

Cash-Flow-at-Risk (CFaR) Model - a Useful Tool for Risk Management in Corporate



Long-term financial modelling is one of the key challenges for the corporate finance function in any company. The future is embedded with a host of uncertainties. Financial performance is contingent upon a host of externalities which are beyond your control, be it at the macro levels (exchange rates, crude prices, interest rates, tax rates inflation) or revenue/cost drivers internal to the company (asset-liability management, wage hikes, attrition, productivity, equipment utilisation, market share etc). In such a scenario it becomes imperative to understand whether there are more scientific ways to forecast such risks and their likely impact on the company. Cash-flow-at-risk (CFaR) models are one such mechanism to grapple with this challenge. Read on...

Definition

Cash Flow-at-Risk (CFaR) is mathematical measure that tries to estimate scenarios where

your company could potentially land in a zone of cash flow shortage, and the likelihood of the same. It is essentially the cash flow-equivalent of the Value-at-Risk-measure that is used by a majority of financial firms.¹

As compared to VaR, which captures the potential change in a portfolio's value on an aggregate basis, in line with attendant change in quantum of market risks, CFaR as a measure is more geared towards helping the stakeholders understand the likely variation in *Operating Cash Flows* due to market



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¹ <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.629.967&rep=rep1&type=pdf>

Risk Management

driven factors.² The underlying philosophy is that it is cash flow which is king from an organisational standpoint, as it helps the company meet its operational and financial obligations such as debt servicing.

Rationale

Companies need flexible risk models, which take into consideration the operating risk. The challenge is to model how market price and sales volumes changes would impact future profits. Instead of considering a string of certain and constant cash flows, one would need to model the uncertain cash flows, which can change because of any of the underlying factors.

Imagine a situation where the project finance team of a debt ridden steel company is in discussion with a consortium of bankers for the 5:25 flexible structuring scheme. 5:25 scheme now allows bankers to fix a longer amortisation tenure for loans to the infra/core industries projects, for say 25 years, based on the economic life/concession period of the project, with periodic refinancing, say every 5 years. Since long term funds are a constraint for bankers due to Asset Liability Management (ALM) issues, they would want to understand the risks surrounding the borrower's ability to make the scheduled bullet payments over the next 25 years.

In course of the Corporate Debt Restructuring (CDR) discussions, let us consider the insights presented by the steel company during a meeting with bankers.

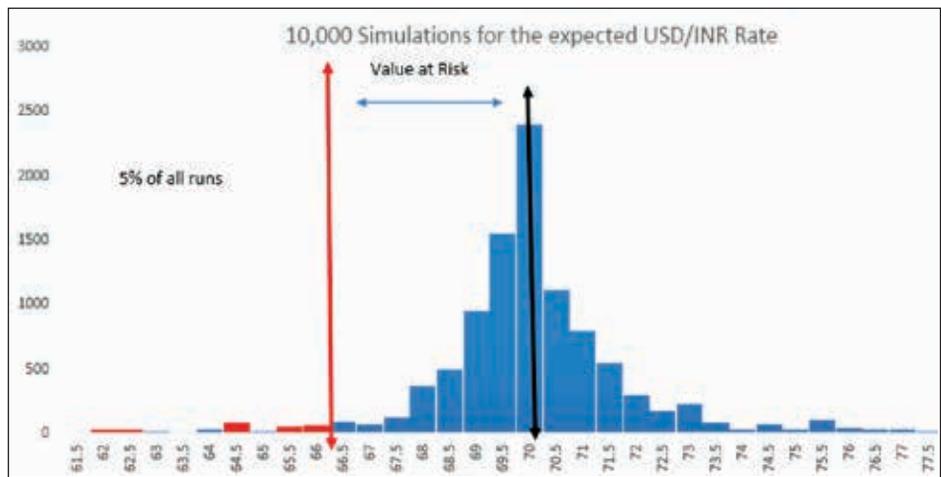
"While we continue to be optimistic about our growth plans, increased volatility in commodity prices would imply that there is a 35% probability that we will not be able to meet our planned growth rates while keeping financial ratios at acceptable levels. This can be reduced to 10% if we increase our longer-term volume of sales that will be made at fixed prices vis-- spot prices."

