AKUR8
RESERVING

Arius

Formula Driven Assumptions

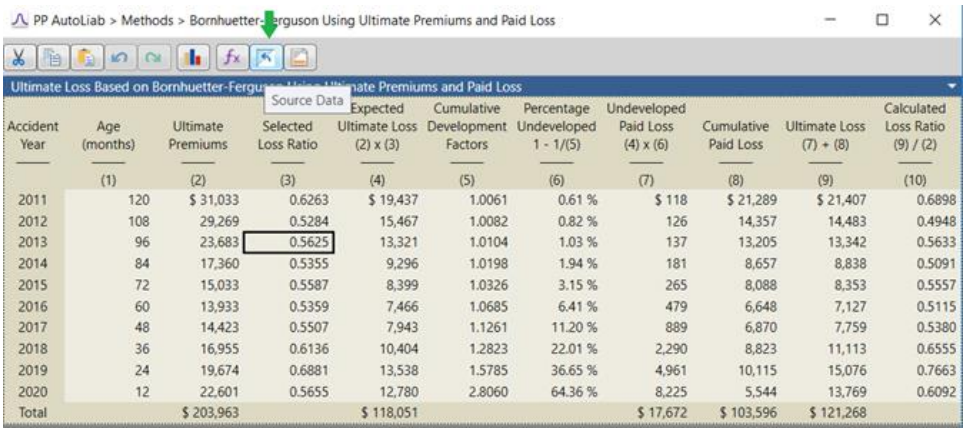
Formula Driven Assumptions

Formula Driven Assumptions (FDAs) are input objects that help you arrive at final selected assumptions by choosing from among inputs from a number of different techniques.

In one commonly used example, Arius provides an FDA to help select a priori loss ratios from among several different techniques for estimating potential loss ratios. Arius includes exhibits such as Prior Selections, Preliminary Weighted Selections, and Trended Expected Selections to help in your understanding of the related loss ratio data. The FDA table **Loss Ratio – BF Method** then lets you choose selected loss ratios by exposure period for use in BF methods (and elsewhere). You can weigh the various inputs into your decision, and can set defaults so the selected loss ratios update automatically in future periods.

To explain how to use FDAs we use the "Bornhuetter-Ferguson Using Ultimate Premium and Paid Loss Method" to illustrate. For every Bornhuetter-Ferguson method there is a collection of objects to help you get to your a priori assumption. There is an FDA object for your a priori average loss, loss rate, and loss ratio for each of the BF methods.

