The Role of A Quantitative Tool in Debt Management Strategy Analysis

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Outline

• What is a risk model? Why is it useful?
• The structure of a simple scenario analysis model
  – Model input, engine and output
  – Description of the simulation process
• Implementation issues
  – How are scenario models used in practice?
  – Off-the-shelf or in-house developed model?
  – Scenario analysis vs. stochastic modeling
• Summary
What is a Risk Model?

- A specific representation of something more general and usually more complex
- Allows quantification of cost and risk
  - Requires clear definition of cost and risk
- Simplified representation of the debt process
- Basic tool for assessment, monitoring and review of risk – support the identification and choice of indicators/targets
- Lars Peter Hansen: “Models are always wrong in some sense; they are simplifications or abstractions”
Risk Models in Debt Management

• Models are widely used by debt managers to provide input to decision-making, and to better understand the cost and risk trade-offs
• Provides supplement to qualitative analysis
• Starting point is a clear definition of cost and risk
  – This may seem trivial, but is at the core of risk modeling
• A model should only contain elements that are needed to answer specific questions
  – Additional details = additional complexity
Is a Model Needed to Develop a Debt Strategy?

- **No**, recent examples include
  - Indonesia, Peru, Colombia

- In the above cases, the strategy was initially formulated as broad guidelines based on “intuition”
  - More domestic debt
  - Longer maturity etc.

- A natural next step is providing more precision in the form of targets for specific risk indicators – this requires a model
The Structure of a Scenario Analysis Model

**INPUT**
- Existing debt cash flows
- Macro Variables
  - Primary fiscal balance
- Structure of new debt
  - Borrowing strategy
- Financial variables
  - Exchange rates
  - Interest rates

**ENGINE**
- Cash-flow

**OUTPUT**
- Cost
- Risk
Basic Budget Arithmetic – the Foundation for the Scenario Analysis Model

- **Primary Balance**
  - Interest payments
  - = Fiscal Balance
  - Principal payments
  - = Funding need

• Future debt charges and redemptions – and therefore future funding needs – will depend on the borrowing actions as well as market rates
  – A higher than expected funding need can be the result of loose fiscal policy and/or higher market rates
Input: Existing Debt Cash Flows

- Cash flows based on outstanding balance as of a specific date (often end of previous fiscal year)
  - By currency
    - Domestic debt
    - Foreign currency debt (USD, EUR, JPY, etc)
  - By interest rate
    - Fixed
    - Floating

- Information should be available from debt recording system
Input: Macroeconomic Variables

- What are the future paths for the macro economy?
  - Primary balance projections
    - Expenditure plans
    - Projected revenues
    - This will determine the new borrowing requirement
  - Projections for GDP growth and revenues if used for cost and risk indicators

- These variables are usually exogenous (though some countries have tried to use structural models to link interest rates and GDP)
Input: Structure of New Debt

- What is amount of new debt that needs to be issued?
  - Primary balance
  - Maturing existing debt
  - Interest cost of existing debt
  - Maturing ‘new’ debt
  - Interest cost of ‘new’ debt

- Assumption: Funding need fully covered by borrowing

- Select a borrowing strategy: For example, all domestic, 50% 1 year / 50% 5 year
Input: Financial Variables

- Scenarios for future market rates
  - Exchange rates
    - E.g. existing rates, Interest Rate Parity etc.
  - Interest rate
    - E.g. existing rates, forward rates etc.

- Among potential scenarios for future market rates a baseline scenario is chosen – this will function as the basis for measuring cost and risk
  - A sound design of the base scenario is vital for the risk analysis
Model Output: Cost and Risk

Cost

Risk Scenario 1

Baseline Scenario

Time

Cost$_{1,X}$

Risk$_{1,X}$
Cash Flow Simulation

- Decide on the time frame of analysis, e.g. 5 years
- The debt service flows generated by the baseline scenario for a given new debt issuance strategy will be defined as the expected cost
- The sensitivity of a borrowing strategy to market rates can be analyzed by comparing cost and risk under alternative scenarios for market rates
- Different borrowing strategies can be analyzed by comparing cost and risk for one or more risk scenarios for market rates
Example of Model Output

Interest to GDP, end of period

Debt to GDP, end of period

- The above charts are based on the future cash flows generated by a model
  - Identifying the preferred strategy is typically difficult – different cost indicators will give different ranking
Using Debt Portfolio Modeling in Practice

- **Pre-requisites for modeling**
  - High quality and timely data on the outstanding debt portfolio
  - Dedicated staff with good knowledge of spreadsheets and finance

- **Issues for modeling**
  - Selection of market variable scenarios, or period of history for parameterizing a simulation, may be difficult when the economy has been through periods of instability
  - The process of developing a model represents a considerable investment
Typical Experiences from Working with Risk Modeling

• **Not the main basis for decision-making**, rather a supplement to experience, sound judgment etc. – provide additional information for making better choices
• Increase knowledge of the cost/risk trade offs
• Requires dedicated resources, time-consuming
• Clarifies framework for decision-making
Off-the-Shelf or In-House-Developed Model?

- Model development requires
  - Adequate staff and software
  - Time – often trial and error
  - Focus on key person risk

- Buying an off-the-shelf model is tempting, but supply is very limited – and will often imply acquiring a black box

- The MTDS Analytical Tool
Deterministic vs. Stochastic Scenario Analysis

• A simple deterministic scenario analysis model provides a basis for more advanced stochastic models
  – In stochastic models the number of market scenarios are increased from a few to several thousand
  – Allows quantification of cost and risk

• Cost-at-Risk models are related to the VaR concept
  – “What is the maximum cost of the debt in a given year with a probability of 95%”
Summary

- A scenario model provides input on the direction and magnitude of risks – requires clear definition of cost and risk
- A simple scenario analysis model can provide input on
  - The costs and risks of the existing borrowing strategy
  - The choice between alternative borrowing strategies
- Strategic targets can be derived from the cost/risk analysis
- Trial and error process that is very time consuming
- A simple scenario model provide the basis for more advanced Cost-at-Risk models