Oracle Financial Services Market Risk

User Guide

Release 8.0.4.0.0

ORACLE
Financial Services

DOCUMENT CONTROL

Version Number	Revision Date	Changes Done
Version 1.0	January 2017	Captured 8.0.4.0.0 Minor Release installation procedure and configuration details.
Version 2.0	June 2018	Updated information on the functional aspects.

This document provides a comprehensive knowledge about the user interface and functionalities in Oracle Financial Services Market Risk, Release 8.0.4.0.0. The latest copy of this guide can be accessed from OHC Documentation Library.

Oracle Financial Services Market Risk User Guide, Release 8.0.4.0.0

Primary Author: Vineeta Mishra

Contributors: Hirak Patel

TABLE OF CONTENTS

ABOUT THE GUIDE

This section provides a brief description of the scope, the audience, the references, the organization of the user guide and conventions incorporated into the user guide. The topics in this section are organized as follows:

SCOPE OF THE GUIDE

The Oracle Financial Services Market Risk User Guide Release 8.0.4.0.0 contains all the essential information for the user to understand and use the product effectively. 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 8.0.4.0.0 of the Oracle Financial Services Market Risk User Guide. This manual is intended for the following audience:

- Functional Engineering Group
- Product Management Group
- Project Manager Team
- Senior Management

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RELATED INFORMATION SOURCES

You can access the below documents online from the documentation Library for OFS TR 8.0.4:

- Oracle Financial Services Market Risk User Guide Release 8.0.4.0.0
- Oracle Financial Services Treasury Risk Installation Guide Release 8.0.4.0.0

You can access the OFS AAI documentation online from the documentation library for OFS AAAI 8.x:

- OFS Advanced Analytical Applications Infrastructure (OFS AAAI) 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 8.0.4.0.0 Technology Matrix

ABBREVIATIONS

Abbreviation	Description
CVA	Credit Valuation Adjustment
DM	Data Model
DVA	Debit Valuation Adjustment
EE	Expected Exposure
ENE	Expected Negative Exposure
FVA	Funding Valuation Adjustment
OFSAAI	Oracle Financial Services Analytical Applications Infrastructure
OFSMR	Oracle Financial Services Market Risk
P&L	Profit and Loss
RF	Risk Factor
SES	Stressed Capital Add-on
VaR	Value at Risk

NOTE: Release **8.0.4.0.0 is the terminal release** of OFS Market Risk and OFS Market Risk Analytics. See OFS Market Risk Measurement and Management User Guide on OHC Documentation Library for OFSAA offering around market risk and valuations.

1 Introduction to Oracle Financial Services Market Risk

Oracle Financial Services Market Risk estimates the market risk of a portfolio through the estimation of loss-distribution based risk measures, such as Value at Risk (VaR), Conditional Value at Risk (CVaR), Component VaR, Marginal VaR, Incremental VaR, and so on. It covers the estimation of risk arising out of movements of multiple risk factors such as interest rates, equity prices, commodity prices and exchange rates.

OFS MR is concerned with the estimation of market risk for the portfolios held by the bank. These portfolios may belong to the trading book or the banking book. The application enables a bank to estimate the market risk of a portfolio based on its underlying positions, through the estimation of risk measures such as Value-at-Risk, Conditional Value-at-Risk and so on. It also enables a bank to carry out Stress Testing and Back Testing procedures for validation.

The scope of OFS MR is not restricted to regulatory reporting. The application caters to the internal reporting needs of the bank, and supports the estimation of market risk of user-defined portfolios covering a wide range of instruments. Additionally, it renders use of Oracle Financial Services Modeling Framework for stress testing of market risk estimates.

The scope of Market Risk, Release 8.0.4.0.0, will be restricted to the testing following areas:

- Analytic Method
- Cash flows Estimation and mapping
- Back testing
- Constant Maturity Function
- Daily Pricing
- Historical Simulation
- Incremental VaR
- Mean Reversion Rate
- Monte Carlo Simulation
- Scenario VaR Calculation
- Stress Testing
- VaR Model Pricing
- Volatility Model

- Zero Coupon Yield Curve
- Performance Issues

2 Getting Started with OFS MR

This chapter details how to get started with the OFS MR application. It describes the organization of the user interface and provides step-by-step instructions for navigating through the application. It includes:

- Logging in to OFS MR Application
- Installing the Solution

2.1 Logging in to OFS MR Application

Access the OFS MR 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.

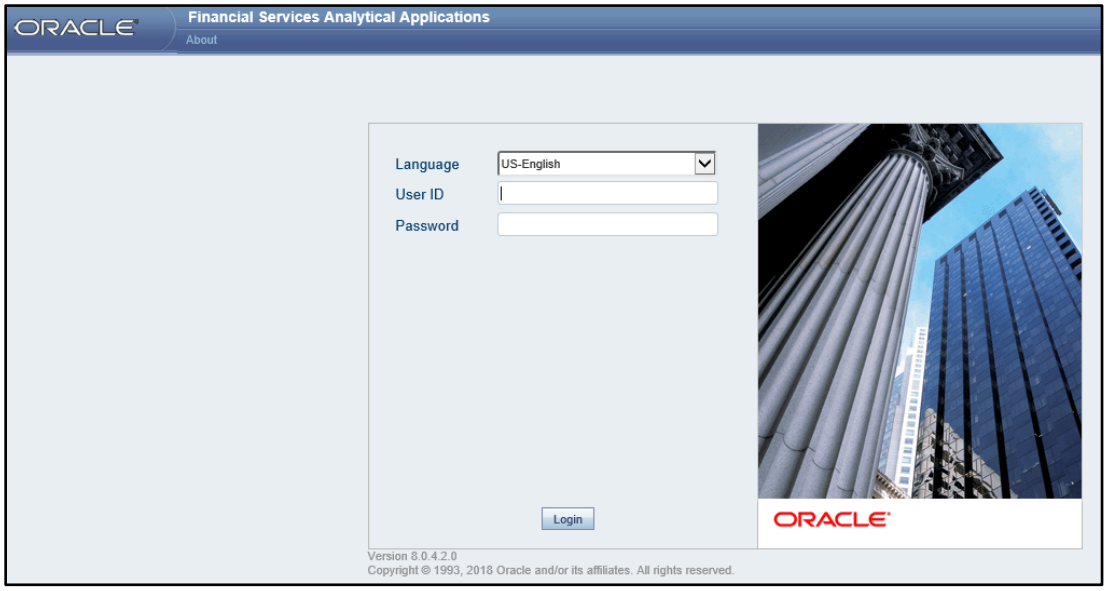


Figure 1 OFSAAI Login Window

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

Figure 2 OFSAAI Landing Page

Click **Market Risk**, the MR landing page is displayed.

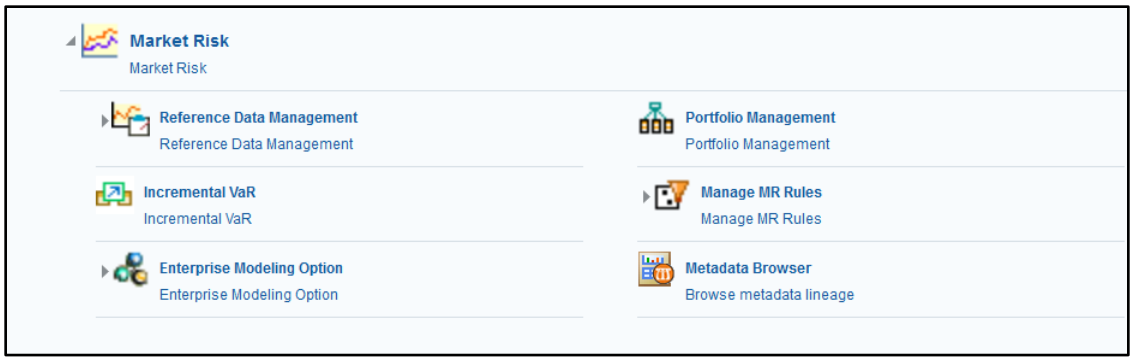
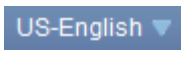


Figure 3 OFS MR Landing Page

Tag	Description
MRUSER (username)	Click this drop-down to select the following options: Preferences, About, Change Password or to logout of OFSAAI.
	Click the icon to view the last log in date.
	Click the icon to view the connection information
	Click this drop-down to select the desired language.

Tag	Description
Object Administration	Object Administration is an integral part of the infrastructure 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 OFS Analytical Applications Infrastructure User Guide on OHC Documentation Library.
Sandbox	Sandbox is an integral part of the Infrastructure system. For more information refer *OFS Analytical Applications Infrastructure User Guide on OHC*.

Table 1 OFSAAI Landing Page

2.2 Installing the Solution

To install Oracle Financial Services Market Risk, refer the Oracle Financial Services Treasury Risk Application Pack Installation Guide, Release 8.0.4.0.0 on OHC Documentation Library.

2.2.1 Uploading the Model

Click Unified Metadata Manager on the left pane of the OFSAAI Infrastructure screen, to perform Model Upload. Click Import Model to open the Business Model Upload screen. Choose the type of Upload as New Upload. Enter the Erwin XML File Path and click Upload and the model will get uploaded.

2.2.2 Loading the Data

Data upload involves the loading of the below stage tables:

- stg_dim_bank_instrument_type
- stg_dim_commodity
- stg_dim_instrument_contract
- stg_dim_mr_asset
- stg_dim_stock_index
- stg_equity_corporate_actions
- stg_fct_bank_positions

- stg_fct_cds_spreads
- stg_interest_rate_parameters
- stg_mkt_instrument_contract
- stg_mr_risk_factor_statistics
- stg_commodity_future_curve
- stg_fct_equity_indices
- stg_fct_instrument_schedule
- stg_fct_funds_composition
- stg_fct_obligors_details
- stg_fct_portfolio_data
- stg_fct_yield_curve

NOTE: Run the Slowly Changing Dimensions (SCDs) to populate the required DIM and FCT tables.

3 Overview of OFSAA Infrastructure Components

OFS MR 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 MR 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 Framework:** Data Quality Rules and Data Quality Groups in the OFSAA Data Quality Framework.
  - **Data Entry Forms and Queries:** OFS MR uses Excel Upload (Atomic), Forms Designer, Forms Authorization, Data Entry from the Data Entry Forms and Queries module of OFSAA. MR uses.
- **Unified Analytical Metadata:** OFS MR uses Dimension Management (Member, Attribute, and Hierarchy Management) from the Unified Analytical Metadata module of OFSAA.
- **Operations:** OFS MR uses Batch Maintenance, Batch Execution, Batch Monitor, Batch Cancellation, Batch Scheduler, View Log from Operations module of OFSAA.
- **Run Rule Framework:** Process Modeling Framework internally uses Process and Run from the OFSAA Run Rule Framework.

Additionally, OFS MR uses the following functionalities of OFSAA Infrastructure. See OFS Analytical Applications Infrastructure User Guide in OHC Documentation Library for features and details.

- Sandbox
- Object Administration
- Managing MR Rules
- Enterprise Modelling Option
- Metadata Browser

4 Reference Data Management

This Chapter describes the Reference Date Management feature in OFS MR.

This chapter includes:

4.1 Overview

Oracle Financial Services Market Risk, Release 8.0.4.0.0, estimates the market risk of a portfolio through the estimation of loss-distribution based risk measures such as VaR, CVaR, Component VaR, Marginal VaR, Incremental VaR, and so on. It covers estimation of risk arising out of movements of multiple risk factors such as interest rates, equity prices, commodity prices and exchange rates.

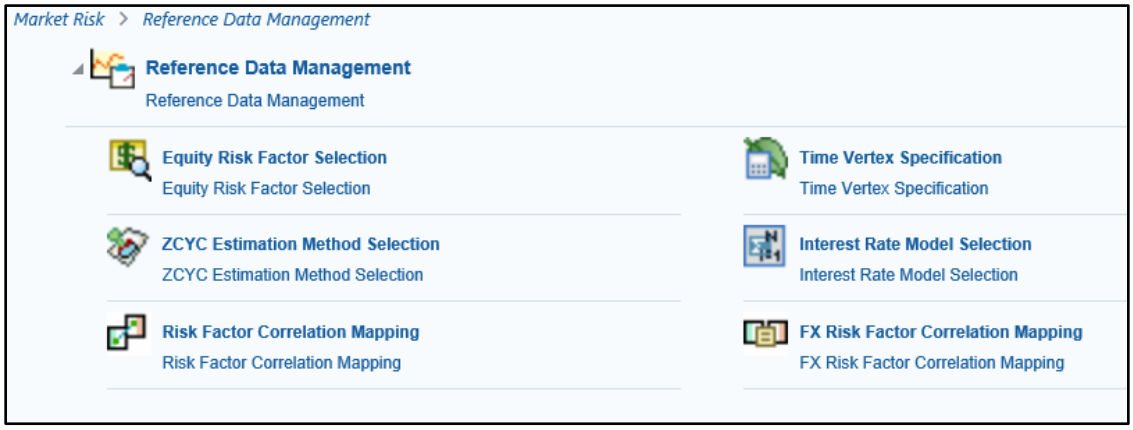


Figure 4 OFS MR Landing Page

4.2 Equity Risk Factor Selection

The Equity Risk Factor Selection summary screen displays the list of equity risk factors that are already defined in a particular currency. The screen also provides a search option for finding, or filtering the risk factors, on the basis of currency selected from the currency browser. You can search, or select a particular currency by clicking ... in the currency browser, to filter the search.

After the selection is entered, all the equity risk factors denominated in that particular currency are displayed.

4.2.1 Defining an Equity Risk Factor

This section details the procedure for selecting Equity Risk Factor.

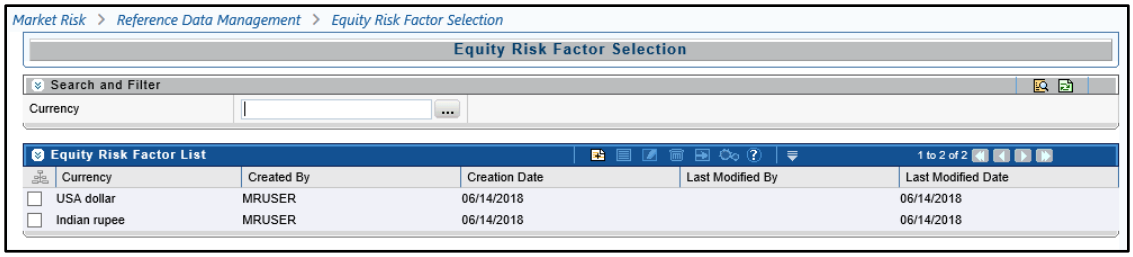


Figure 5 Equity Risk Factor Selection Summary Screen

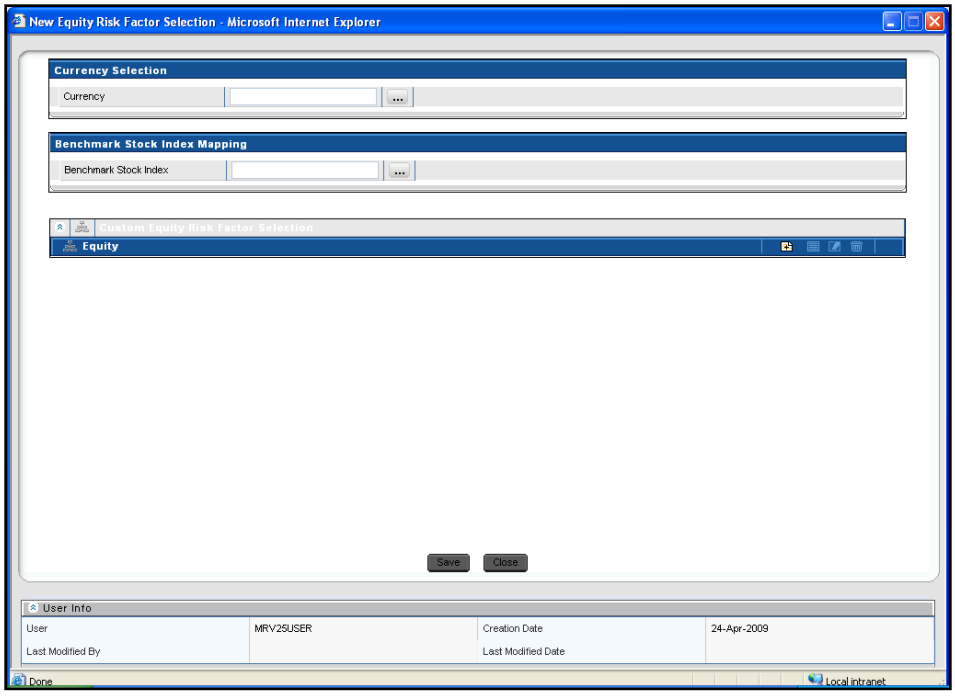


Figure 6 Equity Risk Factor Selection Definition Screen

The following table describes the fields in the Equity Risk Factor Selection window:

Fields	Description
Fields marked in red asterisk(*) are mandatory	
Currency	Select a currency from the currency browser.
Benchmark Stock Index	The indices corresponding to the selected currency are displayed in the benchmark stock index browser. Selecta a single Benchmark Stock Index from the browser.
Custom Equity Risk Factor Selection	This field displays all the custom equities denominated in the selected currency in equity browser. You can perform multiple selections or deletions of custom equities.

Table 2 Fields and their Descriptions in Equity Risk Factor Selection Window

To define a new Equity Risk Factor, follow the below steps:

1. In Oracle Financial Services Analytical Applications Infrastructure home screen, select **Market Risk**
2. Navigate to **Market Risk** > **Reference Data Management** > **Equity Risk Factor Selection** summary screen.
3. Click **Add** .
4. Provide details for fields **Currency** and **Benchmark Stock Index**.

   Benchmark stock index mapping and custom equities selection are editable in this screen. A defined Equity Risk Factor cannot be deleted.
5. Select the equities to be added in **Custom Equity Risk Factor Selection**.
6. Click **Close**. The defined Equity Risk Factor is saved, and displayed in the summary screen.

4.2.2 Viewing an Equity Risk Factor

To view an existing Equity Risk Factor, select an existing record by activating the select button, then click **View** in the right hand corner of the Equity Risk Factor summary screen. The selected Equity risk factor is displayed in view mode, and cannot be edited.

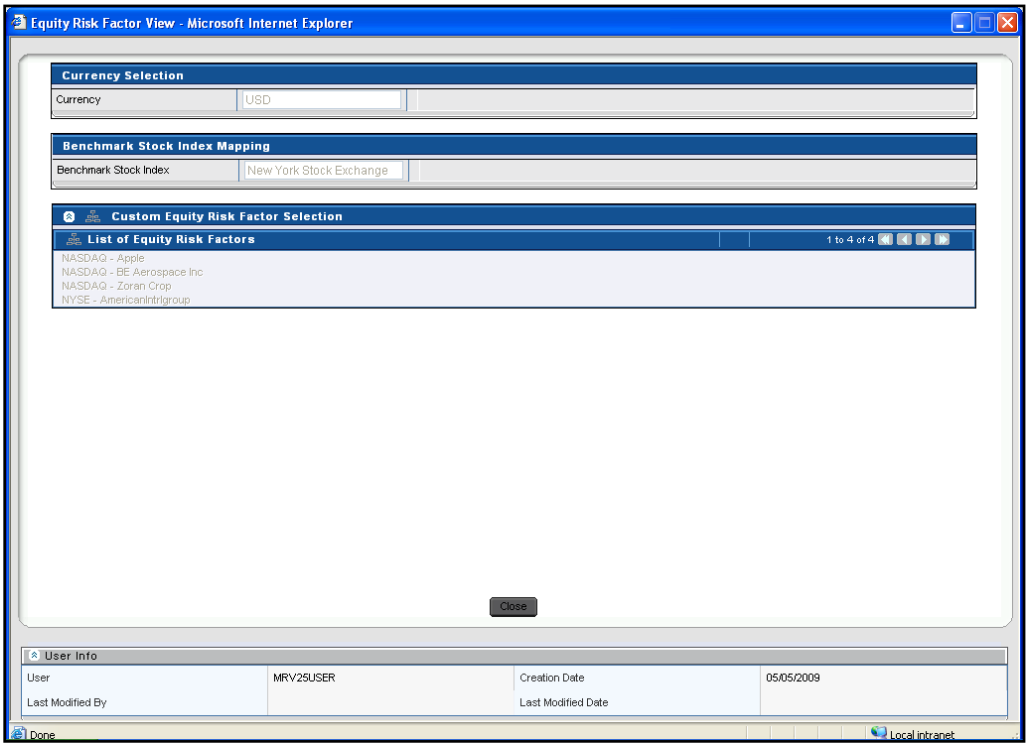


Figure 7 Equity Risk Factor Selection View Screen

4.2.3 Editing an Equity Risk Factor

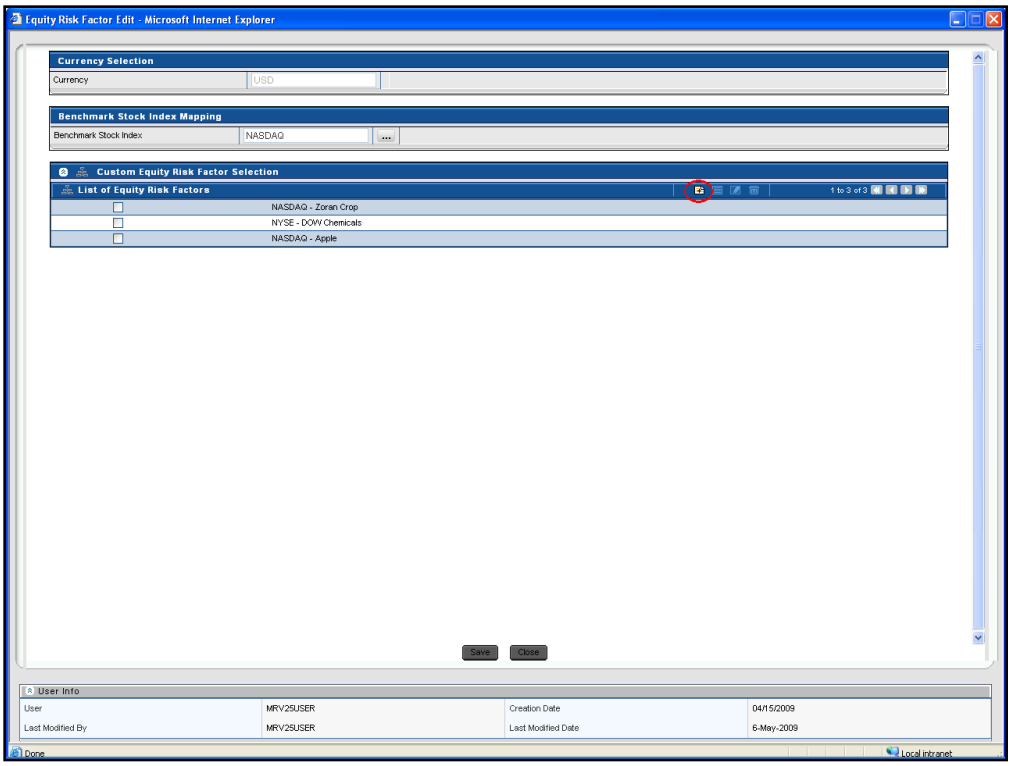


Figure 8 Equity Risk Factor Selection Edit Screen

To edit an Equity Risk Factor, follow the below steps:

1. In the Equity Risk Factor summary screen, select the entry to be edited.
2. Click **Edit** present at the right hand corner of the Equity Risk Factor summary Screen. You can change the Benchmark Stock Index for that particular currency, and add or delete the Equity Risk Factors as required.
3. To add the Equity Risk Factors in the Edit screen, click **Add** .
4. To delete the Equity Risk Factor, select the custom equity to be deleted, and click **Delete** .
5. Click **Save**.

4.3 Time Vertex Specification

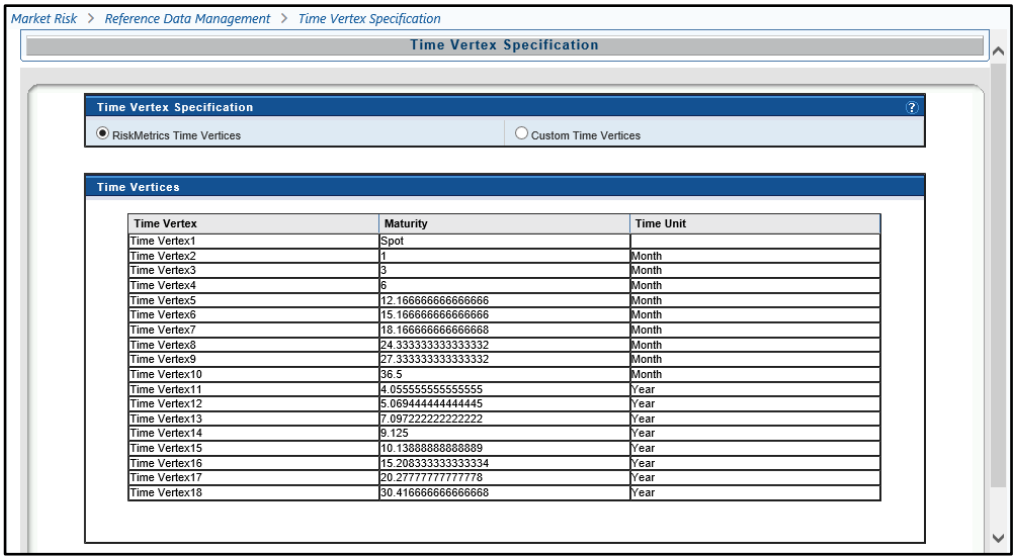
This screen enables you to select the time vertex for all the risk factors. The available time vertices are:

- Risk Metrics Time vertices

- Custom Time vertices

4.3.1 Risk Metrics Time Vertices

The risk matrices time vertex screen is the default display screen for the time vertex specification. Risk matrices are the standard time vertices which cannot be edited. It specifies the time on eighteen standard time vertices following the specific time unit such as, days, months, and years.



Time Vertex	Maturity	Time Unit
Time Vertex1	Spot	
Time Vertex2	1	Month
Time Vertex3	3	Month
Time Vertex4	6	Month
Time Vertex5	12.166666666666666	Month
Time Vertex6	15.166666666666666	Month
Time Vertex7	18.166666666666668	Month
Time Vertex8	24.333333333333332	Month
Time Vertex9	27.333333333333332	Month
Time Vertex10	36.5	Month
Time Vertex11	4.055555555555555	Year
Time Vertex12	5.069444444444445	Year
Time Vertex13	7.097222222222222	Year
Time Vertex14	9.125	Year
Time Vertex15	10.13888888888889	Year
Time Vertex16	15.208333333333334	Year
Time Vertex17	20.27777777777778	Year
Time Vertex18	30.416666666666668	Year

Figure 9 Time Vertex Specification – Risk Metrics Time Vertices

4.3.2 Custom Time vertices

You can change the standard time vertex to a customized time vertex. Enter the custom time vertices on the basis of maturity and time unit. Spot is the default first time vertex, and it cannot be edited. Specify the custom time vertices in the ascending order. In addition to the default sixteen rows provided for entering custom time vertex, you can add new rows to the custom time vertices screen and provide the additional input data.

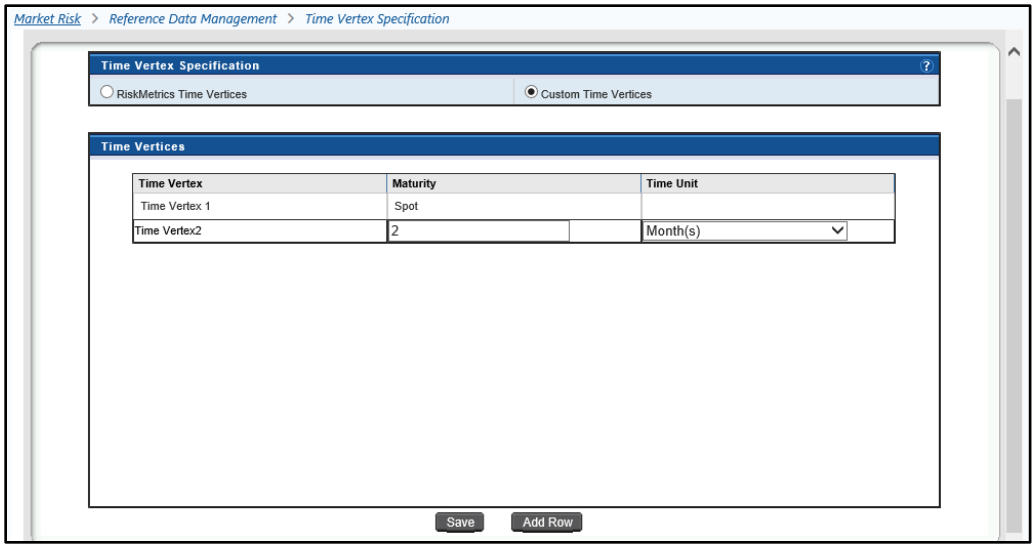


Figure 10 Time Vertex Specification – Custom Time Vertices

4.4 Zero Coupon Yield Curve Estimation Method Selection

Zero Coupon Yield Curve (ZCYC) is selected for every interest rate asset class and currency combination. Ensure to specify the time vertex prior to ZCYC Estimation Method selection.

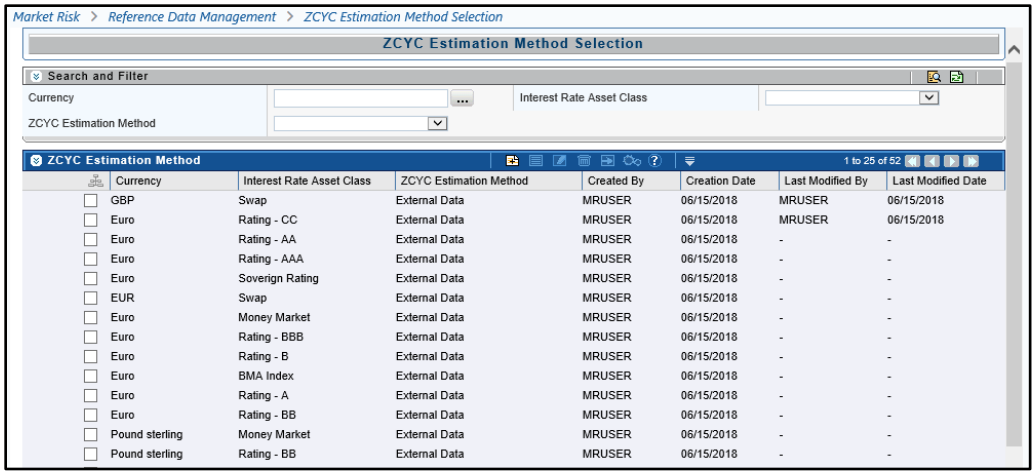


Figure 11 ZCYC Estimation Method Selection Summary Screen

The summary screen enables you to search and filter the ZCYC estimation method selection on the basis of currency, Interest Rate Asset Class and ZCYC Estimation Method. Select one or multiple parameters from currency, Interest Rate Asset Class and ZCYC Estimation Method, and click **Search**.

4.4.1 Methods for ZCYC Estimation

OFS MR provides three methods for ZCYC Estimation.

- Spread over Sovereign Yield Curve
- Bootstrap Yield Curve
- External Data

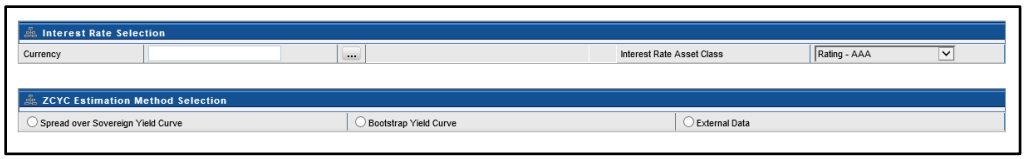
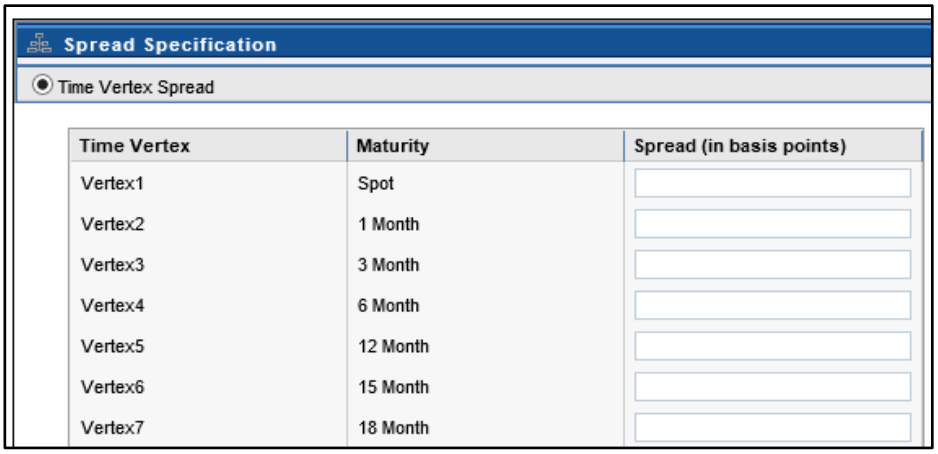


Figure 12 ZCYC Estimation Method Selection

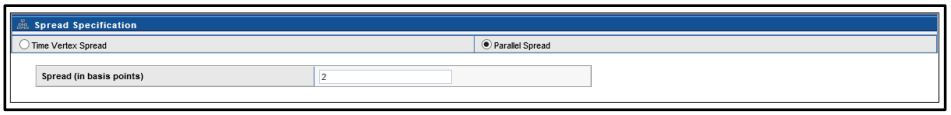
4.4.1.1 Spread Over Sovereign Yield Curve

If you select the Spread Over Sovereign method, you need to specify the type of spread to be applied to the Yield Curve. These spreads can be applied only to the standard time vertex. The available options are:

- **Time Vertex Spread**: Provide multiple spread values (in basis points) for each standard time vertex.



- **Parallel Spread**: Provide a single value for Spread (in basis points), which will be applied to all time standard vertices.



4.4.1.2 Bootstrap Yield Curve

Sovereign and money market asset classes are always estimated using a bootstrapping procedure, or obtained as a download.