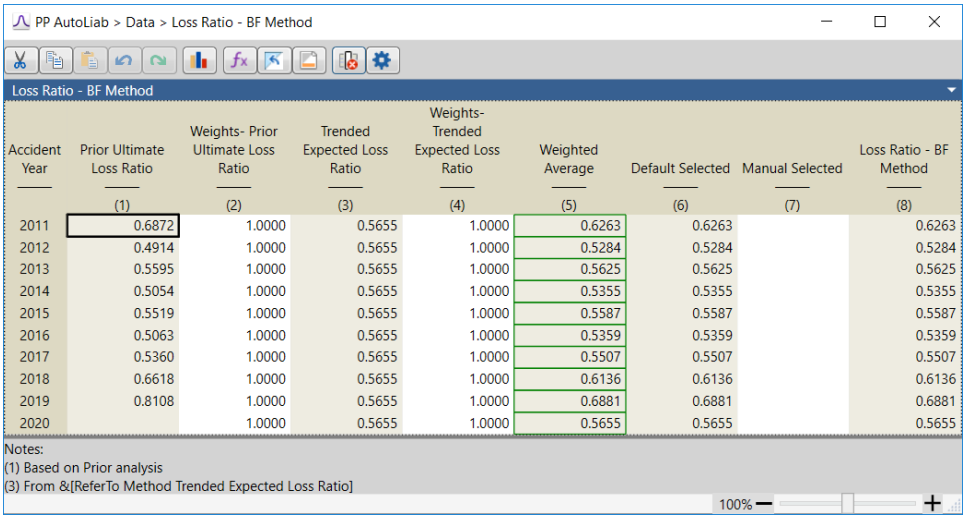
TRACING DATA TO THE SOURCE



Accident Year	Age (months)	Ultimate Premiums	Selected Loss Ratio	Expected Ultimate Loss (2) x (3)	Cumulative Development Factors	Percentage Undeveloped 1 - 1/(5)	Undeveloped Paid Loss (4) x (6)	Cumulative Paid Loss	Ultimate Loss (7) + (8)	Calculated Loss Ratio (9) / (2)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2011	120	$ 31,033	0.6263	$ 19,437	1.0061	0.61 %	$ 118	$ 21,289	$ 21,407	0.6898
2012	108	29,269	0.5284	15,467	1.0082	0.82 %	126	14,357	14,483	0.4948
2013	96	23,683	0.5625	13,321	1.0104	1.03 %	137	13,205	13,342	0.5633
2014	84	17,360	0.5355	9,296	1.0198	1.94 %	181	8,657	8,838	0.5091
2015	72	15,033	0.5587	8,399	1.0326	3.15 %	265	8,088	8,353	0.5557
2016	60	13,933	0.5359	7,466	1.0685	6.41 %	479	6,648	7,127	0.5115
2017	48	14,423	0.5507	7,943	1.1261	11.20 %	889	6,870	7,759	0.5380
2018	36	16,955	0.6136	10,404	1.2823	22.01 %	2,290	8,823	11,113	0.6555
2019	24	19,674	0.6881	13,538	1.5785	36.65 %	4,961	10,115	15,076	0.7663
2020	12	22,601	0.5655	12,780	2.8060	64.36 %	8,225	5,544	13,769	0.6092
Total		$ 203,963		$ 118,051			$ 17,672	$ 103,596	$ 121,268	

We can determine the source of any column of a table by clicking anywhere within the column and then clicking on the **Source Data** icon found in the object window ribbon. In the illustration above we are seeking the source of the Selected Loss Ratio column of our BF method. Clicking on the **Source Data** icon will open the FDA Loss Ratio – BF Method which is shown in the next section.

THE FORMULA DRIVEN ASSUMPTION


PP AutoLiab > Data > Loss Ratio - BF Method

Loss Ratio - BF Method

Accident Year	Prior Ultimate Loss Ratio	Weights- Prior Ultimate Loss Ratio	Trended Expected Loss Ratio	Weights- Trended Expected Loss Ratio	Weighted Average	Default Selected	Manual Selected	Loss Ratio - BF Method
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2011	0.6872	1.0000	0.5655	1.0000	0.6263	0.6263		0.6263
2012	0.4914	1.0000	0.5655	1.0000	0.5284	0.5284		0.5284
2013	0.5595	1.0000	0.5655	1.0000	0.5625	0.5625		0.5625
2014	0.5054	1.0000	0.5655	1.0000	0.5355	0.5355		0.5355
2015	0.5519	1.0000	0.5655	1.0000	0.5587	0.5587		0.5587
2016	0.5063	1.0000	0.5655	1.0000	0.5359	0.5359		0.5359
2017	0.5360	1.0000	0.5655	1.0000	0.5507	0.5507		0.5507
2018	0.6618	1.0000	0.5655	1.0000	0.6136	0.6136		0.6136
2019	0.8108	1.0000	0.5655	1.0000	0.6881	0.6881		0.6881
2020		1.0000	0.5655	1.0000	0.5655	0.5655		0.5655

Notes:
(1) Based on Prior analysis
(3) From &[ReferTo Method Trended Expected Loss Ratio]

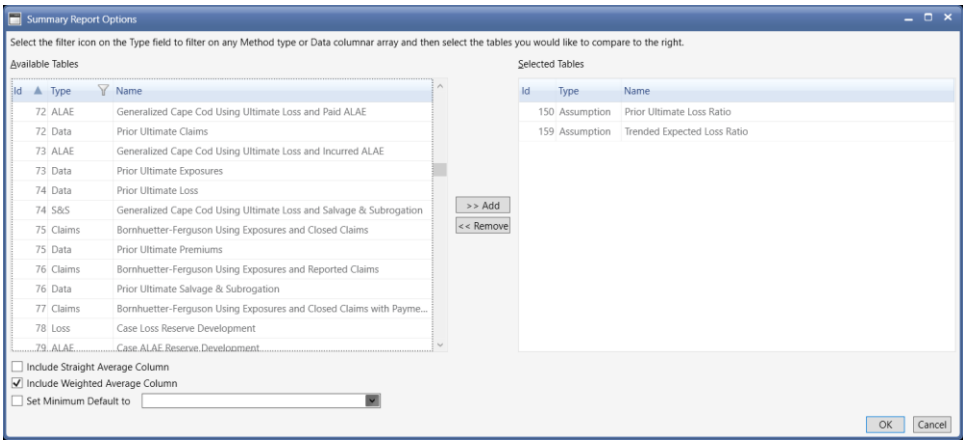
100%

Formula Driven Assumptions are found in the Object Library under the Data node in the Assumptions folder and are identified by this icon:  .

