



Institute of Actuaries of Australia

2004 Financial Services Forum ...The New Environment

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Financial Services Forum

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Financial Modelling of Project Financing Transactions

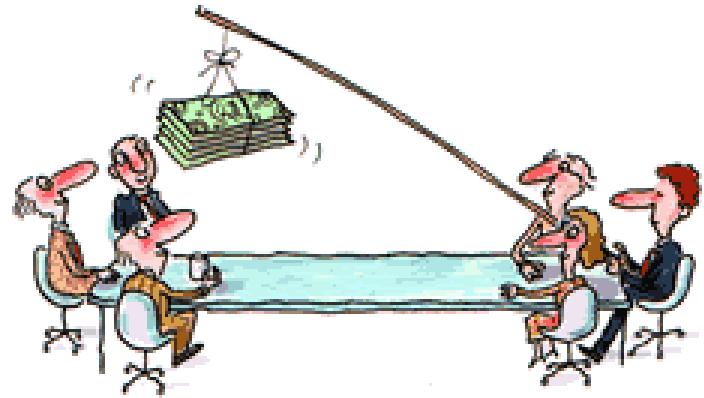
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Project Financing

- What is Project Financing?
 - Recourse to cash flows generated by the project, not to cash flows of the sponsors'
 - Hence minimise the impact of a bad performing project on the sponsors' own business
- Who uses Project Financing?
 - Infrastructure developments, private public partnerships, large scale projects



Project Financing



- The Lenders
 - Subscribers of funds towards the project
 - Highly risk adverse
- Limit Credit Risk Exposure
 - Imposing strict debt covenants
 - Extensive financial engineering to allocate risks amongst the various parties, via LT contracts, guarantees, complex agreements
- Both of these result in making the project's cash flows more challenging to model!

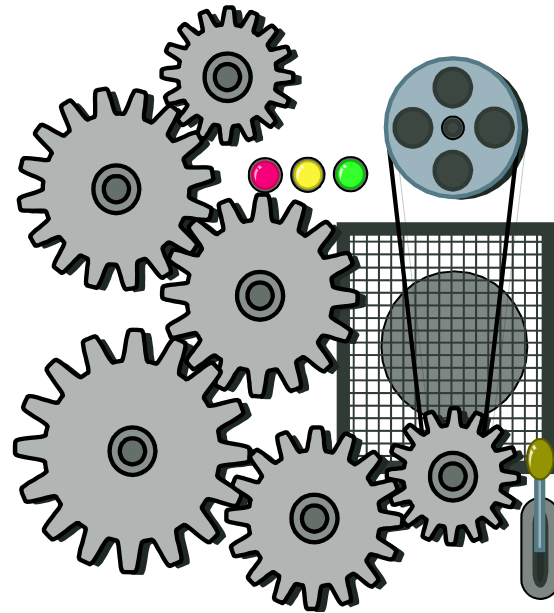
Role of Project Financing Models

- The “Financial Model”
 - In the form of a spreadsheet, with macros
 - Forecasts cash flows, returns to equity, etc
 - Reflects the contractual obligations of the various parties
 - Allows impact of changes in assumptions, for credit risk analysis and debt cover



Role of Project Financing Models

- Model Complications:
 - Regulatory pricing regimes
 - Lockup provisions
 - Ownership structures
- Last Words on the Financial Model:
 - Complex
 - Prone to errors!



