

Oracle Financial Services Market Risk Measurement and Management

User Guide

Release 8.0.6.0.0

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Oracle Financial Services Market Risk Measurement and Management User Guide: Release 8.0.6.0.0

Oracle Financial Services Market Risk Measurement and Management User Guide, Release 8.0.6.0.0

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DOCUMENT CONTROL

Version Number	Revision Date	Changes Done
1.0	Created August 2018	Captured updates for 8.0.6.0.0 release

This document provides a comprehensive knowledge about the user interface and functionalities in Oracle Financial Services Market Risk Measurement and Management, Release 8.0.6.0.0. The latest copy of this guide can be accessed from [OHC Documentation Library](#).

ABOUT THE GUIDE

This section provides a brief description of the scope, intended audience, related information sources, the organization of the user guide, and abbreviations used in the user guide. The topics in this section are organized as below:

- [Scope of the guide](#)
- [Intended Audience](#)
- [Documentation Accessibility](#)
- [Access to Oracle Support](#)
- [Related Information Sources](#)
- [How This Guide is Organized](#)
- [Abbreviations Used](#)

SCOPE OF THE GUIDE

Oracle Financial Services Market Risk Measurement and Management User Guide, Release 8.0.6.0.0, contains all the essential information required by a user to understand and make use of the functionalities in the application. It includes description of the system functions and capabilities, and details the step-by-step process for system access and use.

INTENDED AUDIENCE

Welcome to release 8.0.6.0.0 of the Oracle Financial Services Market Risk Measurement and Management Analytics User Guide. This manual is intended for the following audience:

- **Trading Desk Manager:** Monitors the performance of the investment and trading portfolios of a trading desk using varied tools.
- **Business Analysts:** Reviews the functional requirements and information sources, such as reports.
- **Manager-Finance and Manager-Risk:** Analyzes and evaluates output metrics, which will help to restructure the portfolio in accordance to business needs.
- **Administrator:** Manages system access, data load process, and setup data.

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RELATED INFORMATION SOURCES

You can access the below documents online from the Oracle Help Center (OHC) documentation Library for [OFS MRMM 8.0.6](#):

- Oracle Financial Services Market Risk Measurement and Management Release Notes, Release 8.0.6.0.0
- Oracle Financial Services Market Risk Measurement and Management Installation Guide, Release 8.0.6.0.0
- Oracle Financial Services Market Risk Measurement and Management Analytics User Guide, Release 8.0.6.0.0

You can access the OFS AAI documentation online from the documentation library for [OFS AAI 8.x](#):

- OFS Advanced Analytical Applications Infrastructure (OFS AAI) Application Pack Installation and Configuration Guide
- OFS Analytical Applications Infrastructure User Guide

The additional documents are:

- [OFS Analytical Applications Infrastructure Security Guide](#)
- [OFSAAI FAQ Document](#)
- [OFS Analytical Applications 8.0.6.0.0 Technology Matrix](#)

HOW THIS GUIDE IS ORGANIZED

This guide includes the following chapters:

- [Introduction to Oracle Financial Services Market Risk Measurement and Management](#)
- [Getting Started with OFS MRMM](#)
- [Overview of OFSAA Infrastructure Components](#)
- [OFSAA Rate Management – Currencies](#)
- [Holiday Calendar](#)
- [Application Preferences](#)
- [Business Configurations](#)
- [Instrument Valuation](#)

- [Market Risk – Historical Simulation](#)
- [Market Risk-Monte-Carlo Simulation](#)
- [Model Validation](#)
- [Annexure A: Details of Market Data](#)
- [Annexure B: Approval Workflow](#)
- [Annexure C: List of Instruments](#)
- [Annexure D: List of Models and Methods](#)
- [Annexure E: List of MR Reports](#)
- [Annexure F: Data Expectation](#)

ABBREVIATIONS

Abbreviation	Description
CAS	Cross Asset Server
CVA	Credit Valuation Adjustment
DM	Data Model
DRC	Default Risk Charge
DVA	Debit Valuation Adjustment
EE	Expected Exposure
ENE	Expected Negative Exposure
EOD	End of Day
EPE	Expected Positive Exposure
ES	Expected Shortfall
FRTB	Fundamental Review of Trading Book
FVA	Funding Valuation Adjustment
IMA	Internal Models Approach
IMCC	Internally Modelled Capital Charge
MRF	Modellable Risk Factor
MRMM	Market Risk Measurement and Management
NMRF	Non-Modellable Risk Factor

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Abbreviation	Description
OFSA	Oracle Financial Services Analytical Applications
OFSAI	Oracle Financial Services Analytical Applications Infrastructure
P&L	Profit and Loss
PFE	Positive Future Exposure
RF	Risk Factor
SES	Stressed Capital Add-on
VaR	Value at Risk

1 Introduction to Oracle Financial Services Market Risk Measurement and Management

This chapter provides an introduction to the Oracle Financial Services Market Risk Measurement and Management (OFS MRMM) application. This chapter includes:

- [Overview of OFS MRMM](#)
- [Process Flow](#)
- [Components of OFS MRMM](#)

1.1 Overview of OFS MRMM

Market Risk is the risk of losses, in on-balance sheet, and off-balance sheet positions arising from changes to factors, such as interest rates, currency exchange rates, equity prices, inflation, and so on. Banks and financial institutions must manage market risk from both, regulatory and non-regulatory perspectives. From a regulatory perspective, market risk stems from all the positions included in the banks trading book and from commodity, foreign exchange risk positions in the whole balance sheet.

OFS MRMM enables banks to accurately measure, evaluate, monitor and manage market risk. Additionally, it enables banks to proactively comply with the regulatory requirements of capital calculation as per the Internal Models Approach (IMA). This solution combines, OFSAA's deep expertise with the Numerix analytics ([Numerix Cross Asset Server](#) and [Numerix Oneview Enterprise Platform](#)), to ensure that all the critical elements of a market risk program from pricing, valuations, risk assessment, monitoring and management, stress testing to data governance, data storage, and final regulatory submissions are fully addressed.

OFS MRMM enables banks and financial institutions to comply with the latest market risk capital regulations, such as Fundamental Review of Trading Book (FRTB). MRMM uses Numerix Cross Asset Server 4.1.0 and Numerix Oneview Enterprise Platform 1.5. It includes the models and methods to price instruments, derive historical Value-at-Risk (VaR) and Counterparty Credit Risk measurements.

OFS MRMM includes the following integrated components:

- Instrument Valuation
- Market Risk - Historical Simulation
- Market Risk- Monte Carlo Simulation
- Model Validation

1.2 Process Flow

The process flow of OFS MRMM solution is as follows.

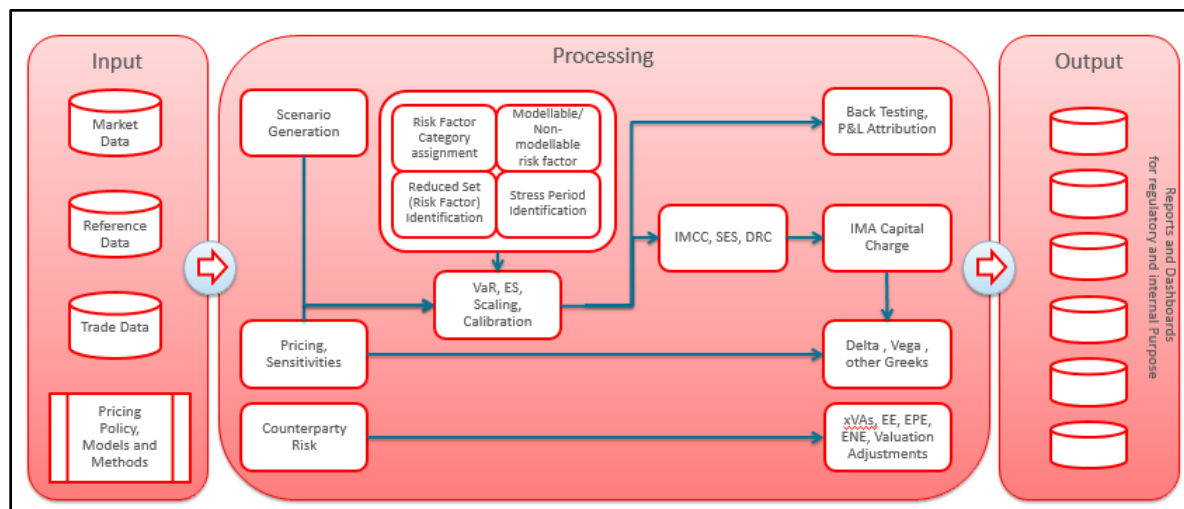


Figure 1 MRMM Process Flow

The process flow is explained below.

1. **Input Data Requirement:** The following types of data are expected as input to the solution:

- **Trade Data:** This is data of on and off balance sheet positions, settled and unsettled trades/deals belonging to trading book that you want to price and calculate risk measures. For example: data of bonds in which investment has been made, or swap transactions entered with the counterparty.
- **Reference Data:** These are dimensions and attributes that describe the trade data. These are used to define business rules, and view reports. For example: Product, Legal Entity, Currency, Netting Agreement, and Credit Support Annex.
- **Market Data:** These are price quotes, yield curves, volatility surface and other forms for financial market data which are supplied by designated agencies such as Bloomberg, Reuters, and various exchanges, or market makers. For example: Interest Rate Curve, Equity prices, Foreign Exchange spot and forward rates and so on.

2. **User Configurations (Processing):** To process the above data and achieve desired results, such as price of a trade or capital requirement for trading book, you need to perform the system configurations, explained below:

- **Application preferences**
 - **Dimension and Hierarchy configuration:** In this section, select the dimension that must be available for further configurations in MRMM, and specify the hierarchy for each selected dimension. The hierarchy must be pre-defined in Dimension

Management. See Dimension Management section in OFS Advanced Analytics Infrastructure User Guide on [OHC Documentation Library](#) for details.

- **Default Settings:** In this section you need to define the default values used by various components of MRMM. It includes:
 - Currency
 - Currency Pair
 - Model and Method
 - Model Parameters
 - Instrument Type Classification
 - Liquidity Horizon
- **Technical Configuration:** In this section you need to define values such as memory strategy, log level and so on, that are used by the application during various processes.
- **Business Configuration:** In this section you need to define the portfolios, configure rules for identification of modellable and non-modellable risk factors, and create market scenarios and hybrid models for use in counterparty credit risk calculations. It includes:
 - Portfolio Definition
 - Modellingable and Non-Modellingable Risk Factor Identification
 - Market Scenarios
 - Hybrid Model
- **Business Processes:** In this section you need to perform valuation of instruments and positions in a trading book, measure the risk of your portfolio or trading desk using historical simulation, and validate the models. It includes:
 - Instrument Valuation
 - Market Risk – Historical Simulation
 - Market Risk – Monte Carlo Simulation
 - Model Validation
- **Output:** MRMM solution has predefined reports to view and analyze data and results. The reports are presented in multiple dashboards which can be modified as per the specific requirements.

1.3 Components of OFS Market Risk Measurement and Management

This section provides an overview of the functionalities available in various components of MRMM application:

- **Instrument Valuation**

This component delivers the following functionalities:

- Pricing of each trade in a portfolio or part of a trading desk
- Calculation of Greeks for instruments
- Computation of sensitivities (such as Delta, Vega) as per the regulatory requirements for the FRTB standardized approach

See [Instrument Valuation](#) for details.

- **Market Risk – Historical Simulation**

This component delivers the following functionalities:

- Risk factor reduced set identification
- Stress period identification, as per the regulatory requirements for FRTB IMA
- Historical VaR and Expected Shortfall (ES) from a non-regulatory perspective
- Stress calibrated ES, as per the regulatory requirements for FRTB IMA
- Stressed capital add-on and Internal Modeled Capital Charge (IMCC), as per regulatory requirements for FRTB IMA

See [Market Risk – Historical Simulation](#) for details.

- **Market Risk – Monte Carlo Simulation**

This component delivers the following functionalities:

- Credit Value Adjustment (CVA) measures
- Potential Future Exposure (PFE) measures
- Monte Carlo VaR

See [Market Risk – Monte Carlo Simulation](#) for details.

- **Model Validation**

This component delivers the following functionalities:

- VaR model backtesting
- Actual, hypothetical and risk-theoretical Profit and Loss (P&L) calculation
- Backtesting and P&L attribution test, as per requirements for FRTB IMA
- R-Y-G zone classification, as per requirements for FRTB IMA

See [Model Validation](#) for details.

2 Getting Started with OFS MRMM

This chapter details how to get started with the OFS MRMM application, and explains the common features available across the components in the user interface. It describes the organization of the user interface, and provides step-by-step instructions for navigating through the application. To avoid repetition, the common functionalities used in different modules of OFS MRMM application are explained under the [Common User Interface Functionalities](#) section. For example, common user interface functionalities in Portfolio Definition.

This chapter includes:

- [Logging in to OFS MRMM Application](#)
- [Managing OFS MRMM](#)
- [Common User Interface Functionalities](#)

2.1 Logging in to OFS MRMM Application

Access the OFS MRMM application using the login credentials (User ID and Password) provided and select the preferred language to navigate. The built-in security system ensures that you are only permitted to access the window and actions based on the authorization.

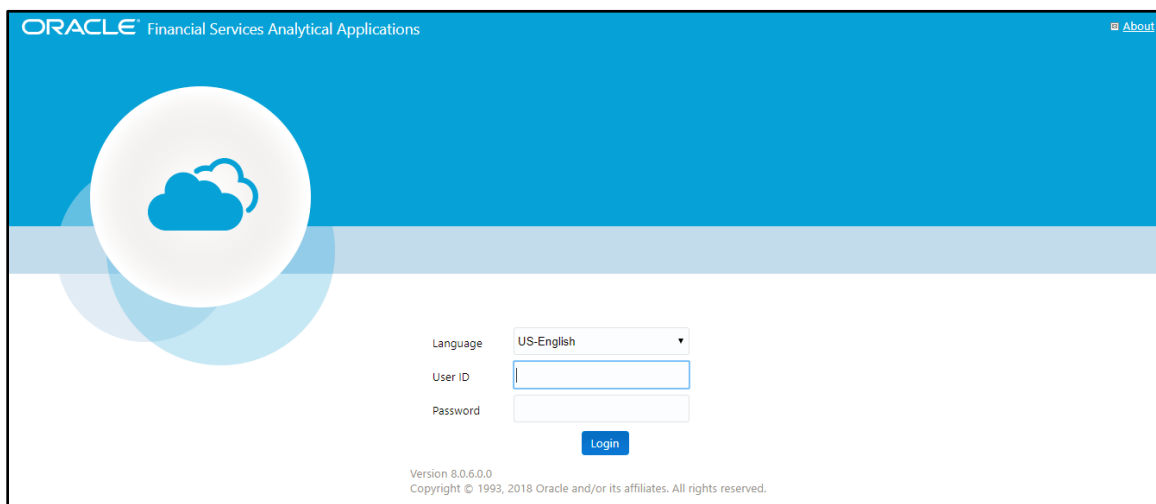


Figure 2 OFSAAI Login Window

After logging in to OFSAAI, the below home screen is displayed.

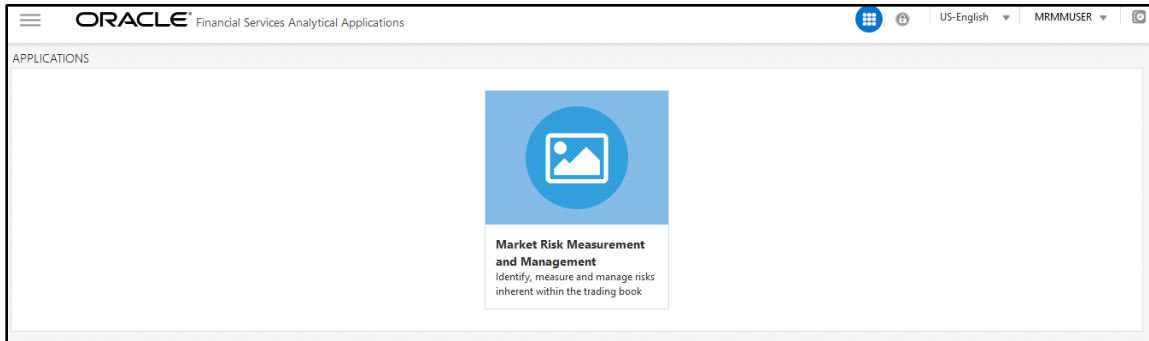


Figure 3 OFSAAI Landing Page


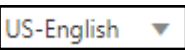


Tag	Description
MRMMUSER (username)	Click this drop-down to select the options: Preferences, About, Change Password or Logout .
	Click the icon and select Financial Services Market Risk Measurement and Management where the MRMM Application is installed.
	Click this drop-down to select the desired language.
	Click this icon to view the Administration related tools such as Process Modelling Framework.
	Click this icon to view details of the last login and last failed login.
Object Administration	Object Administration is an integral part of the infrastructure, and facilitates system administrators to define the security framework. For more information, see <i>OFS Analytical Applications Infrastructure User Guide</i> on OHC
Common Object Maintenance	Common Object Maintenance is an integral part of the Infrastructure system, and facilitates system administrators to define the security framework with the capacity to restrict access to the data and metadata in the warehouse, based on a flexible, fine-grained access control mechanism. For more information, see <i>OFS Analytical Applications Infrastructure User Guide</i> on OHC .
Processing Modelling Framework	This module facilitates built-in tooling for orchestration of human and automatic workflow interfaces. For more information, see <i>OFS Analytical Applications Infrastructure User Guide</i> on OHC .

Table 1 OFSAAI Landing Page

Select **Market Risk Measurement and Management** in the Left Hand Side (LHS) pane. The Market Risk Measurement and Management landing page is displayed.

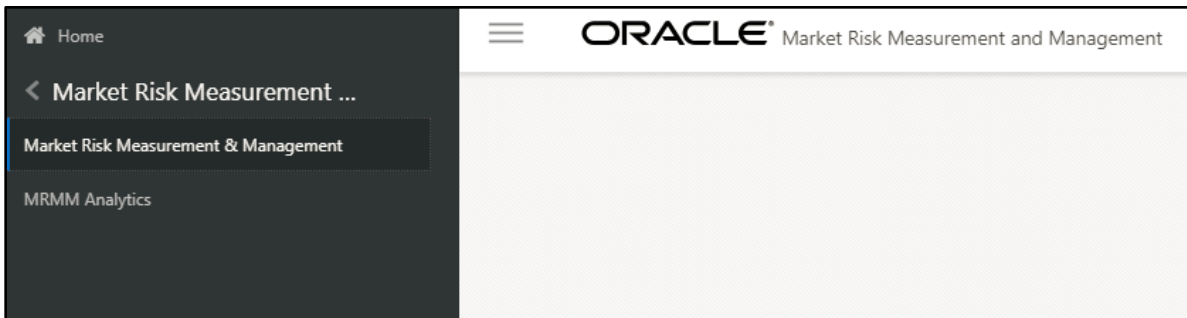


Figure 4 MRMM Landing Page

2.2 Managing OFS MRMM

This section describes how to manage the OFS MRMM application for users across all modules of the application. Some of the functionalities can be specific to the rights owned by the user.

In the MRMM landing page, click the **Market Risk Measurement and Management Application** link to view the MRMM home screen. Click the Username drop-down on the top Right Hand Side (RHS) corner to select the options such as **Preferences**, **About**, **Change Password** or **Logout**.

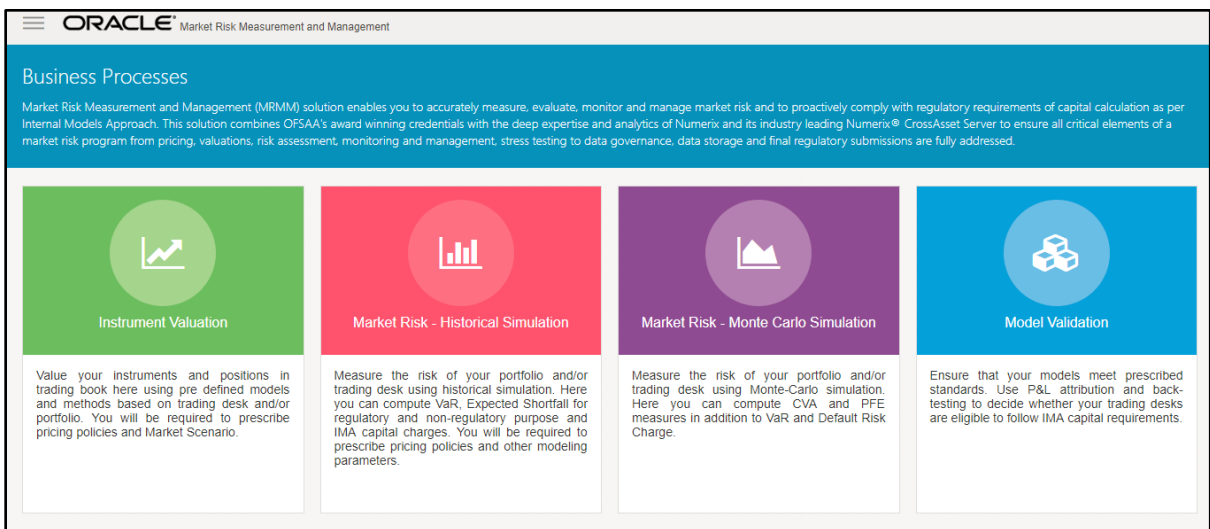


Figure 5 MRMM Home Screen

NOTE: For ease of navigation, click the Application Navigation  icon.

When you click the Application Navigation icon on the Left Hand Side (LHS) top corner, you can view the below options:

- **Business Processes**

The Home screen is referred to as **Business Processes** window. The screen displays the four business processes or components. See [Instrument Valuation](#), [Market Risk-Historical Simulation](#), [Market Risk - Monte Carlo Simulation](#) and [Model Validation](#) for details.

- **Business Configurations**

In the **Business Configuration** screen you can define a portfolio and configure rules to identify modellable and non-modellable risk factors. Additionally, it allows you to define new market scenarios and hybrid model for Monte Carlo Simulation. See [Business Configurations](#) for details.

- **Application Preferences**

In the **Application Preferences** screen you can set preferences to decide the manner in which you want the system to function. The components in this screen such as Dimensions and Hierarchy Configuration, Default Configurations and Technical Configuration are used to set preferences which will be used by the system during valuation, VaR and other calculations. See [Application Preferences](#) for details.

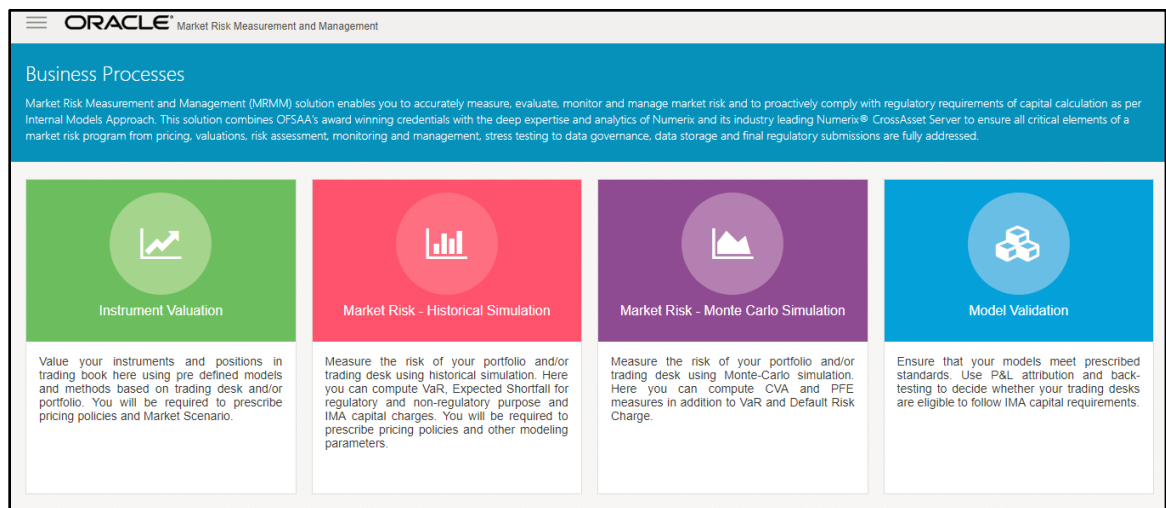


Figure 6 MRMM Business Process

2.3 Common User Interface Functionalities

This section details the common functionalities available across all modules of OFS MRMM such as creating, deleting, sorting, and searching a MRMM object. The following sections explain the procedures, taking the example of the Portfolio Definition screen.

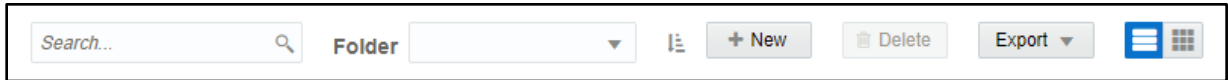


Figure 7 MRMM Common Screen Elements



2.3.1 Search

The Search option in the user interface enables you to find the required information. You can enter the nearest matching keywords to search, and filter the results by entering information on the additional fields. Search values are not case sensitive.

2.3.2 Folder

This option enables you to select the folder where the portfolio is to be defined.

2.3.3 Sorting Objects

This option enables you to sort the portfolios based on the Name (in ascending  or descending  alphabetical order).

2.3.4 New

This option enables you to navigate to the Portfolio Definition screen.


2.3.5 Deleting an Object

To delete an existing Portfolio:

1. Select a portfolio and click **Delete**. Alternatively, you can select multiple Portfolios by using Shift + click/ Ctrl + click, and click Delete on the top right hand corner. A confirmation dialogue appears.
2. Click **Yes**. The Portfolio details are deleted.

NOTE: Definition can be deleted only if it is not used in any MRMM object.

2.3.6 Changing the Layout

The application supports Grid View and List View layouts. You can change the layout by clicking the  icon at the right hand corner of the screen.

2.3.7 Exporting a Portfolio

You can export the listed records to a Microsoft Excel Spreadsheet (XLS), from the summary page. If any search criteria is applied, the values exported are restricted only to the search result.

To export the records:

1. Navigate to the summary page.
2. Click **Export**, and select the required option from the drop down menu. The application supports export to Excel.
3. Specify the location for saving the exported file. You can view the file offline from the folder.

3 Overview of OFSAA Infrastructure Components

OFS MRMM uses the following components and frameworks of OFSAA infrastructure. You can access these components under **Common Object Maintenance** in the OFSAAI landing page. See OFS Analytical Applications Infrastructure User Guide in [OHC Documentation Library](#) for features and details.

- **Data Model Maintenance:** OFS MRMM uses the Data Model Maintenance module of OFSAA. You can upload the data model using this component.
- **Data Management:** Data Management tools such as Data Sources, Data Mapping, Data File Mapping, and Post Load Changes. Data Quality Rules and Data Quality Groups in the OFSAA Data Quality Framework. OFS MRMM uses Excel Upload (Atomic), Forms Designer, Forms Authorization, Data Entry from the Data Entry Forms and Queries module of OFSAA.
- **Unified Analytical Metadata:** OFS MRMM uses Dimension Management (Member, Attribute and Hierarchy Management) from the Unified Analytical Metadata module of OFSAA.
- **Rate Management:** See [OFSAA Rate Management – Currencies](#), for details.
- **Holiday Calendar:** See [Holiday Calendar](#), for details.
- **Operations:** OFS MRMM uses Batch Maintenance, Batch Execution, Batch Monitor, Batch Cancellation, Batch Scheduler, and View Log from Operations module of OFSAA.
- **Process Modeling Framework:** OFS MRMM uses the Process Modeling Framework module of OFSAA.
- **Rule Run Framework:** Process Modeling Framework internally uses Process and Run from the OFSAA Run Rule Framework.

4 OFSAA Rate Management – Currencies

4.1 Currencies

Financial institutions commonly transact business in more than one currency. Transacting business in multiple currencies demands functional capabilities for multi-currency accounting and currency rate management.

OFSAA Rate Management's Currency module supports the definitions and maintenance of currencies. Currency definitions are fundamental to the definition of both interest rate yield curves and currency exchange rates. A key attribute of every yield curve is the currency with which it is associated; and currency exchange rates can only be established between defined currencies. OFSAA Rate Management provides a comprehensive list of ISO-defined currencies; you may also define and add your own user-defined currencies.

Upon initially navigating to **Common Object Maintenance > Rate Management > Currencies**, a summary screen displays a comprehensive list of more than 170 seeded ISO currency codes.

Code	Currency Name	Reference Interest Rate Code	Reporting Currency	Status
			No	Inactive
ADP	Andorran Peseta		No	Active
AED	United Arab Emirates Dirham		No	Active
AOX	test		No	Active
AUD	Australian Dollar		Yes	Active
BBD	Barbados Dollar		No	Active
CAD	Canadian Dollar		Yes	Active
CRC	Costa Rican Colon		No	Active
EUR	Euro (European EMU)		Yes	Active
GBP	Pound Sterling		Yes	Active
INR	Indian Rupee		Yes	Active

Figure 8 Rate Management - Currencies Summary Screen

4.1.1 Search Container

A Search container is provided, in which you may search for currencies by Name, by Currency (by ISO currency code), by status or by reporting currency.

4.1.1.1 Search Control

Enter your desired search criteria and click on the Search control.

4.1.1.2 Reset Control

Clicking on the Reset control removes search constraint you may have specified and refreshes the screen.

