Using Transition Matrices for Corporate Stress Testing

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My Caveats …

- *The opinions expressed herein are my own and do not necessarily represent those of the Federal Reserve.*
- The Conditional Transition Matrix approach is the most commonly used approach by BHCs for CCAR 2013.
  - It is a conceptually sound approach.
    - The point of this presentation is not to criticize the approach in general, but to illustrate some common pitfalls.

    - Many BHCs using this approach have encountered some operational challenges in applying this approach, requiring compensating measures to produce robust stressed loss estimates.

  - The Federal Reserve does not use this approach in its own modeling for CCAR/DFAST.

Transition Matrices

EXHIBIT 24

2011 One-Year Letter Rating Migration Rates

From/To:	Aaa	Aa	A	Baa	Ba	B	Caa	Ca-C	WR	Default
Aaa	91.250%	6.250%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	2.500%	0.000%
Aa	0.000%	73.228%	20.472%	0.787%	0.262%	0.262%	0.000%	0.000%	4.987%	0.000%
A	0.000%	0.108%	84.216%	6.270%	2.270%	0.216%	0.000%	0.000%	6.919%	0.000%
Baa	0.000%	0.085%	1.537%	89.069%	3.416%	1.025%	0.000%	0.000%	4.782%	0.085%
Ba	0.000%	0.000%	0.000%	6.093%	77.061%	5.018%	1.971%	0.000%	9.677%	0.179%
B	0.000%	0.000%	0.000%	0.282%	3.857%	75.071%	5.456%	0.282%	14.958%	0.094%
Caa	0.000%	0.000%	0.000%	0.000%	0.000%	12.710%	64.988%	3.118%	13.429%	5.755%
Ca-C	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	21.053%	31.579%	5.263%	42.105%

- Transition matrices measure the probability of moving from one credit state to another.
- The probability of transitioning from a non-defaulted category into a default category is the PD.
- Matrices can be constructed with chosen periodicity.
  - For example, a quarterly transition matrix can be created.
- The cumulative PD for the loan is the product of matrix math.
  - For example, multiply a quarterly matrix 9 times to get a 9 quarter loss estimate.
  - Several firms use dimensionality reducing techniques for computational reasons.

Conditioning Transition Matrices

- Transition rates are not constant over time.
  - The directionality and rate of change varies with economic cycles.
- With sufficient data, these changes in the transitions can be measured.
  - Instead of having one generic transition matrix, the BHC can create either a series of transition matrices or a conditional matrix in which the speed and direction of each cell in the matrix changes with macro conditioning variables.

Data Scarcity Problems

- Transition matrices (and especially conditional transition matrices), require copious amounts of data.

  - Conditioning transition matrices to changing macro environments demands multiple economic cycles.

  - Each cell in the matrix for which there is a material amount of loans needs to have sufficient observations to draw meaningful conclusions.

Ratings as a Summary Statistic

- An essential assumption in this approach is that the rating is a summary statistic that encapsulates all relevant information regarding default.
  - But loans with very different risks can share the same rating.
    - There may be distinctions by LOB or by industry.
  - This is particularly challenging for BHCs that do not have granular risk rating systems.
  - The transition rate should be reflective of the underlying drivers of risk.
    - Loans with the same rating might transition differently even under the same macro conditions.

Bank Rating Transitions

- Balancing conservatism and accuracy
  - Is the rating system designed to produce accurate and timely ratings, or is it designed to be an early warning system?
  - Concentrations in a few rating grades can skew results.
- Rating definitions drift over time
  - Especially for expert judgment systems.
  - Drift can impact response of transitions to macro changes.
- Absorbing states
  - Default is an absorbing state, meaning that loans that transition into default do not transition out.
  - However, we have seen cases where a non-default cell has such a high transition percentage (e.g. 99.5%), that it essentially becomes another absorbing state and thus nothing transitions to default, artificially reducing loss estimates.

Conditioning a TTC system

- Most bank rating systems are neither purely TTC or PIT.
  - However, most lean towards TTC over PIT.
- TTC systems do not have rating transitions that follow the credit cycle.
  - Many BHCs only update ratings annually, making quarterly transition rates difficult to calibrate.
  - Conditioning a transition matrix built on a TTC system should, by design, produce no transitions.
  - Thus a TTC rating system and a conditional transition matrix approach are incompatible.

Path Dependence in Transitions

- Transitions to non-default states may have information, but may not contribute to PD.
    - The fair value of the loan has changed.
    - The ending state of a loan in one period becomes its beginning state in the next period.
        - This might imply that transitions have to occur at the loan level and not the portfolio level.
        - If transitions occur at the loan level, then the BHC might need to make explicit assumptions about new loans (e.g. credit quality and timing).

Rating Agency Proxies

- Because of these problems, a number of BHCs use transition matrices borrowed from the rating agencies as a proxy for their own data.
  - These have the advantages of being publicly available and cover multiple economic cycles.
- Should a BHC choose to use one of these, they need to show that the selected matrix is a reasonable proxy.
  - Just because a BHC has a "4" rated loan that "maps" to a "BBB" rating; that alone is insufficient to establish that the BHC's "4" rated loans will transition in rating at the same speed and direction as a BBB publicly rated company.
  - This is especially true if the BHC's loan portfolio is concentrated in smaller middle market firms.

Summary

- The problem with transition matrices is not the conceptual approach, it's the execution.
- The transition matrix approach requires:
  - Significant data about transitions over a long time.
  - A rating system that, by design, supports transition analysis.
- A number of BHCs trying to use this approach do not have sufficient histories of transitions that consistently correspond to economic cycles.
  - They may continue to struggle until these challenges are overcome.
  - Realistically, the time needed for this may be measured in years.