

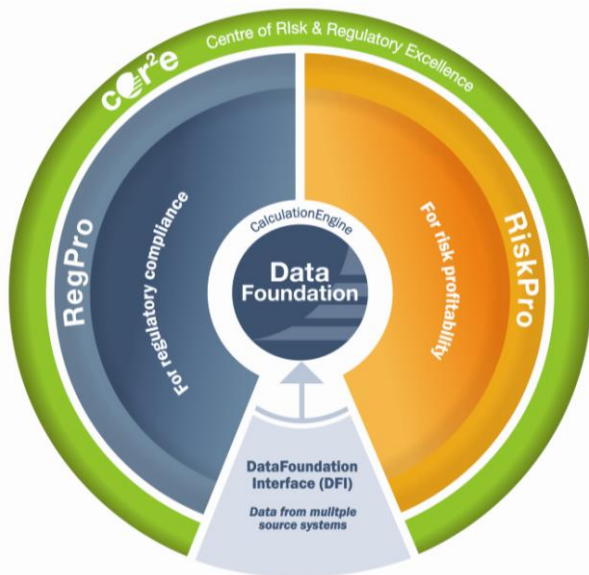
Solution: Credit Risk

local knowledge global solutions

This datasheet describes the FRSGlobal RiskPro Credit Risk solution

Introduction

As a result of the credit crunch, the global financial services industry is faced with increased and more complex regulation and a call for better risk management so that the market may be renewed and become stable. Better data management will provide better **internal** management and detailed reporting for the Board as well as information that is critical to the growth and stability of the global market to the **external** Regulators.

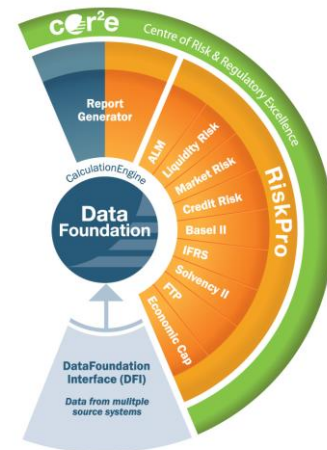


The FRSGlobal solution range

FRSGlobal provides global risk and regulatory compliance solutions on a unified platform through a combination of modules from **RegPro** and **RiskPro** - all fully supported by the FRSGlobal Centre of Risk & Regulatory Excellence (CoR²E).

- The **RegPro** modules are designed to meet global regulatory reporting requirements
- The **RiskPro** modules are designed to meet risk management and profitability analysis and operational risk requirements
- FRSGlobal solutions share a unified platform with DataFoundation risk and regulatory data repository, and CalculationEngine for complex calculations.

RiskPro



RiskPro provides unified risk and profitability analysis. It covers a broad scope and depth of financial analysis, ensuring consistency of results and reducing the cost of analysis.

RiskPro has extensive financial product coverage, from saving accounts, complex loans, insurance instruments to exotic options and structured products.

RiskPro covers value and exposure analysis for all types of methods (fair value, nominal, NPV, observed value, amortised cost, various discounting methods etc), duration, key rate duration, sensitivity measures, various types of gap analysis, price and volatility shift, and VaR (parametric, historical simulation, Monte Carlo).

RiskPro solutions provide the user with the power of dynamic simulation – which allows evaluation of potential decisions in a “*what-if*” environment, and as a consequence enables highly quantified strategic decisions to be made with confidence.

Risk management solutions can no longer exist in silo form – risk management and regulatory reporting is interlinked

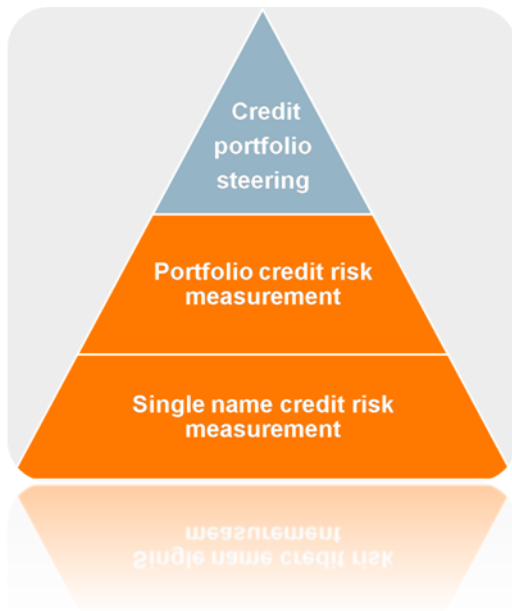
For more information on the FRSGlobal risk solution – visit www.frsglobal.com

What is Credit risk?