The table illustrated above uses the final "Loss Ratio – BF Method" column to populate the "Selected Loss Ratio" column of our BF method. This object functions in the same way as the "Comparison of Ultimate … Estimates" reports. In this case, we are choosing our loss ratio from multiple techniques for arriving at the loss ratio assumption. Here we can choose from the "Prior Ultimate Loss Ratio" technique, "Trended Expected Loss Ratio" technique, or the weighted average of these two techniques.

Selecting techniques for Formula Driven Assumptions

In our example the "Prior Ultimate Loss Ratio" and "Trended Expected Loss Ratio" objects are included as columns in our FDA. We have complete control over which objects are included here. To choose the assumption techniques which you would like to add to this table, click on the gear icon  on the FDA ribbon.


Summary Report Options

Select the filter icon on the Type field to filter on any Method type or Data columnar array and then select the tables you would like to compare to the right.

Available Tables

Id	Type	Name
72	ALAE	Generalized Cape Cod Using Ultimate Loss and Paid ALAE
72	Data	Prior Ultimate Claims
73	ALAE	Generalized Cape Cod Using Ultimate Loss and Incurred ALAE
73	Data	Prior Ultimate Exposures
74	Data	Prior Ultimate Loss
74	S&S	Generalized Cape Cod Using Ultimate Loss and Salvage & Subrogation
75	Claims	Bornhuetter-Ferguson Using Exposures and Closed Claims
75	Data	Prior Ultimate Premiums
76	Claims	Bornhuetter-Ferguson Using Exposures and Reported Claims
76	Data	Prior Ultimate Salvage & Subrogation
77	Claims	Bornhuetter-Ferguson Using Exposures and Closed Claims with Payme...
78	Loss	Case Loss Reserve Development
79	ALAE	Case ALAE Reserve Development

>> Add
<< Remove

Selected Tables

Id	Type	Name
150	Assumption	Prior Ultimate Loss Ratio
159	Assumption	Trended Expected Loss Ratio

Include Straight Average Column
Include Weighted Average Column
Set Minimum Default to

OK Cancel

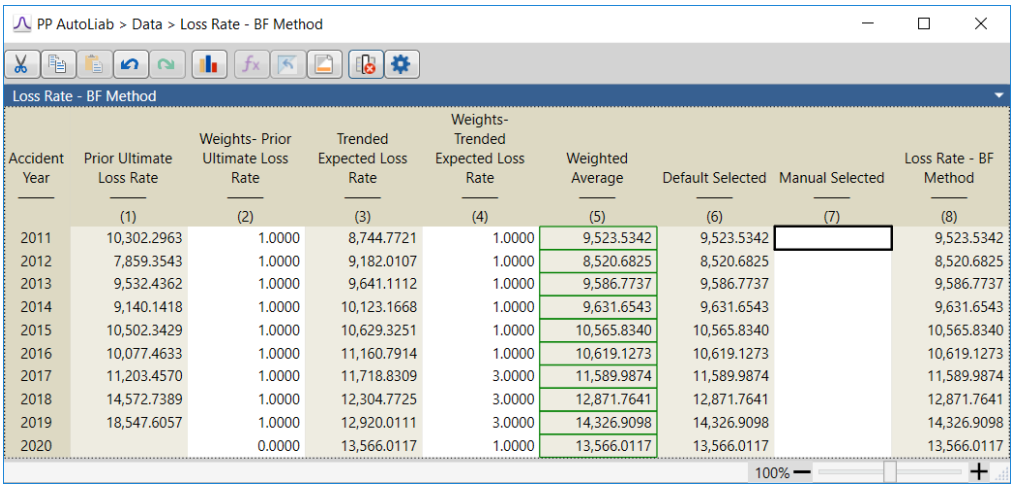
On the left of the Options window is a list of the objects available for display as a column in your FDA (including user-defined objects). The list on the right are those objects which have been selected for inclusion in the FDA. Select an object from the list on the left, then click **>>Add** to move the object to the list on the right. To remove a column from the FDA, click on the object in the list on the right, then click on **<<Remove**.

Note that on the bottom left side of this window you can choose to include a weighted average and/or straight average column on your FDA. You can also choose a minimum default from a drop-down list. Within the FDA, if the default selected value is less than the exposure period value in the object selected from the drop-down list, then the exposure period value from the selected object will become the default selected value on your FDA, which you will see enclosed in a blue box.