4.1.2 Currencies Container

The Currencies container presents a grid containing all of the currencies, which meet your search criteria. The Currencies summary grid offers several controls, which allow you to perform different functions when a currency is selected.

To select a currency, click on a check box in the first column of the grid. Multiple currencies can be selected at a time. However, this disables some of the controls. Clicking on a check-box a second time de-selects the currency.

You may select or deselect all of the currencies in the summary grid by clicking on the check box in the upper left hand corner of the summary grid directly to the left of the Code column header.

4.1.2.1 Add

Clicking on the Add control begins the process of adding a new currency. The Add control is disabled if any rows in the grid have been selected.

4.1.2.2 Edit

Selecting a single row out of the grid enables the Edit control. Clicking on the Edit control allows you to modify an existing currency. The Edit control is only enabled when a single currency has been selected.

NOTE: You can control the number of rows to display on screen by selecting the Pagination Options icon from the action bar.

4.1.2.3 Delete

Selecting one or more rows out of the grid enables the Delete control. Clicking on the Delete control deletes the currency or currencies you have selected.

4.1.3 Currencies Summary Grid

The following columns categorize each currency shown in the summary grid:

- **Code:** For seeded currencies, these are ISO Currency Codes. For user-defined currencies, these may be any pure character string (no numbers) up to a length of 3 characters.
- **Currency Name:** For seeded currencies, these are ISO Currency Codes. For user-defined currencies, these may be any string up to a length of 40 characters.
- **Reference Interest Rate Code:** Reference Interest Rate Code is the Interest Rate Code with which a currency is associated for forecasting purposes. You may define multiple yield curves each of which has the same Reference Currency, but a currency may only have one Reference Interest Rate Code.

- **Reporting Currency:** A reporting currency is an active currency to which balances in other currencies may be consolidated in order to facilitate reporting. Balances in reporting currencies may be, in turn, consolidated to the functional currency. For example, an American multinational bank might consolidate its holdings in Asian currencies to the Japanese yen (reporting currency) and its balances in European currencies to the Euro (reporting currency) after which it might consolidate these reporting currencies to the U.S. dollar (functional currency).
- **Status:** The status of any currency may be either Active or Inactive. You must “activate” a currency before you can configure default configurations for it in application preference. See [Default Configurations](#) for details.

4.1.4 Editing Currencies

To edit a currency, select a currency and then click on the Edit control. You may not modify any currency Code value. You may, however, modify Currency Name, the Reference Interest Rate Code, the Reporting Currency value (limited to Yes or No), or the currency's Status (limited to Active or Inactive). Once you have completed your edits, click **Save**.

4.1.5 Adding Currencies

The first row in the Currencies container is an empty row that is ready for you to edit as a new currency. You may select this empty row, click on the Edit control, and generate a new currency. You may also generate a new currency by clicking on the Add control. This will generate another empty row at the top of the Currencies container that is ready for you to edit.

4.1.6 Deleting Currencies

Click on one or more currencies, and then select the Delete control.

5 Holiday Calendar

This chapter discusses the procedure for creating a Holiday Calendar and generating a list of weekend and holiday dates. These dates are used during valuation of instruments.

This chapter includes:

- [Overview of Holiday Calendars](#)
- [Searching for a Holiday Calendar](#)
- [Creating a Holiday Calendar](#)
- [Executing Holiday Calendar](#)
- [Holiday Exceptions](#)
- [Excel Import/ Export](#)

5.1 Overview of Holiday Calendars

A Holiday is a day designated as having special significance for which individuals, a government, or some religious groups have deemed that observance is warranted, and thus no business is carried on this day. The Holiday Calendar code can range from 1 to 99999.

The procedure for working with and managing a holiday calendar is similar to that of other OFSAA business rules. It includes the following steps:

- Searching for a Holiday Calendar.
- Viewing and Updating a Holiday Calendar.
- Copying a Holiday Calendar.
- Deleting a Holiday Calendar.
- Check Dependencies in the Holiday Calendar definitions.
- Refresh the Holiday Calendar summary page.

5.1.1 Searching for a Holiday Calendar

Search for a Holiday Calendar to perform any of the following tasks:

- View
- Edit
- Copy
- Delete
- Check Dependencies
- Refresh

5.1.1.1 Prerequisites

Predefined holiday calendar

5.1.1.2 Procedure

1. Navigate to the **Holiday Calendar** summary page. This page is the gateway to all Holiday Calendars and related functionality. You can navigate to other pages relating to Holiday Calendar from this page.
2. Enter the Search criteria.
 - Enter the name of the Holiday Calendar.
 - Click the Search icon.

Only holiday calendars that match the search criteria are displayed.

NOTE: You can control the number of rows to display on screen by selecting the "Pagination Options" icon from the action bar.

5.1.2 Creating a Holiday Calendar

You create holiday calendars to capture holidays for a given date range for any organization. It is possible to create and use multiple holiday calendars.

5.1.2.1 Procedure

1. Navigate to the **Holiday Calendar** summary page.
2. Click **Add** Holiday Calendar.
3. The Holiday Calendar details page is displayed.
4. Enter a code value for the new holiday calendar.

Note:

The code, is a numeric identifier for the holiday calendar. The code value must be a number between 1 and 99999. The code value you assign to the new holiday calendar must be unique.

5. Enter the name and a brief description for the holiday calendar.

Note:

The name you assign to the holiday calendar must be unique. Name can hold a maximum of 30 characters.

6. In the Holiday Properties grid, select not more than two weekend days. Then choose the Holiday Period. The Holiday Period can be defined for a range of up to 40 years

less than the current date and 40 years greater than the current date, totally spanning a maximum of 80 years.

In the Holiday Details grid, define the Holiday details for the any period within the holiday range defined in step 6. There are two types of holidays that can be defined: Fixed and Moving.

A fixed holiday is one which is deemed as a holiday for every year in the holiday period, for that particular day.

Example

25th December – Christmas, is a fixed holiday.

Note:

To define a fixed holiday, input the holiday date for the first occurrence in the date range. For example, if your Date Range runs from 01-JAN-2000 to 31-DEC-2050, you should input the fixed holiday, Christmas, as 25-DEC-2000. The holiday calendar procedure will populate all subsequent 25-DEC entries in the holiday list table (FSI_HOLIDAY_LIST). A HOLIDAY_TYPE code = 0 is a Fixed type holiday, code = 1 is a Moving type holiday, and code = 2 is a weekend.

The holiday calendar procedure will also ensure that holiday and weekend entries are not duplicated. For example, if weekends are defined as Saturday/Sunday and Christmas falls on a weekend day, there will be only one entry in the FSI_HOLIDAY_LIST table. The PREVIOUS_WORKINGDAY and NEXT_WORKINGDAY fields designate the valid prior and following working days, respectively.

7. A moving holiday is one which is deemed as a holiday only for that particular date and year, and not for every year in the holiday period. All occurrences of a moving holiday must be input manually.

Once the holiday calendar definition is saved, its status in the summary page is marked as defined.

8. A holiday calendar created can also be deleted. Select one or more rows of holiday calendar definitions and click the Delete control.

5.1.2.2 Excel Import / Export

Excel import/export functionality is used for adding/editing holiday calendar definitions.

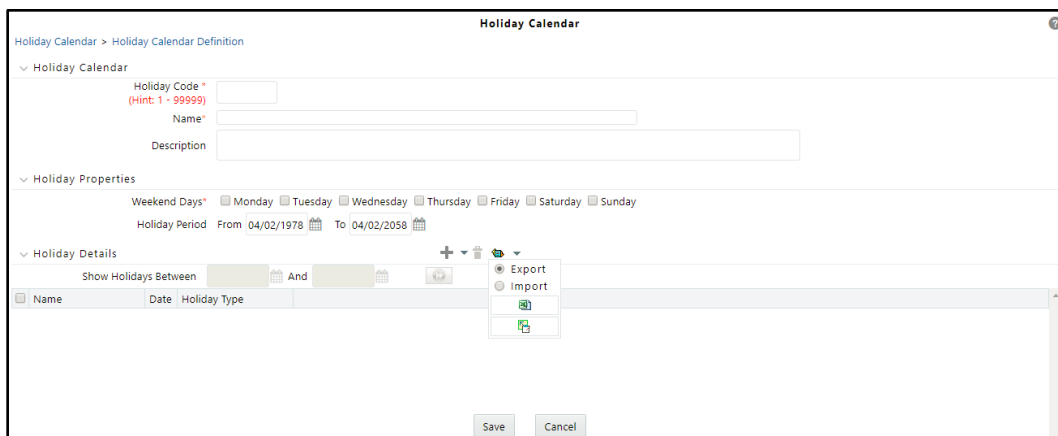


Figure 9 Holiday Calendar-Excel Import/Export for Adding Calendar Definitions

5.1.3 Executing a Holiday Calendar

You execute a holiday calendar definition to generate calendar dates listing the various types of holidays for a given holiday period.

5.1.3.1 Prerequisites

Predefined Rules

5.1.3.2 Procedure

1. Navigate to the **Holiday Calendar** summary page.
2. Search for a rule.
3. Select a Holiday Calendar, and click the Generate Calendar Dates icon to execute the selected holiday calendar. Holiday list for holiday ID #1 generated successfully message appears (where #1 is the holiday calendar code). The holiday list can be confirmed by querying the FSI_HOLIDAY_LIST table.
4. The status of a holiday calendar where holiday dates have been generated displays as “processed” in the status column in the summary page.

Note:

In case you do not want to Generate Calendar dates immediately, you can select that particular holiday calendar anytime later from the summary page with its status defined, and then click the Generate Calendar Dates icon to execute the selected holiday calendar.

5. The generated holiday list is no longer valid if
 - There is a change in the definition of the holiday calendar.

- There is any update or modification to the Holiday Exceptions defined for that holiday calendar.

In such a case, the user will get a message “This holiday calendar has been modified, Please generate the holiday list again” and the holiday calendar state will be changed to “Defined” until the holiday list is regenerated with new definition.

5.1.4 Holiday Exceptions

To specify holiday exceptions, follow the below steps:

1. You can specify exceptions to holidays. As a prerequisite, a holiday calendar should have been properly defined and the status of the holiday calendar in the summary page should be processed. Generating the holiday list will populate the holidays (weekends, fixed and moving) along with the working days. Then the Show Exceptions button is enabled in the detail page. Any changes in the holiday definition will disable the “Show Exceptions” button. The user must generate the holiday list again to define or view the exceptions.
2. Click **Show Exceptions** in the Holiday Exceptions grid. The Holiday Exceptions window opens.
3. The search block in the Exceptions page has 6 fields: From (Year), To (year), Fixed Holidays, Moving Holidays, Holiday Date and All Exceptions.
 - From and To - Denotes the range of years which is a subset out of the holiday list generated, for which exceptions are required to be defined.
 - Fixed Holidays – You can filter the list of holidays by the type of Fixed Holidays.
 - Moving Holidays – You can filter the list of holidays by the type of Moving Holidays.
 - Holiday Date – For a particular known holiday date, exceptions can be defined.
 - All Exceptions - This checkbox when selected lists all the exceptions, if already defined, for the holidays within the From, To Date range.

The search result gives the list of all holidays based on the selection of the above search criteria fields.

4. In the Holiday Exceptions block, there are two types of exceptions that can be defined: Not a holiday and Shift to.

Any holiday can be marked as not a holiday, in which case that day is removed from the Holiday List. If the drop-down list in the exception type is selected as “Not a Holiday”, then the “shift to” date picker field is disabled.

Spring earlier considered as a holiday in the holiday calendar can be marked as Not a Holiday in the Exceptions Window. Further the user can write his comments or remarks in the Notes Text Box next to the Exception Type drop-down list.

Any holiday can be shifted to another day, in which case the earlier declared holiday is removed from the Holiday List, while the shifted to day is included as a holiday.

5.1.5 Excel Import/ Export

Excel import/export functionality is used for adding/editing holiday exceptions.

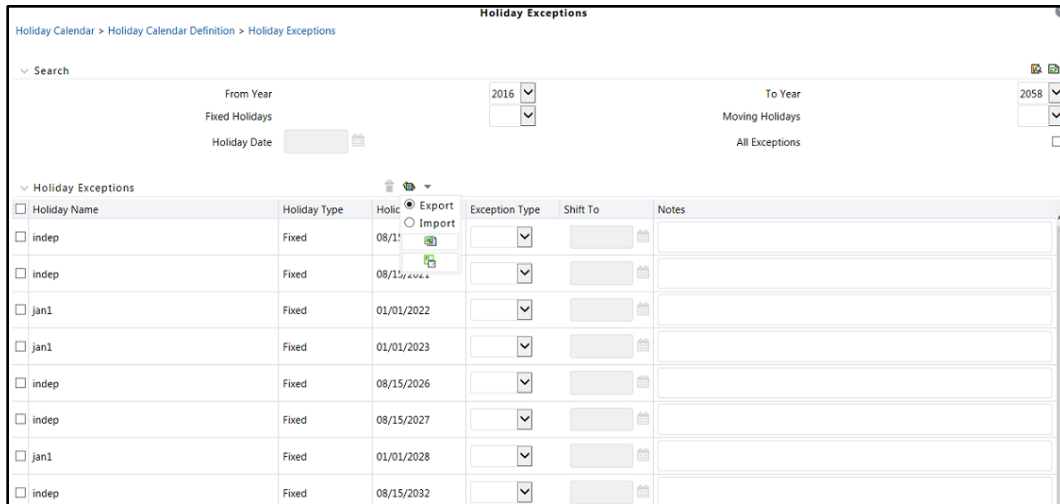


Figure 10 Holiday Calendar – Excel Import/Export for Adding Calendar Exceptions

6 Application Preferences


This chapter describes the application preferences in OFS MRMM and includes the following topics.

- [Overview](#)
- [Understanding Application Preferences](#)
- [Dimension and Hierarchy Configuration](#)
- [Default Configurations](#)
- [Technical Configuration](#)

6.1 Overview

The application preferences section allows to set your preferences for the OFS MRMM application, which will be used for computing valuation, VaR and other measures. The MRMM functional administrator can set the application preferences. Once set they are applicable at a global level, and are applied to all users. Some of the preferences get overwritten by parameters defined at other places, such as data and business processes.

6.2 Understanding Application Preferences

In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Financial Services Market Risk Measurement and Management**. Click  icon in the MRMM home screen to navigate to the **Application Preferences** window.

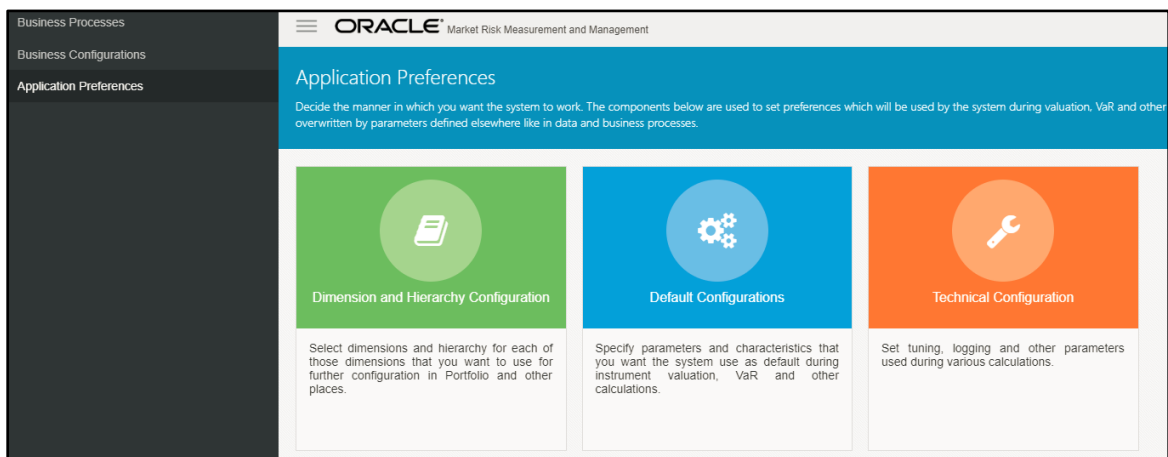


Figure 11 Application Preferences

The Application Preferences section includes:

- Dimension and Hierarchy Configuration
- Default Configurations
- Technical Configurations

6.3 Dimension and Hierarchy Configuration

You can select dimensions from the available list to create a portfolio and decide the aggregation of results such as Value at Risk (VaR). For every selected dimension you must select a hierarchy which will be used to select members to define a trading book portfolio. The dimensions are pre-seeded with the application. You must create at least one hierarchy for all the dimensions that you intend to use in portfolio definition. See *OFS Analytical Applications Infrastructure User Guide* on [OHC Documentation Library](#), for steps to create a hierarchy.

In this window you can perform the following actions:

- **Dimension Configuration:** This window enables you to select one or multiple dimensions from the available list of dimensions.
- **Hierarchy Configuration:** This window enables you to update one hierarchy each for the selected dimensions.

6.3.1 Configuring Dimensions

This section details the process of configuring dimensions.

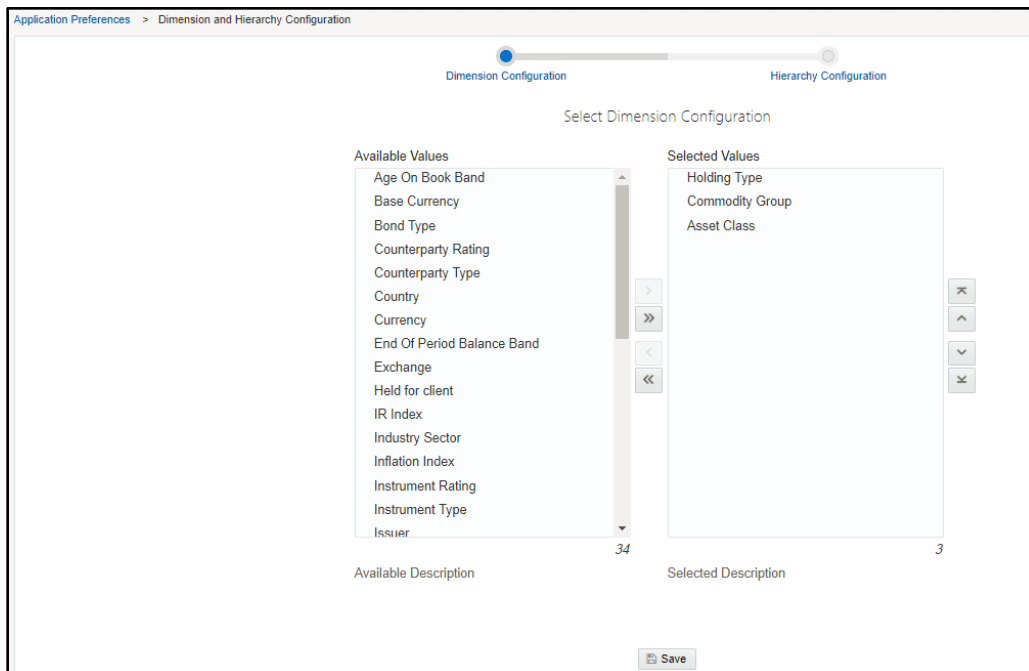







Figure 12 Dimension Configuration

The following table describes the fields in the Dimensions Configuration window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Available Values	Displays the list of available dimensions.
Selected Values	Displays the list of selected dimensions.

Table 2 Fields and their Descriptions in Dimension Configuration

To select a dimension, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM home screen is displayed.
3. Click  button in the MRMM home screen to navigate to the **Application Preferences** window.
4. Click **Dimension and Hierarchy Configuration**.
5. To add the dimensions, select the dimension from the **Available Values** and add them to the list of **Selected Values** by using  button. To select multiple values use Ctrl or Shift key. To select all the Available Values, use  button. To remove any selected value from the list use  button. To remove all the selected values use  button.
6. Click **Save** to update the selected dimensions list. The selected dimensions are populated in the Hierarchy Configuration window.

6.3.2 Configuring Hierarchies

This section details the process of configuring hierarchies.

Dimensions	Folder	Hierarchies
Holding Type	Market Risk Measurement and Management Segment	Holding Type X
Commodity Group	Market Risk Measurement and Management Segment	Select Hierarchies
Asset Class	Select Folder	Select Hierarchies

Figure 13 Hierarchy Configuration

The following table describes the fields in the Hierarchy Configuration window

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Dimensions	Displays name of the dimension selected in Dimension Configuration
Folder	Select the folder from the drop-down box where the hierarchy has been defined
Hierarchies	Select the Hierarchy

Table 3 Fields and their Descriptions in Hierarchy Configuration

To select a hierarchy, follow the below steps:

1. In the **Hierarchy Configuration** window, update the **Folder** and **Hierarchies** fields.
2. Click **Save**. The configured hierarchies will be used to define portfolios.

6.4 Default Configurations

In this section you can specify the default parameters and characteristics to be used by the application during valuation, VaR and other calculations. If the application fails to obtain values from trade, instrument or other specific configurations, then it uses these default values. You can configure the below settings in this window:

- [Currency](#)
- [Currency Pair](#)

- [Model and Method](#)
- [Model Parameters](#)
- [Instrument Type Classification](#)
- [Liquidity Horizon](#)

6.4.1 Currency

In this window you can define the default values at the granularity of currency. If you do not define the values at the instrument granularity, then the default values are used for processing. For each active currency, you can specify characteristics, such as Rank, Interest Rate Index, Interest Rate Tenor, Discount Curve, Dual Curve, Overnight Index, Holiday Calendar, Country, and Allowed Yield Curves.

Currency Name	Currency Code	Rank	Interest Rate Index	Interest Rate Tenor	Discount Curve	Dual Curve	Overnight Index	Holiday Calendar	Country	Allowed Yield Curve
Andorran Peseta	ADP									
Australian Dollar	AUD	4	BBSW	6M	IR.AUD-BBSW-6M	false		SYDNEY	AUS	AUD-BBSW-6M AUD-BBSW-3M
Barbados Dollar	BBD									
Canadian Dollar	CAD	6	CDOR	3M	IR.CAD-CORRA-ON	true	CORRA	TORONTO	CAN	CAD-CORRA-ON CAD-CDOR-6m CAD-CDOR-3m
Costa Rican Colon	CRC									
Euro (European EMU)	EUR	2	EURIBOR	6M	IR.EUR.EONIA-ON	true	EONIA	TARGET	DEU	EUR.EONIA-ON EUR-EURIBOR-1m EUR-EURIBOR-3m EUR-EURIBOR
Indian Rupee	INR	26	MIFOR	6M	IR.INR-MIFOR-6m	false			IND	INR-MIFOR-6m
Jordanian Dinar	JOD									
Pound Sterling	GBP	3	LIBOR	6M	IR.GBP-SONIA-ON	true	SONIA	LONDON	GBR	GBP-SONIA-ON GBP-LIBOR-1M GBP-LIBOR-6m GBP-LIBOR-3M
Romanian Leu	ROL									

Figure 14 Default Configurations - Currency

The following table describes the fields in the Currency window:


Fields	Description
Fields marked in red asterisk(*) are mandatory	
Currency Name	This field displays the list of all currencies which are available in currency dimensions
Currency Code	This field displays the code of the selected currency.
Rank	Rank represents the contribution of currency in global foreign exchange market turnover. Higher the turnover, higher the rank of currency. For example: USD is the most traded currency in world and is assigned rank 1.

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Interest Rate Index	Provide the default index rate associated with currency such as LIBOR, Euribor and so on. It is the standard interest rate index or yield curve which is used for pricing of a trading book instrument. For example: LIBOR for USD, MIBOR for INR
Interest Rate Tenor	Select the default tenor for the given Interest Rate Index, such as 3M, 6M and so on. It represents the term point of the interest rate index mentioned above. It is expressed as Tenor and unit of the term period. For example: 3 months term point is expressed as 3M.
Discount Curve	Select the default discounting curve associated with the currency. It is the default interest rate index or yield curve which is used to discount cash flows during pricing of a trading book instrument. For example: USD-LIBOR-3M
Dual curve	Specify True and False. This field indicates whether two separate indexes are used to construct a risk-free discount curve. For example: In the US market, OIS swaps with tenor greater than 2 years are not as liquid as Federal funds/LIBOR basis swaps, which are called Feds. Therefore, overnight index swaps are usually used to construct the first two years of the risk-free discount curve, while Fed funds/LIBOR basis swaps with maturities of 3-30 years are used to build the longer end of the curve.
Overnight Index	It is the interest rate index/curve that is designated as overnight rate for the selected currency. For example: SONIA for GBP and EONI for EUR.
Holiday Calendar	Specify the default holiday calendar to be used for the corresponding currency. It indicates the default calendar which will be used to price any instrument denominated in the selected currency.
Country	This indicates the country code of the currency.

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Allowed Yield Curve	This is the list of all interest rate curves which are allowed to be used by the application. For a specific currency, all the possible interest rate index or yield curves that the application can use are stored here.

Table 4 Fields and their Descriptions in Currency Window

Follow the below procedure for defining the Currency:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen, to navigate to the **Application Preferences** window.
4. Click **Default Configurations > Currency**.
5. Select the currency row that needs to be updated, and enter the details for **Rank, Interest Rate Index, Interest Rate Tenor, Discount Curve, Dual Curve, Overnight Index, Holiday Calendar, Country** and **Allowed Yield Curve**.

Note: Use 'F2' key, or click on any other row to come out of the edit mode in a table, before updating or navigating to a different tab.

6. Click **Update**.

6.4.2 Currency Pair

The Currency Pair window enables you to provide default values at the granularity of currency pair. This is used for pricing of cross-currency instruments. If you do not define the values at the instrument granularity, then the default seeded values are used for processing.

Oracle Financial Services Market Risk Measurement and Management User Guide
Release 8.0.6.0.0

The screenshot shows the 'Default Configurations' window with the 'Currency Pair' tab selected. The table below represents the data shown in the screenshot:

Currency Pair Code	Base Currency	Term Currency	Base CC Basis Tenor	Term CC Basis Tenor	Inverse Price	CC Basis Curve	Basis Spread Leg
ADPAED	ADP	AED			false	2	
ADPAUD	ADP	AUD			true		
ADPBBD	ADP	BBD					
ADPCAD	ADP	CAD			false		
ADPCRC	ADP	CRC					
ADPEUR	ADP	EUR					
ADPOGBP	ADP	GBP					
ADPINR	ADP	INR					
ADPJOD	ADP	JOD					
ADPROL	ADP	ROL					

Figure 15 Default Configurations – Currency Pair


The following table describes the fields in the Currency Pair window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Currency Pair Code	A currency pair is the quotation and pricing structure of the currencies traded in the market.
Base Currency	The first listed currency in currency pair is called the base currency.
Term Currency	The second listed currency in currency pair is called the term currency.
Base CC Basis Tenor	Specify the tenor of interest rate index of base currency. This is represented as tenor and tenor unit. For example: 3M
Term CC Basis Tenor	Tenor of interest rate index of term currency. This is represented as tenor and tenor unit. For example: 3M
Inverse Price	This is an indicator field with values as TRUE or FALSE. The value TRUE allows the usage of inverse price of currency pair with preference to direct price, FALSE will use only direct price.
CC Basis Curve	Select the default currency basis curve to be used for corresponding currency pair. Example: AUD-LIBOR-3M/USD-LIBOR-3M

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Basis Spread Leg	Specify the currency (from currency pair) which should be used as basis spread leg. For example: AUD

Table 5 Fields and their Descriptions in Currency Pair Window

To define the Currency Pair, follow the below steps:

1. In **Oracle Financial Services Analytical Applications Infrastructure** home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the **Application Preferences** window.
4. Click **Default Configurations > Currency Pair**.
5. Select the Currency Pair Code row that needs to be updated and enter the details for **Base CC Basis Tenor**, **Term CC Basis Tenor**, **Inverse Price**, **CC Basis Curve**, and **Basis Spread Leg**.

Note:

Use 'F2' key, or click on any other row to come out of the edit mode in a table, before updating or navigating to a different tab

6. Click **Update**.

6.4.3 Model and Method

For a specific instrument type, you can select models and methods that will be used to price the instruments. Values defined in this screen are used, if the models and methods are not provided as input with data, or if you have not provided value in the pricing policy in the business definitions of Instrument Valuation, or VaR components. Default models and methods are specified at the granularity of instrument type.

Asset Class	Instrument Type	Model	Method
Interest Rate	Certificate of Deposit	IR Hull White 2-Factor Model	Forward Monte Carlo
Commodity	Commodity American Option on Future	Commodity Black Model	CDVM JuZhong
Commodity	Commodity Bullet Swap	Commodity Black Model	Forward Monte Carlo
Commodity	Commodity Swaption	Commodity Black Model	Not applicable
Equity	Equity American Option	EQ Black-Scholes Model	Backward Partial Differential Equation
Equity	Equity Asian Option	EQ Deterministic Model	Vecer Discrete Partial Differential Equation
Equity	Equity Convertible Bond Option	EQ Convertible Model	Backward Monte Carlo
Forex	FX Asian Option	FX Heston Model	Forward Monte Carlo
Interest Rate	Amortizing Bond	IR Hull White 2-Factor Model	Forward Monte Carlo
Interest Rate	Amortizing Floating Rate Note	IR Hull White 2-Factor Model	Forward Monte Carlo

Figure 16 Default Configurations – Model and Method


The following table describes the fields in the Model and Method window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Asset Class	Displays the asset class (Interest Rate, Equity, Commodity and so on) of instrument type for which models and methods needs to be defined.
Instrument Type	Displays the instrument types.
Model	Select the model to be used for the specific instrument type from the drop-down list.
Method	Select the method to be used for selected model from the drop-down list.

