

SUBJECT

RISK ANALYSIS

SESSION 9 Valuation of Risk

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Valuation of Risk

Valuation risk is the financial risk that an asset is overvalued and is worth less than expected when it matures or is sold. Factors contributing to valuation risk can include incomplete data, market instability, financial modeling uncertainties and poor data analysis by the people responsible for determining the value of the asset. This risk can be a concern for investors, lenders, financial regulators and other people involved in the financial markets. Overvalued assets can create losses for their owners and lead to reputational risks; potentially impacting credit ratings, funding costs and the management structures of financial institutions.^[1]

Valuation risks concern each stage of the transaction processing and investment management chain. From front office, to back office, distribution, asset management, private wealth and advisory services. This is particularly true for assets that have low liquidity and are not easily tradable in public exchanges. Moreover, issues associated with valuation risks go beyond the firm itself. With straight through processing and algorithmic trading, data and valuations must remain synchronized among the participants of the trade processing chain. The executing venue, prime brokers, custodian banks, fund administrators, transfer agents and audit share files electronically and try to automate such processes, raising potential risks related to data management and valuations.

To mitigate this risk it is important to provide transparency and ensure the integrity and consistency of the data, models and processes used to process and report calculations within valuations for all participants.

Background[

The growth and diversity made in financial engineering has led to highly creative and innovative strategies where new products and new structures are offered at very fast pace on the market. As most innovations are first proposed on over-the-counter (OTC) markets, they tend to rely on financial models, sometimes combining several models together. Financial models typically build on underlying assumptions and require calibration to a breadth of scenarios, business conditions and variations of the assumptions increasing the model risk.

The shock wave which affected the credit and capital markets following the burst of the US sub-prime mortgage crisis in late 2007, tested most underlying assumptions and had sweeping effects on a number of models that would unlikely be calibrated for extreme market conditions, or tail risk. This led to an emergency call for transparency and assessments of exposure from the financial institutions' clients, shareholders and managers, echoed by the regulators. In this process, it appears that market exposure and credit exposure intricately mix into a single notion of valuation risk.

Managing Valuation Risk

Valuation risks result from data management issues such as: Accuracy, integrity and consistency of static data. Accuracy and timeliness of information such as corporate events, credit events, or news potentially impact them. Streaming data, such as prices, rates, volatilities are even more vulnerable as they also depend on IT infrastructure and tools therefore adding a notion of technical and connectivity risk.

Some financial institutions have setup centralised data management platforms, open to multiple sources of static and streaming data where all financial instruments traded or held can possibly be defined, documented, priced, historised and distributed across the enterprise. Such centralisation facilitates data cleansing, historising and auditing allow organisations to define and control pricing and valuation procedures as required for compliance. For OTC instruments, the platforms also involve the definition and storage of underlying information such as yield curves and credit curves, volatility surfaces, ratings and correlation matrices and probabilities of default.

In addition, an important aspect of managing valuation risk is associated with model risk. In search of transparency, market participants tend to adopt multiple model approaches and rely on consensus rather than science. In the absence of deep and liquid market transactions, and given the highly non-linear nature of some of the structured products, the mark-to-model process itself requires transparency. To achieve this, open pricing platforms may be linked to the centralised data warehouse. Those platforms are capable of using multiple models, scenarios, data sets with various distribution and dispersion models to price and re-price under ever changing assumptions.

The final aspect of managing valuation risks relate to the actions that can be taken within the firm as a result of the assessments of exposures and sensitivities reported. The management of tail risks should also be reviewed so that

allocating economic capital weighted by a very low probability of occurrence of an event amounted to considering a normal distribution of events or simply overlooking the tail risk

Risk analysis is the process of defining and analyzing the dangers to individuals, businesses and government agencies posed by potential natural and human-caused adverse events. In IT, a risk analysis report can be used to align technology-related objectives with a company's business objectives. A risk analysis report can be either quantitative or qualitative.

In quantitative risk analysis, an attempt is made to numerically determine the probabilities of various adverse events and the likely extent of the losses if a particular event takes place.

Qualitative risk analysis, which is used more often, does not involve numerical probabilities or predictions of loss. Instead, the qualitative method involves defining the various threats, determining the extent of vulnerabilities and devising countermeasures should an attack occur.

Risk Analysis

DEFINITION of 'Risk Analysis'

The study of the underlying uncertainty of a given course of action. Risk analysis refers to the uncertainty of forecasted future cash flows streams, variance of portfolio/stock returns, statistical analysis to determine the probability of a project's success or failure, and possible future economic states. Risk analysts often work in tandem with forecasting professionals to minimize future negative unforeseen effects.