It is here that the Cash Flow at Risk (CFaR) model will help the company mitigate its aggregate financial risk exposures. These can provide invaluable inputs to the company's senior management in making decisions such as how to go about contracting for both purchasing and sales, hedging, asset mix in strategic portfolios, optimisation of assets utilisation, decisions to make/buy, capital budgeting and the overall financial structure with liquidity management.

Illustration

Let us consider the example of a company which prepares its Annual Business Plan on the basis of USD/INR rate of 70 for the forthcoming year. The company which exports cars out of India is likely to earn an EBITDA (Earnings before Interest, Taxation, Depreciation and Amortisation) of INR 500 mn.

The application of Value at Risk can be applied as follows :



However, once we apply CFaR model, we analyse the results of 10,000 simulations and find that the expected profit of INR 500 mn, may get translated into a loss of INR 100 mn, if the USD/INR rate of 70 falls to 66.5.

Thus its maximum loss caused by movements in forex markets can be INR 600 million given a confidence interval of 95%. In 5% of the cases, the loss might be higher than that.

But since we are sticking to 95% limits, we can ignore the same.

² <http://people.stern.nyu.edu/adamodar/pdfiles/valrisk/ch7.pdf>

Risk Management

However, it is certainly better to go by a defined range rather than an absolute number.

There are essentially 3 takeaways if a corporate were to implement the CFaR model.

Key Takeaway - 1. Likely Impact on Liquidity?

To illustrate the insights that can be obtained, the models can be used to gauge whether Cash from operations (plus retained cash) will be sufficient to meet the cash needs. Thus the measurement centres on the forecasted levels of profitability (e.g. EBITDA, or earnings before interest, taxes, depreciation, and amortisation), cash flow and earnings. Since cash is the most crucial item for the company's operations and its shareholders, the primary metric is operating cash flow—hence the generic name, cash flow at risk.

Insights can be as follows.

'Expected consolidated cash at the end of FY 27 is USD 350 mn. There is only a 10% chance that it will be above USD 350 mn, but there is a 90% level of confidence that it will not be worse than -\$ USD 350 mn. It is only 40% likely that the closing cash will be negative'

Key Takeaway -2. The Portfolio Risk Matrix and its constituents?

The company's senior management is often interested in the "why?" as much as the "what"?

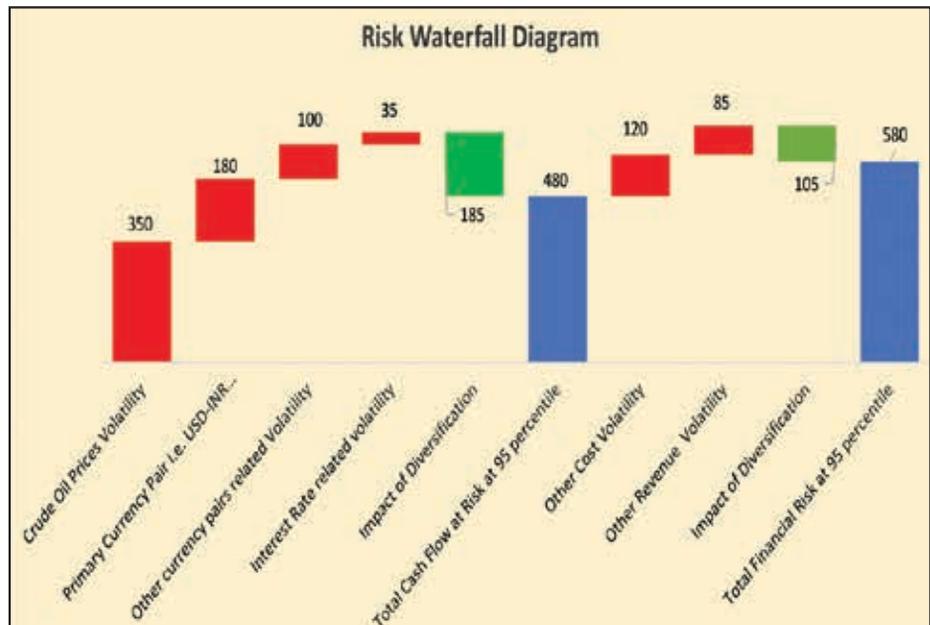
- How the aggregate risk compared with that at the individual item level?
- Are there risk elements *inter-se* that offset each other (say if a company has Accounts Payables due to imports of cooking coal and Accounts Receivable due to export of finished steel, both being in the same currency i.e. USD?. In other cases, the model tries to mathematically

compute the correlation between different asset classes and thus reduce risk, which needs to be hedged through an instrument, on an overall basis.

