Failing Banks

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The views expressed here do not necessarily represent those of the Federal Reserve Bank of New York or the Federal Reserve Board.
Motivation

• Bank failures are an endemic feature of banking
  • 20% of all national banks in existence between 1863 and 1934 failed
  • 15% of all commercial banks in existence between 1935 and 2023 failed

• Bank failures often lead to real economic disruptions
  Bernanke (1983)

• Systemic banking crises are associated with severe macroeconomic downturns
  Reinhart and Rogoff (2009)
Why Do Banks Fail?

• Liquidity-driven failures due to self-fulfilling panic runs (Diamond and Dybvig, 1983).
  
  • Original cause of bank failure: depositor behavior.

• Insolvency-driven failures from realized credit risk, interest rate risk, or fraud can cause insolvency (Allen and Gale, 1998; Goldstein and Pauzner, 2005).
  
  • Original cause of bank failure: weak fundamentals, but amplified by coordination failures.

• Panic runs based on deteriorating solvency (Allen and Gale, 1998; Goldstein and Pauzner, 2005).
  
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Which types of failures are most empirically relevant?
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This Paper

• **Challenge:** government interventions make liquidity-driven failures less likely
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- **This paper:** study the history of **failing banks in the United States from 1863-2023**

  → New dataset with **balance sheets for most banks** in the U.S. since the Civil War
    - 38,630 distinct banks
    - 4,764 bank failures
    - Sample before/after Federal Reserve System and deposit insurance
Main Finding

1. **Facts** about failing banks
   
   (i) **Deteriorating solvency** several years before failure
   
   (ii) Increasing **reliance on expensive/non-core funding**
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⇒ Deterioration of bank fundamentals is a necessary condition for failure
   - To the extent that runs matter for failure, they only happen in very weakest banks
   - Runs happen late, and depositors appear slow to react, even before deposit insurance
Data and Context
Data

Bank fundamentals:
- OCC Call Reports of national banks, 1863-1941
  - Source: OCC’s Annual Report to Congress
  - 1865-1904: Carlson, Correia, and Luck (2022)
  - 1905-1941: digitized for this project
    - OCR methods by Correia and Luck (2023)
- FFIEC Call Report, 1959-2023
- Extend data back from 1976 to 1959

Bank failures:
- Definition of failure: receivership
- OCC list of failing banks, 1863-1941
- FDIC list of failing banks, 1935-2023
Predicting Bank Failures
Consider the conditional probability of failure

\[ P(\text{Failure}_{b,t+1\rightarrow t+3} | \text{Insolvency}_{b,t}, \text{Funding Vulnerability}_{b,t}) ), \]
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  - Capitalization
  - Income
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- **Insolvency}_{b,t}: proxy distance to default
  - Capitalization
  - Income
  - Non-performing assets
- **Funding Vulnerability}_{b,t}: reliance on expensive funding
  - Wholesale funding
  - Time deposits
    - More sensitive to federal funds rate \((\text{Drechsler, Schnabl, and Savov, 2017})\)
    - More sensitive to bank risk \((\text{Martin, Puri, and Ufier, 2022})\)
Conditional Probability of Failure: 1959-2023

- Unconditional probability
- Insolvency
- Insolvency + Funding Vulnerability: >95th
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Graph showing probability of failure over time from 1959 to 2023. The x-axis represents insolvency categories (<p50, p50-p75, p75-p90, p90-p95, >p95), and the y-axis represents the probability of failure (h=3). The graph illustrates the conditional probability of failure increasing with higher insolvency categories.
Conditional Probability of Failure: 1959-2023

Graph showing the probability of failure over different insolvency intervals from p50 to >p95.
Conditional Probability of Failure: 1865-1904

- Probability of Failure (h=3)
  - $p_{50}$
  - $p_{50}-p_{75}$
  - $p_{75}-p_{90}$
  - $p_{90}-p_{95}$
  - $>p_{95}$

- Insolvency
- Unconditional probability
- Insolvency + Funding Vulnerability: >95th

Graph shows the probability of failure for different insolvency categories, with the red line representing the unconditional probability.
Conditional Probability of Failure: 1865-1904
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![Graph illustrating the conditional probability of failure with various insolvency probability intervals. The graph shows the probability of failure (h=3) for different insolvency categories: <p50, p50-p75, p75-p90, p90-p95, >p95. The unconditional probability line remains constant across the intervals, while the insolvency and insolvency + funding vulnerability lines show an increasing trend with higher probabilities for higher insolvency categories.]
Prediction Framework