Table 6 Fields and their Descriptions in Model and Method Window

To define the default model and methods, follow the below steps:

1. In **Oracle Financial Services Analytical Applications Infrastructure** home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.

3. Click  in the MRMM home screen to navigate to the **Application Preferences** window.
4. Click **Default Configurations > Model and Method**.
5. Select the instrument type row to be updated.
6. Select the **Model** and the **Method** from the drop-down box.

Note:

Use 'F2' key, or click on any other row to exit the edit mode in a table, before updating or navigating to a different tab.

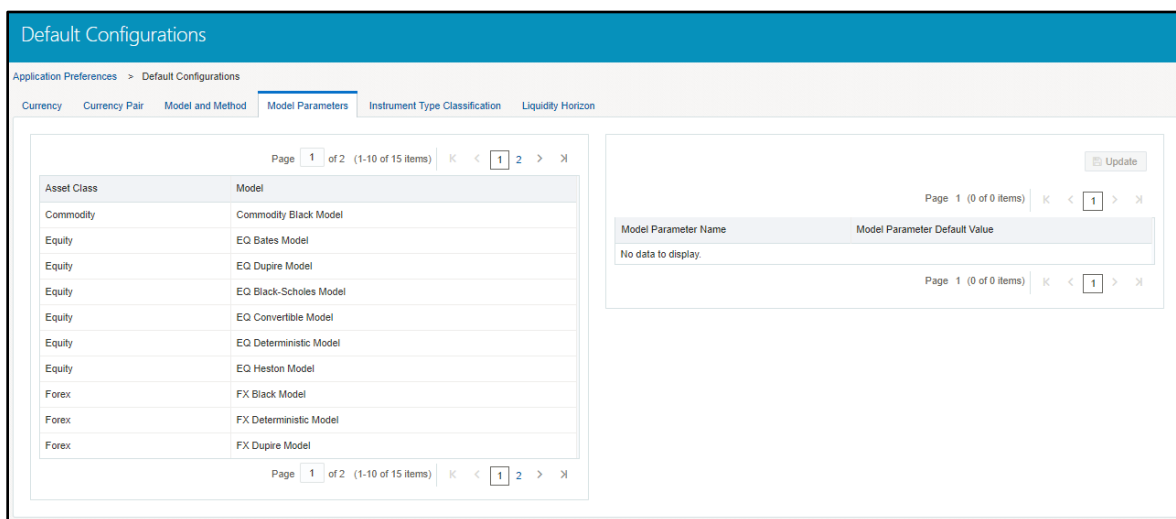
7. Click **Update**. Each instrument type is mapped to one of the asset class and its value is displayed.

NOTE: Model and Methods to be selected for a specific instrument type is limited to the models that are applicable to the corresponding asset class. See [Annexure D: List of Models and Methods](#) for details.

6.4.4 Model Parameters

You can define parameters for models which are used for pricing and calibration. Default model parameters are specified for each model used in the MRMM application.

The model table displays the asset classes and their corresponding model(s). Each model has a specific list of inputs that are required. Input for each model is integrated with the instrument parameters. For example, currency is integrated with market data used such as volatility parameter for some of the instrument types. You can define the default value for such parameters in this window. In a scenario where data for parameter is missing, the values assigned to the model parameter is used, while pricing the instrument with corresponding model.



The screenshot displays the 'Default Configurations' window with the 'Model Parameters' tab selected. The window contains a table of Asset Class and Model, and a form for defining Model Parameter Name and Model Parameter Default Value.

Asset Class	Model
Commodity	Commodity Black Model
Equity	EQ Bates Model
Equity	EQ Dupire Model
Equity	EQ Black-Scholes Model
Equity	EQ Convertible Model
Equity	EQ Deterministic Model
Equity	EQ Heston Model
Forex	FX Black Model
Forex	FX Deterministic Model
Forex	FX Dupire Model

The form on the right is titled 'Model Parameters' and contains the following fields:

- Model Parameter Name
- Model Parameter Default Value

The form also includes a 'No data to display' message and a 'Page 1 (0 of 0 items)' indicator.


Figure 17 Default Configurations – Model Parameters

The following table describes the fields in the Model Parameters window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Asset Class	Displays the type of asset for which model and method needs to be defined.
Model	Displays the model name.
Model Parameter Name	Displays the model parameters associated with the selected model.
Model Parameter Default Value	Specify a value for the model parameter.

Table 7 Fields and their Descriptions in Model Parameters Window

To define the default Model Parameter value, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the **Application Preferences** window.
4. Click **Default Configurations > Model Parameters**.
5. Select the model for which model parameter values needs to be updated. When you select a model, then all the parameters associated with the model will be displayed in the model parameter table on the Right Hand Side (RHS) of the window. Enter the default model parameter value against each model parameter. In this table you can either provide any default value, or leave it blank.
6. Click **Update**. The updated values are displayed.

6.4.5 Instrument Type Classification

The configuration and processing in OFS Market Risk Measurement and Management, is primarily based on the instrument type. The list of instrument types and their names generally differ for each financial institution. The table in **Instrument Type Classification** window allows you to map the instrument type as per the financial institution, and the standard instrument type names used in MRMM application.

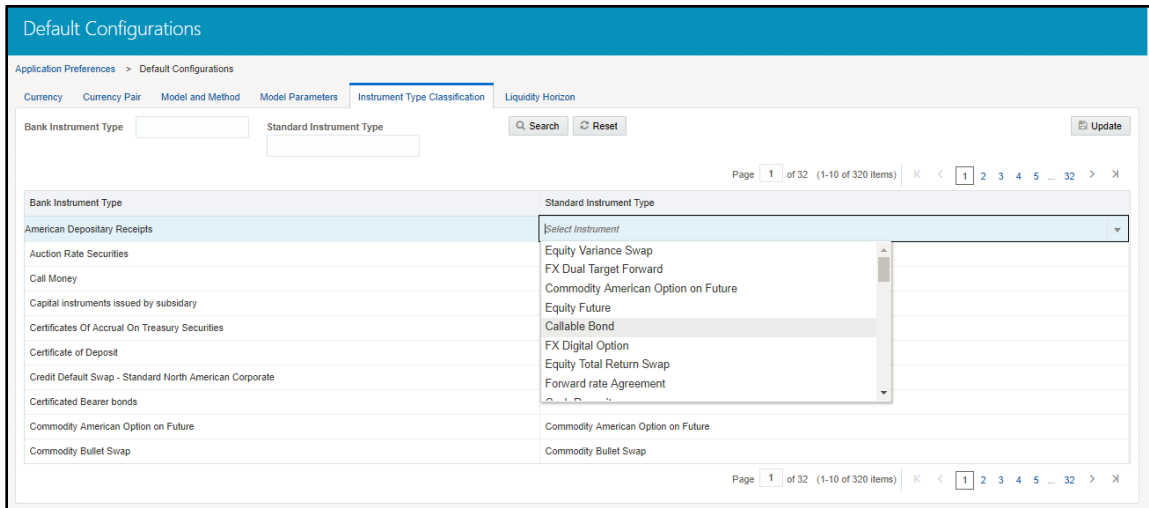



Figure 18 Default Configurations – Instrument Type Classification

The following table describes the fields in the Instrument Type Classification window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Bank Instrument Type	It is the instrument type name as specified in instrument type dimension.
Standard Instrument Type	It is the instrument type name as used by MRMM application. Select the Standard Instrument Type from the drop-down box.

Table 8 Fields and their Descriptions in Instrument Type Classification Window

To select the standard instrument type for a specific bank instrument, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the **Application Preferences** window.
4. Click **Default Configurations > Instrument Type Classification**.
5. Click any **Bank Instrument Type**. Select the **Standard Instrument Type** from the drop-down list on the RHS column.

Note:

Use 'F2' key, or click on any other row to exit the edit mode in a table, before updating or navigating to a different tab.

6. Click **Update**. The mapping is saved.

6.4.6 Liquidity Horizon

OFS MRMM application incorporates the risk of market liquidity, by varying the liquidity horizons for calculating regulatory Expected Shortfall. This enables to mitigate the risk of a sudden, and severe impairment of market liquidity across asset markets. Liquidity horizon for each risk factor category is specified through the MRMM User Interface (UI) either at a global level, or individually for each trading desk and portfolio. The default values applied by the application are as per Basel regulation (Reference: [BCBS document d352](#)).

Liquidity Horizon screen provides a mapping between the risk factor category and the values associated with each category. The table below lists the default liquidity horizon values as per Basel regulation (Reference: [BCBS document d352](#)).


Risk factor category	<i>n</i>	Risk factor category	<i>n</i>
Interest rate: specified currencies - EUR, USD, GBP, AUD, JPY, SEK, CAD and domestic currency of a bank	10	Equity price (small cap): volatility	60
Interest rate: – unspecified currencies	20	Equity: other types	60
Interest rate: volatility	60	FX rate: specified currency pairs ³⁷	10
Interest rate: other types	60	FX rate: currency pairs	20
Credit spread: sovereign (IG)	20	FX: volatility	40
Credit spread: sovereign (HY)	40	FX: other types	40
Credit spread: corporate (IG)	40	Energy and carbon emissions trading price	20
Credit spread: corporate (HY)	60	Precious metals and non-ferrous metals price	20
Credit spread: volatility	120	Other commodities price	60
Credit spread: other types	120	Energy and carbon emissions trading price: volatility	60
		Precious metals and non-ferrous metals price: volatility	60
Equity price (large cap)	10	Other commodities price: volatility	120
Equity price (small cap)	20	Commodity: other types	120
Equity price (large cap): volatility	20		

Figure 19 Default Liquidity Horizon Values as Specified in BCBS d352

Liquidity horizon can be defined for each portfolio and trading desk individually.

To assign a risk factor value to each risk factor category, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.

2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the **Application Preferences** window.
4. Click **Default Configurations > Liquidity Horizon**.

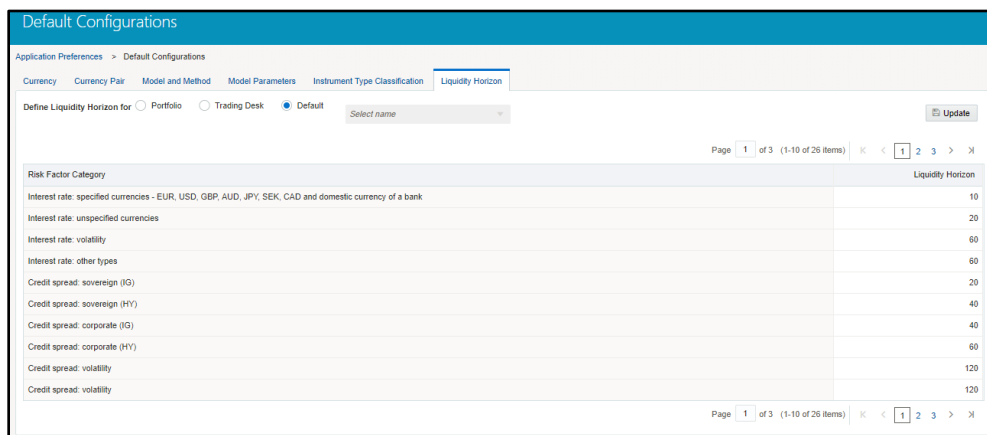


Figure 20 Default Configurations - Liquidity Horizon

5. In the field **Define Liquidity Horizon For**, select **Portfolio**, **Trading Desk** or **Default**. If you select default, the pre-seeded values are considered for calculation of stress calibrated Expected Shortfall. You can update pre-seeded default values. If you select Portfolio or Trading Desk the list of Portfolio/ Trading Desk is displayed and liquidity horizon can be specified for each of them separately
6. Select the Portfolio or Trading Desk for which the Risk Factor values needs to be assigned.
7. Select any **Risk Factor Category**, and update the Liquidity Horizon or risk factor value.

Note:

Use 'F2' key, or click on any other row to exit the edit mode in a table, before updating or navigating to a different tab.

8. Click **Update**. If the Risk Factor values are not defined for any Liquidity Horizon, or are partially defined, then the application considers default values for those items.

6.5 Technical Configurations

In this section you can set the tuning, logging and other parameters used during various calculations.

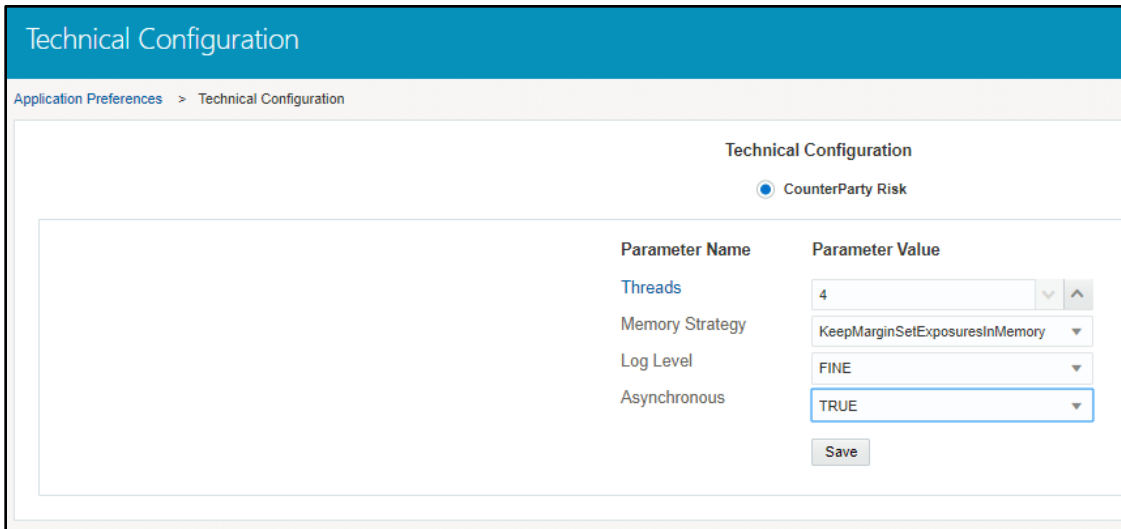


Figure 21 Technical Configuration


The table in **Technical Configurations** window allows you to add additional parameters for computation in Counterparty Risk

The following table describes the fields in the Technical Configurations window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Threads	Specify the number of threads to be used for the computation. The default value is Four.
Memory Strategy	<p>Specify the memory strategy to be used for intermediate results.</p> <p>Note: XVA results (i.e., the final results) are always kept in memory.</p> <p>Available values are:</p> <ul style="list-style-type: none"> • KeepAllExposuresInMemory: Keep trade exposures in memory. With this option, intermediate netting set and margin set exposures are kept in memory. However, the adjusted exposures used for incremental and marginal calculations are not stored in memory. • KeepMarginSetExposuresInMemory (Default): In addition to final results, margin set exposures are also kept in memory. With this option, the aggregation of trade exposures at the margin set level will only be done once, because exposures for each margin set are stored in memory.
Log Level	<p>Define the amount of information that is logged. Available values are:</p> <ul style="list-style-type: none"> • INFO: It logs high level information. • FINE: It is the default value, and is used to log calculation details. • SEVERE: It only logs errors.
Asynchronous	<p>Set this to true to call the CAS extension asynchronously so that you do not have to wait till the end of the calculation to perform other actions.</p> <p>The value is True, by default.</p>

Table 9 Fields and their Descriptions in Instrument Type Classification Window

To add the additional parameters, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the **Application Preferences** window.
4. Click **Technical Configurations**.
5. Enter details for the fields **Threads**, **Memory Strategy**, **Log Level**, and **Asynchronous**.

Note:

Use 'F2' key, or click on any other row to exit the edit mode in a table, before updating or navigating to a different tab.

6. Click **Save**. The values entered are consider for Monte-Carlo executions.

7 Business Configurations

This Chapter describes the Business Configurations module in OFS MRMM.


This chapter includes:

- [Overview](#)
- [Understanding Business Configuration Settings](#)
- [Portfolio Definition](#)
- [Modellable and Non-modellable Risk Factor Classification](#)
- [Market Scenarios](#)
- [Hybrid model](#)

7.1 Overview

The Business Configurations section enables you to define a portfolio and configure rules to identify modellable and non-modellable risk factors. This screen enables you to define new market scenarios and hybrid models for Market Risk - Monte Carlo Simulation.

7.2 Understanding Business Configuration Settings

In Oracle Financial Services Analytical Applications Infrastructure home screen, select **Market Risk Measurement and Management**. Click  icon in the MRMM home screen to navigate to the Business Configurations window.

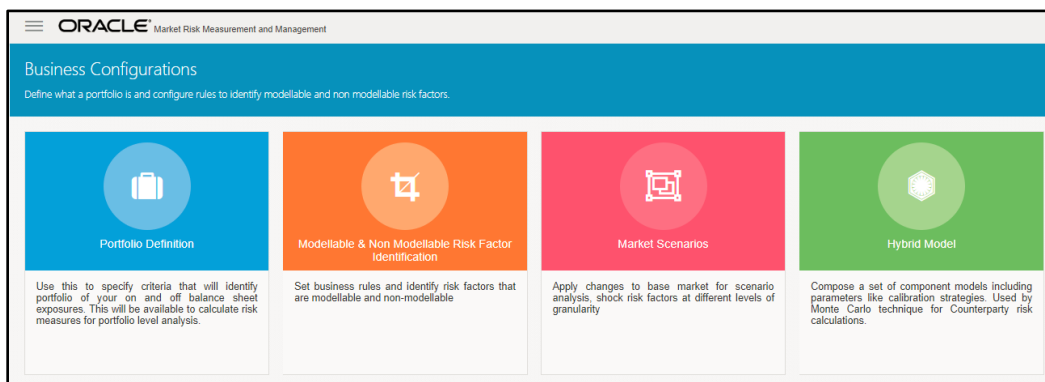


Figure 22 Business Configurations

The Business Configurations window includes the following sections:

- Portfolio Definition
- Modellable and Non-modellable Risk Factor
- Market Scenarios

- Hybrid Model

7.3 Portfolio Definition

This section discusses the procedure for defining and maintaining a Portfolio.

Portfolio is a group of financial instruments bundled together. It gives business user a flexibility to analyze a group of instruments together, which results in better business decisions.

In all the three modules of OFS Market Risk Measurement and Management, portfolio is the base for any evaluation to be performed. For example in Market Risk- Historical Simulation all the analysis that are performed are at granularity of portfolio or Trading Desk. Therefore, portfolio becomes a prerequisite for all Market Risk Measurement and Management modules if analysis is to be performed based on portfolio. Portfolio definition functionality provides a flexibility to create portfolio based on business hierarchy, or by selecting individual instruments. Business hierarchy provides a flexibility to cut across any supported hierarchy and create a desired portfolio for further analysis. Alternatively, MRMM also provides the option to select individual instruments and create a portfolio. The options provide a wider view for analysis using various dimensions.

You can define a portfolio to specify the criteria for portfolio identification of on and off balance sheet exposures. This will be available to calculate risk measures for portfolio level analysis. Portfolio defined in this section will be used in analysis of instrument valuations and portfolio valuations.

7.3.1 Defining a Portfolio

This section details the procedure for configuring a Portfolio.

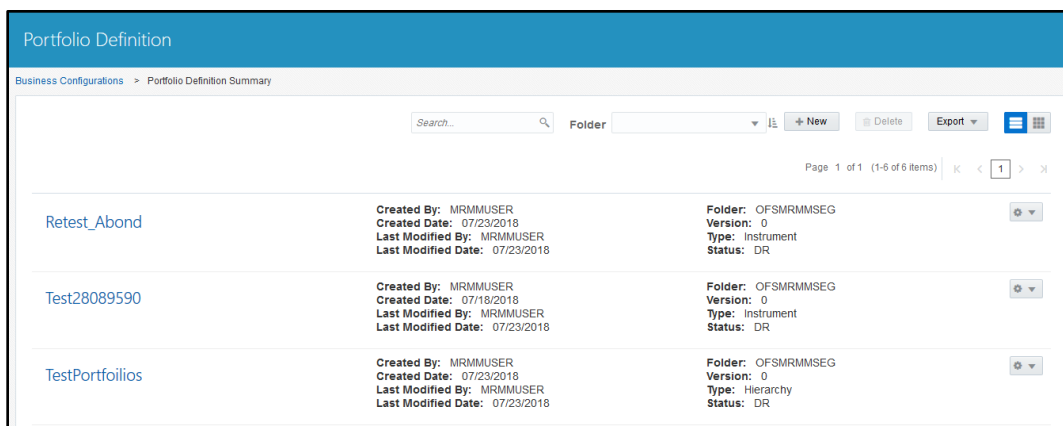



Figure 23 Business Configurations – Portfolio Definition Summary Screen

The following table describes the fields in the Portfolio Definition window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name*	Enter the portfolio name.
Description	Enter a short description for the portfolio
Folder*	Select the Folder in which you want to save the definition.
Access Type	Specify the access type for the Business Definition created for selected trading desk/portfolio Specify whether the definition is Read Only/ Read Write
Version*	Displays the workflow version.
Portfolio Type	This option determines whether the Portfolio is defined based on Instruments or Hierarchy. Select the desired radio button to create portfolio based on Instruments or Hierarchy
Filters	If you have selected Instrument option. You will be provided with two filters such as, Currency and Instrument type to filter the instrument records.

Table 10 Fields and their Descriptions in Portfolio Definition Window

To define a Portfolio, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the Business Configuration window.
4. Click **Portfolio Definition**. The Portfolio Definition Summary Screen is displayed. You can view all the Portfolios, and perform operations such as searching, sorting, changing the layout, deleting and exporting the portfolios to an Excel Spreadsheet. For details see section [Common User Interface Functionalities](#).
5. In the Portfolio Summary screen, click **New**. The **Create New** screen is displayed.
6. Enter the Portfolio **Name** and **Description**.
7. Select the **Folder** from the drop down.

8. Specify the **Access Type**.
9. In the **Portfolio Type** field, select whether the portfolio should be based on **Hierarchy** or **Instruments**. For example, if you select **Instruments**, then the list of Instruments is displayed. The list displays all the available marketable instruments.
 - a. To create the Portfolio based on instruments, follow the below steps:
 - i. Select the **Instrument** radio button in **Portfolio Type**.
 - ii. Select the instruments to be added in the portfolio by toggling the switch in the **Include** column. The application allows multiple selections for this section.

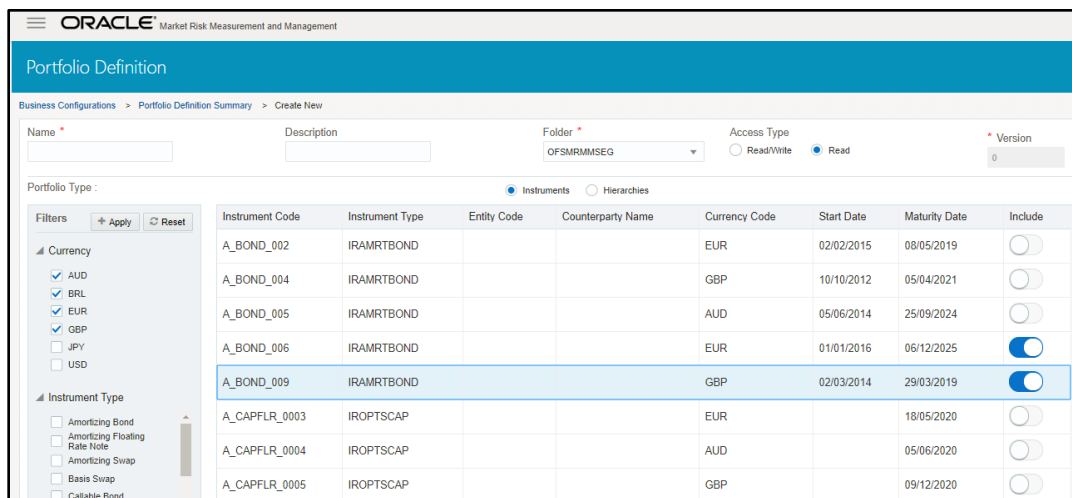


Figure 24 Business Configurations – Portfolio Definition Based on Instruments

- b. To create the Portfolio based on hierarchy, follow the below steps:
 - i. Select the **Hierarchy** radio button in **Portfolio Type**.
 - ii. Select the hierarchy from the **Available Values** and add them to the list of **Selected Values** by using button. To select multiple values use Ctrl or Shift key. To select all the Available Values, use button. To remove any selected value from the list use button. To remove all the selected values use button.
 - iii. In the **Select Currencies for Current Portfolio** field, select the desired currency.

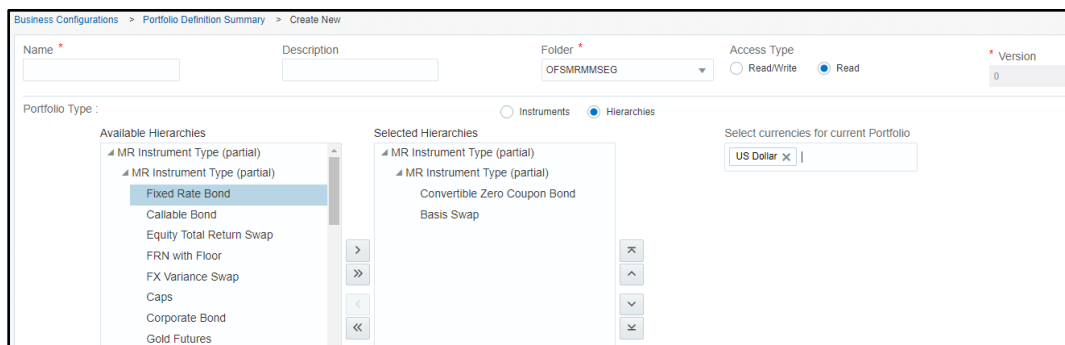


Figure 25 Business Configurations – Portfolio Definition Based on Hierarchy

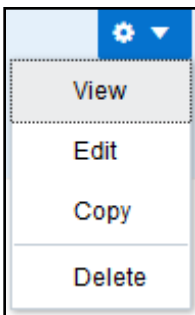
10. Click **Save**. Portfolio ID saved successfully message is displayed. You can now view the Portfolio in the Summary screen. The Portfolios created in this module are further used for computation in the MRMM Instrument Valuation module.

Click **Submit**, to save and submit the portfolio.


11. Click **OK**. You can view the Portfolio in the Portfolio Summary screen.

12. To submit the Portfolio for approval, open the portfolio in edit mode, and click **Submit**. The portfolio is submitted for approval.

To perform actions such as editing an existing portfolio, creating a copy and so on, click the actions drop-down menu adjacent to each portfolio name.




7.3.2 Viewing a Portfolio

You can view a Portfolio at any given point from the Portfolio Summary page. To view an existing Portfolio, select View in the actions drop down list  adjacent to the Portfolio name. The Portfolio Definition window displays the details of the selected Portfolio. You cannot edit any details in view mode.


7.3.3 Editing a Portfolio

You can edit a portfolio at any given point from the Portfolio Summary page. To edit an existing portfolio:

1. Select **Edit** in the actions drop down list  adjacent to the portfolio name. The Portfolio Definition window displays the details of the selected portfolio for editing.
2. Edit the required fields.
3. Click **Save**. The updated information can be viewed in the Portfolio Summary page.

7.3.4 Copying a Portfolio

You can copy a Portfolio at any given point from the Portfolio Summary page. To copy an existing portfolio, follow the below steps:

1. Select **Copy** in the actions drop-down list  adjacent to the Portfolio name.
2. Assign a new **Portfolio Name**, and edit the **Description**.

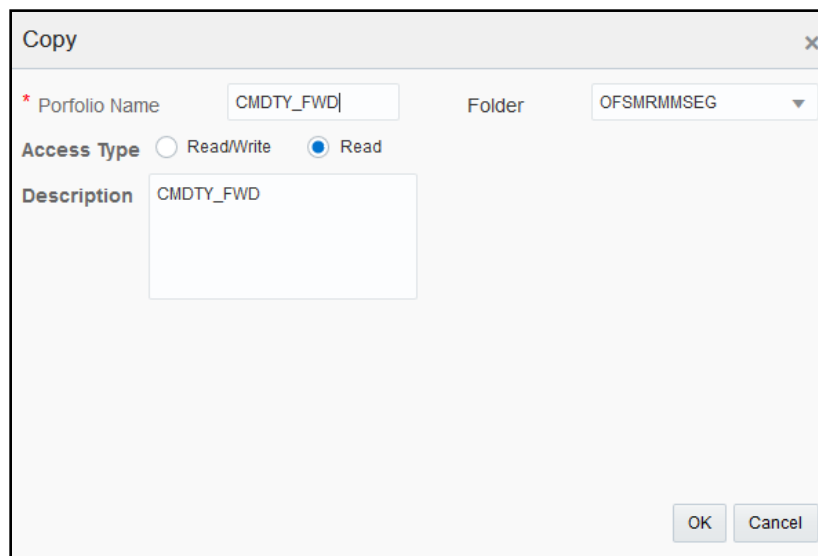


Figure 26 Portfolio Definition – Copying a Portfolio

3. Click **OK**. The copy is created and can be viewed in the Portfolio Summary screen.

7.4 Modellable and Non-Modellable Risk Factor

A risk factor is referred as modellable, when the price of risk factor is real and is continuously available. All the risk factors should be classified into modellable and non modellable. Expected Shortfall (ES) and Value at Risk (VaR) computation is done only for modellable risk factor. In this screen you can set the business rules and identify risk factors as modellable or non-modellable.

