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
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**

- **Reputation management by a regulator**

- **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 $> R_f$

\[
\begin{align*}
q_t &= g \\
q_t &= b \\
R &= 1
\end{align*}
\]

Lending $\Leftrightarrow$ Risk-taking
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$$
\begin{align*}
\alpha & \quad q_t = g \\
q_t = b & \quad R > 1 \\
d & \quad 0
\end{align*}
$$

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 $\beta$
- When recapitalizing, the capital provider receives a fraction $\phi$ of the banks’ equity
- With probability $\gamma$, recapitalization fails (high cost of capital $\rho_H$)
- With probability $1 - \gamma$, recapitalization (low cost of capital $\rho_L$):
  \[ \phi (1 - d) R = \rho_L + \beta [(1 - d) R - \rho_L] \]
  \Rightarrow \text{Recapitalization 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 \( Pr(\text{Strategic}) = z_t \).
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

<table>
<thead>
<tr>
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<th>Strategic regulator</th>
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<td>$g$ bank</td>
<td>Pass (no action)</td>
<td>Pass (no action)</td>
</tr>
<tr>
<td>$b$ bank</td>
<td>Pass (no action)</td>
<td>Fail (recapitalization)</td>
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- 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
The bank originates a risky loan if and only if

$$\left[\alpha + (1 - \alpha) \left[ z_2 + (1 - z_2) \gamma \right] (1 - d) \right] (R - 1)$$

pass, or fail but recapitalization infeasible

$$+ (1 - \alpha)(1 - z_2)(1 - \gamma)(1 - \phi)(1 - d)R$$

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

The figure illustrates the bank's lending decision in the second period. The x-axis represents the value of $z_2$, while the y-axis represents the value of $z_2^*$. The graph shows the boundaries for risky loans and safe investments. The red line represents the risky loan boundary, and the blue dashed line represents the safe investment boundary. The intersection of these boundaries determines the bank's lending decision. For values of $z_2$ greater than $z_2^*$, the bank should lend for risky investments; otherwise, it should lend for safe investments.
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

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- 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:

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

- Exists if low externalities of lending $X$, high reputation concern $\delta$
- 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

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- **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 $\delta$

- 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
An equilibrium exists (for $X$ high and $\delta$ 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 conducted in 2010, 2011, 2014, 2016, 2018

- Delay in this situation may be a way of choosing softness
Equilibrium multiplicity and strategic complementarity:
Regulator’s stress testing strategy 1st period ⇔ Bank lending 2nd period

- Suppose market conjectures tough strategic regulator ($\pi^*$ low)
  ⇒ If bank passes in 1st period, more likely the regulator is lenient
  - Excessive risk-taking in 2nd period, $U_L(z^\text{pass}_2)$ low
  ⇒ Strategic regulator fails bank in 1st period more ($\pi^*$ low)
  - For fear of inducing future excessive risk-taking if passes in 1st period
Availability of capital

- $\gamma_1$: prob. that recapitalization is infeasible in 1st period
- Higher $\gamma_1$ exacerbates regulator’s reputation building incentives
  - Cost of passing a bad bank or failing a good bank in 1st period smaller
- 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
  ⇒ 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 ⇔ 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 recapitalization is difficult
  - Stress tests more informative if bank is more systemic
  - Banking supervision results differ from stress tests