IBM Software

Clustering Course
Lab 2: Portfolio construction

Contents

Hello everybody! Welcome to second lab of this series.

We are already on our way to construct our first investment portfolio. Our portfolio will consist of 3 stocks.

The question is, if we decided to invest in these 3 stocks, how we should allocate our capital?

Markowitz portfolio theory has an answer for the problem. We will see how we can implement markowitz portfolio theory to create efficient portfolios.

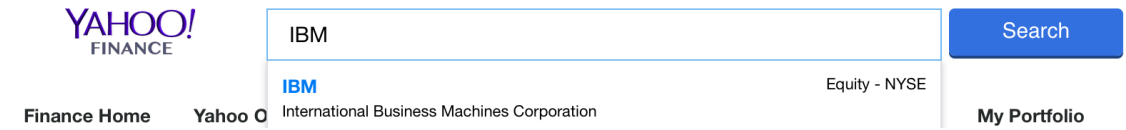
Let’s get started.

1. Downloading historical data for 3 companies and S&P 500 Index

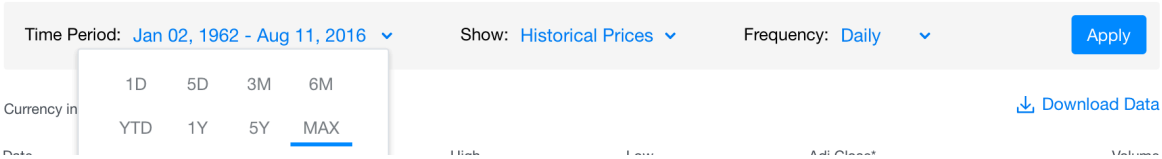
I will open my browser and navigate to finance.yahoo.com

I will download historical data for IBM, Procter & Gamble and Goldman Sachs.

I will type “IBM” in search box and will select IBM.



In resulting page, I will adjust time range by selecting “MAX” and click “Apply” then click “Download”.

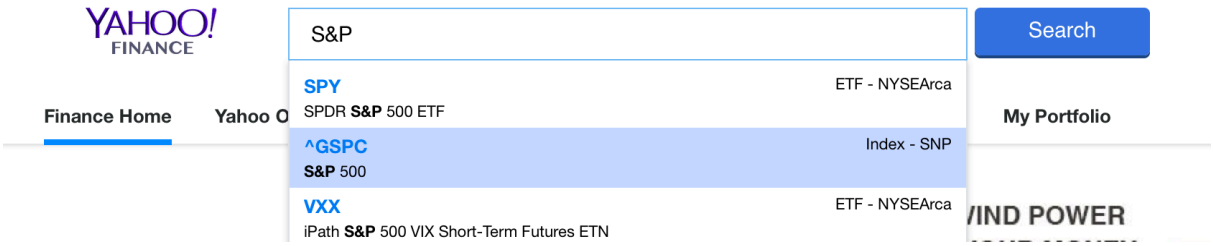


I will rename file as “IBM.csv”

I will go through same steps and download data for Procter & Gamble and Goldman Sachs as well. I will rename files as “PG.csv” and “GS.csv”.

In CAPM, we use market return and for U.S. stock markets we can use S&P 500 Index for that purpose.

I will download historical data for S&P 500 Index and rename it as “sp500.csv”