Credit risk is the risk of financial loss due to an unexpected deterioration of a counterparty's credit quality.

Credit risk has played a significant role in the majority of financial crises to date, which makes it a very important risk to be able to measure and manage.

Credit risk management starts with an assessment of credit quality (i.e. rating, probability of default, loss given default) and credit exposure at the counterparty level. Sound single-name credit risk measurement is the necessary foundation stone for building institution wide credit risk measurement and management methodologies.



Portfolio credit risk models aggregate the building blocks of single name credit risk measures to obtain a portfolio loss distribution, taking into account interdependencies between counterparties. Various portfolio risk measures can then be derived from the portfolio loss distribution and used for economic and regulatory capital purposes, pricing, provisioning, as well as for general portfolio steering. The two most important risk metrics are expected loss and some measure of unexpected loss, for example Credit Value at Risk.

Credit exposure

Credit exposure calculations concern themselves with the question 'How much would I lose if the counterparty defaults?'

There is a distinction between current and potential exposure. Current exposure looks at the exposure at the current date. It does not have a time dimension.

However, losses from credit risk can evolve over a relatively long time and the exposure may change over time. This could be due to changes in risk factors (e.g. yields, FX rates), because of scheduled repayments or because of new business generated with the counterparty. Potential exposure represents this range of outcomes rather than a single snapshot estimate.

Current exposure can be broken down into its constituent components, i.e. gross exposure, credit enhancements and net exposure. Potential exposure can be calculated using add-ons.

Both current and potential exposures can be grouped according to various attributes and used to for general credit control, such as limit, concentration and strategy management.

Moreover they become inputs in credit risk portfolio models as well as regulatory capital calculations.

Expected loss

Expected loss is the average level of loss a bank is exposed to. For a single contract or counterparty it is calculated as follows:

$$EL = EAD \times PD \times LGD,$$

where PD is the probability of default, LGD is the loss given default and EAD is the exposure at default.

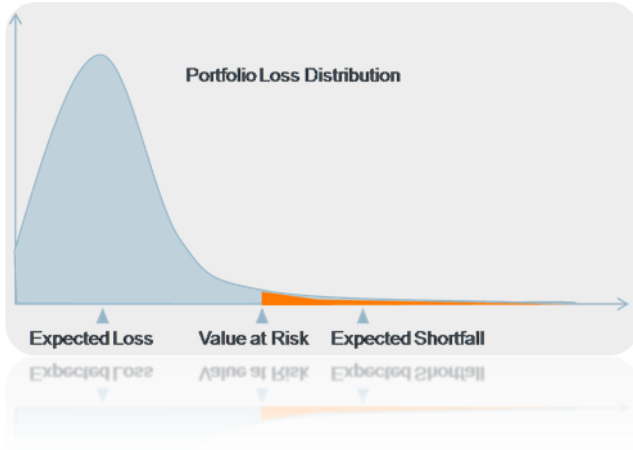
The expected loss of a portfolio is the sum of the expected losses of the contracts within the portfolio, or, if portfolio loss distribution is available, it is the mean of this distribution.

Unexpected loss: Credit Value at Risk

Credit Value at Risk is the most widely used risk measure derived from the portfolio loss distribution. It measures the maximum loss on an asset or a portfolio over a given time (usually a year for credit risk) at a specified confidence level (e.g. 95 percent, 99 percent).

Credit Value at Risk is often criticised for violating the sub-additivity property, that is the sum of CVaRs of portfolio subsets is not always greater or equal to the CVaR of the whole portfolio. An alternative measure, which not only possesses the desired sub-additivity property but also

carries information about the distribution tail, is Expected Shortfall. It is defined as the average size of losses exceeding CVaR.



