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VIEWPOINTS

An Integrated Approach to Stress-Testing Corporate Credit Risk

Moody's Capital Markets Research, Inc.

Author

Danielle H. Ferry, PhD
1.212.553.7781
danielle.ferry@moodys.com

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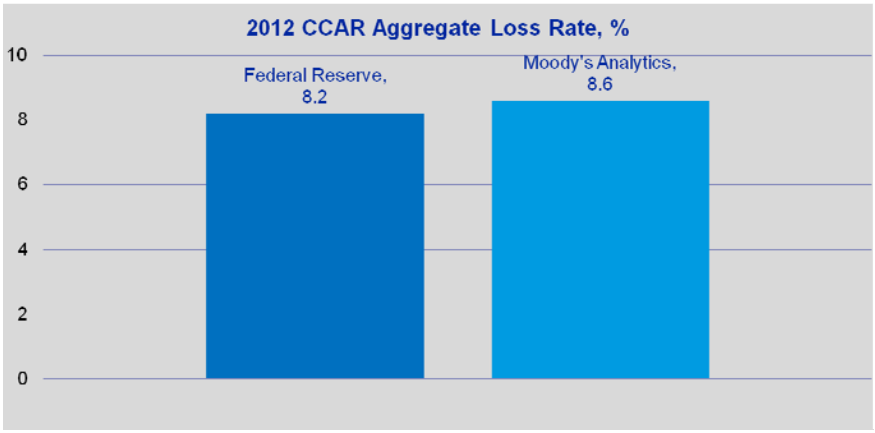
Introduction

Since the onset of the recent global financial crisis, stress testing has been at the forefront of risk professionals' minds. Regulators have recognized that Value-at-Risk (VaR) cannot be used in isolation, that a richer approach is needed — one which considers contextual risks in the macroeconomy. For years, economists have made use of sophisticated model systems to explain the dynamic relationships between different segments of the economy, while the finance community has developed complex models to explain the behavior of financial instruments. However, there has historically been much less progress in linking economic variables to financial variables — until recently.

Stressed EDF™ (Expected Default Frequency) measures help bridge this gap by relating economic indicators to corporate default risk. Stressed EDF measures are conditional forecasts for one-year, firm-level default probabilities (PDs) given a set of assumptions about the future evolution of the economy. They are a valuable tool for financial institutions who wish to or are required to estimate losses under hypothetical, extreme economic scenarios.

In this Viewpoints, we briefly recount the methodology used to construct Stressed EDF measures and then highlight some of their strengths for macroeconomic stress testing. History shows that Stressed EDF measures are capable of accurately predicting credit risk under severe economic conditions. The degree of granularity afforded by these firm-level PDs increases flexibility and improves precision in credit analytics where portfolio composition is important. We also show that Stressed EDF measures can be used to simulate the macroeconomic stress testing exercises of supervisory authorities, such as the Federal Reserve's Comprehensive Capital Analysis and Review (CCAR).



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A Multi-Stage, Structural Econometric Model

Stressed EDF measures are conditional forecasts for Moody's Analytics' point-in-time EDF measures for publicly listed firms, which are the product of a Merton-style PD model of the fundamental drivers of credit risk. The Moody's Analytics Public Firm EDF model uses financial statement and real-time equity market information to construct measures of financial and business risk for each firm. The informational content of these two metrics is synthesized in the distance-to-default (DD), which represents the distance between a firm's asset value and the value of its liabilities that would trigger a default. A one-to-one mapping function converts DD to EDF, or the probability a firm will default within one year from the reference period.[1]

The Moody's Analytics Stressed EDF model combines the historical, structural relationships between DD and 11 macroeconomic drivers with forecasts of those drivers to derive projections of each firm's PD, conditional on the realization of the economic scenario. It is important that the scenarios be plausible and that the variables contained in them be internally consistent (i.e., the unemployment rate rises when GDP falls).[2] Stressed EDF measures rely on holistic economic scenarios developed by Moody's Analytics' Economic and Consumer Credit Analytics (ECCA) division in a large-scale macroeconometric model framework — for ECCA's baseline, one upside, and three downside scenarios as well as the Federal Reserve's baseline and supervisory stress scenarios designed for the Comprehensive Capital Analysis and Review (CCAR).[3]