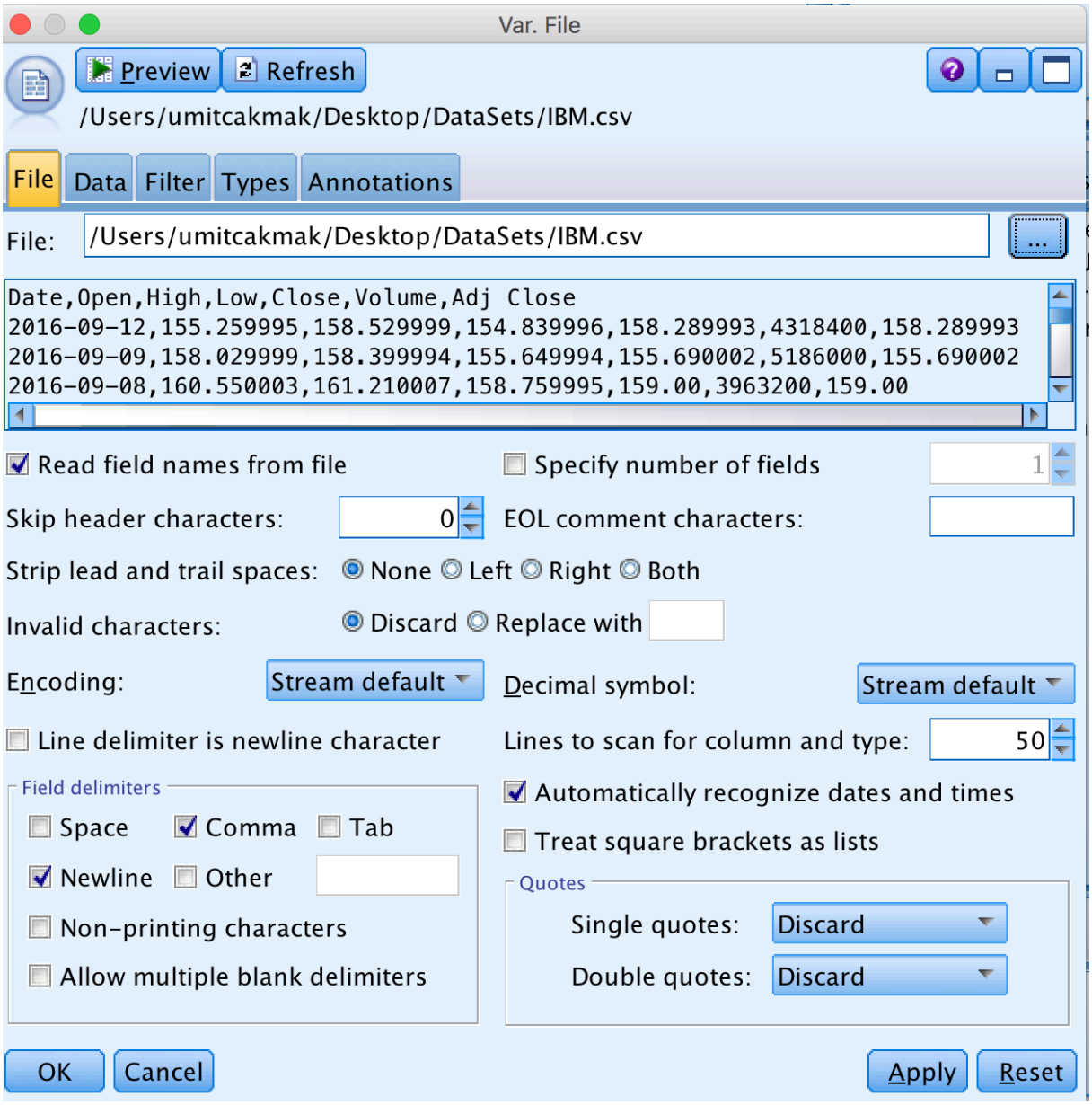


2. Data preparation

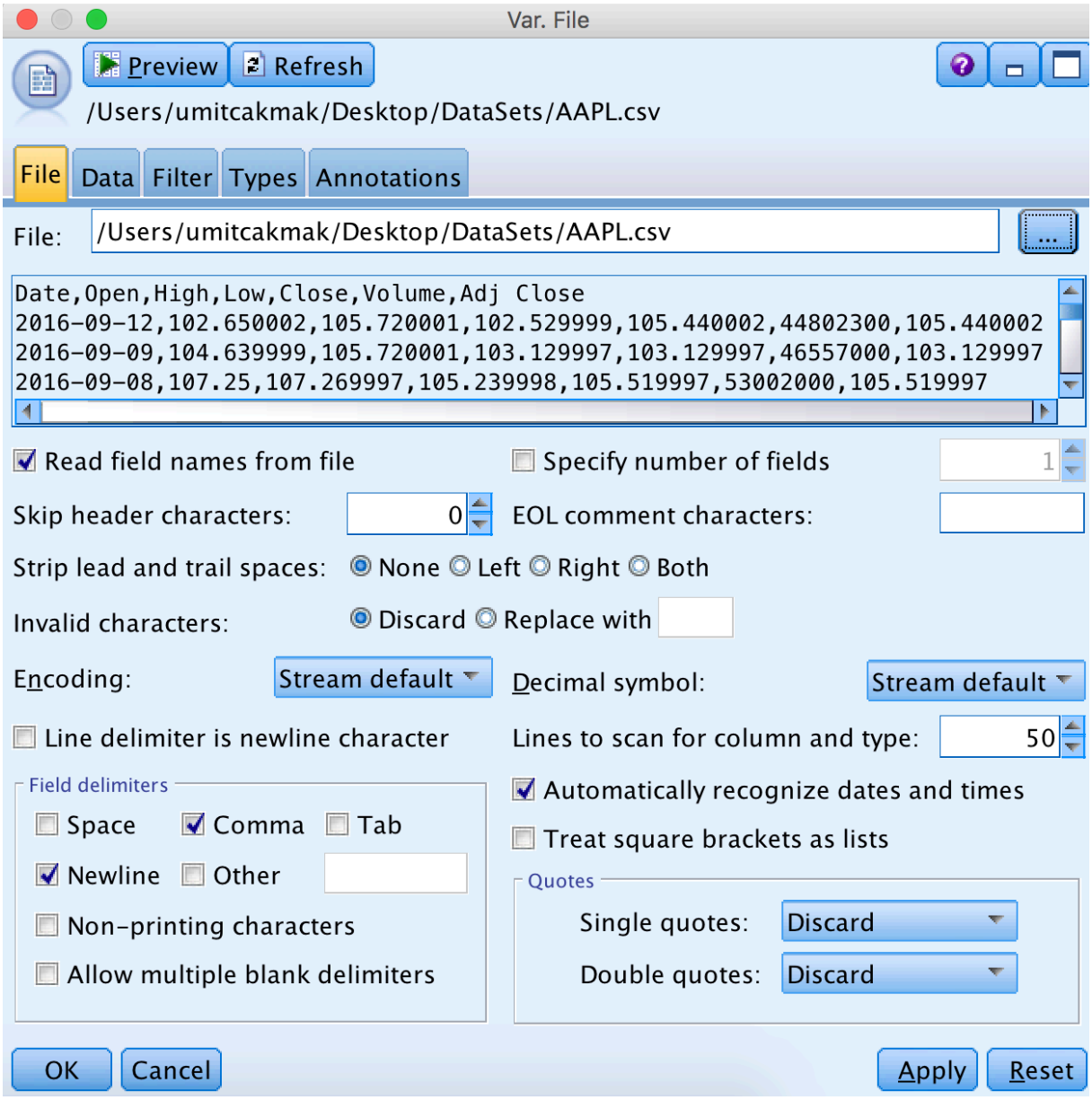
I will open SPSS Modeler and create a new stream, I will save stream as “Lab_2” to my labs folder.

I will add 4 “Var. File” node from “Sources” palette and import downloaded datasets to my stream.

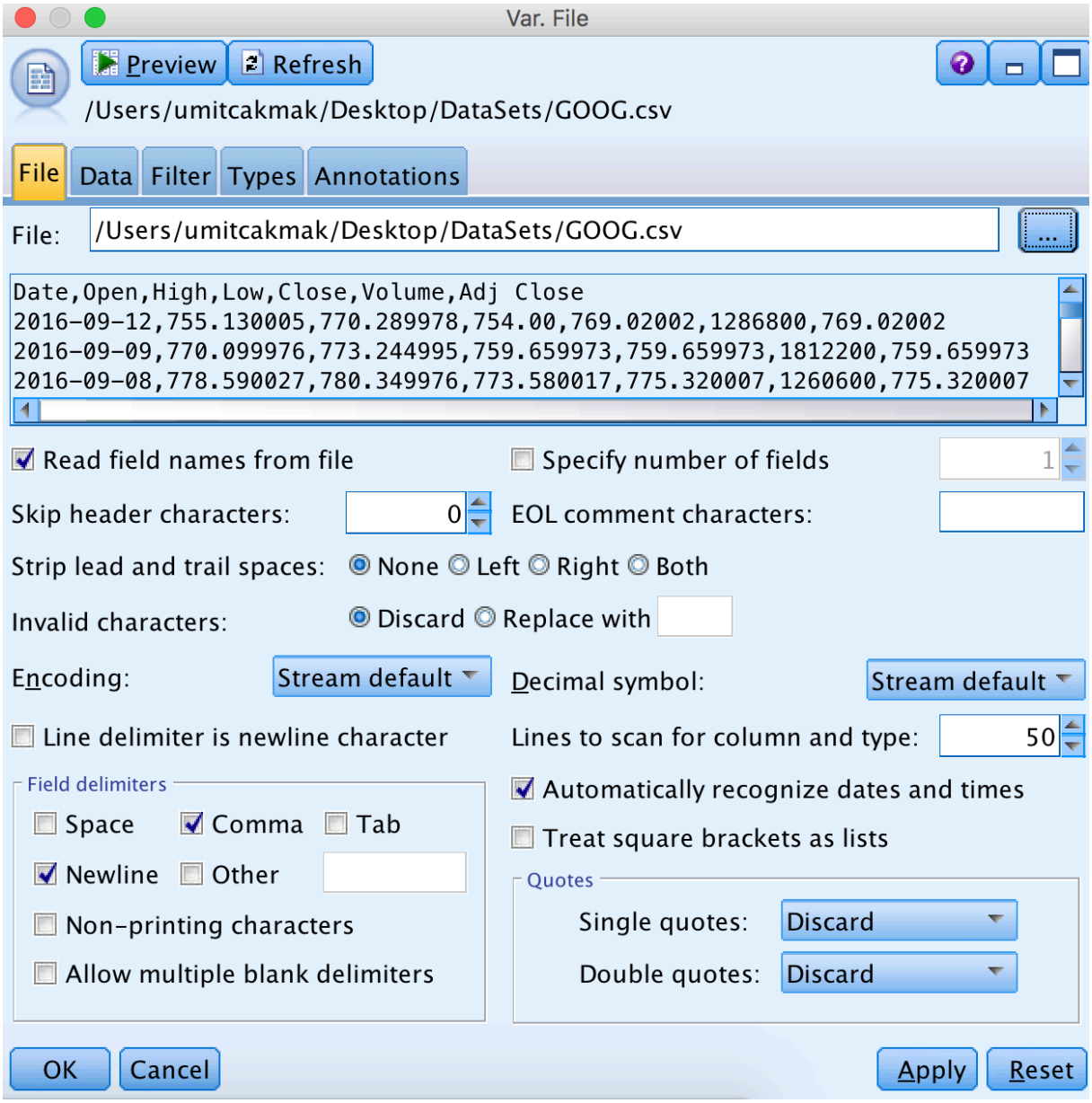
First IBM,


Var. File
Preview
Refresh
/Users/umitcakmak/Desktop/DataSets/IBM.csv
File
Data
Filter
Types
Annotations
File:
/Users/umitcakmak/Desktop/DataSets/IBM.csv
Date,Open,High,Low,Close,Volume,Adj Close
2016-09-12,155.259995,158.529999,154.839996,158.289993,4318400,158.289993
2016-09-09,158.029999,158.399994,155.649994,155.690002,5186000,155.690002
2016-09-08,160.550003,161.210007,158.759995,159.00,3963200,159.00
Read field names from file
Specify number of fields
1
Skip header characters:
0
EOL comment characters:
Strip lead and trail spaces:
None
Left
Right
Both
Invalid characters:
Discard
Replace with
Encoding:
Stream default
Decimal symbol:
Stream default
Line delimiter is newline character
Lines to scan for column and type:
50
Field delimiters
Space
Comma
Tab
Newline
Other
Non-printing characters
Allow multiple blank delimiters
Automatically recognize dates and times
Treat square brackets as lists
Quotes
Single quotes:
Discard
Double quotes:
Discard
OK
Cancel
Apply
Reset