7.4.1 Defining Modellable and Non-Modellable Risk Factors

This section details the procedure for classifying a risk factor into modellable or non- modellable. The classification of a risk factor as modellable or non-modellable is performed using this screen.

The screen has the below two sections:

- Modellable and Non-modellable Executions

This section displays the list of executions and their status. You can select the previous execution from the Select Execution Date drop-down box, and check the status as Success or Failed.

- Modellable and Non-modellable Risk Factors

This screen has two sections. The LHS displays the list of filters where you can select the nodes of given filter. Click Apply to apply the filters to the risk factors, or Reset to remove all the filters. The filtered set of risk factors can be viewed in the screen.

Risk Factor	Institutio...	Price for...	Committ...	Price Obt...	Non-mod...	Real Price	Continuo...	Modellable
CMDTY.USD-COMEX-GCA.FWD-29-DEC-2017.MID	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
CMDTY.USD-COMEX-GCA.VOL:1M:0.900.:STRIKE-RLTV.MID	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
CR.USD-MS_SNRFOR_MR.CDS-1Y.SPREAD.MID	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
CR.USD-MS_SNRFOR_MR.CDS.RECOVERY	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
EQ.USD-COMEX-GCA.DIV.ABSLT-15-AUG-2016-15-AUG-2016	✓	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
EQ.USD-COMEX-GCA.DIV.CONT	✓	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
EQ.USD-COMEX-GCA.SPOT.VOL:3M:0.900.:STRIKE-RLTV.MID	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
EQ.USD-COMEX-GCA.SPOT.VOL:3M:0.950.:STRIKE-RLTV.MID	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
FX.GBPUSD.FWD-07-JAN-2017.MID	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>
FX.GBPUSD.FWD-08-JAN-2017.MID	x	x	x	x	x	x	✓	<input checked="" type="checkbox"/>

Figure 27 Modellable and Non-Modellable Risk Factor Identification Summary Screen

Following is the list of applicable filters:

- Risk Factor Type
- Term/Target Currency
- Inflation Index Name
- Market Capitalization Category
- Commodity Group
- Bond Type
- Market Data Source
- Asset Class
- Market Data Type
- Currency
- Base/Known Currency

The table on the RHS displays information about all the risk factors with following columns:

- Name of the Risk Factor
- Institution Conducted a Transaction (ICAT)
- Price form Transaction Between Other Arms-Length Parties (TBOALP)
- Committed Quote (CQ)
- Price Obtained from Third Party Vendor (TPV)
- Non- Modellable Idiosyncratic credit spread (NMICS)
- Real Price (RP)
- Continuously Available (CA)
- Modellable

You need to set rules for the risk factors before proceeding for identification of the modellable risk factors. After configuration of rules, modellable/non-modellable classification is performed as explained in the below example. Assume that following is the list of risk factors.

Market Data String	Asset Class	Market Data Type	Market Data Source	IR Index	Currency	Exchange Name
IR.EUR-EONIA.CASH-ON.MID	IR	CASH	Blue	EONIA	EUR	
IR.USD-USTREASURY-USGOVT.BILL-0-01-apr-2016.01-dec-2016.Price.MID	IR	SOV_BILL	Blue		USD	
FX.AUDUSD-SPOT.MID	FX	FX_SPOT	FX Source			
EQ.GBP-LN-CRH.SPOT.MID	EQ	EQ_SPOT	EQ Source		GBP	LN
CMDTY.USD-NYMEX-HO.SPOT.MID	CMDTY	CMDTY_SPOT	Commodity Source		USD	NYMEX
IR.ZAR-JIBAR-3m.FRA-4M-7M.MID	IR	FRA	IR Source	JIBAR	ZAR	
IR.USD-LIBOR-3m.SWAP-6Y.MID	IR	SWAP	Blue	LIBOR	USD	

The rules created are as below.

Rule for Institution Conducted a Transaction

Rule Name	Asset Class	Currency
Rule 1	IR	EUR,USD

Rule Name	Market Data Source	Currency
Rule 2	Commodity Source	USD

Rule for Price from Transaction Between other Arms-Length Parties

Rule Name	Asset Class	Market Data Type
Rule 1	IR, CMDTY	CASH, SOV_BILL, CMDTY_SPOT

Rule for Committed Quote

Rule Name	Market Data Type
Rule 1	FRA, SWAP

Rule for Price Obtained from Third Party Vendor

Rule Name	Market Data Source
Rule 1	FX Source

For each risk factor the flag is updated based on the rule as shown in the below table.

Market Data String	ICAT	TBOALP	CQ	TPV
IR.EUR-EONIA.CASH-ON.MID	Y	Y	N	N
IR.USD-USTREASURY-USGOVT.BILL-0-01-apr-2016.01-dec-2016.Price.MID	Y	Y	N	N
FX.AUDUSD-SPOT.MID	N	N	N	Y
EQ.GBP-LN-CRH.SPOT.MID	N	N	N	N
CMDTY.USD-NYMEX-HO.SPOT.MID	Y	Y	N	N
IR.ZAR-JIBAR-3m.FRA-4M-7M.MID	N	N	Y	N
IR.USD-LIBOR-3m.SWAP-6Y.MID	Y	N	Y	N

The RP value is computed as Yes for each risk factor if the following condition is met:

(Institution conducted a transaction= "Yes" AND (Price form transaction between other arms-length parties= "Yes" OR Committed quote = "Yes") OR Price Obtained from Third Party Vendor = "YES")

Based on the condition in the above table the application identifies whether the price is Real Price (RP), as shown below.

Market Data String	Real Price
IR.EUR-EONIA.CASH-ON.MID	Y
IR.USD-USTREASURY-USGOVT.BILL-0-01-apr-2016.01-dec-2016.Price.MID	Y
FX.AUDUSD-SPOT.MID	Y
EQ.GBP-LN-CRH.SPOT.MID	N
CMDTY.USD-NYMEX-HO.SPOT.MID	Y
IR.ZAR-JIBAR-3m.FRA-4M-7M.MID	N
IR.USD-LIBOR-3m.SWAP-6Y.MID	Y

The Continuously Available value is flagged as Yes/No based on the below calculation:

If the following conditions are met for the historical data of risk factor for a specified period, then the risk factor will be identified as Continuously Available, else it is marked as not Continuously Available:

- At least 24 data points should be available for continues availability period of 1 year. If there is a continuous availability period of 2 years, then at least 48 (24 * 2) data points should be available.
- Maximum period between two consecutive data points should not be more than 1 month.


For the current example, assume that all risk factors are Continuously Available.

Market Data String	Continuously Available
IR.EUR-EONIA.CASH-ON.MID	Y
IR.USD-USTREASURY-USGOVT.BILL-0-01-apr-2016.01-dec-2016.Price.MID	Y
FX.AUDUSD-SPOT.MID	Y
EQ.GBP-LN-CRH.SPOT.MID	Y
CMDTY.USD-NYMEX-HO.SPOT.MID	Y
IR.ZAR-JIBAR-3m.FRA-4M-7M.MID	Y
IR.USD-LIBOR-3m.SWAP-6Y.MID	Y

The flag for Modellable is computed with values as Yes/No. Risk Factor will be identified as Modellable if “Real Price” is Yes and “Continuously Available” is Yes. The modellable and non-modellable flag is updated based on the logic, as shown below.

Market Data String	Modellable
IR.EUR-EONIA.CASH-ON.MID	Y
IR.USD-USTREASURY-USGOVT.BILL-0-01-apr-2016.01-dec-2016.Price.MID	Y
FX.AUDUSD-SPOT.MID	Y
EQ.GBP-LN-CRH.SPOT.MID	N
CMDTY.USD-NYMEX-HO.SPOT.MID	Y
IR.ZAR-JIBAR-3m.FRA-4M-7M.MID	N
IR.USD-LIBOR-3m.SWAP-6Y.MID	Y

To set rules for each risk factor follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the **Business Configuration** window.
4. Select **Modellable and Non-modellable Risk Factor Identification**. The Modellable and Non-modellable Summary page is displayed.
5. Click **Set Rules**. The Risk Factor Rules screen is displayed. The screen displays the five flags Institution Conducted a Transaction, Transaction between Other Arm Length Parties, Committed Quote, Third Party Vendor and Idiosyncratic Credit Spread. The calculation of the risk factors Real Price (RP) and Continuously Available (CA) is dependent on these five flags. You can add multiple rules to each flag.

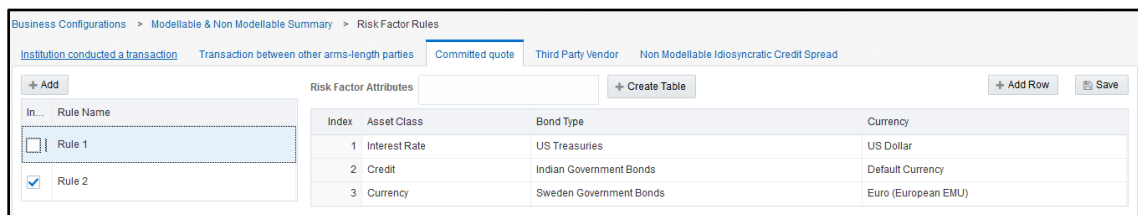


Figure 28 Modellable and Non-Modellable Risk Factor Identification- Setting Rules

6. Navigate to any of the five flags and click **Add**. A new rule is created.

7. Select the attributes for each rule which is created. For example, when you click Add in the Committed Quote column, a new Rule is created. When you click on the rule name, the **Risk Factor Attributes** field becomes available. For every rule, you need to add one or multiple risk factor attributes.

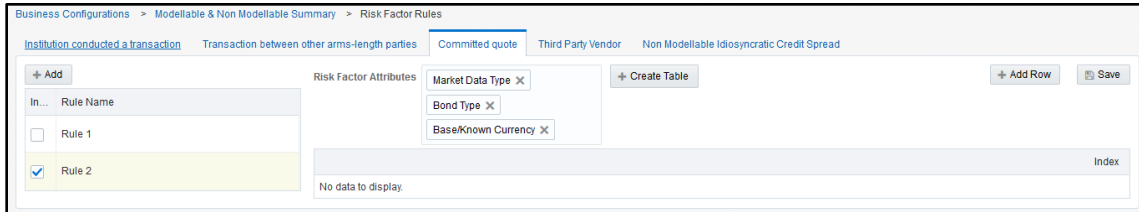


Figure 29 Modellable and Non-Modellable Risk Factor Identification- Adding Attributes

8. After selecting attributes, click **Create Table**. The selected attributes are displayed as column headers in the table.
9. Click **Add Row** to create a new row, and click on each cell. The pre-seeded dimensions for the attributes are displayed. Select the required dimensions and add in the table.

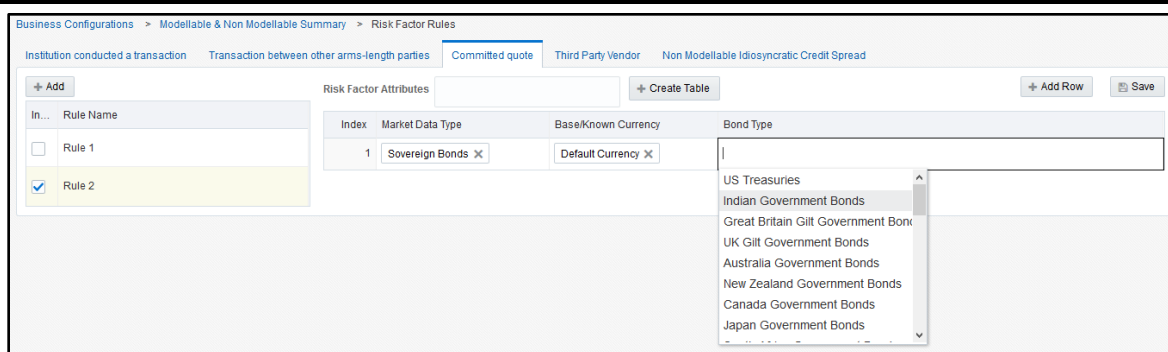
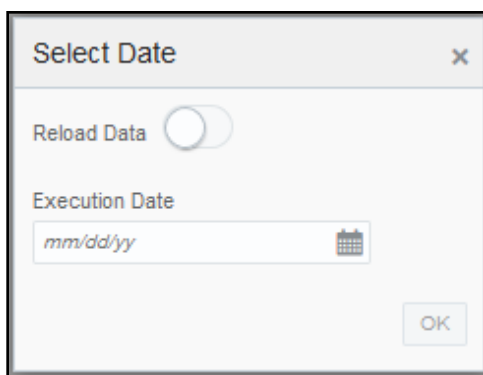


Figure 30 Modellable and Non-Modellable Risk Factor Identification – Adding Dimensions to Attributes

Note:

Use 'F2' key, or click on any other row to exit the edit mode in a table, before updating or navigating to a different tab.

10. Click **Save**. The rules are saved. Additionally, you can also change the sequence of the rules to be executed by dragging the rules. Sequence of the rule in table will be sequence of execution of rule. You will have to select the check box for each rule if you wish to apply the rule for identifying the corresponding attribute. If you do not select the check box, the application will not execute the rule. Similarly set rules for all the required flags.
11. Click **Execute** in the summary screen. **Select Date** message box appears. To reload risk factor data of the last execution of given date, select **Reload Data**. In this case, the application will not derive the risk factor data required for instruments it will take last identified risk factor data. Else provide the Execution Date and click **OK**.



The rules created for Institution Conducted a Transaction (ICAT), Price form Transaction Between Other Arms-Length Parties (TBOALP), Committed Quote (CQ), Price Obtained from Third Party Vendor (TPV) and Non-Modellable Idiosyncratic credit spread (NMICS) will be executed in the sequence displayed in the respective interface. Rules will update the target column based on mapping selected in source column.

The RP value is computed as Yes, for each risk factor if following condition is met:

The Continuously Available value is flagged as Yes/No

The flag for Modellable is computed with values as Yes/No. Risk Factor will be identified as Modellable if “Real Price” is Yes and “Continuously Available” is Yes. Corresponding risk factor should be marked as Modellable (Yes) else mark risk factor as non Modellable (No).

12. The RHS of the summary screen has filters that can be applied to filter the risk output data based on the risk factors. You can manually modify the system computed values for modellable and non-modellable for each risk factor.
13. Click **Save** to save the modifications made to the modellable status of risk factor. The resulting data is further used in the output metrics computed in historical simulation.

7.5 Market Scenarios

OFS MRMM uses a variety of market data such as Rate, Price, Curve, and Volatility to perform Instrument, Counterparty and Portfolio level risk analysis.

A Scenario is a set of changes which can be applied to a base market. Current market data can be used for business as usual analysis. However, to perform what-if analysis and other scenario analysis modified market data is required. Market Scenarios section in MRMM application, enables you to define market data under multiple scenarios, which can be further used to perform valuations.

7.5.1 Configuring a Scenario

The functionality enables you to create and configure a new scenario.

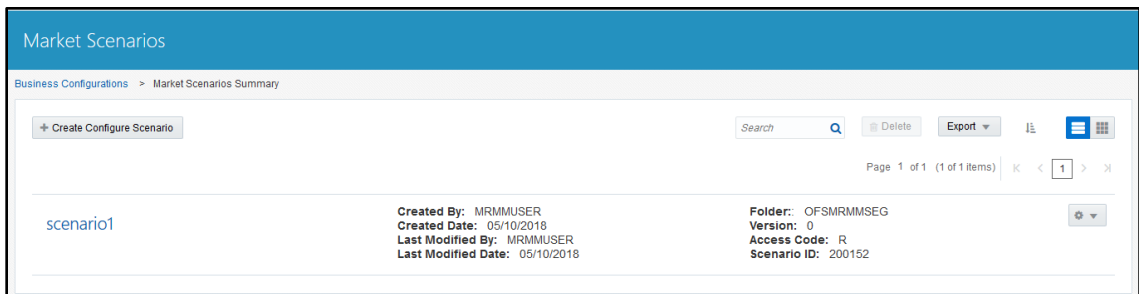


Figure 31 Market Scenario – Scenario Definition Summary Screen


Figure 32 Scenario Definition Screen

The following table describes the fields in the Scenario Definition window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name*	Displays the identification number assigned to the Scenario.
Description	Provide a short description for the Scenario
Folder*	Assign a folder name where the Scenario will be saved
Access Type	Specify the user access type for the Scenario.
Version*	Specify the version.
Risk Factor Type	Select the Risk Factor Type from the drop-down box
Market Data Type	Select the Market Data from the drop-down box
Shock Type	Select the type of Shock. Available values are Percentage, Absolute Value and Basis Point
Shock Value	Specify the shock value to be applied
Definition ID	In the audit trail section, this ID displays the identification number assigned to the Shock.

Table 11 Fields and their Descriptions in Scenario Definition window

To configure a new scenario follow the below procedure:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  button in the MRMM home screen to navigate to the Application Preferences window.
4. Click Market scenarios. The **Market Scenarios Summary** screen is displayed.
5. Click **Configure Scenario** to create a new scenario.
6. Enter details for the fields Name, Description, Folder and Access Type
7. To add a shock to the scenario, in the Shock at Risk Factor Type Level box, click **Add Row**.
8. Select the **Risk Factor Type** and the corresponding **Market Data Type** from the drop-down list.
9. Select the **Shock Type** and assign a **Shock Value**. For details see [Shock Definition Parameters](#). You can create multiple shocks in a scenario.
10. In the Shock at Attribute Level box, click **Add Row**. Based on the Risk Factor Type and Market Data Type selected, the available factors/keys for shock definition are displayed. Provide the details in the fields. See table below for details of [shock attributes](#).
11. Click **Save**. The Scenario is defined and displayed in the summary page.
Click **Submit**, to save and submit the scenario.
12. Click **OK**. You can view the Scenario in the Scenario summary screen.
13. To submit the scenario for approval, open the scenario in edit mode, and click **Submit**.
The scenario is submitted for approval.

7.5.2 Shock Definition Parameters

Shock can be defined at various levels of dimension and market data market quotes. You need to select the factors based on which the shock needs to be defined. The factors used to define a shock are dependent on the Risk Factor Type and Market Data Type. Depending on the factor the definition of a shock can be classified into the four categories. The categories are explained considering Interest Rate Shock as an example:

- **Highest Level of Risk Factor:** Any shock defined at this level will impact all the yield curves. In the example, of Interest Rate Shock, this shock will be applied is at the level of Interest Rate (IR). Any shock defined at IR level will impact all yield curves.
- **Currency Level:** Any shock defined at this level will impact all yield curves mapped to a specific currency type. In the example, of Interest Rate Shock, this shock will be applied is

at the level of IR, mapped to a specific currency type such as US Dollar (USD). Any shock defined at IR-USD level will impact all yield curves where currency is USD.

- **Yield Curve Level:** Any shock defined at this level will impact the dimensions mapped to a specific to a currency type, of a specific yield curve. In the example, of Interest Rate Shock, this shock will be applied is at the level of IR, mapped to a specific currency type such as US Dollar (USD), and yield curve such as LIBOR. Any shock defined at IR-USD-LIBOR level will impact only LIBOR yield curve where currency is USD
- **Yield Curve Term Point Level** Any shock defined at this level will impact the dimensions mapped to a specific currency type, of a specific yield curve with a defined term point. In the example, of Interest Rate Shock, this shock will be applied is at the level of IR, mapped to a specific currency type such as US Dollar (USD), and yield curve such as LIBOR with a fixed term point. Any shock defined at IR-USD-LIBOR-3M level will impact only 3 months term point of LIBOR yield curve where currency is USD.

For example if the shock value for IR-USD-LIBOR-3M is 1% and that for IR-USD-LIBOR is 2%. In this case a three month term point will be shocked by 1% whereas all other term points in yield curve will be shocked by 2%. Below table illustrates the way shock definition is expected to work in the form of a hierarchy. As a result the below percentage of shock is applied to the yield curves:

- 4% shock to 3 month term point of yield curve IR-USD-LIBOR
- 3% shock to all term points except 3 month of yield curve IR-USD-LIBOR
- 2% shock to all USD yield curves except LIBOR
- 1% shock to all yields curves where currency is not USD

Level 1	Level 2	Level 3	Level 4	Shock value
IR				1%
IR	USD			2%
IR	USD	LIBOR		3%
IR	USD	LIBOR	3M	4%

The below table lists the factors for each type of market data which can be used to define shock. Additionally, dimensions such as Cash Flow, Time Bucket, industry/sector of the Counterparty, Counterparty Type, and Rating of Instrument and so on can also be used to define shock. Generic dimensions are applicable to all the shock factors. The granularity of the shock is inversely proportional to the number of dimensions selected.

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Type of Risk Factor	Type of Market Data	Available Factors/Key for Shock Definition
CMDTY	Commodity Forward	Currency, Exchange, Ticker, Maturity
CMDTY	Commodity Spot	Currency, Exchange, Ticker
CMDTY	Commodity volatility surface	Currency, Exchange, Ticker, Maturity, Strike, Strike Type
CR	Credit index swap	Currency, Index Series Version, Tenor, Indicator (Spread/Recovery)
CR	Single-name credit default swap	Currency, Reference Entity, Debt Type, Restructuring clause, Tenor
CR	Survival Probabilities	Currency, Reference Entity, Debt Type, Restructuring clause, Maturity
EQ	Equity Dividends	Currency, Exchange, Ticker, Dividend Structure
EQ	Equity Futures	Currency, Exchange, Contract code, Maturity Code
EQ	Equity Spot	Currency, Exchange, Ticker
EQ	Equity volatility surface	Currency, Exchange, Ticker, Maturity, Strike, Strike Type
FX	Foreign exchange forward	Base Currency, Term Currency, Market Type, Maturity
FX	Foreign exchange spot	Base Currency, Term Currency
FX	FX volatility surface	Base Currency, Term Currency, Tenor, Strike
INFL	Inflation-Indexed Options	Currency, Inflation Index, Flavour, Strike, Maturity
INFL	Inflation-Indexed Swaps	Currency, Inflation Index, Maturity
INFL	Inflation-Linked Bonds	Currency, Type of bond, Issuer, Inflation Index
INFL	Seasonality	Currency, Inflation Index, Season Month
IR	Basis Swap	Currency, IR Index, IR Index Tenor for both legs of swap, Maturity of swap
IR	Bonds/Bills	Currency, Type of bond/Bill, Issuer, Maturity
IR	Cap volatility surface	Currency, IR Index, IR Index Tenor, Cap Tenor, Cap Strike
IR	Cash	Currency, IR Index, IR Index Tenor
IR	Cross-currency basis swap	Currency, IR Index, IR Index Tenor for both legs of swap, Maturity of swap
IR	Cross-currency fixed-for-floating swap	Currency, IR Index, IR Index Tenor for both legs of swap, Maturity of swap, Market Type

Type of Risk Factor	Type of Market Data	Available Factors/Key for Shock Definition
IR	Forward rate agreement	Currency, IR Index, IR Index Tenor, FRA Period
IR	Represent a point on a swaption volatility cube	IR.[Underlying].SWPT.StrikeType::Strike::OptTenor::SwapTenor::DataType.QuoteType where [Underlying] = Currency-IRIndex-IRIndexTenor.VOL
IR	Swap	Currency, IR Index, IR Index Tenor, Swap Tenor
IR	Swaption volatility cube	Currency, IR Index, IR Index Tenor, Strike Type, Strike, Option Tenor, Swap Tenor
IR	Swaption volatility surface	Currency, IR Index, IR Index Tenor, Swaption Strike, Option Tenor, Swap Tenor

Table 12 Shock Attributes

7.5.3 Type of Shocks

Shock types are defined as a set of additive and multiplicative operations. It results in either an increase or decrease of the base market quotes.

Shock can be defined as Percent, Basis Points or Absolute Value.

7.5.3.1 Shock in Terms of Percent

In this scenario the shock value is defined in terms of percent. For example: 1%, -2% and so on. This is applicable to all risk factors.

Below are a few examples:

Example 1: If the Base quote = 2 and the Shock value = - 2%

Modified quote = $2 * [1 + (-2\%)] = 1.96$

Example 2: If the Base quote = 2 and the Shock value = 1%

Modified quote = $2 * [1 + (1\%)] = 2.02$

7.5.3.2 Shock in Terms of Basis Points

In this scenario the shock value is defined in terms of Basis Points (BP). For example: 1 BP up, 5 BP down and so on. This is applicable to risk factors expressed in terms of rate such as Interest Rate, Swap Rate, and Forward Rate Agreement (FRA) Rate and so on. Below are a few examples:

Example 1: If the Base quote = 2 and the Shock value = - 5 BP

Modified quote = $2 + (-0.05) = 1.95$

Example 2: If the Base quote = 2 and the Shock value = 4 BP

Modified quote = $2 + 0.04 = 2.04$

7.5.3.3 Shock in Terms of Absolute Value

In this scenario the shock value is defined in absolute terms. For example: USD 10 up, GBP 5 down and so on. This is applicable to risk factors expressed in terms of price such as Equity Spot Price, Index, Futures, Bond Price and so on. Below are a few examples:

Example 1: If the Base quote = 112 and the Shock value = 5

Modified quote = $112 + 5 = 117$

Example 2: If the Base quote = 112 and the Shock value = - 8

Modified quote = $112 + (- 8) = 94$

7.6 Hybrid Model

Hybrid model is a combination of models used to price multi-asset class deals. The Monte Carlo technique used for Counterparty risk calculations requires a global hybrid model to be constructed and used for the exposure calculation of each trade. The hybrid model is composed of a set of component models, for which parameters, correlation values and calibration strategies must be defined.

Rule within a hybrid model defines a pattern that is used to match the name of the underlying's specified by the trades. If a rule's pattern matches the name of an underlying, other attributes in the Rule element specify what type of model should be generated, and the parameters for that (such as calibration strategy, and primary/secondary selection). Multiple rules can match an underlying, since the same underlying can require multiple factor models.

7.6.1 Adding a Hybrid Model

This section details the procedure for adding a hybrid model. The following table describes the fields in the Hybrid Model window:


Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name*	Enter the portfolio name.
Quote Type	Correlation factors are found by looking in the market data, and this element notes how to form the full key of those correctly factor quote keys. Select any one value from available list – ASK, BID, FIX, LAST, MID
Version*	Displays the workflow version.

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Workflow Status	Displays the status of the workflow
Pattern	Defines a pattern with positional strings that is used to match the name of an underlying. This determines if the rule is applicable for a specific trade's underlying. If the pattern matches, the rule is used to generate one or more factor models in the output hybrid model setup. For example, "IR.<Currency>" will match any underlying with the pattern that it starts with the string "IR." and ends with some currency string. The positional strings are set with the specified name (or names), and will be substituted in the value of other attributes of the rule.
Number Factor	The number of factors for the underlying component model, if it can be configured with multiple factors.
Priority	It indicates the priority that is used when two or more pattern match the name of an underlying.
Model ID	This field indicates the ID string of the model to be created for the single-factor model. It can refer to positional strings found when the Pattern was matched. For example, "IR.MODEL.HW1F.<Currency>" will be the string "IR.MODEL.HW1F.USD" if the previous example's Pattern matched the underlying "IR.USD".
Calibration Script	A Numerix (NXEL) script function to call to generate the calibration instruments for the model
Is primary	Set this to "true" or "false" to indicate if the generated model is a primary or secondary one. Secondary models are separate from other secondary models, and are only correlated with the primary models.

Table 13 Fields and their Descriptions in Hybrid Model Window

To add a hybrid model, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.

2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Click  in the MRMM home screen to navigate to the **Business Configuration** window.
4. Click **Hybrid Model**, to view the hybrid model definition screen.

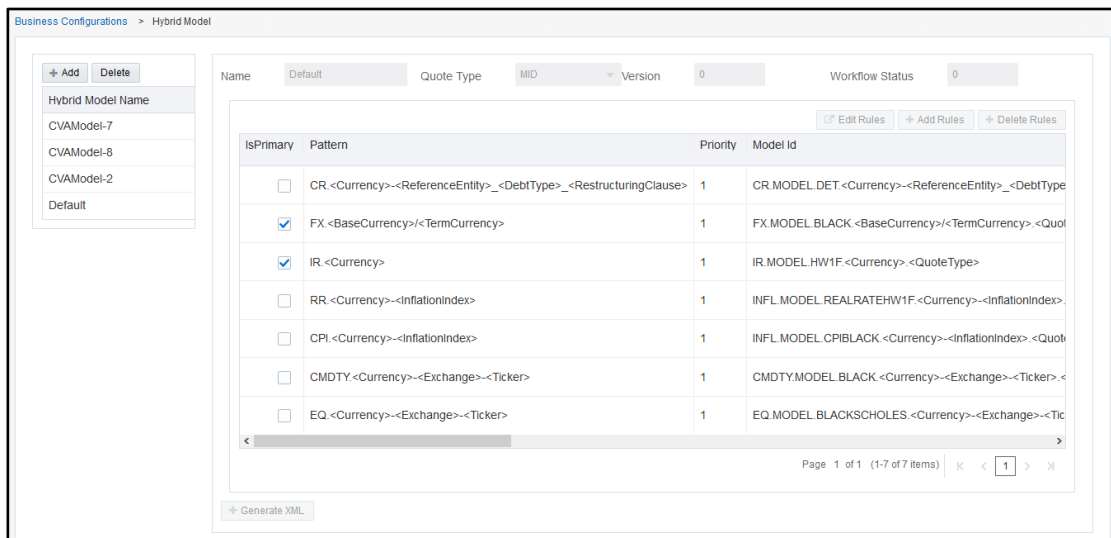


Figure 33 Hybrid Model Definition Screen

5. Click **Add**.
6. Provide a **Name** and **Quote Type** for the model.
7. Click **Add Rule**.
8. Based on the selected Pattern, the fields are displayed. Enter the relevant details in the fields. The below table lists the mapping between pattern and fields displayed:

Pattern	Fields
Common	Number Factor
	Priority
	Model ID
	Calibration Script
IR.<Currency>	Currency
FX.<Basecurrency>/<Termcurrency>	Base Currency
	Term Currency
CR.<Currency>	Currency

Pattern	Fields
<ReferenceEntity>_<DebtType>_<RestructuringClause>	Debt Type
	Reference Entity
	Restructuring Clause
EQ.<Currency>-<Exchange>-<Ticker>	Currency
	Exchange
	Ticker
CMDTY.<Currency>-<Exchange>-<Ticker>	Currency
	Exchange
	Ticker
CPI.<Currency>-<InflationIndex>	Currency
	Inflation Index
RR.<Currency>-<InflationIndex>	Currency
	Inflation Index

9. Provide details for **Number Factor**, **Priority**, **Model ID**, and **Calibration Script**.
10. Check the Is Primary check box, if applicable.
11. Click **Save**.
12. Click **Generate XML**. This file is used while defining a business definition in Monte-Carlo simulation > [Model Parameters](#) (Hybrid Model Name).