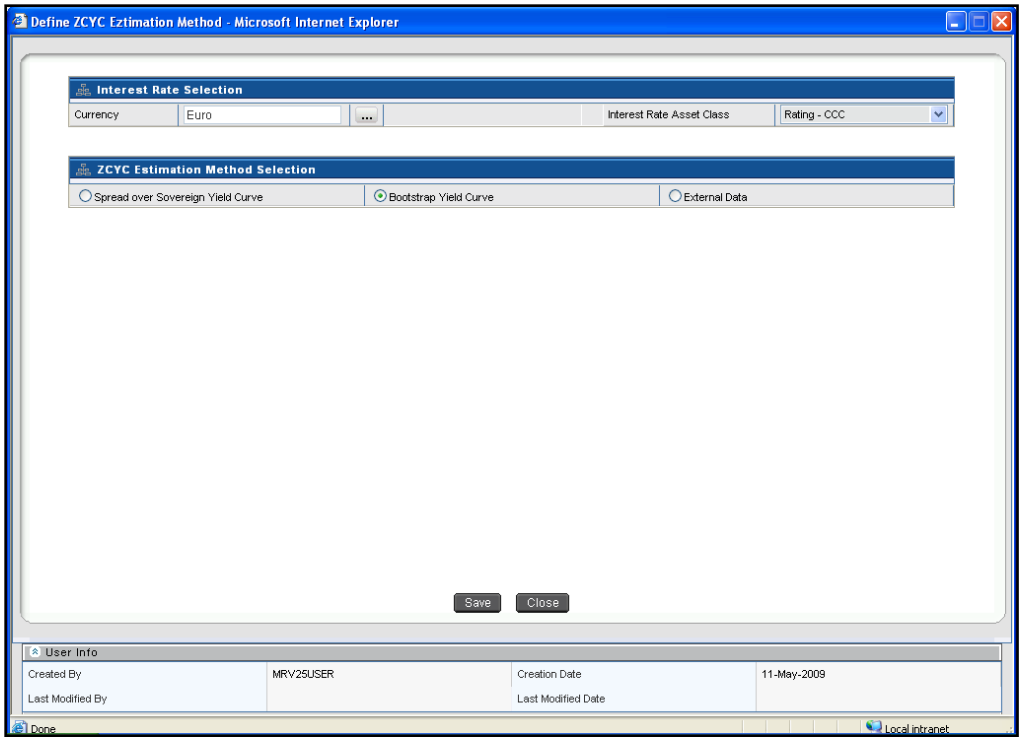


Figure 13 ZCYC Estimation Method Selection Bootstrap Yield Curve Screen

4.4.1.3 External Data

You can provide Zero Coupon Yield Curve as a download by selecting the External Data.

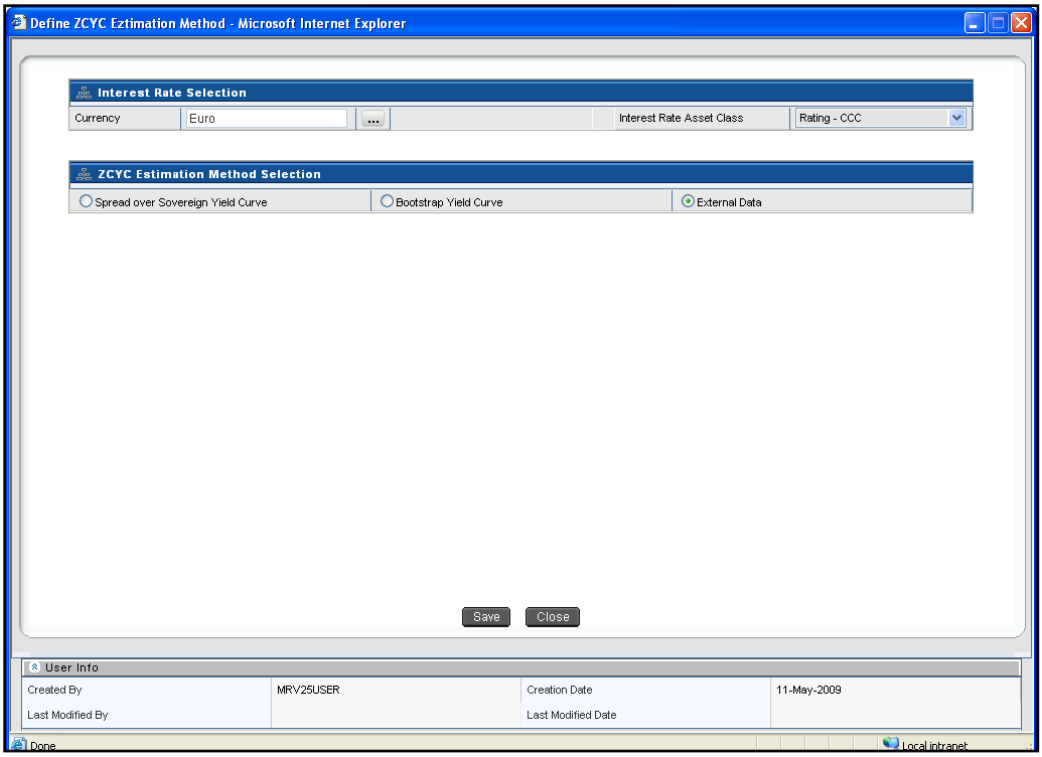


Figure 14 ZCYC Estimation Method Selection External Data Screen

4.4.2 Adding a ZCYC Estimation Method Selection

Follow the below steps, to add a ZCYC Estimation Method:

1. Navigate to **Market Risk** > **Reference Data Management** > **ZCYC Estimation Method Selection**
2. Click **Add** . The definition screen is divided into two sections:
   - Interest Rate Selection
   - ZCYC Method selection
3. In the **Interest Rate Selection** section, select the below:
   - **Currency Selection**: Click . The currency browser displays all available currencies. Select a single currency from the currency browser. OFS MR does not allow selection of multiple currencies.
   - **Interest Rate Asset Class**: The list displays all the interest rates defined in the selected currency. Select a single Interest Rate Asset Class from the drop down list. The Available Interest Rate Asset Classes are:
     - Rating AAA

- Rating AA
- Rating A
- Rating BBB
- Rating BB
- BMA Index
- Rating B
- Rating CCC
- Rating CC
- Rating C
- Rating D
- Government Agency
- Money Market
- Sovereign Rating
- Swap

4. In the ZCYC Estimation Method Selection section, select a single method for ZCYC estimation, for the defined Currency – Interest Rate Asset Class combination. The available options are:
   - Spread Over Sovereign
   - Bootstrap Yield Curve
   - External Data
5. Click **Save**.

4.4.3 Viewing a ZCYC Estimation Method Selection

In order to View an existing ZCYC Estimation Method, select a record by activating the select button, then click View present on the right hand corner of the ZCYC Estimation Method summary screen. The selected ZCYC Estimation Method is displayed in view mode, and it cannot be edited.

4.4.4 Editing a ZCYC Estimation Method Selection

Follow the below steps, to edit a ZCYC Estimation Method:

1. Select the defined estimation method that needs to be edited.

2. Click **Edit** present at the right hand corner of the ZCYC Estimation Method Screen. In the Edit screen you can modify the ZCYC Estimation Method Selection only, the changes can only be done to the previously defined ZCYC Estimation Method. The Interest Rate Selection section cannot be edited.

3. Click **Save**.

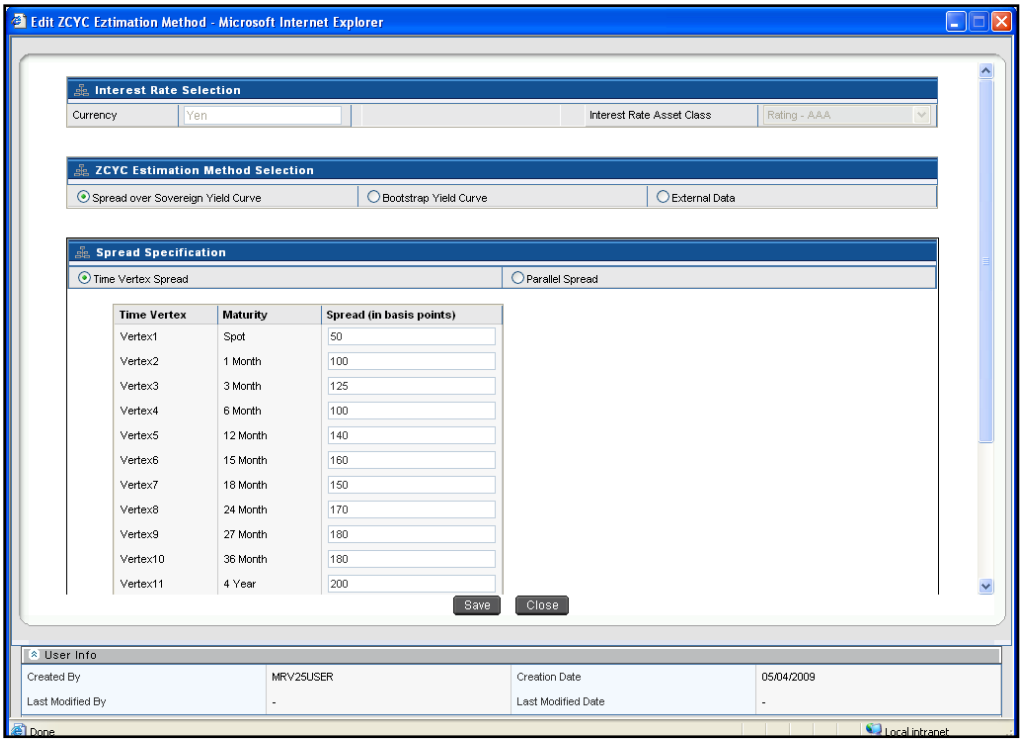


Figure 15 ZCYC Estimation Method Selection Edit Screen

4.5 Interest Rate Model Selection

This screen enables you to map an interest rate model for each currency-interest rate combination. If a Zero Coupon Yield Curve Estimation Method has not been specified for all the interest rate asset classes in a particular currency, then that currency will not appear for selection in the Currency Browser.

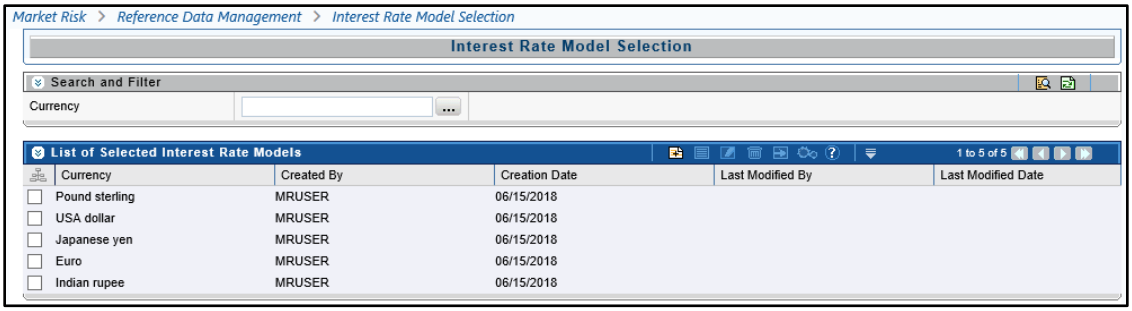


Figure 16 Interest Rate Model Selection Summary Screen

4.5.1 Adding an Interest Rate Model

Follow the below steps, to add a new Interest Rate Model:

1. Navigate to **Market Risk** > **Reference Data Management** > **Interest Rate Model Selection.**
2. Click **Add** . The New Interest Rate Model Selection screen is displayed.
3. In the **Currency** field, select a single currency from the currency browser. Multiple selections are not allowed. Once a particular currency selected, then all the interest rates asset class available in that currency will be displayed.
4. In the **Interest Rate Model Mapping** section, select one Interest Rate Model for each Interest Rate Asset Class, from the following:
   - Black Model
   - Hull White Model
   - Ho-lee Model
   - Ornstein Uhlenback Model

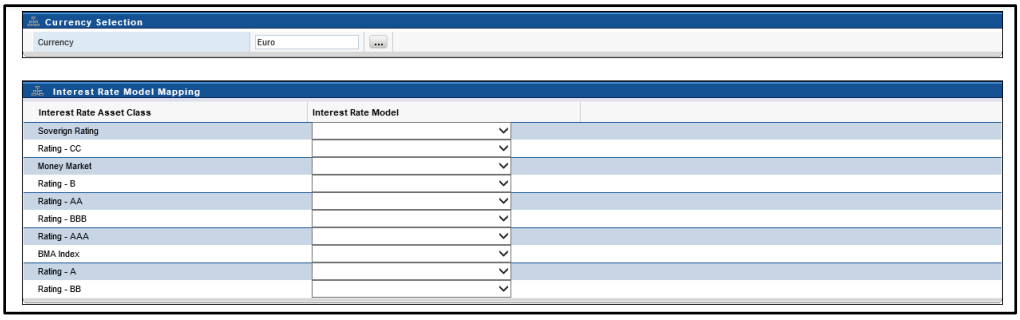


Figure 17 Interest Rate Model Selection Add Screen

After a model is defined for a particular interest rate-currency combination, it can be edited, and a different model can be selected. You cannot save the selection unless an Interest Rate Model is mapped to every Interest Rate Asset Class, for the selected currency.

If spread over sovereign yield curve is specified for any Currency – Interest Rate Asset Class combination, then a separate Interest Rate Model is not allowed to be selected for that combination.

4.5.1.1 Viewing an Interest Rate Model Selection

In order to View, select an existing record by activating the select button, then click **View** present on the right hand corner of the screen. The selected Interest Rate Model is displayed in view mode and it cannot be edited.

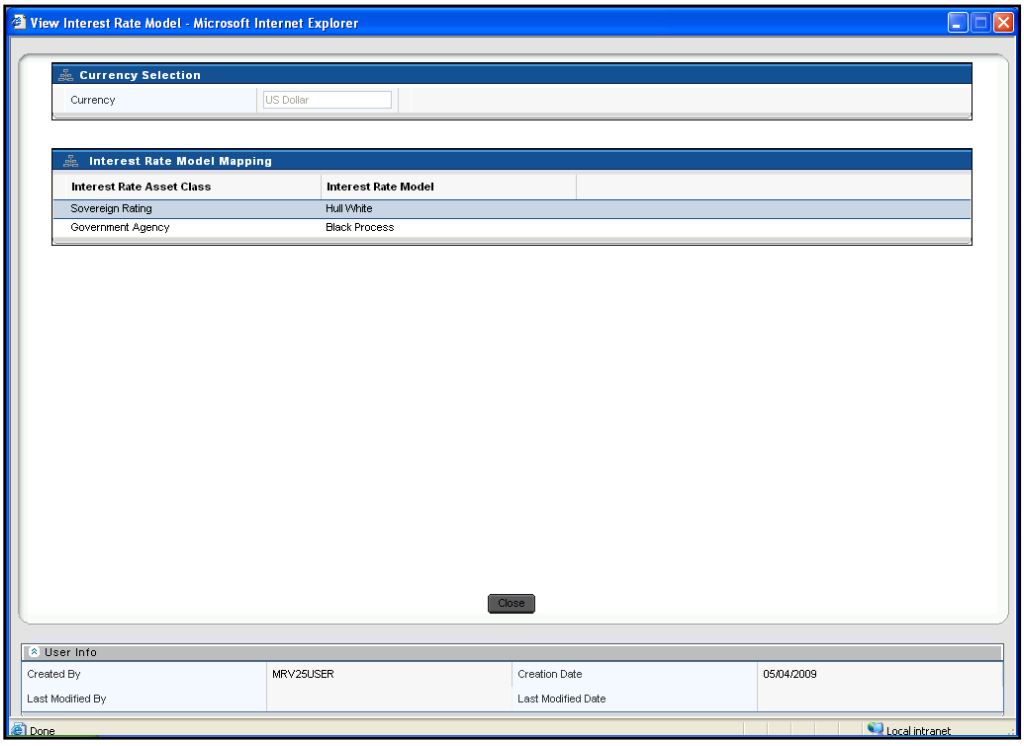


Figure 18 Interest Rate Model Selection View Screen

4.5.1.2 Editing an Interest Rate Model

Follow the below steps, to edit an Interest Rate Model:

1. Select a defined Interest Rate model that needs to be edited by clicking the select button

2. Click **Edit** present at the right hand corner of the Interest Rate Model Selection Screen. In the edit screen, you can only add or modify the already defined models for a particular Asset Class. Currency once defined cannot be edited.

3. Click **Save**.

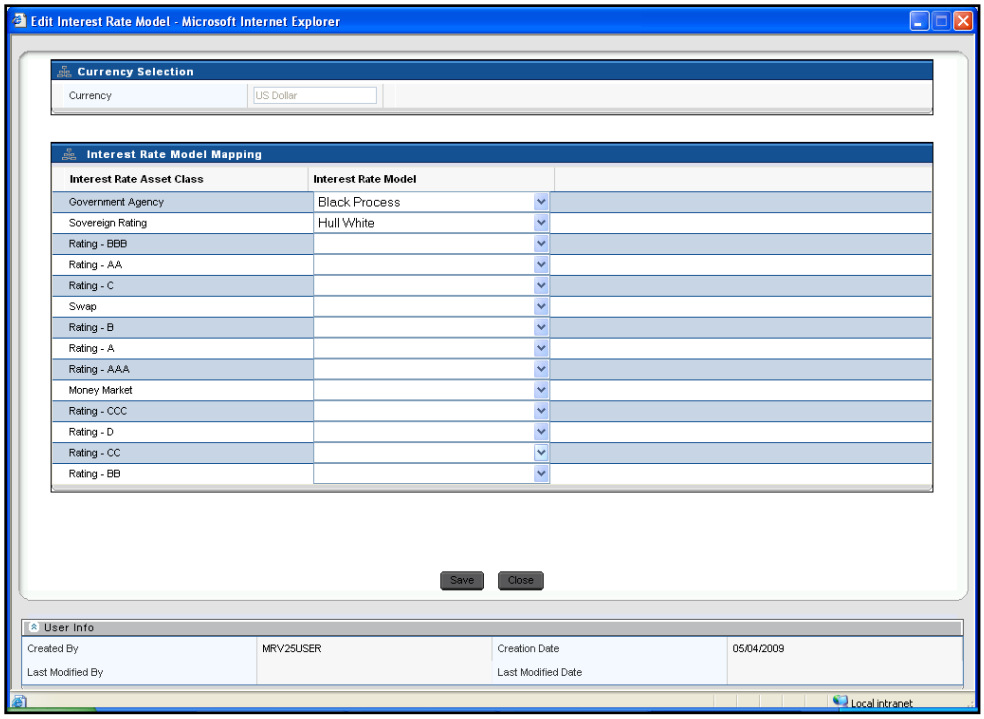


Figure 19 Interest Rate Model Selection Edit Screen

4.6 Correlation Mapping

Risk Factor Correlation mapping and FX Risk Factor Correlation Mapping are one time configuration user interface. In this screen you can setup the risk factors to be considered for computing correlation. Correlation matrix is used in VaR computation, therefore, ensure to select all the risk factors which are part of the portfolio.

4.6.1 Risk Factor Correlation Mapping

Risk Factor correlation mapping enables you to select the risk factors applicable to the portfolio based on asset and asset class combination.

Follow the below steps, to add a risk factor:

1. Click **Risk Factor Correlation Mapping**. The summary screen displays the list of selected risk factors.

2. Click **Add** icon to add the risk factor

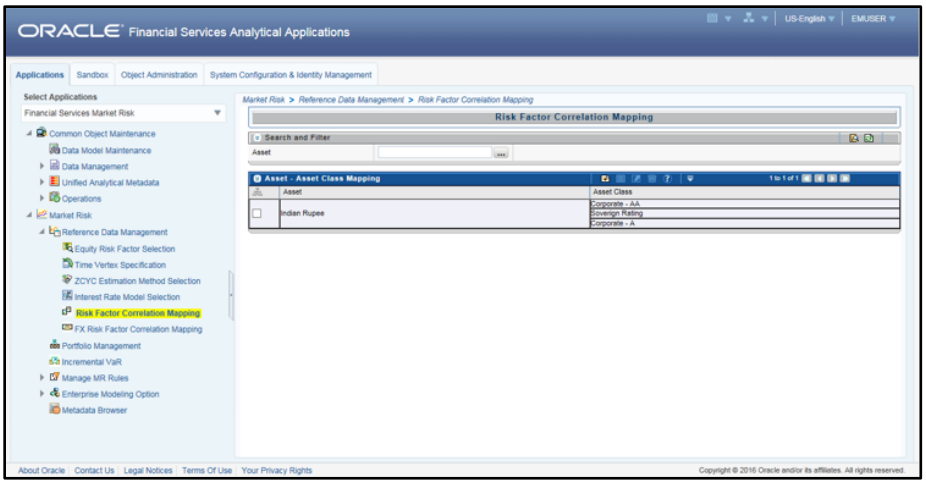


Figure 20 Risk Factor Correlation Mapping – Add screen

3. Select Asset of risk factor.

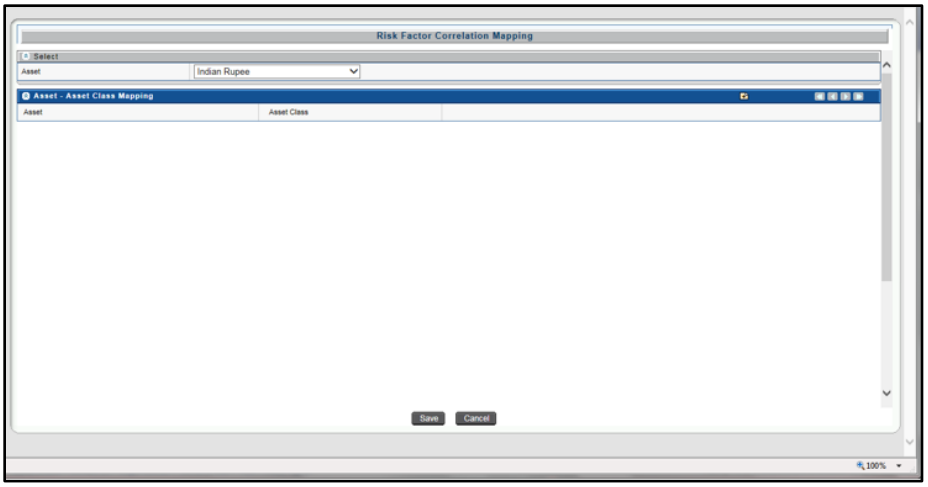


Figure 21 Risk Factor Correlation Mapping – Asset Class Selection

4. Click the Add icon to select all Asset Classes applicable for the selected asset.

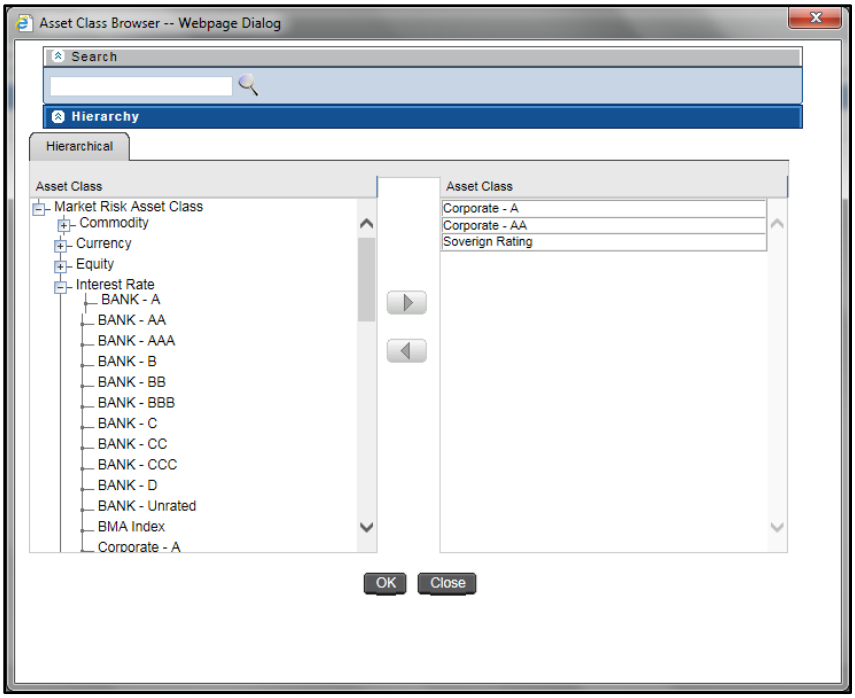


Figure 22 Risk Factor Correlation Mapping – Asset Class Browser

5. Click **OK** to save the mapping

4.6.2 FX Risk Factor Correlation Mapping

FX Risk Factor correlation mapping enables you to select the risk factors applicable to Forex instruments based on currency. You can select the pair of currency applicable as risk factor for forex instruments in the portfolio.

Follow the below steps, to add a risk factor:

1. Click **FX Risk Factor Correlation Mapping**. The summary screen with list of selected risk factor is displayed.
2. Click the **Add** icon to add the risk factor.

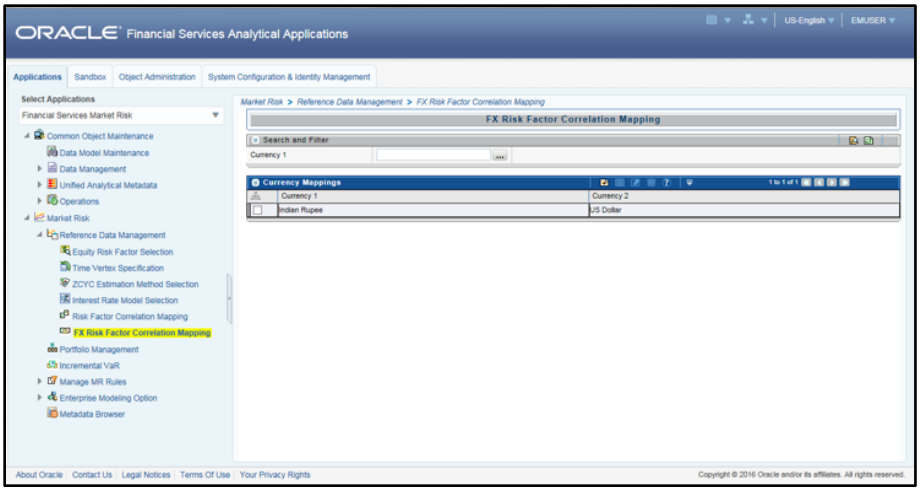


Figure 23 FX Risk Factor Correlation Mapping

3. Select **Currency 1**. It denotes the first currency in currency pairs of forex instruments.

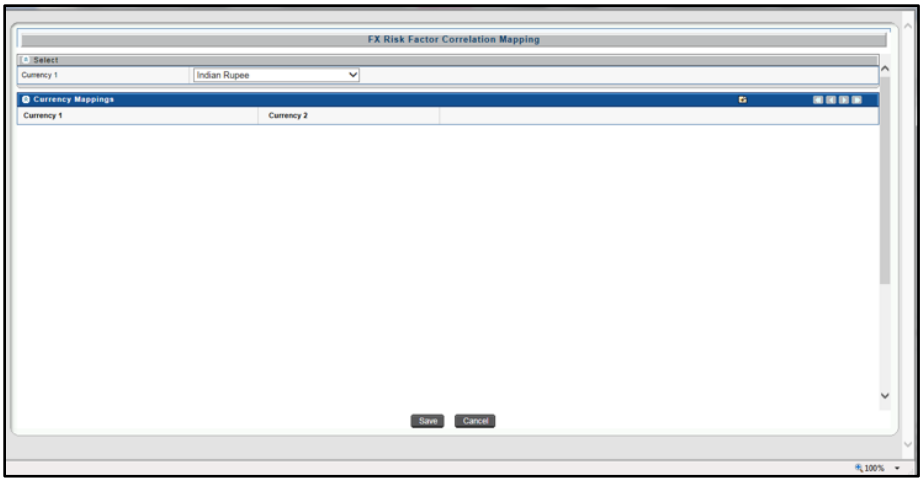


Figure 24 FX Risk Factor Correlation Mapping – Currency Selection

4. Click the Add icon, to select all the Currency 2 applicable for the selected Currency 1. Currency 2 denotes the second currency in currency pair of forex instruments.

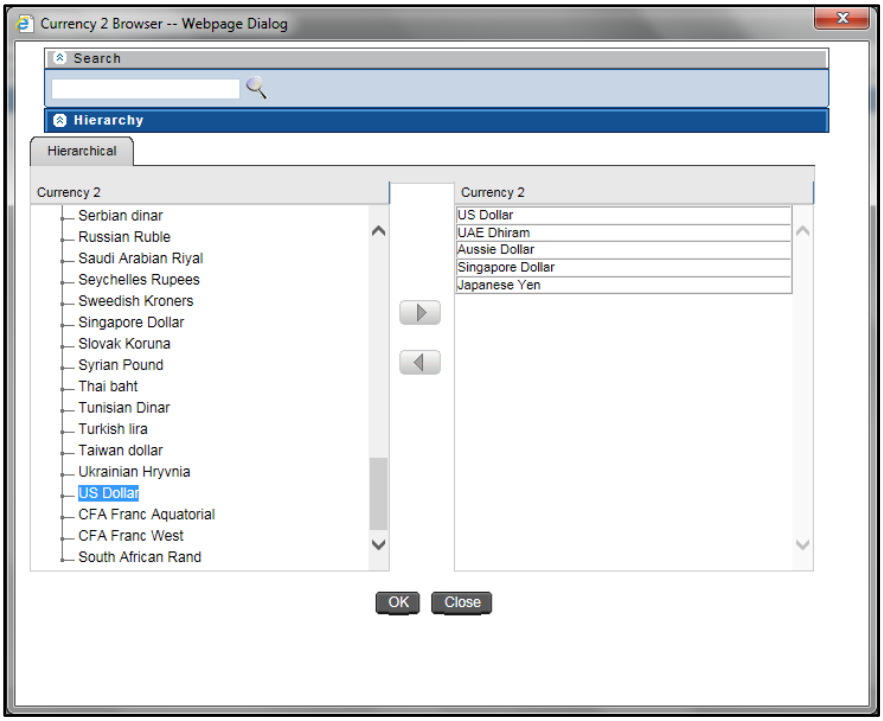


Figure 25 FX Risk Factor Correlation Mapping-Currency 2 Browser

5. Click **OK,** to save the mapping

5 Portfolio Management

This chapter describes the Portfolio Management feature in OFS MR.

This chapter includes:

5.1 Overview

This screen enables you to define a portfolio on the basis of multiple dimensions. A portfolio is a combination of currency, MR asset class, Line of business, Trading Desk, Legal Reporting, Bank Instrument Type, Market Risk Instrument Type, Counterparty, Market Risk Asset and MR Bank Asset Class. A portfolio can be defined on one or multiple dimensions, along with one or multiple leaf nodes. Once a portfolio is defined it can be deleted but cannot be edited.

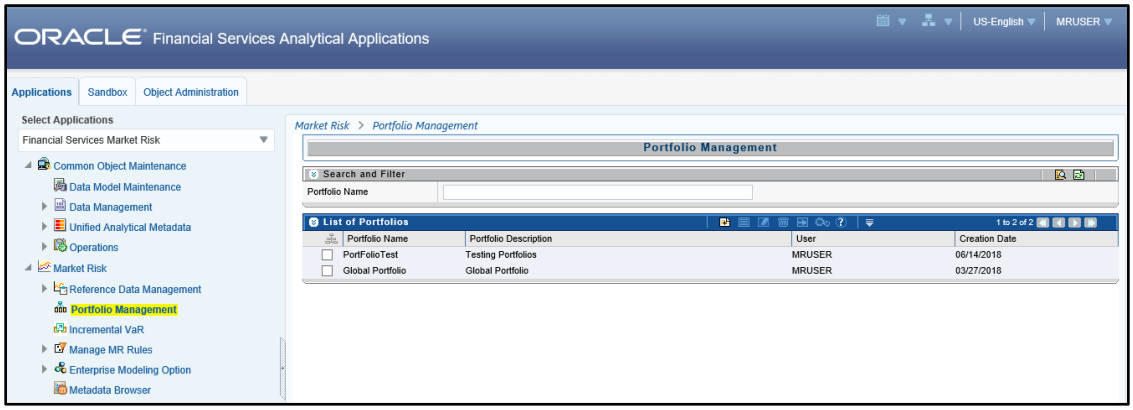


Figure 26 Portfolio Management Summary Screen

5.2 Defining a Portfolio

Follow the below steps to define a new Portfolio:

1. Navigate to **Market Risk** > **Portfolio Management**
2. Click **Add** in the Portfolio Management Summary Screen.
3. Enter the details in the below fields:
   - **Portfolio Name** – Give an appropriate portfolio name.

- **Portfolio Description** – Describe the portfolio in brief.

4. Add dimensions to the portfolio:

   Click **Add**  in the Filter Specification section. Dimension Hierarchy Browser will open.

5. Configure the dimensions as required. A portfolio is a combination of one or more following dimensions. A position can belong to multiple portfolios. You can define a portfolio as a combination of multiple level under each dimensions

   - MR Currency
   - MR Asset Class
   - MR Line of Business
   - Trading Desk
   - Legal Reporting
   - Instrument Type
   - Market Risk Instrument Types
   - Counterparty
   - Market Risk Asset
   - Asset Class

     You can select one or multiple nodes under each dimension. A combination of different dimensions and different nodes make a unique portfolio. Once the dimensions are selected from the Dimension browser, depending upon the selection leaf nodes of each dimension needs to be selected. For example: from Bank Instrument Type Browser, you need to select one or more instruments which need to be included in a particular portfolio.

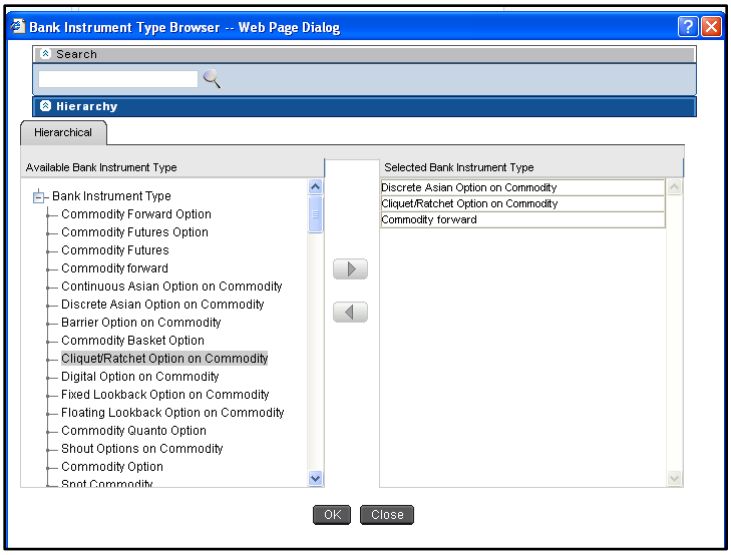


Figure 27 Portfolio Management-Adding Dimensions

6. Click **OK** and **Save**.

5.3 Viewing a Portfolio

To view an existing Portfolio, select an existing record by activating the select button and click View, on the RHS corner of the screen. The selected portfolio will be displayed in view mode and it cannot be edited.

