



## SAS® Risk Management for Banking

A powerful, integrated risk data infrastructure for measuring exposure and risk across all risk types and books of business

### What does SAS® Risk Management for Banking do?

SAS Risk Management for Banking supports a bank's risk management activities by delivering functionality for all major risk types, as well as data management and reporting. The solution allows business units to calculate risk measures – e.g., market, credit and ALM – independently and separately, as well as firmwide, using models and correlated aggregation techniques. The solution's integrated risk applications can be used together, individually or in any combination, enabling you to start in one area (e.g., market risk) and then expand usage to other areas (e.g., credit risk, firmwide risk or ALM) as needed.

### Why is SAS® Risk Management for Banking important?

SAS Risk Management for Banking's more advanced, integrated and scalable infrastructure is necessary for adequately protecting the bank, the financial industry, investors and other stakeholders. The solution provides a high-quality, integrated risk data infrastructure that enables banks to measure exposure and risk across all risk types and books of business. The solution also enables the distribution of incentives for consistent optimization of risk-adjusted returns throughout the organization.

### For whom is SAS® Risk Management for Banking designed?

The solution is designed primarily for the chief risk officer (CRO) and associated groups of risk analysts and power users.

SAS Risk Management for Banking is a complete, integrated and firm-wide solution for risk management in banking. It is based on SAS software's core functionality and covers the entire spectrum of risk types – including market, credit and liquidity risk.

In addition to allowing for interdependencies between risk types, the solution can aggregate interrelated risks on a firmwide level using state-of-the-art risk analytics. These analytics comprise a wide range of methods and models, along with simulation capabilities.

Based on the valuation and exposure calculation of the constituent instruments, the solution lets you calculate portfolio risks with respect to different risk measures – e.g., value-at-risk, expected shortfall, earnings-at-risk or liquidity-at-risk. You can also calculate economic capital for the bank's entire portfolio or at a user-defined cross-classification level, from which you can derive risk-adjusted performance measures.

In addition, the solution's portfolio optimization capabilities lay the foundation for identifying buy/sell strategies in order to attain portfolios with better risk-return characteristics.

### Key Benefits

- **Adopt an integrated risk management strategy** that meets all data, methodology and usability requirements and enables the effective distribution of key risk information across the enterprise to different user types.
- **Gain a comprehensive view of risk across risk types** by analyzing the risk/return profiles across all lines of business.
- **Customize models, analyses and reports on an ongoing basis** to adapt to changing business needs both today and in the future.
- **Support innovation** through the introduction of new risk measures and models in a fully transparent and auditable environment.
- **Extract, integrate and validate risk data from almost any source**, including market data providers, portfolio/loan accounting systems, trade capture systems, clearing systems, etc.
- **Get up and running quickly** with preconfigured models, methods and reports for market risk, credit risk, ALM and firmwide risk.
- **Achieve better investment performance** by optimizing investment strategies.
- **Take full advantage of current and future business opportunities** by reallocating capital and risk capacity.
- **Gain more control over, and ownership of, your risk data** via comprehensive data management capabilities, a banking-specific data model and prebuilt data management processes.
- **Lower your total cost of ownership** with an end-to-end solution that covers everything from data management to risk analysis to reporting.



## Solution Overview

SAS Risk Management for Banking includes a banking-specific data model, prebuilt data management capabilities and reporting functionality. These applications comprise the solutions:

- SAS® Asset and Liability Management for Banking.
- SAS® Credit Risk for Banking.
- SAS® Market Risk for Banking.
- SAS® Firmwide Risk for Banking.

## A Powerful Risk Engine

SAS High-Performance Risk, which includes SAS Risk Dimensions, provides powerful and versatile risk engine capabilities that underpin the analytical functionality of SAS Risk Management for Banking. This risk engine supports a wide range of risk analysis methods and provides a configuration and exploration user interface for both quantitative risk analysts and model builders. The risk engine can run in high-performance mode using in-memory grid computing technology that supports both single node and distributed processing modes.

## Risk Data Management

SAS Risk Management for Banking is an integrated risk management system that provides a banking-specific risk data model with preconfigured data flows. Existing data flows can be modified for a bank's specific conditions and data quality controls (for example, rules for handling bad data, unclassified data or data not fitting the model). Risk data management capabilities enable you to acquire and consolidate historical data from both internal and external sources for risk analysis and reporting. The solution also provides:

- **Risk data warehouse.** SAS Detail Data Store for banking serves as a single source of all the information for creating a risk data warehouse.

