An Historical Loss Approach to Community Bank Stress Testing

Timothy J. Yeager
Arkansas Bankers Association Chair in Banking
Sam M. Walton College of Business
Primary Objective

• Introduce a community bank macro stress-testing model that
  – provides a realistic worst-case forecasts at a high confidence level
  – poses no additional regulatory burden on banks
  – can be run quarterly by banks and/or regulators similar to the Fed’s Economic Value Model
Why is a stress test needed?

- Traditional early warning signals
  - are static and cannot account for abrupt and severe changes in banking & economic conditions
  - failed to perceive the magnitude of the banking downturn.
  - Basel II capital ratios were about to be lowered in 2008!
Why is a stress test needed?

• Stress tests
  – have been successfully implemented at the large banking organizations
  – are required already by community bank regulators to measure CRE concentration risk and interest rate risk
  – provide more credible benchmarks for required capital
CRE concentration at community banks rose substantially and remains high.
CLD mean chargeoffs were especially high
Key components of the stress test

• Each community bank is
  – grouped with other community banks by the relevant geography (MSA or state)
  – subjected to a 5-year simulation where (net) chargeoff rates for each group and loan type are drawn from the 90th percentile chargeoffs rates each year between 2008 and 2012
    • imposes a rigid backward-looking bias
Key assumptions of the stress test

- Each community bank
  - maintains the initial asset composition except that charged off loans are not replaced
  - set provision expense equal net chargeoffs each year
  - pays dividends equal to its initial dividend to net income ratio if net income is positive, and $0 if the bank suffers losses
Five-Year Simulation Flow Chart

- **Bank’s initial condition at end of Year 0**
- **90th pctl chargeoff rates from 2008 applied**
  - 2009
  - (2010)
  - 2011
- **Provisions = chargeoffs**
- **Net income, retained earnings, capital computed**
- **Bank’s condition at end of Year 1**
- **Year 2**
  - Year 3
  - Year 4
- **90th pctl chargeoff rates from 2012 applied**
  - 2009
  - (2010)
  - 2011
- **Provisions = chargeoffs**
- **Net income, retained earnings, capital computed**
- **Bank’s condition at end of Year 5**
Stress test applied to Arkansas community banks

<table>
<thead>
<tr>
<th>Area</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>No MSA</td>
<td>78</td>
</tr>
<tr>
<td>Little Rock</td>
<td>14</td>
</tr>
<tr>
<td>NWA</td>
<td>13</td>
</tr>
</tbody>
</table>
Chargeoff rates

All Loans

CLD Loans
### Stress Test Results

**Beginning Year = 2014**  
\(N=105\)

#### Equity to Assets

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>11.9%</td>
<td>11.8%</td>
<td>11.6%</td>
<td>11.3%</td>
<td>11.1%</td>
<td>10.9%</td>
</tr>
<tr>
<td>Median</td>
<td>11.0%</td>
<td>11.0%</td>
<td>10.9%</td>
<td>10.8%</td>
<td>10.6%</td>
<td>10.6%</td>
</tr>
<tr>
<td>No. &lt; 2%</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>No. &lt; 6%</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

#### Chargeoffs to Loans

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.24%</td>
<td>1.25%</td>
<td>2.05%</td>
<td>2.32%</td>
<td>1.74%</td>
<td>1.42%</td>
</tr>
<tr>
<td>Actual Percentile</td>
<td>91%</td>
<td>91%</td>
<td>90%</td>
<td>94%</td>
<td>92%</td>
<td></td>
</tr>
</tbody>
</table>
## Stress Test Results

**Beginning Year = 2007**

(N=143)

<table>
<thead>
<tr>
<th>Equity to Assets</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>11.6%</td>
<td>11.5%</td>
<td>11.1%</td>
<td>10.7%</td>
<td>10.5%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Median</td>
<td>10.8%</td>
<td>10.6%</td>
<td>10.2%</td>
<td>10.1%</td>
<td>10.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>No. &lt; 2%</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>No. &lt; 6%</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>13</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chargeoffs to Loans</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.25%</td>
<td>1.49%</td>
<td>2.42%</td>
<td>2.48%</td>
<td>2.00%</td>
<td>1.65%</td>
</tr>
</tbody>
</table>
CRE loan portfolios are a bit different...

2007
- NFR OWN, 25%
- NFR OTH, 25%
- CLD RES, 10%
- CLD OTH, 20%
- FRM, 15%
- MFM, 4%

2014
- NFR OWN, 28%
- NFR OTH, 28%
- CLD RES, 5%
- CLD OTH, 12%
- FRM, 20%
- MFM, 6%
...and far fewer banks in 2014 have low equity ratios relative to 2007.
In-Sample Model Performance

• Should be a strong correlation between weakest banks in 2007 and weakest stress test outcomes
  – banks that failed or issued equity under distress
  – banks with lowest 2007 equity ratios
  – banks with highest failure probability in 2007
Equity issuers 2008-2012

- One Arkansas bank failed from credit risk and at least 13 issued equity under distress
  - The model predicted the failure, and it correctly identified 11 of the 13 as having weak equity ratios.
## Spearman Rank Correlations of Early Warning Signals and Stress Test Outcomes

<table>
<thead>
<tr>
<th>Variable rank</th>
<th>Year 5 projected equity rank (2012)</th>
<th>Variable rank</th>
<th>Year 5 projected equity rank (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity ratio, 2007</td>
<td>0.76</td>
<td>Equity ratio, 2014</td>
<td>0.73</td>
</tr>
<tr>
<td>DFP, 2007</td>
<td>0.65</td>
<td>DFP, 2014</td>
<td>0.58</td>
</tr>
<tr>
<td>CRE/TA, 2007</td>
<td>0.20</td>
<td>CRE/TA, 2014</td>
<td>-0.04</td>
</tr>
</tbody>
</table>
Take-aways

• A community bank stress test can add value to banks and supervisors.
• An historical loss approach provides a realistic worst-case forecast at a high confidence level.
• In-sample testing shows a high correlation between model outcomes and actual bank performance.
• The loss rates in the model are rigidly backward looking, but they can be easily modified if desired.