Info to *SimplexNumerica*

Dealing with Econometric Data

V17

What is Econometrics?

From Wikipedia: https://en.wikipedia.org/wiki/Econometrics
Econometrics is the application of statistical methods to economic data in order to give empirical content to economic relationships. More precisely, it is "the quantitative analysis of actual economic phenomena based on the concurrent development of theory and observation, related by appropriate methods of inference"

Reference Program

The software Gretl[1] is a kind of reference program for econometric subjects. *SimplexNumerica* adapts only a few objectives related to this huge topic of econometrics. A few functions are explained here. Perhaps the scope will grow in the future…

But, by the way, many of *SimplexNumerica's* built-in algorithm can be assigned to this topic. Here we will focus only on new operations in *SimplexNumerica*, like:

- File Import from Gretl,
- Cross Scatter Plot
- Regression Algorithm
- Filter Algorithm

Reference Resource

The article 'Using Gretl for Principles of Econometrics, 4th edition' from Lee C. Adkins, Professor of Economics Oklahoma State University will be our reference for this introduction.

You can find the document here:
http://www.learneconometrics.com/gretl/index.html

File Import from *Gretl*

The first step is to import a *Gretl* example file (e.g. the food expenditure and income data) in *SimplexNumerica*. The data file is included in the *SimplexNumerica* user directory (press key <F1>)

```
…\Sample Data\Econometric Analysis
```

SimplexNumerica Example evaluations can be found here:

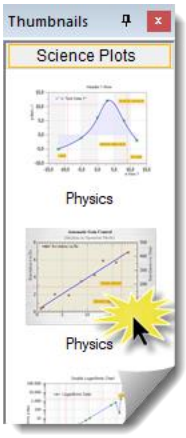
```
…\Examples\Econometric Analysis
```

Sample files, provided from the article '…Principles of Econometrics' are also available on their website – there where you can find the document above. Unfortunately, the original xml files are lying here in binary form and cannot directly imported into *SimplexNumerica*. You have to save them from *Gretl* as *.xml. So, we did that for the files used in this document., here.

[1] *Gretl* is an acronym for Gnu Regression, Econometrics and Time-series Library. It is an open source software package for doing econometrics related stuff.

Dealing with Econometric Data

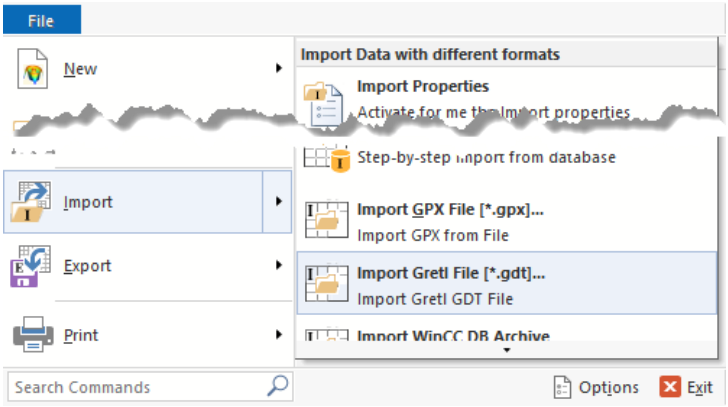
Before we can import a data file, we need a reference chart. Use the Thumbnail Window to drag one into an empty page, or empty gray desktop, respectively.



Please use the 2nd *Physics Chart* for our example.

The food expenditure data can be loaded from the file '`food xml.gdt`' using

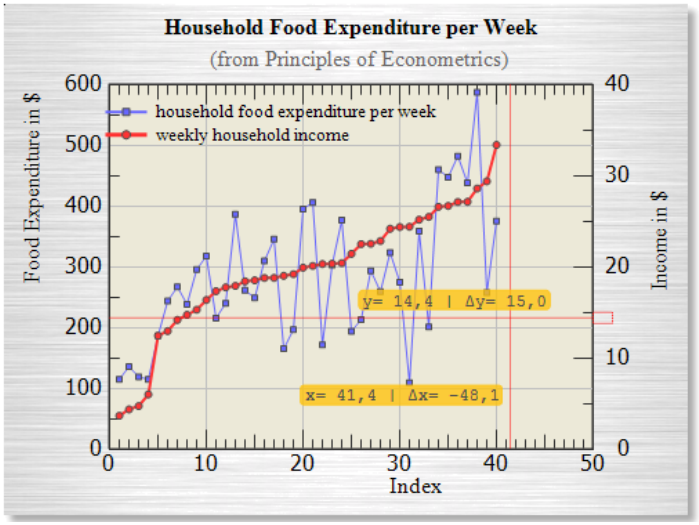
File → Import → Import Gretl File (*.gdt) as shown in the next picture.



