R2Metrics

BondRisk Software Certification

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by

Alpha-Numeric Consulting, LLC

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Introduction

Financial institutions recognize the need for accurate equity and earnings simulations as part of their comprehensive strategic planning; additionally, there is a regulatory and business requirement to identify exposure, monitor risk, and measure compliance with established parameters. The accurate capturing of the contractual and expected behavior of the current and future balance sheet positions starts with precise record level data, code that applies relevant and defensible assumptions within an industry accepted theoretical and conceptual framework, and calculations that result in meaningful and timely output.

R2Metrics has engaged the independent and expert services of Alpha-Numeric Consulting, LLC to perform extensive testing to a certify that the software is able to meet the Asset-Liability Management (ALM) and Interest Rate Risk (IRR) modeling needs for a variety of balance sheet compositions, mathematically calculate simple and complex formulae, accurately and consistently apply default and custom assumptions to multiple sets of data, and respect the parameters of the categories' characteristics.

This third party review satisfies OCC Bulletin 2011-12 and other regulatory directives with respect to the software (code) component piece of an institution's overall model validation and verification.

Scope

All testing was performed in program version 6.00 of the software. To realistically test the calculations in a practical application, a compilation database representing a moderately complex and commonly structured balance sheet was utilized. Institution information was stripped from the database to remove any possible identification or bias.

Internal testing including regression analysis, incremental code changes, sample databases, real world application, bug reporting, enhancement requests, version to version comparison and other quality control procedures are part of the on-going responsibilities of the management of R2Metrics. This external independent testing is supplemental to the internal Quality Assurance and is not intended as a replacement form of Q/A.

This certification proves out the model math and represents only a single component piece of a comprehensive model verification. Several tests were performed to determine that the model is properly calculating the results, based on the data and the assumptions. In all cases, the expected behavior was predicted by the model's calculations. Examples of expected behavior include, but are not limited to an increase/decrease in value, an increase/decrease in interest income/expense, an acceleration of the return of principal due to the effects of prepayments, non-proportional movement in rising and declining rate scenarios, adherence to floor and ceiling definitions, repricing balances, and proper maturities. To fully comply with Bulletin 2011-12 and the January 6, 2010 FDIC Advisory in Interest Rate Risk and other Model Governance requirements, financial institutions must also have an independent review of their policies and procedures, data (input and imported), assumptions, and output.

Model Description

The BondRisk software is designed as a companion to the BankRisk software, and in aggregation allows for the modeling of interest rate risk, earnings and equity projections, forecasting, budgeting, alternative funding strategies, and any number of "what-if" predictive and risk analysis simulations. Current R2Metrics clients represent a variety of balance sheet compositions, asset sizes, complexities, charters, and geographical locations. The software, used as part of an out-sourced ALM program, is modular and compatible with the BankRisk modeling system.

Data, Assumptions, Theory, Code and Reporting

To assess the mathematical capabilities of the BondRisk model, multiple scenarios were created to enable the use of a myriad of data, assumptions, behavioral characteristics and interest rate scenarios.

Six unique Economic Value of Equity (EVE) and Net Interest Income (NII) scenarios were the focus for certification purposes, representing a Base Case (rates remaining at current levels), and instantaneously and sustained +/-100 bp and 200 bp shocks.

Categories were chosen for review to not only represent those on a typical financial institution's balance sheet, but also to represent a broad cross section of attributes for interest sensitive and non interest sensitive assets and liabilities. Sample categories comprise 100% of total investments, and 43.11% of total assets. Non investment categories and were reviewed in conjunction with the BankRisk model.

Testing Matrix

The Testing Matrix illustrates the categories and resulting scenarios utilized as part of the process of verifying the model math.

Portfolio Sector	Current Values		
	Current Par Value (000's)	Current Book Value (000's)	Current Market Value (000's)
FIXED:			
Fixed MBS	$128,411	$131,065	$132,090
Fixed CMO/ABS	$56,853	$57,885	$58,136
Agency Stepups	$16,500	$16,496	$16,512
Corporates	$750	$786	$792
Taxable Municipals	$1,276	$1,276	$1,342
Tax-Free Municipals	$15,200	$15,487	$16,467
Total Fixed:	**$218,990**	**$222,995**	**$225,339**
FLOATING:			
ARMs	$6,801	$6,943	$6,980
Hybrid ARMs	$563	$565	$595
CMO/ABS Floaters	$6,801	$6,806	$6,768
Inverse Floaters	$168	$182	$168
Total Floating:	**$14,333**	**$14,496**	**$14,512**
TOTALS	**$233,322**	**$237,491**	**$239,851**

Data

Balances and rates (yields and costs) are available for beginning, new, ending, average and summary periods, and flow by definition into subtotal and total categories. Maturity and repricing cash flow is available for all periods. Manual input allows for easy modification and automated data feeds reduce the likelihood of entry error. Web-based updates are also an integral part of the model population.

Assumptions

The flexibility of the model allows for a great amount of detail to be applied in the definitions of the assumptions for the existing portfolio as well as the new and replacements to the portfolio.

Assumptions that will alter the current and future positions are correctly applied and results are calculated immediately for review and analysis. The following assumptions are available for definition within the model and were reviewed in conjunction with this certification:

- Category type (asset, liability, off balance sheet),
- Instrument type
- Balances and Rates (Book, Par),
- Interest Sensitivity,
- Repricing and maturity timing, fixed rate periods (lockouts), balloon terms,
- Rate restrictions (floors, ceilings, repricing delay, betas),
- Interest index, rates, curves, offsets, adjustments,
- Cash flow (amortizing/non amortizing, level payment, level principal, interest only, principal only, payment at maturity),
- Prepayments, decay, early withdrawals,
- Discount rate, discount method, and
- Taxes: Federal, State, Local

Theory

Industry best practices for simulation models require that the model be able to use beginning balances that tie to the institution's application and subsidiary ledgers, apply unique behavioral assumptions, and create results for a variety of interest rate and economic environments from which management can measure and monitor risks and make applicable corrections and enhancements to strategic planning. The BondRisk software has the fundamental conceptual ability to meet and these standards.

Code and Calculations

In addition to the internal testing applied to the software code, the math was tested externally to determine if the model is correctly presenting the beginning, interim and final results. As part of a comprehensive certification, model math was proven out by independent calculations. When evaluated within the context of expected behaviors, results were reviewed to determine if they were correct in terms of increases/decreases, volatility, asymmetric/symmetric variances, and adherence to defined parameters. After testing, the following hypotheses were proven:

- Math proven for one type of category is presumed to work for all subsets of the category assuming good data and similar characteristic definition. For example, if the model math is correct for the 6 month CD category, the math is correct for all short term, fixed rate, bullet time deposit categories.
- Categories and assumptions copied from one category to another for the same institution are presumed to work in an identical fashion.
- Results produced in one database will be reproduced in another database if defined in the same manner.

Reporting

The software contains a variety of predesigned reports and allows exporting of results to Excel and/or to pdf formats. System generated reports, in multiple formats, also reconcile to the data within the model and to the final results without exception.

Summary Statement

The BondRisk software, version 6.00, has the conceptual and functional ability to represent current balance sheet positions, utilize assumptions and characteristics to produce future balance sheet positions, calculate shocked EVE and NII IRR results, and is mathematically accurate in a variety of most likely, rising, and declining rate scenarios.

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