Risks of Project Financing Models

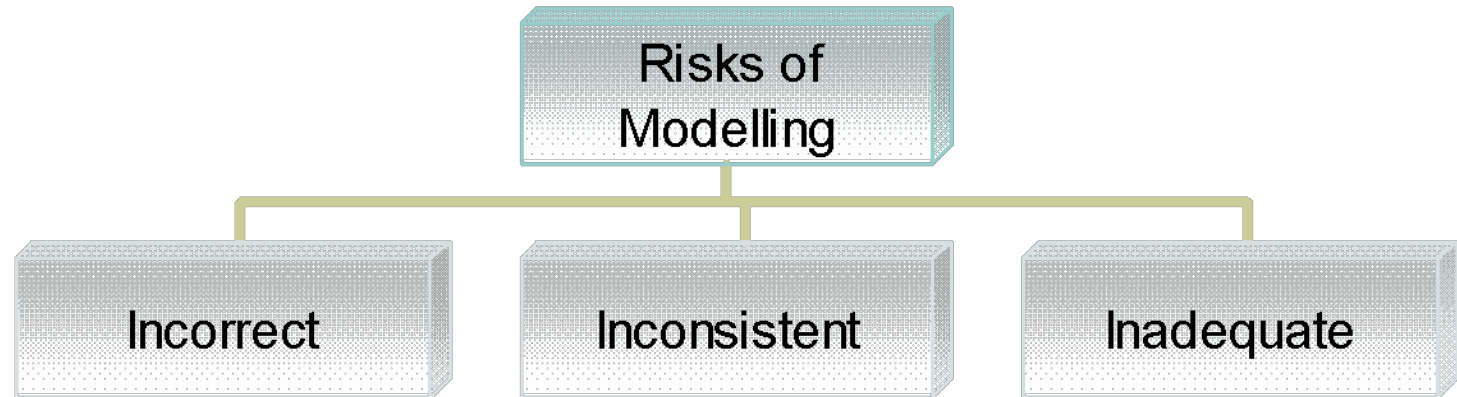
- *“Spreadsheet end-users, who by definition are interested in solving a problem, are unlikely to acquire professional spreadsheet programming skills with experience.*

This seems to explain the troubling experimental results: experienced spreadsheet users are but amateur spreadsheet programmers. Although their experience presumably taught them much about their problems, it taught them little about spreadsheet programming.”

