Public Sector Credit Framework

Introducing the Public Sector Credit Framework: An Open Source Solution for Evaluating Sovereign and Municipal Bond Issuers

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Government Credit Ratings Lack Transparency

[N]o one, including some of the analysts involved, with whom we have spoken, with whom others that we know have spoken at very great length indeed, are quite sure what a rating is based upon. The criteria are foggy. The rating services maintain a sort of an aloofness and are not too willing to discuss with the representatives in municipal offices of cities what it is about the city that occasions the upward or downward move in a rating.

- Roy Goodman, Director of Finance, New York City, In Congressional Testimony, Dec. 5, 1967 (but could have been said yesterday)
... and Are Subject to Accusations of Bias

All three credit rating agencies systematically and intentionally gave lower credit ratings to bonds issued by states, municipalities and other public entities as compared to corporate and other forms of debt with similar or even worse rates of default, Blumenthal alleges.

As a result of these deceptive and unfairly low ratings, Connecticut's cities, towns, school districts, and sewer and water districts have been forced to spend millions of taxpayer dollars to purchase bond insurance to improve their credit rating, or pay higher interest costs on their lower rated bonds.

"We are holding the credit rating agencies accountable for a secret Wall Street tax on Main Street -- millions of dollars illegally exacted from Connecticut taxpayers," Blumenthal said. "Connecticut's cities and school districts have been forced to spend millions of dollars, unconscionably and unnecessarily, on bond insurance premiums and higher interest rates as a result of deceptive and deflated credit ratings. Their debt was rated much lower than corporate debt despite their much lower risk of default and higher credit worthiness.

Our Research into US Muni Bonds Finds . . .

• Municipal bond ratings performed poorly during the Depression, with a 10% default rate among Aaa issuers – far worse than the rate for Aaa corporate issuers.

• Rating agencies (over)-reacted by severely grading municipalities for the next 70 years, creating the so-called dual ratings scale.

• Low municipal ratings gave rise to the monoline bond insurance industry, which received billions of taxpayer dollars and then blew itself up by using proceeds to insure toxic assets.
What Investors Need

Investors need sovereign and municipal bond assessments that:

• Are based on thorough research of historic credit performance and issuer-specific financial conditions rather than conjectures and/or generalizations

• Rely primarily or exclusively on quantitative approaches (given the large number of issuers together with the expense and subjectivity of analytical talent)

• Are transparent, well communicated and thus clearly understood by participants on both the buy and sell sides

• Use one overall approach that addresses both sovereign and general obligation municipal bonds, since these two asset classes share relevant characteristics
The Solution: PSCF

- PF2’s Public Sector Credit Framework is:
  - **Quantitative**
    - to decrease the likelihood that unconscious biases will affect the analysis
    - to take advantage of the computer’s ability to rapidly perform large numbers of calculations.
  - **Transparent** – So that other analysts can examine and update assumptions.
  - **Open Source** – To enable a community of developers to enhance the tool.
- The open source release provides a framework. Users or vendors have to build their own issuer-specific models. We are supplying two fully developed sample models to kick-start this process.
Solution Overview

Quantitative methodology based on:

- Multi-Year Budget Projections for Each Public Sector Issuer
  - Can rely in part on estimates published by the government itself
- Monte Carlo Simulation of economic variables such as GDP growth, inflation and interest rates
  - Forecasts and historical data are available from a number of vendors
- Default point stated in terms of a fiscal ratio
  - Debt to GDP
  - Interest Expense to Revenue
  - Debt to Assessed Valuation
  - Others?
- Annual default probabilities calculated as the percentage of simulation trials resulting in ratios exceeding the specified threshold; DPs can be mapped to ratings within the framework
Technology Overview

• User interface implemented as an Excel add-in
• User enters simulation data parameters in 2-4 tabs of an Excel workbook and then runs the simulation from a control panel callable from Excel and written in Visual Basic for Applications (VBA)
• Excel inputs are converted to a C-language program, the program is compiled and then it is executed. Results are written to text file(s) and loaded into new Excel tab(s)
• Generated C-language simulation programs are compiled with the GNU C++ compiler and are thus compatible with Linux and other operating systems. GNU compiler is installed with the framework.
• We also install the Boost C++ library which we use for random number generation
• C-language translation and compiling are used in order to maximize speed, enabling the user to run complex simulations and large numbers of trials
Walkthrough Part 1: Model Sheet

First metric used to establish the default point

Additional metrics can be calculated and viewed in Projection Details
Part 2: Series Sheet / Random Numbers

- Create any number of random series.
- One random number generated per series per trial.
- Three random number distributions currently supported:
  - Uniform / Normal / Cauchy (allowing fat tails)
- User can impose maxima and minima on generated numbers
Part 3: Series Sheet / Macroeconomic Variables

- Inflation, GDP and interest rates can be modeled using any combination of constants, functions of random numbers and functions of other variables or prior year values
- Any C-compliant expression may be used
- Minima and maxima also supported
- Can apply different formulas at different stages of the forecast
Part 4: Series Sheet / Revenues & Expenditures

- Revenue and expenditure items can also use any valid C expression.
- Items may be linked to macroeconomic variables such as inflation or GDP.
- Annual surpluses or deficits can be computed from the revenue and expenditure series and then added to the previous year’s debt.
Walkthrough Part 5: Adjustments Sheet (Optional)

• Legislative/executive decisions to reduce deficits (or spend large surpluses) can be simulated in the adjustments sheet.
• Revenue/Expenditure ratios can be bounded and changes to either revenues or expenditures can be distributed pro rata back to select budget lines.
• We expect to enhance this feature in future releases.
Walkthrough Part 6: Mapping to Ratings (Optional)

- Associate cumulative default probabilities with rating grades.
- Any rating system can be used.
- System returns a vector of annual ratings recognizes that bonds with different tenors carry different levels of risk.
# Walkthrough Part 7: Results Sheet

<table>
<thead>
<tr>
<th>Year</th>
<th>Default Count</th>
<th>Default Probability</th>
<th>Cumulative Default Count</th>
<th>Cumulative Default Probability</th>
<th>Rating Equivalent</th>
<th>Minimum Interest Expense/Total</th>
<th>Maximum Interest Expense/Total</th>
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Walkthrough Part 8: Projection Sheet

- Optional projection tab shows trial-by-trial, year-by-year results for each variable you want to see.
- Default flag is set whenever the first metric specified in the “model” sheet surpasses the default threshold.
Key

• DP = default probability
• GO = general obligation (bond)
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