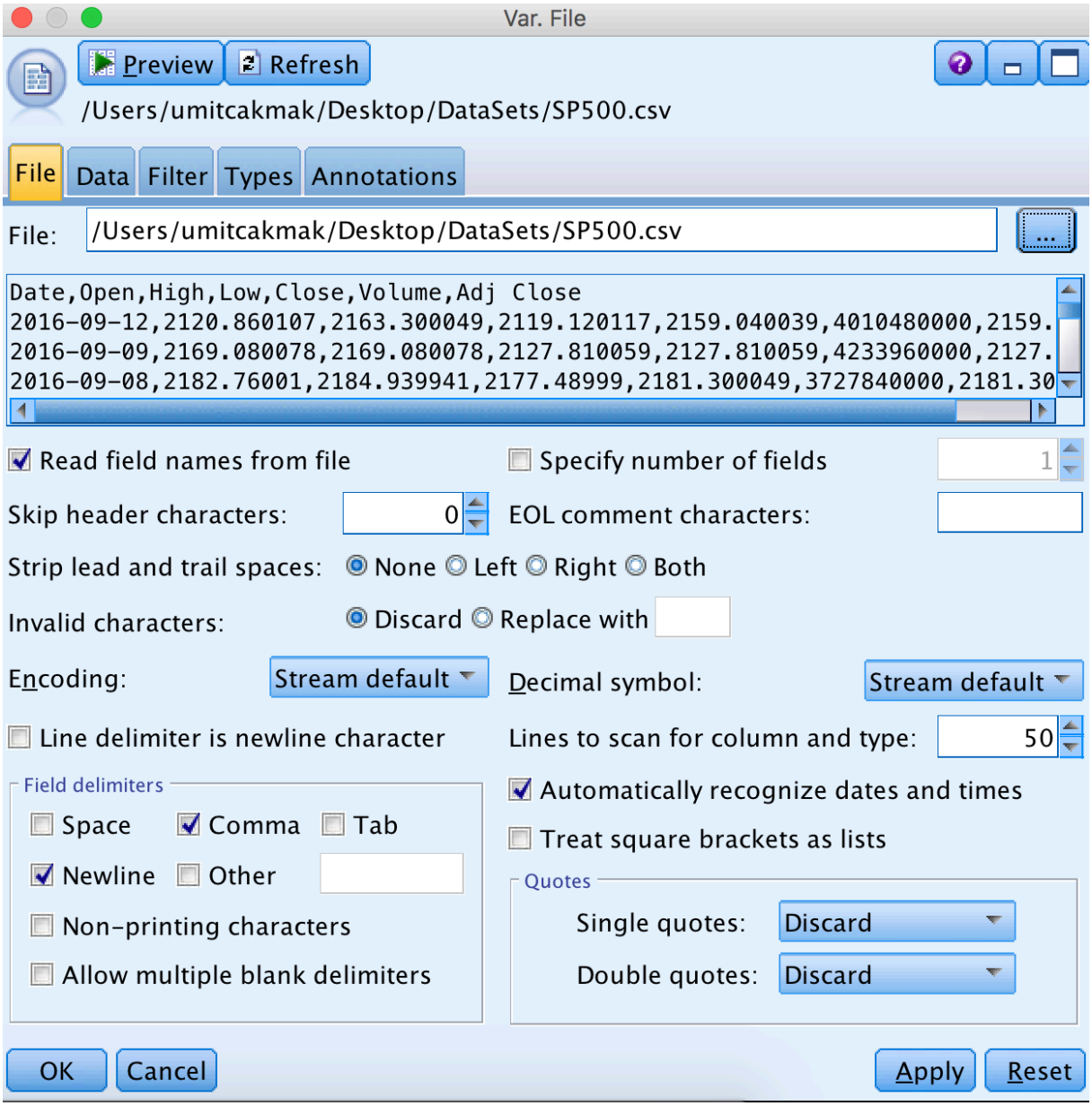
Second Apple,



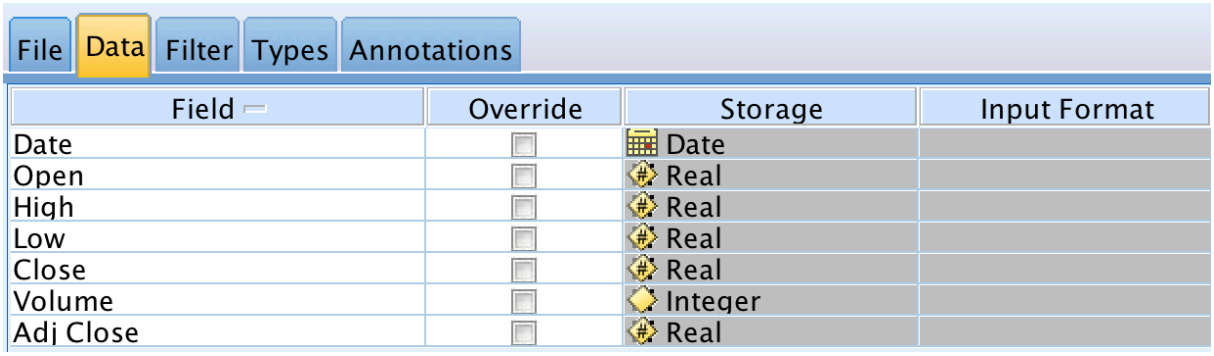
Third Google,


Var. File
Preview
Refresh
/Users/umitcakmak/Desktop/DataSets/GOOG.csv
File
Data
Filter
Types
Annotations
File:
/Users/umitcakmak/Desktop/DataSets/GOOG.csv
...
Date,Open,High,Low,Close,Volume,Adj Close
2016-09-12,755.130005,770.289978,754.00,769.02002,1286800,769.02002
2016-09-09,770.099976,773.244995,759.659973,759.659973,1812200,759.659973
2016-09-08,778.590027,780.349976,773.580017,775.320007,1260600,775.320007
Read field names from file
Specify number of fields
1
Skip header characters:
0
EOL comment characters:
Strip lead and trail spaces:
None
Left
Right
Both
Invalid characters:
Discard
Replace with
Encoding:
Stream default
Decimal symbol:
Stream default
Line delimiter is newline character
Lines to scan for column and type:
50
Field delimiters
Space
Comma
Tab
Newline
Other
Non-printing characters
Allow multiple blank delimiters
Automatically recognize dates and times
Treat square brackets as lists
Quotes
Single quotes:
Discard
Double quotes:
Discard
OK
Cancel
Apply
Reset

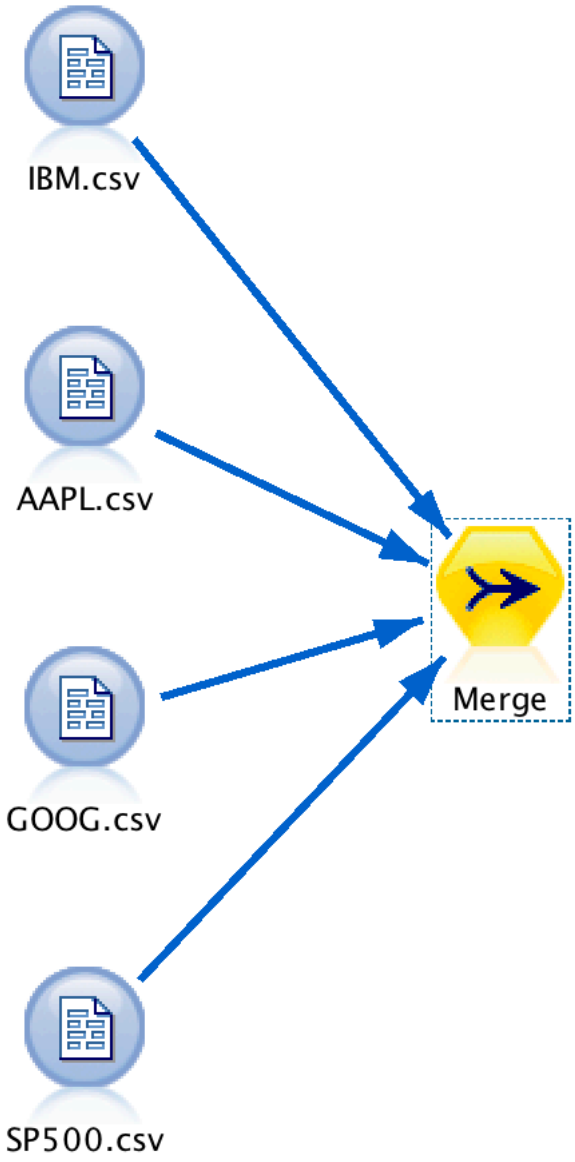
And finally, S&P 500 Index



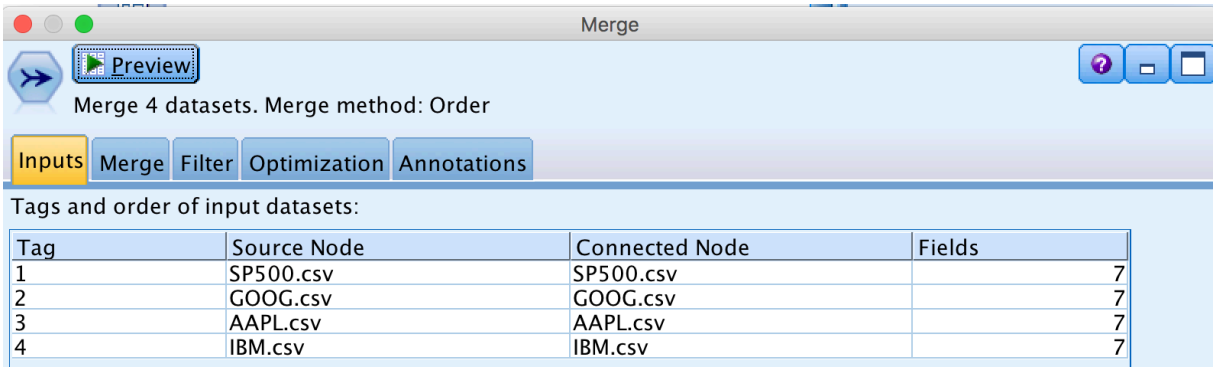
In each “Var. File” node in “Data” tab, you will see that field types are identified correctly



