[1]University of Oxford

[2]University of Vienna

[3]Frankfurt School of Finance & Management

January 2020 (ECB)

Stress testing and bank lending

- Stress test:
  - Assessments of a bank's ability to withstand adverse shocks
  - Generally accompanied by capital buffer requirements

- Stress tests affect banks' lending decisions
  - Banks that underwent SCAP and CCAR reduced their risk-taking
    (Acharya, Berger and Roman (forthcoming))

- Regulators are concerned about how their behaviour affects banks
  - State-level banking regulators rate banks more leniently than federal regulators due to concerns over the local economy (Agarwal et al. 2014)
  - Paul Tucker and LIBOR scandal
  - Japanese government change accounting rule to improve banks' appearance during crisis Hoshi and Kashyap (2010), Skinner (2008)

This paper

- We model the feedback effect between stress testing and bank lending in a dynamic setting

Key findings:

- Reputation building to incentivize lending
  - Regulator leniency: Pass banks that should fail

- Reputation building to reduce excessive risk-taking
  - Regulator toughness: Fail banks that should pass

- Self-fulling behavior and multiple equilibria
  - Regulatory uncertainty as a source of fragility, leading to excess default or reduced lending

Theoretical Literature

- Stress testing
  - Prescott (2008), Bouvard, Chaigneau and de Motta (2015), Goldstein and Leitner (2015), Faria-e-Castro, Philippon and Martinez (2016), Williams (2017)

- Reputation management by a regulator
  - Boot and Thakor (1993), Morrison and White (2013), Shapiro and Skeie (2015)

- Reputation concern as a source of fragility
  - Ordonez (2013, 2017)

The Model

- The regulator conducts the stress test for a bank in each period $t \in \{1, 2\}$

- For in each period there are 3 stages:

  1. Bank chooses between investment in a safe project or a risky project;

  2. Regulator privately observes the quality of the bank's risky investment, decides whether to pass or fails the bank. In case of failure, the regulator requires the bank to raise capital;

  3. All payoffs realise.

The Bank's Lending Opportunities

- Bank has raised 1 unit fully insured deposits (before the start of the game)

- Safe asset returns $R_f > 1$ at stage 3.

- Risky loan: expected return $> R_f$

$$\alpha \diagdown q_t = g \longrightarrow R > 1$$
$$q_t = b \underset{d}{\diagup} 0$$
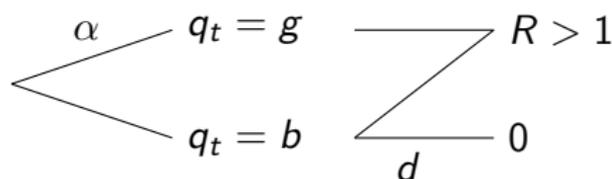
Lending $\Leftrightarrow$ Risk-taking
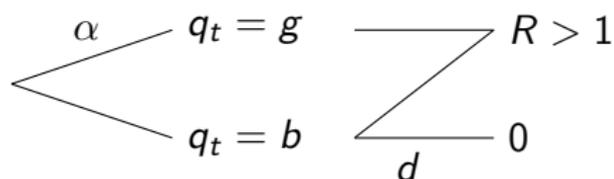
The Bank's Lending Opportunities

- Bank has raised 1 unit fully insured deposits (before the start of the game)

- Safe asset returns $R_f > 1$ at stage 3.

- Risky loan: expected return $> R_f$

$$\alpha \diagup q_t = g \longrightarrow R > 1$$
$$q_t = b \diagup_{d} 0$$

Lending $\Leftrightarrow$ Risk-taking

Regulator and Stress Testing

- Regulator privately observes the quality q_t of the bank's risky loan

- Regulator decides whether to require the bank to raise capital ("fail")

- Regulator's objective is to maximize social welfare

Recapitalization

- There is a capital provider with bargaining power β

- When recapitalizing, the capital provider receives a fraction ϕ of the banks' equity

- With probability γ, recapitalization fails (high cost of capital ρ_H)

- With probability $1 - \gamma$, recapitalization (low cost of capital ρ_L):

$$\phi(1 - d)R = \rho_L + \beta\left[(1 - d)R - \rho_L\right]$$

$\Rightarrow$ Recapiatlization incurs a dilution cost to the bank

The Regulator's Reputation

- The regulator's type: strategic or lenient

- Lenient type: behavioral and always passes the bank (uninformative)

- Strategic type: trades off social benefits and costs associated with recapitalization

- The regulator knows its own type, but the market has a belief that $Pr(Strategic) = z_t$.