Spreadsheet Engineering: A Research Framework

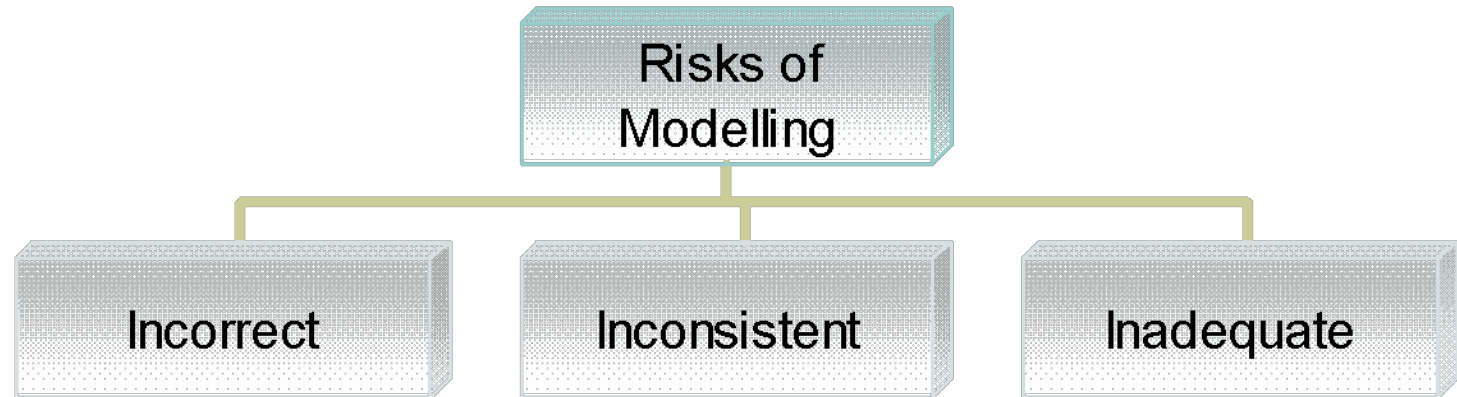
- *Thomas A. Grossman 2002*

Risks of Project Financing Models



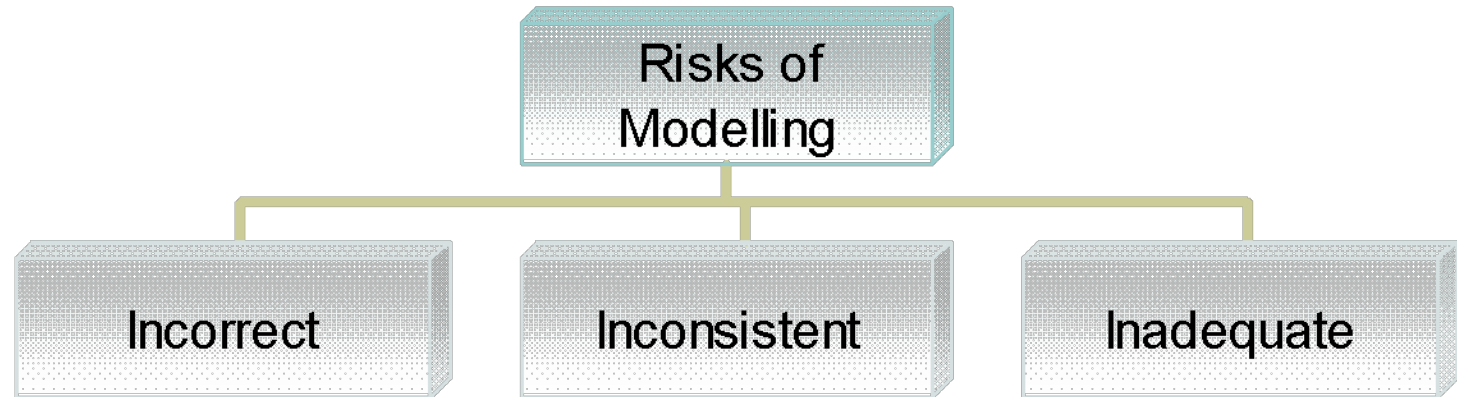
- Incorrect Errors
 - Outright errors
 - Can be qualitative, eg poor design that leads to error
 - Or quantitative:
 - Mechanical errors – mistyping, incorrect cell references
 - Logical errors - mistakes in formulae, linking the wrong cell
 - Omission errors – leaving out an important factor

Risks of Project Financing Models



- Inconsistent Errors
 - Inconsistent with project documentation, eg the Subscription Agreement, the Electricity Contract
 - Internally inconsistent, eg debt interest being calculated by different conventions for different tranches of debt

Risks of Project Financing Models



■ Inadequate Errors

- Did not adequately model some aspects of the transaction, e.g. hard-coded an assumption in the formulae such that the results will be incorrect when the assumption changes
- Or did not model some aspects of the transaction at all, e.g. a contractual obligation

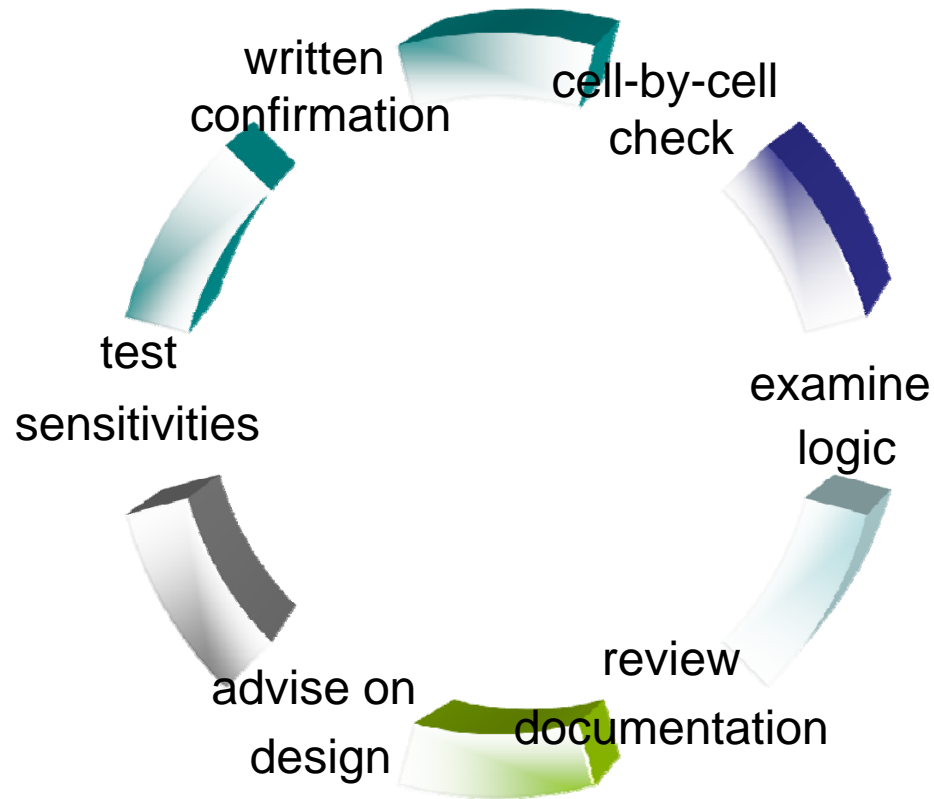
Risks of Project Financing Models

- The risks of modelling are well understood in the project financing industry, particularly in the Australian market
- This is due to a number of reasons:
 - A large number of parties relying on the model results
 - Large amounts of money involved
 - Extreme timing pressures in bid situations



Risk Management

- Independent External Review - What is involved?