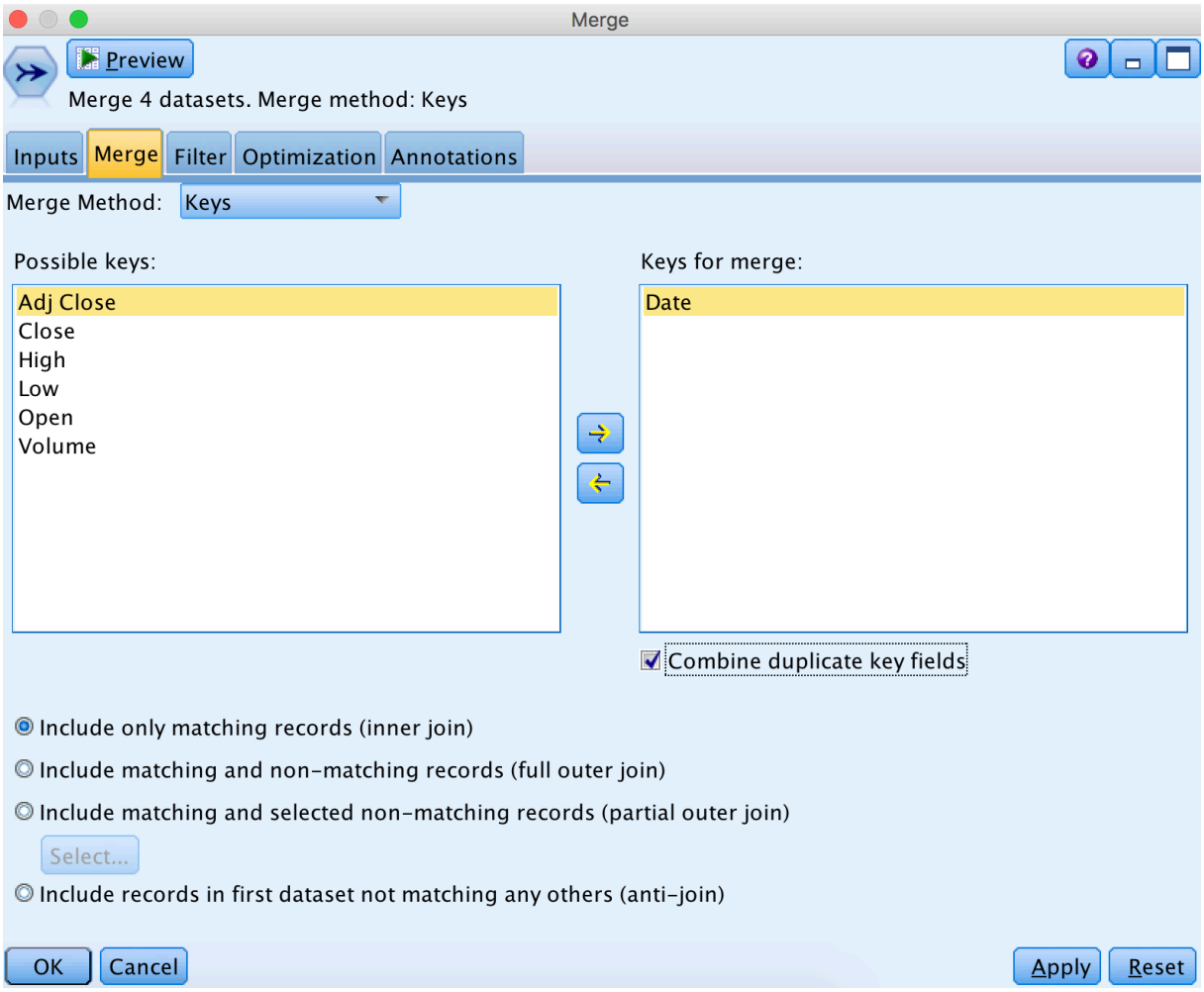
I can now merge these datasets into one by using “Merge” node from “Record Ops” palette.



Double click to open “Merge” node. In first tab, it shows you list of input files.

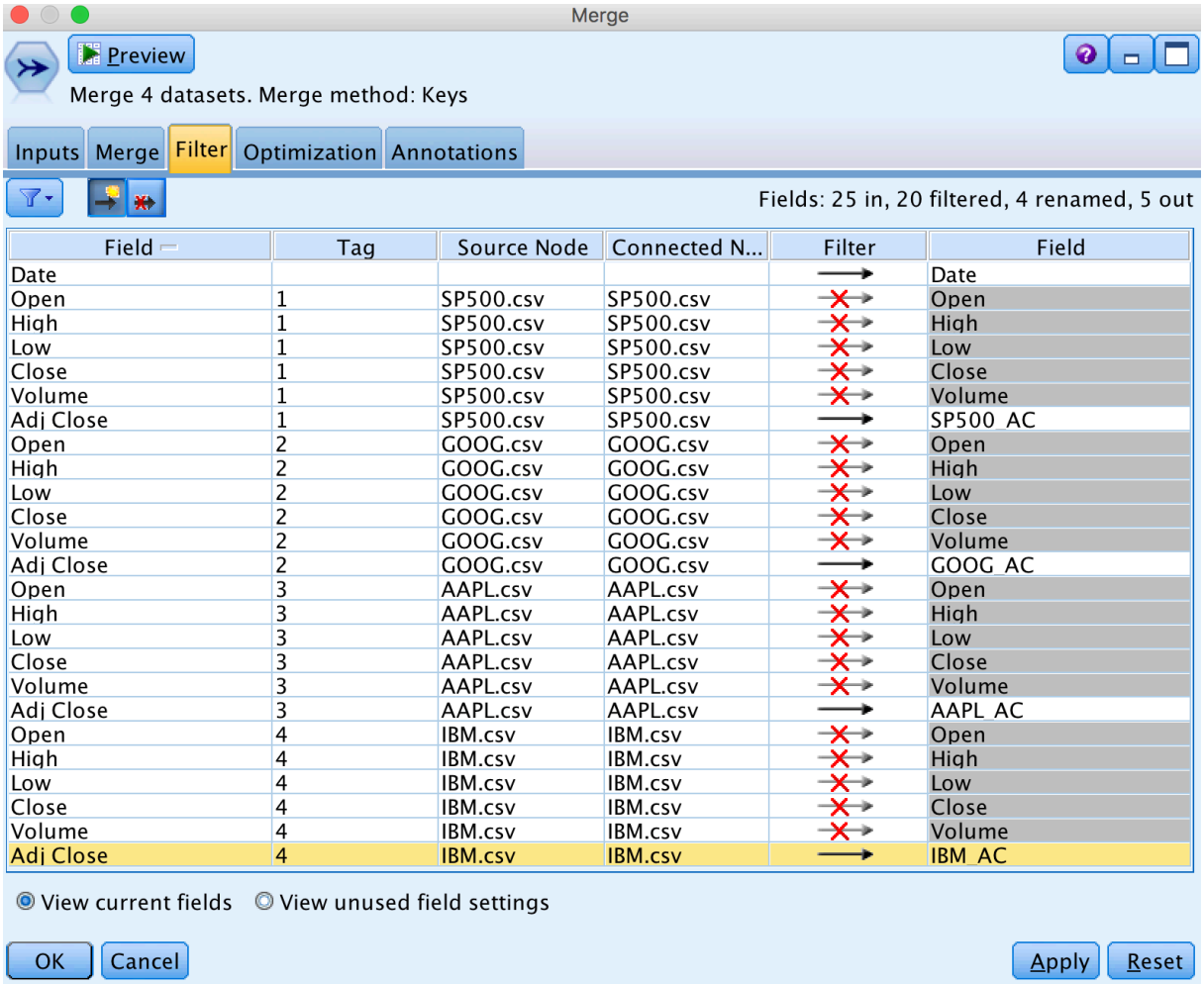


In “Merge” tab, we need to select “Key” for merging these datasets. “Key” should be common in all datasets and it will be used to match records and merge them. In our case, it’s “Date” column.



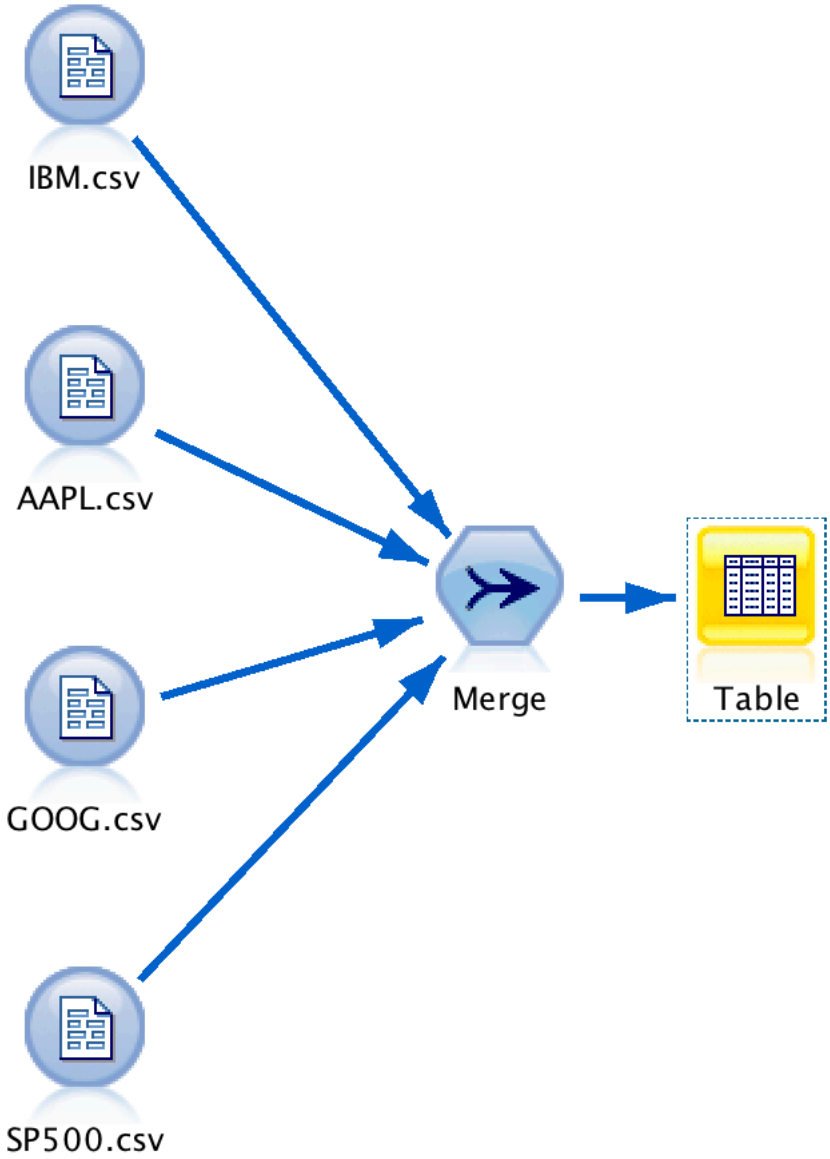
We will use default option “inner join” to merge datasets based on shorter dataset.