FRSGlobal solution to Credit risk

Using the FRSGlobal RiskPro Credit Risk module, the following elements can be considered and analysed:

- Risk mitigation techniques considered include close-out netting, collateral and guarantees. Both, collateral and a guarantee, can be given for one specific exposure or for all the exposures of a given counterparty. A given contract can have any number of pieces of collateral (or guarantees). This gives the financial institution the freedom to model any contract structure, whether from the corporate, trading or retail business. Close-out netting is also recognised
- Credit lines are included in the analysis. The expected usage of the undrawn part of the credit line can be modelled.
- Besides assets, off-balance sheet positions, that have positive replacement value, are integrated in the credit risk computations. Netting agreements and positions with a negative replacement value are also included in the exposure computation.
- The counterparty structure allows drill down to the individual subsidiaries of an organisation. The full legal structure can be implemented with distinction between branches and legally independent subsidiaries. Subsidiaries can be consolidated

based on the percentage ownership. Flexible analysis by country is also available.

- Consistency between market and credit risk analysis is guaranteed through the following aspects:
 - Scenarios for the potential exposure calculation can be taken directly from the market risk scenario simulation
 - Credit risk factors for Credit VaR can be the same or form a subset of market risk factors.
- **Financial Product / Instrument Coverage:** All credit exposure calculations are applied consistently for any type of financial product/instrument from deposits to exotic options. Specific instruments for credit risk include collateral, guarantees, credit lines, credit line opening, credit default swaps, total return swaps and credit spread options.

FRSGlobal RiskPro functionality

The FRSGlobal RiskPro Credit Risk module provides single name and portfolio credit risk analysis by means of three components:

- Current and Potential Exposure
- Expected (Credit) Loss
- Credit Value at Risk

Current and Potential Exposure

FRSGlobal RiskPro Credit Exposure capabilities range from simple to advanced:

- Current Exposure
- Advanced Current Exposure
- Potential Exposure with Add-Ons
- Potential Exposure Scenario Simulation
- Potential Exposure Monte Carlo.

 **Current Exposure:** FRSGlobal RiskPro provides a static view of credit exposure. The net exposure is broken down into its components, taking into account

risk mitigation: Gross exposure; Close-out netting; Collateral; Guarantee; Net recovery rate.

Book value as well as net present value (MTM) results can be calculated. Each exposure can be compared to the relevant limit.

The reporting is done on MS Excel.

- **Advanced Current Exposure:** same as above but with reporting on a BusinessObjects (OLAP tool) on the **RiskPro** global analysis database (GADB), which allows a more powerful handling of the reports than MS Excel

- **Potential Exposure with Add-ons:** FRSGlobal RiskPro provides a quick and regulatory-approved view of potential exposure. A safety margin (the add-on) is added to the current exposure to reflect future fluctuations of the exposure due to market price volatility.

The add-on is typically a function of the product type (e.g. interest rate, FX, equity) and maturity, and is expressed as a percentage of current exposure or notional amount. Regulatory values can be used but the institution can introduce its own dimensions and values too.

- **Potential Exposure Scenario Simulation:** FRSGlobal RiskPro simulates the evolution of the current exposure over time based upon a particular user-defined interest and exchange rate scenario. Credit risk mitigation is taken into account.

- **Potential Exposure Monte Carlo:** FRSGlobal RiskPro allows a dynamic Monte Carlo simulation for credit exposure. The yield curve evolution and the changes in exposure are simulated 'along the path'. Gross and net exposures are calculated, taking into account recovery. Summary exposure results provided include the average of maximum exposure per path and the maximum average exposure. It is possible to drill down to individual paths.

Expected Loss

FRSGlobal RiskPro provides probabilistic computations that result in the expected credit loss. Migration matrices model the migration and default probability per rating. The inputs are probability of default, loss given default and the exposure at default. The outputs can be seen in reports in the form of expected credit losses as well as credit risk NPV, where PDs are used to weight future cash flows.

Credit Value at Risk

FRSGlobal RiskPro offers two approaches, mark-to-market and default-mode, to calculate the portfolio loss distribution and hence various risk measures. The choice of approach depends on the type of portfolio, available data and resources.