Risk Management

- Independent External Review - Advantages



The model developer
is too “close”

Deduce the details of the proposed transaction from the model itself, without any pre-conceived notions

Capture inconsistent or inadequate modelling risks by asking the model developer questions on the transaction

Lawyers and model developers think differently! Does the model reflect the same deal that the lawyers have drafted?

Risk Management



- Review is by no means easy
- Who are the independent external reviewers?
 - Overseas - accounting firms
 - Australia - actuaries are preferred
- Skills needed
 - Ability to think logically
 - Understanding of the financial instruments used
 - Good grasp of the fundamentals of cash flow valuation
- But actuaries have a more dynamic role

The Need for Enhancing Models

Construction



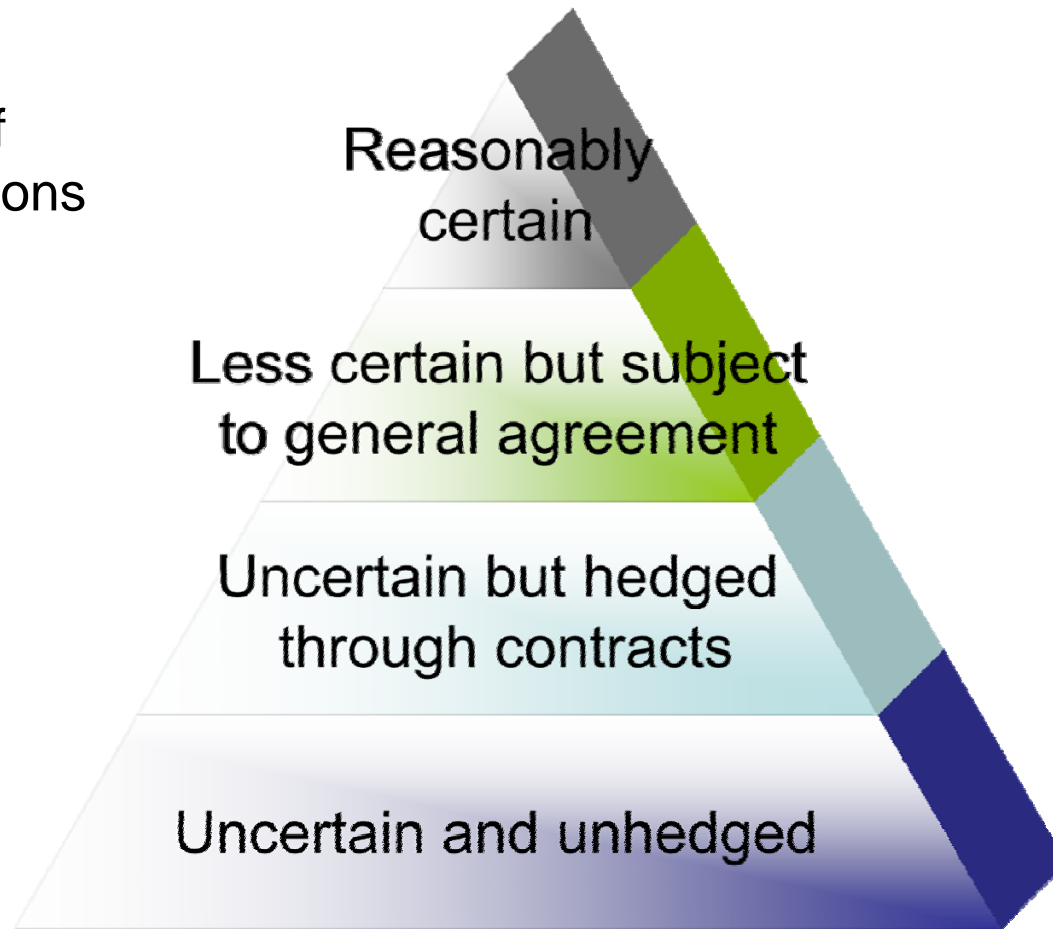
- Completion Risk
- Cost Overrun Risk
- Performance Risk
- Environmental Risk