The Stressed EDF methodology employs a multi-stage regression model that makes a number of assumptions based on historical observation. First, firm-level default risk sensitivity to macro drivers will differ by industry and credit quality.[4] Second, default risk is a function of entity-specific heterogeneity in addition to systematic risk factors. Third, the rank order of any given firm within the aggregate distribution of DD will vary with economic conditions. Fourth, the shape of the aggregate distribution will also vary with economic conditions. Additionally, the methodology is designed with three objectives: that the model results be stable over time, that the model results be consistent with observed historical relationships, and that the model results under an adverse economic scenario depict an appropriate rise in credit risk.[5]

Capable of Accurately Predicting Credit Risk Under Severe Economic Conditions

The experience of the 2008 recession provides an ideal benchmark against which to validate the methodology. For this purpose, we re-estimated the regression models using only the information known before the onset of the financial crisis and recession and calculated Stressed EDF measures treating realized economic data since September 2007 as a future, adverse scenario we might have considered at that time. Exhibit 1 compares the aggregated results of this exercise to actual EDF levels leading up to and during the crisis. Notably, this "perfect foresight" validation exercise Stressed EDF median accurately predicts the timing of the peak in the actual EDF median. Furthermore, the Stressed EDF median is close to or somewhat more conservative than the actual EDF median in the period prior to the crisis and at its apex (a desirable result in periods when the economy is transitioning from expansion to contraction).

[1] Moody's Analytics' DD-to-EDF mapping is calibrated to yield default probability levels that are highly correlated with historical default rates. See Sun et al (2012) for a more detailed discussion of the EDF model.

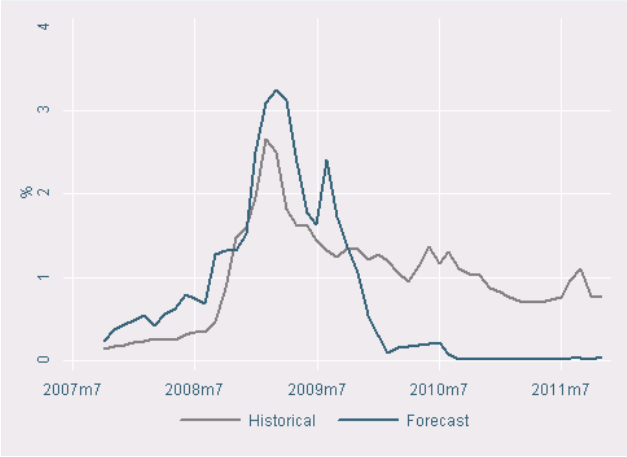
[2] Breuer and Krenn (2000) discuss some of the challenges of identifying appropriate scenarios for stress testing.

[3] A detailed description of the ECCA macroeconomic modeling approach can be found in Zandi (2011).

[4] We classify firms into 16 industries and delineate between investment grade and non-investment grade.

[5] See Ferry et al (2012) for a full description of the modeling methodology.

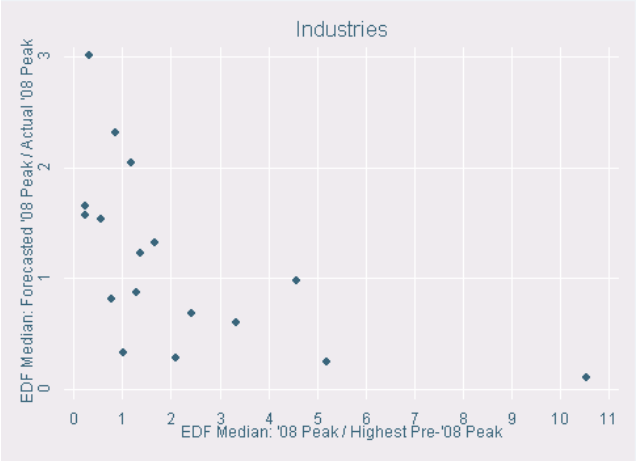
Exhibit 1: Actual EDF Median vs. Validation Exercise Stressed EDF Median, North American Firms