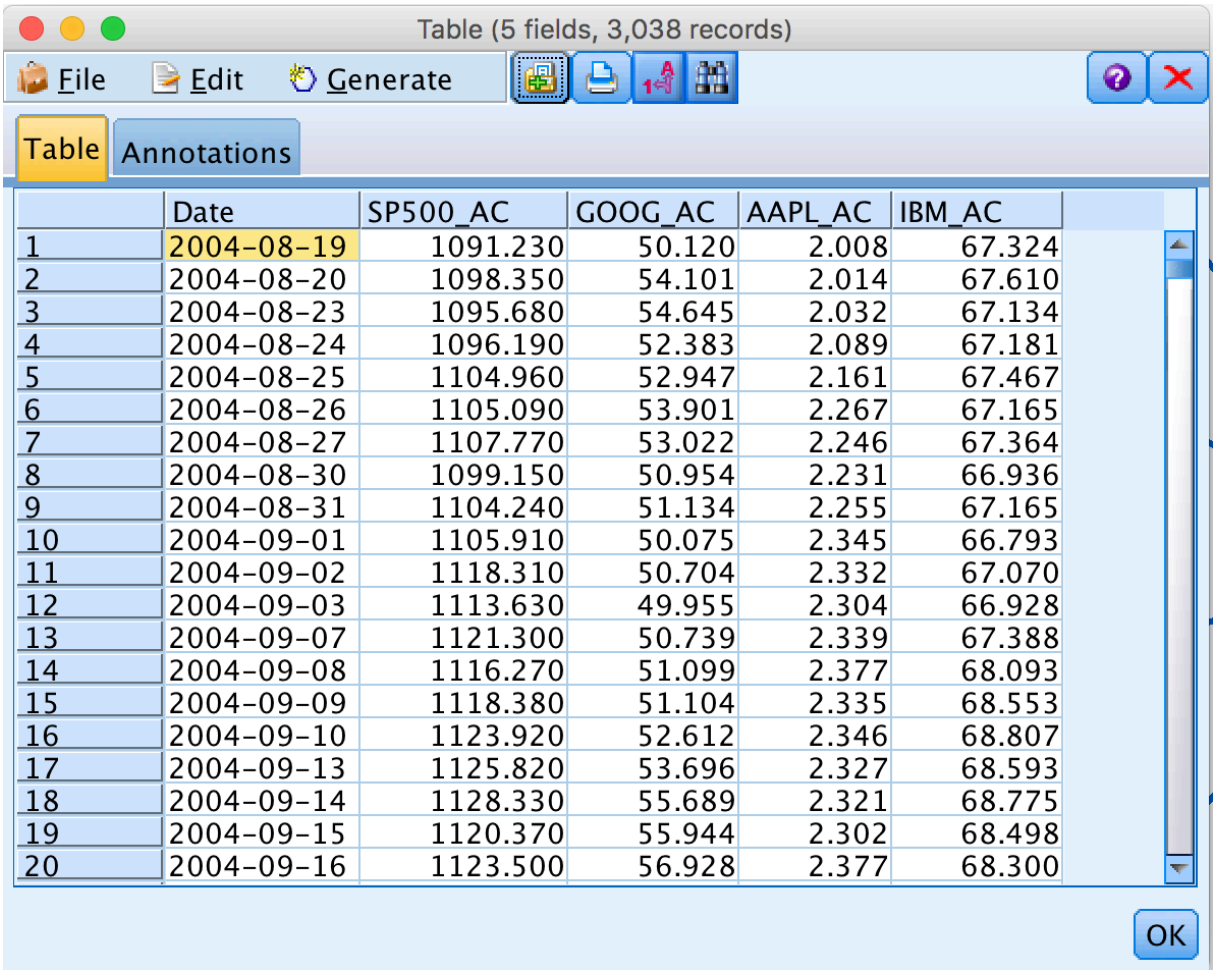
In “Filter” tab, we will filter out unnecessary columns and use suitable name, initials in this case, for “Adj Close” field coming from each dataset.



Field	Tag	Source Node	Connected N...	Filter	Field
Date				→	Date
Open	1	SP500.csv	SP500.csv	✗	Open
High	1	SP500.csv	SP500.csv	✗	High
Low	1	SP500.csv	SP500.csv	✗	Low
Close	1	SP500.csv	SP500.csv	✗	Close
Volume	1	SP500.csv	SP500.csv	✗	Volume
Adj Close	1	SP500.csv	SP500.csv	→	SP500_AC
Open	2	GOOG.csv	GOOG.csv	✗	Open
High	2	GOOG.csv	GOOG.csv	✗	High
Low	2	GOOG.csv	GOOG.csv	✗	Low
Close	2	GOOG.csv	GOOG.csv	✗	Close
Volume	2	GOOG.csv	GOOG.csv	✗	Volume
Adj Close	2	GOOG.csv	GOOG.csv	→	GOOG_AC
Open	3	AAPL.csv	AAPL.csv	✗	Open
High	3	AAPL.csv	AAPL.csv	✗	High
Low	3	AAPL.csv	AAPL.csv	✗	Low
Close	3	AAPL.csv	AAPL.csv	✗	Close
Volume	3	AAPL.csv	AAPL.csv	✗	Volume
Adj Close	3	AAPL.csv	AAPL.csv	→	AAPL_AC
Open	4	IBM.csv	IBM.csv	✗	Open
High	4	IBM.csv	IBM.csv	✗	High
Low	4	IBM.csv	IBM.csv	✗	Low
Close	4	IBM.csv	IBM.csv	✗	Close
Volume	4	IBM.csv	IBM.csv	✗	Volume
Adj Close	4	IBM.csv	IBM.csv	→	IBM_AC

From “Output” palette, we can add “Table” node to see resulting dataset.