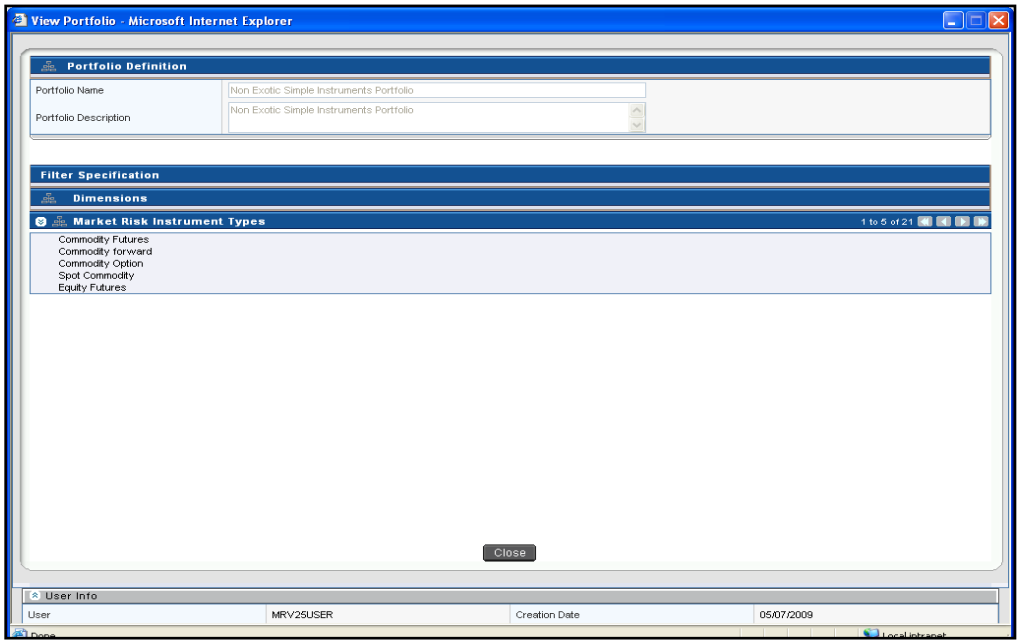


Figure 28 Portfolio Management-View Screen

5.4 Deleting a Portfolio

In order to delete a particular portfolio, select an existing record by activating the select button  , and click delete  , on the RHS corner of the screen. The selected portfolio is deleted, multiple deletion is not allowed under this screen.

6 Incremental VaR

This Chapter describes the Incremental VaR feature in OFS MR.

This chapter includes:

6.1 Overview

Incremental VaR is calculated for all portfolios which are previously defined under portfolio management screen and for which risk measures have been calculated. An incremental portfolio is defined based on the following parameters: reference portfolio, execution date, VaR model and instruments. Position specific details like number of units and position type are required for each instrument mapped to the portfolio.

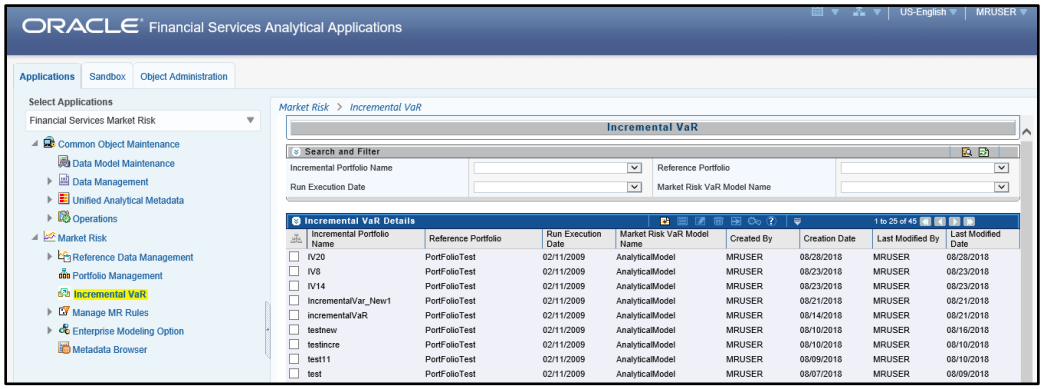


Figure 29 Incremental VaR Summary Screen

6.2 Adding an Incremental VaR

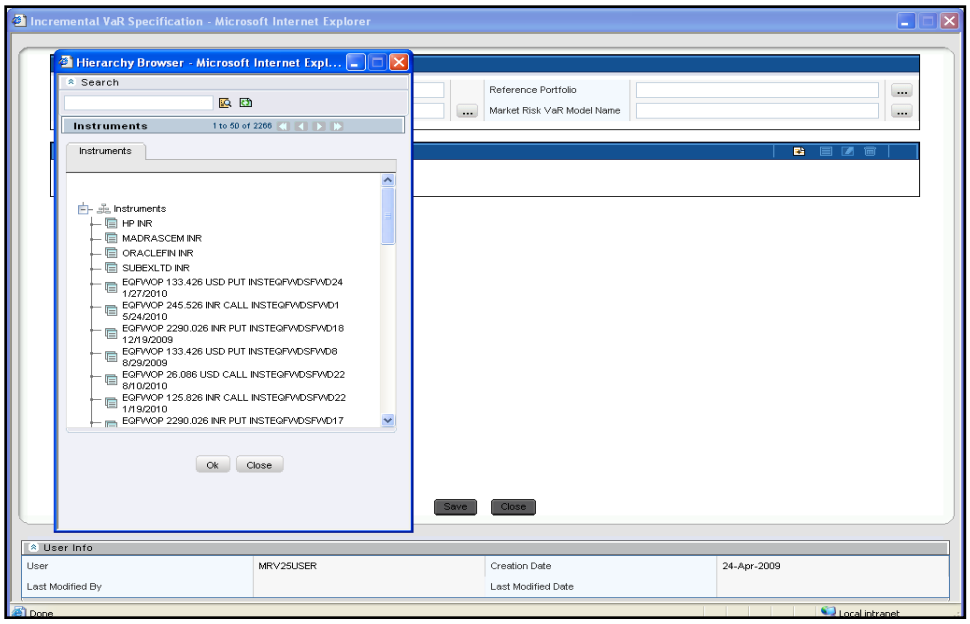


Figure 30 Incremental VaR Add Screen

Follow the below steps, to add an Incremental VaR:

1. Navigate to **Market Risk** > **Incremental VaR**
2. Click **Add** in the Incremental VaR Screen.
3. Enter the details in the below fields:
   - **Incremental Portfolio Name**: Give an appropriate incremental portfolio name.
   - **Reference Portfolio**: For a specific incremental portfolio, single existing portfolio can be selected along with multiple instruments mapped to it from the hierarchy browser.
   - **Run Execution Date**: Select an appropriate Run Execution date from the calendar browser which will be the fic mis date for you.
   - **Market Risk VaR Model Name**: Select single market risk VaR model name from the market risk VaR model hierarchy browser to which this particular Incremental VaR model will be mapped.
4. Add details in **Position Specifications** section, by following the below steps:
   a. Click **Add** on the RHS corner of the Position Specifications section in the Incremental VaR screen.

b. Select the instruments from the hierarchy browser. Multiple instruments mapped to the portfolio can be selected but only one instrument can be selected at a time.

c. Provide details for the fields **Units** and **Position Type**.

5. Click **Save**.

6.3 Viewing an Incremental VaR

To view an existing defined Incremental VaR Portfolio, select a record by activating the select button, then click **View** on the RHS corner of the screen. The chosen Incremental VaR Portfolio is displayed and it cannot be edited.

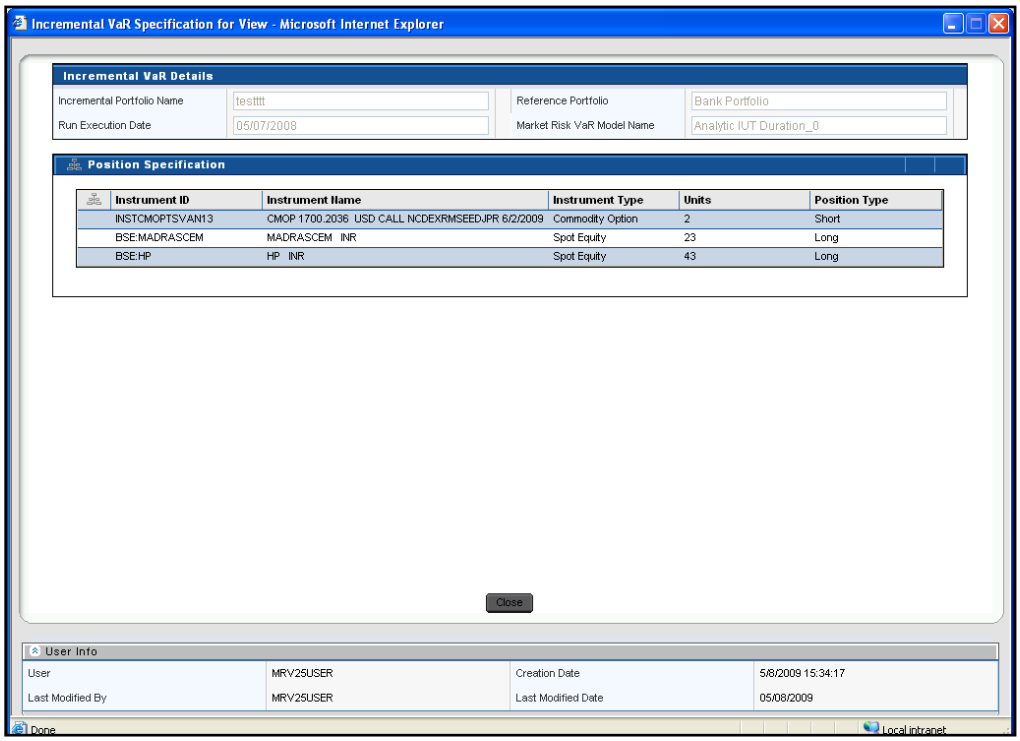


Figure 31 Incremental VaR View Screen

6.4 Editing an Incremental VaR

Follow the below steps, to edit an Incremental VaR:

1. Select a defined Incremental VaR portfolio that needs to be edited by clicking the select button.
2. Click **Edit** at the right hand corner of the Incremental VaR summary screen.

3. You can change the execution date and check for incremental VaR. All the dimensions under position specification column can be edited or deleted for a given Incremental VaR portfolio. The reference portfolio and VaR model name once defined cannot be edited. You can modify the number of units and position type for a particular instrument mapped to the defined portfolio.

4. Click **Save**.

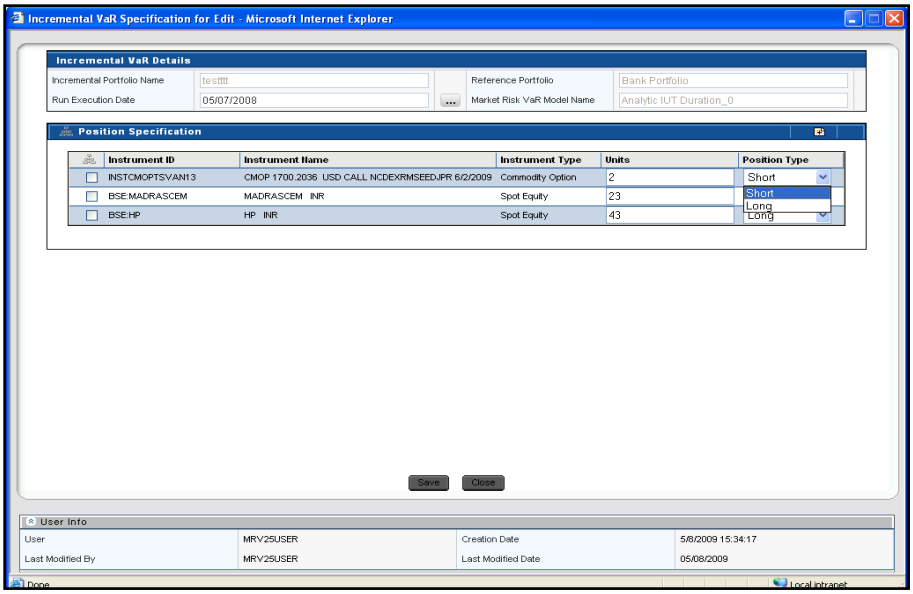


Figure 32 Incremental VaR Edit Screen

7 Process Description

Following is the description of processes in Market Risk version 8.0.4.0.0:

Process Name	Rule Name	Description
Positions Data Population	POSITIONS DATA POPULATION	This module loads the positions data from stage table to FACT table if positions data is given as download
Market Data Population	MARKET DATA POPULATION	This module loads the market data from stage table to FACT table if market data is given as download
Commodity Future Curve Population	COMMODITY FUTURE CURVE POPULATION	This module loads the commodity future curve from stage table to FACT table if commodity future curve is given as download
Equity Corporate Actions Data Population	CORPORATE ACTIONS DATA POPULATION	This module loads the corporate action data from Stage table to FACT table
Instruments Obligors Data Population	OBLIGORS DATA POPULATION	This module loads the obligors details from stage table to FACT table
Instruments Schedule Data Population	INSTRUMENT SCHEDULE POPULATION	This module loads the Instruments Schedule from stage table to FACT table
MR VaR Data Preparation	Currency and Interest Rate Instruments Re-classification	This module does the Instrument Reclassification of instruments with risk factor type as Currency and Interest Rate
MR VaR Data Preparation	Commodity and Equity Instruments Re-classification	This module does the Instrument Reclassification of instruments with risk factor type as Commodity and Equity.
MR VaR Data Preparation	Currency Asset Re-Classification	This module does the reclassification of all the instrument with risk factor type as Currency
MR VaR Data Preparation	Commodity Asset Re-Classification	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Re-classification for Quanto Options	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Sovereign Asset Class Re-Classification	This set of modules does the Reclassification of Asset Class

Process Name	Rule Name	Description
MR VaR Data Preparation	Asset Class Classification - Simple Derivatives on Sovereign	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Classification Compound Derivatives on Sovereign	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Reclassification	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Reclassification based on Rating	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Classification on Rating for Simple Derivatives	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Classification on Rating for Compound Derivative	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Reclassification for Equity	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Reclassification for Simple Equity Derivatives	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Reclassification for Compound Equity Derivatives	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Reclassification for CDS	This set of modules does the Reclassification of Asset Class
MR VaR Data Preparation	Asset Class Reclassification for Convertible Bonds	This set of modules does the Reclassification of Asset Class

Process Name	Rule Name	Description
MR VaR Data Preparation	POSITION DATA POPULATION	This module loads the Position Data of Instruments from stage table to FACT table.
MR VaR Data Preparation	MARKET INSTRUMENT DATA POPULATION	This module loads the Instrument Parameter from stage table to FACT table.
MR VaR Data Preparation	EQUITY INDEX DATA POPULATION	This module loads the Equity Index Data from stage Table to FACT Table.
MR VaR Data Preparation	PORTFOLIO DATA POPULATION	This module loads the Portfolio data like VaR Limit and Actual P&L from Stage Table to FACT Table.
MR VaR Data Preparation	YIELD CURVE POPULATION	This module loads the Yield Curve Data from stage table to FACT Table for all the Rating and Currency combinations for which you have selected the download option.
MR VaR Data Preparation	CDS SPREAD POPULATION	This module loads the CDS Spread data from stage Table to FACT Table.
MR VaR Data Preparation	Interpolate_CDS_Spreads	This module maps the given CDS spread to the standard time vertices as specified by you. If the standard time vertices are not in the downloaded CDS Spread then spread values are interpolated for the intermediate time vertices.
MR VaR Data Preparation	Pop_Correlation_AC	This module populates the Funds and Benchmark Codes as Asset Class, this module is purely for calculation purposes where correlation between Benchmark Codes, Funds and Risk Factors is required for Calculating of VaR and other Risk Measures.
MR VaR Data Preparation	RISK FACTOR STATISTICS POPULATION	This module loads the Variance, Co-variance, Mean and Correlation Data between all the Risk Factors from stage table to FACT table. This module will be useful if you want to give the Variance, Co-variance, Mean and Correlation data as download.

Process Name	Rule Name	Description
MR VaR Data Preparation	RunningAccCalc	This module calculates the Running Accumulator for Asian Option and updates the value for the corresponding instrument.
MR VaR Data Preparation	ZCYCEstimation	This module calculates the Yield Curve for all the Rating and Currency combinations for which you have selected either Bootstrap method or choose to apply spread over Sovereign Yield Term Structure.
MR VaR Data Preparation	CMFEstimation	This module calculates the Commodity Future Curve using all the Commodity futures traded in the market.
Interest Rate Mean Reversion Estimation	IRMeanReversion	This module calculates the Mean Reversion Rate for Interest Rate instrument
Risk Factor Volatility Correlation Estimation	EWMA 0.94	This module first fetches the historical data of all the Risk Factors given by you and applies the corporate action if available to the equities. Once the corporate action has been applied then the module will check for the missing value and fill up the missing values using the method as selected by you. Thereafter, the module calculates the Variance, Co-variance, Mean, and Correlation for all the Risk Factors.
Pricing OTC Instruments	OTCPricing	This module uses the output of Risk Factor Volatility Correlation Estimation Module and calculates the price of all the OTC Instruments available with the bank. Along with the price calculation, module also calculates the Greeks for all the option instruments and Modified Duration for all the bonds.
Market Risk VaR Estimation	Analytic Model / Historical Model / Monte Carlo Model	This module calculates the Risk Measures like VaR, CVaR for the model as defined by you.
Market Risk VaR Estimation	Simulated_PL_Bucketing	This module buckets the P&L distribution as generated in Monte Carlo or Historical VaR

Process Name	Rule Name	Description
		Estimation Methodology for plotting the curve of P&L distribution.
MR Incremental VaR Estimation	MRIncrementalVaR	This module calculates the Incremental VaR of the position defined by you added in the selected portfolio.

Table 3: Process Description

8 Examining Results

In order to examine results, you verify the corresponding tables. After execution is complete, verify the T2T logs and the Run-Rule logs, for execution status and errors, if any. The logs will also mention the name of the table in which the Output is populated. You have to access the particular table to view the results.

Additionally, you can view the final outputs in the reports section. This can be accessed by clicking Information Delivery on the left pane of the OFSAAI Infrastructure. Under that click Insight and then click Viewer to view all the reports.

9 Market Risk Models

This section explains the functional inputs required to create the below MR models:

- Exponentially Weighted Moving Average (EWMA) Model
- Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model
- Market Risk VaR Model.

For information on deployment of the models, see Oracle Financial Services Analytical Applications Infrastructure 8.0.4.0.0 User Guide on OHC Documentation Library.

9.1 Exponentially Weighted Moving Average model

OFS Market Risk estimates the Variance of, Covariance and correlations between the historical returns of risk factors using the Exponentially Weighted Moving Averages (EWMA) Method. The risk factors are correlated, and risk estimation models are factored in the calculations.

EWMA method allows for greater weight being given to recent observations. These risk factors are values of interest rates, exchange rates, equities and commodities at the relevant vertices. The number of observations to be used for the Variance-Covariance estimation is specified as part of the Market Risk VaR Model.

Volatilities and correlations of certain asset classes, such as commodities, may be heavily influenced by seasons. OFS Market Risk allows adjustments to calculations to factor in the effect of seasons. Seasonality adjustment requires specification of season start and end dates. When seasonality is specified, only those historical returns on risk factors for the observations that fall within the relevant season are used for computations.

For example, if the number of seasons specified is 3, then three dates should be provided that is, first date for start of season 1, second date for end of Season 1 and third date for end of season 2.

Where seasonality is specified the price observations are taken from seasons in which the valuation date falls.

9.1.1 Estimation of Variance - Covariance

This section details the calculations involved in the estimation of variance-covariance.

9.1.1.1 Calculation of Returns

The first step in estimation of variance-covariance is the calculation of returns for each risk factor. Returns are calculated over the historical time period in intervals corresponding to the VaR horizon.

For example, if the observation period is 250 days, and VaR horizon is 2 days, then a total of 124 non-overlapping returns are calculated. The return over a time interval is calculated using the following formula:

$$R_t = Ln(P_t) - Ln(P_{t-n})$$

Where,

P_t = Price at time t

P_{t-n}= Price at time t-n.

9.1.1.2 Estimation of Variance and Volatility

Variance of each of the risk factor's returns over the VaR horizon is calculated using the following formula:

$$\sigma R_t = \frac{\sum_{t=1}^{T}(\lambda^{T-t} * R_t^2)}{\sum_{t=1}^{T}(\lambda^{T-t})}$$

Where,

σR_t = Estimated volatility of risk factor R_tP_{t-n}= Price at time t-n.

R_t = Return on risk factors at time t

T=Number of historical observations

t = Day on which a particular historical observation has occurred

λ^{T-t} = Decay factor which gives the relative weight (T-t) to each observation

Volatility is calculated using the following formula:

$$Volatility = \sqrt{\sigma R_t}$$

9.1.1.3 Estimation of Covariance

Covariance is a measure of the extent of joint movement in two variables, which in case of market risk are the risk factors. OFS Market Risk estimates the covariance between each pair of risk factors using the following formula:

$$Cov\ (R_{t1}, R_{t2}) = \frac{\sum_{t=1}^{T}(\lambda^{T-t}\ R_{t1}\ R_{t2})}{\sum_{t=1}^{T}\lambda^{T-t}}$$

Where,

Cov (R_{t1}, R_{t2}) = Covariance between risk factor returns R_{t1} and R_{t2}

R_{ti} = Return at time t, on risk factor i

9.1.2 Estimation of Correlation

Correlation is a measure of the strength of the joint movement in two variables. In case of market risk these are the risk factors. OFS Market Risk estimates the correlation between each pair of risk factors using the following formula:

$$\rho(R_{t1}, R_{t2}) = \frac{\text{Cov}\ (R_{t1}, R_{t2})}{\sigma R_{t1}\ \sigma R_{t2}}$$

Where,

$\rho(R_{t1}, R_{t2})$ = Correlation between risk factor returns R_{t1} and R_{t2}

σR_t = Estimated volatility of risk factor R_t

Cov (R_{t1}, R_{t2}) = Covariance between risk factor returns R_{t1} and R_{t2}

9.1.2.1 Cross Correlations

Where cross correlations are not considered in a given run, the value of correlation across asset class is reset to 0. Intra asset class correlations are unchanged. For example, correlation between interest rates of different maturities and across currencies is considered, while correlation between interest rate asset classes and stock indices is reset to 0. Whether cross-correlations are to be considered or not, is specified as part of Market Risk VaR model definition.

9.1.3 Defining an EWMA Model

Follow the below steps to create an EWMA model.

1. In Oracle Financial Services Analytical Applications Infrastructure under Select Applications select **Financial Services Market Risk**.
2. To open the Model Creation screen, select the **Sandbox** tab > **Modeling** > **Model Creation** on the Left-Hand Side (LHS) menu.
3. Click **Add** button in the Model Creation screen.

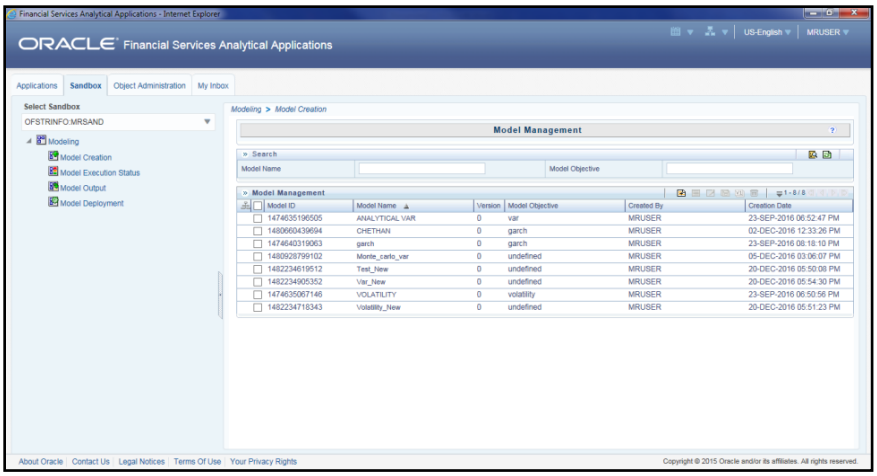


Figure 33 Model Creation Screen

4. Enter the **Model Name** and **Model Description**.
5. Select the **Model Objective**.
6. Select the technique as **EWMA Model**.

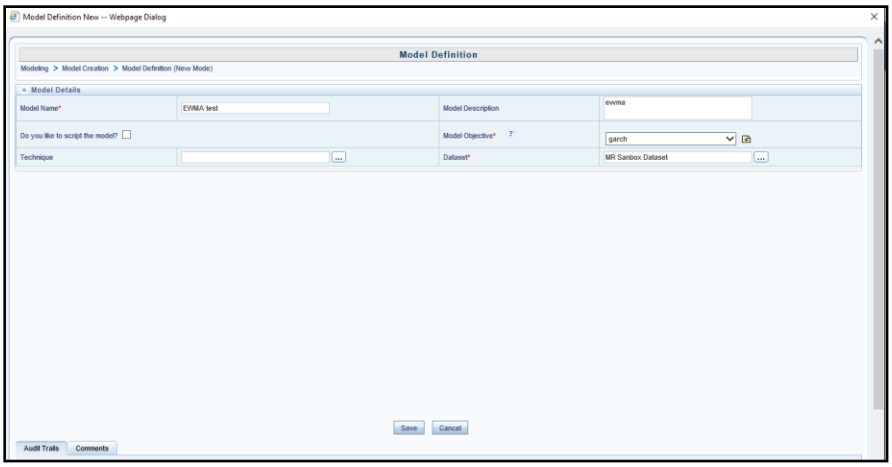


Figure 34 Model Definition Screen

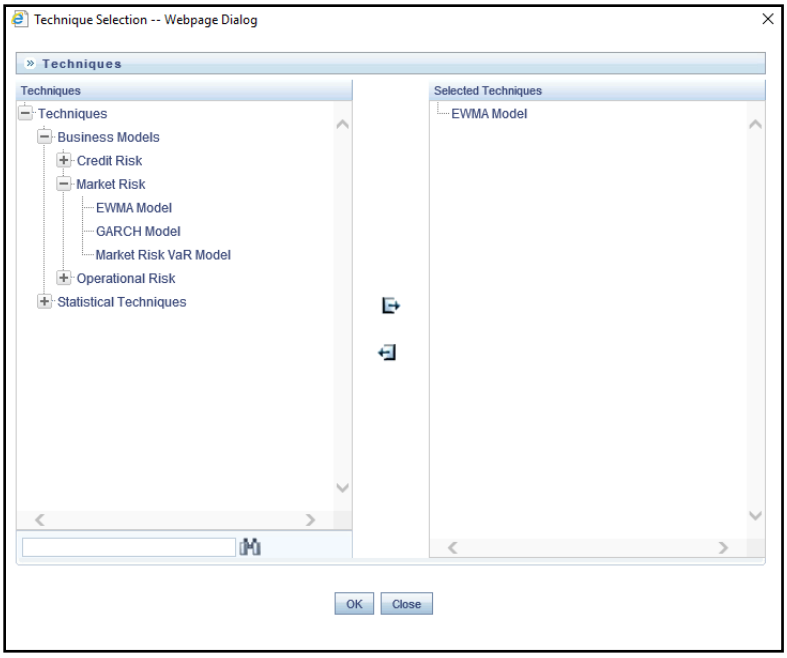


Figure 35 Technique Selection Browser

7. There are two available options **Volatility Correlation parameters** and **Seasonality Parameters**.

   a. **Volatility Correlation Parameters**:

   Oracle Financial Services Market Risk estimates the Variance-Covariance Matrix based on the following parameters:

   i. Select the **Missing Observation Estimation Method**. OFS Market Risk supports the following methods for the estimation of missing observations in the historical data:

      - Linear Interpolation
      - Prior-day
      - Nearest-day
      - Omit-day

      OFS Market Risk estimates the missing observations in the data before carrying out further calculations.

   ii. Specify the **Number of Observation Days**. The number of observation days is specified for the purpose of selecting the historical risk factor values. For example, if the number of observation days is specified as 250, then the observations related to a trailing period of 250 business days from the date,

for which the computations are made are considered.

iii. Specify the **Decay Factor**. It provides the weight for each observation under the EWMA method of Variance-Covariance estimation also called as “Lambda”. It is specified as a number between zero and one (inclusive). Decay factor of 1 indicates that equal weight is given to all observations. A value closer to zero indicates that more weight is given to the recent observations

b. Seasonality Parameters

Seasonality plays an important role when the volatilities and correlations are greatly influenced by seasons, specifically in case of instruments linked to commodities. Seasonality Adjustments can be specified as Yes or No.

If you select **Yes**, then specify the following seasonality parameters:

i. **Number of Seasons:** It should be specified as a numeric value. It divides the year into the specified number of seasons.

ii. **Season 1 Start Date**: The start date of the first season is specified in terms of the month, and the day when the first season in a year begins. Therefore, a season need not follow the calendar year. The start dates for each subsequent season are determined based on the end date of the previous season.

iii. **Season End Date/s**: The end date is specified for each of the seasons, except the last season. The end date of the last season is computed as the day prior to the season start date for the next year. When seasonality is specified, OFS Market Risk considers the season to which the date on which computations are run belongs, and accordingly picks up the historical values of risk factors which fall in that season.

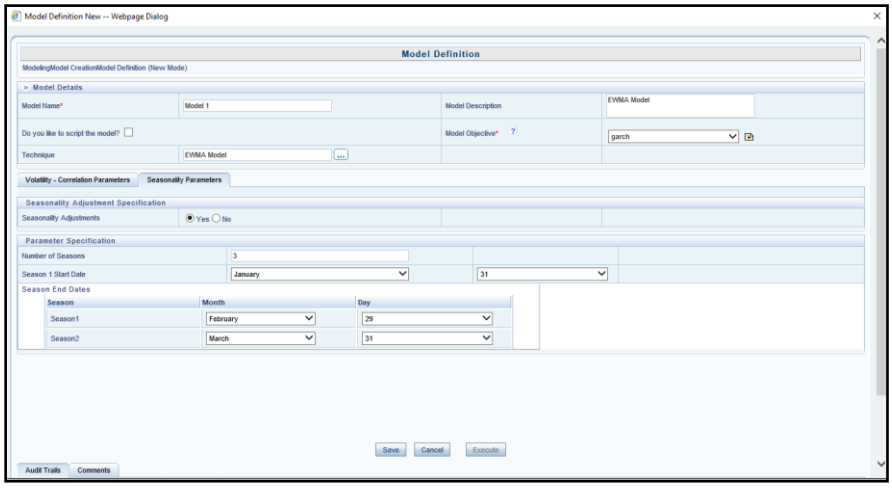


Figure 36 Technique Selection Browser

9.2 Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Method

The volatilities and correlations are estimated using both the EWMA methods as well as the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) method. The volatility – correlation calculations take into account the seasonality parameters, cross correlations and the horizon specified.

9.2.1 Estimation of GARCH Parameters

OFS Market Risk utilizes the Linear Programming Problem function of NAG libraries for the estimation of the GARCH parameters. Alpha (α), Beta (β) and Omega (ϖ). α, β and ϖ are estimated by maximizing the following equation:

$$mlecoff = \sum_{m}^{t=1}\left[-Ln(Cov_t) - \left(\frac{X_{t-1}Y_{t-1}}{Cov_t}\right)\right]$$

Where,

m = number of observation days

X_{t-1} = Returns of risk factor X on day t-1

Y_{t-1} = Returns of risk factor Y on day t-1

$$Cov_t = \omega + \alpha(X_{t-1}Y_{t-1}) + \beta\, CovXY_{t-1}$$

Where,

$CovXY_{t-1}$ = Covariance between risk factor X and Y on day t-1

α, β and ω = GARCH Parameters

$$\omega = V_L\,(1 - \alpha - \beta)$$

$$V_L = Long\ term\ covariance = \frac{\sum_{m}^{t=1}(X_{t-1} - \mu_X)(Y_{t-1} - \mu_Y)}{m}$$

Where,

μ_X = Mean of Risk factor X on time t-1

μ_Y = Mean of Risk factor Y on time t-1

With constraints,

α, β, ϖ > 0

α + β < 1

The variance is predicted for each day using the guess values for α, β and ϖ. The maximum likelihood estimate for each day is computed using the formula given above. Values of α, β and ϖ are estimated using the LPP function of NAG libraries, in an iterative manner such that the overall MLE during the observation period is maximized.

Following are the steps for estimation of GARCH parameter:

1. Generate guess parameter of α, β and ϖ, such that α, β , $\varpi > 0$ and $\alpha+\beta < 1$
2. Calculate mlecoff for scenarios
3. Repeat step 1 and 2 for 3000 scenarios.
4. Select the scenario where mlecoff is maximum and use the corresponding α, β and ϖ values to derive variance/covariance and correlation using equations explained in section below.

Alternatively, GARCH parameters can be provided as a download, and while defining the model you can select the option of not calibrating the GARCH parameters.

9.2.2 Estimation of Variance and Volatility

The formula for estimating variance using GARCH model is as follows:

$$VarX_t = \omega + \alpha(X_{t-1}X_{t-1}) + \beta\, VarX_{t-1}$$

Where,

$VarX_t$ = Variance of risk factor X on day t

$VarX_{t-1}$ = Variance of risk factor X on day t-1

X_{t-1} = Returns of risk factor X on day t-1

α, β and ω = GARCH Parameters estimated in above step

On the first day when the GARCH model is applied, the predicted variance as on the previous day is not available. In this case, the first value of predicted variance is taken as the square of the returns. Thereafter, the GARCH model is applied to predict the variance. Volatility is calculated using the following formula:

$$\sigma X_t = \sqrt{VarX_t}$$

Where,

σX_t = Volatility of Risk Factor X on day t

$VarX_t$ = Variance of risk factor X on day t

Covariance based on the GARCH model is estimated using the formula as follows:

$$Cov_t = \omega + \alpha(X_{t-1}Y_{t-1}) + \beta\, CovXY_{t-1}$$

Where,

X_{t-1} = Returns of risk factor X on day t-1

Y_{t-1} = Returns of risk factor Y on day t-1

$CovXY_{t-1}$ = Covariance between risk factor X and Y on day t-1

On the first day when the GARCH model is applied, the predicted covariance as on the previous day is not available. In this case, the first value of predicted covariance is taken as the square of the returns. Thereafter, the GARCH model is applied to predict the covariance.

9.2.3 Estimation of Correlation

Correlation is a measure of the strength of the joint movement in two variables. In case of market risk these are the risk factors. OFS Market Risk estimates the correlation between each pair of risk factors as per the formula given:

$$\rho XY_t = \frac{CovXY}{\sigma X_t \sigma Y_t}$$

Where,

ρXY_t = Correlation between risk factor X and Y on day t

$CovXY_t$ = Covariance between risk factor X and Y on day t

σX_t = Volatility of Risk Factor X on day t

σY_t = Volatility of Risk Factor Y on day t

9.2.4 Cross Correlations

Where cross correlations are not considered in a given run, the value of correlation across asset class is reset as 0. Intra asset class correlations are unchanged. For example, correlation between interest rates of different maturities, and across currencies is considered while correlation between Interest Rate Asset Classes and Stock Indices is reset to 0. Whether cross-correlations are to be considered or not is specified as part of Market Risk VaR Model definition.

9.2.5 Defining a GARCH Model

Follow the below steps to create a GARCH model:

1. In Oracle Financial Services Analytical Applications Infrastructure under Select Applications select **Financial Services Market Risk**.

2. To open the Model Creation screen, Select the **Sandbox** tab > **Modeling** > **Model Creation** on the Left-Hand Side (LHS) menu.
3. Click **Add** button in the Model Creation screen.