Operations

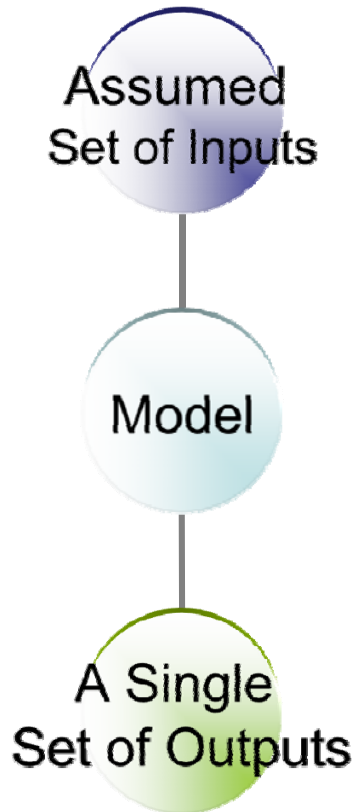
- Regulatory Risk
- Off-take Risk (eg electricity purchase in a Power Project)
- Market Risk (eg traffic flow in a Tollroad Project)
- Performance Risk
- Environmental Risk

The Need for Enhancing Models

- Quality of Assumptions

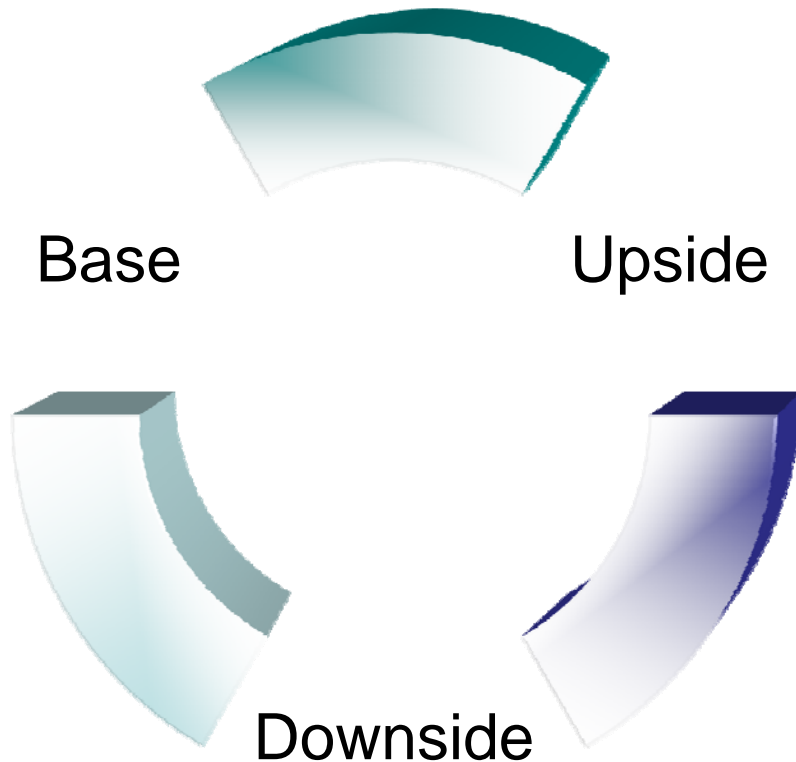


Deterministic Risk Modelling



- What is Deterministic Risk Modelling
 1. Sensitivity analysis
 - Varying one risky / uncertain input at a time
 - Identify which inputs have greater impact on the project's CFs
 2. Scenario testing
 - Many key inputs are varied together in one "likely" scenario
 - At least 3 scenarios are constructed: Base, Downside, Upside.