8 Instrument Valuation

OFS MRMM Instrument Valuation module, enables you to create and analyze different perspectives of viewing the valuation of instruments. This chapter includes:

- [Overview](#)
- [Creating and Executing a Business Definition](#)

8.1 Overview

This module primarily aims to deliver the instrument granularity computations and metrics using NUMERIX. It computes the price of instruments in the portfolio, and addresses the needs of both regulatory reporting and internal risk management. You can perform valuation of instruments and positions in trading book here using pre-defined models and methods based on trading desk and/or portfolio. This module provides the below computations:

- Present value of instrument
- Cash flow of instrument
- Greeks and sensitivity associated with instrument
- Yield Risk report of instrument

8.2 Creating and Executing a Business Definition

This section elaborates the process of creating a business approach, and executing a business definition. A business definition allows you to set business specific parameters required for analysis. You need to define a business approach before creating a business definition.

8.2.1 Defining a Business Approach

A new business approach enables you to analyze each module from a trading desk or portfolio perspective. Follow the below procedure for defining a new business approach:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen select, **Market Risk Measurement and Management**.
2. Click **Market Risk Measurement and Management**, in the MRMM landing page. The MRMM Home screen is displayed.
3. Select **Business Processes > Instrument Valuation**. The Instrument Valuation Summary screen is displayed. The screen displays the list of business approaches based on Trading Desk or Portfolio.

Instrument Name	Created By	Created Date	Last Modified By	Last Modified Date	Folder
PortIV	MRMMUSER	2018-05-11 15:44:09.0	MRMMUSER	2018-05-11 15:44:09.0	OFSMRMMSEG
testBug	MRMMUSER	2018-05-11 15:01:52.0	MRMMUSER	2018-05-11 15:01:52.0	OFSMRMMSEG
HS_AMOR_FRN HS_AMOR_FRN	MRMMUSER	2018-05-08 17:24:38.0	MRMMUSER	2018-05-09 17:25:05.0	OFSMRMMSEG
AMOR_FRN_BS	MRMMUSER	2018-05-08 18:33:50.0	MRMMUSER	2018-05-08 18:33:50.0	OFSMRMMSEG

Figure 34 Instrument Valuation Summary Screen

4. Click **New**. The **New Business Approach** window is displayed.

New Business Approach

Portfolio Trading Desk

Name: Portfolio_1

Description: portfolio

Access Type: Read/Write Read

Folder: OFSMRMMSEG

OK Cancel

Figure 35 Instrument Valuation – New Business Approach

The following table describes the fields in the New Business Approach window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name	Displays the list of Trading Desk/Portfolio that you have access. Select the Trading Desk/Portfolio from the drop-down list.
Description	Displays the description for the Trading Desk/Portfolio.
Access Type	Specify the access type.
Folder	Select the folder from the drop down list.

Table 14 Fields and their Descriptions in New Business Approach Window

5. Select **Trading Desk** or **Portfolio** using the radio button.
6. In the **Name** drop-down box select the Trading Desk/Portfolio that needs to be analyzed. The list displays items that you have access to only.
7. The description field is auto populated based on the selected Portfolio/Trading desk. This is an uneditable field.
8. Select the **Access Type**, and **Folder**.
9. Click **OK**. The business approach is created.

After a business approach is created, it is listed in the Instrument Valuation Summary page. You can select any Trading Desk/Portfolio and proceed for creation of Business Definition.

8.2.2 Defining a New Business Definition

In the Valuation Summary screen, click on any business approach to navigate to the business definition screen for a specific Portfolio or Trading Desk. Click **New Business Definition**, to view the definition screen.

Figure 36 Instrument Valuation – Business Definition Screen

The screen includes the below two sections.

- **Trading desk/Portfolio information:** This section displays the trading desk/portfolio information such as Name, Description, Folder and Access Type. These fields are uneditable.
- **Business Definition:** You can define one or multiple business definitions in this section. The created definitions are displayed as tabs. Click on each tab to view details about the business definition. You can perform the below actions in this section:
 - **Editing a Business Definition:** Only business definitions in draft stage can be edited. Click a Business Definition in draft stage to edit.
 - **Viewing the Execution Summary:** You can view the execution details of the business definitions here, such as Execution ID, Execution Date, Execution Status, Definition Workflow Status, and End Of Day (EOD) execution. You can select any one execution for a given date as EOD execution. All the reports use EOD run for reporting purpose. If an EOD run has not been selected, then by the system considers the last successful execution is as EOD run.

Execution Date	Execution Id	Execution Status	Definition workflow status	EOD Execution
2016-01-01	1532345936769	SUCCESS	Draft	<input checked="" type="checkbox"/>

Figure 37 Instrument Valuation – Execution Summary

8.2.2.1 Pricing Policy

In this pane, you can select the pricing policy to be used for instrument pricing. Pricing Policy enables you to select models and methods to be used for pricing the instrument. You can either download, or define the pricing policy

- **Download:** If you select the Download option, then with all the corresponding instrument data, you will need to provide the models and methods to be used for pricing.

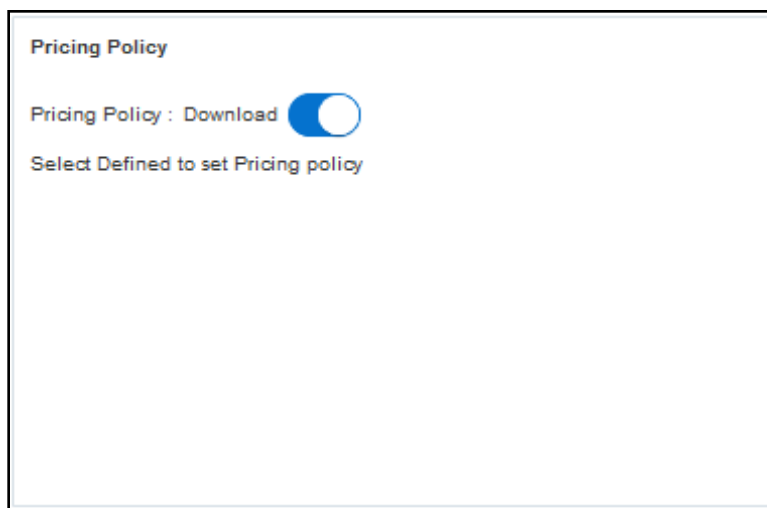


Figure 38 Instrument Valuation – Pricing policy Download

NOTE: In case for some instrument data the download values have not been provided, then default models will be used for pricing. The default models are defined in the [Business Configuration](#) section.

- **Define:** The Define option allows you to select the models and methods at the granularity level of Instrument Type and Currency. The pricing policy of an instrument can be defined based on the instruments considered for valuation. You can select the models and methods for the corresponding Instrument type and Currency.

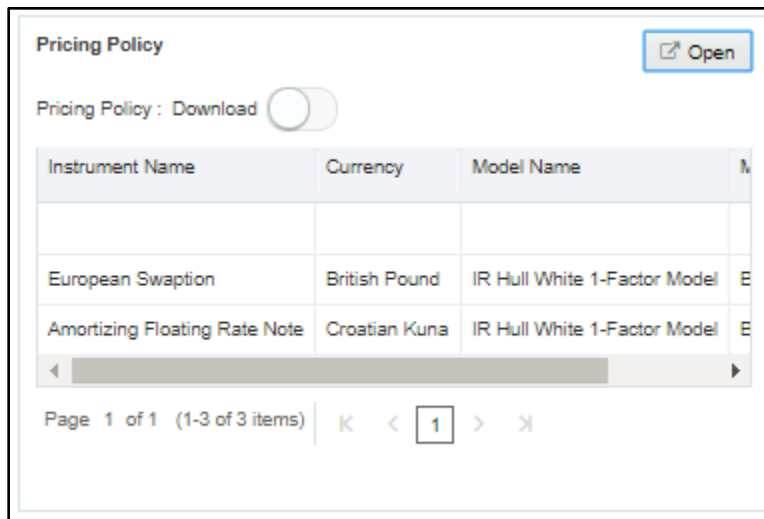


Figure 39 Instrument Valuation – Defining a Pricing Policy

To define a pricing policy, follow the below steps:

1. In the **Pricing Policy** pane, toggle off the Download button.
2. Click **Open**.
3. Click **Add** to create a new row in the table.
4. Click on each cell and select inputs for the below fields from the drop-down list.
 - **Instrument Type:** Select the instrument type for which you need to provide model and method.
 - **Currency:** Select the currency for which you need to specify model and method.
 - **Model Name:** Select the model from the drop down list. Specific list of models are eligible for specific instrument type. See [Annexure D](#) for the list of models and methods.
 - **Method:** Select the method from the drop down list. Specific list of methods are eligible for specific instrument type. See [Annexure D](#) for the list of models and methods.

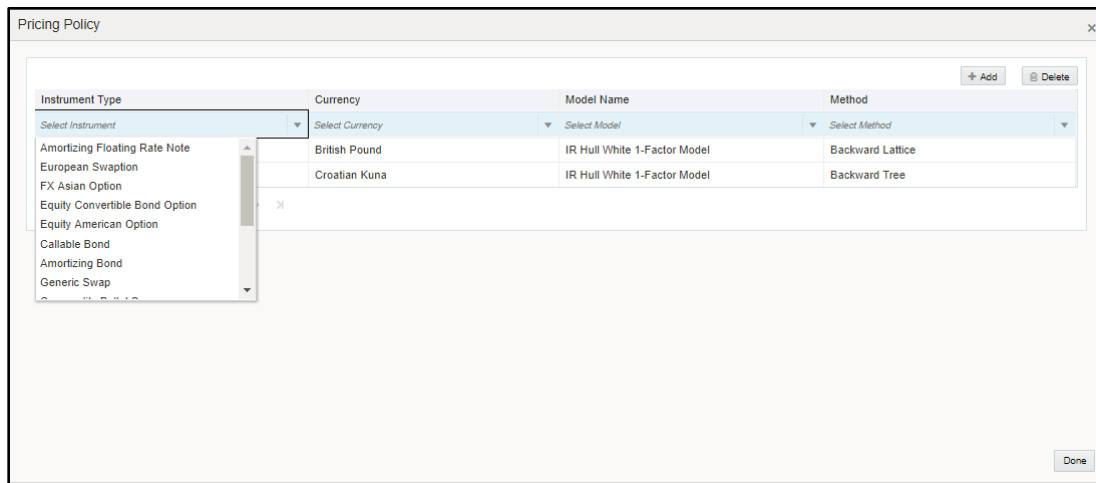


Figure 40 Instrument Valuation- Defining a Pricing Policy

5. Click **Done** to save the entries.

NOTE: In case for some instrument type and currency models and methods are not defined then default models will be used for pricing. The default models are defined in the [Business Configuration](#) section.

8.2.2.2 Scenario

In this pane, you can select only the Baseline scenario for execution. The Baseline scenario is displayed by default and cannot be deleted.



Figure 41 Instrument Valuation - Scenario

To add a scenario, follow the below steps:

1. In the Scenario pane, click **Open**.
2. Select the required scenarios from the drop-down list, and click **Add**.

NOTE: Baseline scenario is added by default in the Market Scenario drop-down, in addition to the defined scenarios.

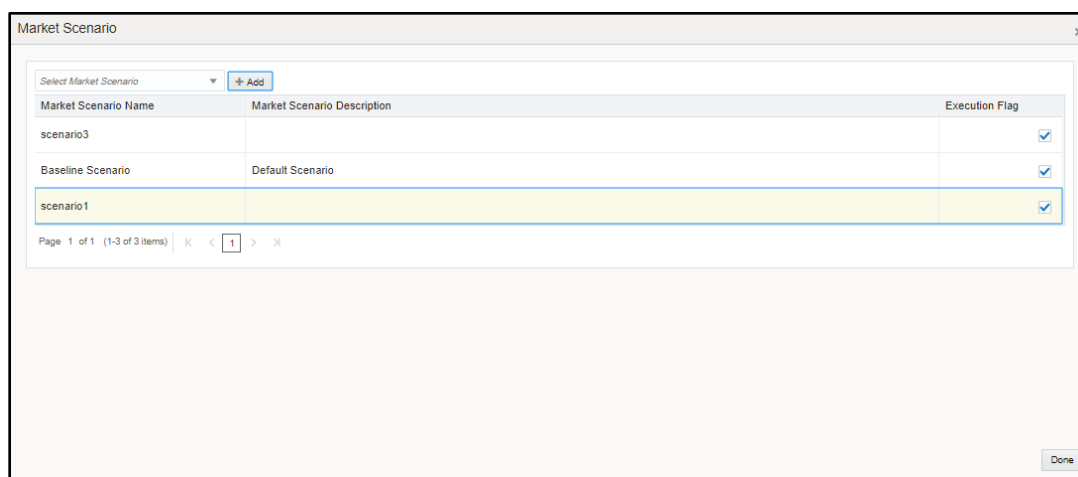


Figure 42 Instrument Valuation – Adding the Baseline Scenario

3. Select the scenario from the **Select Market Scenario** drop-down.
4. Click **Add**.
5. Click **Done**. The scenario is added to the list.

8.2.3 Procedure for Creating a Business Definition in Instrument Valuation

The defined executions are listed in the OFS MRMM Instrument Valuation summary screen. Click either Portfolio or Trading Desk tabs to view the list. Each business definition is executed as a separate run. The following table describes the fields in the new business definition window:

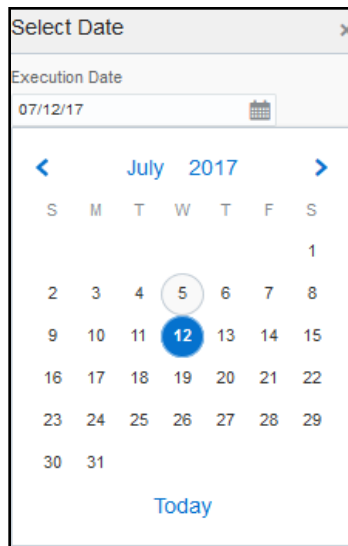
Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name*	Enter the name of the business definition.
Description	Provide a description for the business definition.
Reporting Currency*	It is the currency in which all the output for given definition will be computed. Select the currency type from the drop-down list.
Version	Displays the workflow version of the business definition.
Workflow Status	Displays the workflow status of the business definition.
Pricing Policy	Select the models and methods to be used for instrument pricing.

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Market Scenario	Select the scenario to be executed. The Baseline scenario is selected by default.
Execution Summary	Displays the execution history of the business scenarios. Select the execution to be marked as EOD execution.

Table 15 Fields and their Descriptions in Instrument Valuation-Business Definition Window

Follow the below steps to create a new business definition in Instrument Valuation:

1. Click the business approach from the OFS MRMM Instrument Valuation summary screen, for which the business definition needs to be created.
2. Click **New Business Definition**. A new tab is created.
3. Click on the new tab, and provide details in the **Name**, **Description** fields.
4. In the **Currency** field, select the currency type from the drop-down list.
5. In the **Pricing Policy** pane, select Download or Define. You can Add or Delete a defined pricing policy. See [Pricing Policy](#) for details.
6. In the **Scenario** pane, select the baseline scenario. See [Scenario](#) for details.
7. Click **Save** and **Submit**.
8. Click **Execute** to trigger an adhoc run. A pop up message with a date-time editor is displayed. Specify the date on which the execution needs to be performed and click **OK**. The execution is triggered.



9. After executing the Business Definition, select any one execution for a given date as EOD execution.

9 Market Risk – Historical Simulation

The Market Risk Historical Simulation module enables you to compute portfolio level metrics using historical simulation. This chapter includes:

- [Overview](#)
- [Creating and Executing a Business Definition](#)

9.1 Overview

This module primarily aims to measure the risk of your portfolio and/or trading desk, and deliver the portfolio granularity metrics using NUMERIX and historical simulation. MRMM Historical Simulation enables you to compute VaR, Expected Shortfall for regulatory and non-regulatory purpose and IMA capital charges, and addresses the needs of both regulatory reporting and internal risk management.

The module provides the following computation:

- ES and VaR
- Stress calibrated ES
- Internally modelled capital charge
- Stressed capital add-on
- Aggregated Charge

9.2 Creating and Executing a Business Definition

This section elaborates the process of creating a business approach, and executing a business definition. A business definition allows you to set business specific parameters required for analysis. You need to define a business approach before creating a business definition.

9.2.1 Defining a Business Approach

Business approach enables you to analyze each module from a trading desk or portfolio perspective. You can define a new business approach and view the existing business approach from the Market Risk- Historical Simulation Summary screen.

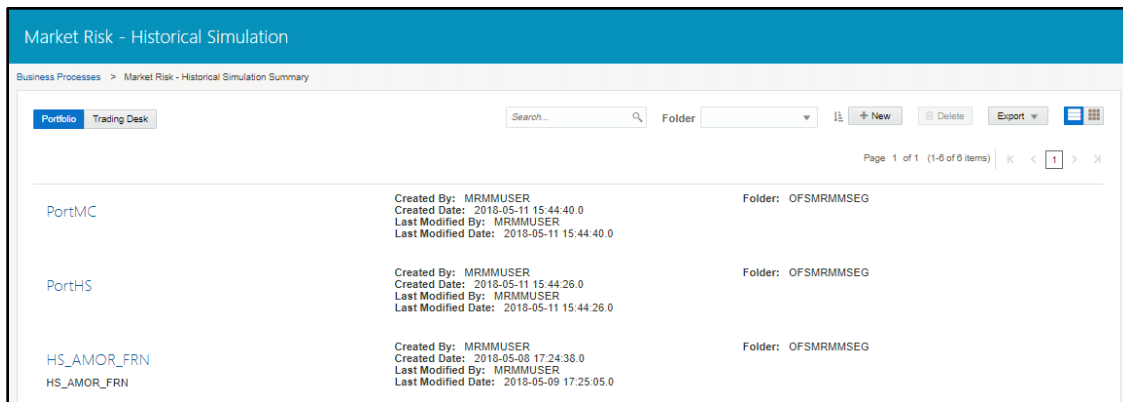


Figure 43 Market Risk – Historical Simulation Summary Screen

See [Instrument Valuation - Defining a Business Approach](#) for the detailed procedure.

9.2.2 Defining a New Business Definition

In the Market Risk – Historical Simulation Summary screen, click on any business approach to navigate to the business definition screen for the specific Portfolio or Trading Desk. Click **New Business Definition**, to view the definition screen.

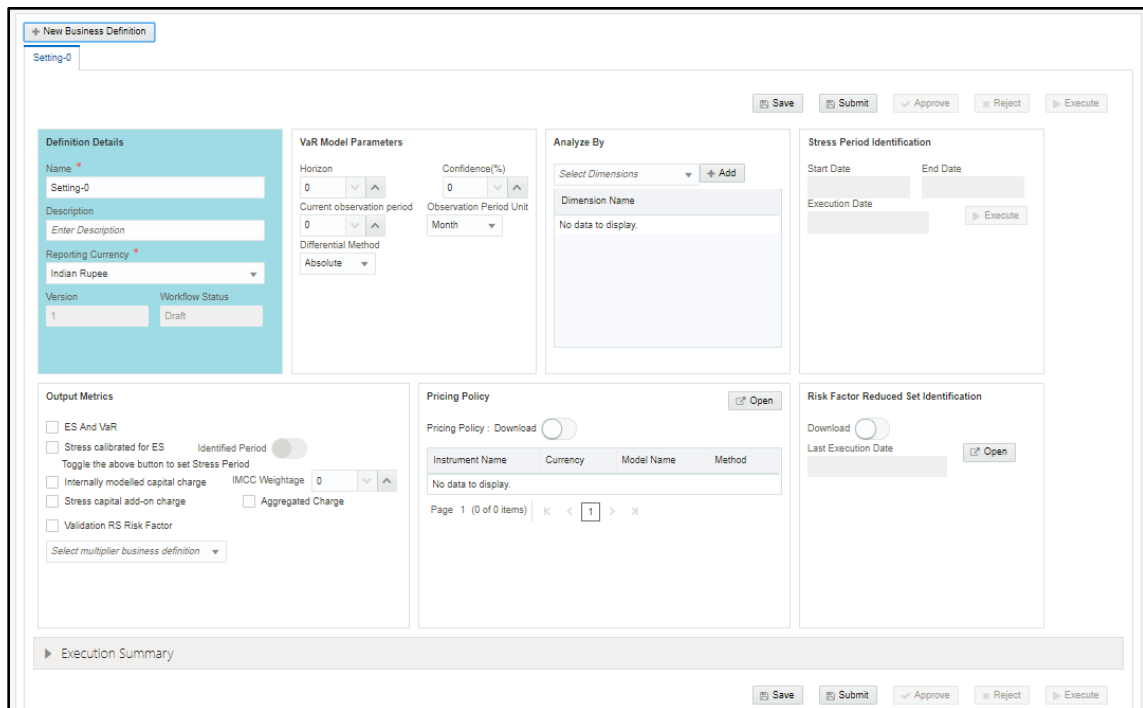


Figure 44 Market Risk Historical Simulation – Business Definition Screen

The screen includes the below two sections.

- Trading Desk/Portfolio information:** It displays the trading desk/portfolio information. These fields are uneditable.

- **Business Definition:** You can define one or multiple business definitions in this section. The created definitions are displayed as tabs. Click on each tab to view details about the business definition. You can perform the below actions in this section:
 - Edit a Business Definition: Only business definitions in draft stage can be edited. Click a Business Definition in draft stage to edit.
 - View the Execution Summary: You can view the execution details of the business definitions here, such as Execution ID, Execution Date, Execution Status, Workflow Status, and End Of Day (EOD) Execution. You can select any one execution for a given date as EOD execution. All the reports use EOD run for reporting purpose. If an EOD run has not been selected, then by the system considers the last successful execution is as EOD run.

Execution Summary					
Execution Date	Execution Id	Execution Status	Execution Type	Definition workflow status	EOD Execution
2016-01-01	1531895787350	SUCCESS	Portfolio_Risk	Draft	<input checked="" type="checkbox"/>
2016-01-01	1531894989029	SUCCESS	Portfolio_Risk	Pending Approval	<input type="checkbox"/>

Figure 45 Historical Simulation – Execution Summary

9.2.2.1 Risk Factor Reduced Set Identification

This section enables you to identify the reduced set of risk factors in such a way that it explains 75% of the variation of the full model. The last successful execution date of reduced set identification is displayed on the reduced set of risk factor pane. You can either define or download the reduced set.

Download: If you choose to download the reduced set, then reduced set of risk factors should be provided as download in FSI_MR_PORT_RISK_RED_RSK_FACTR. See Download Specifications sheet in [MoS](#) for details.

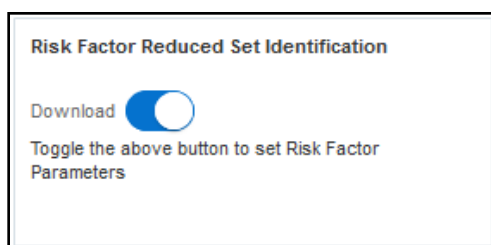


Figure 46 Risk Factor Reduced Set Identification - Download

Define: This option enables you to set the risk factor parameters.

NOTE: To compute Stress Calibrated ES of the corresponding business definition, ensure that a valid Reduced Set ES is available.

Follow the below steps to define the risk factors for reduced set identification:

1. Toggle off the download option in the **Risk Factor Reduced Set Identification** pane.

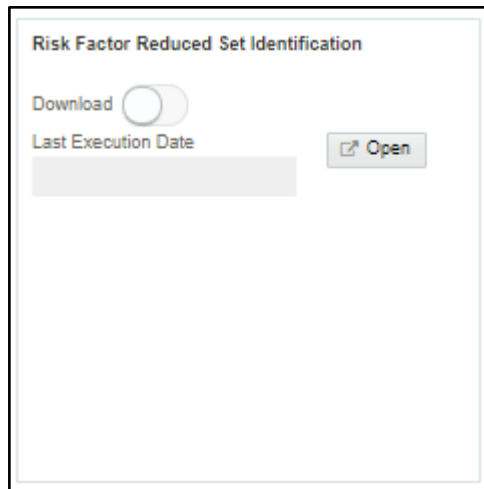


Figure 47 Risk Factor Reduced Set Identification - Define

2. Click **Open**, to view the zoom window.
3. Specify the date from the date-time editor.

Provide the number of historical days and select the unit as days, months or years from the drop-down list.

4. Click **Fetch**. The risk factor for all the instruments is fetched for the selected execution date. Fetch is background process which identifies the risk factors of the instrument for selected date. Once fetch is clicked you will have to click on refresh. If risk factors for given dates are already fetched then you can skip fetch and directly click on refresh button.
5. Click **Refresh**. Refresh will refresh the screen with already fetched risk factor for selected date.

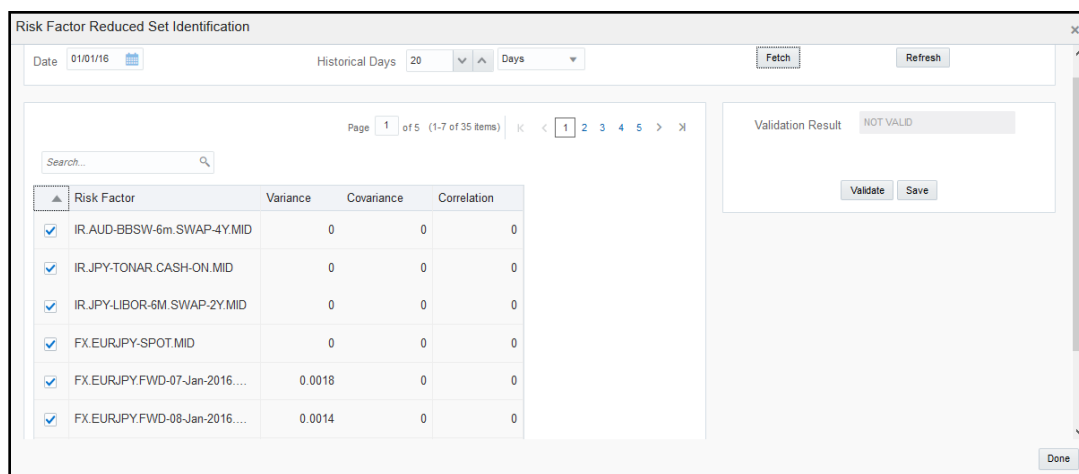


Figure 48 Defining Risk Factor Reduced Set

6. Select the check box for risk factors to be considered for reduced set.
7. Validate the reduced risk factor set after reduced set identification. OFS MRMM validates the reduced risk factor set using the below steps:
 - a. The system fetches the Expected Shortfall for full set and current observation period [ES (F, C)] amount for historical period. System expects that ES for full set is already computed for all the dates in historical period.
 - b. Computes the value for Expected Shortfall for reduced set and current observation period [ES(R, C)] for the specified historical period. To compute ES(R, C), the VaR Model Parameter and Pricing Policy specified in business definition is considered.
 - c. For each date of historical period the percentage of ES(R,C) with respect to ES(F,C) is computed by using the below formula:

$$\text{Reduced set Percentage} = \frac{ES_{(R,C)}}{ES_{(F,C)}}$$

- d. Reduced Set Identified is Valid, if ES of the reduced set of risk factors is greater than equal to 75% of the fully specified ES model on average measured over the historical period as specified by user.

$$\text{Average of "Reduced set Percentage"} \geq 0.75$$

Where,

Average is computed over historical period specified by user

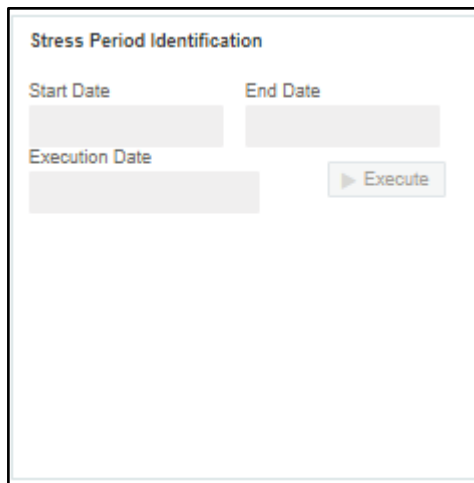
Note:

OFS MRMM skips the dates within historical period where ES full set is not available. Such dates are not considered for computing average.