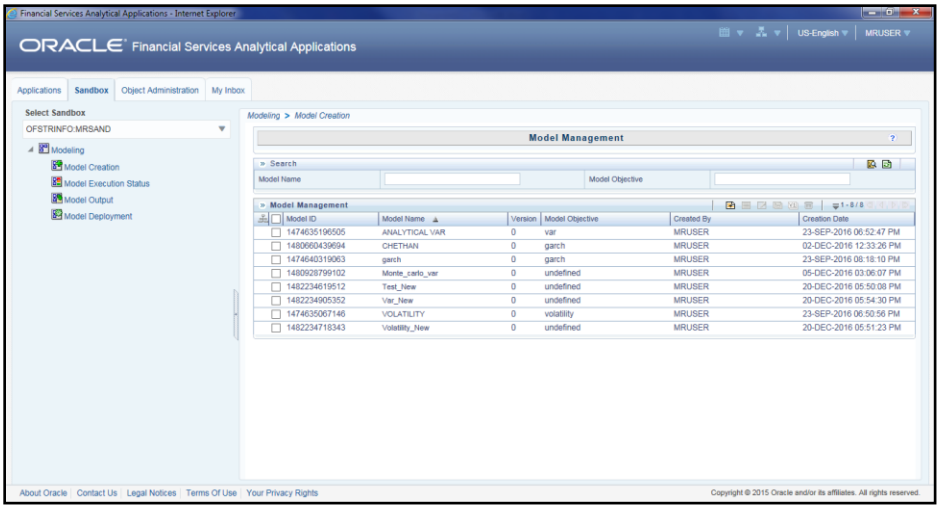


Figure 37 Model Creation Screen

4. Enter the **Model Name** and **Model Description.**
5. Select the model objective
6. Select the technique as **GARCH** Model.
7. There are two available options **Volatility Correlation parameters** and **Seasonality Parameters**.
   a. **Volatility Correlation Parameters**:

      Oracle Financial Services Market Risk estimates the Variance-Covariance Matrix based on the following parameters:

      i. Select **Yes** or **No**, for the field **Calibrate GARCH Model**: If you select Yes, then system will calibrate GARCH parameter alpha, beta and omega as per the method mentioned. Else system will pick the given GARCH parameter and proceed for computation.

      ii. Select the **Missing Observation Estimation Method**. Oracle Financial Services Market Risk supports the following methods for the estimation of missing observations in the historical data:

      - Linear Interpolation
      - Prior-day
      - Nearest-day

- Omit-day

OFS Market Risk estimates the missing observations in the data before carrying out further calculations.

iii. Specify the **Number of Observation Days**. The number of observation days is specified for the purpose of selecting the historical risk factor values. For example if the number of observation days is specified as 250, then the observations relating to a trailing period of 250 business days from the date, for which the computations are made, are taken into consideration.

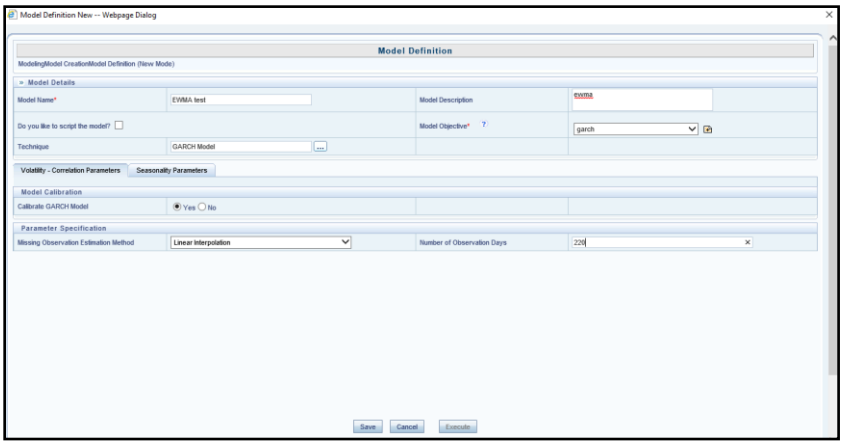


Figure 38 Model Definition Screen

b. Seasonality Parameters

Seasonality plays an important role when the volatilities and correlations are greatly influenced by seasons, specifically in case of instruments linked to commodities. Seasonality Adjustments can be specified as Yes or No.

If you select **Yes**, then specify the following seasonality parameters:

i. **Number of Seasons**: It should be specified as a numeric value. It divides the year into the specified number of seasons.

ii. **Season 1 Start Date**: The start date of the first season is specified in terms of the month and the day when the first season in a year begins. Therefore, a season need not follow the calendar year. The start dates for each subsequent season are determined based on the end date of the previous season.

iii. **Season End Date/s**: The end date is specified for each of the seasons, except the last season. The end date of the last season is computed as the day prior to the season start date for the next year. When seasonality is specified, OFS Market

Risk considers the season to which the date on which computations are run belongs and accordingly picks up the historical values of risk factors which fall in that season.

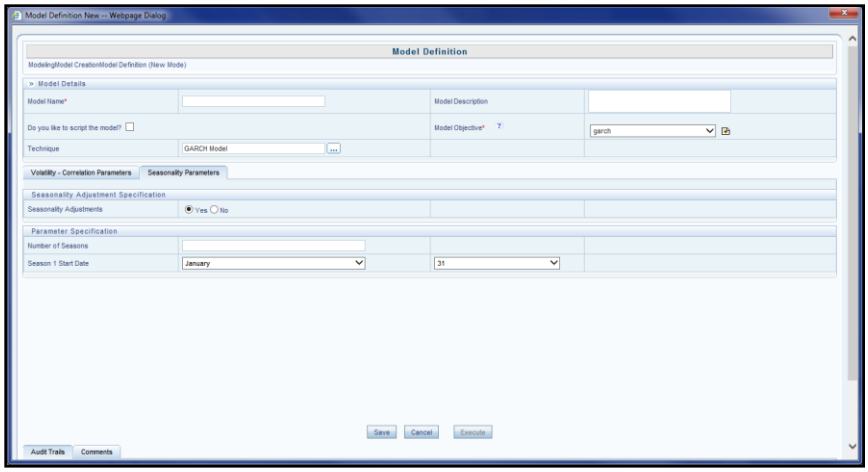


Figure 39 Model Definition Screen

9.3 VaR Estimation

Value-at-Risk (VaR) is the worst expected portfolio loss under normal market conditions over a specific time interval at a given confidence level. This section details the types of VaR models available in OFS MR, for VaR estimation.

9.3.1 Risk Measure Estimation Parameters

This section details the methods that OFS MR supports, for estimating risk measures, and provides steps to define the parameters. Following are the supported methods:

- Analytic (Parametric / Variance Covariance Method) Method
- Historical Simulation Method
- Monte Carlo Simulation Method

9.3.1.1 Analytic (Parametric / Variance Covariance Method) Method

Calculation of VaR of a portfolio is a two-step process, which includes:

- **Calculation of Undiversified VaR**: This method is calculated by multiplying the volatility vector with the cash flows and summing them up. The output of this step is the undiversified VaR corresponding to each Asset – Asset Class – Maturity vertex as well as the undiversified VaR of the portfolio.

  The first step in estimating the portfolio VaR is to estimate the undiversified VaR of each of the positions. The undiversified VaR of each Asset – Asset

Class – Maturity vertex is arrived at by multiplying the cash flow matrix with the respective risk factor volatilities. The cash flow matrix is an n x 1 matrix, which has rows equal to the number of Asset - Asset Class – Maturity combination and 1 column holding cash flows.

$$VU = z\alpha \left(\frac{V}{\sqrt{360}}\right)$$

Where,

VU = Vector of Undiversified VaR for each position.

CF = nx1 Vector of Cash Flows

V = Annual Volatility Vector

zα = Standard normal value z, corresponding to the confidence level α

The Undiversified VaR of the portfolio is the simple summation of the elements of the undiversified VaR vector.

- **Calculation of Diversified VaR:** This method is computed by multiplying the vector of undiversified VaR with the correlation matrix. The output of this step is the diversified portfolio VaR in the reporting currency.

  OFS Market Risk estimates the VaR of a portfolio as function of Cash flow Vector and the Variance Covariance matrix. . Here, the VaR is calculated at the portfolio level.

$$VaRp = (CFT * Q * CF)^{1/2}$$

Where,

VaRp = Portfolio VaR

CF = Cashflow Matrix

CFT = Transpose of the vector of Cashflow Matrix

Q = VarianceCovariance Matrix * zα2

zα = Standard normal value z, corresponding to the confidence level α

Component VaR

Under the analytic method to risk measure estimation, component VaR is calculated as the contribution of each Asset – Asset Class – Maturity vertex to the Diversified Portfolio VaR as follows:

- Delta VaR of each Asset – Asset Class – Maturity vertex maturity is calculated as follows:

$$DelVaR = \frac{(CFT * Q)}{VaRP}$$

Where,

DelVaR = Delta VaR of each Asset,Asset Class and Maturity vertex

CFT= Transpose of the Cash Flow Vector

zα2 = Square of standard normal value,z,at a confidence level of α

VaRP = Diversified Portfolio VaR

Q = VarianceCovariance Matrix * zα2

- Component VaR is calculated as follows:

$$Component\ VaR = Cash\ Flow * the\ respective\ DelVaR$$

9.3.1.2 Historical Simulation Method

Simulation of Risk Factor

Simulation is carried out by applying historical returns on the current value of risk factors based on the parameters specified in the Market Risk VaR Model.

The output of this process is the simulated values of all the risk factors in a given portfolio. The number of simulated values of each risk factor is equal to n-1 number of historical observations specified in the Market Risk VaR Model.

For historical simulation methods, returns on risk factors are calculated using the returns method. The returns observed historically, are applied to the current value of the risk factors to simulate the possible values of the risk factors. The returns are calculated over the historical time period in intervals corresponding to the VaR horizon.

Stock index is the risk factor for equity instruments. The returns are thus calculated on the historical values of stock index and stocks specified as custom equity risk factors. The equity prices are calculated from the stock index returns.

Simulation of Portfolio Value

Simulated portfolio value refers to the price of portfolio under each scenario.

The instrument value for all instruments as part of a portfolio is calculated under all simulated scenario. Simulated portfolio value in the reporting currency is derived as the sum of all the instrument prices under each scenario.

P&L Distribution

P&L Distribution is Profit or Loss of the portfolio under each scenario against the portfolio value as on the current day.

Portfolio VaR and CVaR

The VaR and CVaR values which are obtained from the P&L Distribution are based on the confidence level and horizon specified in the Market Risk VaR Model.

Based on the confidence level α, the 1-day α-VaR is the $(1 - \alpha)^{th}$ value in the arranged P&L values. The confidence level α must be entered in the OFS Market Risk application. The t-day α-VaR is estimated by multiplying the 1-day α-VaR by $\sqrt{t}$.

CVaR is calculated as the expected value of all simulated data points that exceed the VaR. It is the expected loss conditional on the occurrence of loss greater than VaR. The P&L distribution and is calculated as:

$$CVaR = E(Y / Y > VaR)$$

Where,

Y = Value of simulated loss

Thus, it is the arithmetic average of all simulation points exceeding the VaR value.

Component VaR

Under the Simulation Methods of risk measure estimation, both Monte Carlo as well as Historical, Component VaR is calculated as the contribution of each position to the Portfolio VaR as detailed below.

- The scenario position values are estimated for n instruments in the portfolio for m scenarios of prices, and converted to the home currency.
- The variance of the scenario portfolio values is estimated as follows:

$$Variance = 1/m \, \Sigma j=1m \, (jPt+1 - \mu j)^2$$

Where,

m = Number of scenario portfolio values

jPt+1 = Scenario portfolio value

μj = Mean of the scenario portfolio values

- The covariance between the scenario position values of each instrument and the scenario portfolio values is estimated as follows:

$$\text{Covariance} = 1/m \; \Sigma \; k=1m \; j=1m \; (xk - \mu k) \; (jPt+1 - \mu j)$$

Where,

Xk = Scenario position values of instrument “i”

The covariance of each position with the scenario portfolio values is calculated.

- Component VaR for each instrument is calculated as follows:

$$\text{Component VaR} = [(\text{Covariance}) / (\text{Variance})] * \text{Portfolio VaR}$$

9.3.1.3 Monte Carlo Simulation Method

Simulation of Risk Factor

For the purpose of Monte Carlo Simulation, risk factors are simulated using stochastic processes such as:

- Geometric Brownian Motion - for Equity and Commodities
- Garman-Kohlhagen process - for Currency
- Hull-White process/ Black process/ Ornstein Uhlen Beck process/ Ho-Lee process - for Interest Rate

The parameters of each of the stochastic process are available as a download.

Risk factor scenario under Monte Carlo simulation is derived using stochastic process for each risk factor, Correlation Matrix, and seed value to generate pseudo random number. Monte Carlo Simulation Method is a three step process detailed below.

Step 1

Pseudo random number is given as input for stochastic process to arrive at the simulated risk factor values.

Pseudo random number is generated using a seed value provided by user. You can provide seed value while defining the VaR model. If a seed value is not provided, then system generates random seed value.

Step 2

Generated pseudo random number is used to simulate the value of each risk factor using the stochastic process assigned to them. Additionally, to pseudo random number each stochastic process requires specific inputs such as mean and variance. Details of stochastic process for each risk factor are explained below.

Equity and Commodity Risk Factors

Custom equities and benchmark indices and commodities are modeled using the Geometric Brownian Motion. The output of this process is the simulated prices of all the equities in the portfolio. Geometric Brownian Motion generates a scenario for respective risk factors using Pseudo random number and three inputs, such as initial value, Mue (mean) and Sigma (Variance) of the risk factor.

Geometric Brownian Motion is governed by following equation:

$$dS(t,S) = \mu\, Sdt + \sigma\, SdW\_t.$$

The risk factor for equities is either the benchmark stock index to which it is mapped or the equity itself. Custom equity risk factors are modeled using a Geometric Brownian Motion. In case of equities mapped to the stock index, the index itself is modeled and the index returns are estimated. The price of a particular equity is estimated from the modeled returns on the respective stock index. OFS Market Risk estimates the equity prices using the Capital Asset Pricing Model as follows:

$$Et+1 = Et * \exp(\beta im * Rm)$$

Where,

Et+1 = Equity Price at time t+1

Et = Equity Price at time t

βim = Beta or the sensitivity of asset returns to stock index returns

Rm = Return on stock index

Currency Risk Factor

Currencies are modeled using Garman Kohlagen Process. The output of this process is the simulated prices of exchange rates. Garman Kohlagen Process generates scenarios for respective risk factors using four inputs, such as spot value between currencies, risk free term structure of the first currency, risk free term structure of the second currency and volatility term structure. Initial value provided to equation is the current spot value. Risk factor scenarios are created by propagating initial value and Garman Kohlagen Process equation preserves the volatility of generated scenarios.

Garman Kohlagen Process is governed by the following equation:

$$dS(t,S) = \left(r(t) - r_f(t) - \frac{\sigma(t,S)^2}{2}\right)dt + \sigma dW\_t$$

Interest Rates Risk Factor

Interest rates are modeled using the interest rate model specified by the user (Hull White Process, Black Process, Ornstein Uhlen Beck Process or Ho-Lee Process). If Spread over Sovereign yield curve is specified for any interest rate, then that spread is applied to the simulated values of the sovereign yield curve to arrive at the simulated values for the given rating. Benchmark indices such as Libor are simulated using the interest rate model specified for the sovereign yield curve.

Hull White process generates scenarios for the respective risk factors using Pseudo random number and three inputs, such as yield term structure, mean reversion rate and Sigma (variance). To estimate the mean reversion rate and speed, each interest rate risk factor's change of rate are computed for the specified number of days. Change of rate is regressed with rate using linear regression. Speed of the mean reversion is -1* slope. Mean reversion rate and speed are calculated using NAG library's liner equation "nag_simple_linear_regression (g02cac)". Details description of NAG equation is available on http://www.nag.com/numeric/CL/nagdoc_cl23/html/G02/g02cac.html.

This process is repeated for all interest rate risk factors.

Hull White Process is governed by following equation:

$$dr_t = (\theta(t) - ar_t)dt + \sigma dW_t$$

Black Process generates scenario for respective risk factors using overnight rate and volatility term structure. Black Process is governed by following equation:

$$dS_t = \left(r(t) - q(t) - \frac{\sigma(t,S)^2}{2}\right)dt + \sigma dW\_t$$

Ornstein Uhlen Beck Process generates scenario for respective risk factor using Pseudo Random number and Overnight rate and speed value as provided by user while defining VaR Model. Ornstein Uhlen Beck Process is governed by following equation:

$$dXt = \kappa(\theta - Xt)dt + \sigma dWt$$

Ho-Lee Process generates scenario for respective risk factor using mean reversion rate and Sigma (variance). Ho-Lee model is equivalent to Hull-White model with a mean-reversion rate as zero.

Interest rate model specified are short-rate models and therefore model the (spot) overnight rate for all Interest Rate Asset Classes. For other maturity buckets, the interest rate is modeled using the correlation of the overnight rate with the maturity bucket rate. This is done by calculating the beta coefficient. An error value is also included in Beta function, error value is with respect to maximum deviation observed in target maturity bucket.

Error value in beta function is computed using iterative process. This error value is to address variance of spot with respect to target time vertex. In certain scenarios where spot rate is stable and target time vertex rate is volatile in nature, beta function's resultant scenario of target time vertex represents the variation as in spot rate and not target time vertex rate. Error value in beta function tends to incorporate the variation of target time vertex in the generated scenario. Maximum of 1000 iterations will be performed to compute the error value. Initial error value is set to 0.5. After each iteration the difference between maximum deviation in historical data is compared with the maximum deviation generated in simulation. Iteration where above mentioned difference is minimum will be stamped as the final scenario set for corresponding maturity time bucket.

$$\beta_{0,i} = \rho_{0,i} * \left(\frac{\sigma_i}{\sigma_0}\right) * \in$$

Where,

$\beta_{0,i} = Beta\ Coefficient\ for\ i^{th}\ maturity\ time\ bucket$

$\rho_{0,i} = Correlation\ between\ overnight\ rate\ and\ i^{th}\ maturity\ time\ bucket$

$\sigma_0 = Volatility\ of\ the\ overnight\ rate$

$\sigma_i = Volatility\ of\ i^{th}\ maturity\ time\ bucket$

$\in = Error\ value$

The log change in the spot rate is multiplied by the Beta coefficient to arrive at the log change to the target maturity time bucket rate with respect to all scenarios.

$$Ln(r_{i,Xscenario}) - Ln(r_{i,spot}) = \beta_{0,i}\left[Ln(r_{0,Xscenario}) - Ln(r_{0,spot})\right]$$

Where,

$r_{i,Xscenario} = X^{th}\ scenario\ rate\ of\ i^{th}\ maturity\ time\ bucket$

$r_{i,spot} = Spot\ rate\ of\ i^{th}\ maturity\ time\ bucket$

$r_{0,Xscenario} = X^{th}\ scenario\ rate\ of\ overnight\ time\ bucket$

$r_{0,spot} = Spot\ rate\ of\ overnight\ time\ bucket$

$\beta_{0,i} = Beta\ Coefficient\ for\ i^{th}\ maturity\ time\ bucket$

The simulated value of ith-day interest is calculated by solving for $r_{i,Xscenario}$ in the above equation.

While simulating interest rates, the resulting values may be negative. A floor of 0.001 is applied to all the simulated values. Any interest rate going below this value is taken as 0.001 for the purpose of calculations.

CDS Spreads

In case of Credit Defaults Swaps and Collateralized Debt Obligations, the risk factor to be simulated is the CDS spread. Only the spreads at the shortest maturity are modeled using the Geometric Brownian Motion process. The spreads of all other maturities are simulated in a manner similar to ;l simulation. The beta co-efficient is calculated based on the equation given above. The absolute change in the spread value at the shortest maturity is multiplied with the by the Beta coefficient to arrive at the value of the other maturities.

$$S1, i - S1,0 = \beta 0.5, 1\ (S\ 0.5, i - S0.5,0)$$

Where,

$S1, i = Scenario\ value\ of\ 1 - year\ spread\ rate$

$S1,0 = Scenario\ value\ of\ 1 - year\ spread\ rate$

$S0.5, i = Scenario\ value\ of\ 6 - month\ spread\ rate$

$S0.5,0 = Scenario\ value\ of\ 6 - month\ spread\ rate$

$B0.5, 1 = Beta\ Coefficient$

Under Historical Simulation, the absolute change in the value of spread rates is taken as the return which is applied to the current spread rate. The formula for calculating spread returns is as follows:

$$Rt = St - St - 1$$

Where,

$Rt = Return\ on\ spread\ rates\ at\ time\ t$

$St = Spread\ rate\ at\ time\ t$

$St - 1 = Spread\ rate\ at\ time\ t - 1$

Step 3

Correlated Risk factor scenarios are then derived using correlation matrix and simulated risk factor generated in the above step.

Simulation of Portfolio Value

Simulated portfolio value is the price of the portfolio under each scenario.

The instrument value for all instrument as part of a given portfolio is calculated under all simulated scenario. The simulated portfolio value in the reporting currency is derived as sum of all instrument prices under each scenario.

P&L Distribution

The P&L distribution is Profit or Loss of the portfolio under each scenario against the portfolio value as on the current day.

Portfolio VaR and CVaR

The VaR and CVaR values obtained from the P&L Distribution are based on the confidence level and horizon specified in the Market Risk VaR Model.

Based on the confidence level α the 1-day α-VaR is the $(1 - \alpha)^{th}$ value in the arranged P&L values. The confidence level α must be entered in OFS Market Risk application. The t-day α-VaR is estimated by multiplying the 1-day α-VaR by $\sqrt{t}$.

CVaR is calculated as the Expected Value of all simulated data points that exceed the VaR. It is the expected loss conditional on the occurrence of loss greater than VaR. The P&L distribution is calculated as follows:

$$CVaR = E(Y / Y > VaR)$$

Where,

Y : Value of Simulated Loss

Thus, it is the arithmetic average of all simulation points exceeding the VaR value.

Component VaR

Under the Simulation Methods to risk measure estimation, both Monte Carlo as well as Historical, Component VaR is calculated as the contribution of each position to the Portfolio VaR as follows:

- The scenario position values are estimated for “n” instruments in the portfolio for “m” scenarios of prices and converted to the home currency.
- The variance of the scenario portfolio values is estimated as follows:

$$\mathbf{Variance = 1/m\ \Sigma j=1m\ (jPt+1 - \mu j)^2}$$

Where,

m = Number of scenario portfolio values

jPt+1 = Scenario portfolio value

μj = Mean of the scenario portfolio values

- The covariance between the scenario position values of each instrument and the scenario portfolio values is estimated as follows:

$$\text{Covariance} = 1/m \, \Sigma \, k=1m \, j=1m \, (xk - \mu k) \, (jPt+1 - \mu j)$$

Where,

xk = Scenario position values of instrument i

The covariance of each position with the scenario portfolio values is calculated.

- Component VaR for each instrument is calculated as follows:

$$\text{Component VaR} = [(\text{Covariance}) / (\text{Variance})] * \text{Portfolio VaR}$$

9.3.2 Back Test Parameter

Back testing refers to the procedure of verifying the accuracy of the VaR model by comparing the realized P&L value with the value predicted by the VaR model.

OFS Market Risk back tests VaR estimates using Hypothetical P&L. Hypothetical P&L is defined as the gain / loss from a position at some specific time (Example, end of local business day) resulting from changes in market over the next twenty four hours, assuming a static portfolio

Actual P&L is affected by internal risk management policy and practice. Here a dynamic portfolio is assumed. OFS Market Risk back tests VaR estimates using the following methods:

- Simple Back Test
- Kupiec Test

A simple back test involves counting the number of loss exceptions for a given time period. Kupiec Test counts the number of exceptions in any given sample and performs a Likelihood-Ratio-Test at a given confidence level. Back testing is done for the days.

Back Testing comprises of calculation of the following:

- Hypothetical P&L
- Profit/Loss Exceptions
- P-value
- Critical Value
- Loss Exception Deviation
- Average Loss Duration
- Loss Duration Deviation

9.3.2.1 Calculation of Hypothetical P&L

OFS Market Risk calculates the hypothetical P&L of the portfolio assuming that the portfolio composition remains unchanged over the VaR horizon. Portfolio value at time "t" is calculated based on the actual prices of the instruments as on time "t" and the position held in the instruments. Hypothetical portfolio value at time "t+1" is calculated based on the actual prices of the instruments as on time "t+1" and the position held in the instruments at time "t". Hypothetical P&L is calculated as the difference between the hypothetical portfolio value as of time "t+1" and the portfolio value as of time "t".

The formula for computing hypothetical portfolio value is as follows:

$$HP\ t+1 = \Sigma i=1\ n\ [w\ t\ (i)\ pt+1(i)]$$

Where,

HPt+1 = Hypothetical Value of Portfolio at "t+1"

w t (i) = Number of units of instrument "i" in the portfolio at time "t"

pt+1(i) = Price of instrument "i" at time "t+1"

9.3.2.2 Calculation of Profit/Loss Exceptions

OFS Market Risk compares the actual as well as the hypothetical portfolio loss with the estimated VaR value for the back testing period specified by the user in order to find the number of exceptions. Loss exception is the number of times the actual loss exceeds the estimated VaR value for a given confidence level. OFS Market Risk also calculates the profit exceptions.

9.3.2.3 Calculation of P-value

P-value refers to the probability of the frequency of exceptions for a given level of confidence.

P-Value is calculated by passing the number of back testing points, number of Actual exceptions and the exception probability to the Binomial Distribution and then passing the probability calculated to Chi square distribution.

Where,

Number of back testing points is number of back testing days taken as input from user in VaR Model definition

Number of Actual exceptions is Profit/Loss Exceptions"

Exception probability is number of Actual Exceptions / number of back testing points

OFS Market Risk uses the following Binomial Distribution equation:

Let X denote a random variable having a Binomial distribution with parameters n and p (n ≥ 0 and 0 <p< 1).

Then,

$$Prob\{X = k\} = \left(\frac{n}{k}\right) p^k (1 - p)^{n-k}, for\ k = 0, 1, .., n.$$

Where

n = number of back testing points

p = exception probability

k = number of Actual exceptions

OFS Market Risk uses the following Chi-Distribution equation:

The lower tail probability for the χ2 distribution with v degrees of freedom, for calculating probability P(X ≤ x : v) a transformation of a gamma distribution is employed, i.e., a χ2 distribution with v degrees of freedom is equal to a gamma distribution with scale parameter 2 and shape parameter v/2.

Where,

$$P(X \leq x : v) = \frac{1}{2^{v/2}\Gamma(v/2)} \int_{0.0}^{x} X^{(v/2)-1} e^{-X/2}\, dX,\ x \geq 0, v > 0$$

9.3.2.4 Estimation of Critical Value

Critical value is asymptotically Chi Square distributed with one degree of freedom. OFS Market Risk compares the P-value with the critical value at 5% and 1% significance level, on both the loss as well as profit tail of the P&L distribution, in order to check the validity of the Model.

Critical Value is calculated as two-step process.

- First step is to calculate P-value by passing the number of back testing points, number of Actual exceptions and the probability as 1% (for Critical value at 1%) and 5% (for critical value at 5%) to the Binomial Distribution. Resultant output is further processed using Chi-Distribution to generate probability for the χ2 distribution, to arrive at Critical Value.

9.3.2.5 Calculation of Loss Exception Deviation

Loss Exception Deviation is the absolute average deviation of the loss exceptions from the CVaR. It is calculated as follows:

$$\text{Loss Exception Deviation} = \frac{\sum_{t=1}^{n}(L_t - CVaR_t)}{n}$$

Where,

n = Number of loss exceptions

Lt = Loss exceeding VaR at time “t”

CVaRt = Conditional VaR of the portfolio at time “t”

9.3.2.6 Calculation of Average Loss Duration

Average Loss Duration is the average time interval between successive loss exceptions.

9.3.2.7 Calculation of Loss Duration Deviation

Loss Duration Deviation refers to the standard deviation of time interval between successive loss exceptions. The standard deviation of time interval between successive loss exceptions is calculated.

It is calculated as per the formula given below:

$$\text{Loss Duration Deviation} = \left(\frac{\sum_{t=1}^{n}(Average\ Deviaiton\ Loss - Deviaiton\ Loss)}{n}\right)^{1/2}$$

Where,

$$\text{Average Deviation Loss} = \left(\frac{\sum_{t=1}^{n}(Deviaiton\ Loss)}{n}\right)$$

n= Number of loss exceptions

9.3.3 Defining Risk Measure Estimation Parameters

Follow the below steps to define the Risk Measure Estimation Parameters:

1. In Oracle Financial Services Analytical Applications Infrastructure under Select Applications select **Financial Services Market Risk**.
2. To open the Model Creation screen, Select the **Sandbox** tab > **Modeling** > **Model Creation** on the Left-Hand Side (LHS) menu.
3. Follow steps 1 to 6, in section Defining a Market Risk VaR Model.
4. Specify the following Risk Measure Estimation Parameters:

a. **General Parameter Specification:** The general risk measure parameters are generic in nature and are should be specified

for each of the risk measure estimation method selected. These parameters include:

i. **Reporting Currency**: Select the currency in which risk measures are to be reported, from a pop-up list of currencies.

ii. **Horizon**: Specify the horizon in terms of days. It is the future point in time over which risk measures are estimated.

iii. **Confidence Level**: Specify the confidence level as a percentage and up to 4 digits after decimal points.

iv. **Yield Curve Interpolation Method**: Select the interpolation method required for interpolating the yield curve from the below:

- Linear Interpolation Method
- Log Linear Interpolation Method
- Cubic Spline Interpolation Method
- Log Cubic Interpolation Method

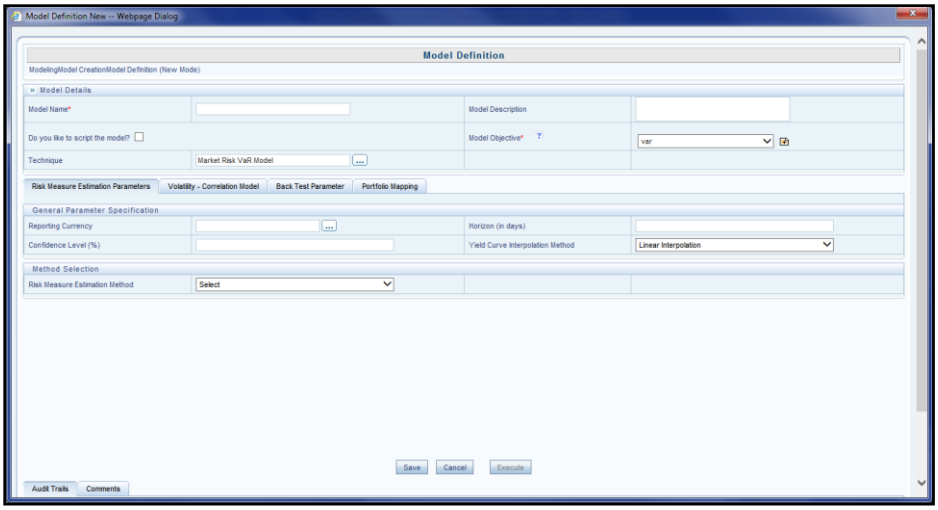


Figure 40 Model Definition Screen

b. Method Selection: OFS Market Risk supports the following methods for estimating risk measures:

i. **Analytic Method Parameters**: If you select the Analytic Method to risk measure estimation, specify the following parameters:

- **Cash Flow Type**: It determines whether the cash flows from instruments will be returned in terms of the future value or will

be discounted to obtain the present values. Select one of the following:

- Present Value
- Future Value

- **Cross Correlation**: It determines whether the inter-asset class correlation should be taken into account or not. If you select Yes, then the inter-asset class correlation is used as computed. If you select No, then the inter-asset class correlations are changed to zero. Cross correlation does not affect intra-asset class correlation. For example, for a given portfolio consisting of positions in US equities, US interest rate instruments and Indian equities, if cross correlations is specified as No then the correlation between Indian equities and US interest rates is changed to zero while the correlation between US equities and Indian equities remains unchanged. Cross Correlation is specified with respect to the inter-Asset Class correlations as one of the following:

  - Yes
  - No

- **Cash Flow Allocation**: It is the method of splitting cash flows and allocating them to the standard vertices in a manner that preserves either the VaR or the duration of the original cash flow. VaR-preserving Allocation allocates cash flows in a manner that preserves the VaR and the present value of the original cash flow, while Duration-preserving Allocation preserves the present value and duration. Select any one of the following:

  - VaR-preserving Allocation
  - Duration-preserving Allocation

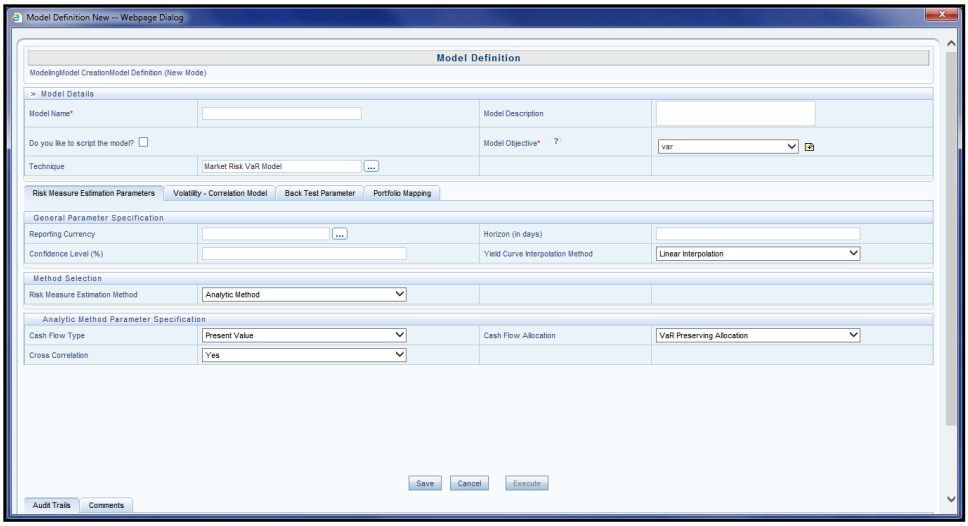


Figure 41 Model Creation

ii. **Monte Carlo Simulation Method Parameters:** If you select the Monte Carlo Simulation Method Parameters for risk measure estimation, specify the following parameters:

- **Number of Iterations:** Specify the number of iterations for simulating risk factors and instrument prices as a numeric value.
- **Random Number Seed:** It is the initial value required for generating a set of pseudo-random numbers. A given seed will always generate the random numbers in a particular sequence. Specify random number seed as one of the following:

  - Default Random Number Seed: If you select this option, then an internally generated seed is used for generating the sequence of random numbers.
  - Random Number Seed: If you select this option, then you will have to provide a seed which is used for generating the sequence of random numbers.

- **MtM Value:** It is a method of estimating the iteration values of the P&L distribution. Select one of the following:

  - MtM Present Value: If you select this option, then the scenario values of the portfolio at horizon will be discounted using the prevailing rate of the reporting currency before arriving at the P&L distribution.

- MtM Future Value: If you select this option, then the P&L distribution is arrived at using scenario values estimated at the horizon.

- **Drift:** It is the instantaneous mean of the change in the value of the risk factor for a given time. Select either Yes or No. Specifying drift determines if the drift value of the risk factors is to be taken into account while estimating the values of risk factors. If you select Yes, then the drift values as estimated will be used for computations, else drift is taken to be zero.

- **Cross Correlation:** Specifying Cross Correlation determines if the inter – Asset Class correlations are to be taken into account during calculations or not. This is similar to the cross correlation specified.