Source: Moody's Analytics

At a more micro level, the validation exercise Stressed EDF peaks tended to over- or underestimate actual EDF peaks relative to historical experience. For example, among industries for which the 2008 recession EDF peak was extraordinarily high by historical standards (represented by the area to the right of one on the x-axis of Exhibit 2), the validation Stressed EDF peak underestimated the actual EDF peak (represented by the area below one on the y-axis). For these sectors — such as financials and consumer discretionary — the Stressed EDF model estimated pre-2008 is unable to predict such an extreme degree of credit stress. The operational Stressed EDF model, however, not only accounts for sector-specific sensitivities to the macro drivers, but also has the benefit of hindsight that includes the most severe financial crisis since the Great Depression.

Exhibit 2: Actual EDF Median vs. Validation Exercise Stressed EDF Median, North American Firms



Source: Moody's Analytics

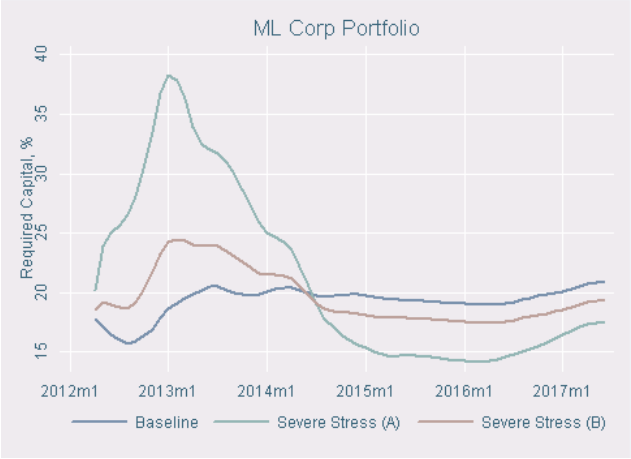
Allowing Maximum Degree of Granularity of Credit Analysis

Because they are firm-level metrics, Stressed EDF measures offer a unique flexibility. Portfolio-level analysis utilizing Stressed EDF measures will be sensitive to portfolio composition in a way that cannot be achieved using aggregate PD estimates, and this can have important implications. Additionally, credit analysis becomes possible at the name level.

Exhibit 2 illustrates the impact of stressing PDs heterogeneously or homogenously in calculations of capital requirements under Basel II/III for a severe economic scenario. Here, required capital is calculated using Moody's Analytics' firm-level Stressed EDF measures based on the baseline and protracted slump economic

scenarios, for a sample portfolio comprised of the BofA Merrill Lynch US Corporate Index constituents.[6] These are shown as the blue and green lines, respectively. At its highest (38.3%), required capital under the severe stress scenario is approximately two times greater than in the baseline scenario. If, instead, stressed PDs were derived by multiplying each entity's baseline PD by a ratio reflecting some average degree of stress in the adverse scenario relative to the baseline, required capital in the severe stress scenario would peak at 24.2%, or 1.3 times the baseline (rose line).[7]

Exhibit 3: Heterogenous vs. Homogenous Stressed PD Assumptions in Basel II/III Capital Requirement Calculations



Source: Moody's Analytics

In this example, stressing PDs homogenously would understate required capital estimates compared with estimates obtained using heterogeneously stressed PDs. This is because the homogenous assumptions are based on averages for US publicly listed firms as a whole, and the constitution of the sample portfolio is relatively more heavily weighted towards entities operating in cyclically sensitive industries. In another portfolio — one which is optimally diversified across industries — required capital estimates using aggregate-based stressed PD assumptions might be too high relative to estimates derived from entity-specific stressed PD assumptions.