Deterministic Risk Modelling



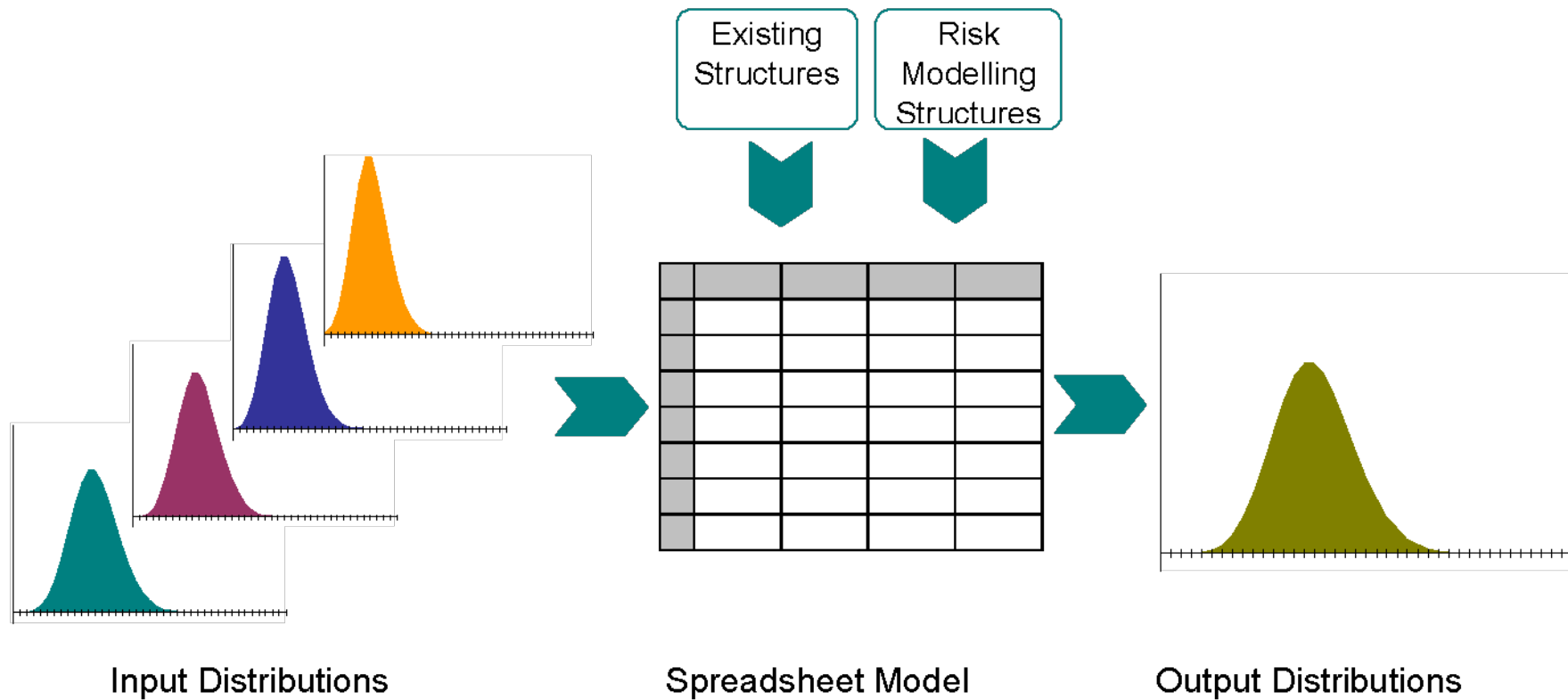
- Base (Lenders') Case
 - conservative assumption
 - setting scheduled debt amortisation
- Downside Case
 - pessimistic assumptions
 - setting reserve level, testing flexibility of loan principal repayments and impact of lock-up provisions
- Upside (Sponsors') Case
 - most likely scenario
 - testing pre-payment and re-finance options

Stochastic Risk Modelling

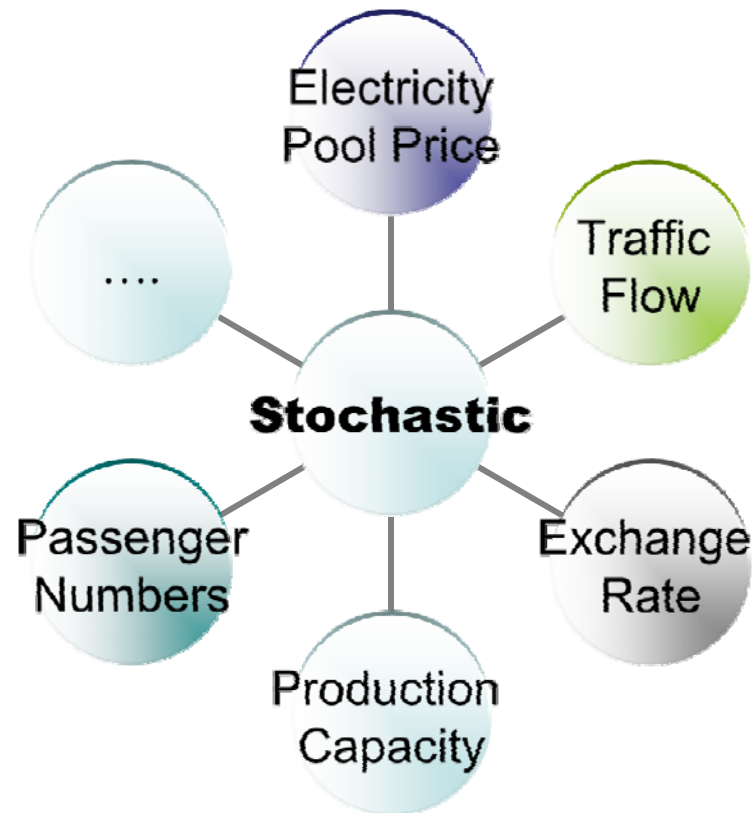
- *“The lack of historical data on the occurrence of events that are being guaranteed against limits the usefulness of actuarial or econometric methods for measuring risks and expected losses. The Colombian government finds it more useful to use a model based on contingent claims theory and Monte Carlo simulations. This allows projections to be made based on multiple scenarios with different probabilities in order to determine the probability of bad states of the world.”*