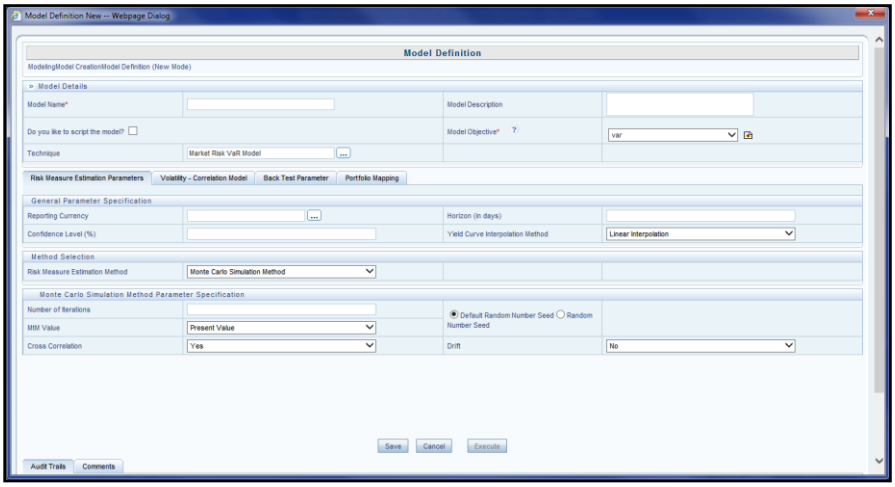


Figure 42 Risk Measure Estimation Parameters

iii. Historical Simulation Method Parameters: If you select the Historical Simulation method for risk measure estimation, specify the following parameters:

- **Historical Period:** Specify the number of days to calculate the historical returns.

  If you select the Relative option, then historical period can be specified relative to the execution date. In this case historical period start date specifies the day on which historical period starts and end date specifies the day on which the historical period ends. By default, for an existing model definition, the execution start day is set to 0 and the end day is set to the number of historical days specified.

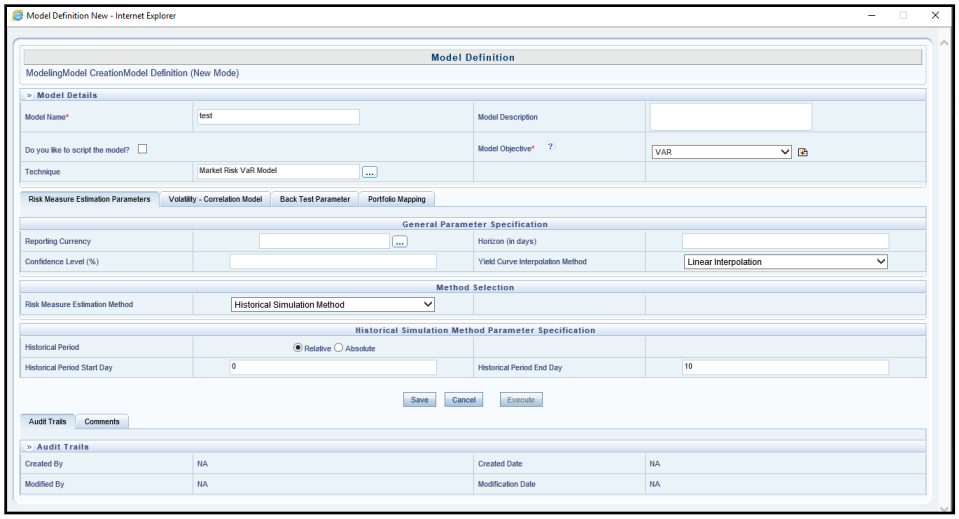


Figure 43 Historical Simulation Method - Relative

If you select the Absolute option, then historical period can be specified as an absolute period of history. In this case historical period start date and end date are specific dates of history for which the historical data should be selected for simulation.

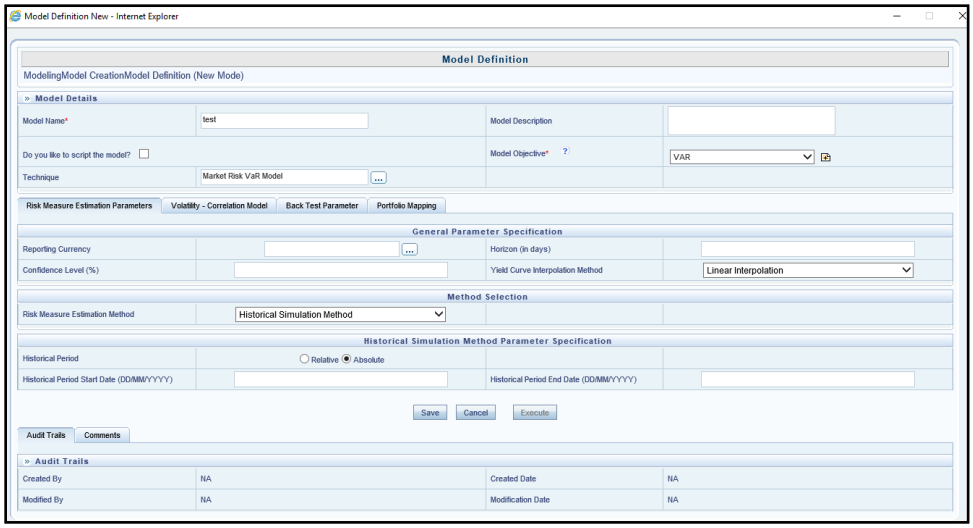


Figure 44 Historical Simulation Method - Absolute

9.3.4 Defining a Volatility - Correlation Model

Specify the Volatility – Correlation Data. You can provide the volatility and correlation data as download or, select the model defined in the application.

a. **Model Output**: If you select this option, then specify the corresponding model defined in system. Models

corresponding to EWMA and GARCH technique will be displayed for selection.

b. **External Data**: If you select this option, then system will expect volatility and correlation data as input in staging area.

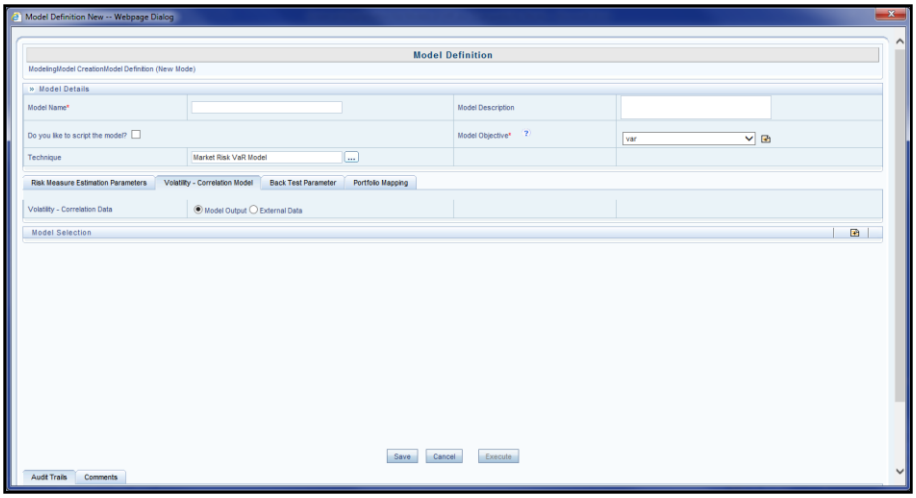


Figure 45 Volatility Correlation Method

9.3.5 Defining a Back Test Parameter

Specify the number of days for which back testing needs to be performed. The back testing period is estimated by counting the number of days backwards from the date when back testing is performed.

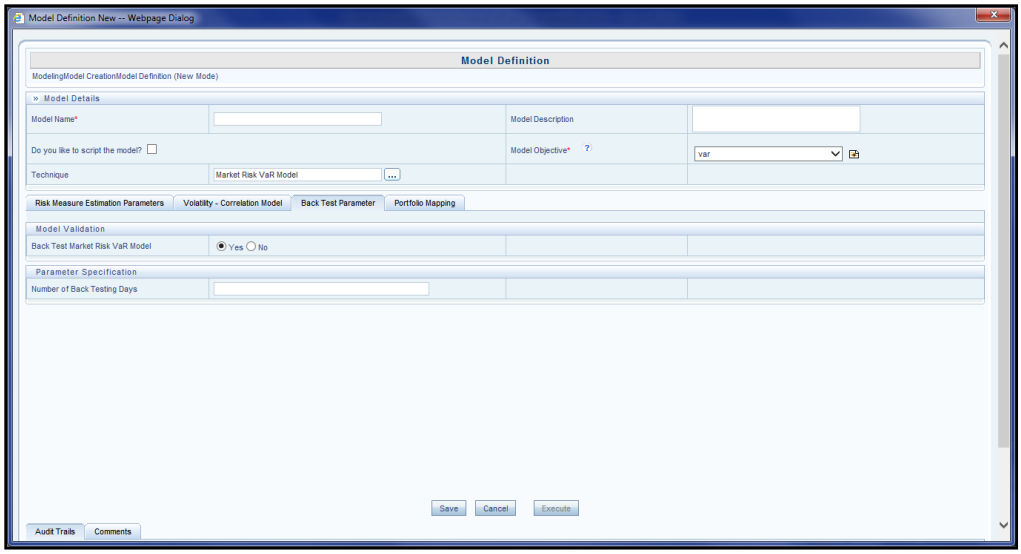


Figure 46 Model Definition – Back Test Parameter

9.3.6 Defining a Portfolio Mapping

This step involves portfolio selection, from an existing list of pre-defined portfolios, which are to be mapped to the given VaR Model. The risk measures along with the back test measures for each portfolio are estimated using the Market Risk VaR Model to which they are mapped.

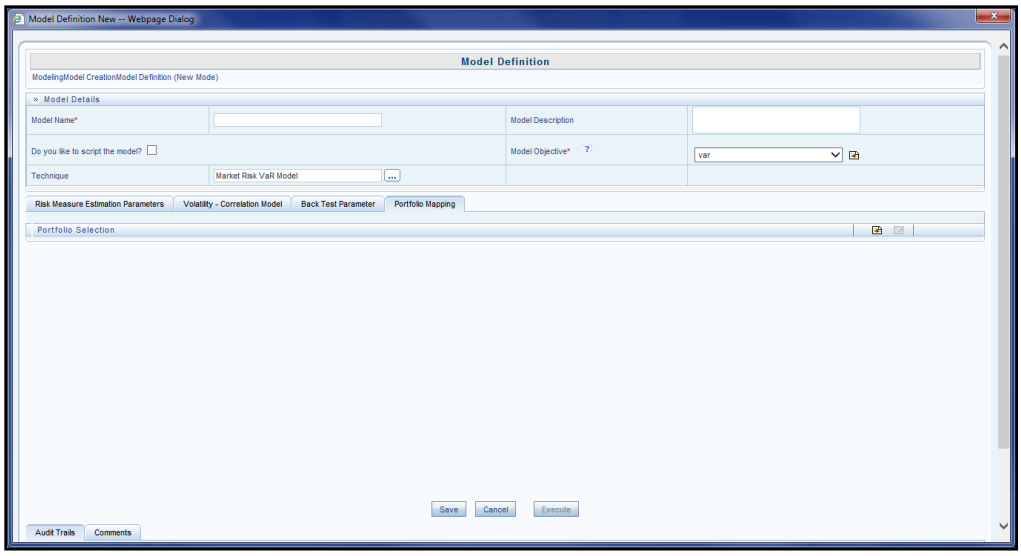


Figure 47 Model Definition – Portfolio Mapping

Note: You can edit and delete a Market Risk VaR Model. If you modify the following parameters while editing a Market Risk VaR Model, then it results in the model being saved as a new model.

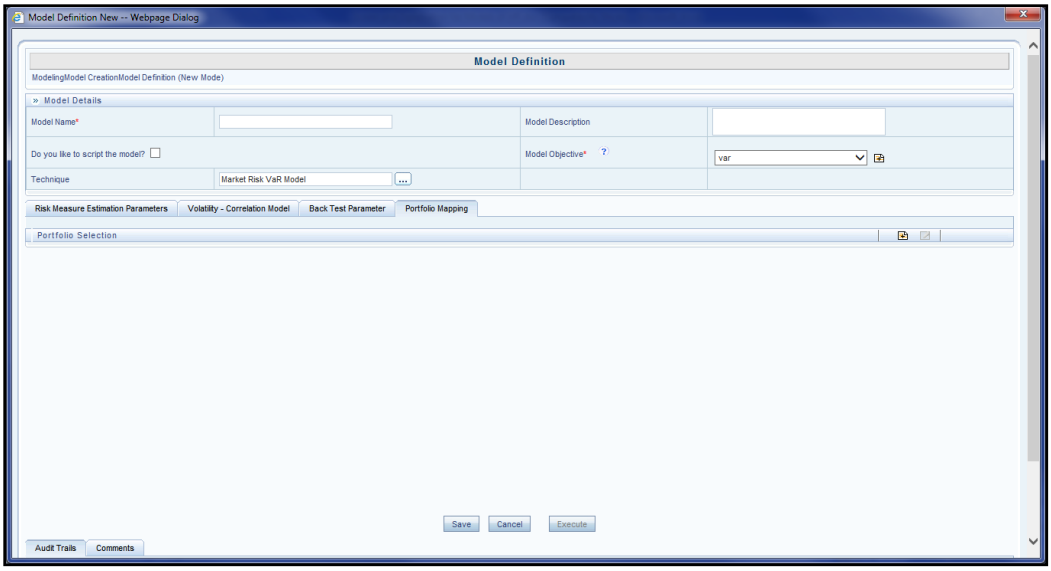
- Confidence Level
- Reporting Currency
- Horizon
- Risk Measure Estimation Method
- Variance-Covariance Method

If any additional parameters of the Market Risk VaR Model are edited, then it results in creation of a new version of the existing model.

9.3.6.1 Portfolio Mapping

This step involves portfolio selection, from an existing list of pre-defined portfolios, which are to be mapped to the given VaR Model. The risk measures along with the back test

measures for each portfolio are estimated using the Market Risk VaR Model to which they are mapped.



9.3.7 Defining a Market Risk VaR Model

OFS Market Risk estimates risk measures for a given portfolio as per the parameters specified as part of the Market Risk VaR Model. Follow the below steps to create a Market Risk VaR model:

1. In Oracle Financial Services Analytical Applications Infrastructure under Select Applications select **Financial Services Market Risk**.
2. To open the Model Creation screen, Select the **Sandbox** tab > **Modeling** > **Model Creation** on the Left-Hand Side (LHS) menu.
3. Click **Add** button in the Model Creation screen.

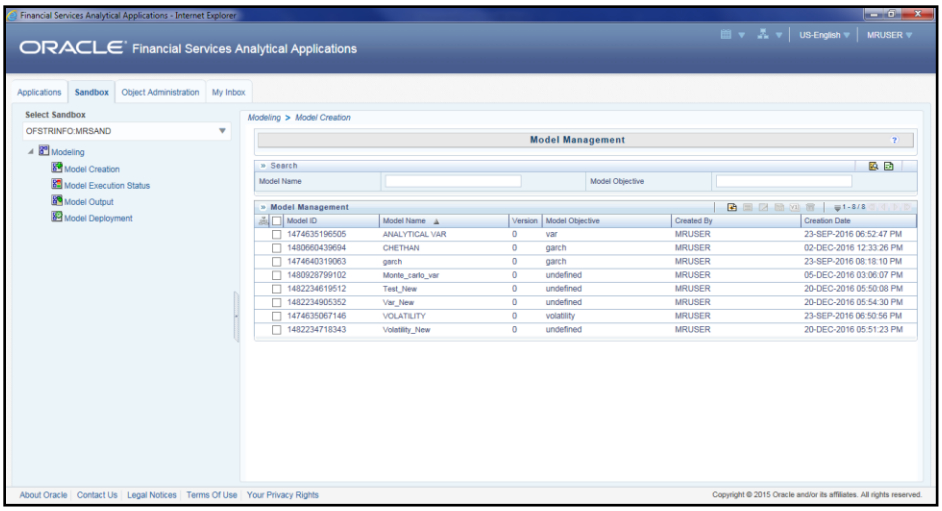


Figure 48 Model Management Screen

4. Enter the **Model Name** and **Model Description**.
5. Select the model objective
6. Select the technique as **Market Risk VaR Model**.
7. There are four available options - **Risk Measure Estimation Parameters**, **Volatility - Correlation Model**, **Back Test Parameter**, and **Portfolio Mapping**. Follow the steps mentioned in the below section to specify the parameters defined in the options.
8. Click **Save**.

Note: You can edit and delete a Market Risk VaR Model. If you modify the following parameters while editing a Market Risk VaR Model, then it results in the model being saved as a new model.

- Confidence Level

- Reporting Currency
- Horizon
- Risk Measure Estimation Method
- Variance-Covariance Method

If any additional parameters of the Market Risk VaR Model are edited, then it results in creation of a new version of the existing model.

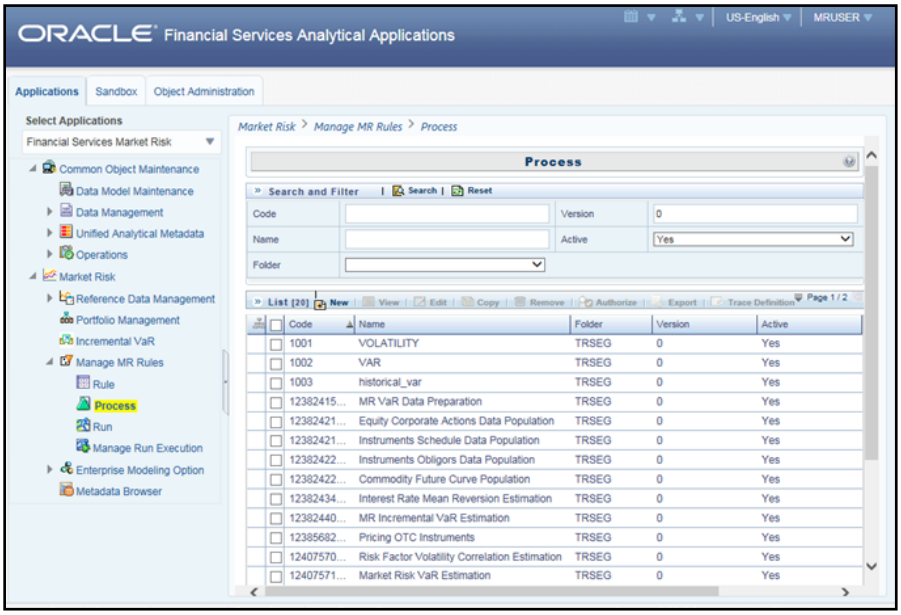
10 Annexure A: Generating Download Specifications

Data Model for Market Risk Release 8.0.4.0.0 is available on customer request as an ERwin file. Download Specifications can be extracted from this model.

11 Annexure B: Including a Market Risk Model

Perform the below steps to include a Market Risk model in a run. Before performing the steps ensure that the model is already defined in Sandbox, and has been approved and deployed. For details on approval and deployment, see the OFS Enterprise Modelling User Guide on OHC Documentation Library.

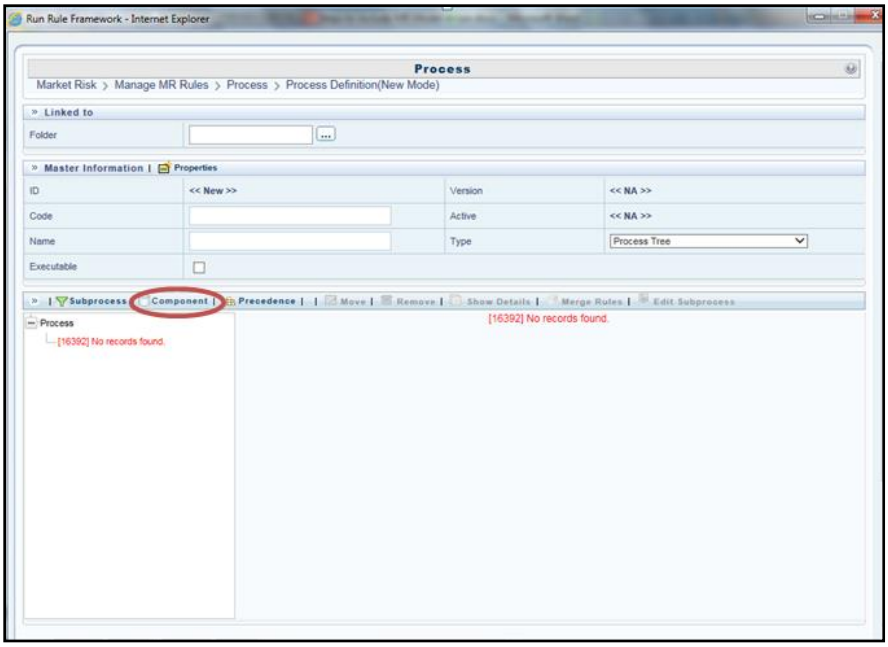
1. Navigate to **Manage MR Rule** > **Process**.
2. Create a Process for the deployed model.



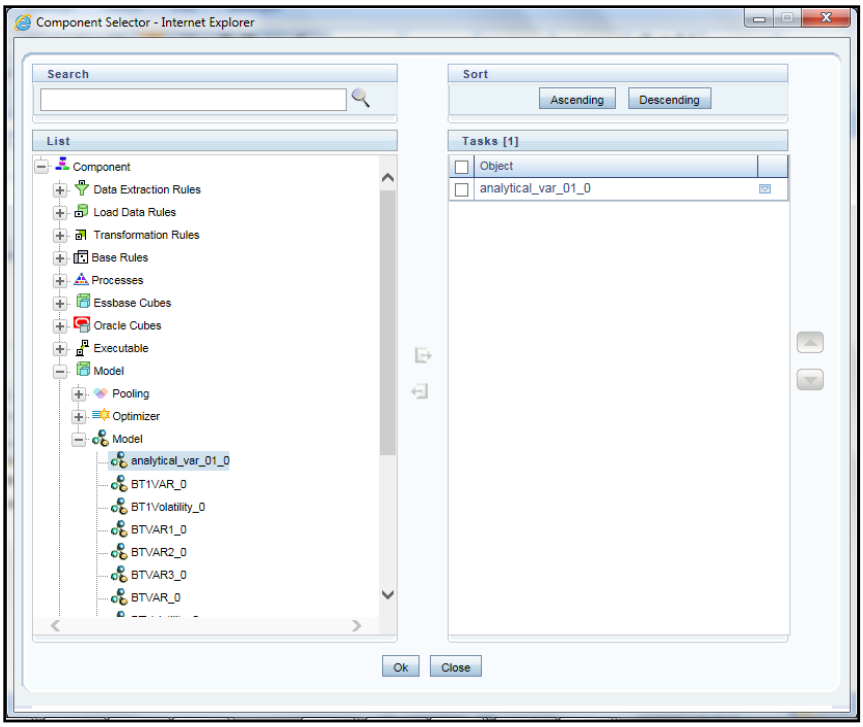
3. Click the **New** button. The Process definition window is displayed.
4. Provide inputs in the fields **Folder**, **Code**, and **Name**.
5. Select the Type.

   Note: Do not check the executable check box for MR application.

6. Click the Component tab, to include the MR model in the process. The Component selector is displayed.

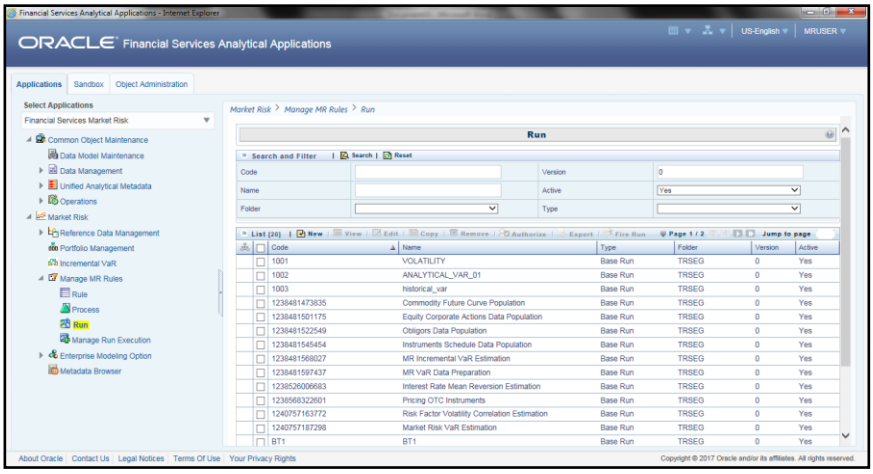


7. Select the required model to be included in the run. All the deployed models will be listed under the link **Component** > **Model** > **Model**.



8. Click **Ok** to save the process.

9. To include the created process in the run, navigate to **Manage MR Rule** > **Run**.

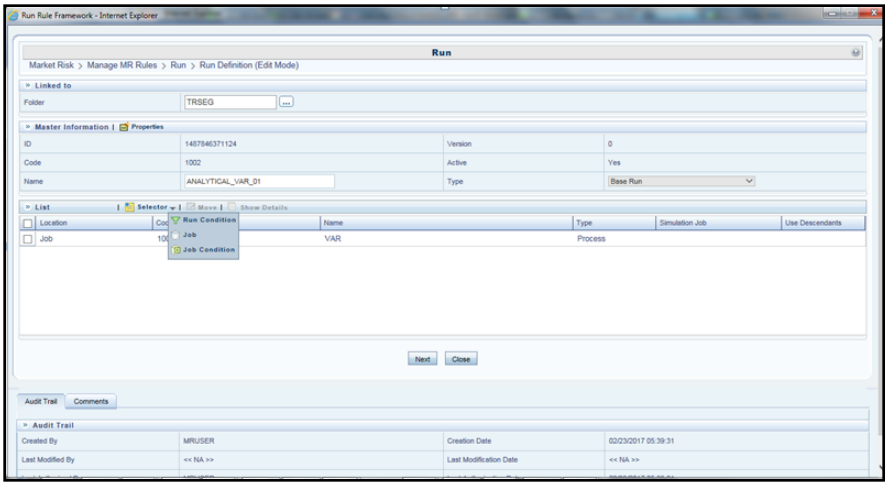


10. Create new Run similar to the Market Risk VaR Estimation sample run seeded in application. Alternatively you can create a copy of the existing Market Risk VaR Estimation Run and edit it.

    Note: Do not edit the seeded run. It is a sample run installed in the MR application for reference.

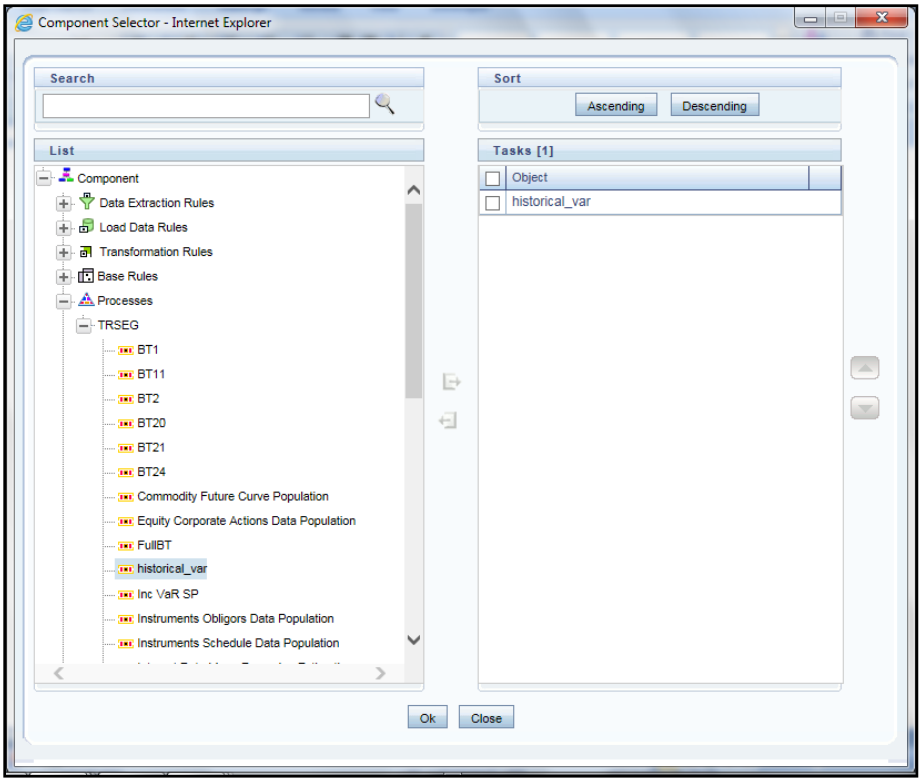
11. Select the new Run and click **Edit**.

12. Select Job under Selector drop-down. The Component selector is displayed.



13. Select the required process to be included in the run. All the processes will be listed under the link **Component** > **Processes**

14. Select the process and click **Ok**, to add process in the Run.

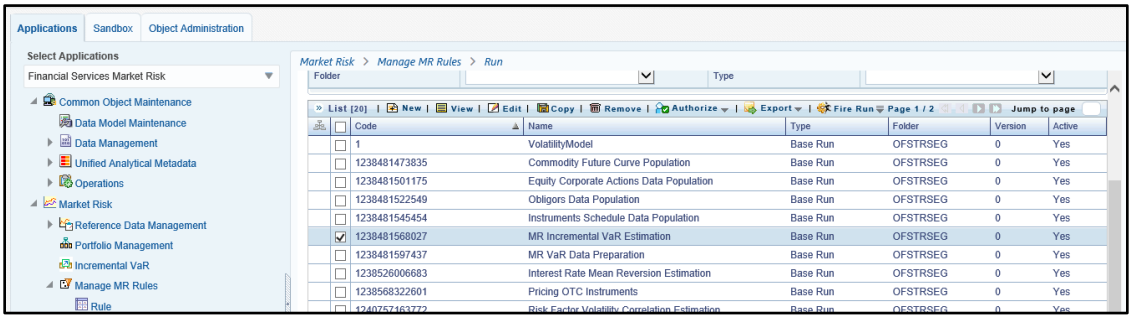


15. After Process selection is complete, you can select the other required tasks in the run.
16. Click **Ok** to save the run.

12 Annexure C: Executing a MR Run/ Batch Execution

Perform the below steps to execute a MR run. Before performing the steps ensure that the Process is already defined. For details on approval and deployment, see the OFS Enterprise Modelling User Guide on OHC Documentation Library.

1. Navigate to **Manage MR Rule** > **Run**.
2. Select the Process for the deployed model.



3. Click **Fire Run**. The **Fire Run** window is displayed.
4. Specify if the request type is **Single** or **Multiple**.
5. In the Batch field, select **Create and Execute** from the drop-down list.
6. Provide a **MIS Date**.
7. Specify **Yes** or **No**, in the **Wait** field.
8. Click **OK**, to execute the batch.

13 Annexure D: Defining Stress Variables

MR application's back end engine VAR –value at risk and Volatility can be stressed using OFSAA stress modelling frame work. MR risk factors are stressed using Oracle Reveleus stress testing framework.

In the Market Risk requirement and design, the stress variable supports only based on Measure type of stress variables. OFS MR provides the capability to generate stress Volatility Model and VaR Model run for the bank's portfolios.

The process flow for Stress Testing is as follows:

- **Step 1:** Variable Definition – Define the variables that need to be shocked during stress run
- **Step 2:** Variable Shock – Define the type and extent to which the variables defined in Step 1 need to be shocked.
- **Step 3:** Scenario – Define a Scenario by adding all the required variable shocks to the scenario
- **Step 4:** Stress Definition – Map the scenario to the VaR/Volatility Model to create a Stress Run
- **Step 5:** Stress Run – "Fire Run" the Stress Run from the **Run** Window

The bank can stress the following variables:

- Exchange Rate between Currencies
- Equity Price
- Index Price
- Interest Rate
- Commodity Price
- Volatility of Asset Class
- Correlation between Asset Classes

13.1 Defining a Variable

The process for defining a variable and assigning variable shocks for each of the below listed variables, is explained in this section. After defining the shocks you can add them to a scenario, which will be mapped to a Baseline Model to generate a Stress Run.

- Exchange Rate between Currencies

- Equity Price
- Interest Rate
- Commodity Price
- Volatility of Asset Class
- Correlation between Asset Classes

13.1.1 Exchange Rate Between Currencies

Follow the below steps to define a variable, and assign shock for Exchange Rate Between Currencies:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.
2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.
3. Click **Add** icon in the **Variable Definition** screen.

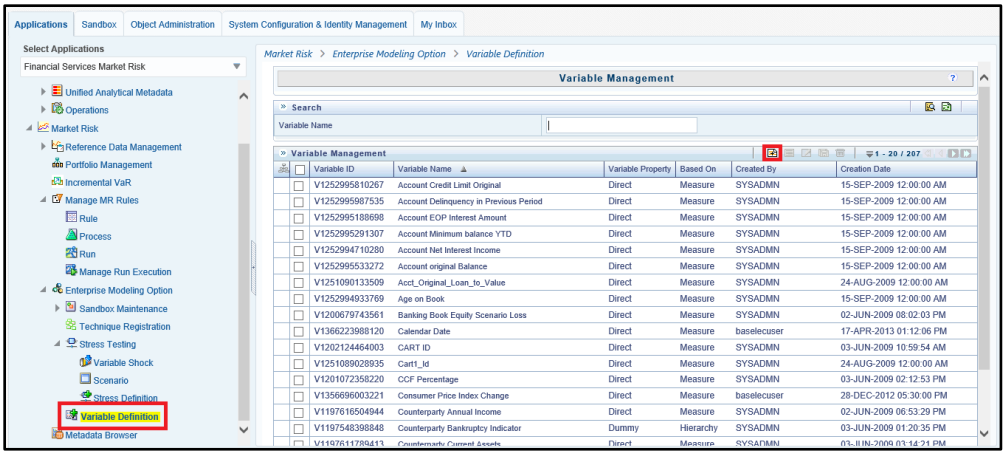


Figure 49 Variable Definition Screen

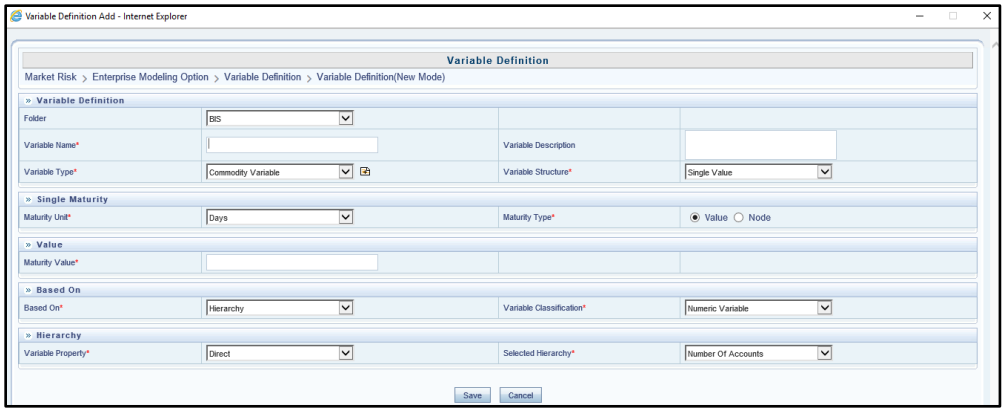


Figure 50 Variable Definition Screen

4. Define the exchange rate variables as below:

Folder	Select the Folder from the drop-down list, in which the Variable Definition is to be saved.
Variable Name	Provide the variable name.
Variable Description	Provide the variable description.
Variable Type	Select the **Currency Variable** from the drop-down list.
Variable Structure	Select **Single Value**.
Based On	Select **Measures**.
Variable Classification	Select **Numeric Variable**
Apply Filters	Select **Yes**.
Data Set	Select **Exchange Rate Dataset** from the drop-down list.
Selected Measures	Select **MSR – MR Exchange Rate** from the drop-down list
Filters	Click the edit button, and select **CURRENCY1** and **CURRENCY2** from the Hierarchy browser.
Currency1	Select Currency 1 under Filters. Click the edit button corresponding to Currency1, and select the required first currency.
Currency2	Select Currency 2 under Filters. Click the edit button corresponding to Currency2, and select the required second currency.