Consistent with the PD Models of Supervisory Authorities

Moody's Analytics Stressed EDF measures can be useful benchmarks for internal rating systems, especially in the context of regulatory compliance. The results of the Federal Reserve's 2012 Comprehensive Capital Analysis and Review (CCAR) estimated an aggregate loss rate of 8.2% under the supervisory stress scenario for commercial and industrial (C & I) loans in the 19 participating banks. In a case study using Stressed EDF measures based on a close approximation of the Fed's economic stress scenario and some simplified assumptions about loss given default (LGD) and exposure at default (EAD), Moody's Analytics estimates an aggregate loss rate of 8.6% for representative portfolios of 15 of the participating banks.[8, 9]

In order to simulate the C & I portfolios of each bank, we used loan performance data from the Federal Reserve's Bank Holding Company Performance Reports (BHCPR) as of September 2011 to impute comparable EDF measures for each bank's C & I portfolio. We then randomly generated diversified portfolios for each bank with the desired average EDF. Finally, we calculated losses using Stressed EDF measures based on an economic scenario that closely follows the Fed's supervisory stress scenario, constant LGD of 50%,

[6] The BofA Merrill Lynch US Corporate index is comprised of over 400 investment grade names with an average EDF of approximately 5% as of March 2012.

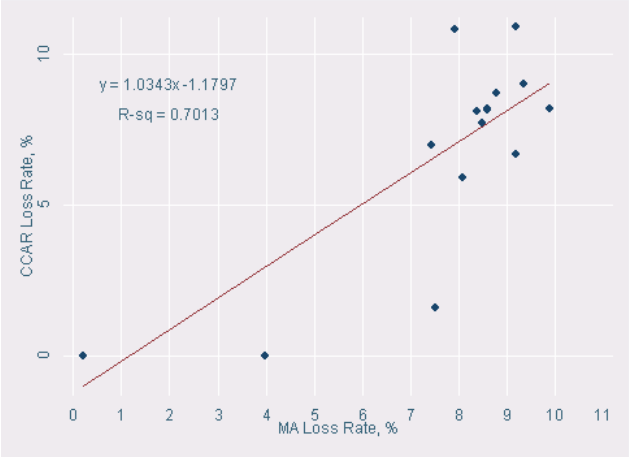
[7] Specifically, each entity's stressed PD is computed by multiplying its baseline Stressed EDF measure by a time-varying ratio of the average severe stress Stressed EDF metric to the average baseline Stressed EDF metric, where averages are calculated for the full Stressed EDF universe of US firms.

[8] Since the only credit information available on which to base the selection of our simulated portfolios is the default rate for each bank, we eliminate the 4 banks for which the default rate is a poor predictor of estimated losses under the CCAR. The aggregate CCAR loss rate for the remaining 15 banks' C & I portfolios is also 8.2%.

[9] The current CCAR economic scenarios were designed in November 2011. Stressed EDF measures based on revised CCAR scenarios can be expected to be available within two weeks of the public announcement of the next CCAR round's scenarios.

and equally weighted loan exposures. The results for each bank are shown in Exhibit 4. The high degree of correlation between Moody's Analytics' loss rates and those estimated by the Fed is striking given the limitations of the study — in particular, the assumptions that LGD and EAD are constant over time and homogenous across banks as well as the fact that the simulated portfolios are only rough approximations of the banks' actual portfolios.

Exhibit 4: Comparison of Estimated Loss Rates Using Stressed EDF Metrics with 2012 CCAR Loss Rates



Source: Moody's Analytics

Concluding Thoughts

Stress testing of credit risk has become a necessity in the post-2008 financial crisis era, and regulators have increasingly emphasized macroeconomic stress testing, in particular. Stressed EDF measures bring together two disciplines — economics and finance — and reflect the impact of systematic, macroeconomic risk drivers on corporate default probabilities while also acknowledging the importance of idiosyncratic risk. Baseline Stressed EDF metrics currently point to a benign outlook for US corporate credit risk, with average default probabilities remaining close to or below their 30-year average over the next five years. Average PDs under the most severe economic scenario, however, are comparable to those realized during the 2008 recession, highlighting the importance for risk practitioners to remain vigilant.

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Author

Danielle Ferry 1.212.553.7781
danielle.ferry@moodys.com

David T. Hamilton 1.212.553.1695
david.hamilton@moodys.com

Editor

Dana Gordon 1.212.553.0398
dana.gordon@moodys.com

Contact Us

Americas : 1.212.553.1653

Europe: +44 (0) 20.7772.5588

EMEA +44.20.7772.5454

Asia (excluding Japan) +852.3551.3077

Japan +81.3.5408.4100