*Clemente del Valle, Director General
Ministry of Finance and Public Credit
Colombia*

Stochastic Risk Modelling



Stochastic Risk Modelling



Stochastic Risk Modelling



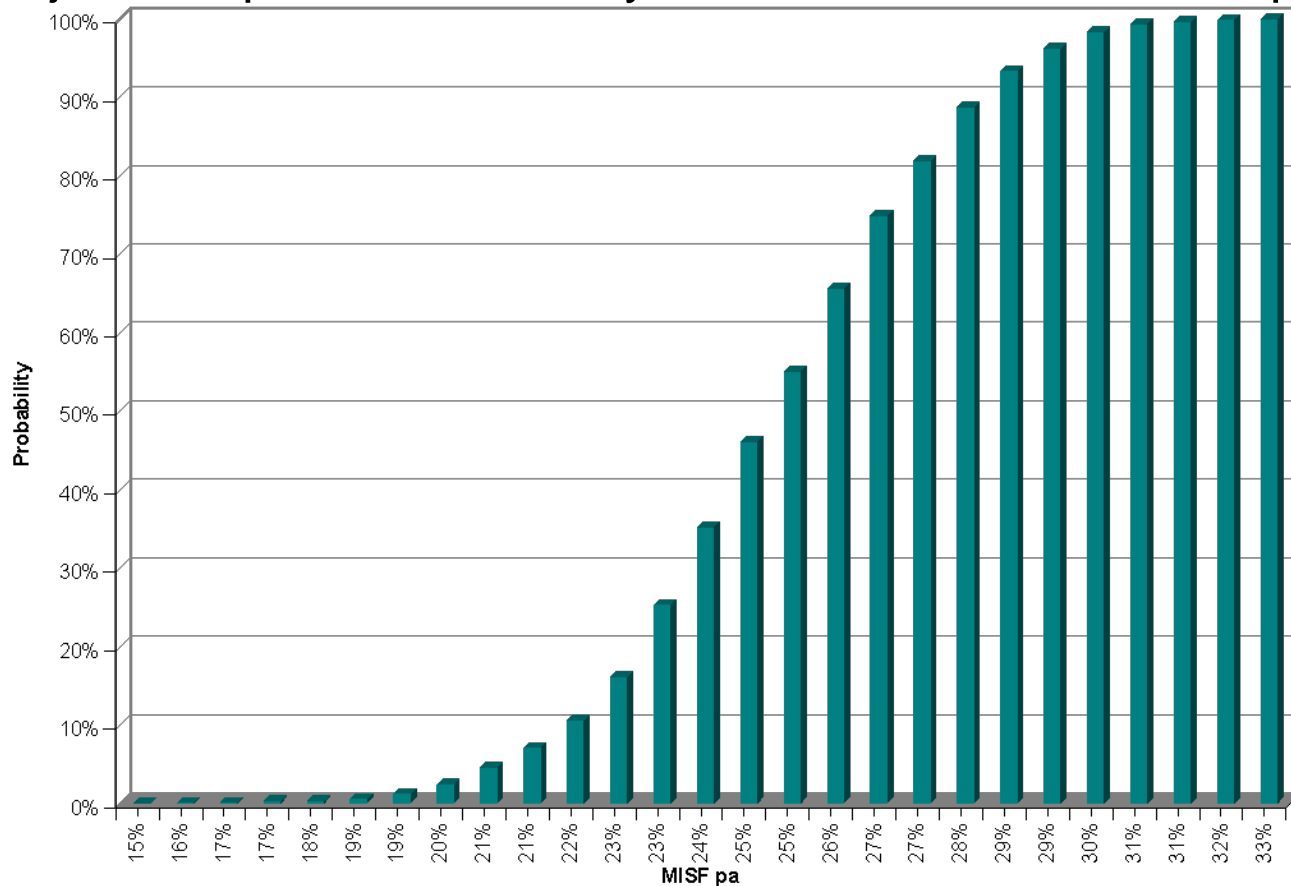
- Example: An Airport Project
 - Stochastic variable: Passenger numbers
 - Assume
 - annual no. of passengers \sim Poisson (x)
 - annual no of passengers grow at $y\%$ pa for n future periods
 - all other inputs deterministic
 - 1st simulation trial:
 - generate a series of n sequential Poisson random variates
 - feed into spreadsheet model
 - model re-calculates and produces a series of n projected cash flow outcomes, i.e. the results of the first trial
 - This process is then run another 49,999 times