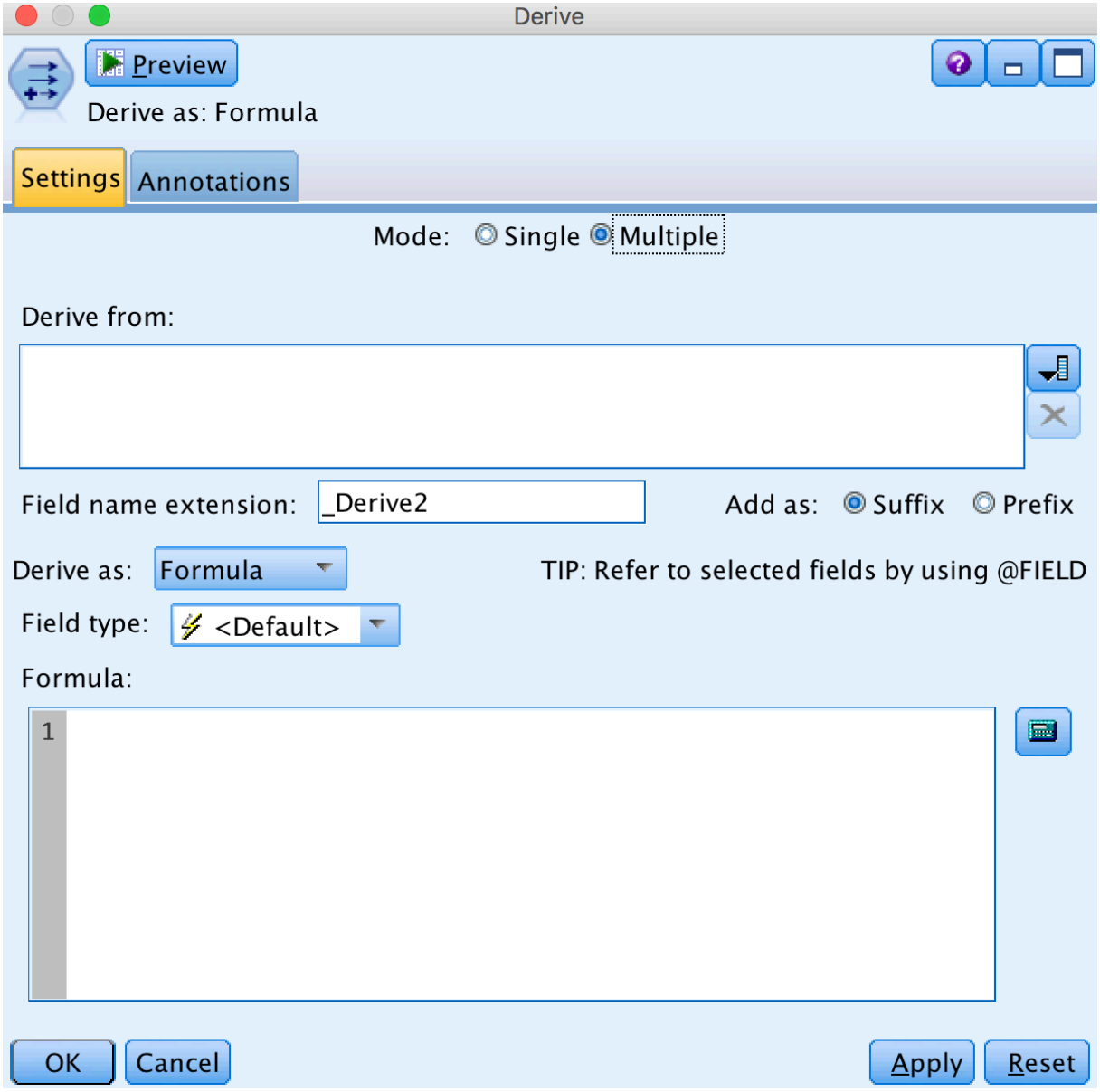


	Date	SP500_AC	GOOG_AC	AAPL_AC	IBM_AC
1	2004-08-19	1091.230	50.120	2.008	67.324
2	2004-08-20	1098.350	54.101	2.014	67.610
3	2004-08-23	1095.680	54.645	2.032	67.134
4	2004-08-24	1096.190	52.383	2.089	67.181
5	2004-08-25	1104.960	52.947	2.161	67.467
6	2004-08-26	1105.090	53.901	2.267	67.165
7	2004-08-27	1107.770	53.022	2.246	67.364
8	2004-08-30	1099.150	50.954	2.231	66.936
9	2004-08-31	1104.240	51.134	2.255	67.165
10	2004-09-01	1105.910	50.075	2.345	66.793
11	2004-09-02	1118.310	50.704	2.332	67.070
12	2004-09-03	1113.630	49.955	2.304	66.928
13	2004-09-07	1121.300	50.739	2.339	67.388
14	2004-09-08	1116.270	51.099	2.377	68.093
15	2004-09-09	1118.380	51.104	2.335	68.553
16	2004-09-10	1123.920	52.612	2.346	68.807
17	2004-09-13	1125.820	53.696	2.327	68.593
18	2004-09-14	1128.330	55.689	2.321	68.775
19	2004-09-15	1120.370	55.944	2.302	68.498
20	2004-09-16	1123.500	56.928	2.377	68.300

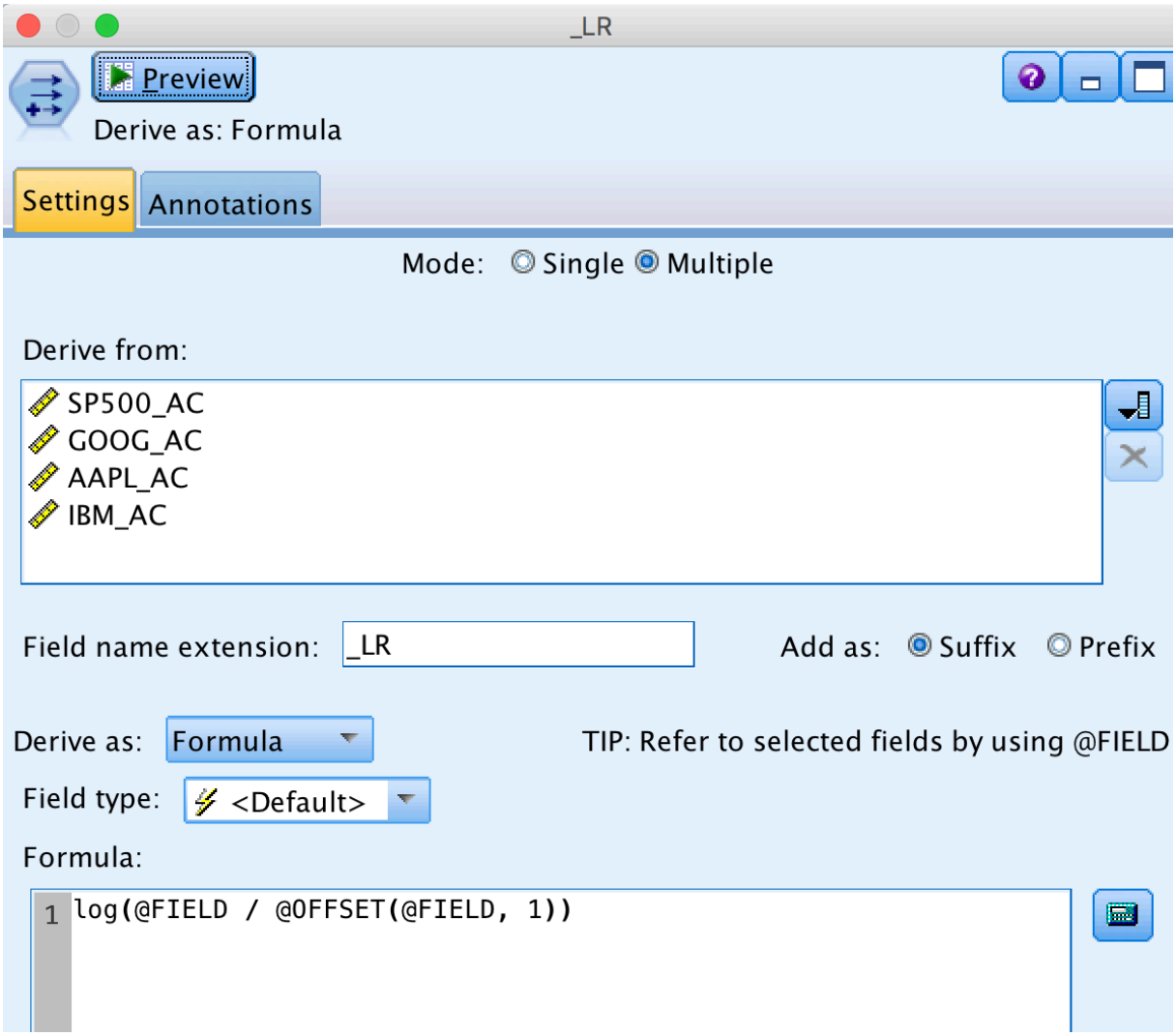
3. Calculating Log Return Series for All Datasets

We will add “Derive” node from “Field Ops” palette

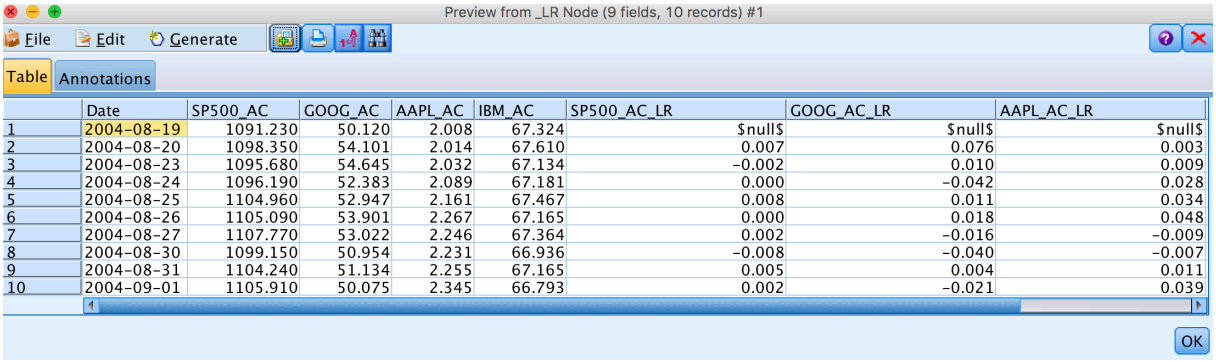
We use “Multiple” option to calculate log return series for all data sets at once.