INVESTOPEDIA EXPLAINS 'Risk Analysis'

Almost all sorts of large businesses require a minimum sort of risk analysis. For example, commercial banks need to properly hedge foreign exchange exposure of overseas loans while large department stores must factor in the possibility of reduced revenues due to a global recession. Risk analysis allows professionals to identify and mitigate risks, but not avoid them completely.

Proper risk analysis often includes mathematical and statistical software programs.

Risk Analysis — Overview

Risk analysis is the systematic study of uncertainties and risks we encounter in business, engineering, public policy, and many other areas. Risk analysts seek to identify the risks faced by an institution or business unit, understand how and when they arise, and estimate the impact (financial or otherwise) of adverse outcomes. Risk managers start with risk analysis, then seek to take actions that will mitigate or hedge these risks.

Some institutions, such as banks and investment management firms, are in the business of taking risks every day. Risk analysis and management is clearly crucial for these institutions. One of the roles of risk management in these firms is to quantify the financial risks involved in each investment, trading, or other business activity, and allocate a risk budget across these activities. Banks in particular are required by their regulators to identify and quantify their risks, often computing measures such as Value at Risk (VaR), and ensure that they have adequate capital to maintain solvency should the worst (or near-worst) outcomes occur.

Quantitative Risk Analysis

Quantitative risk analysis is the practice of creating a mathematical model of a project or process that explicitly includes uncertain parameters that we cannot control, and also *decision variables* or parameters that we *can* control. A quantitative risk model calculates the impact of the uncertain parameters and the decisions we make on outcomes that we care about -- such as profit and loss, investment returns, environmental consequences, and the like. Such a model can help business decision makers and public policy makers understand the impact of uncertainty and the consequences of different decisions.

Risk Modeling and Simulation

One way to learn how to deal with uncertainty is to perform an experiment. But often, it is too dangerous or expensive to perform an experiment in the "real world" -- so we resort to a model, such as a scale model of an airplane in a wind tunnel. With a model, we can simulate what would happen in the real world, and perform many experiments -- for example, subjecting our model airplane to various air currents and forces -- and learn how it behaves. We can introduce uncertainty into our experiments using devices such as a coin toss, dice roll, or roulette wheel. A single experiment that involves a coin toss may not tell us very

much, but if we perform a simulation that consists of *many* experiments or trials, and collect statistics about the results, we can learn quite a lot.

If we have the skills and software tools needed to create a mathematical model of a project or process on a computer, we can perform a simulation with many trials in a very short time, and at very low cost. With such advantages over experiments in the real world, it's no wonder that computer-based simulation has become so popular. For business models, Microsoft Excel is an ideal tool for creating such a model -- and simulation software such as Frontline Systems' [Risk Solver Pro](#) or [Risk Solver Platform](#) can be used to get maximum insight from the model.

Monte Carlo Simulation and Quantitative Risk Analysis

Named after the city in Monaco famed for its casinos and games of chance -- is a powerful mathematical method for conducting quantitative risk analysis. Monte Carlo methods rely on random sampling -- the computer-based equivalent of a coin toss, dice roll, or roulette wheel. The numbers from random sampling are "plugged into" a mathematical model and used to calculate outcomes of interest. This process is repeated many -- typically thousands of -- times. With the aid of software, we can obtain statistics and view charts and graphs of the results. After you have gone through this short risk analysis tutorial, we recommend you go through our [Monte Carlo simulation tutorial](#).

Monte Carlo simulation is especially helpful when there are several different sources of uncertainty that interact to produce an outcome. For example, if we're dealing with uncertain market demand, competitors' pricing, and variable production and raw materials costs at the same time, it can be very difficult to estimate the impacts of these factors -- in combination -- on Net Profit. Monte Carlo simulation can quickly analyze thousands of 'what-if' scenarios, often yielding surprising insights into what can go right, what can go wrong, and what we can do about it.

Risk Management and Simulation Optimization

Simulation Optimization goes one step further than just helping us understand risk to allow us to make better decisions taking into account that risk. We do this by building a model where for each decision choice we run a Monte Carlo simulation, record the results and then continue to test additional decisions until we reach an optimal solution. Once you become familiar with simulation and Monte Carlo simulation, you'll most likely want to learn more about [simulation optimization](#).

Risk Management - Useful Tools and Techniques

In this section, the tools and methodologies that you can use during various phases of managing a risk are briefly described.

