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

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.

This matrix is chosen as publicly available illustration only. Its use here does not imply an endorsement of this particular matrix.
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.