Externalities from lending

- Social costs of risky lending:
  - Cost to society D of a bank default
    - Loss of future intermediation, cost of resolving the bank, cost of contagion
  - Cost of recapitalization
    - Forgone return on the capital provider's alternative investment

- Social benefit of risky lending
  - Loans generate positive externality B

Let X represent the net social externalities of lending:

$$X \equiv B - (1-\alpha)\left[\gamma dD + (1-\gamma)(\rho_L - 1)\right]$$

Stress Testing in the Second Period

	Lenient regulator	Strategic regulator
g bank	Pass (no action)	Pass (no action)
b bank	Pass (no action)	Fail (recapitalization)

- If risky loan of g quality: Pass
    - No risk of default, but capital is socially costly

- If risky loan of low credit quality: Depends on regulator type
    - Social cost of default dD higher than social cost of recapitalization: $dD > \rho_L - 1$
    - The strategic regulator is in conflict with the lenient regulator
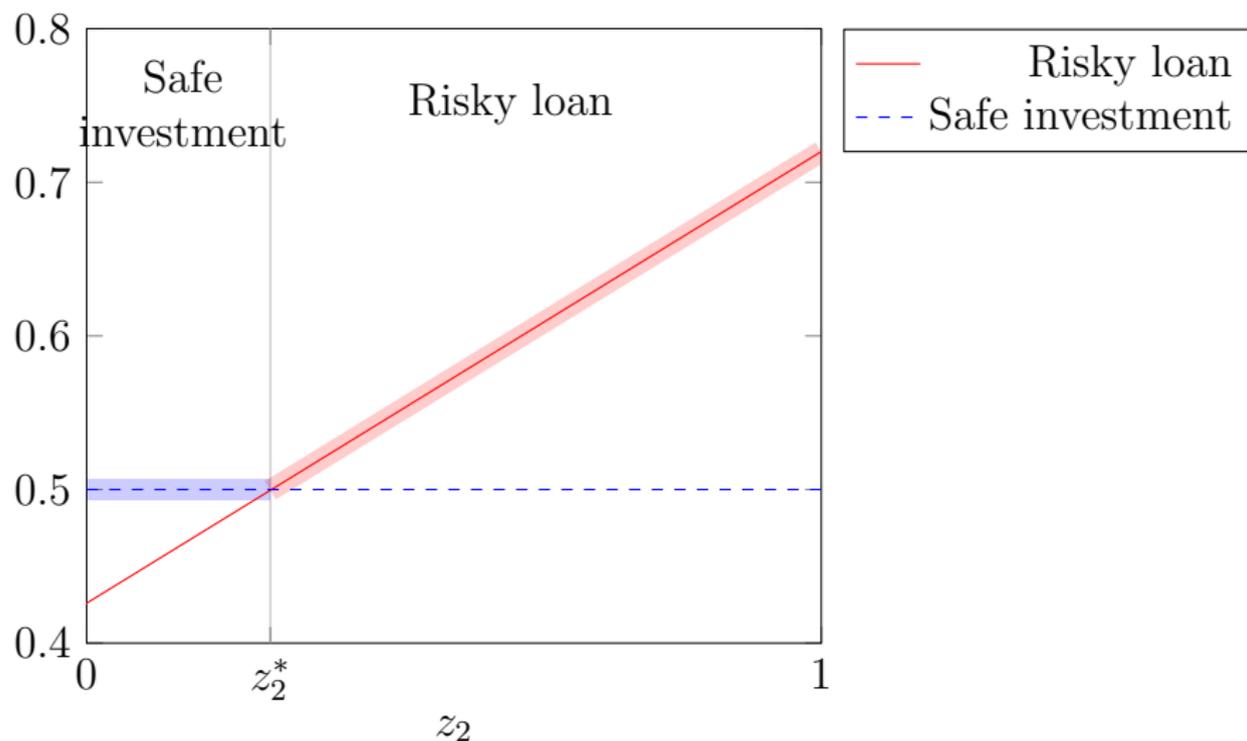
Bank's Lending Decision in the Second Period

- The bank originates a risky loan if and only if

$$\underbrace{[\alpha + (1 - \alpha)\,[z_2 + (1 - z_2)\gamma]\,(1 - d)]\,(R - 1))}_{\text{pass, or fail but recapitalization infeasible}}$$

$$+ \underbrace{(1 - \alpha)(1 - z_2)(1 - \gamma)(1 - \phi)(1 - d)R}_{\text{fail and recapitalized}}$$

$$\geq R_0 - 1.$$

Proposition

There exists z_2^*, such that the bank originates a risky loan if and only if $z_2 \geq z_2^*$.