Risk Identification

There are many tools and techniques for Risk identification. Documentation Reviews

- Information gathering techniques
 - Brainstorming
 - Delphi technique – here a facilitator distributes a questionnaire to experts, responses are summarized (anonymously) & re-circulated among the experts for comments. This technique is used to achieve a consensus of experts and helps to receive unbiased data, ensuring that no one person will have undue influence on the outcome
 - Interviewing
 - Root cause analysis – for identifying a problem, discovering the causes that led to it and developing preventive action
- Checklist analysis
- Assumption analysis -this technique may reveal an inconsistency of assumptions, or uncover problematic assumptions.
- Diagramming techniques
 - Cause and effect diagrams
 - System or process flow charts
 - Influence diagrams – graphical representation of situations, showing the casual influences or relationships among variables and outcomes
- SWOT analysis
- Expert judgment – individuals who have experience with similar project in the not too distant past may use their judgment through interviews or risk facilitation workshops

Risk Analysis

Tools and Techniques for Qualitative Risk Analysis

- Risk probability and impact assessment – investigating the likelihood that each specific risk will occur and the potential effect on a project objective such as schedule, cost, quality or performance (negative effects for threats and positive effects for opportunities), defining it in levels, through interview or meeting with relevant stakeholders and documenting the results.

- Probability and impact matrix – rating risks for further quantitative analysis using a probability and impact matrix, rating rules should be specified by the organization in advance. See example in appendix B.
- Risk categorization – in order to determine the areas of the project most exposed to the effects of uncertainty. Grouping risks by common root causes can help us to develop effective risk responses.
- Risk urgency assessment - In some qualitative analyses the assessment of risk urgency can be combined with the risk ranking determined from the probability and impact matrix to give a final risk sensitivity rating. Example- a risk requiring a near-term responses may be considered more urgent to address.
- Expert judgment – individuals who have experience with similar project in the not too distant past may use their judgment through interviews or risk facilitation workshops.

Tools and Techniques for Quantities Risk Analysis

- Data gathering & representation techniques
 - Interviewing–You can carry out interviews in order to gather an optimistic (low), pessimistic (high), and most likely scenarios.
 - Probability distributions– Continuous probability distributions are used extensively in modeling and simulations and represent the uncertainty in values such as tasks durations or cost of project components\ work packages. These distributions may help us perform quantitative analysis. Discrete distributions can be used to represent uncertain events (an outcome of a test or possible scenario in a decision tree)
- Quantitative risk analysis & modeling techniques- commonly used for event-oriented as well as project-oriented analysis:
 - Sensitivity analysis – For determining which risks may have the most potential impact on the project. In sensitivity analysis one looks at the effect of varying the inputs of a mathematical model on the output of the model itself. Examining the effect of the uncertainty of each project element to a specific project objective, when all other uncertain elements are held at their baseline values. There may be presented through a tornado diagram.
 - Expected Monetary Value analysis (EMV) – A statistical concept that calculates the average outcome when the future includes scenarios that may or may not happen (generally: opportunities are positive values, risks are negative values). These are commonly used in a decision tree analysis.
 - Modeling & simulation – A project simulation, which uses a model that translates the specific detailed uncertainties of the project into

their potential impact on project objectives, usually iterative. Monte Carlo is an example for a iterative simulation.

- Cost risk analysis - cost estimates are used as input values, chosen randomly for each iteration (according to probability distributions of these values), total cost will be calculated.
- Schedule risk analysis - duration estimates & network diagrams are used as input values, chosen at random for each iteration (according to probability distributions of these values), completion date will be calculated. One can check the probability of completing the project by a certain date or within a certain cost constraint.
- Expert judgment – used for identifying potential cost & schedule impacts, evaluate probabilities, interpretation of data, identify weaknesses of the tools, as well as their strengths, defining when is a specific tool more appropriate, considering organization's capabilities & structure, and more.

Risk Response Planning

- Risk reassessment – project risk reassessments should be regularly scheduled for reassessment of current risks and closing of risks. Monitoring and controlling Risks may also result in identification of new risks.
- Risk audits – examining and documenting the effectiveness of risk responses in dealing with identified risks and their root causes, as well as the effectiveness of the risk management process. Project Manager's responsibility is to ensure the risk audits are performed at an appropriate frequency, as defined in the risk management plan. The format for the audit and its objectives should be clearly defined before the audit is conducted.
- Variance and trend analysis – using performance information for comparing planned results to the actual results, in order to control and monitor risk events and to identify trends in the project's execution. Outcomes from this analysis may forecast potential deviation (at completion) from cost and schedule targets.
- Technical performance measurement – Comparing technical accomplishments during project execution to the project management plan's schedule. It is required that objectives will be defined through quantifiable measures of technical performance, in order to compare actual results against targets.
- Reserve analysis – compares the amount of remaining contingency reserves (time and cost) to the amount of remaining risks in order to determine if the amount of remaining reserves is enough.

- Status meetings – Project risk management should be an agenda item at periodic status meetings, as frequent discussion about risk makes it more likely that people will identify risks and opportunities or advice regarding responses