Sector Category	Sector Subcategory	Weierstrass Stable Panjer Recursion Value At Risk	Panjer Recursion Value At Risk	Saddle Point Value At Risk
	*	\$5,510,000.00	\$5,680,000.00	\$5,509,099.44
	*	\$5,930,000.00	\$5,090,000.00	\$5,929,802.97
CORPORATE LOAN	Corp Loan	\$4,920,000.00	\$4,920,000.00	\$4,915,818.41
	ELOC	\$1,080,000.00	\$1,080,000.00	\$1,084,978.81
	Loss	\$440,000.00	\$440,000.00	\$441,343.44
	*	\$430,000.00	\$430,000.00	\$426,657.70
MORTGAGE	ARM	\$60,000.00	\$60,000.00	\$65,868.64
	Refx	\$410,000.00	\$410,000.00	\$410,131.63
	*	\$890,000.00	\$890,000.00	\$879,809.55
RETAIL	Direct			
	Secured	\$40,000.00	\$40,000.00	\$27,800.29
	Direct			

*Gain a complete view of economic capital Web-based analysis and reporting*

- **Advanced data quality.** Data quality tools provide the ability to eliminate or reduce data inconsistencies.
- **Third-party integration.** Supports integration with third-party applications.
- **User security.** Enables creation and amendment of user security for access, authentication and authorization.
- **Audit functionality.** Enables creation and inquiry of automatic audit trails.

## Risk Reporting

Configure your own workflows and integrate daily and ad hoc advanced risk analytics procedures into your preferred environments using SAS Stored Processes. For example, you could integrate your reporting and analysis workflows into your desktop environment using SAS Add-In for Microsoft Office. In addition, SAS Risk Management for Banking includes a wide array of preconfigured reports and risk analysis workflows. The reporting framework includes sample reports, OLAP cubes and interactive analysis results for all solution components.

## Solution Components

### Asset and Liability Management

Determine the value of traditional balance-sheet instruments (e.g., loans and deposits) while factoring in embedded options (e.g., prepayment and withdrawal), as well as credit and liquidity risk. You can measure your organization's performance with the addition of Basel III liquidity ratios and monitoring standards, better business workflows for stress testing and reserves management, and improved cash flow management. You can also:

- Calculate key liquidity risk ratios, assessing your portfolio liquidity situation and liquidity hedging strategy.
- Assess fund transfer pricing with or without risk-based spreads (e.g., credit, liquidity and option-adjusted spreads), and calculate economic value.
- Perform advanced analysis across risk types, including stress testing and modeling liquidity risk, net interest income and economic value.

- Assess the effect of hedge instruments, and analyze optimal cash flow replication hedges.

### Credit Risk Management

Calculate and stress test credit exposures, taking into account the effect of netting and collateral. In addition, you can:

- Perform advanced simulation of potential future exposure.
- Calculate portfolio credit risk measures using advanced models, such as actuarial and reduced form stochastic transition matrix models.
- Optimize the credit portfolio using risk/return measures.

### Market Risk Management

With the market risk management component, you can value complex market instruments, including exotic derivatives; perform stress tests; and calculate VaR, expected shortfall and other risk measures using a variety of methods – e.g., historical, covariance and Monte Carlo simulation. In addition, you can:

- Decompose portfolio risk in additive risk contributions and analyze the relative importance of risk factors in determining portfolio loss.
- Perform back tests of the VaR model and determine the optimal portfolio by optimizing risk/return measures.

### Firmwide Risk Management

This component lets you calculate the firm's aggregate risk using either correlation matrices or correlated copula aggregations of marginal risk distributions. In addition, you can:

- Perform bottom-up, firmwide risk exposure calculations – taking into account the different risk type sensitivity of exposures – by a joint simulation of market and credit risk factors.
- Calculate risk-based performance of the firm based on the effect from both balance-sheet and off-balance-sheet items. Sample economic capital calculations are provided.

## Key Features

### Risk Data Management

- Risk data model with preconfigured data flows.
- Modification of existing data flows for organization-specific conditions and data quality controls (e.g., rules for handling bad data, unclassified data or data not fitting the model).
- Ability to acquire and consolidate historical data from internal and external sources for risk analysis and reporting.
- SAS Detail Data Store for banking, serving as a single source of all information for creating a risk data warehouse.
- Data quality tools that help reduce or eliminate data inconsistencies.
- Support for integration with third-party applications.
- Creation and amendment of user security for access, authentication and authorization.
- Enables the creation and inquiry of automatic audit trails.