The mark-to-market approach is largely based on the CreditMetrics methodology, but is extended and improved using more recent research. Rating upgrades and downgrades and their effect on portfolio value are taken into account in this approach. The mark-to-market approach requires simulation and hence broad data basis and is more resource intensive than the default-mode.

The default -mode approach is based on the CreditRisk+ methodology, but is also improved and extended using more recent research. Default-mode means that only default and non-default are considered as the possible states of credit quality.

The corresponding methodologies are described below.

- **Credit VaR Parametric:** Based on the CreditRisk+ methodology and calculated using an analytical solution based on the Fast Fourier Transform (FFT) technique. The effects of default correlations are incorporated by using default rate volatilities and sector analysis. The inputs required are credit exposures, sector decomposition, counterparty default rates, default rate volatilities and recovery rates. The result is the full loss distribution of any portfolio from which Credit VaR, Expected Shortfall and other measures are calculated.
- **Dynamic Credit VaR Monte Carlo:** The full credit loss distribution is obtained through a Monte Carlo simulation of ratings. The inputs are migration matrices, recovery rates, credit spreads and specific industry or country indices, which play a role in credit risk factors.

The Monte Carlo simulation generates different rating paths based on migration matrices, sensitivities to risk factors and correlations between the risk factors. FRSGlobal RiskPro supports two extensions:

- Multi-period rating migration simulation, which allows firms to take into account finer migration data. It also enables the tracking of time to default and hence enables the correct treatment of double default situations.
- Credit Risk NPV calculation using the Expected Loss approach, which uses PDs to weight future cash flows and does not require spreads per rating class.

Several rating systems, including in-house ratings, are supported.

More details are available on request info@frsglobal.com

Features and benefits of FRSGlobal RiskPro Credit Risk solution

Problem	FRSGlobal solution feature	Benefit to you
What will the losses be if tomorrow is a bad day? How volatile are the potential losses?	Credit Value at Risk: User-defined time horizon and confidence level	FRSGlobal RiskPro enables the assessment of portfolio risk distribution due to possible changes in the credit quality of borrowers.
How will the risk profile of the portfolio change if a certain strategy is employed?	Credit Value at Risk: User-defined strategy	FRSGlobal RiskPro allows firms to determine the impact of strategies and scenarios on the loss distribution of the portfolio.
What is the risk profile of different business units or regions?	Credit Value at Risk: Break-out reports by business unit or country	FRSGlobal RiskPro enables the examination of loss distributions for different subsets of a portfolio to identify potential areas for active portfolio steering.
How can I calculate full loss distribution with minimal data and resource requirements?	Credit Value at Risk: Parametric	The CreditRisk+ based methodology enables fast loss distribution computation with few inputs and is particularly suitable for large homogeneous portfolios.
What will my Credit Value at Risk be if rating downgrades increase by 50%?	Credit Value at Risk: Monte Carlo	The CreditMetrics based methodology takes into account rating migrations when calculating the portfolio loss distribution. Hence one can use a "stressed" migration matrix, for example with many more downgrades, to replicate economic downturn scenarios.
What will my credit exposure be if interest rates go up by x%?	Potential exposure with user defined scenarios	FRSGlobal RiskPro enables the simulation of credit exposure over time using a scenario of your choice.
How is my credit exposure distributed today between different subsidiaries of client X?	Current exposure with break out report using counterparty structure.	The counterparty structure within FRSGlobal RiskPro allows drill down to the individual subsidiaries of an organisation. The full legal structure can be implemented with distinction between branches and subsidiaries.
What is my maximum potential exposure in one year?	Potential exposure: Overall maximum exposure report	Potential exposure results can be summarised as maximum and average exposure for easy and concise management reporting.
What is the effect of specific credit risk mitigation techniques on my exposure?	Current exposure	The current exposure reports break the exposure down, showing the gross exposure and the impact on the exposure of close-out netting, collateral, guarantees and recovery separately.
What expected loss should I include in the pricing of every transaction?	Expected loss	Expected loss can be calculated at the transaction level to assist risk based pricing of products.

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