- Predictive model:

\[
\text{Failure}_{b,t+1\rightarrow t+s} = \alpha + \beta_1 \times \text{Insolvency}_{b,t} + \beta_2 \times \text{Funding Vuln.}_{b,t} \\
+ \beta_3 \times \text{Insolvency}_{b,t} \times \text{Funding Vuln.}_{b,t} + \epsilon_{b,t+1\rightarrow t+s}
\]

What does predictability say about the nature of bank failures?
- Purely liquidity-driven, self-fulfilling failures not predictable by fundamentals
- Fundamental-based panics less predictable than insolvency-driven failures

- Predictability metric:

Area Under the Receiver Operating Characteristics Curve (AUC)

- AUC = 0.50 → Naive predictor (coin toss)
- AUC > 0.50 → Informative predictor

- Benchmark: predicting financial crises AUC ≈ 0.74
  Greenwood, Hanson, Shleifer, Sorensen, 2022
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Bank Failures Are Highly Predictable
AUC Statistics: One-Year Horizon

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Failures With Runs
Deposit Outflows in Failing Banks Were Large Before Deposit Insurance

... But Small After
• Define failures with runs as those with deposit outflow $>7.5\%$
Deposit Outflows Before 1935

- Define failures with runs as those with deposit outflow $>7.5\%$
Failures **With Runs** Are Easier to Predict Than Other Failures

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<th>No Run</th>
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<td>NB Era (1880-1904)</td>
<td>0.892</td>
<td>0.798</td>
</tr>
<tr>
<td>Early Fed (1914-1928)</td>
<td>0.902</td>
<td>0.861</td>
</tr>
<tr>
<td>Great Depr. (1929-1934)</td>
<td>0.820</td>
<td>0.816</td>
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- Failures with runs are not disconnected from bank fundamentals, even in historical context where failures due to non-fundamental runs are possible
Cause of Failure Assigned by OCC Examiner
Sample: Failures from 1865 to 1931

Percent of all failures between 1865-1931

- Fraud
- Losses
- External
- Governance Excess. Lending
- Run
- Other
Predicting Aggregate Waves of Bank Failures
Does the Link between Fundamentals and Failures Hold During Crises?

\[
\text{FailureRate}_{t+1} = \alpha + \beta_1 \text{Avg.} \quad \text{Predicted Failure}_{t+1|t} + \beta_2 \text{Banks-at-Risk}_{t+1|t} + \epsilon_{t+1}
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<th>Dependent variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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<td>Banks-at-Risk (BaR)</td>
<td>11.81***</td>
<td>8.34***</td>
<td>4.07***</td>
<td>1.58***</td>
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<tr>
<td></td>
<td>(1.55)</td>
<td>(2.84)</td>
<td>(0.76)</td>
<td>(0.52)</td>
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<tr>
<td>Avg. predicted failure rate</td>
<td>3.94***</td>
<td>1.45</td>
<td>1.26***</td>
<td>0.93***</td>
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<tr>
<td></td>
<td>(0.60)</td>
<td>(1.00)</td>
<td>(0.10)</td>
<td>(0.12)</td>
<td></td>
<td></td>
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<tr>
<td>N</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>52</td>
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<tr>
<td>R^2</td>
<td>0.64</td>
<td>0.57</td>
<td>0.66</td>
<td>0.69</td>
<td>0.84</td>
<td>0.89</td>
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Wrapping Up
Which Theories Best Fit the Facts?

- Purely liquidity-driven, self-fulfilling failures
  
  Diamond and Dybvig (1983), Allen and Gale (2000)...

- Inconsistent with strong predictability based on weak fundamentals

- Panics based on fundamentals
  
  Allen and Gale (1998), Goldstein and Pauzner (2005), He and Xiong (2012)

- To extent runs based on coordination failures matter, they require weak fundamentals

- Challenges:
  
  - Despite high depositor loss rates, many failures without runs
  
  - And, while runs should happen immediately once signal is sufficiently strong...
  
  - Probability of failure between 13-40% not uncommon

  → Sleepy depositors, even before deposit insurance

- Insolvency-driven failures

  - Consistent with: predictability based on weak fundamentals; examiner-assigned cause of failure; failures in modern era without runs; low recovery rates
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Conclusion

• **Objective:** What causes bank failures and banking crises?

• **Approach:** Study the close to complete history of (failing) banks in the U.S.

• **Main Finding:** Bank failures and runs are highly predictable based on fundamentals

• **Policy:** Focus on solvency versus “fire-fighting”

Bank failures are (almost) always and everywhere a phenomenon of deteriorating fundamentals.