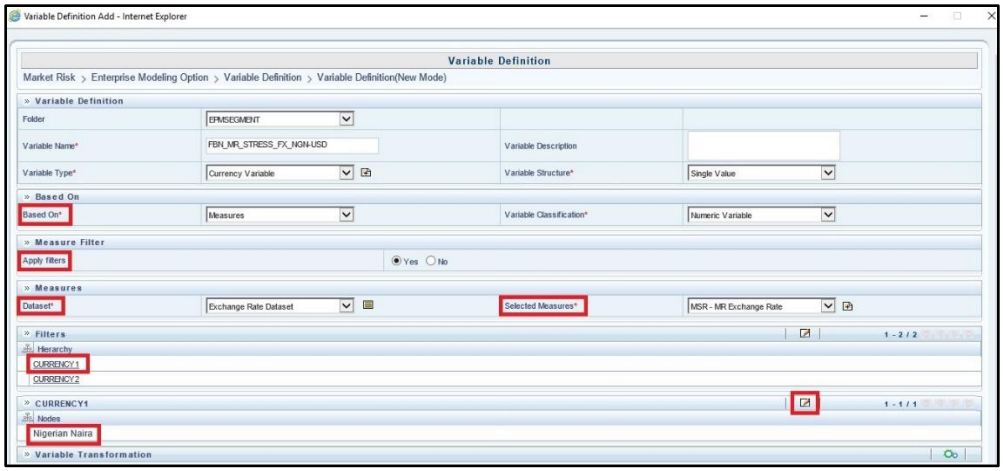


Figure 51 Variable Definition Screen

5. Navigate to the **Variable Shock** screen.

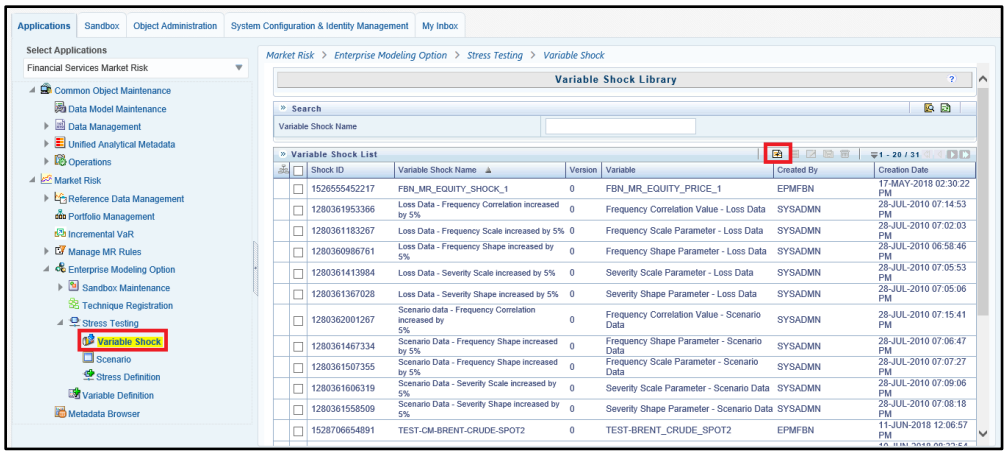
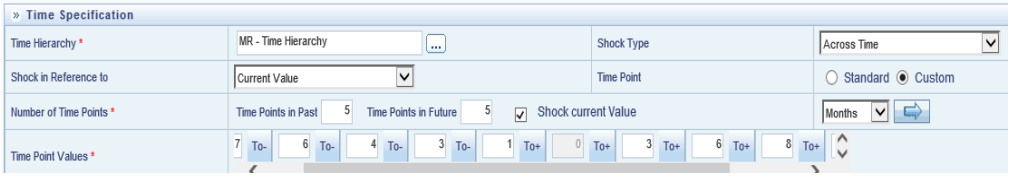
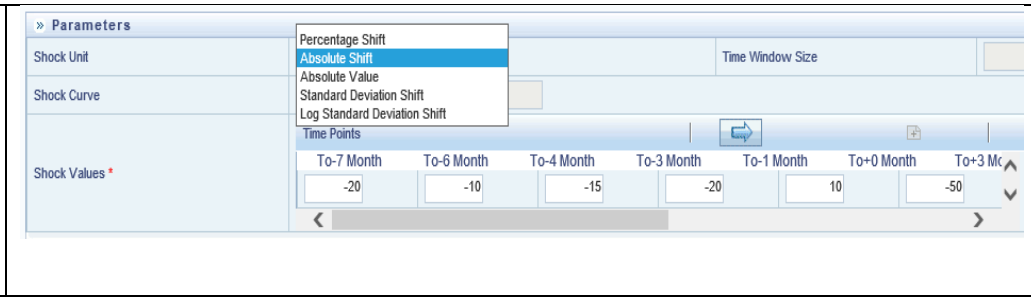


Figure 52 Variable Definition Screen

6. Define the variable shock as follows:

Shock Name	Specify a Shock Name
Shock Description	Provide a description for the Shock.
Dataset	Select **Exchange Rate Dataset** from the drop-down list
Variable Name	Select the variable which needs to be shocked from under the **Currency Variable** > **Numeric Variable**.

Is Formula Based	Select Yes.
Time Hierarchy	Select **MR – Time Hierarchy** for Time Hierarchy. This hierarchy determines the horizon of the shock.
Shock Type	Shock Type selection has two options: ▪ Instantaneous ▪ Across Time In you select Across Time, provide information in the fields: - Shock in Reference to: Select whether it is Current Value, or Future Estimated Value - Time Point: Select whether Custom or standard - Number of Time Points: Enter values for **Time Points in Past** and **Time Points in Future** - Shock Current Value: Select the check box, and specify the time as Days, Weeks, months or Years, and click  - Time Point Values: Specify the Time point values. In case of “Standard” option selected in “Time Point”. The points will be consecutive values between “Time Points in Past” to “Time Points in Future”. The value will be in “Days”, “Weeks”, “Months” and “Years” depending on the value selected In case of “Custom” option selected in “Time Point”. The points will be custom user specified values between “Time Points in Past” to “Time Points in Future” 
Parameters	**Shock Unit**: Select one of the following: ▪ Percentage Shift ▪ Absolute Shift ▪ Absolute Value ▪ Standard Deviation Shift ▪ Log Standard Deviation Shift: If you select this option, specify the **Time Window Size**. Click  button to add shock values as shown below.



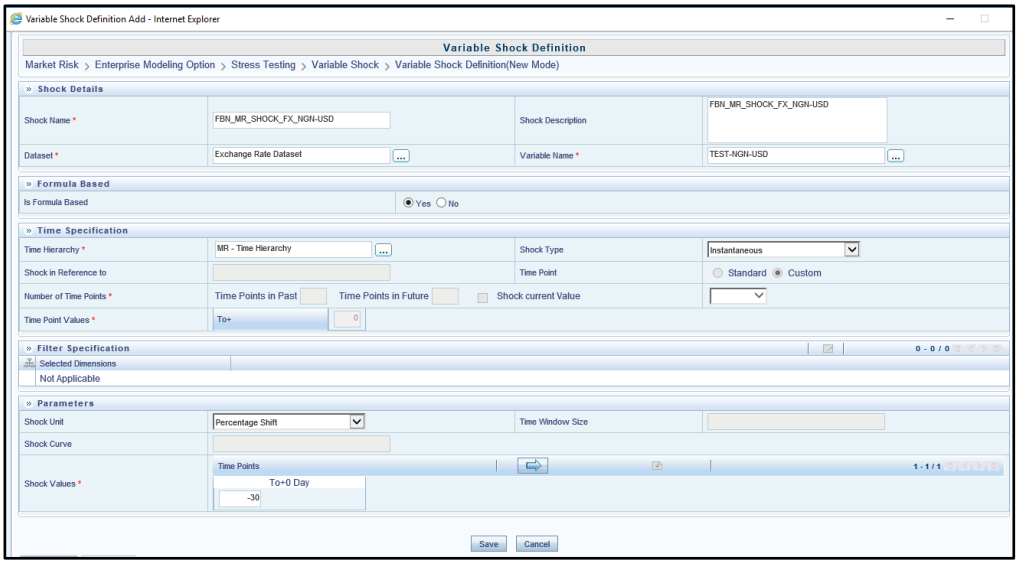


Figure 53 Variable Shock Definition Screen

7. Save the Definition.

13.1.2 Equity Price

Follow the below steps to define a variable, and assign shock for Equity Price:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.
2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.
3. Click **Add** icon in the **Variable Definition** screen.

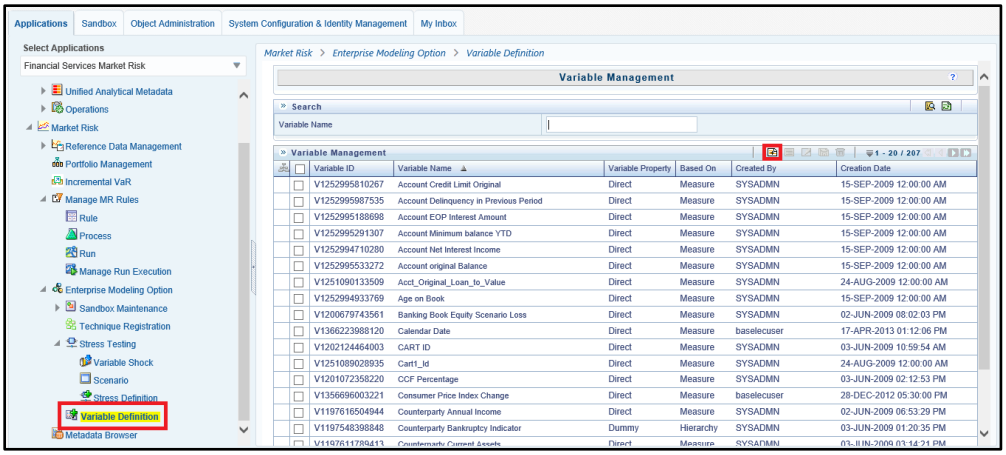


Figure 54 Variable Definition Screen

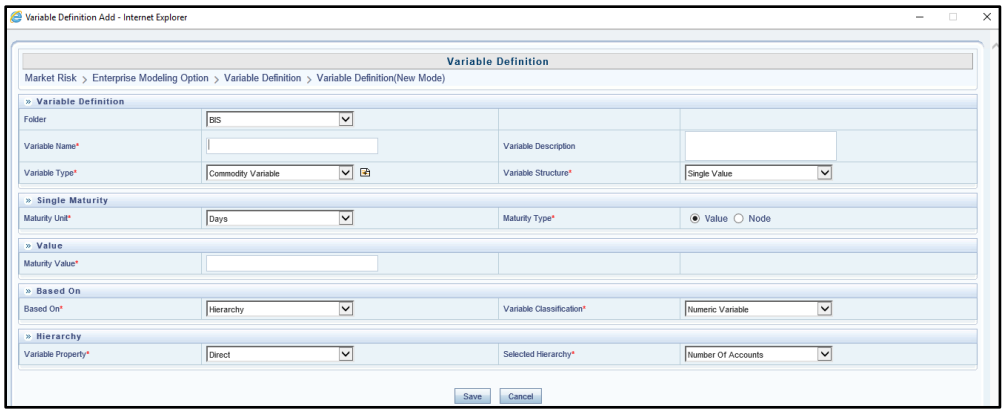


Figure 55 Variable Definition Screen

4. Define the equity variable as below:

Folder	Select the Folder from the drop-down list, in which the Variable Definition is to be saved.
Variable Name	Provide the variable name.
Variable Description	Provide the variable description.
Variable Type	Select **Equity Variable** from the drop-down list.
Variable Structure	Select **Single Value**.
Based On	Select **Measures**.
Variable Classification	Select **Numeric Variable**

Apply Filters	Select **Yes**.
Data Set	Select **Equity Dataset** from the drop-down list.
Selected Measures	Select **Equity Price** from the drop-down list
Filters	Click the edit button, and select **Equity** from the Hierarchy browser.
Equity	Select Equity under Filters. Click the edit button corresponding to Equity, and select the required Equity.

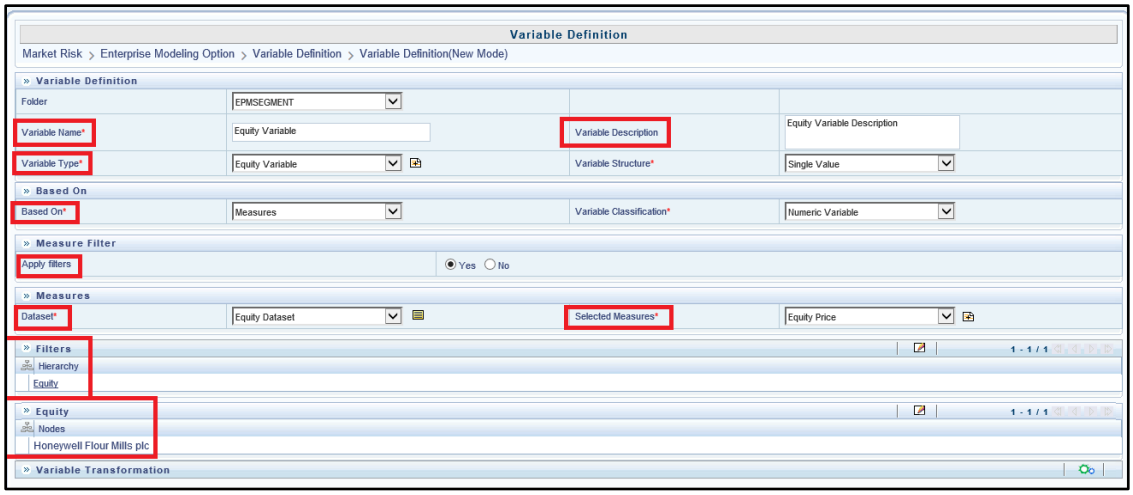


Figure 56 Variable Definition Screen

5. Navigate to the **Variable Shock** screen.

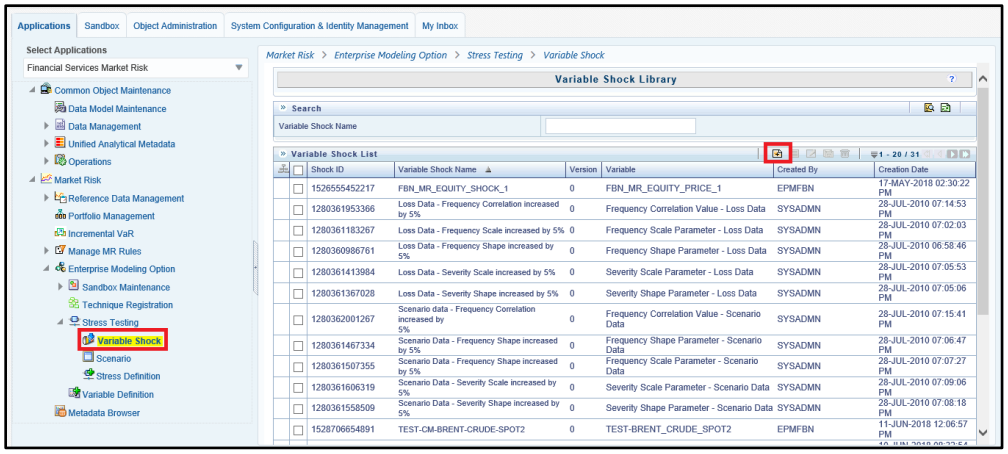
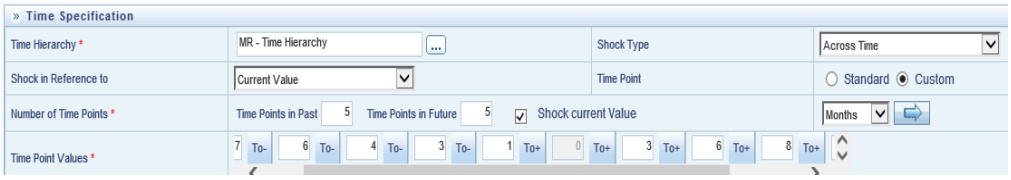
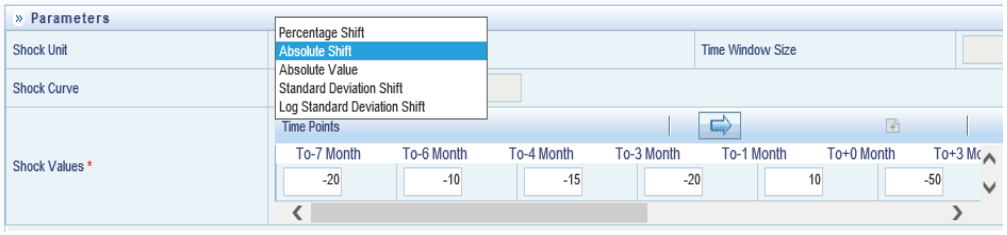


Figure 57 Variable Definition Screen

6. Define the variable shock as follows:

Shock Name	Specify a Shock Name
Shock Description	Provide a description for the Shock.
Dataset	Select **Equity Dataset** from the drop-down list
Variable Name	Select the variable which needs to be shocked from under the **Equity Variable** > **Numeric Variable**.
Is Formula Based	Select **Yes**.
Time Specification	Select **MR – Time Hierarchy**. This hierarchy determines the horizon of the shock.
Shock Type	Shock Type selection has two options: ▪ Instantaneous ▪ Across Time In you select Across Time, provide information in the fields: - Shock in Reference to: Select whether it is Current Value, or Future Estimated Value - Time Point: Select whether Custom or standard - Number of Time Points: Enter values for **Time Points in Past** and **Time Points in Future** - Shock Current Value: Select the check box, and specify the time as Days, Weeks, months or Years, and click to load the time point values. - Time Point Values: Specify the time point values. If you select the **Standard** option, the points will be consecutive values between **Time Points in Past** to **Time Points in Future**. The value will be in **Days**, **Weeks**, **Months** and **Years** depending on the selection. If you select **Custom**, the points will be custom user specified values between **Time Points in Past** to **Time Points in Future.** 
Parameters	**Shock Unit**: Select one of the following: ▪ Percentage Shift ▪ Absolute Shift ▪ Absolute Value

	▪ Standard Deviation Shift ▪ Log Standard Deviation Shift: If you select this option, specify the **Time Window Size**. Click button to add shock values as shown below. 

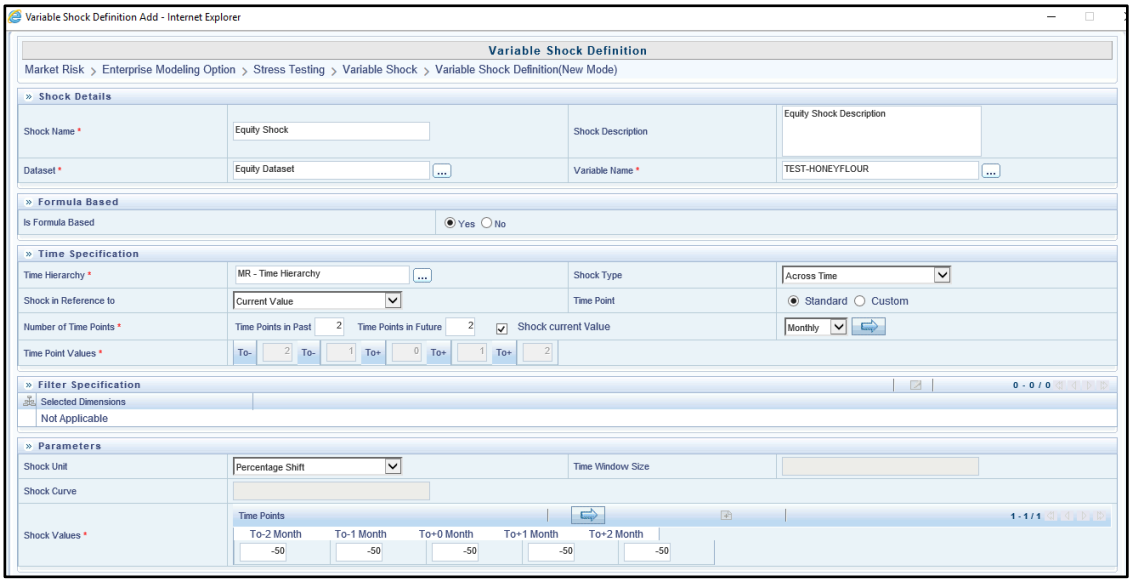


Figure 58 Variable Shock Definition Screen

7. Save the Definition.

13.1.3 Interest Rate

Follow the below steps to define a variable, and assign shock for Interest Rate:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.
2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.

3. Click **Add** icon in the **Variable Definition** screen.

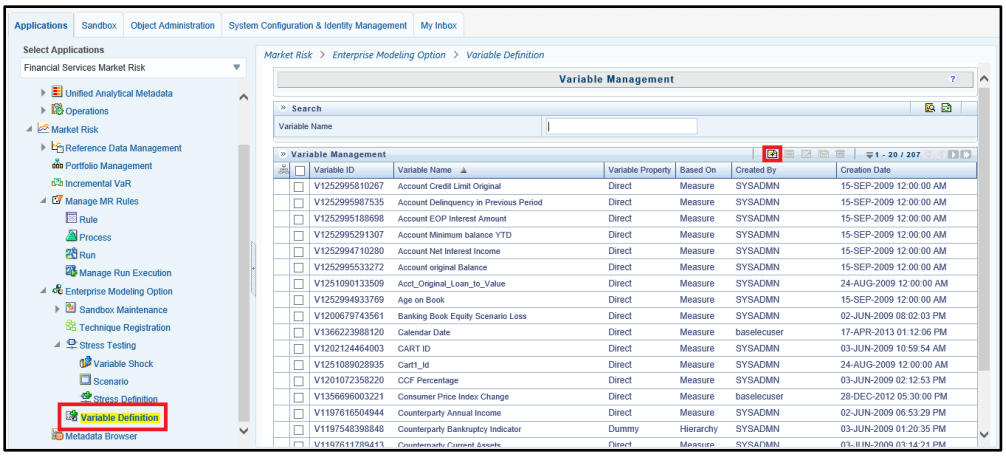


Figure 59 Variable Definition Screen

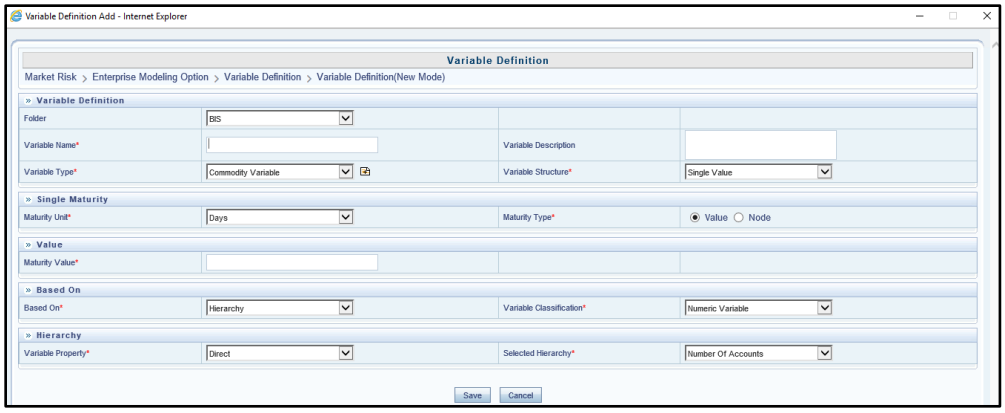


Figure 60 Variable Definition Screen

4. Define the exchange rate variables as below:

Folder	Select the Folder from the drop-down list, in which the Variable Definition is to be saved.
Variable Name	Provide the variable name.
Variable Description	Provide the variable description.
Variable Type	Select **Interest Rate Variable** from the drop-down list.
Variable Structure	Select **Single Value**.
Maturity Unit	Select one of the following: ▪ Days

	▪ Months ▪ Quarters ▪ Years
Maturity Type	Select **Node**
Selected Hierarchy	Select **Standard Time Vertices** from the list.
Selected Node	Select one of the time vertex points.
Based On	Select **Measures**.
Variable Classification	Select **Numeric Variable**
Apply Filters	Select **Yes**.
Data Set	Select **Interest Rate Dataset** from the drop-down list.
Selected Measures	Select **Interest Rate** from the drop-down list
Filters	Click the edit button, and select **Interest Rate Asset Class, Currency Asset** and **Standard Time Vertices** from the Hierarchy browser.
Interest Rate Asset Class	Select Interest Rate Asset Class under Filters. Click the edit button corresponding to Interest Rate Asset Class, and select the required Interest Rate.
Currency Asset	Select Currency Asset under Filters. Click the edit button corresponding to Currency Asset, and select the required Currency Asset.
Standard Time Vertices	Select Standard Time Vertices under Filters. Click the edit button corresponding to Standard Time Vertices, and select the required Standard Time Vertices.

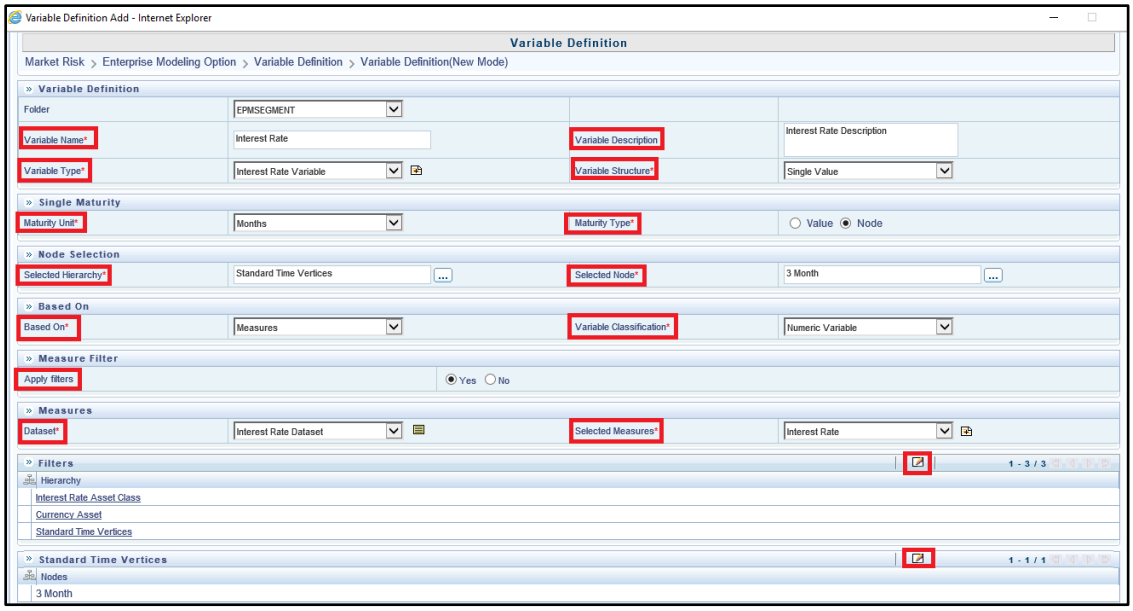


Figure 61 Variable Definition Screen

5. Navigate to the **Variable Shock** screen.

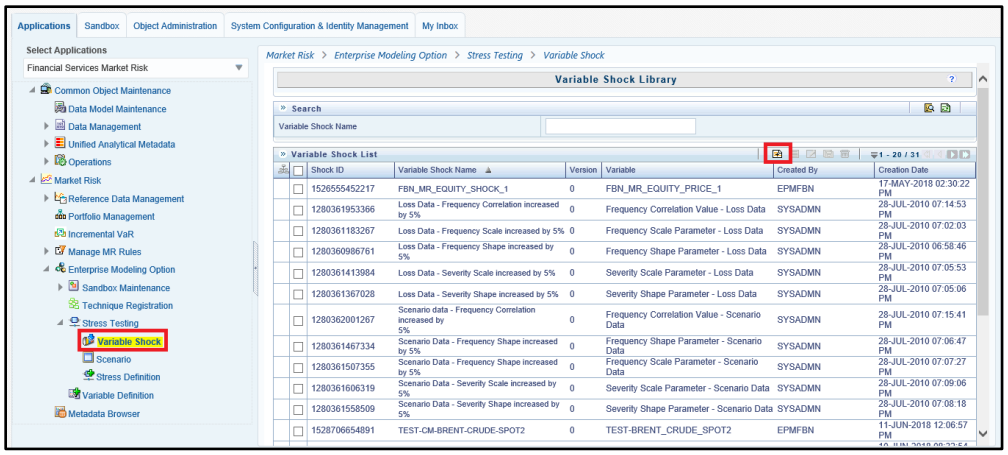
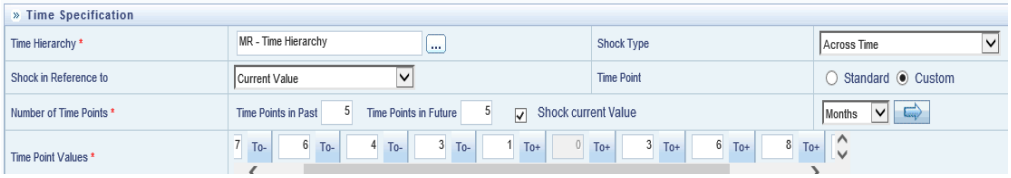
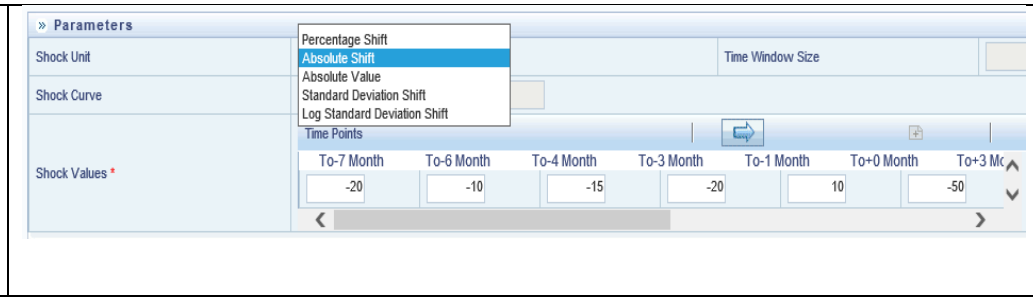


Figure 62 Variable Definition Screen

6. Define the variable shock as follows:

Shock Name	Specify a Shock Name
Shock Description	Provide a description for the Shock.
Dataset	Select **Interest Rate Dataset** from the drop-down list

Variable Name	Select the variable which needs to be shocked from under the **Interest Rate Variable** > **Numeric Variable**.
Is Formula Based	Select **Yes**.
Time Specification	Select **MR – Time Hierarchy**. This hierarchy determines the horizon of the shock.
Shock Type	Shock Type selection has two options: ▪ Instantaneous ▪ Across Time In you select Across Time, provide information in the fields: - Shock in Reference to: Select whether it is Current Value, or Future Estimated Value - Time Point: Select whether Custom or standard - Number of Time Points: Enter values for **Time Points in Past** and **Time Points in Future** - Shock Current Value: Select the check box, and specify the time as Days, Weeks, months or Years, and click to load the time point values. - Time Point Values: Specify the time point values. If you select the **Standard** option, the points will be consecutive values between **Time Points in Past** to **Time Points in Future**. The value will be in **Days**, **Weeks**, **Months** and **Years** depending on the selection. If you select **Custom**, the points will be custom user specified values between **Time Points in Past** to **Time Points in Future.** 
Parameters	**Shock Unit**: Select one of the following: ▪ Percentage Shift ▪ Absolute Shift ▪ Absolute Value ▪ Standard Deviation Shift ▪ Log Standard Deviation Shift: If you select this option, specify the **Time Window Size**. Click button to add shock values as shown below.



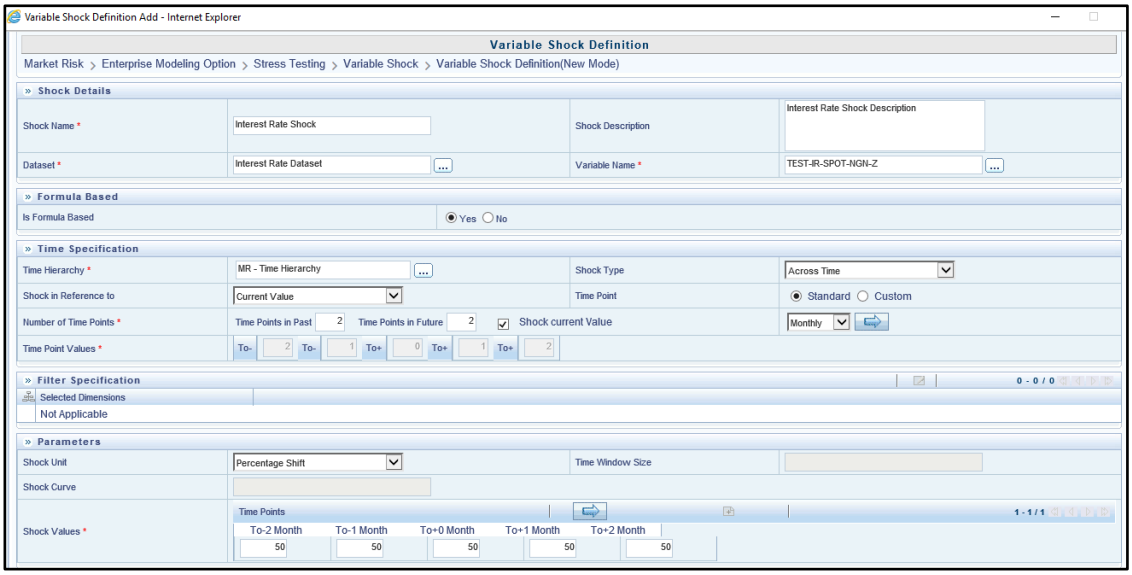


Figure 63 Variable Shock Definition Screen

7. Save the Definition.

13.1.4 Commodity Price

Follow the below steps to define a variable, and assign shock for Commodity Price:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.
2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.
3. Click **Add** icon in the **Variable Definition** screen.