8. Click **Save**.
9. Click **Done** to return to the business definition window.

9.2.2.2 Stress Period Identification

Stress period is identified as a 12-month period of stress since 2007 till execution date in which the portfolio experiences the largest loss. This section enables you to identify the stress period for a corresponding portfolio or trading desk.



The screenshot shows a web form titled "Stress Period Identification". It contains three input fields: "Start Date", "End Date", and "Execution Date". The "Start Date" and "End Date" fields are positioned side-by-side at the top. The "Execution Date" field is located below them. To the right of the "Execution Date" field is a button labeled "Execute" with a right-pointing arrow icon.

Figure 49 Stress Period Identification

This pane displays the below information:

- **Start Date:** Indicates start day of the stress period
- **End Date:** Indicates end date of the stress period
- **Execution Date:** Indicates the last execution date on which the stress period was identified

To trigger the Stress period identification process:

1. Click **Execute**.
2. Select the execution date from the date-time editor.
3. Click **OK**. The execution is triggered successfully.

9.2.2.3 VaR Model Parameters

In this section you need to define the below VaR model parameters. VaR model parameters allows you define and determine the behavior of VaR Model outputs.

Figure 50 VaR Model Parameters

- **Horizon:** It is the time horizon over which you can compute the VaR number output. Specify the horizon in terms of days.
- **Confidence:** Confidence is the percentage value that you need to define the VaR numbers. Specify the confidence value required for calculating the output.
- **Current Observation Period:** This is the current historical observation period to be considered for computation of VaR. The current historical period starts from execution date till the period specified in this column. Observation period is computed relative to execution date.
- **Observation Period Unit:** Specify the current observation period in terms of calendar days, months or years from the drop-down list.
- **Differential Method:** This is interpolation method used for interpolating missing values in historical data. This parameter indicates how to construct the simulated market from execution date's market. You can select Absolute, or Relative. The following formula explains the computation of scenario values under each method.

$$\begin{aligned} \text{Absolute difference} &= RF_t - RF_{t-1} \\ RF_{\text{Scenario Value}} &= RF_{\text{Execution date}} + \text{Absolute difference} \end{aligned}$$

$$\begin{aligned} \text{Relative difference} &= (RF_t / RF_{t-1}) - 1 \\ RF_{\text{Scenario Value}} &= RF_{\text{Execution date}} (1 + \text{Relative difference}) \end{aligned}$$

Where, RF is the risk factor, and t is the number of execution days.

9.2.2.4 Analyze By

In this pane you can select the dimensions for analyzing the VaR and ES numbers. Analyze By enables you to view VaR outputs at different granularity. For a selected dimension the application creates the tree structure of its nodes and provide the output.

For Example, Instrument Type and Currency is selected in Analyze By in the same sequence. If a portfolio has two instrument types such as Zero Coupon Bond and Equity Forward, and has two currencies such as INR and USD. Then the application generates VaR numbers at following granularity.

- VaR at Group level
- VaR for Zero Coupon Bond with both currency
- VaR for Equity Forward with both currency
- VaR for Zero Coupon Bond and INR
- VaR for Zero Coupon Bond and USD
- VaR for Equity Forward and INR
- VaR for Equity Forward and USD

You can change the sequence of selected dimension by using drag and drop feature of the user interface.

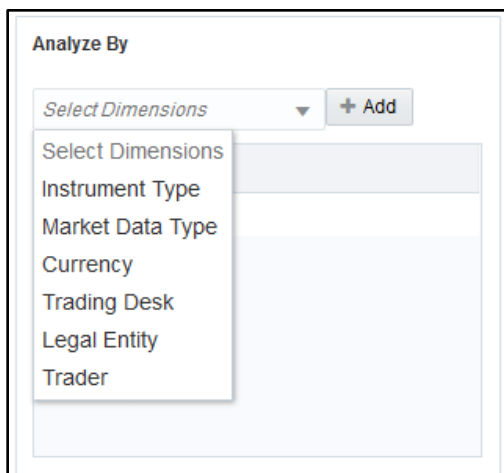


Figure 51 Analyze By

9.2.2.5 Output Metrics

This section allows you to select the list of desired outputs mentioned below.

Figure 52 Output Metrics

The outputs are:

- **ES and VaR:** This option calculates the Expected Shortfall (ES) and Value at Risk (VaR) using the current observation period.

VaR is computed as maximum amount of potential loss that can occur for given confidence and time horizon.

ES is computed using the following equation:

$$ES = \sqrt{(ES_T(P))^2 + \sum_{j \geq 2} \left(ES_T(P, j) \sqrt{\frac{(LH_j - LH_{j-1})}{T}} \right)^2}$$

Where,

ES is the regulatory liquidity-adjusted expected shortfall;

T is the length of the base horizon;

$ES_T(P)$ is the expected shortfall at horizon T of a portfolio P;

$ES_T(P, j)$ is the expected shortfall at horizon T of a portfolio P with respect to shocks for subset of risk factors Q (j), with all other risk factors held constant;

Q (j) is the subset of risk factors whose liquidity horizon is at least as long as LH_j

LH_j is the liquidity horizon j as specified by in the Liquidity Horizon user interface

- **Stress Calibrated for ES:** This selection provides you the option to identify the stress period, or select the system identified stress period.
 - If you choose to define the observation period, toggle the Identified Period button and provide the Observation Start Date and Observation End Date.

- If you select System Identified Period, then the stress period start and end date computed in the Stress Period Identification grid will be considered for computation.

Stress calibrated ES is computed using following equation

$$\text{Stress calibrated ES} = ES_{R,S} \frac{ES_{F,C}}{ES_{R,C}}$$

Where,

$ES_{R,S}$ is Expected short fall for reduced set of risk factor and stress observation period

$ES_{F,C}$ is Expected short fall for full set of risk factor and current observation period

$ES_{R,C}$ is Expected short fall for reduced set of risk factor and current observation period

NOTE: For Reduced set ES Matrix calculation (ES(R, C)), reduced set Validation Result must have Valid status.

- **Internally Modelled Capital Charge:** If you select this option, specify the Relative weight assigned to the firms internal model. This output is required to compute Internally Modelled Capital Charge (IMCC).

IMCC is computed using following equation:

$$IMCC = \rho (IMCC(C)) + (1 - \rho) \left(\sum_{i=1}^R IMCC(C_i) \right)$$

Where,

$IMCC(C)$ is Stress calibrated ES

$IMCC(C_i)$ is stress calibrated ES with respect to shocks for broad risk factors class i with all other risk factor held constant.

i is broad regulatory risk classes: interest rate risk, equity risk, foreign exchange risk, commodity risk and credit spread risk

ρ is the relative weight assigned to the firm's internal model

- **Stress Capital Add-on Charge:** Select this option to set computation of stress scenario capital charge (SES) with execution.

Stress capital add-on is computed using following equation

$$SES = \sqrt{\sum_{i=1}^L SES_{NM,i} + \sum_{j=1}^K SES_{NM,j}}$$

Where,

L is non-modellable idiosyncratic risk factor

K is non-modellable non idiosyncratic risk factor

$SES_{NM,X}$ is the stress scenario capital charge for non-modellable risk factor X, with respect to shock for X risk factor with all other risk factors held constant

- **Aggregated Charge:** Select this option to set computation of Aggregated Charge with execution. Computation of aggregated charge requires a multiplier. Multiplier is the number which is associated with number of exception arrived in Model Validation. Select the business definition defined in Model Validation module from the drop down box, to add a multiplier. If not selected system will take 1.5 as default value of multiplier.

Aggregated Charge is computed using following equation

$$\text{Aggregated Charge} = \max\{IMCC_{t-1} + SES_{t-1}; m_c \cdot IMCC_{avg} + SES_{avg}\}$$

Where,

IMCC and SES average is average taken over 60-days

m_c is multiplier derived from backtesting model.

See [Exception Probability and Multiplier](#) for details.

- **Validation RS Risk Factor Flag:** Selecting this option enables you to check the validity of reduced set with execution. Validation logic is as specified in [Risk Factor Reduced Set Identification](#).

NOTE: If there is any dependency between two outputs, then the application auto selects the related output. For example, if you select Internally Modelled Capital Charge, then the application auto selects ES and VaR and Stress Calibrated for ES.

9.2.2.6 Pricing Policy

It allows you to select the pricing policy models and methods to be used for instrument pricing. You can either download, or define the pricing policy. See section [Pricing Policy](#) in Instrument Valuation chapter for details.

9.2.3 Procedure for Creating a Business Definition in Market Risk Historical Simulation

The defined executions are listed in the Market Risk Historical Simulation summary screen. Click either Portfolio or Trading Desk tabs to view the list. Each Business Definition is executed as a separate run. The new business definition screen is shown below:

Figure 53 Market Risk Historical Simulation – New Business Definition

The following table describes the fields in the business definition window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name*	Enter the name of the business definition.
Description	Provide a description for the business definition.
Reporting Currency*	It is the currency in which all the output for given definition will be computed. Select the currency type from the drop-down list.
Version	Displays the workflow version of the business definition.
Workflow Status	Displays the workflow status of the business definition.
Risk Factor Reduced Set Identification	Displays the last successful execution date of risk factor identification. Select whether you want to download or define the risk factor parameters.

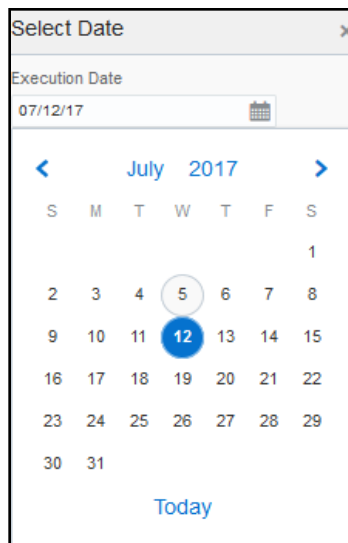
Fields	Description
Fields marked in red asterisk(*) are mandatory	
Horizon	Specify the horizon in terms of days.
Confidence (%)	Specify the confidence level for computation.
Current Observation Period	Specify the current observation period for computation of VaR
Observation Period Unit	Specify the unit for current observation period in terms of days, months or year
Differential Method	Select the differential method from the drop-down list.
Analyze By	Select dimensions for analyzing the VaR and ES numbers from the drop-down list.
Stress Period Identification	Displays the start data and end date of the stress period. Specify the start and end date for stress period execution.
Output Metrics	Select the list of desired outputs.
Pricing Policy	Select the models and methods to be used for instrument pricing.
Execution Summary	Displays the execution history of the business scenarios. Select the execution to be marked as EOD execution.

Table 16 Fields and their Descriptions in Historical Simulation-Business Definition Window

Follow the below steps to create a new business definition in Market Risk-Historical Simulation:

1. Click the business approach from the Market Risk-Historical Simulation summary screen, for which the business definition needs to be created.
2. Click **New Business Definition**. A new tab is created.
3. Click on the new tab, and provide details in the **Name**, **Description** fields.
4. In the **Currency** field, select the currency type from the drop-down list.
5. Identify the reduced set of risk factors. See [Risk Factor Reduced Set Identification](#) for details.
6. Provide stress period start and end date and execute **Stress Factor Identification**. See [Stress period Identification](#) for details.

7. Provide details for the fields **Horizon**, **Confidence**, and **Current Observation Period** in **VaR Model Parameters** pane. See [VaR Model Parameters](#) for details.
8. Select the dimensions in the **Analyze By** pane. See [Analyze By](#) for details.
9. Select Download or Define in the **Pricing Policy** pane, and specify models and methods to be used for instrument pricing. See [Pricing Policy](#) for details.
10. Select the list of desired outputs in the **Output Metrics** pane. See [Output Metrics](#) for details.
11. Click **Save** and **Submit**.
12. Click **Execute** to trigger an adhoc run. A pop up message with a date-time editor is displayed. Specify the date on which the execution needs to be performed and click **OK**. The execution is triggered.



13. After executing the Business Definition, select any one execution for a given date as EOD execution.

10 Market Risk- Monte Carlo Simulation

The Market Risk- Monte Carlo Simulation module enables you to derive counterparty risk measures and Monte-Carlo VaR at counterparty and trade level. This chapter includes:

- [Overview](#)
- [Creating and Executing a Business Definition](#)

10.1 Overview

The module enables the application to calculate counterparty risk quantities, which provide a measure of the adjustments that should be made to the value of deals, to predict the possibility of a counterparty defaulting.

- Valuation (XVA) adjustments such as Credit Valuation Adjustment (CVA), Debt Valuation Adjustment (DVA), Funding Valuation Adjustment (FVA). CVA, DVA and FVA provide a single value which can be used as an adjustment to the total value of a set of positions in a portfolio, taking into account collateral that may be posted between the counterparties as determined by the Credit Support Annex (CSA) agreements.
- Future exposures such as Potential Future Exposure (PFE), Expected Positive Exposure (EPE), Expected Negative Exposure (ENE), and Expected Exposure (EE). They provide a measure of the potential loss or gain due to future market changes and are reported as a table of values for user-specified future observation dates.
- Trade level present value (PV) and Value-at-Risk (VaR)

Counterparty risk values are portfolio-level measures such as values for groups of trades instead of as single quantities for each trade. Future exposures are computed using American Monte Carlo techniques, for a user-specified number of Monte Carlo paths and set of future observation dates. To do this, a global hybrid model must be constructed and used by all the trades in the simulation. The hybrid model consists of a set of individual factor models that simulate the dynamics of underlying's of the selected trades.

The inputs required to set up a calculation of counterparty risk are:

- Definitions for all the counterparties that will be used by the trades in the calculation.
- Each trade must identify which counterparty, netting set and which CSA i.e. sub-netting set it is associated with, and be able to identify the list of underlying's used by that trade.

Counterparties are organized into the following hierarchy for aggregation of results:

- **Parent counterparty:** At the top level of the hierarchy, there is a list of separate counterparty entities. Each Counterparty is considered as a separate entity.

- **Child counterparty:** Within each parent counterparty, there is a list of one or multiple child counterparties. Each child has a unique name within that parent counterparty.
- **Netting Agreement or Sets:** Under each child counterparty there are one or multiple netting sets. Each netting sets has an unique name within that counterparty, and defines the level at which all the counterparty risk measures are calculated directly from the results of netting exposures from different trades, after accounting for the collaterals. At least one netting set must be defined for each counterparty.
- **Sub-Netting Agreement or Margin Set or CSA:** At the lowest level of the hierarchy, under each netting set there can be a set of margin sets. Each margin set has a unique name within that netting set, and it is at this level that the individual parameters that define the CSA used to calculate collateral exchange are defined. This allows you to define separate parameters for subsets of trades that must have specialized collateral calculation rules, while still allowing the net result of exposures and collateral from those trades to be offset or netted with exposures from other sets of trades under the same netting set. It is also possible to define a margin set to take into account those trades that are not collateralized; these trades should be placed in a margin set named "Residual".

10.2 Creating and Executing a Business Definition

This section elaborates the process of creating a business approach, and executing a business definition. A business definition allows you to set business specific parameters required for analysis. You need to define a business approach before creating a business definition.

10.2.1 Defining a Business Approach

Business approach enables you to analyze each module from a trading desk or portfolio perspective. You can define a new business approach and view the existing business approach from the Market Risk- Monte Carlo Simulation Summary screen.

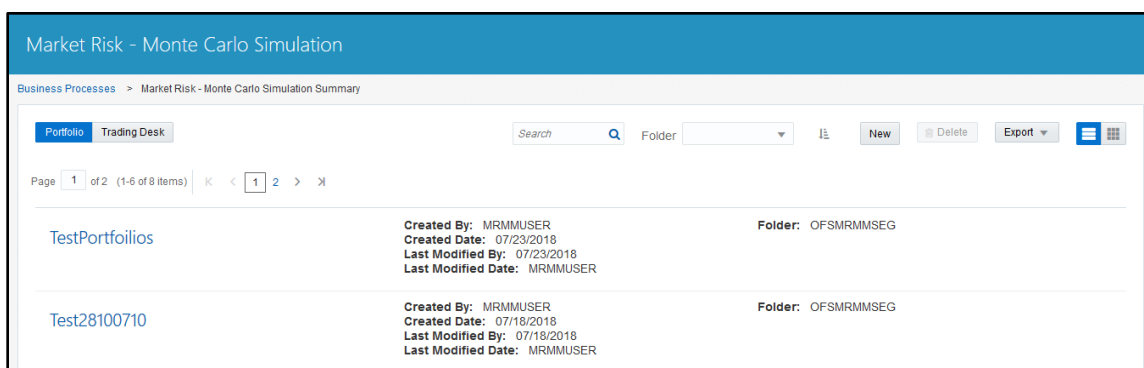


Figure 54 Market Risk – Monte Carlo Simulation Summary Screen

See [Instrument Valuation - Defining a Business Approach](#) for the detailed procedure.

10.2.2 Defining a New Business Definition

In the Market Risk – Monte Carlo Simulation Summary screen, click on any business approach to navigate to the business definition screen for the specific Portfolio or Trading Desk. Click **New Business Definition**, to view the definition screen.

Figure 55 Market Risk Monte Carlo Simulation – Business Definition Screen

The screen includes the below two sections.

- **Trading Desk/Portfolio information:** It displays the trading desk/portfolio information. These fields are un-editable.
- **Business Definition:** You can define one or multiple business definitions in this section. The created definitions are displayed as tabs. Click on each tab to view details about the business definition. You can perform the below actions in this section:
 - **Edit a Business Definition:** Only business definitions in draft stage can be edited. Click a Business Definition in draft stage to edit.
 - **View the Execution Summary:** You can view the execution details of the business definitions here, such as Execution ID, Execution Date, Execution Status, Workflow Status, and End of Day (EOD) Execution. You can select any one execution for a given date as EOD execution. All the reports use EOD run for reporting purpose. If an EOD run has not been selected, then by the system considers the last successful execution is as EOD run.



Execution Date	Execution Id	Execution Status	Scenario	Definition workflow status	EOD Execution
2016-01-01	100012	SUCCESS		Draft	<input checked="" type="checkbox"/>

Figure 56 Monte Carlo Simulation – Execution Summary

10.2.2.1 Purpose

This section enables you to select the various computation measures in a business definition. You can select one or multiple purposes.



Purpose

CVA Measures PFE Measures

Monte-Carlo VaR

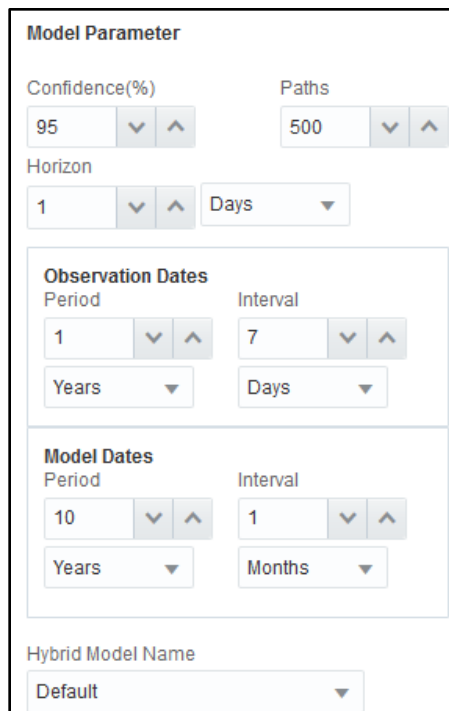
Figure 57 Monte Carlo Simulation – Purpose

You can select both CVA and PFE or Monte Carlo VaR. Each of the subsequent inputs will be enabled or disabled based on the selected purpose.

- CVA Measures
- PFE Measures
- Monte-Carlo VaR

10.2.2.2 Model Parameter

In this section you need to define the below model parameters.



Model Parameter

Confidence(%) 95 Paths 500

Horizon 1 Days

Observation Dates
 Period 1 Years Interval 7 Days

Model Dates
 Period 10 Years Interval 1 Months

Hybrid Model Name Default

Figure 58 Monte Carlo Simulation – Model Parameter Definition

- **Confidence:** Specify the Confidence. Confidence level is required for PFE calculations.
- **Paths:** Specify the Number of paths. This is the number of Monte-Carlo paths to be used for the simulations.
- **Horizon:** It is the time horizon over which the VaR is computed. Specify the horizon in terms of days, months or years. For example, if the horizon is specified as 10 Days then the run will be executed for VaR outputs with observation date as 10 Days: 10 Days.
- **Observation Dates:** Observation dates are the future dates on which you want to calculate PFE, and use for the exposures to capture the future behavior during CVA computation. Specify the observation date in <year> :< month> format. For example 30Y:1M, indicates that one observation date will be generated every month till 30 years.
- **Model Dates:** Model dates are additional dates that are used in the simulation internally, but not used for the final reporting, to obtain better simulation results and capture more behavior of the deals during their schedules. Specify the model date in <Period> :< Interval> format. For example 30Y:30D which indicates that observation dates are to be generated, every day for the next 30 years.

- **Hybrid Model Name:** The hybrid model is a set of models to be used for individual risk factor for generating the paths under Monte Carlo simulation. Select the strategy from the drop-down menu. See [Hybrid Model Setup](#) for details.

10.2.2.3 Optional Outputs

Additionally, you can also select the below optional outputs for execution.

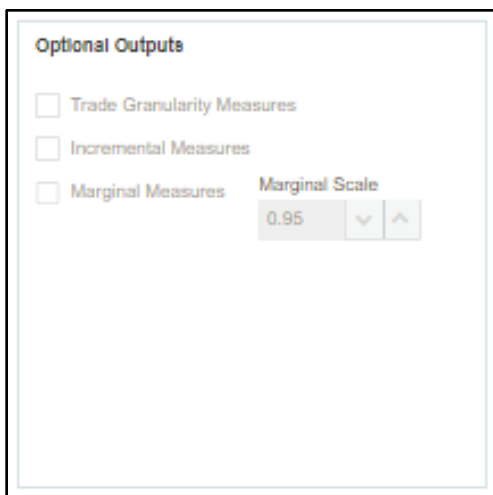


Figure 59 Monte Carlo Simulation – Optional Outputs

Specify the desired optional outputs:

- **Trade Granularity Measures:** Select this check box to calculate measures at the trade level (in addition to the counterparty level). This is set to false by default.
- **Incremental Measures:** Select this check box to calculate incremental measures. This is only available for XVA and PFE and is set to false by default.
- **Marginal Measures:** Select this check box to calculate marginal measures. This is only available for XVA and is set to false by default.
 - **Marginal Scale:** The scaling value used for marginal XVA calculations. The default value is 0.95.

10.2.2.4 Configurations

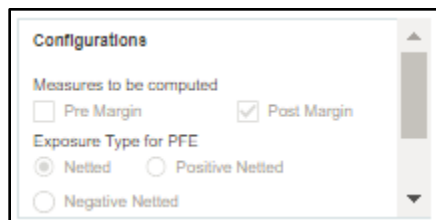


Figure 60 Monte Carlo Simulation – Configurations

The application enables you to specify the following configurations:

- **Measures to be computed:** Select pre-margin exposure or post-margin exposures to calculate the counterparty measures. The default value is Post-Margin.
- **Exposure type for PFE:** Select the types of exposures to be used for calculating PFE from the below options:
 - **Netted:** It is the sum of pre-margin or post-margin exposures.
 - **Positive Netted:** It is the sum of positive exposures calculated at the netting set level.
 - **Negative Netted:** It is the sum of negative exposures calculated at the netting set level.
- **Align Margin Dates with Observation Dates:** This option enables you to align the margin dates of counterparty with the observation dates provided in model parameters. The default values is Yes.

10.2.2.5 Pricing Policy

It allows you to select the pricing policy models and methods to be used for instrument pricing. You can either download, or define the pricing policy. See section [Pricing Policy](#) in Instrument Valuation chapter for details.

10.2.3 Procedure for Creating a Business Definition in Market risk Monte-Carlo Simulation

The defined executions are listed in the Market Risk Monte Carlo Simulation summary screen. Click either Portfolio or Trading Desk tabs to view the list. Each Business Definition is executed as a separate run. The new business definition screen is shown below:

Figure 61 Market Risk Monte Carlo Simulation – New Business Definition

The following table describes the fields in the business definition window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name*	Enter the name of the business definition.
Description	Provide a description for the business definition.
Reporting Currency*	It is the currency in which all the output for given definition will be computed. Select the currency type from the drop-down list.
Version	Displays the workflow version of the business definition.
Workflow Status	Displays the workflow status of the business definition.
Purpose	Select the various computation measures in a business definition.
Model Parameter	Define the fields in Model Parameters, specify the Observation Dates, Model Dates, and Hybrid Model Name
Optional outputs	Select the optional Outputs.

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Pricing Policy	Specify if you want to download or define the pricing policy.
Configurations	Specify the configurations.
Execution Summary	Displays the execution history of the business scenarios. Select the execution to be marked as EOD execution.

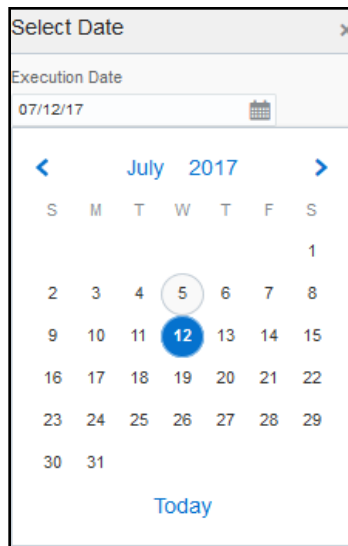
Table 17 Fields and their Descriptions in Historical Simulation-Business Definition Window

Follow the below steps to create a new business definition in Market Risk - Monte Carlo Simulation:

1. Click the business approach from the Market Risk - Monte Carlo Simulation summary screen, for which the business definition needs to be created.
2. Click **New Business Definition**. A new tab is created.
3. Click on the new tab, and provide details in the **Name**, **Description** fields.
4. In the **Reporting Currency** field, select the currency type from the drop-down list.
5. Specify the **Purpose**. See [Purpose](#) for details.
6. Specify the **Model Parameters**, **Observation Dates**, **Model Dates**, and **Strategy Name** in Hybrid Model Setup. See [Model Parameters](#) for details.
7. Select the optional outputs. See [Optional Outputs](#) for details.
8. Specify the configurations required. See [Configurations](#) for details.
9. Specify the details for Pricing Policy. See [Pricing Policy](#) for details.
10. Click **Save** and **Submit**.

Note: Ensure that the supportive convention files are present in the set up before execution.

11. Click **Execute** to trigger an adhoc run. A pop up message with a date-time editor is displayed. Specify the date on which the execution needs to be performed and click **OK**. The execution is triggered.



12. After executing the Business Definition, select any one execution for a given date as EOD execution.

11 Model Validation

This module enables you to ensure that your models meet prescribed standards. This chapter includes:

- [Overview](#)
- [Creating and Executing a Business Definition](#)

11.1 Overview

OFS Market Risk Model Validation Module enables you to validate historical VaR model. You can use Profit and Loss (P&L) attribution and back-testing to decide whether your trading desks are eligible to follow IMA capital requirements. The module provides the following computations:

- Actual, Hypothetical and Risk Theoretical Profit and Loss (P&L)
- Exception
- First Ratio
- Second Ratio

11.2 Creating and Executing a Business Definition

This section elaborates the process of creating a business approach, and executing a business definition. A business definition allows you to set business specific parameters required for analysis. You need to define a business approach before creating a business definition.

11.2.1 Defining a Business Approach

Business approach enables you to analyze each module from a trading desk or portfolio perspective. You can define a new business approach and view the existing business approach from the Model Validation Summary screen.

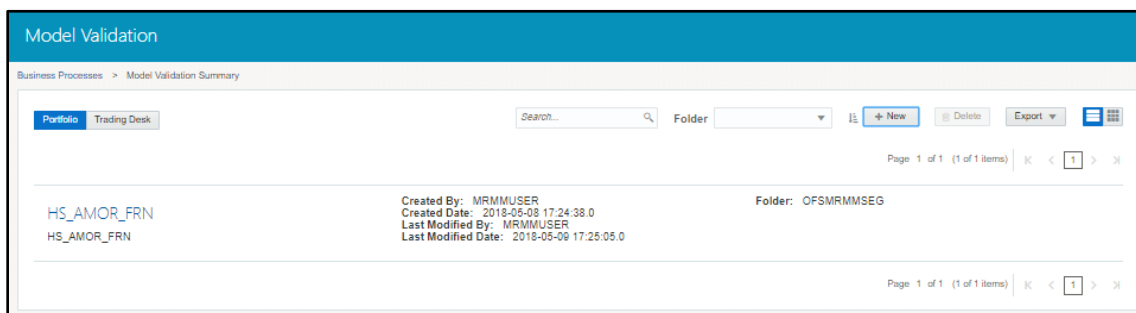


Figure 62 Model Validation Summary Screen

See [Instrument Valuation - Defining a Business Approach](#) for the detailed procedure.

11.2.2 Defining a New Business Definition

In the Model Validation Summary screen, click on any business approach to navigate to the business definition screen for that Portfolio/Trading Desk. Click **New Business Definition**, to view the definition screen.

Figure 63 Model Validation – Business Definition Screen

The screen includes the below two sections.

