An Introduction to Scenario Analysis in Practice: Capturing Risk
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
• Computation tool – what-if scenarios
• Basic tool for assessment, monitoring and review of risk – support the identification and choice of indicators/targets
Why is a risk model useful?

- Allows analysis of many scenarios and strategies - monitor and review strategies to alter risk
- Maintain integrity across different scenarios/strategies
- Forces discipline
- Gives deeper insight into the process
- Basis needs to be in order: Access to high quality and timely data
Is a model needed to develop an MTDS?

• No, recent examples include
  – Indonesia, Peru, Brazil, 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 simple 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 Simulation

**OUTPUT**
- Cost
- Risk
Input: Existing debt cash flows

- Cash flows based on outstanding balance today
  - By currency
    - Domestic debt
    - Foreign currency debt (USD, EUR, JPY, etc)
  - By interest rate
    - Fixed
    - Floating
Input: Macroeconomic variables

• What are the future paths for the macro economy?
  – Primary surplus/deficit projections
    • Expenditure plans
    • Projected revenues
    • This will determine the new borrowing requirement
  – Projections for GDP growth

• These variables are usually exogenous (though some countries have tried to use structural models to link interest rates and GDP)
JVI Workshop Medium Term Debt Management Strategy (MTDS)

Input: Structure of new debt

• What is amount of new debt that needs to be issued?
  – Primary deficits
  – Maturing existing debt
  – Interest cost of existing debt
  – Maturing ‘new’ debt
  – Interest cost of ‘new’ debt

• Assumption: finance maturing debt and interest cost through new debt

• Select a strategy: e.g. all domestic, 50% 1 yr / 50% 5 yr
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 base 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

Base-case Scenario

Risk$_{1,X}$

Cost$_{1,X}$
Cash flow simulation

- Decide on the time frame of analysis, e.g. 10 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 the cost of 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
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
How can the tool support the development of the MTDS?

• Forces discipline
  – Clear cost and risk definition
  – Clarification of macro framework
  – Clarification of constraints regarding market
  – Clear time horizon

• Ensures integrity when comparing alternative strategies

• Allows monitoring and review of risks

• Gives deeper insight to the debt-process
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

• Simple concept, but need lot of details

• Lack of integrated and high quality database
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
  – What are the implications of the above statement for the MTDS Analytical Tool?
Scenario analysis vs. stochastic modeling

• A simple scenario analysis model provides a basis for more advanced stochastic models
  – Number of 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
Some final thoughts …

• Scenario analysis is extremely useful when developing a Medium Term Debt Management Strategy

• Can a sound MTDS be developed without scenario analysis?
  – Yes, but the Tool allows digging deeper

• Is the “Box too black”?
  – Not custom built, rather, can accommodate many types of debt
  – Requires training