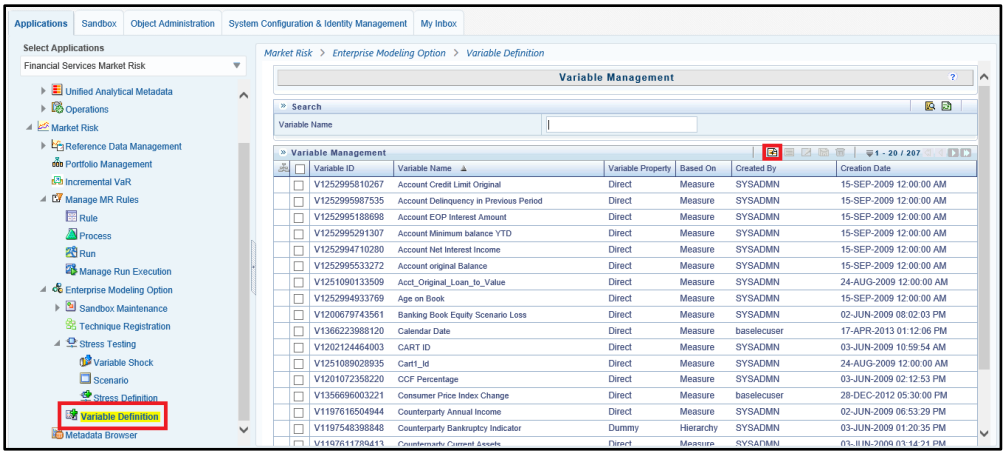


Figure 64 Variable Definition Screen

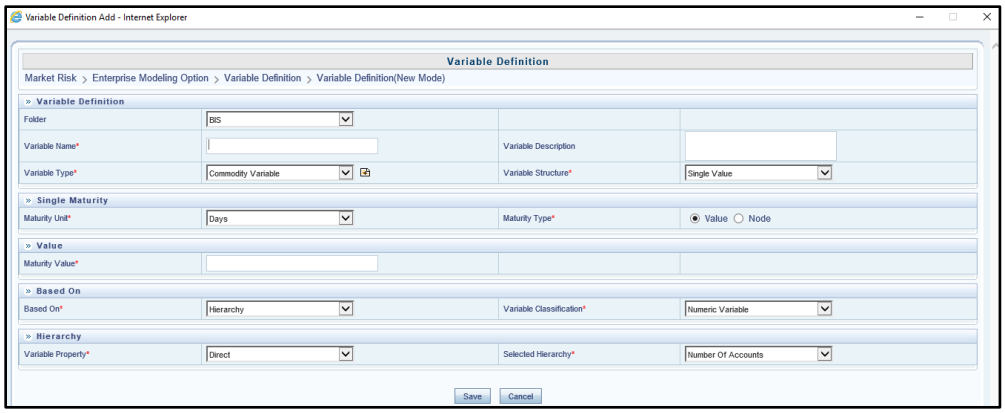


Figure 65 Variable Definition Screen

4. Define the exchange rate variables as below:

Folder	Select the Folder from the drop-down list, in which the Variable Definition is to be saved.
Variable Name	Provide the variable name.
Variable Description	Provide the variable description.
Variable Type	Select **Commodity Variable** from the drop-down list.
Variable Structure	Select **Single Value**.
Maturity Unit	Select one of the following: ▪ Days ▪ Months

	▪ Quarters ▪ Years
Maturity Type	Select **Node**
Selected Hierarchy	Select **Standard Time Vertices** from the list.
Selected Node	Select one of the time vertex points.
Based On	Select **Measures**.
Variable Classification	Select **Numeric Variable**
Apply Filters	Select **Yes**.
Data Set	Select **Commodity Dataset** from the drop-down list.
Selected Measures	Select **Commodity Price** from the drop-down list
Filters	Click the edit button, and select **Commodity Asset** and **Standard Time Vertices** from the Hierarchy browser.
Commodity Asset	Select **Commodity Asset** under Filters. Click the edit button corresponding to Commodity Asset, and select the required Commodity Asset.
Standard Time Vertices	Select Standard Time Vertices under Filters. Click the edit button corresponding to Standard Time Vertices, and select the required Standard Time Vertices.

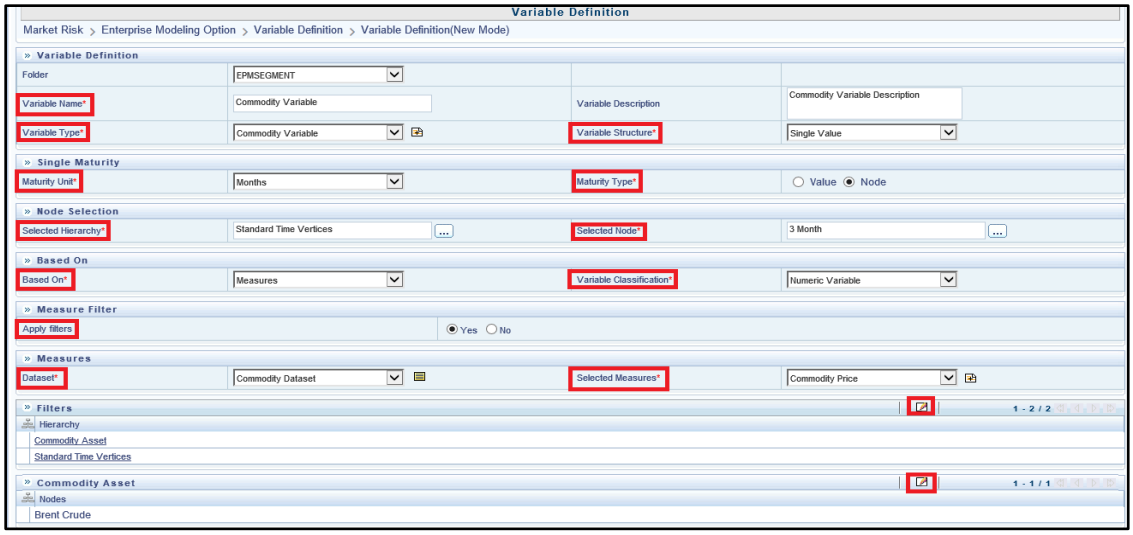


Figure 66 Variable Definition Screen

5. Navigate to the **Variable Shock** screen.

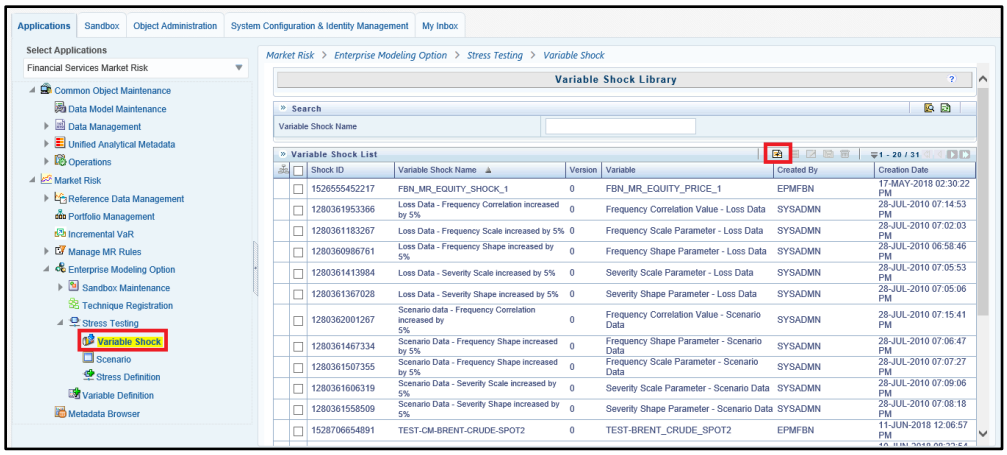
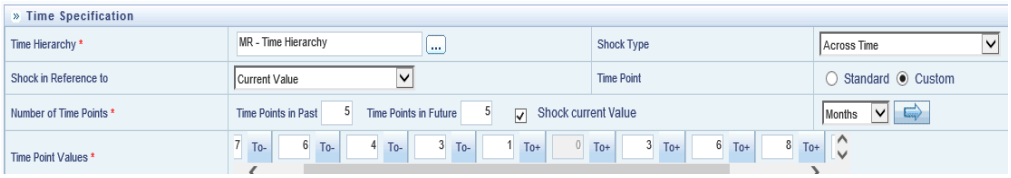
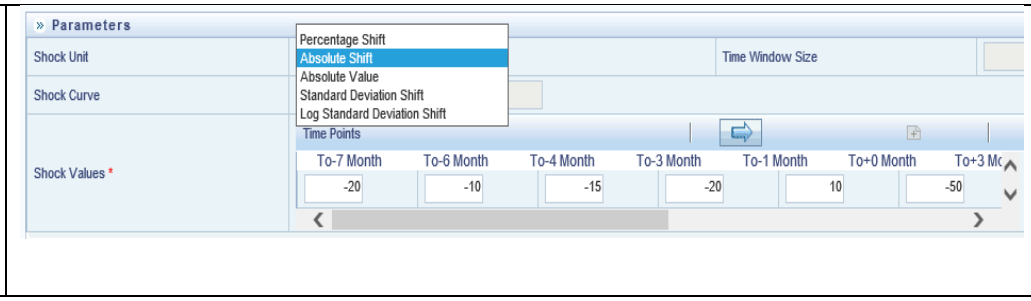


Figure 67 Variable Definition Screen

6. Define the variable shock as follows:

Shock Name	Specify a Shock Name
Shock Description	Provide a description for the Shock.
Dataset	Select **Commodity Dataset** from the drop-down list
Variable Name	Select the variable which needs to be shocked from under the **Commodity Variable** > **Numeric Variable**.

Is Formula Based	Select **Yes**.
Time Specification	Select **MR – Time Hierarchy**. This hierarchy determines the horizon of the shock.
Shock Type	Shock Type selection has two options: ▪ Instantaneous ▪ Across Time In you select Across Time, provide information in the fields: - Shock in Reference to: Select whether it is Current Value, or Future Estimated Value - Time Point: Select whether Custom or standard - Number of Time Points: Enter values for **Time Points in Past** and **Time Points in Future** - Shock Current Value: Select the check box, and specify the time as Days, Weeks, months or Years, and click ➡ to load the time point values. - Time Point Values: Specify the time point values. If you select the **Standard** option, the points will be consecutive values between **Time Points in Past** to **Time Points in Future**. The value will be in **Days**, **Weeks**, **Months** and **Years** depending on the selection. If you select **Custom**, the points will be custom user specified values between **Time Points in Past** to **Time Points in Future.** 
Parameters	**Shock Unit**: Select one of the following: ▪ Percentage Shift ▪ Absolute Shift ▪ Absolute Value ▪ Standard Deviation Shift ▪ Log Standard Deviation Shift: If you select this option, specify the **Time Window Size**. Click ➡ button to add shock values as shown below.



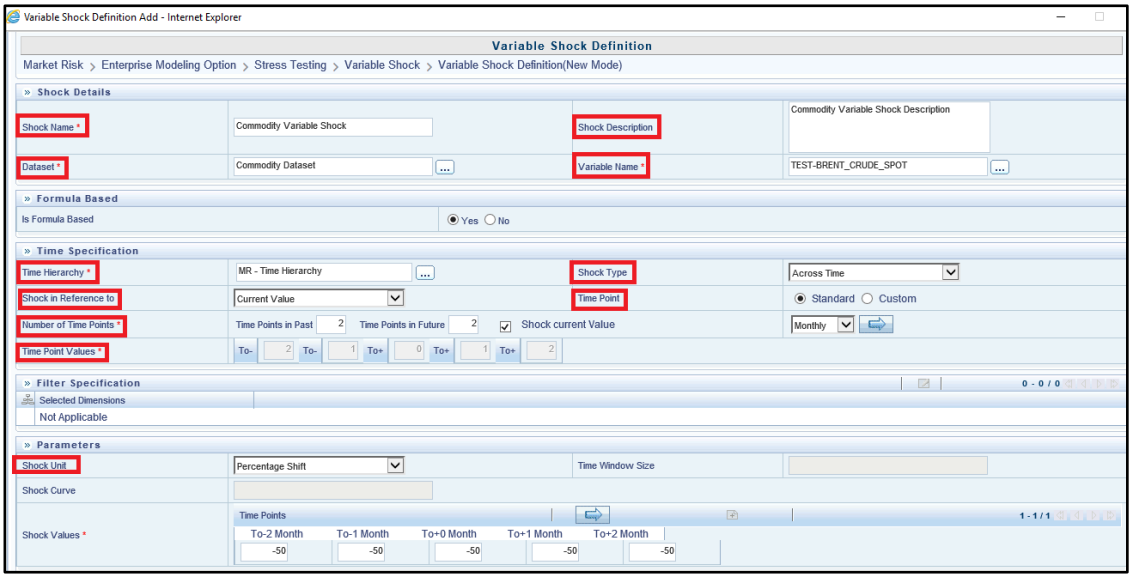


Figure 68 Variable Shock Definition Screen

7. Save the Definition.

13.1.5 Volatility

Follow the below steps to define a variable, and assign shock for Volatility:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.
2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.
3. Click **Add** icon in the **Variable Definition** screen.

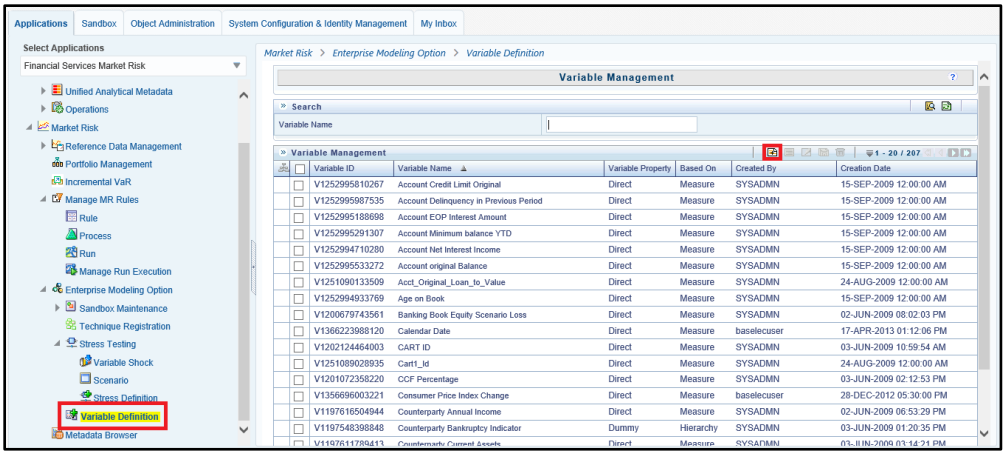


Figure 69 Variable Definition Screen

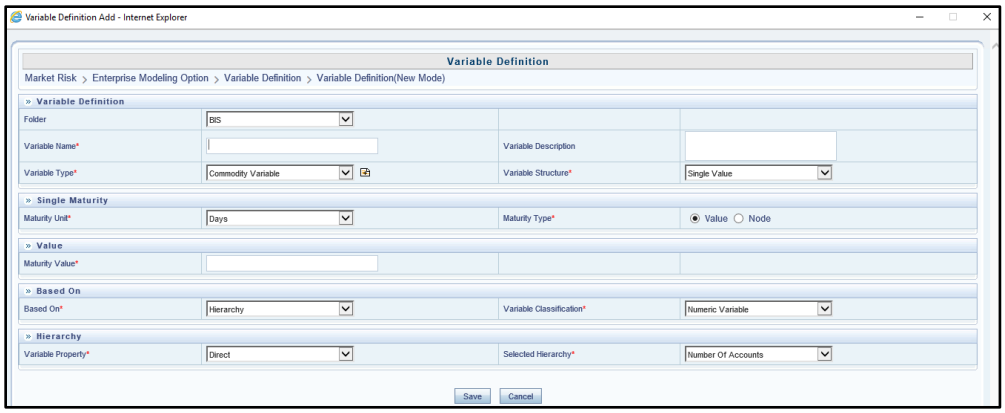


Figure 70 Variable Definition Screen

4. Define the exchange rate variables as below:

Folder	Select the Folder from the drop-down list, in which the Variable Definition is to be saved.
Variable Name	Provide the variable name.
Variable Description	Provide the variable description.
Variable Type	Select **Idiosyncratic Variable** from the drop-down list.
Variable Structure	Select **Single Value**.
Based On	Select **Measures**.
Variable Classification	Select **Numeric Variable**

Apply Filters	Select **Yes**.
Data Set	Select **Market Risk Factor Statistics** from the drop-down list.
Selected Measures	Select **Risk Factor Volatility** from the drop-down list
Filters	Click the edit button, and select **ASSETCLASS1, ASSET1, TIMEVERTEX1, CURRENCY1, ASSETCLASS2, ASSET2, TIMEVERTEX2 and CURRENCY2** from the Hierarchy browser.
ASSETCLASS1, ASSET1, TIMEVERTEX1, CURRENCY1, ASSETCLASS2, ASSET2, TIMEVERTEX2 and CURRENCY2	Click each member under Filters. Click the edit button corresponding to each member, and select the required item.

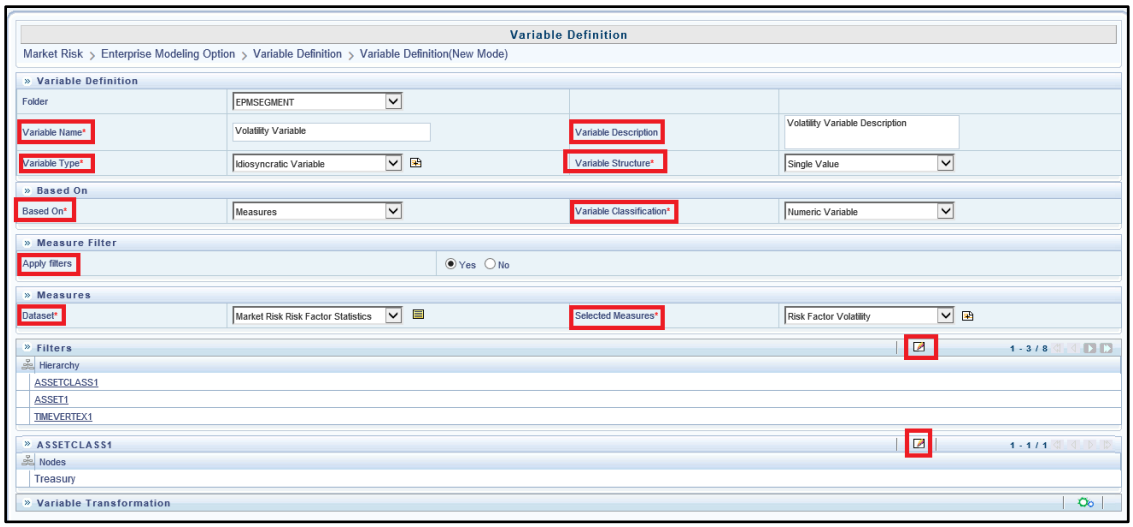


Figure 71 Variable Definition Screen

5. Navigate to the **Variable Shock** screen.

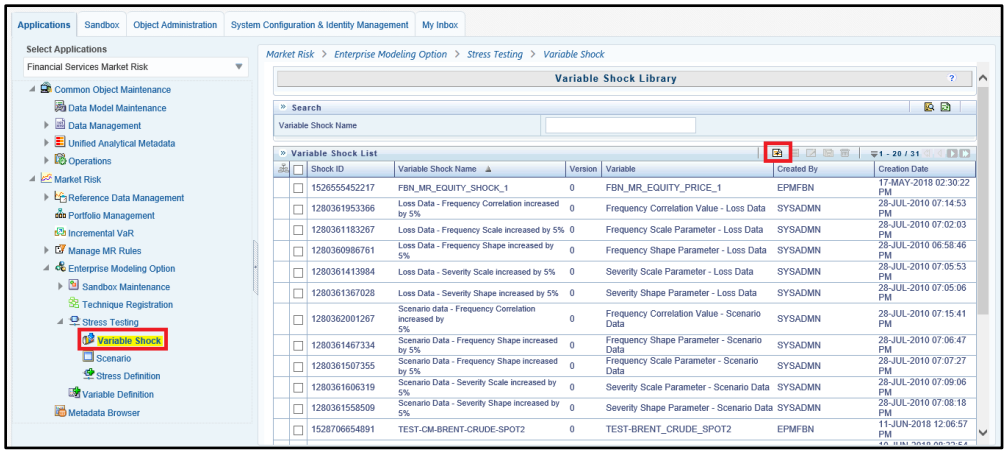
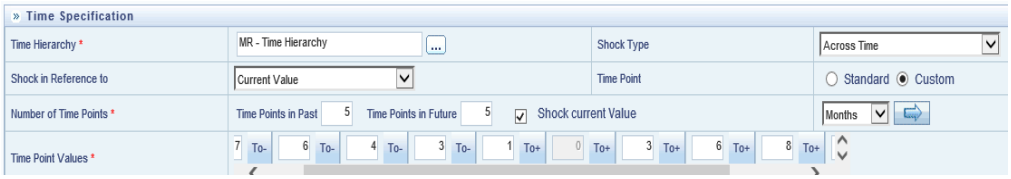
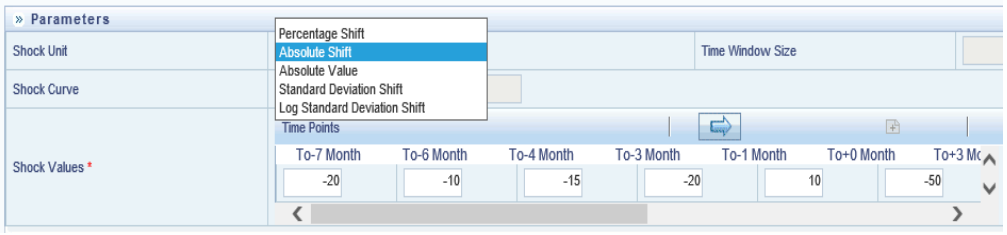


Figure 72 Variable Definition Screen

6. Define the variable shock as follows:

Shock Name	Specify a Shock Name
Shock Description	Provide a description for the Shock.
Dataset	Select **Market Risk Risk Factor Statistics** from the drop-down list.
Variable Name	Select the variable which needs to be shocked from under the **Idiosyncratic Variable** > **Numeric Variable**.
Is Formula Based	Select **Yes**.
Time Specification	Select **MR – Time Hierarchy**. This hierarchy determines the horizon of the shock.
Shock Type	Shock Type selection has two options: ▪ Instantaneous ▪ Across Time In you select Across Time, provide information in the fields: - Shock in Reference to: Select whether it is Current Value, or Future Estimated Value - Time Point: Select whether Custom or standard - Number of Time Points: Enter values for **Time Points in Past** and **Time Points in Future** - Shock Current Value: Select the check box, and specify the time as Days, Weeks, months or Years, and click ➡ to load the time point values.

	- Time Point Values: Specify the time point values. If you select the **Standard** option, the points will be consecutive values between **Time Points in Past** to **Time Points in Future**. The value will be in **Days**, **Weeks**, **Months** and **Years** depending on the selection. If you select **Custom**, the points will be custom user specified values between **Time Points in Past** to **Time Points in Future.** 
Parameters	**Shock Unit**: Select one of the following: ▪ Percentage Shift ▪ Absolute Shift ▪ Absolute Value ▪ Standard Deviation Shift ▪ Log Standard Deviation Shift: If you select this option, specify the **Time Window Size**. Click button to add shock values as shown below. 

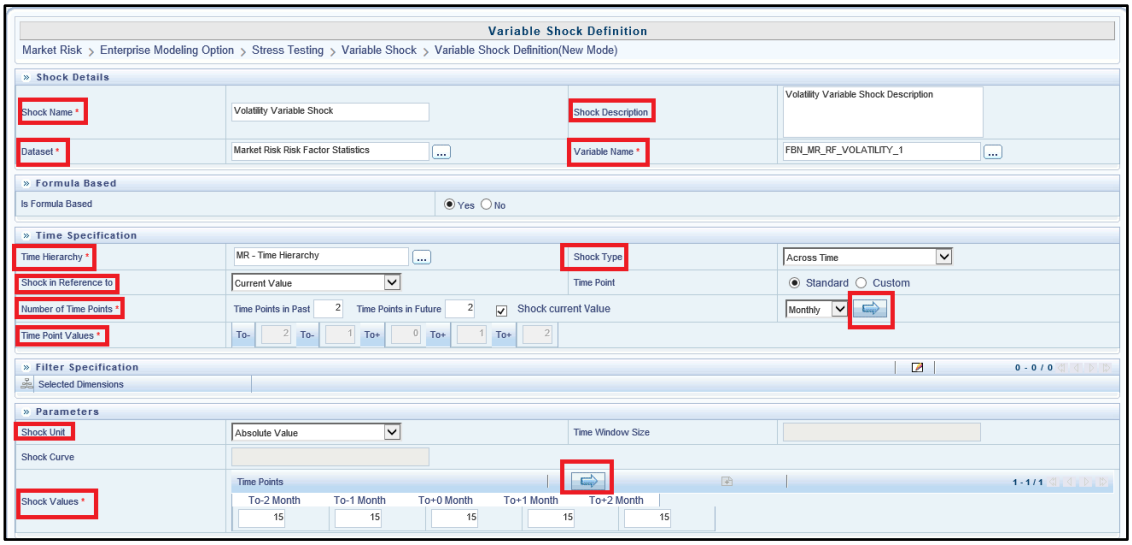


Figure 73 Variable Shock Definition Screen

7. Save the Definition.

13.1.6 Correlation

Follow the below steps to define a variable, and assign shock for Correlation:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.
2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.
3. Click **Add** icon in the **Variable Definition** screen.

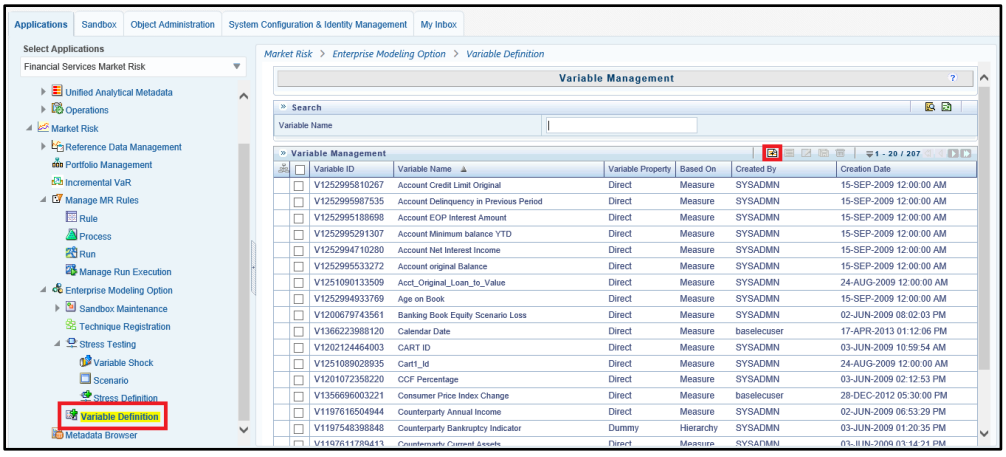


Figure 74 Variable Definition Screen

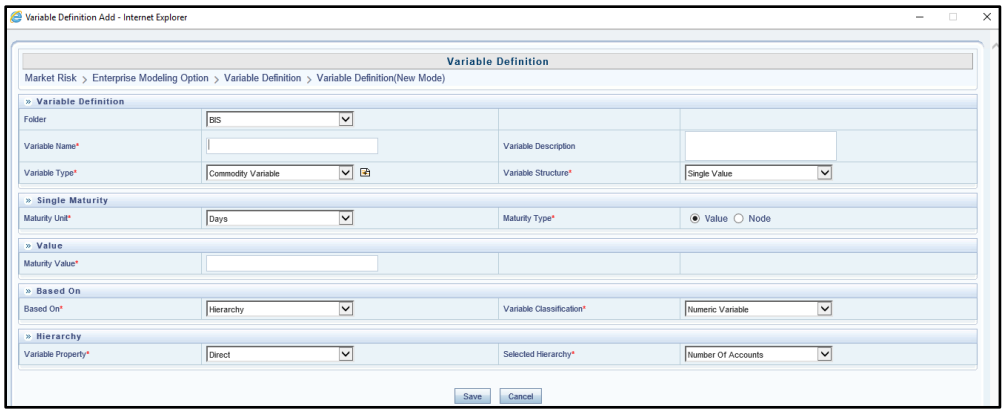


Figure 75 Variable Definition Screen

4. Define the exchange rate variables as below:

Folder	Select the Folder from the drop-down list, in which the Variable Definition is to be saved.
Variable Name	Provide the variable name.
Variable Description	Provide the variable description.
Variable Type	Select **Idiosyncratic Variable** from the drop-down list.
Variable Structure	Select **Single Value**.
Based On	Select **Measures**.
Variable Classification	Select **Numeric Variable**
Apply Filters	Select **Yes**.
Data Set	Select **Market Risk Factor Statistics** from the drop-down list.
Selected Measures	Select **Risk Factor Correlation** from the drop-down list
Filters	Click the edit button, and select **ASSETCLASS1, ASSET1, TIMEVERTEX1, CURRENCY1, ASSETCLASS2, ASSET2, TIMEVERTEX2 and CURRENCY2** from the Hierarchy browser.
ASSETCLASS1, ASSET1, TIMEVERTEX1,	Click each member under Filters. Click the edit button corresponding to each member, and select the required item.

CURRENCY1, ASSETCLASS2, ASSET2, TIMEVERTEX2 and CURRENCY2	

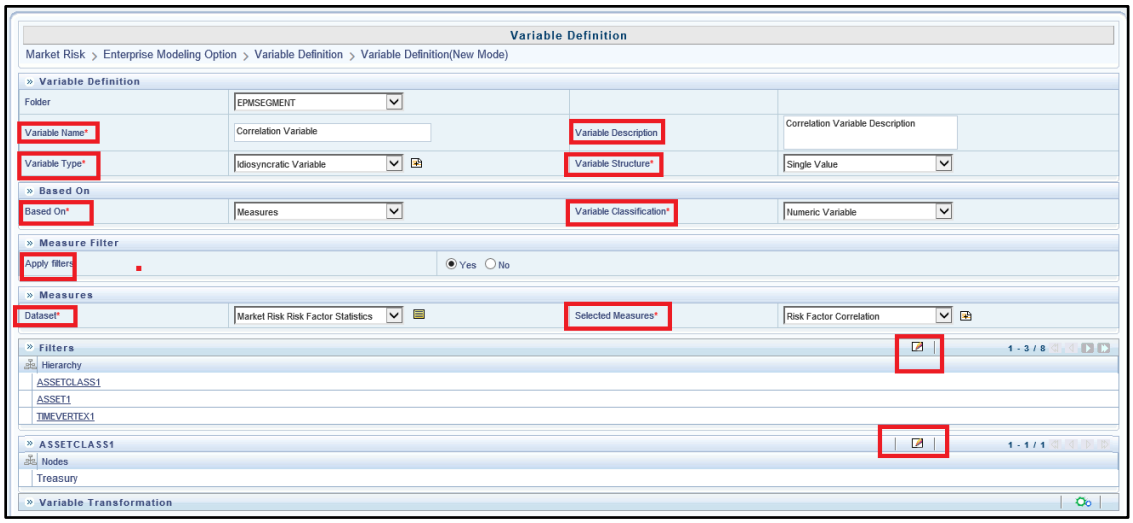


Figure 76 Variable Definition Screen

5. Navigate to the **Variable Shock** screen.

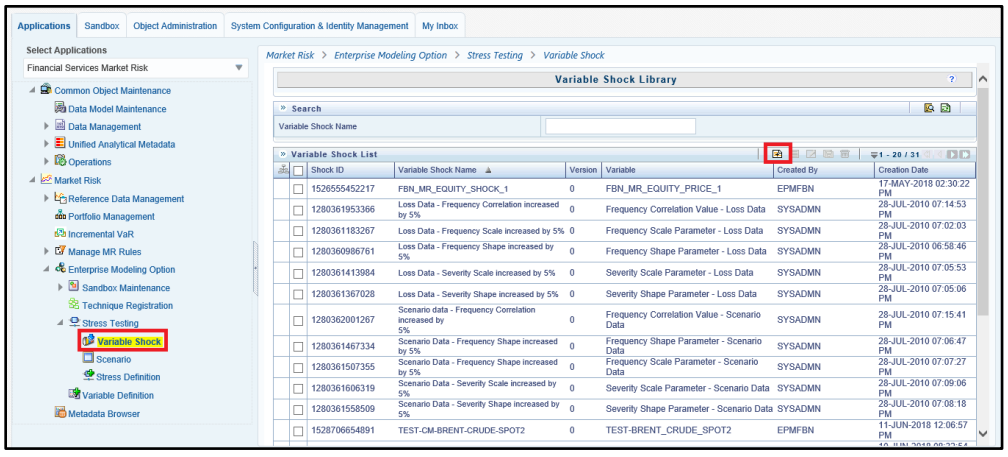
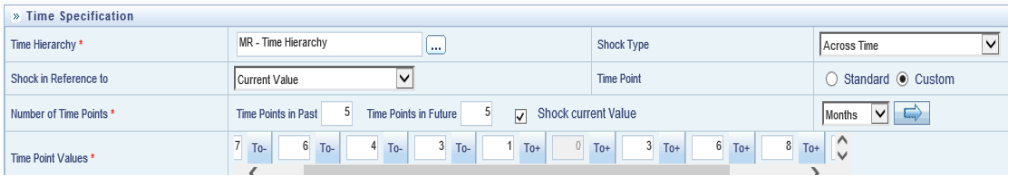
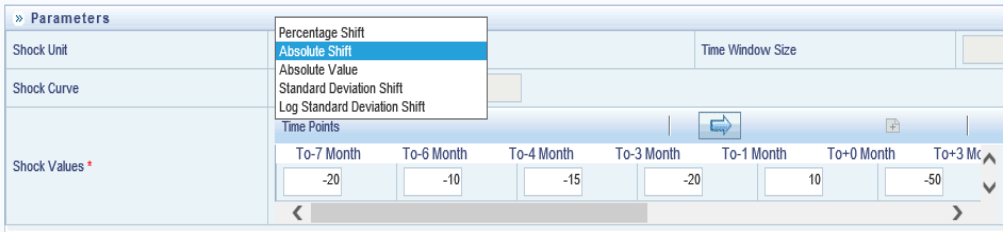


Figure 77 Variable Definition Screen

6. Define the variable shock as follows:

Shock Name	Specify a Shock Name
Shock Description	Provide a description for the Shock.
Dataset	Select **Market Risk Risk Factor Statistics** from the drop-down list.
Variable Name	Select the variable which needs to be shocked from under the **Correlation Variable** > **Numeric Variable**.
Is Formula Based	Select **Yes**.
Time Specification	Select **MR – Time Hierarchy**. This hierarchy determines the horizon of the shock.
Shock Type	Shock Type selection has two options: ▪ Instantaneous ▪ Across Time In you select Across Time, provide information in the fields: - Shock in Reference to: Select whether it is Current Value, or Future Estimated Value - Time Point: Select whether Custom or standard - Number of Time Points: Enter values for **Time Points in Past** and **Time Points in Future** - Shock Current Value: Select the check box, and specify the time as Days, Weeks, months or Years, and click to load the time point values. - Time Point Values: Specify the time point values. If you select the **Standard** option, the points will be consecutive values between **Time Points in Past** to **Time Points in Future**. The value will be in **Days**, **Weeks**, **Months** and **Years** depending on the selection. If you select **Custom**, the points will be custom user specified values between **Time Points in Past** to **Time Points in Future.** 
Parameters	**Shock Unit**: Select one of the following: ▪ Percentage Shift ▪ Absolute Shift ▪ Absolute Value

	▪ Standard Deviation Shift ▪ Log Standard Deviation Shift: If you select this option, specify the **Time Window Size**. Click ➡ button to add shock values as shown below. 