- Is the quantum of risk directly proportional to anticipated changes in business volumes?

The CFaR at 95th percentile can be disaggregated item-wise and thus provide useful insights for corporate boardroom discussions.

Risk Waterfall Diagram³



Particulars	Amount (mn \$)
Crude Oil Prices Volatility	350
Primary Currency Pair i.e. USD-INR Exchange Rate related Volatility	180
Other currency pairs related Volatility	100
Interest Rate related volatility	35
Impact of Diversification	(185)
Total Financial Risk at 95 percentile	480
Other Cost Volatility	120
Other Revenue Volatility	85
Impact of Diversification	(105)
Total Cash Flow at Risk at 95 percentile	580

³ <http://www.mckinsey.com/business-functions/risk/our-insights/strategic-commodity-and-cash-flow-at-risk-modeling-for-corporates>

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Interpretation

At 95% confidence, we can state

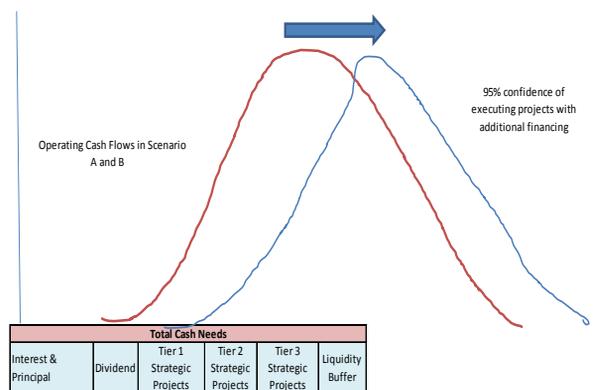
- The volatility in crude prices alone will not contribute to more than 350 mn\$ of the gap.
- Since the company imports machinery as well as coking coal, calibrated in USD, the volatility will in itself not cause the gap to be more than 180 mn\$.
- Since it exports steel products majorly to the European as well as Japanese markets, fluctuations in rates for Euro and Yen will in itself not contribute to more than 100 mn\$ of the volatility.
- Since the company has raised a mix of USD as well as INR denominated loan, being pegged against Libor and SBI base rates, respectively, fluctuations in this will not cause more than 35 mn\$ of the volatility.
- The above cited factors being often having a correlation less than 1, i.e. both being 'bad' at the same time, they tend to offset each other. The cumulative impact of diversification is 185 mn\$.
- Fluctuations in revenue/cost drivers at the operational level will increase volatility by 120 mn\$ and 85 mn\$ respectively.
- The above cited factors being often having a correlation less than 1, i.e. both being 'bad' at the same time, they tend to offset each other. The cumulative impact of diversification is 105 mn\$.
- Thus the company stares at a probable cash flow at risk of 580 mn\$.

Key Takeaway -3. How will the risk drivers impact decision making at the strategic level?

One of the most powerful utilities provided by the CFaR model is indicating how the company's risk trajectory in projected performance can be influenced by its financing and strategic choices.

The CFaR model key focus is on "what ifs" and impact of alternate strategies rather than on pure aggregation and monitoring.

- What if the company delays capital expenditure?
- What if it alters the hedging or contracting strategy?
- What if the macro-economic drivers such as crude or exchange rates worsen?
- What if the company changes the Debt: Equity in the proposed financing mix?
- What if the benefits envisaged from the proposed operational transformation do not arise as expected?