We will add all series to “Derive from:” section. We will use “log” and “OFFSET” formula to calculate log returns and notice how did we use “@FIELD” to refer to all added fields. We will rename this new field as original field name plus suffix “_Log_Return”



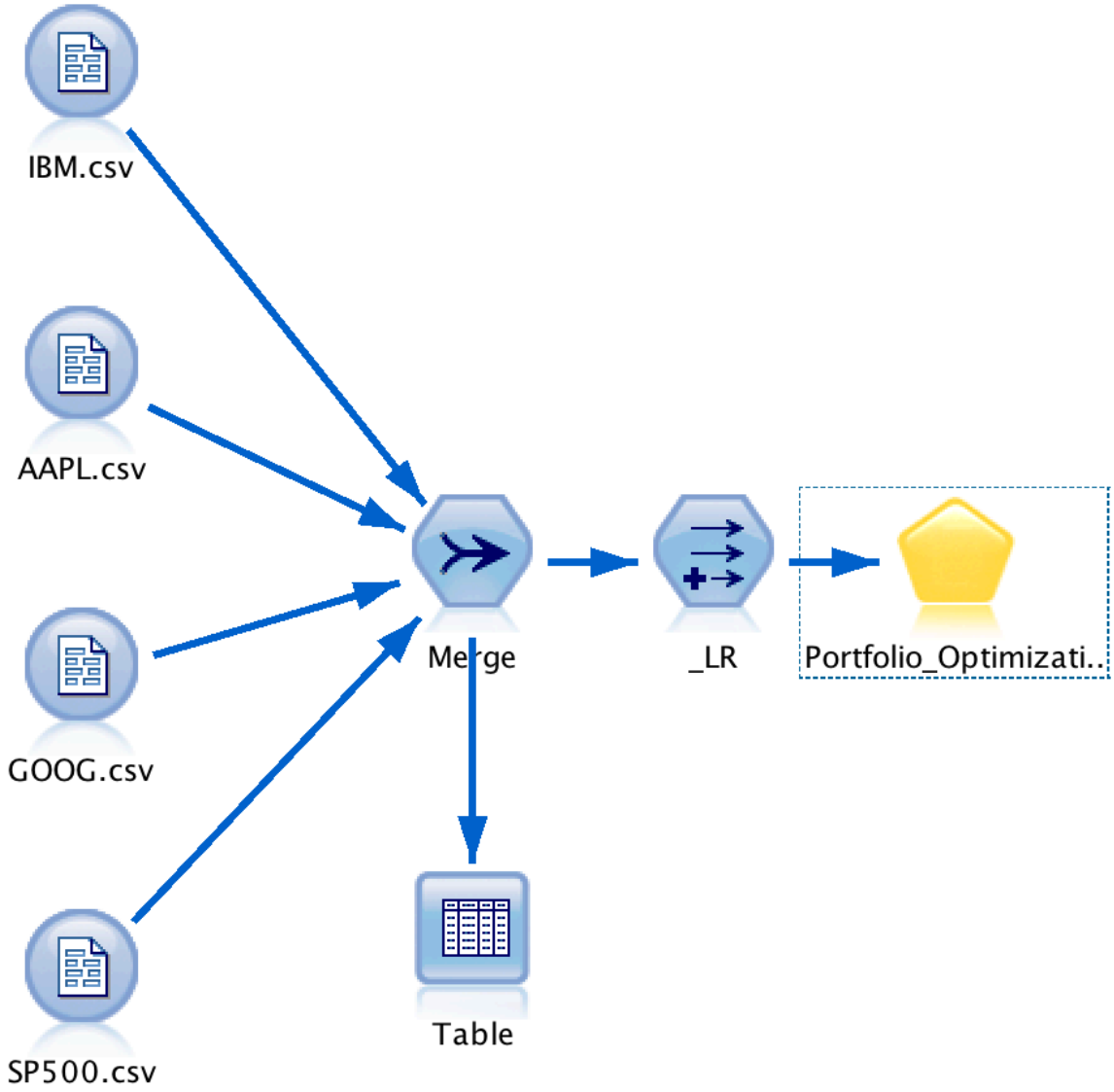
You can click preview to see resulting dataset.



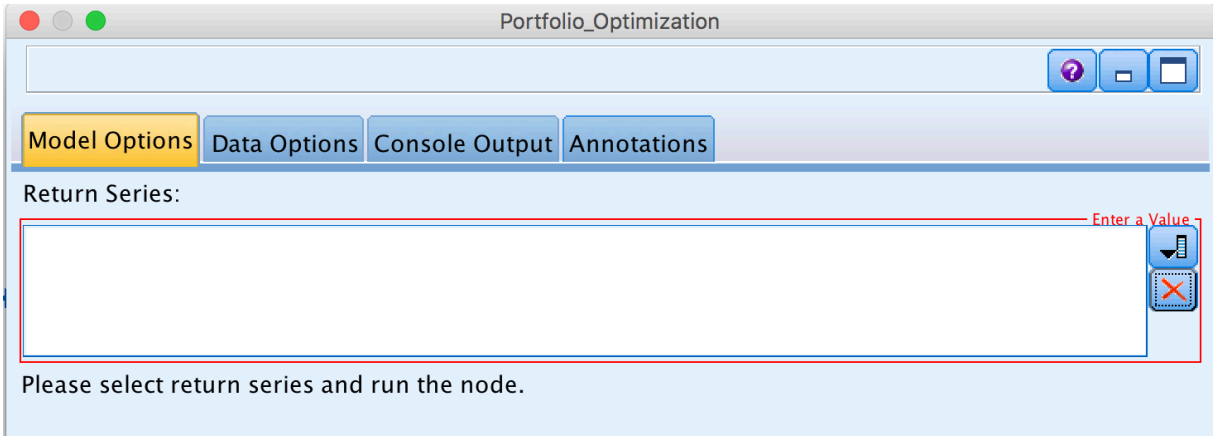
	Date	SP500_AC	GOOG_AC	AAPL_AC	IBM_AC	SP500_AC_LR	GOOG_AC_LR	AAPL_AC_LR
1	2004-08-19	1091.230	50.120	2.008	67.324	$null$	$null$	$null$
2	2004-08-20	1098.350	54.101	2.014	67.610	0.007	0.076	0.003
3	2004-08-23	1095.680	54.645	2.032	67.134	-0.002	0.010	0.009
4	2004-08-24	1096.190	52.383	2.089	67.181	0.000	-0.042	0.028
5	2004-08-25	1104.960	52.947	2.161	67.467	0.008	0.011	0.034
6	2004-08-26	1105.090	53.901	2.267	67.165	0.000	0.018	0.048
7	2004-08-27	1107.770	53.022	2.246	67.364	0.002	-0.016	-0.009
8	2004-08-30	1099.150	50.954	2.231	66.936	-0.008	-0.040	-0.007
9	2004-08-31	1104.240	51.134	2.255	67.165	0.005	0.004	0.011
10	2004-09-01	1105.910	50.075	2.345	66.793	0.002	-0.021	0.039

We will need to download following extension from this url (https://github.com/Umit-Mert/Portfolio_Optimization)

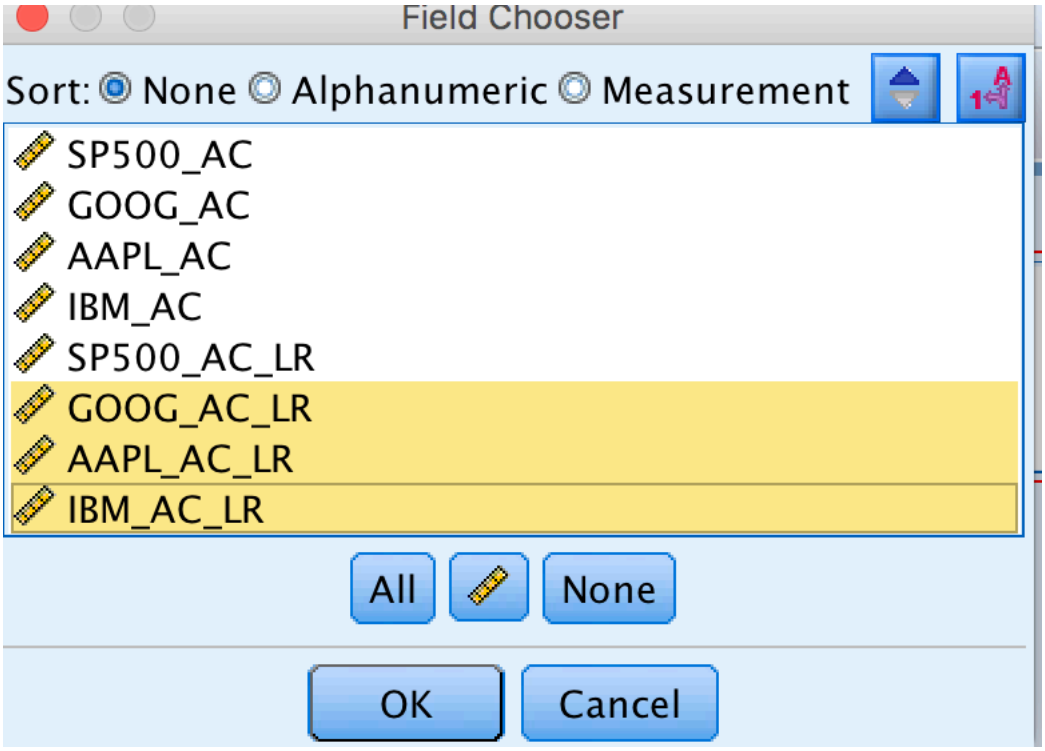
Once download and install finished. We need to add “Portfolio_Optimization” node from “Modeling” palette to our stream.