When you are done selecting your FDA settings, click **OK**. You will have the option of applying these settings for this FDA object across all of your segments if you desire.

Weighting your technique columns

If you elect to include a weighted average column on your FDA, then you will see weight columns with white backgrounds beside each of the assumption technique columns. You will use these columns to enter your own weightings by exposure period. These weights do not need to add to 100. For example, in the illustration shown below we have entered 1 for each of our weights in years 2011 through 2016, which results in equal weight given to each assumption technique for those years. In years 2017 through 2019, weight entries of 1 and 3 for our two assumption techniques results in a 25%/75% weighting of these techniques when calculating the weighted average column in our FDA. You can toggle the view of these weight columns by clicking on the  icon in the FDA ribbon.



Accident Year	Prior Ultimate Loss Rate	Weights- Prior Ultimate Loss Rate	Trended Expected Loss Rate	Weights- Trended Expected Loss Rate	Weighted Average	Default Selected	Manual Selected	Loss Rate - BF Method
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2011	10,302.2963	1.0000	8,744.7721	1.0000	9,523.5342	9,523.5342		9,523.5342
2012	7,859.3543	1.0000	9,182.0107	1.0000	8,520.6825	8,520.6825		8,520.6825
2013	9,532.4362	1.0000	9,641.1112	1.0000	9,586.7737	9,586.7737		9,586.7737
2014	9,140.1418	1.0000	10,123.1668	1.0000	9,631.6543	9,631.6543		9,631.6543
2015	10,502.3429	1.0000	10,629.3251	1.0000	10,565.8340	10,565.8340		10,565.8340
2016	10,077.4633	1.0000	11,160.7914	1.0000	10,619.1273	10,619.1273		10,619.1273
2017	11,203.4570	1.0000	11,718.8309	3.0000	11,589.9874	11,589.9874		11,589.9874
2018	14,572.7389	1.0000	12,304.7725	3.0000	12,871.7641	12,871.7641		12,871.7641
2019	18,547.6057	1.0000	12,920.0111	3.0000	14,326.9098	14,326.9098		14,326.9098
2020		0.0000	13,566.0117	1.0000	13,566.0117	13,566.0117		13,566.0117

Selecting your default assumption

Picking your Loss Ratio for an exposure year is accomplished by placing a green selection box around your ratio choice or making an entry into the “Manual Selected” column which will override your default selection. To place a green box around your selected assumption, right-click on an individual assumption value or contiguous assumption values from any of the techniques on the average column then choose **Set As Default**, or you can right-click on a column heading to select the entire column then choose **Set As Default**. Note that the values in the green boxes flow into the the “Default Selected” column which then flows into the final column “Loss Ratio – BF Method.” This is the value which will carry over to your BF method. If desired, you can make an entry into the “Manual Selected” column

which will override your “Default Selected” value to become your final “Loss Ratio – BF Method” selection.

Assumption collections

The system provides collections of all related objects for arriving at your assumptions for average loss, loss rate, and loss ratio. If you would like to add these collections to your Arius project files, click on **Collection Library** from the Arius Home ribbon then select **Open Collection Library**. You will find these under various sub-nodes within the Deterministic node starting with the titles “Selection of Average Loss …”, “Selection of Loss Rate …” and “Selection of Loss Ratio …” Simply drag and drop from the Collection Library into the navigation pane of your Arius project.

Creating user-defined Formula Driven Assumptions

You can create your own FDAs by opening the Object Library from the Arius Home ribbon, then click **NEW** in the Object Library ribbon. Choose **New Input** from the drop-down list. Then choose an Array Type of “Formula-Driven Assumption”. You will find your new FDA in the Data node of the Object Library in the “User Defined” folder. Double-click on your new object to open it and use the gear icon as described in the section of this document “Selecting techniques for formula driven assumptions.” You can add your new FDA object to a collection in your navigation pane following the Helpful Tips document found from the Arius Home ribbon under HELP | USER DOCUMENTATION | WORKING WITH COLLECTIONS IN ARIUS.

FORMULA DRIVEN ASSUMPTIONS AND THE ARIUS API

You can retrieve Formula Driven Assumptions using the Arius API using the “Input” table type. If retrieving a Formula Driven Assumption which includes a weighted average the following algorithm is required to arrive at the correct column count:

```
NumCols = AriusProject.NumColumns(FullPath, Segment, "Input", TableName, Incremental)
NumCols = ((NumCols - 2) * 2) + 4
```