### Risk Reporting

- SAS Stored Processes – Enables users to configure their own workflows and integrate daily and ad hoc advanced risk analytics procedures into preferred environments.
- A wide array of preconfigured reporting and risk analysis workflows.
- Report framework that includes sample reports, OLAP cubes and interactive analysis results for all application components. Sample reports include:
  - Asset and liability management:
    - Funds transfer pricing (with credit and option-adjusted spreads, capital costs and expenses).
    - Funding liquidity risk (cash flow gaps in stress scenarios and simulation).
    - Interest rate (repricing) risk (repricing cash flow gaps in stress scenarios and simulations).
    - Net interest income.
    - Economic value and fair value (under stress scenarios and simulations).
    - Cash flow replication/hedge optimization.
    - Enhanced cash flow mismatch report (FSA mandated).
  - Market risk management:
    - Portfolio valuation report.
    - Market risk VaR (using simulation).
    - Market risk VaR (using delta normal approach).
    - Portfolio optimization of trading book.
    - Portfolio sensitivity report.
  - Credit risk management:
    - Current exposure.
    - Potential future exposure (under a scenario or simulation).
    - Portfolio credit risk model VaR – actuarial approach.
    - Portfolio credit risk model VaR – transition matrix-based approach.
    - Credit portfolio optimization.
    - Incremental risk charge (IRC) for rating migration/default in trading book.
  - Firmwide risk:
    - Correlated and copula aggregation of VaR.
    - Firmwide VaR, economic capital and RAROC using joint simulation.
- A common reporting data model, SAS Risk Reporting Repository. Supports integration and reporting of enterprise risk measures and decomposed measures at the entity, business unit, geography or any other user-defined hierarchy.
  - Audit, change, archive and historization support.
  - Meets both current and future reporting requirements.

## SAS® Risk Management for Banking System Requirements

To learn more about SAS Risk Management for Banking, download white papers, view screenshots and see other related material, please visit [sas.com/riskmgmtbanking](http://sas.com/riskmgmtbanking).

For information on configurations and system requirements, please contact your local SAS sales representative.

## Key Features, continued

### Asset and Liability Management

- Value traditional balance-sheet instruments and their associated (off-balance-sheet) hedges, factoring in embedded options (e.g., prepayment and withdrawal, credit risk, etc. ).
- Fund transfer rates assessment, with or without risk-based spreads (e.g., credit spreads, liquidity spreads, option-adjusted spreads, capital costs and allocated overhead expenses). Includes the ability to calculate economic value with and without such spreads.
- Ability to perform advanced analysis across risk types, stress testing and modeling of funding liquidity risk, net interest income and economic value.
- Analysis and creation of optimal cash flow replication hedges.
- Calculation of Basel III liquidity risk measures: liquidity coverage ratio, net stable funding ratio.
- Calculation of counterbalancing capacity for liquidity hedging portfolios using assumptions on trade volumes, haircuts and repo activity.
- Enhanced modeling of deposits and facilities with separate schedules for payments and balance changes.

### Credit Risk Management

- Calculate and stress test credit exposures, taking into account the effect of netting and collateral.
- Perform advanced simulation of potential future exposure.
- Calculate portfolio credit risk measures using advanced portfolio credit risk models, such as actuarial models and reduced form stochastic transition matrix models.
- Optimize the credit portfolio using risk/return measures.

### Market Risk Management

- Ability to value complex market instruments, including exotic derivatives (e.g., basket CDS/ CDO, cash flow caplet/floorlet, equity swap, rainbow options).
- Ability to perform stress tests and calculate VaR, expected shortfall and other risk measures using a variety of methods (e.g., historical, covariance and Monte Carlo simulation).
- Decomposition of portfolio risk in additive risk contributions, and analyze the relative importance of risk factors in determining portfolio loss.
- Ability to back test the VaR model.
- Optimization of return/risk measures.

### Firmwide Risk Management

- Risk aggregation using either correlation matrices or correlated copula aggregations of marginal risk distributions.
- Bottom-up firmwide risk exposure calculations, taking into account the different risk type sensitivity of exposures, by a joint simulation of market and credit risk factors.
- Calculation of the firm's risk-based performance based on the effect from balance sheet and off-balance-sheet items. Sample economic capital calculations provided.