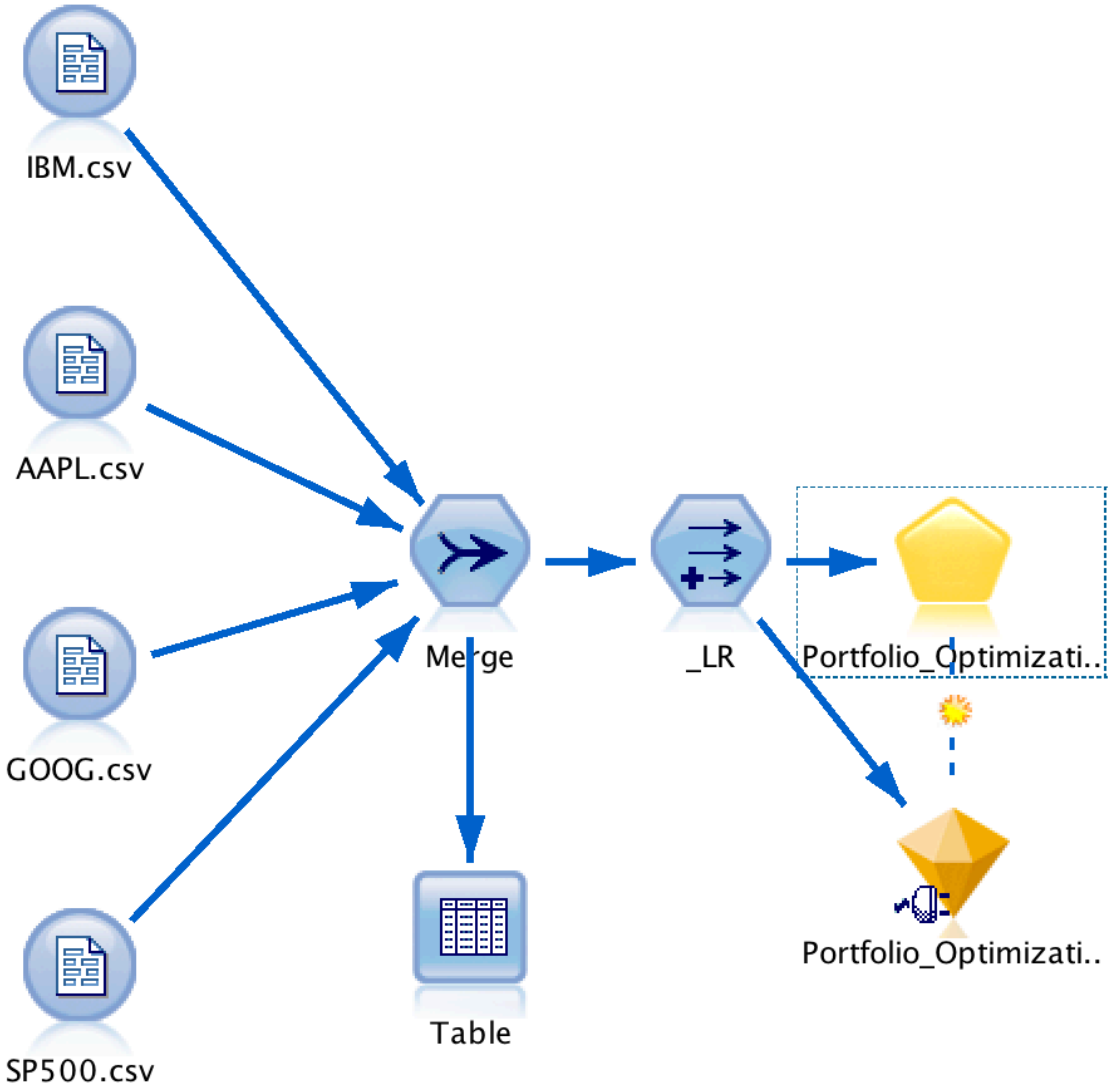
Double click to open that and select return series that we would like to work with.



In our case, return series are “GOOG”, “AAPL” and “IBM”.

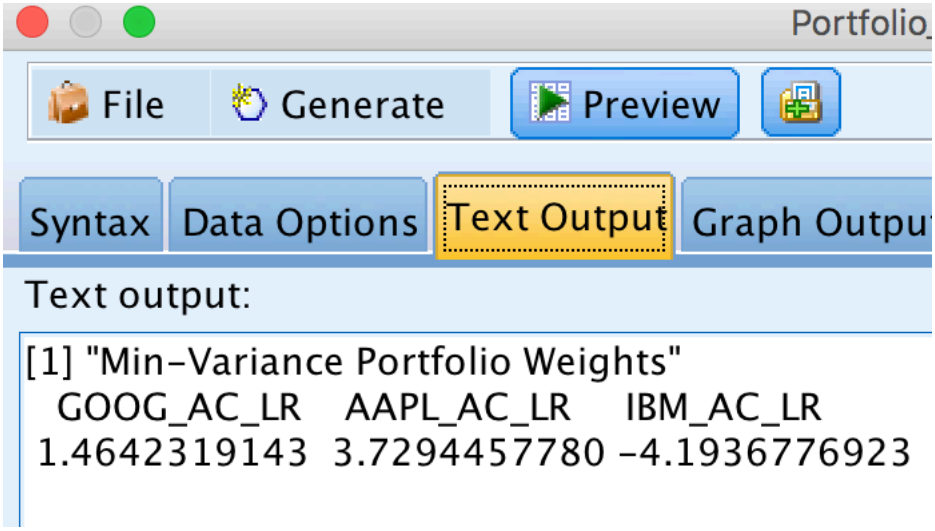


Let’s click run and open the model nugget.

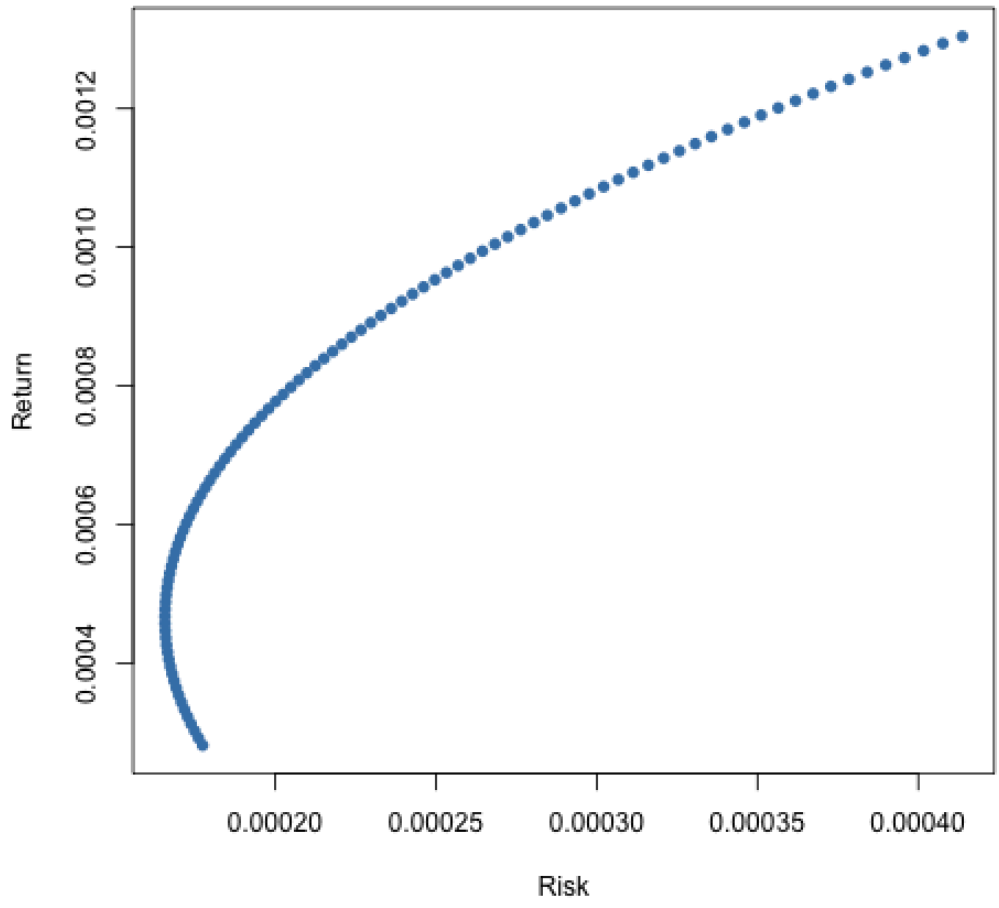


In model nugget, you should click “Text Output” tab to see the result.

We can see proportions in Portfolio weights section that we should invest in stocks “GOOG”, “AAPL” and “IBM”



You can also click “Graph Output” tab to see Markowitz bullet.



Our portfolio weights are referring to minimum variance portfolio which is far left point closest to “Return” axis.

Summary

In this lab, you learned how to use “MPT” node to construct risk efficient portfolios. Thank you and hope to see you next time.