



Financial Risk Modeling

"If you don't know for sure what will happen, but you know the odds, that is risk. If you don't even know the odds, that is uncertainty."

-Frank Knight, 1921

Risk management is an emerging area that has gained significant importance in recent times. Turning a blind eye to risk measurement and management can erode the profitability of organizations (*See case studies*).

There are a variety of risks an organization faces, not all of which can be modeled - business risk, financial risk, event risk, war risk, project risk, country risk, and even, risk risk (the risk of being unaware of other risks!). It is important to identify, and measure risks so that they can be

- **Managed** (by developing indigenous strategies) or
- **Hedged** (using available financial instruments/processes) or
- **Transferred** (by insuring)

Financial risk modeling is the practice of measuring risks in various domains of finance viz. financial markets, banking, insurance etc. It is the most important part of pricing financial instruments and also helps in regulation of financial activities like investment banking, and lending. Financial risks can be classified broadly into the following categories:

1. Market Risk
2. Credit Risk
3. Operational Risk

Market Risk is the change in value of assets due to changes in the underlying economic factors such as interest rates, foreign exchange rates, macroeconomic variables, stock prices, and commodity prices. **All economic entities that own assets face**



Case Studies

[Not Just One Man - Barings](#)

[Financial risk management -Case studies with SKF and Elof Hansson](#)

[Lessons from the Collapse of Hedge Fund, Long-Term Capital Management](#) (by David Shirreff)

[Modeling Operational Risk at ANZ](#)

More Resources

- [Credit Risk Modeling](#)
- [Operational Risk Research Forum](#)
- [Derivatives resources](#)
- [Bank for International Settlements](#)

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We provide decision-making

market risk. For example, bills receivable of software exporters that are denominated in foreign currencies are exposed to exchange rate fluctuations; while value of bonds/government securities owned by investors depend on prevailing interest rates. Organizations with huge exposures, either have a dedicated treasury department, or outsource market risk management to banks. The role of modeling in measuring market risk is to **forecast the changes in the economic factors**, and assess their impact on the asset value. The most popular measure for expressing market risk is Value-at-Risk, which is 'the maximum loss' from an unfavorable event, within a given level of confidence, for a given holding period. Various financial instruments like options, futures, forwards, swaps etc. can be used effectively to hedge the market risk. Availability of huge data on various markets has facilitated the development of many sophisticated models.

Credit Risk is the change in value of a debt due to changes in the perceived ability of counterparties to meet their contractual obligations (or credit rating). Also known as **default risk or counterparty risk**, credit risk is faced by lending institutions like banks, investors in debt instruments of corporate houses, and by parties involved in contractual agreements like forward contracts. There are independent agencies that assess the credit risk in form of credit ratings. Credit rating is an opinion (of the credit rating agency) on the ability of the organization to perform its contractual obligations (pay the principle and/or interest of the loan) on a timely basis. Each level of rating indicates a probability of default. International credit rating agencies (like Moody's, Fitch, and S&P) use quantitative models along with their experience to predict the credit ratings. Credit scoring models of banks and lending institutions use stock prices (if available), financial performance and sector specific data, and macroeconomic forecasts to predict the credit rating. Although credit ratings for retail lending are not available, credit scoring models for individuals are gaining popularity. **Credit risk can be transferred using credit derivatives, and also by securitization.** An attempt by a consortium of international banks (Basel Accords) to set regulatory standards for lending institutions has led to development of better and robust credit assessment models.

Operational Risk is defined as the risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events. In this sense all organizations face operational risk. But for a financial institution/bank operational risk can be defined as the **possibility of loss due to mistakes made in carrying out transactions** such as settlement failures, failures to meet regulatory requirements, and untimely collections. As of today, there is neither a concept nor a model for measuring operational risk that has gained acceptance by financial engineers.

solutions to improve operational efficiency and business responsiveness. Our consulting services employ our strengths in industry knowledge, conceptual rigor, and information technologies. Developed using concepts from decision theory; our solutions use robust optimization, simulation, and statistical engines adapted to our client's focus areas.

DecisionCraft Services

[Business Diagnostics](#)

We analyze business processes and transactional data to identify underlying patterns, unravel hidden relationships and recommend areas for improvement that can improve ROI and reduce costs.

[Predictive Analytics](#)

We use historical data intelligently to develop a view of future market trends and help our clients focus on the right audiences thereby developing their competitive edge.

[Forecasting](#)

We use advanced time-series and regression techniques for forecasting behavior of critical business variables that allows our clients to plan for their resources intelligently.

There have been efforts by international banks, and financial institutions to indigenously develop models, none of which are available in public domain. **Till date insurance is the only avenue to manage (transfer) operational risk.** Due to absence of sound techniques, not many insurance companies offer cover for operational risk.

	Measurement Models	Manage/ Hedge/Transfer
Market Risk	Nelson-Seigel Svensson Model, Cubic B-Spline, Cox, Ingersoll & Ross Model, Vasicek Model, Black Kara, Riskmetrics	Derivatives (Options, Futures, Swaps etc.)
Credit Risk	Structural Models - Black & Scholes, Merton Model, Black & Cox, Geske, Delianedis & Geske Reduced form Models - Litterman & Iben, Jarrow & Turnbull, Duffie & Singleton Products - KMV, Creditmetrics, Credit Portfolio View, Credit Risk+, Loan Analysis System etc.	Credit Derivatives, Securitization
Operational Risk	Score card, Simulation, Causal Modeling etc.	Insurance

Next Issue: [Contact Center Analytics](#)
 Previous Issue: [Workforce Planning and Scheduling](#)