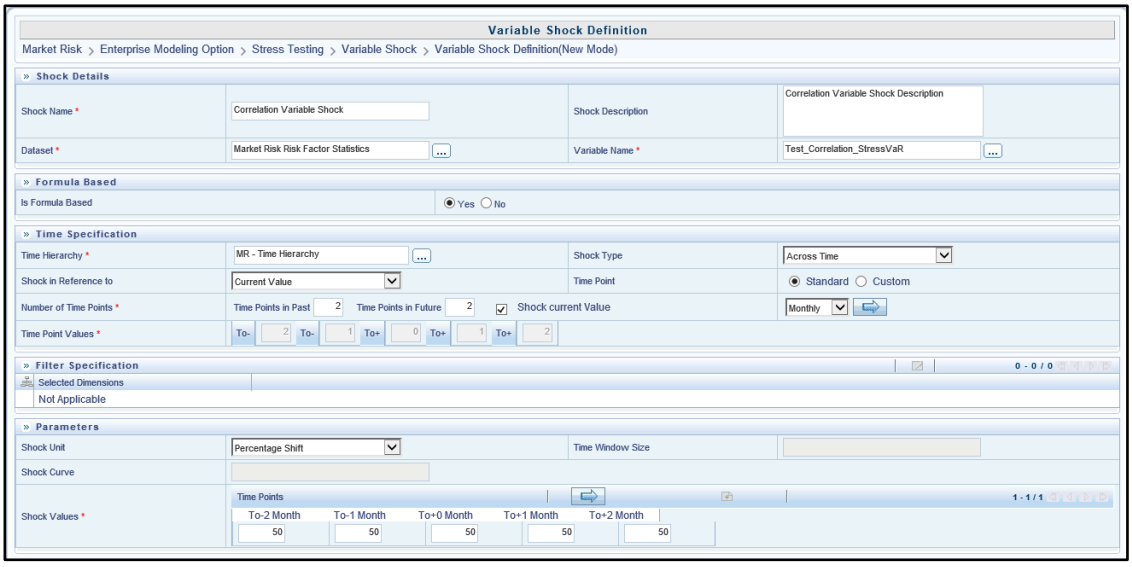


Figure 78 Variable Shock Definition Screen

7. Save the Definition.

13.2 Defining a Scenario

Follow the below steps to define a scenario:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.
2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.

3. Click **Scenario**.
4. Click the Add icon in the Scenario Management screen. Ensure that the variable and variable shocks are defined, before they are added to the Scenario in the below steps.

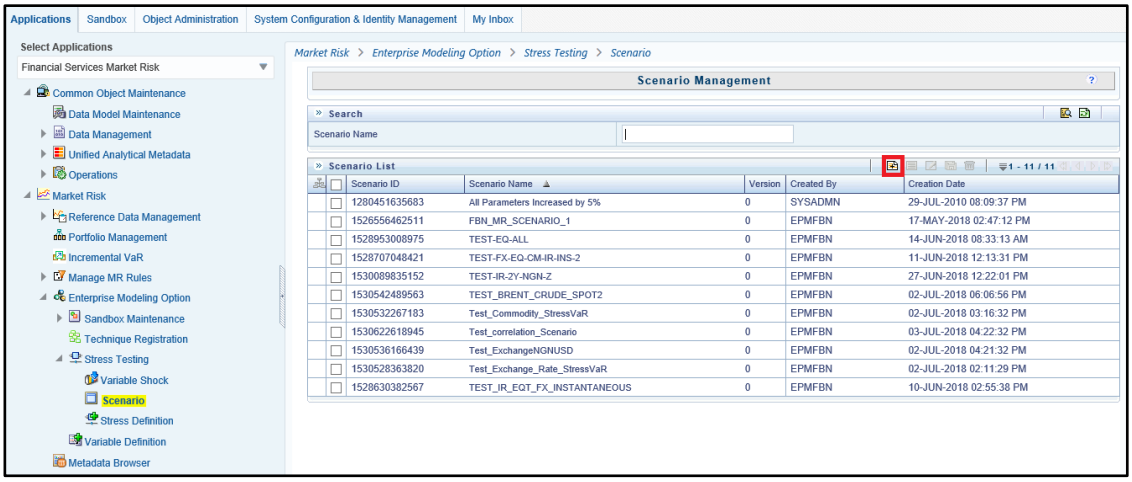


Figure 79 Scenario Management Screen

5. The scenario definition screen is displayed.

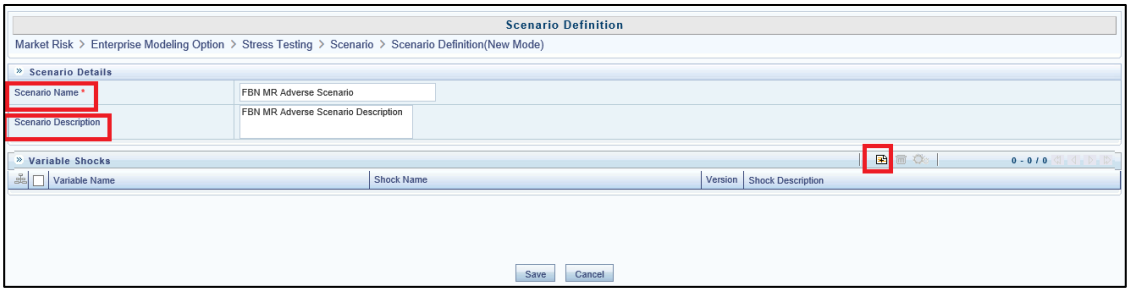


Figure 80 Scenario Definition Screen

6. Provide a name and description for the scenario. Click the Add icon in **Variable Shocks** section. The below screen is displayed.

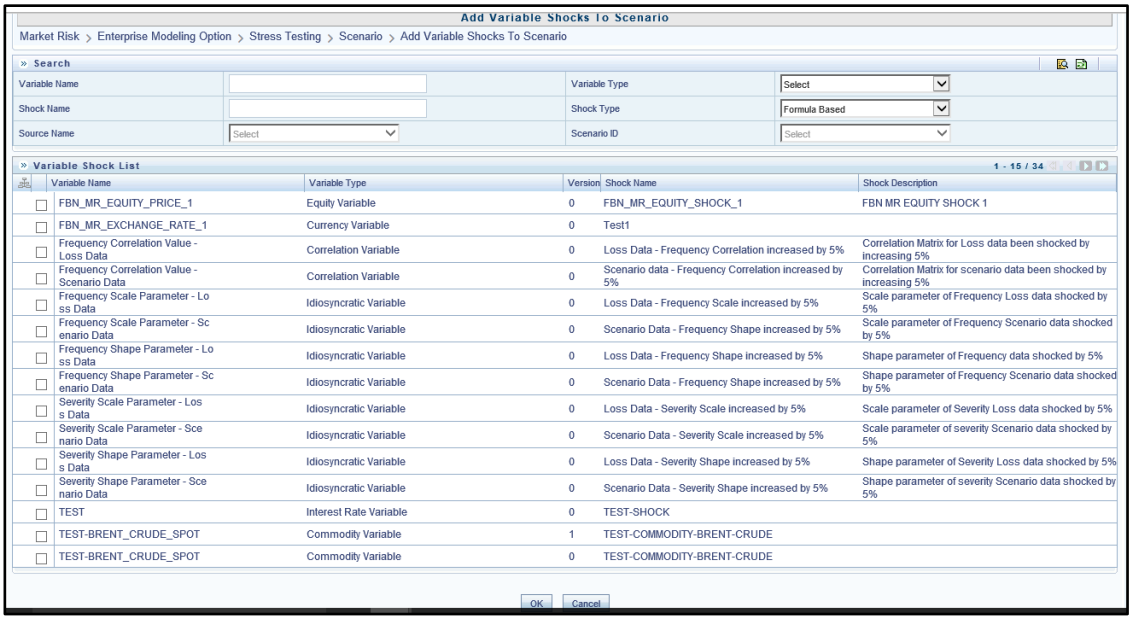


Figure 81 Adding Variable Shocks to Scenario

7. Select the shocks.

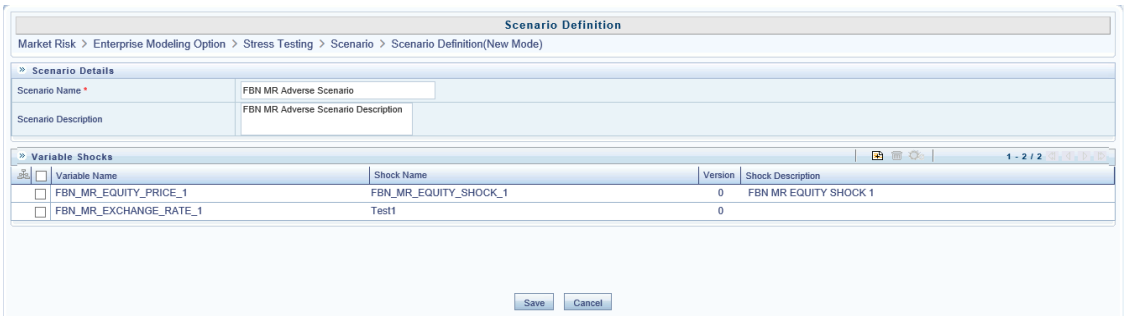


Figure 82 Adding Variable Shocks to Scenario – Scenario Definition

8. Click **Save**.

13.3 Defining a Stress

Follow the below steps to define a stress:

1. In **Oracle Financial Services Analytical Applications Infrastructure** under Select Applications select **Financial Services Market Risk**.

2. To open the stress testing screen, Select **Enterprise Modeling Option** > **Stress Testing** on the Left-Hand Side (LHS) menu.
3. Click **Stress Definition**.
4. Click the Add icon in the **Stress Definition** screen. Ensure that the scenario is defined, before they are added to the Stress definition in the below steps.

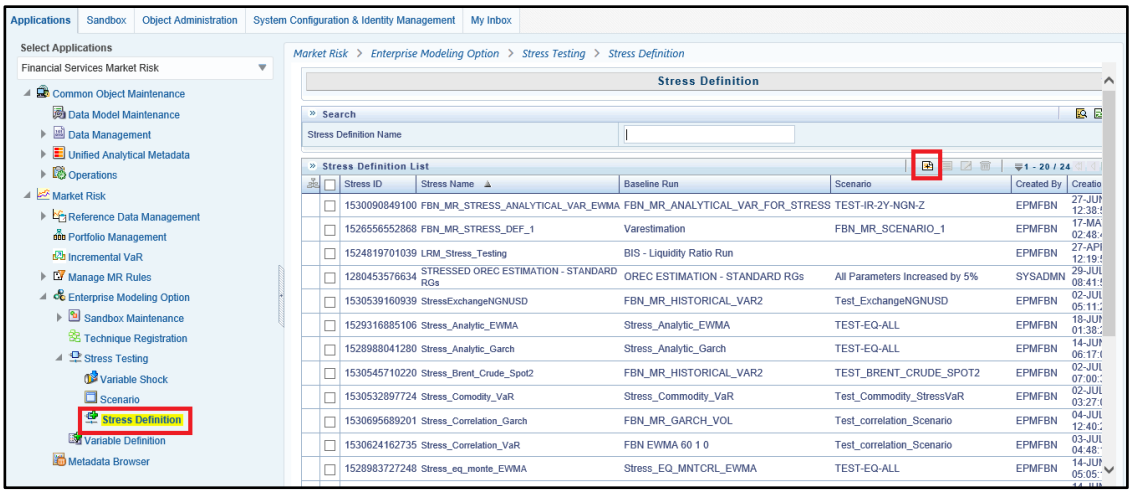


Figure 83 Stress Definition Screen

5. The Stress definition screen is displayed.

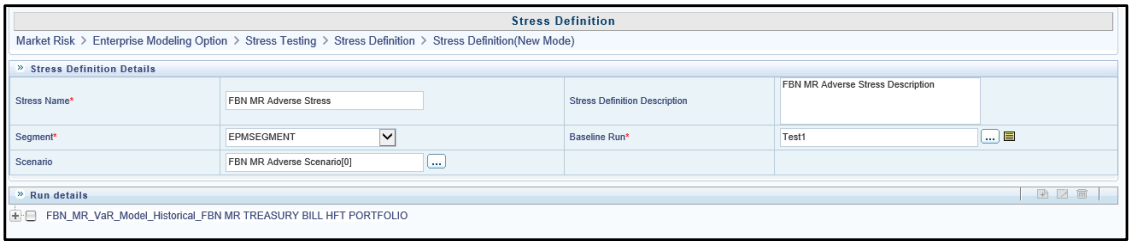


Figure 84 Stress Definition

6. Provide a name and description for the stress.
7. Select the Baseline VaR or Baseline Volatility Run.
8. Select the required scenario.

   Note: The Volatility and Correlation Shocks affect the Volatility Model runs. When a Stressed VaR model is run, the application first searches for the

Stressed Volatility output. In the absence of Stressed Volatility, the application takes the Baseline Volatility for processing.

9. Click **Save**.

14 Annexure E: Market Risk Reports

The reports which form part of the Market Risk dashboard are grouped into the following subject areas based on their functionality:

- Risk Measures
- Cash Flows
- Component VaR - Analytic Method
- Component VaR - Simulation Method
- Marginal & Incremental VaR
- Greeks
- Stress & Back Testing
- Comparison Across Portfolios
- Comparison Across VaR Models
- Market Analysis

14.1 Risk Measures Subject Area

The following reports are displayed as part of the Risk Measures subject area:

- Combined Alert
- Portfolio Value Across Time
- Profit and Loss Distribution
- Risk Estimation Static
- Risk Measure Report
- Risk Measures Across Time

14.1.1 Combined Alert

Dashboard Page Name	Risk Measures
Report Name	Combined Alert
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Reveleus Market Risk Dashboard displays the following Alerts: Limit Alert Limit Alert is displayed when the VaR estimate of a portfolio under a given Market Risk VaR Model exceeds the VaR Limit specified. Hypothetical P&L Alert Hypothetical P&L Alert is displayed when the Hypothetical Loss of a portfolio exceeds the VaR estimate. The Alerts are displayed for all portfolios under all Market Risk VaR Models to which they are mapped for the selected date.

14.1.2 Portfolio Value Across Time

Dashboard Page Name	Risk Measures
Report Name	Portfolio Value Across Time
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Portfolio Value across Time is a 3-axis chart for a trailing period of 30 business days on a daily time-step basis. The graph has the date on the horizontal axis, Portfolio Value on the left-side vertical axis and the VaR % of Portfolio Value on the right-side vertical axis.

14.1.3 Profit and Loss Distribution

Dashboard Page Name	Risk Measures
Report Name	Profit and Loss Distribution
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Profit and Loss Distribution is a graphical display of the Profit & Loss Distribution under the Simulation Methods to Risk Measure Estimation. The graph has the P&L values on the horizontal axis and the frequency of the P&L values on the vertical axis. The P&L values are bucketed into equal-width buckets in order to estimate the frequency. The graph is a stacked column graph where the data falling within the 10% mark, 20% mark, 30% mark and 40%-70% is displayed in a different color.

14.1.4 Risk Estimation Static

Dashboard Page Name	Risk Measures
Report Name	Risk Estimation Static
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	On selection of page level filters parameters of selected Market Risk VaR Model are displayed. Details displayed are Risk Measure Estimation Method, Confidence Level, Reporting Currency and Horizon (in days).

14.1.5 Risk Measure Report

Dashboard Page Name	Risk Measures
Report Name	Risk Measure Report
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Report displays the risk measures for the selected portfolio and VaR model. The following risk measures are reported in a tabular format: Value-at-Risk Conditional Value-at-Risk Current Portfolio Value Simulated Portfolio Value VaR % of Current Portfolio Value Portfolio VaR Limit

14.1.6 Risk Measures Across Time

Dashboard Page Name	Risk Measures
Report Name	Risk Measures Across Time
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Risk Measures across Time is a 2-axis chart for a trailing period of 30 business days on a daily time-step basis. The graph has the date on the horizontal axis and the VaR, CVaR and Portfolio VaR Limit values on the vertical axis.

14.2 Cash Flows Subject Area

The following reports are displayed as part of the Cash Flows subject area:

- Aggregate Cash Flow Map

- Allocated Cash Flow Report
- Cash Flow by Asset
- Cash Flow by Asset Class
- Risk Estimation Method

14.2.1 Aggregate Cash Flow Map

Dashboard Page Name	Cash Flows
Report Name	Aggregate Cash Flow Map
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Aggregate Cash Flow Map is a 2-dimensional surface chart which has the Asset Class – Maturity on the x-axis, the cash flows on the y-axis and the Asset indicated as stacked.

14.2.2 Allocated Cash Flow Report

Dashboard Page Name	Cash Flows
Report Name	Allocated Cash Flow Report
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Allocated Cash Flow Report is a report displaying the cash flows of each Asset – Asset Class – Maturity vertex in a tabular format.

14.2.3 Cash Flow by Asset

Dashboard Page Name	Cash Flows
Report Name	Cash Flow by Asset
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Cash Flow Map by Asset is a 2-axis chart which has the Asset on the horizontal axis and the cash flows on the vertical axis.
Drill-through On	On selection of a particular bar, the cash flows from each Asset Class – Maturity in the selected Asset are displayed.

14.2.4 Cash Flow by Asset Class

Dashboard Page Name	Cash Flows
Report Name	Cash Flow by Asset Class
Dashboard Name	Market Risk

Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Cash Flow Map by Asset Class is a 2-axis chart which has the Asset Class on the horizontal axis and the cash flows on the vertical axis. The cash flows of various maturities of an Asset Class are summed up and the aggregate cash flows from each Asset Class are displayed.

14.2.5 Risk Estimation Method

Dashboard Page Name	Cash Flows
Report Name	Risk Estimation Method
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	On selection of page level filters parameters of selected Market Risk VaR Model are displayed. Details displayed are Risk Measure Estimation Method, Confidence Level, Reporting Currency and Horizon (in days).

14.3 Component VaR - Analytic Method Subject Area

The following reports are displayed as part of the Component VaR - Analytic Method subject area:

- Baseline Portfolio VaR
- Component VaR by Vertex
- Component VaR by Dimension
- Risk Estimation Method
- Top 10 Contributors to Portfolio VaR (by Vertex)

14.3.1 Baseline Portfolio VaR

Dashboard Page Name	Component VaR - Analytic Method
Report Name	Baseline Portfolio VaR
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	The VaR of the selected portfolio under the Market Risk VaR Model selected is displayed.

14.3.2 Component VaR by Vertex

Dashboard Page Name	Component VaR - Analytic Method
Report Name	Component VaR by Vertex
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Component VaR by Vertex is a detailed report of the Component VaR of each Asset – Asset Class – Maturity vertex of the selected portfolio. It consists of the following: Asset Asset Class – Maturity Component VaR % of Portfolio VaR Rank The ranking is done by displaying a different color for each Asset –Asset Class – Maturity vertex whose Component VaR falls within the following range: Top 10% 10% - 20% 20% -30% Others

14.3.3 Component VaR by Dimension

Dashboard Page Name	Component VaR - Analytic Method
Report Name	Component VaR by Dimension
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0

Report Description	Component VaR by Dimension is a graphical report displaying the component VaR of each member of the selected dimension. The dimensions to be displayed are as follows: Asset Asset Class
Drill-through On	Level 1Drill-through Asset Drill-through to the level of Component VaR of each maturity of each selected Asset (commodity only). Asset Class Interest Rate/Commodity Asset Classes On selection of the interest rate or commodity section of the chart, the component VaR of each Maturity in the selected Asset Class is displayed. Equity/Currency Asset Classes On selection of the equity or currency section of the chart, the component VaR of each Maturity in the selected Asset Class is displayed. Level 2 Drill-through Only the Asset Class dimension has a 2-level drill-through. Interest Rate On selection of a particular maturity in the Level 1 drill-through chart, the component VaR of each Asset (currency) belonging to the selected Asset Class – Maturity combination is displayed. Commodity On selection of a particular maturity in the Level 1 drill-through chart, the component VaR of each Asset (commodity) belonging to the selected Asset Class – Maturity combination is displayed. **Note**: All dimensions excluding Asset Class have only 1 level of drill-through. Also, the Asset Classes Currency and Equity do not have a second level drill-through.

14.3.4 Risk Estimation Method

Dashboard Page Name	Component VaR - Analytic Method

Report Name	Risk Estimation Method
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	On selection of page level filters parameters of selected Market Risk VaR Model are displayed. Details displayed are Risk Measure Estimation Method, Confidence Level, Reporting Currency and Horizon (in days).

14.3.5 Top 10 Contributors to Portfolio VaR (by Vertex)

Dashboard Page Name	Component VaR - Analytic Method
Report Name	Top 10 Contributors to Portfolio VaR (by Vertex)
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	This is a graphical report of the 10 Asset – Asset Class – Maturity vertices which have the highest Component VaR.

14.4 Component VaR - Simulation Method Subject Area

The following reports are displayed as part of the Component VaR - Simulation Method subject area:

- Component VaR by Dimension
- Risk Estimation Method
- Top 10 Contributors to Portfolio VaR (by Instrument)

14.4.1 Component VaR by Dimension

Dashboard Page Name	Component VaR - Simulation Method
Report Name	Component VaR by Dimension
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Component VaR by Dimension is a graphical report displaying the component VaR of each member of the selected dimension. The dimensions to be displayed are as follows: Asset Asset Class Counterparty Currency Instrument Type Legal Entity Line of Business Trading Desk
Drill-through On	Level 1Drill-through Asset Drill-through to the level of Component VaR of each maturity of each selected Asset (commodity only). Asset Class Interest Rate/Commodity Asset Classes

	On selection of the interest rate or commodity section of the chart, the component VaR of each Maturity in the selected Asset Class is displayed. Equity/Currency Asset Classes On selection of the equity or currency section of the chart, the component VaR of each Maturity in the selected Asset Class is displayed. Instrument Type On selection of a particular instrument type, the component VaR of each instrument of the selected instrument type is displayed. iv. Trading Desk On selection of a particular trading desk, the component VaR of each trader belonging to the selected trading desk is displayed. **Note**: There is no drill-through for the dimensions Counterparty, Currency, Legal Entity and Line of Business. Level 2 Drill-through Only the Asset Class dimension has a 2-level drill-through. Interest Rate On selection of a particular maturity in the Level 1 drill-through chart, the component VaR of each Asset (currency) belonging to the selected Asset Class – Maturity combination is displayed. Commodity On selection of a particular maturity in the Level 1 drill-through chart, the component VaR of each Asset (commodity) belonging to the selected Asset Class – Maturity combination is displayed. **Note**: All dimensions excluding Asset Class have only 1 level of drill-through. Also, the Asset Classes Currency and Equity do not have a second level drill-through.

14.4.2 Risk Estimation Method

Dashboard Page Name	Component VaR - Analytic Method
Report Name	Risk Estimation Method
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model

Report Level Filters	0
Report Description	On selection of page level filters parameters of selected Market Risk VaR Model are displayed. Details displayed are Risk Measure Estimation Method, Confidence Level, Reporting Currency and Horizon (in days).

14.4.3 Top 10 Contributors to Portfolio VaR (by Instrument)

Dashboard Page Name	Component VaR - Analytic Method
Report Name	Top 10 Contributors to Portfolio VaR (by Instrument)
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	This is a graphical report of the 10 Instruments which have the highest Component VaR.

14.5 Marginal & Incremental VaR Subject Area

The following reports are displayed as part of the Marginal & Incremental VaR subject area:

- Incremental VaR
- Marginal VaR by Vertex
- Risk Estimation Method
- Top 10 Marginal VaR Contributors (by Vertex)

14.5.1 Incremental VaR

Dashboard Page Name	Marginal & Incremental VaR
Report Name	Incremental VaR
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model

Report Level Filters	0
Report Description	This is a tabular report displaying information related to incremental VaR. Following are the information that are displayed in tabular format: Incremental Portfolio VaR Portfolio VaR limit Limit utilization as incremental VaR percentage Baseline portfolio VaR Percentage Increase in portfolio VaR Limit utilization as baseline portfolio percentage

14.5.2 Marginal VaR by Vertex

Dashboard Page Name	Marginal & Incremental VaR
Report Name	Marginal VaR by Vertex
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	This is tabular report displaying marginal VaR by Asset - Asset Class and Maturity. Additionally it also displays the ranking among the given rows. Following is the information that is displayed: Asset Asset Class Maturity Marginal VaR Rank

14.5.3 Risk Estimation Method

Dashboard Page Name	Marginal & Incremental VaR
Report Name	Risk Estimation Method
Dashboard Name	Market Risk

Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	On selection of page level filters parameters of selected Market Risk VaR Model are displayed. Details displayed are Risk Measure Estimation Method, Confidence Level, Reporting Currency and Horizon (in days).

14.5.4 Top 10 Marginal VaR Contributors (by Vertex)

Dashboard Page Name	Marginal & Incremental VaR
Report Name	Top 10 Marginal VaR Contributors (by Vertex)
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	This is Graphical representation of top ten Marginal VaR. Top ten ranking of marginal VaR is done at Asset, Asset Class and Maturity granularity. X-axis displays Marginal VaR value and Y-axis displays Asset, Asset Class and Maturity.

14.6 Greeks

The following report is displayed as part of the Greeks subject area:

- Greeks of Option Instruments

14.6.1 Greeks of Option Instruments

Dashboard Page Name	Greeks
Report Name	Greeks of Option Instruments
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Volatility Model
Report Level Filters	0

Report Description	Report displays the greek values for option instrument in tabular format. Following measures are displayed for each Option Instrument: Delta Gamma Vega Theta Rho

14.7 Stress & Back Testing

The following reports are displayed as part of the Stress & Back Testing subject area:

- Back Test Report
- Baseline Portfolio VaR
- P&L Comparison Report
- Loss across Stress Scenarios
- P&L Distribution under Stress Scenarios
- Risk Estimation Static
- Stress Testing Report

14.7.1 Back Test Report

Dashboard Page Name	Stress & Back Testing
Report Name	Back Test Report
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Back Test report is tabular report and displays the following back test measures: Number of Back Testing Days Number of Exceptions P-value Critical value at 1% Significance Level

	Critical Value at 5% Significance Level Loss Exception Deviation Average Loss Duration (in days) Loss Duration Deviation (in days)

14.7.2 Baseline Portfolio VaR

Dashboard Page Name	Stress & Back Testing
Report Name	Baseline Portfolio VaR
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	The baseline VaR of the selected portfolio under the Market Risk VaR Model selected is displayed.

14.7.3 P&L Comparison Report

Dashboard Page Name	Stress & Back Testing
Report Name	P&L Comparison Report
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Hypothetical P&L Report is a 2-axis report which displays the hypothetical P&L and the VaR estimate under the selected Market Risk VaR Model across a trailing period of 30 business days. This graph has the date on the horizontal axis and the VaR and Hypothetical P&L on the vertical axis.

14.7.4 Loss across Stress Scenarios

Dashboard Page Name	Stress & Back Testing
Report Name	Loss across Stress Scenarios
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	This is a 2-axis bar chart displaying the stressed loss under all the stress scenarios mapped to the selected Portfolio – Market Risk VaR Model combination. The graph has the stressed loss on the horizontal axis and the stress scenarios on the vertical axis.

14.7.5 P&L Distribution under Stress Scenarios

Dashboard Page Name	Stress & Back Testing
Report Name	P&L Distribution under Stress Scenarios
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Stressed P&L Distribution is a graphical display of the P&L Distribution under the selected stress scenario. The graph has the Stressed P&L values on the horizontal axis and the frequency of the P&L values on the vertical axis. The Stressed P&L values are bucketed into equal-width buckets in order to estimate the frequency. The graph is a stacked column graph where the data falling within the 10% mark, 20% mark, 30% mark and 30%-70% is displayed in a different color.

14.7.6 Risk Estimation Static

Dashboard Page Name	Stress & Back Testing

Report Name	Risk Estimation Static
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	On selection of page level filters parameters of selected Market Risk VaR Model are displayed. Details displayed are Risk Measure Estimation Method, Confidence Level, Reporting Currency and Horizon (in days).

14.7.7 Stress Testing Report

Dashboard Page Name	Stress & Back Testing
Report Name	Stress Testing Report
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio, Market Risk VaR Model
Report Level Filters	0
Report Description	Stress Testing Report is tabular report which displays the stressed loss under each scenario mapped to the selected Portfolio.

14.8 Comparison Across Portfolios

The following reports are displayed as part of the Comparison Across Portfolios subject area:

- Back Test Report
- Risk Estimation Method
- Risk Measure Report
- Stress Testing Report

14.8.1 Back Test Report

Dashboard Page Name	Comparison Across Portfolios

Report Name	Back Test Report
Dashboard Name	Market Risk
Page Level Filters	Date, Market Risk VaR Model
Report Level Filters	0
Report Description	Back Test Report is tabular report which displays the back testing outputs for portfolio associated with Market Risk VaR Model. Number of Back Testing Days, the back test parameter of the selected Market Risk VaR Model, is displayed. In addition, the following back test measures are displayed for all the portfolios mapped to the selected Market Risk VaR Model: Number of Exceptions P-value Critical value at 1% Significance Level Critical Value at 5% Significance Level Loss Exception Deviation Average Loss Duration (in days) vii. Loss Duration Deviation (in days)

14.8.2 Risk Estimation Method

Dashboard Page Name	Comparison Across Portfolios
Report Name	Risk Estimation Method
Dashboard Name	Market Risk
Page Level Filters	Date, Market Risk VaR Model
Report Level Filters	0
Report Description	On selection of page level filters parameters of selected Market Risk VaR Model are displayed. Details displayed are Risk Measure Estimation Method, Confidence Level, Reporting Currency and Horizon (in days).

14.8.3 Risk Measure Report

Dashboard Page Name	Comparison Across Portfolios
Report Name	Risk Measure Report
Dashboard Name	Market Risk
Page Level Filters	Date, Market Risk VaR Model
Report Level Filters	0
Report Description	Risk Measure Report is tabular report which displays the VaR Model outputs for portfolio. Risk Measure Report displays the following risk measures, for all the portfolios which are mapped to the selected Market Risk VaR Model, in a tabular format: Value-at-Risk Conditional Value-at-Risk Current Portfolio Value Simulated Portfolio Value VaR % of Current Portfolio Value vi. Portfolio VaR Limit

14.8.4 Stress Testing Report

Dashboard Page Name	Comparison Across Portfolios
Report Name	Stress Testing Report
Dashboard Name	Market Risk
Page Level Filters	Date, Market Risk VaR Model
Report Level Filters	Stress Scenario
Report Description	Stress Testing Report displays stressed loss of all portfolios, mapped to the selected Market Risk VaR Model, in a tabular format. A list of all the stress scenarios defined are available for selection.

14.9 Comparison Across VaR Models

The following reports are displayed as part of the Comparison Across VaR Models subject area:

- Back Test Report
- Risk Measure Report
- Stress Testing Report

14.9.1 Back Test Report

Dashboard Page Name	Comparison Across VaR Models
Report Name	Back Test Report
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio
Report Level Filters	0
Report Description	Back Test Report is tabular report which displays the back testing outputs for portfolio associated with Market Risk VaR Model. Number of Back Testing Days, the back test parameter of the selected Market Risk VaR Model, is displayed. In addition, the following back test measures are displayed for all the portfolios mapped to the selected Market Risk VaR Model: Number of Exceptions P-value Critical value at 1% Significance Level Critical Value at 5% Significance Level Loss Exception Deviation Average Loss Duration (in days) Loss Duration Deviation (in days)

14.9.2 Risk Measure Report

Dashboard Page Name	Comparison Across VaR Models
Report Name	Risk Measure Report

Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio
Report Level Filters	0
Report Description	Risk Measure Report is tabular report which displays the VaR Model outputs for portfolio. Risk Measure Report displays the following risk measures, for all the portfolios which are mapped to the selected Market Risk VaR Model, in a tabular format: Value-at-Risk Conditional Value-at-Risk Current Portfolio Value Simulated Portfolio Value VaR % of Current Portfolio Value Portfolio VaR Limit

14.9.3 Stress Testing Report

Dashboard Page Name	Comparison Across VaR Models
Report Name	Stress Testing Report
Dashboard Name	Market Risk
Page Level Filters	Date, Portfolio
Report Level Filters	Stress Scenario
Report Description	Stress Testing Report displays stressed loss of all portfolios, mapped to the selected Market Risk VaR Model, in a tabular format. A list of all the stress scenarios defined is available for selection.

14.10 Market Analysis

The following reports are displayed as part of the Market Analysis subject area:

- Commodity Prices
- Exchange Rates
- Stock Index Values

- Interest Rates

14.10.1 Commodity Prices

Dashboard Page Name	Market Analysis
Report Name	Commodity Prices
Dashboard Name	Market Risk
Page Level Filters	Date
Report Level Filters	Commodity
Report Description	On selection of a particular commodity, its spot price is displayed for a trailing period of 90 business days. The chart has the date on the horizontal axis and the commodity prices on the vertical axis.

14.10.2 Exchange Rates

Dashboard Page Name	Market Analysis
Report Name	Exchange Rates
Dashboard Name	Market Risk
Page Level Filters	Date
Report Level Filters	Currency
Report Description	On selection of a particular currency, the following exchange rates are displayed for a trailing period of 90 business days: GBP – Selected Currency USD – Selected Currency EUR - Selected Currency JPY - Selected Currency The chart has the date on the horizontal axis and the exchange rates on the vertical axis.

14.10.3 Stock Index Values

Dashboard Page Name	Market Analysis
Report Name	Stock Index Values
Dashboard Name	Market Risk
Page Level Filters	Date
Report Level Filters	Stock
Report Description	This section has 2 reports: Index Value across Time On selection of a particular stock index, its value across a trailing period of 90 business days is displayed. The chart has the date on the horizontal axis and the index values on the vertical axis. List of all available stock indices is displayed for selection. Values of Major Stock Indices The values of certain key indices are displayed in a tabular format with the following column headers: Stock Index Index Value The closing value of the stock index is displayed for the selected date. Change Change in the value of the index over the previous day's value is displayed. % Change The % change in the value of the index over the day's value is displayed.

14.10.4 Interest Rates

Dashboard Page Name	Market Analysis
Report Name	Interest Rates
Dashboard Name	Market Risk

Page Level Filters	Date
Report Level Filters	Currency
Report Description	This section has 2 charts which displays the interest rates for a given currency. Zero Coupon Yield Curve This is a 2-axis chart which displays the Zero Coupon Yield Curve of the Sovereign, Money Market and AAA Interest Rate Asset Classes. It has the maturity on the horizontal axis and the zero coupon rates on the vertical axis. Interest Rate across Time On selection of a particular maturity, the zero coupon rates of the Sovereign, Money Market and AAA Interest Rate Asset Classes for the selected maturity is displayed for a trailing period of 90 business days. It has the date on the horizontal axis and the zero coupon rates for the selected maturity on the vertical axis. A list of all available maturities is displayed for selection.

Oracle Financial Services Market Risk
User Guide Release 8.0.4.0.0

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200
www.oracle.com/ financial_services/