- **Trading desk/Portfolio information:** It displays the trading desk/portfolio information. These fields are uneditable.
- **Business Definition:** You can define one or multiple business definitions in this section. The created definitions are displayed as tabs. Click on each tab to view details about the business definition. You can perform the below actions in this section:
 - **Edit a Business Definition:** Only business definitions in draft stage can be edited. Click a Business Definition in draft stage to edit.
 - **View the Execution Summary:** You can view the execution details of the business definitions here, such as Execution ID, Execution Date, Execution Status, Workflow Status, and End Of Day (EOD) Execution. You can select any one execution for a given date as EOD execution. All the reports use EOD run for reporting purpose. If an EOD run has not been selected, then by the system considers the last successful execution is as EOD run.

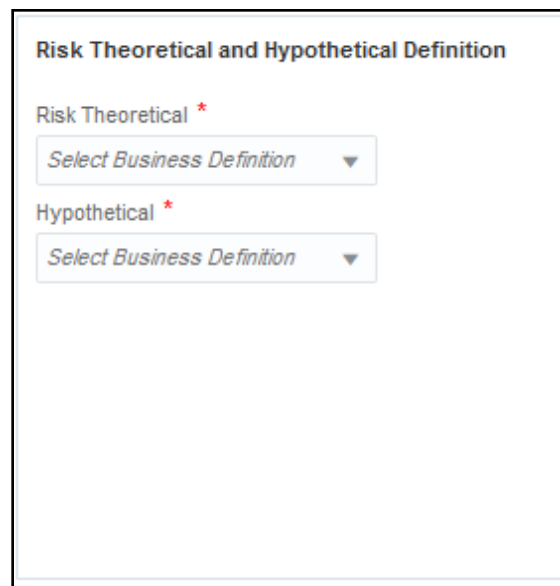


Execution Date	Execution Id	Execution Status	Scenario	Definition workflow status	EOD Execution
2016-01-01	100012	SUCCESS		Draft	<input checked="" type="checkbox"/>

Figure 64 Model Validation – Execution Summary

11.2.3 Risk Theoretical and Hypothetical Definition

Select the business definition created in the module Market Risk – Historical Simulation, to be considered for Risk Theoretical and Hypothetical from the drop-down list.



Risk Theoretical and Hypothetical Definition

Risk Theoretical *

Select Business Definition ▼

Hypothetical *

Select Business Definition ▼

Figure 65 Risk Theoretical and Hypothetical Definition

- **Risk Theoretical**

This is the P&L calculated by the risk factors generated from the pricing models of the trading desk. Risk Theoretical P&L is similar to Hypothetical P&L and is computed using business definitions selected for Risk Theoretical.

- **Hypothetical**

Actual and Hypothetical P&L are computed using business definitions selected for Hypothetical.

- Actual P&L is difference in portfolio value as off time t and time t-1, where t is any specified historical date. Additionally, Actual P&L incorporates the change in instrument data for calculating P&L.
- Hypothetical P&L for time t is difference in portfolio value computed with market data as off time t and instrument data as off time t, and, portfolio value computed with market

data as off time t+1 and Instrument data as off time t. For the calculation of Hypothetical P&L it is assumed that composition of the portfolio has not changed across the time.

NOTE: If you do not intend to use the output of Historical Simulation, then follow the below process to upload portfolio values to be considered for model validation:

Populate data in to the Fact table (FCT_MR_PORTFOLIO_VALUE) and execute the batch <<INFODOM>>_MRMM_MDL_VALDN_INPUT_POP to populate the FSI_MR_PORTFOLIO_VALUE table for Model Validation Service. Use the below T2Ts for data population:

- T2T_MR_PORTFOLIO_VALUE_FCT_POP – For populating data from Portfolio Risk to FCT population table
- T2T_MR_PORTFOLIO_VAL_FSI_POP – FCT – for populating data from FCT population table of Portfolio Risk to FSI of Model Validation

See the OFS MRMM Download specification document available in [OHC Documentation Library](#) for the column details in FCT_MR_PORTFOLIO_VALUE table.

11.2.4 Model Parameters

Define the parameters for model validation in this section.

The screenshot shows a configuration pane titled "Model Parameters". It contains the following elements:

- Backtesting * Period:** A numeric input field containing the value "5" and two arrow buttons for incrementing and decrementing the value.
- Backtesting * Period Unit:** A dropdown menu currently set to "Month".
- Actual P&L:** A checkbox that is checked.
- Risk Theoretical P&L:** A checkbox that is checked.
- Hypothetical P&L:** A checkbox that is checked.

Figure 66 Model Parameters

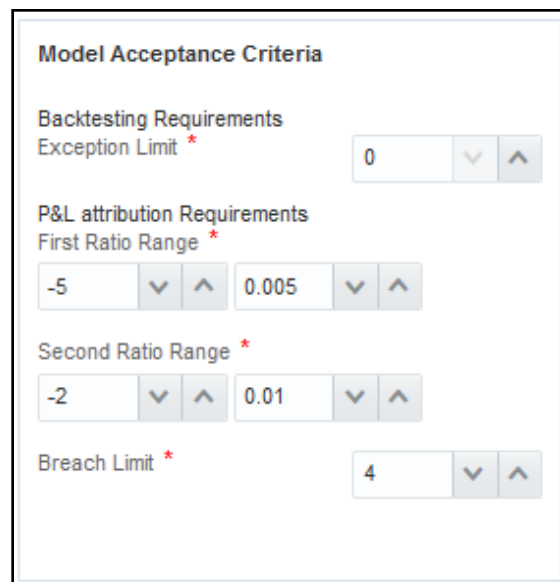
Provide the below details in this pane:

- **Backtesting Period:** It is the period over which model is to be validated and is relative to the execution date. Specify the backtesting period

- **Backtesting Unit:** It is the units in terms of which backtesting period is specified, such as Month Day or Year. The period entered should be in accordance to calendar days/months/year.
- **Specify the P&L for which exception should be computed.** You can select multiple P&L for exception computation. All the observations in backtesting period where loss is greater than the VaR are considered as exceptions. For a specific back testing period if on any of the day computed P&L (assuming all profit values as zero, and absolute value of Loss are considered for computation) is more VaR value for the given business definition then it has to marked as backtesting breached. If you select multiple P&L for computation, then the application considers maximum number of exceptions for validating the model.

11.2.5 Model Acceptance Criteria

If the value of the computed exception exceeds the specified exception limit, then the portfolio or trading desk fails the backtesting assessment. Exception is defined as the total number of backtesting breaches which occurs over a specific backtesting period.



The screenshot shows a configuration window titled "Model Acceptance Criteria". It contains four sections, each with a label and a red asterisk indicating a required field:

- Backtesting Requirements:** Exception Limit * with a value of 0.
- P&L attribution Requirements:** First Ratio Range * with values -5 and 0.005.
- Second Ratio Range *** with values -2 and 0.01.
- Breach Limit *** with a value of 4.

Figure 67 Model Acceptance Criteria

You need to specify the below information in this grid for backtesting validation and P&L attribution validation:

- **Backtesting Requirements**
 - Exception Limit: Specify the number of exceptions allowed. If this limit is breached then the model assessment fails.
- **P&L Attribution Requirements**
 - First Ratio Range: First ratio is the mean of unexplained daily P&L (that is risk theoretical P&L minus hypothetical P&L) over the standard deviation of hypothetical daily P&L, for the specified backtesting period. Specify the acceptable range for first ratio of P&L attribution. If the first ratio computed is not in the specified range then model assessment fails.
 - Second Ratio Range: Second ratio is the ratio of variances of unexplained daily P&L and variance of hypothetical daily P&L, for the specified backtesting period. Specify the acceptable range for second ratio of P&L attribution. If second ratio computed is not in specified range then model assessment fails.
 - Breach Limit: If first ratio computed is not in user specified range or second ratio computed is not in user specified range then the model is considered as P&L breached. If total Number of Breaches in a specific backtesting period exceeds the specified total number of breach limit then the Portfolio / Trading Desk is considered as P&L assessment failed.

11.2.6 Exception Probability and Multiplier

This pane displays the probability of occurrence and Multiplier values.

No. of Exception	Probability of Occurrence %	Multiplier
0	8.1	1.5
1	20.5	1.5
2	25.7	1.5
3	21.5	1.5

Page 1 of 3 (1-4 of 11 items) | K < 1 2 3 > X

Figure 68 Exception Probability and Multiplier

To add multipliers follow the below steps:

1. Click **Open** in the **Exception Probability and Multiplier** pane.

No. of Exception	Probability of Occurrence	Type 1 % - Probability of	Type 2 % - Probability of	Multiplier
0	8.1	100	0	1.5
1	20.5	91.9	8.1	1.5
2	25.7	71.4	28.6	1.5
3	21.5	45.7	54.3	1.5
4	13.4	24.2	75.8	1.5
5	6.7	10.8	89.2	1.7
6	2.7	4.1	95.9	1.76
7	1	1.4	98.6	1.83
8	0.3	0.4	99.6	1.88
9	0.1	0.1	99.9	1.92
10	0	0	100	2

Figure 69 Adding Exception Probability and Multiplier

2. Click **Add**. A new row is created.
3. Provide values for the below columns:
 - Probability of occurrence (exact): Provide the exact probability of obtaining corresponding number of exceptions.
 - Multiplier: Provide the multiplier value/multiplication factor for the capital which is sufficient to return the model to a 99th percentile standard.

Values for the below columns are computed by the application:

- Number of Exception: This is auto populated number of exceptions starting with 0 and will keep on increasing as we add rows.
- Probability of rejecting model (Type 1): This is system computed column. Type 1 is the probability that using a given number of exceptions as the cut-off for rejecting a model will imply rejection of an accurate model. Column is reverse-cumulative of Probability of occurrence (Column 2) starting with 100%.
- Probability of accepting model (Type 2): This is system computed column. Type 2 is the probability that using a given number of exceptions as the cut-off for rejecting a model will imply acceptance of an inaccurate model. Column is cumulative of Probability of occurrence (Column 2) starting from 0%.

4. Click **Done**.

NOTE: When you add a row, it will be added as last line, and when you delete a row, the last row will be deleted.

11.2.7 Zone Classification

Each model is classified into three zones Green, Yellow and Red which will be identified based on the Type 2 probability of occurrence.

The screenshot displays a 'Zone Classification' configuration window. It contains three sections, each with a title and a range of values:

- Green Zone (Start & End Range) % ***: Start value is 0, end value is 95.
- Yellow Zone (Start & End Range) % ***: Start value is 95.001, end value is 99.989.
- Red Zone (Start & End Range) % ***: Start value is 99.99, end value is 100.

Each value is displayed in a text box with up and down arrow buttons for adjustment.

Figure 70 Zone Classification

Specify the probability range for the below zones in terms of percentage:

- Green
- Yellow
- Red

11.2.8 Procedure for Creating a Business Definition in Model Validation

The defined executions are listed in the Model Validation summary screen. Click either Portfolio or Trading Desk tabs to view the list. Each business definition is executed as a separate run.

The screenshot shows the 'New Business Definition' window with the following sections and fields:

- Definition Details:** Name (Setting 0), Description (Enter Description), Reporting Currency (Indian Rupee), Version (1), Workflow Status (Draft).
- Risk Theoretical and Hypothetical Definition:** Risk Theoretical (Select Business Definition), Hypothetical (Select Business Definition).
- Model Acceptance Criteria:** Backtesting Requirements Exception Limit (0), P&L attribution Requirements First Ratio Range (2, 2.001), Second Ratio Range (2, 2.001), Breach Limit (0).
- Model Parameters:** Backtesting Period (2), Backtesting Period Unit (Month), checkboxes for Actual P&L, Risk Theoretical P&L, and Hypothetical P&L.
- Exception Probability and Multiplier:** Table with columns: No. of Exception, Probability of Occurrence %, Multiplier. Page 1 (0 of 0 items).
- Zone Classification:** Green Zone (Start & End Range) % (0, 93.001), Yellow Zone (Start & End Range) % (93.002, 99.999), Red Zone (Start & End Range) % (99.99, 100).

Figure 71 Business Definition – Model Validation

The following table describes the fields in the model validation new business definition window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Name*	Enter the name of the business definition.
Description	Provide a description for the business definition.
Currency*	It is the currency in which all the output for given definition will be computed. Select the currency type from the drop-down list.
Version	Displays the workflow version of the business definition.
Workflow Status	Displays the workflow status of the business definition.
Risk Theoretical*	Select the business definitions for Risk Theoretical from the drop-down list.
Hypothetical*	Select the business definitions for Hypothetical from the drop-down list.
Backtesting Period*	Provide the backtesting period

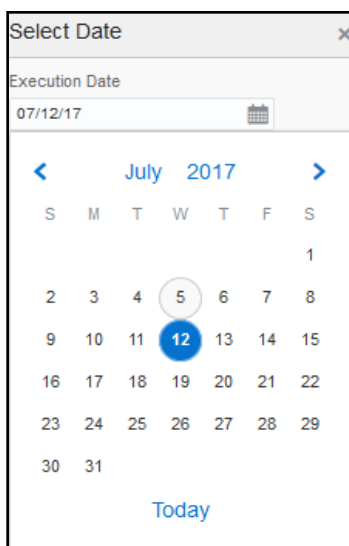
Fields	Description
Fields marked in red asterisk(*) are mandatory	
Backtesting Period Unit*	Select the unit for backtesting period from the drop-down box
Backtesting Requirements Exception Limit*	Specify the number of exceptions allowed during backtesting for the model validation to pass.
P&L Attribution Requirements – First Ratio Range*	Specify the acceptable range for first ratio of P&L attribution.
P&L Attribution Requirements – Second Ratio Range*	Specify the acceptable range for second ratio of P&L attribution.
P&L Attribution Requirements – Breach Limit*	Specify the number of permissible breaches
Zone Classification Green Zone, Yellow Zone, Red Zone*	Specify the probability range for the three zones.
Exception Probability and Multiplier	Specify the probability of occurrence and multiplier values.
Execution Summary	Displays the execution history of the business scenarios. Select the execution to be marked as EOD execution.

Table 18 Fields and their Descriptions in Model Validation-Business Definition Window

Follow the below steps to create a new business definition in Model Validation:

1. Click the business approach from the MRMM Model Validation Summary screen, for which the business definition needs to be created.
2. Click **New Business Definition**. A new tab is created.
3. Click on the new tab, and provide details in the **Name**, **Description** fields.
4. In the **Currency** field, select the currency type from the drop-down list.
5. Select the business definitions for **Risk Theoretical** and **Hypothetical** from the drop-down list. See [Risk Theoretical and Hypothetical Definition](#) for details.

6. Specify the **Backtesting Period**, and select the P&L for which exceptions need to be computed, in the **Model Parameters** pane. See [Model Parameters](#) for details.
7. Provide details for **Backtesting Requirement**, and **P&L Attribution Requirements** fields displayed in the Model Acceptance Criteria pane. See [Model Acceptance Criteria](#) for details.
8. Provide the probability range for the Green, Yellow and Red zones in **Zone Classification** pane. See [Zone Classification](#) for details.
9. Add or remove rows based on the requirement in the Exception Probability and Multiplier section. See [Exception probability and Multiplier](#) for details.
10. Click **Save** and **Submit**.
11. Click **Execute** to trigger an adhoc run. A pop up message with a date-time editor is displayed. Specify the date on which the execution needs to be performed and click **OK**. The execution is triggered.



12. After executing the business definition, select any one execution for a given date as EOD execution.

11.3 Model Performance Outputs

Following are the additional outputs computed in Model Validation module:

1. P-value

P-value is probability of experiencing k or more exceptions within model where k is total number of observed exceptions. It is calculated for all P&Ls (Risk theoretical, Hypothetical and Actual P&L) using the following formula.

$$P - Value = \sum_{i=0}^k {}^n C_i * p^i * (1 - p)^{n-i}$$

Where,

P-value = probability of experiencing k or more exceptions

n = Total number of backtesting days. This is the actual number of days that are used in backtesting. For example, if the backtesting period is 1 year but due to holidays total number of observation points is 252, then consider 252 days for computation in this formula)

p = (1- confidence level)

k = total number of exceptions

2. Loss Exception Deviation:

Loss Exception Deviation is the absolute average deviation of the loss exceptions from the ES. It is to be computed for all P&Ls (risk theoretical, Hypothetical and Actual P&L)

It is calculated as follows:

$$\text{Loss Exception Deviation} = \frac{\sum_1^n \text{ABS}[(\text{Loss}-\text{VaR})-ES]}{k}$$

Where,

Loss is corresponding P&L

VaR is corresponding VaR value

ES is corresponding ES value

K = total number of exceptions

n = is total number of backtesting days

3. Average Loss Duration

Average Loss Duration is the average time interval between successive loss exceptions. Suppose back testing was carried out for a portfolio for a period of 90 days. The below table details the loss exceptions observed during the back testing period. It is computed for all P&Ls (Risk Theoretical, Hypothetical and Actual P&L)

Loss Exception	Time of Loss Exceptions (in days)
L1	20
L2	50
L3	60

$$\text{Average Loss Duration} = (20 + 30 + 10) / 3 = 20 \text{ days}$$

4. Loss Duration Deviation

Loss Duration Deviation refers to the standard deviation of time interval between successive loss exceptions. It is computed for all P&Ls (Risk Theoretical, Hypothetical and Actual P&L). It is calculated as per the formula given below:

$$\text{Loss Duration Deviation} = \left(\frac{\text{Sum of Squared Deviations}}{\text{Number of Exceptions}} \right)^{1/2}$$

The Loss Duration Deviation is calculated for the illustration as follows:

Loss Exception	Time Interval Between Successive Loss Exceptions (in days)	Average Loss Duration	Deviation	Squared Deviation
L1	20	20	0	0
L2	30	20	-10	100
L3	10	20	10	100

Loss Duration Deviation = $(200/3)^{1/2} = 8.16$ days

12 Annexure A: Details of Market Data

Market Data refers to the multiple types of data required from financial market to price interest rate, equity, foreign exchange and other types of products. The following types of market data are required by OFS MRMM application.

- **Rate:** These are daily input of FX spot, IR cash, repo rates, and so on.
- **Prices:** These are daily input of a number of spot prices, such as equity spot prices, bond spot prices, and for all exchange-traded futures and options contract types
- **Curves:** These include:
 - Yield curves represent the market data for the term structure of interest rates
 - Basic yield curve identified by currency and index
 - Cross currency basis curves, identified by a currency-index pair (currency-index/currency-index)
 - Cross currency swap curves, identified by a currency-index pair (currency-index/currency-index where first index is FIXED)
 - Single currency basis curves, identified by currency-index pair and an additional money market index
 - Dividend curves: These are methods to represent the dividends for the equity, and can be created using either dividend yields or discrete dividends that may be expressed either as yield or absolute amounts.
 - Constant value: Yield represented as specific percentage of equity's market price on a specific date
 - Dividend yield: Dividend expressed as percentage of equity's market price.
 - Absolute dividend: Absolute amount of dividend.
 - Repo and bond repo curves: Repo curves are used to model the cost of carrying a share associated with repurchase agreements
 - Fair strike curves: These are used when pricing products such as EQ Variable Swap deals. A Fair Strike curve provides market quotes for variable swaps, in the form of a tabular list of dates and fair strike market quotes.
 - Volatility spread curves: These are used when pricing products such as EQ Variable Swap deals. Volatility spread curves provide volatility basis term structures that comprises a collection of dates and associated strike adjustments
 - Credit curves: These are inputs such as Recovery Rate, Credit Spread, Survival Probabilities required by credit models for a specific counterparty.

- Real rate curves: These are nominal yield curve adjusted for inflation by a Consumer Price Index
- Commodity forward curves: These are built from the futures prices of the underlying commodity for several contract months
- Volatilities: These include:
 - Cap volatilities
 - Swaption volatilities: Swaption volatility cubes are used to aggregate a number of swaption surfaces and generate a full 3 dimensional surface for volatility over strikes
 - FX Volatilities: Matrix of FX volatilities are required for use with FX options.
 - Equity Volatilities: Equity volatility surfaces are presented as two matrices, one for call volatilities and one for put volatilities.
- Fixings: These are historical fixing rates / spot rates/value of the following categories, for example Libor is set, or “fixed”, every day:
 - Interest rate
 - FX spot
 - Inflation index

The market data is specified in a uniquely identifiable and logical form. These can be raw or derived data and can be shocked to created different Market Scenarios i.e. one or more shifts applied to selected market data. The above data will be sourced through stage tables. The logical quote structure in which market data is expected is given below. When data moves from stage table to processing, appropriate values are concatenated to form the required quote.

Type	Asset Class	Market Data Type Code	Market Data Type	Market Data Description	Logical Quote structure
Curve	CR	CDS	Single-Name Credit Default Swaps	Single-name credit default swap (Spread and Recovery)	CR.Currency-ReferenceEntity_DebtType_RestructuringClause.CDS-Tenor.Indicator.QuoteType Example: CR.USD-DELLN_SNRFOR_MR.CDS-30Y.SPREAD.MID
Curve	CR	CR_IDX_SWAPP	Credit Index Swaps	Credit index swap (Spread and Recovery)	CR.Currency-Index_Series_Version.CDIX-Tenor.Indicator.QuoteType Example: CR.EUR.ITRAXXMAIN_S15_V2.CDIX-5Y.RECOVERY
Curve	CR	SP	Survival Probabilities	Survival Probabilities	CR.Currency-ReferenceEntity_DebtType_RestructuringClause.SP-

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Type	Asset Class	Market Data Type Code	Market Data Type	Market Data Description	Logical Quote structure
					Maturity.QuoteType Example: CR.USD-AET_SNRFOR_CR.SP-20-Jun-2013.MID
Curve	EQ	EQ_DIV	Equity Dividends	Equity Dividends	EQ.Currency-{Exchange}-Ticker.DIV.[Structure] Example: EQ.USD-NYSE-IBM.DIV.CONT
Curve	INFL	INFL_SEASONALITY	Seasonality	Seasonality	INFL.Currency-InflationIndex.SEASONALITY-Month Example: INFL.USD-CPI.SEASONALITY-JAN
Curve	IR	BASIS_SWAP	Basis Swaps	Basis Swap	IR.[TargetUnderlying]/[KnownUnderlying].BASIS-Mat.QuoteType where [Underlying] = Currency-IRIndex-IRIndexTenor Example: IR.JPY-LIBOR-6M/JPY-LIBOR-3M.BASIS-1M.MID
Curve	IR	BASIS_SWAP_XCCY	Cross-currency Basis Swaps	Cross-currency basis swap	IR.[TargetUnderlying]/[KnownUnderlying].BASIS-Mat.QuoteType where [Underlying] = Currency-IRIndex-IRIndexTenor Example: IR.JPY-LIBOR-3M/USD-LIBOR-3M.BASIS-5Y.MID
Curve	IR	CASH	Cash	Cash Instrument	IR.Currency-IRIndex.CASH-InstrumentTenor.QuoteType Example: IR.USD.LIBOR.CASH-1M.BID
Curve	IR	SWAP_XCCY	Cross-currency Fixed/Float Swaps	Cross-currency fixed-for-floating swap	IR.[UnderlyingFixed]/[UnderlyingFloating].SWAPMarketType-Mat.QuoteType where [Underlying] = Currency-IRIndex-IRIndexTenor; For [UnderlyingFixed], IRIndexTenor is FIXED Example: IR.TWD-FIXED/USD-LIBOR-6M.SWAP-5Y.MID
Curve	IR	SWAP_XCCY_ND	Cross-currency Fixed/Float Swaps-Offshore	Cross-currency fixed-for-floating swap – Offshore (Non deliverable) market	IR.[UnderlyingFixed]/[UnderlyingFloating].SWAPMarketType-Mat.QuoteType where [Underlying] = Currency-IRIndex-IRIndexTenor; For [UnderlyingFixed], IRIndexTenor is FIXED Example: IR.TWD-FIXED/USD-LIBOR-6M.SWAPND-7Y.MID
Curve	IR	SWAP_XCCY_ONSHORE	Cross-currency Fixed/Float	Cross-currency fixed-for-floating	IR.[UnderlyingFixed]/[UnderlyingFloating].SWAPMarketType-Mat.QuoteType where [Underlying] = Currency-

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Type	Asset Class	Market Data Type Code	Market Data Type	Market Data Description	Logical Quote structure
			Swaps-Onshore	swap – Onshore market	IRIndex-IRIndexTenor; For [UnderlyingFixed], IRIndexTenor is FIXED Example: IR.TWD-FIXED/USD-LIBOR-6M.SWAPONSHORE-4Y.MID
Price	CMDTY	CMDTY_FWD	Commodity Forward	Commodity Forward	CMDTY.Currency-Exchange-Symbol.FWD-Mat.QuoteType Example: CMDTY.USD-COMEX-GCA.FWD-28-Aug-2013.MID
Price	CMDTY	CMDTY_SPOT	Commodity Spot	Commodity Spot	CMDTY.Currency-Exchange-Symbol.SPOT.QuoteType Example: CMDTY.USD-NYMEX-NG.SPOT.ASK
Price	EQ	EQ_FUT	Equity Futures	Equity Futures	EQ.Currency-Exchange-ContCode.FUT-MatCode.QuoteType Example: EQ.USD-NYSE-ESZ12.FUT-Z12.MID
Price	EQ	EQ_SPOT	Equity Spot	Equity Spot	EQ.Currency-{Exchange}-Ticker.SPOT.QuoteType Example: EQ.USD-NYSE-IBM.SPOT.MID
Price	EQ	EQDIV_FUT	Equity Dividends from Equity Dividend Futures	Equity dividend key with the dividend curve stripped from equity dividend futures	EQ.Currency-Exchange-ContractCode.DIV.FUT-MaturityCode.QuoteType Example: EQ.USD-NYSE-ESZ12.DIV.FUT-Z12.MID
Price	EQ	EQDIV_SWAP	Equity Dividends from Equity Dividend Swaps	Equity dividend key with the dividend curve stripped from equity dividend swaps	EQ.Currency-{Exchange}-Ticker.DIV.SWAP.Tenor.QuoteType Example: EQ.USD-NYSE-IBM.DIV.SWAP.1M.MID
Price	INFL	INFL_BOND	Inflation-Linked Bonds	Inflation-Linked Bonds (Price and Yield)	INFL.Currency-Type-Issuer-InflationIndex.ILBOND-Coupon-IssueDate.Maturity.Indicator.QuoteType Example: INFL.JPY-JGBI-MOF-JCPI.ILBOND-0.04234-09-Aug-2010.13-Aug-2015.Yield.MID
Price	INFL	INFL_YOYOPTION	Year-on-Year Options	Year-on-Year Options	INFL.Currency-InflationIndex.YOYOPTION-Flavour-Strike-Maturity.PRICE.QuoteType

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Type	Asset Class	Market Data Type Code	Market Data Type	Market Data Description	Logical Quote structure
					Example: INFL.EUR-EURCPI.YOYOPTION-CAP-0.02-30Y.PRICE.MID
Price	INFL	INFL_ZCIIOPTION	Zero-Coupon Inflation-Indexed Options	Zero-Coupon Inflation-Indexed Options	INFL.Currency-InflationIndex.ZCIIOPTION-Flavour-Strike-Maturity.PRICE.QuoteType Example: INFL.EUR-EURCPI.ZCIIOPTION-FLOOR-0.00-7Y.PRICE.MID
Price	INFL	INFL_ZCIIS	Zero-Coupon Inflation-Indexed Swaps	Zero-Coupon Inflation-Indexed Swaps	INFL.Currency-InflationIndex.ZCIIS-Maturity.QuoteType Example: INFL.EUR-HICP.ZCIIS-2Y.MID
Price	IR	CORP_BOND	Corporate Bonds	Corporate Bonds (Price and Yield)	IR.Currency-Type-Issuer.BOND-Coupon-IssueDate.Maturity.Indicator.QuoteType Example: IR.USD-USCORPORATE-MSFT.BOND-0.00875-27-SEP-2010.27-SEP-2013.YIELD.MID
Price	IR	SOV_BILL	Sovereign Bills	Sovereign Bills(Price and Yield)	IR.Currency-Type-Issuer.BILL-0-IssueDate.Maturity.Indicator.QuoteType Example: IR.USD-USTreasury-USGovt.BILL-0-01-Apr-2011.01-Oct-2017.Price.MID
Price	IR	SOV_BOND	Sovereign Bonds	Sovereign bonds (Price and Yield)	IR.Currency-Type-Issuer.BOND-Coupon-IssueDate.Maturity.Indicator.QuoteType Example: IR.USD-USTreasury-USGovt.BOND-0.0125-01-Apr-2011.01-Oct-2017.Price.MID
Rate	FX	FX_FWD	Forex Forward	Foreign exchange forward	FX.BaseCurrencyTermCurrency.FWD-Maturity.QuoteType Example: FX.JPYUSD.FWD-ON.MID
Rate	FX	FX_FWDND	Forex Forward Offshore	Foreign exchange forward	FX.BaseCurrencyTermCurrency.FWDND-Maturity.QuoteType Example: FX.GBPUSD.FWDND-18-Apr-2022.MID
Rate	FX	FX_FWDONSHORE	Forex Forward Onshore	Foreign exchange forward	FX.BaseCurrencyTermCurrency.FWDONSHORE-Maturity.QuoteType Example: FX.EURUSD.FWDONSHORE-1Y.MID
Rate	FX	FX_SPOT	Forex Spot	Foreign exchange spot	FX.BaseCurrencyTermCurrency-SPOT.QuoteType Example: FX.AUDUSD-SPOT.MID

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Type	Asset Class	Market Data Type Code	Market Data Type	Market Data Description	Logical Quote structure
Rate	IR	FRA	Forward rate agreement	Forward rate agreement	IR.Currency-IRIndex-IRIndexTenor.FRA-Period.QuoteType Example: IR.GBP-LIBOR-6M.FRA-12M-18M.MID
Rate	IR	ON_SWAP	Overnight Indexed Swaps	Overnight Indexed Swaps	IR.Currency-IRIndex-ON.SWAP-Tenor.QuoteType Example: IR.USD-FEDFUNDS-ON.SWAP-5Y.BID
Rate	IR	SWAP	Swaps	Swap	IR.Currency-IRIndex-IRIndexTenor.SWAP-Tenor.QuoteType Example: IR.CHF-LIBOR-3M.SWAP-5Y.LAST
Volatility	CMDTY	CMDTY_VOL	Commodity Volatility	Represent a point on a commodity volatility surface	CMDTY.Currency-Exchange-Symbol.VOL::Maturity::Strike::StrikeType.QuoteType Example: CMDTY.USD-COMEX-GCA.VOL::16-Oct-2012::1490.58::STRIKE-ABSLT.MID
Volatility	EQ	EQ_SPOT_VOL	Equity Volatility	Represent a point on an equity volatility surface	EQ.Currency-{Exchange}-Ticker.SPOT.VOL.Maturity::Strike::StrikeType.QuoteType Example: EQ.USD-NYSE-SPX.SPOT.VOL::3m::1506.527::STRIKE-ABSLT.MID
Volatility	FX	FX_VOL	Forex Volatility	Represent a point on a FX volatility surface	FX.BaseCurrTermCurr.VOL::Tenor::[FXStrike]::QuoteType Example: FX.USDJPY.VOL::1m::25D CALL::ASK
Volatility	IR	CAP_VOL	Caps	Represent a point on a cap volatility surface	IR.[Underlying].[Instrument]::QuoteType where [Underlying] = Currency-IRIndex-IRIndexTenor.VOL and [Instrument] = CAP.CapTen::CapStrike Example: IR.USD-LIBOR-3M.VOL.CAP::1Y::ATM::MID
Volatility	IR	SWPT_VOL	Swaptions	Represent a point on a swaption volatility surface	IR.[Underlying].[Instrument]::QuoteType where [Underlying] = Currency-IRIndex-IRIndexTenor.VOL and [Instrument] = SWPT.SwaptionStrike::OptionTenor::SwapTenor Example: IR.USD-LIBOR-3M.VOL.SWPT.ATM::9Y::10Y::MID
Volatility	IR	SWPT_VOL_CUBE	Swaption Cubes	Represent a point on a swaption	IR.[Underlying].SWPT.StrikeType::Strike::OptionTenor::SwapTenor::DataType.QuoteType where

Type	Asset Class	Market Data Type Code	Market Data Type	Market Data Description	Logical Quote structure
				volatility cube	[Underlying] = Currency-IRIndex-IRIndexTenor.VOL Example: IR.USD-LIBOR-3M.VOL.SWPT.RLTV.ATM+150bps::2Y::2Y::LOGNORMAL.MID
Volatility	IR	SWPT_VOL_CUBE_SHIFT	Swaption Cube Shifts	Specify a shift of the swaption volatility cube	IR.[Underlying].SWPT.StrikeType::Strike::OptionTenor::SwapTenor::SHIFT where [Underlying] = Currency-IRIndex-IRIndexTenor.VOL Example: IR.USD-LIBOR-3M.VOL.SWPT.RLTV.ATM+150bps::2Y::2Y::SHIFT

Table 19 Expected Logical Quote Structure for Market Data

The logical quote structure in which fixings data is expected is given below. When data moves from stage table to processing, appropriate values are concatenated to form the required quote.