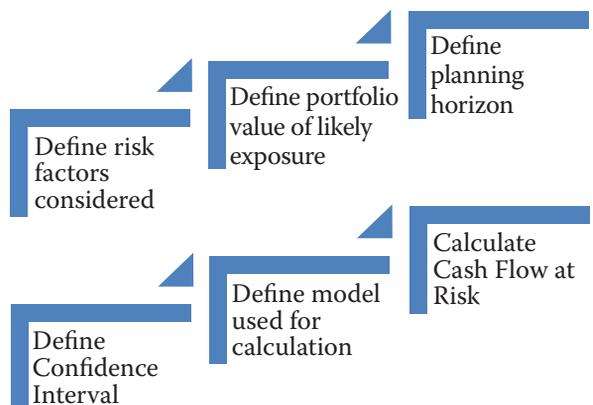


The shift represents the impact of additional refinancing that the company is planning to raise from bankers

The shift in the operating cash flows is the impact of the company executing the additional capex projects on raising additional funds.

Basic Calculation Methodology

The steps can be enumerated in the table below:



Define risk factors considered	Forex Risk, USD/INR
Define portfolio value of likely exposure	USD 100 mn
Define planning horizon	12 months
Define Confidence Interval	90%
Define model used for calculation	Historic simulation with 10,000 runs
Calculate	Result will be a range, say 65-70, in which USD/INR is likely to be

Thus, you can run 10,000 simulations for the expected USD/INR rate in the next 12 months. This can lead to a two-sided confidence interval, where you can predict, for a given probability, say 90%, a range in which the exchange rate is likely to be. This would be far better than predicting a single number for the exchange rate, which may or may not hold good.

Mathematically, we express it as

$$\text{CFaR}(\alpha, T) = x$$

Thus the specific cash flows series will not vary by an amount more than 'x' for a given confidence level of α and given time period of T days.

Mapping future cash flows across interdependent paths

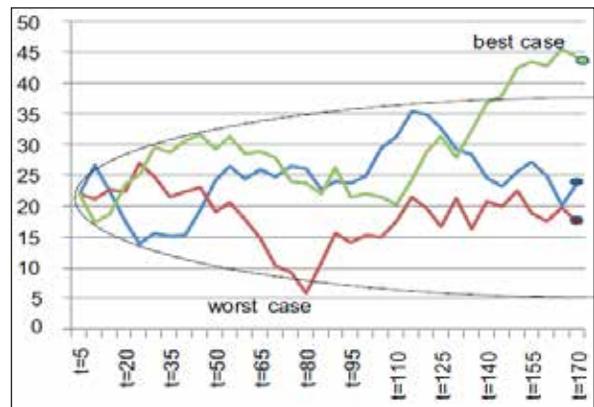
CFaR model calculations are essentially based on the variance covariance matrices, historical simulations and Monte Carlo simulations.⁴



Using stochastic processes (having a random probability distribution that may be analysed statistically but may

not be predicted precisely), we simulate how factors such as Interest Rates, Currency Rates and Raw Material Prices could develop over time.

Based on the correlation and conditional probabilities involved, we can arrive at integrated scenarios for gauging the integrated impact of the risk factors in the planning horizon. Thus we can plot the range in which our cash flows are likely to be across the Base, Pessimistic and Optimistic Cases, represented by the green, blue and red lines in the diagram below :



Summing Up

In traditional budgeting and financial planning approaches, we essentially look at absolute numbers. As compared to that, in CFaR, we are now looking at the distributions and the random variables, many of which are macro factors which are way beyond our control. Thus the quality of risk management in terms of the accuracy of our cash flow forecasts is enhanced significantly.

CFaR model holds great promise for companies which have a significant exposure to external market risks, be it commodity intensive companies, energy companies or the ones who take up long term infrastructure projects with significant gestation period. CFaR as a risk statistic can help the corporate finance team understand how to manage liquidity risk in relation to the entity level debt capacity. By helping corporates gain a clear insight into their exposures embedded in their treasury, trading, banking and operations activities, it helps them formulate the optimum risk management plan, lower volatility in Earnings per Share and increase the efficiency of the strategic outline. ■

⁴ https://ocw.mit.edu/courses/mathematics/18-s096-topics-in-mathematics-with-applications-in-finance-fall-2013/lecture-notes/MIT18_S096F13_lecnote7.pdf