Bank's Lending Decision in the Second Period

Equilibria in the First Period

3 different types of equilibrium can (co-)exist:

A Regulator employs same strategy as in 2nd period

B Reputation building to incentivize lending in 2nd period

C Reputation building to reduce excessive risk-taking in 2nd period

Reputation Building to Reduce Excessive Risk-Taking

	Lenient regulator	Strategic regulator
g bank	Pass	Pass w.p. $\pi_h^* < 1$
b bank	Pass	Fail

- Concerns about risk-taking $\Rightarrow$ Toughness
  - If the strategic regulator fails bank in the 1st period to reveal its type
  - Bank has a strong incentive to reduce risky lending in 2nd period in order to avoid failing the test

- Net gain from passing the risky bank with high credit quality:

$$\underbrace{(1 - \gamma)(\rho_L - 1)}_{\text{Capital cost savings}} + \underbrace{\delta[U_L(z_2^{pass}) - U_L(z_2^{fail})]}_{\text{Efficiency loss due to excessive risk-taking in 2nd period}} < 0$$

Reputation Building to Reduce Excessive Risk-Taking

- Exists if low externalities of lending X, high reputation concern δ

- U.S. stress test generally regarded as stricter than European ones
- Tests have regularly been accompanied by Asset Quality Reviews
- There is a qualitative element that can (and has been) used to fail banks
- Institutionalized as yearly implies reputation concerns are important

Reputation Building to Incentivize Lending

	Lenient regulator	Strategic regulator
g bank	Pass	Pass
b bank	Pass	Pass w.p. $\pi_\ell^* > 0$

- Concerns about lending $\Rightarrow$ Softness

    - If the strategic regulator passes bank in the 1st period, it pools with the lenient regulator

    - Bank expects a soft stress test and chooses risky lending in the 2nd period

Reputation Building to Incentivize Lending

- Exists if higher externalities of lending X, high reputation concern δ

- In Europe, 2010 exercise missed Irish banks, 2011 missed Dexia
- Normal times: The 2016 stress test
    - eliminated the pass/fail criteria
    - reduced the number of banks stress tested by about half
    - used less adverse scenarios than the U.S. or the UK
    - only singled out one bank as undercapitalized - Monti dei Paschi di Siena, which had failed the previous (2014) stress test and was well known to be in distress

Strategic Delay of Stress Test

- An equilibrium exists (for X high and δ high) in which:
  - Both types of regulator passes the bank in the first period with certainty
  - This is equivalent to the regulator not conducting the stress tests for the bank in the first period

- European stress test less frequent compared to the annual U.S. tests
  - They were conduced in 2010, 2011, 2014, 2016, 2018

- Delay in this situation may be a way of choosing softness

Self-fulfilling Regulatory Reputation Building

Equilibrium multiplicity and strategic complementarity:

Regulator's stress testing strategy 1st period $\Leftrightarrow$ Bank lending 2nd period

- Suppose market conjectures tough strategic regulator (π^* low)
    - $\Rightarrow$ If bank passes in 1st period, more likely the regulator is lenient
        - Excessive risk-taking in 2nd period, $U_L(z_2^{pass})$ low
    - $\Rightarrow$ Strategic regulator fails bank in 1st period more (π^* low)
        - For fear of inducing future excessive risk-taking if passes in 1st period

Availability of capital

- γ_1: prob. that recapitalization is infeasible in 1st period
- Higher γ_1 exacerbates regulator's reputation building incentives
    - Cost of passing a bad bank or failing a good bank in 1st period smaller
- $\Rightarrow$ Stress test is less informative

Implication:

- A swifter recovery from the crisis means that capital raising for banks is likely to be easier in the U.S.

Stress Tests of Systemic Banks

- D_1: social cost of a bank default in 1st period

- Higher D_1 reduces regulator's reputation building incentives
  - Cost of passing a bad bank in 1st period is higher

$\Rightarrow$ Stress test is more informative

Implications:

- The regulator may want to customize the stress test for individual banks depending on how systemic they are

- In both U.S. and Europe there have been debates about how large/systemic a bank must be in order to be included in the stress test

Bank Supervision Exams

- The quality q_t of the bank's risky asset is also known by the bank
  - The exam uncovers information already known by the bank
  - The test produces new information that is shared with the bank

- Compared to a public stress test, a supervision exam
  - is more informative when the regulator is concerned about excessive risk-taking (X low)
  - is less informative when the regulator is concerned about incentiving lending (X high)
    - In line with Agarwal et al. (2014)

Summary

- Stress test affects banks' lending decisions
  - Too little lending if "tough"
  - Excessive risk-taking if "soft"

- Feedback: Bank's lending $\Leftrightarrow$ Regulator's stress testing
  - Tough to curb excessive risk-taking OR lenient to encourage lending
  - Regulator reputation building can be self-fulfilling (source of fragility)

- Further implications:
  - A regulator may strategically delay stress testing
  - Stress tests less informative if recapiatlization is difficult
  - Stress tests more informative if bank is more systemic
  - Banking supervision results differ from stress tests