Asset Class	Logical Quote structure	Remarks
IR	Currency-Interest Rate Index-Tenor	Historical fixing / spot interest rate is required. Ex. USD-LIBOR-3M
FX	BaseCurrencyTermCurrency-SPOT	Historical spot exchange rate is required in the form "1 unit of base currency = n unit of term currency". Ex. AUDJPY-SPOT
INFL	Currency-Inflation Index	Historical value of inflation index is required. Ex. USD-CPI

Table 20 Logical Quote Structure for Fixing Data

13 Annexure B: Approval Workflow

13.1 Overview

OFS MRMM supports approval workflows based on user roles. A one-step maker-checker approval is supported for business assumption definition and Run definition to ensure that computations are carried out using the right input data.

A definition goes through multiple stages, each with a different status, before it can be used for computation. For instance, when a new business assumption is defined and saved, it will be in 'Draft' status. When the definition is edited and sent for authorization, the status of the definition changes to 'Pending Approval' and so on. Each stage requires action from the relevant user based on the role assigned to her. Similarly, a Run definition goes through the same stages of approval.

13.2 Understanding Approval Work Flow

The approval work flow and the logical change in each status is depicted as part of the process flow below:

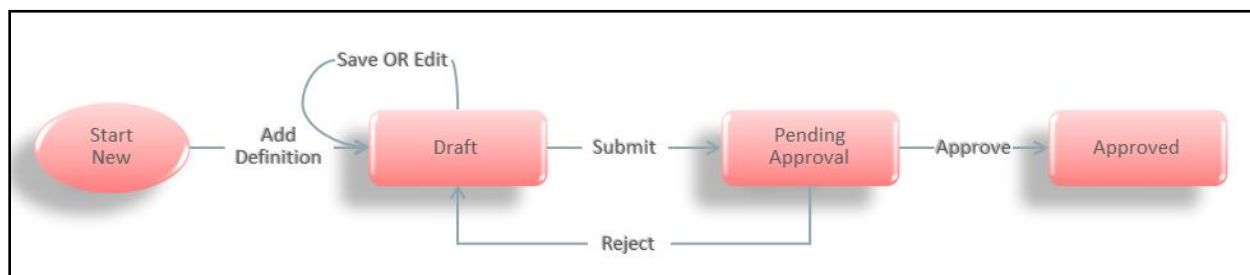


Figure 72 Approval Workflow

Each definition goes through multiple stages and has a status associated with it in each stage and the following table explains the status at each stage.

Status	Description
Draft	When a new definition is created and saved for the first time it is in 'Draft' status. While in draft status, the user is allowed to make any necessary edits without a change in the version number.
Pending Approval	When a definition is sent for approval but is not yet approved by the approver the status changes to 'Pending Approval'. This does not result in a change in the version number.
Draft	When a definition is rejected by the approver, it changes to 'Draft' status and is required to be updated or rectified. This result in a change in the version number. After the necessary updates have been made, it goes through the approval process again. You are allowed to delete a version in 'Draft' status.

Status	Description
Approved	When a definition has been approved its status changes to 'Approved'. This does not result in a change in the version number.

The steps which explain the approval work flow process and the tasks that a user can perform during each stage are as follows:

To create a new definition, click Add icon in the Business Assumptions Summary window. On creation of a new definition it is in 'Draft' status. The icons which are enabled while a definition is in Draft status are as follows: View, Edit, Copy, Delete, Send for Approval, and Approval Summary.

The actions which are permissible when a definition is in 'Draft' status are as follows:

- You can view the definition by clicking the View icon in the summary window. You cannot edit the values in View mode.
- You can edit the definition by clicking the Edit icon in the summary window and make the required changes. This does not result in a new version.
- You can copy the definition and save it with a new name by clicking the Copy icon in the summary window. The new definition will have the same attributes as the existing definition and will be created as version 0. This definition will be in 'Draft' status and the necessary edits can be made.
- You are allowed to delete any definition which is in 'Draft' status, by selecting the definition from the summary window and clicking the Delete icon.
- Once the definition is finalized, you can initiate the approval process by opening the definition in edit mode and clicking the Send for Approval icon in the definition window. This changes the status of the definition to 'Pending Approval'.
- You can view the approval workflow for the definition in the Approval Summary window, by clicking the Approval Summary icon. This window provides details of each change in the approval status.
- Once the definition is finalized, it is sent for approval and its status changes to 'Pending Approval'. The icons which are enabled in the 'Pending Approval' status are as follows: View, Copy, Approve, Reject, and Approval Summary.

The actions which are permissible when a definition is in 'Pending Approval' status are as follows:

- You can view the definition by clicking the View icon in the summary window. You cannot edit the values in View mode.
- You can copy the definition and save it with a new name by clicking the Copy icon in the summary window. The new definition will have the same attributes as the existing definition

and will be created as version 0. This definition will be in 'Draft' status and the necessary edits can be made.

- You can approve the definition, if you have the appropriate access rights, by clicking the Approve icon. You are allowed to add comments. The status changes to 'Approved' when you have completed the approval process.
- You can reject the definition, if you have the appropriate access rights, by clicking the Reject icon. You are allowed to add comments. Rejecting a definition changes the status back to 'Draft'.
- You can view the approval workflow for the definition in the Approval Summary window, by clicking the Approval Summary icon. This window provides details of each change in the approval status. This window provides details of each change in the approval status.

NOTE: The Approve or Reject buttons are present only for users who are mapped to the MR Approver role.

The actions which are permissible when a definition is in 'Approved' status are as follows:

- You can view the definition by clicking the View icon in the summary window. You cannot edit the values in View mode.
- You can edit the definition by clicking the Edit icon in the summary window and make the required changes. The definition is still in 'In Review' status.
- You can copy the definition and save it with a new name by clicking the Copy icon in the summary window. The new definition will have the same attributes as the existing definition and will be created as version 0. This definition will be in 'Draft' status and the necessary edits can be made.
- You can view the approval workflow for the definition in the Approval Summary window, by clicking the Approval Summary icon. This window provides details of each change in the approval status.
- Approved definition cannot be edited.

14 Annexure C: List of Instruments Supported by OFS MRMM

The instruments supported by MRMM are listed in this section.

- [List of Instruments Supported by OFS MRMM](#)
- [List of Instruments Supported for Monte Carlo Simulation](#)

14.1 List of Instruments Supported by MRMM

OFS MRMM supports the following instruments.

Sl. No.	Asset Class	Name of the Instrument	MRMM Release Version
1	Interest Rate	Amortizing Bond	8.0.5.0.0
2	Interest Rate	Basis Swap	8.0.5.0.0
3	Interest Rate	Amortizing Floating Rate Note	8.0.5.0.0
4	Credit	Credit Asset Swap	8.0.5.0.0
5	Equity	Equity Future	8.0.5.0.0
6	Interest Rate	Cross-Currency Basis Swap	8.0.5.0.0
7	Inflation	Inflation Zero Coupon Swap	8.0.5.0.0
8	Interest Rate	Cash Deposit	8.0.5.0.0
9	Interest Rate	Certificado de Deposito Bancario	8.0.5.0.0
10	Interest Rate	CapFloor	8.0.5.0.0
11	Commodity	Commodity Forward	8.0.5.0.0
12	Commodity	Commodity Future	8.0.5.0.0
13	Interest Rate	Sovereign bond	8.0.5.0.0
14	Forex	FX Forward	8.0.5.0.0
15	Interest Rate	Floating Rate Note	8.0.5.0.0
16	Interest Rate	Forward rate Agreement	8.0.5.0.0
17	Interest Rate	Treasury Bill	8.0.5.0.0
18	Interest Rate	Vanilla IR Swap	8.0.5.0.0
19	Equity	Equity Variance Swap	8.0.5.0.0
20	Interest Rate	Callable Bond	8.0.5.0.0

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SI. No.	Asset Class	Name of the Instrument	MRMM Release Version
21	Commodity	Commodity American Option on Future	8.0.5.0.0
22	Interest Rate	Cross-Currency Fix Float Swap	8.0.5.0.0
23	Equity	Equity American Option	8.0.5.0.0
24	Forex	FX American Option	8.0.5.0.0
25	Interest Rate	Amortizing Swap	8.0.5.0.0
26	Commodity	Commodity European Option On Spot	8.0.5.0.0
27	Equity	Equity Asian Option	8.0.5.0.0
28	Forex	FX Asian Option	8.0.5.0.0
29	Equity	European Swaption	8.0.5.0.0
30	Interest Rate	Generic Swap	8.0.5.0.0
31	Inflation	Inflation Linked Bond	8.0.5.0.0
32	Forex	FX European Option	8.0.5.0.0
33	Equity	Equity European Option	8.0.5.0.0
34	Forex	FX Variance Swap	8.0.5.0.0
35	Equity	Equity Convertible Bond Option	8.0.5.0.0
36	Equity	Equity Total Return Swap	8.0.5.0.0
37	Commodity	Commodity Swaption	8.0.5.0.0
38	Commodity	Commodity Bullet Swap	8.0.5.0.0
39	Credit	Credit Default Swap - Standard North American Corporate (SNAC)	8.0.5.0.0
40	Forex	FX Pivot	8.0.6.0.0
41	Forex	FX Dual Target Forward	8.0.6.0.0
42	Forex	FX Binary Option	8.0.6.0.0
43	Forex	FX Digital	8.0.6.0.0
44	Forex	FX Barrier Scripted	8.0.6.0.0

Table 21 List of Instruments Supported By MRMM

14.2 List of Instruments Supported for Monte Carlo

OFS MRMM supports the following instruments for Monte Carlo Simulation:

Sl. No.	Asset Class	Name of the Instrument	MRMM Release Version
1	Interest Rate	Amortizing Bond	8.0.5.0.0
2	Interest Rate	Basis Swap	8.0.5.0.0
3	Interest Rate	Amortizing Floating Rate Note	8.0.5.0.0
4	Credit	Credit Asset Swap	8.0.5.0.0
5	Equity	Equity Future	8.0.5.0.0
6	Interest Rate	Cross-Currency Basis Swap	8.0.5.0.0
7	Interest Rate	Cash Deposit	8.0.5.0.0
8	Interest Rate	CapFloor	8.0.5.0.0
9	Commodity	Commodity Forward	8.0.5.0.0
10	Commodity	Commodity Future	8.0.5.0.0
11	Interest Rate	Sovereign bond	8.0.5.0.0
12	Forex	FX Forward	8.0.5.0.0
13	Interest Rate	Floating Rate Note	8.0.5.0.0
14	Interest Rate	Forward rate Agreement	8.0.5.0.0
15	Interest Rate	Treasury Bill	8.0.5.0.0
16	Interest Rate	Vanilla IR Swap	8.0.5.0.0
17	Equity	Equity Variance Swap	8.0.5.0.0
18	Interest Rate	Callable Bond	8.0.5.0.0
19	Commodity	Commodity American Option on Future	8.0.5.0.0
20	Equity	Equity American Option	8.0.5.0.0
21	Forex	FX American Option	8.0.5.0.0
22	Interest Rate	Amortizing Swap	8.0.5.0.0
23	Commodity	Commodity European Option On Spot	8.0.5.0.0
24	Forex	FX Asian Option	8.0.5.0.0
25	Equity	European Swaption	8.0.5.0.0

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Sl. No.	Asset Class	Name of the Instrument	MRMM Release Version
26	Interest Rate	Generic Swap	8.0.5.0.0
27	Forex	FX European Option	8.0.5.0.0
28	Equity	Equity European Option	8.0.5.0.0
29	Equity	Equity Total Return Swap	8.0.5.0.0
30	Commodity	Commodity Swaption	8.0.5.0.0
31	Commodity	Commodity Bullet Swap	8.0.5.0.0
32	Credit	Credit Default Swap - Standard North American Corporate (SNAC)	8.0.5.0.0
33	Forex	FX Pivot	8.0.6.0.0
34	Forex	FX Dual Target Forward	8.0.6.0.0
35	Forex	FX Barrier Scripted	8.0.6.0.0

Table 22 List of Instruments Supported By MRMM for Monte-Carlo Simulation

15 Annexure D: List of Models and Methods

OFS MRMM supports the following models and methods:

Instrument Type	Model	Method	Asset Class
Commodity American Option on Future	Commodity Black Model	Backward Monte Carlo	Commodity
Commodity American Option on Future	Commodity Black Model	Forward Monte Carlo	Commodity
Commodity American Option on Future	Commodity Black Model	JuZhong	Commodity
Commodity American Option on Future	Commodity Black Model	CDVM JuZhong	Commodity
Commodity Bullet Swap	Commodity Black Model	Forward Monte Carlo	Commodity
Equity Convertible Bond Option	EQ Convertible Model	Backward Partial Differential Equation	Equity
Equity Convertible Bond Option	EQ Convertible Model	Backward Monte Carlo	Equity
Equity American Option	EQ Black-Scholes Model	Backward Partial Differential Equation	Equity
Equity American Option	EQ Black-Scholes Model	CDVM JuZhong	Equity
Equity American Option	EQ Black-Scholes Model	JuZhong	Equity
Equity Asian Option	EQ Deterministic Model	Vecer Discrete Partial Differential Equation	Equity
Equity Total Return Swap	EQ Deterministic Model	Not applicable	Equity
Equity Total Return Swap	EQ Black-Scholes Model	Backward Analytic	Equity
Equity Total Return Swap	EQ Black-Scholes Model	Backward Finite Difference	Equity
Equity Total Return Swap	EQ Black-Scholes Model	Backward Lattice	Equity
Equity Total Return Swap	EQ Black-Scholes Model	Backward Partial Differential Equation	Equity
Equity Total Return Swap	EQ Black-Scholes Model	Backward Tree	Equity
Equity Total Return Swap	EQ Black-Scholes Model	Forward Analytic	Equity
Equity Total Return Swap	EQ Black-Scholes Model	Forward Monte Carlo	Equity
Equity Total Return Swap	EQ Bates Model	Backward Finite Difference	Equity

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Instrument Type	Model	Method	Asset Class
Equity Total Return Swap	EQ Bates Model	Backward Monte Carlo	Equity
Equity Total Return Swap	EQ Bates Model	Forward Monte Carlo	Equity
Equity Total Return Swap	EQ Dupire Model	Backward Analytic	Equity
Equity Total Return Swap	EQ Dupire Model	Backward Finite Difference	Equity
Equity Total Return Swap	EQ Dupire Model	Backward Monte Carlo	Equity
Equity Total Return Swap	EQ Dupire Model	Backward Partial Differential Equation	Equity
Equity Total Return Swap	EQ Dupire Model	Backward Tree	Equity
Equity Total Return Swap	EQ Dupire Model	Forward Analytic	Equity
Equity Total Return Swap	EQ Dupire Model	Forward Monte Carlo	Equity
Equity Total Return Swap	EQ Heston Model	Backward Analytic	Equity
Equity Total Return Swap	EQ Heston Model	Backward Finite Difference	Equity
Equity Total Return Swap	EQ Heston Model	Backward Monte Carlo	Equity
Equity Total Return Swap	EQ Heston Model	Backward Partial Differential Equation	Equity
Equity Total Return Swap	EQ Heston Model	Forward Analytic	Equity
Equity Total Return Swap	EQ Heston Model	Forward Monte Carlo	Equity
FX Asian Option	FX Dupire Model	Backward Analytic	Forex
FX Asian Option	FX Dupire Model	Backward Finite Difference	Forex
FX Asian Option	FX Dupire Model	Backward Monte Carlo	Forex
FX Asian Option	FX Dupire Model	Backward Partial Differential Equation	Forex
FX Asian Option	FX Dupire Model	Backward Tree	Forex
FX Asian Option	FX Dupire Model	Forward Analytic	Forex
FX Asian Option	FX Dupire Model	Forward Monte Carlo	Forex
FX Asian Option	FX Black Model	Backward Analytic	Forex
FX Asian Option	FX Black Model	Backward Finite Difference	Forex
FX Asian Option	FX Black Model	Backward Lattice	Forex
FX Asian Option	FX Black Model	Backward Partial Differential	Forex

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Instrument Type	Model	Method	Asset Class
		Equation	
FX Asian Option	FX Black Model	Backward Tree	Forex
FX Asian Option	FX Black Model	Forward Analytic	Forex
FX Asian Option	FX Black Model	Forward Monte Carlo	Forex
FX Asian Option	FX Deterministic Model	Not applicable	Forex
FX Asian Option	FX Heston Model	Backward Analytic	Forex
FX Asian Option	FX Heston Model	Backward Finite Difference	Forex
FX Asian Option	FX Heston Model	Backward Monte Carlo	Forex
FX Asian Option	FX Heston Model	Backward Partial Differential Equation	Forex
FX Asian Option	FX Heston Model	Forward Analytic	Forex
FX Asian Option	FX Heston Model	Forward Monte Carlo	Forex
Amortizing Bond	IR Deterministic Model	Backward Analytic	Interest Rate
Amortizing Bond	IR Deterministic Model	Forward Analytic	Interest Rate
Amortizing Bond	IR LIBOR Market Model	Backward Monte Carlo	Interest Rate
Amortizing Bond	IR LIBOR Market Model	Forward Monte Carlo	Interest Rate
Amortizing Bond	IR Hull White 1-Factor Model	Backward Lattice	Interest Rate
Amortizing Bond	IR Hull White 1-Factor Model	Backward Monte Carlo	Interest Rate
Amortizing Bond	IR Hull White 1-Factor Model	Backward Partial Differential Equation	Interest Rate
Amortizing Bond	IR Hull White 1-Factor Model	Backward Tree	Interest Rate
Amortizing Bond	IR Hull White 1-Factor Model	Forward Monte Carlo	Interest Rate
Amortizing Bond	IR Hull White 2-Factor Model	Backward Lattice	Interest Rate
Amortizing Bond	IR Hull White 2-Factor Model	Backward Monte Carlo	Interest Rate

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Instrument Type	Model	Method	Asset Class
Amortizing Bond	IR Hull White 2-Factor Model	Backward Partial Differential Equation	Interest Rate
Amortizing Bond	IR Hull White 2-Factor Model	Forward Monte Carlo	Interest Rate
Amortizing Floating Rate Note	IR Deterministic Model	Backward Analytic	Interest Rate
Amortizing Floating Rate Note	IR Deterministic Model	Forward Analytic	Interest Rate
Amortizing Floating Rate Note	IR LIBOR Market Model	Backward Monte Carlo	Interest Rate
Amortizing Floating Rate Note	IR LIBOR Market Model	Forward Monte Carlo	Interest Rate
Amortizing Floating Rate Note	IR Hull White 1-Factor Model	Backward Lattice	Interest Rate
Amortizing Floating Rate Note	IR Hull White 1-Factor Model	Backward Monte Carlo	Interest Rate
Amortizing Floating Rate Note	IR Hull White 1-Factor Model	Backward Partial Differential Equation	Interest Rate
Amortizing Floating Rate Note	IR Hull White 1-Factor Model	Backward Tree	Interest Rate
Amortizing Floating Rate Note	IR Hull White 1-Factor Model	Forward Monte Carlo	Interest Rate
Amortizing Floating Rate Note	IR Hull White 2-Factor Model	Backward Lattice	Interest Rate
Amortizing Floating Rate Note	IR Hull White 2-Factor Model	Backward Monte Carlo	Interest Rate
Amortizing Floating Rate Note	IR Hull White 2-Factor Model	Backward Partial Differential Equation	Interest Rate
Amortizing Floating Rate Note	IR Hull White 2-Factor Model	Forward Monte Carlo	Interest Rate
Amortizing Swap	IR Deterministic Model	Backward Analytic	Interest Rate
Amortizing Swap	IR Deterministic Model	Forward Analytic	Interest Rate
Amortizing Swap	IR LIBOR Market Model	Backward Monte Carlo	Interest Rate
Amortizing Swap	IR LIBOR Market Model	Forward Monte Carlo	Interest Rate
Amortizing Swap	IR Hull White 1-Factor	Backward Lattice	Interest Rate

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Instrument Type	Model	Method	Asset Class
	Model		
Amortizing Swap	IR Hull White 1-Factor Model	Backward Monte Carlo	Interest Rate
Amortizing Swap	IR Hull White 1-Factor Model	Backward Partial Differential Equation	Interest Rate
Amortizing Swap	IR Hull White 1-Factor Model	Backward Tree	Interest Rate
Amortizing Swap	IR Hull White 1-Factor Model	Forward Monte Carlo	Interest Rate
Amortizing Swap	IR Hull White 2-Factor Model	Backward Lattice	Interest Rate
Amortizing Swap	IR Hull White 2-Factor Model	Backward Monte Carlo	Interest Rate
Amortizing Swap	IR Hull White 2-Factor Model	Backward Partial Differential Equation	Interest Rate
Amortizing Swap	IR Hull White 2-Factor Model	Forward Monte Carlo	Interest Rate
Callable Bond	IR Deterministic Model	Backward Analytic	Interest Rate
Callable Bond	IR Deterministic Model	Forward Analytic	Interest Rate
Callable Bond	IR LIBOR Market Model	Backward Monte Carlo	Interest Rate
Callable Bond	IR LIBOR Market Model	Forward Monte Carlo	Interest Rate
Callable Bond	IR Hull White 1-Factor Model	Backward Lattice	Interest Rate
Callable Bond	IR Hull White 1-Factor Model	Backward Monte Carlo	Interest Rate
Callable Bond	IR Hull White 1-Factor Model	Backward Partial Differential Equation	Interest Rate
Callable Bond	IR Hull White 1-Factor Model	Backward Tree	Interest Rate
Callable Bond	IR Hull White 1-Factor Model	Forward Monte Carlo	Interest Rate
Callable Bond	IR Hull White 2-Factor	Backward Lattice	Interest Rate

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Instrument Type	Model	Method	Asset Class
	Model		
Callable Bond	IR Hull White 2-Factor Model	Backward Monte Carlo	Interest Rate
Callable Bond	IR Hull White 2-Factor Model	Backward Partial Differential Equation	Interest Rate
Callable Bond	IR Hull White 2-Factor Model	Forward Monte Carlo	Interest Rate
Certificate of Deposit	IR Deterministic Model	Backward Analytic	Interest Rate
Certificate of Deposit	IR Deterministic Model	Forward Analytic	Interest Rate
Certificate of Deposit	IR LIBOR Market Model	Backward Monte Carlo	Interest Rate
Certificate of Deposit	IR LIBOR Market Model	Forward Monte Carlo	Interest Rate
Certificate of Deposit	IR Hull White 1-Factor Model	Backward Lattice	Interest Rate
Certificate of Deposit	IR Hull White 1-Factor Model	Backward Monte Carlo	Interest Rate
Certificate of Deposit	IR Hull White 1-Factor Model	Backward Partial Differential Equation	Interest Rate
Certificate of Deposit	IR Hull White 1-Factor Model	Backward Tree	Interest Rate
Certificate of Deposit	IR Hull White 1-Factor Model	Forward Monte Carlo	Interest Rate
Certificate of Deposit	IR Hull White 2-Factor Model	Backward Lattice	Interest Rate
Certificate of Deposit	IR Hull White 2-Factor Model	Backward Monte Carlo	Interest Rate
Certificate of Deposit	IR Hull White 2-Factor Model	Backward Partial Differential Equation	Interest Rate
Certificate of Deposit	IR Hull White 2-Factor Model	Forward Monte Carlo	Interest Rate
Commodity Swaption	Commodity Black Model	Not applicable	Commodity
European Swaption	IR Hull White 2-Factor Model	Backward Lattice	Interest Rate

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Instrument Type	Model	Method	Asset Class
European Swaption	IR Hull White 2-Factor Model	Backward Monte Carlo	Interest Rate
European Swaption	IR Hull White 2-Factor Model	Backward Partial Differential Equation	Interest Rate
European Swaption	IR Hull White 2-Factor Model	Forward Monte Carlo	Interest Rate
European Swaption	IR Hull White 1-Factor Model	Backward Lattice	Interest Rate
European Swaption	IR Hull White 1-Factor Model	Backward Monte Carlo	Interest Rate
European Swaption	IR Hull White 1-Factor Model	Backward Partial Differential Equation	Interest Rate
European Swaption	IR Hull White 1-Factor Model	Backward Tree	Interest Rate
European Swaption	IR Hull White 1-Factor Model	Forward Monte Carlo	Interest Rate
European Swaption	IR LIBOR Market Model	Backward Monte Carlo	Interest Rate
European Swaption	IR LIBOR Market Model	Forward Monte Carlo	Interest Rate
Generic Swap	IR Deterministic Model	Backward Analytic	Interest Rate
Generic Swap	IR Deterministic Model	Forward Analytic	Interest Rate
Generic Swap	IR LIBOR Market Model	Backward Monte Carlo	Interest Rate
Generic Swap	IR LIBOR Market Model	Forward Monte Carlo	Interest Rate
Generic Swap	IR Hull White 1-Factor Model	Backward Lattice	Interest Rate
Generic Swap	IR Hull White 1-Factor Model	Backward Monte Carlo	Interest Rate
Generic Swap	IR Hull White 1-Factor Model	Backward Partial Differential Equation	Interest Rate
Generic Swap	IR Hull White 1-Factor Model	Backward Tree	Interest Rate
Generic Swap	IR Hull White 1-Factor Model	Forward Monte Carlo	Interest Rate

Instrument Type	Model	Method	Asset Class
Generic Swap	IR Hull White 2-Factor Model	Backward Lattice	Interest Rate
Generic Swap	IR Hull White 2-Factor Model	Backward Monte Carlo	Interest Rate
Generic Swap	IR Hull White 2-Factor Model	Backward Partial Differential Equation	Interest Rate
Generic Swap	IR Hull White 2-Factor Model	Forward Monte Carlo	Interest Rate

Table 23 List of Models and Methods

16 Annexure E: MR Reports

See the OFS Market Risk Measurement and Management Analytics User Guide Release 8.0.6.0.0 on [OHC Documentation Library](#) for details about reports.

17 Annexure F: Data Expectation

For information about stage tables in which input data of below types is expected, see OFS MRMM Download Specification and Run chart document in [MOS](#).

- Trade Data
- Market Data
- Reference Data

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Release 8.0.6.0.0



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Measurement and Management
User Guide

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