Stochastic Risk Modelling



Stochastic Risk Modelling

- On the assumptions used, there is 65% likelihood that the project's expected after tax yield will not fall below 26%pa



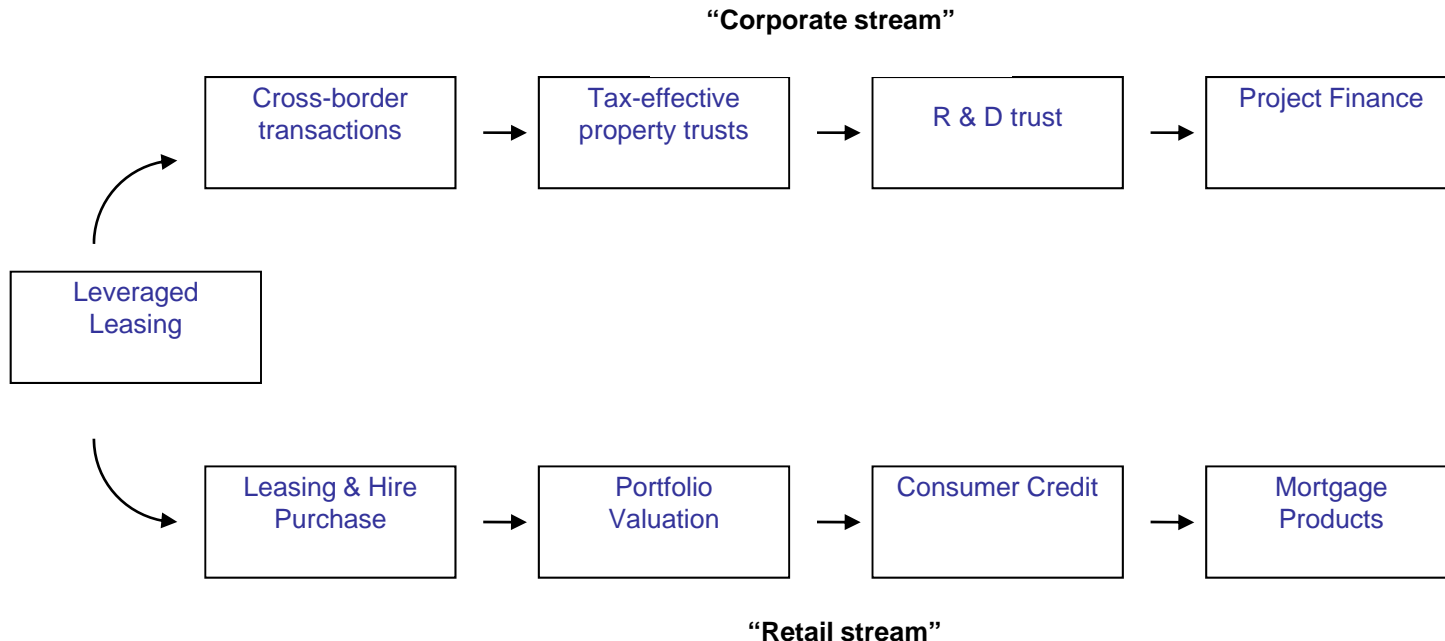
Stochastic Risk Modelling

- Adds the dimension of dynamic analysis to project financing models
- But results are only as good as the assumptions. If the input distributions are unreliable then the output distributions will be equally unreliable



Role of Actuarial Profession

- A bit of history
 - leveraged leasing experts in the 70s
 - ES Knight & Co, later acquired by Mercer
 - 2 streams of actuarial involvement in finance emerging:



Role of Actuarial Profession

- Today
- Potential opportunities



Financial Modelling of Project Financing Transactions

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