The food expenditure data is loaded from '`food xml.gdt`' into *SimplexNumerica's GraphTable*.

View	food_exp SampleData		income SampleData	
Legend	G0.x	G0.y	G1.x	G1.y
1	1,000	115,220	1,000	3,690
2	2,000	135,980	2,000	4,390
3	3,000	119,340	3,000	4,750
4	4,000	114,960	4,000	6,030
5	5,000	187,050	5,000	12,470
6	6,000	243,920	6,000	12,980
7	7,000	267,430	7,000	14,200
8	8,000	238,710	8,000	14,760

Hint: The active Graph is selected in the GraphTable. Swap to the Graphics View and assign the second Graphs to the right axis brings us:



Now, if we want to plot 'Food Expenditures' on the y-Axis and (Weekly) 'Income' on the x-Axis (instead the index), we can use a new feature of *SimplexNumerica* V17.3 called ***Cross Scatter Plot***...

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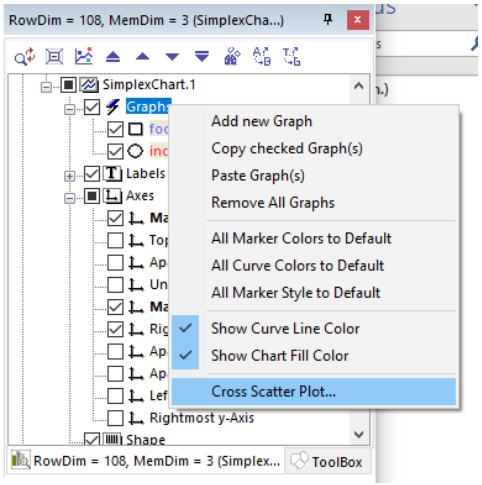
Cross Scatter Plot

A Cross Scatter Plot is synonym for scatter plots used primarily in the Earth Sciences and Social Sciences to describe a specialized main chart that compares multiple measurements (in *SimplexNumerica* from different charts, possible) made at a single time or location along two or more axes (see Wikipedia).

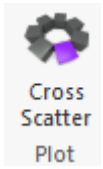
That means:
You can grab single x/y/z arrays (= columns from the GraphTable) from different Charts & Graphs into one main chart with a new Graph structure. The previous data and graph structure from the main chart will be removed, completely, so that its data gets lost! To avoid that, you can make a clone (use Copy & Paste) of any chart and use that as the main (focus) chart.

You can find the new Cross Scatter Plot on two menus inside the environment of *SimplexNumerica*:



Menu 1
To find in the Chart Explorer when you right-click on the ***Graphs*** entry. A popup menu appears with the entry *Cross Scatter Plot*.

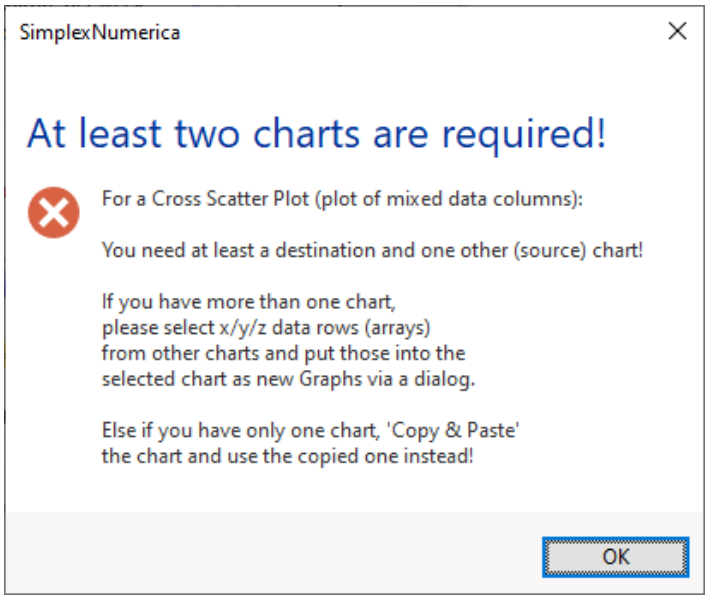
Menu 2



To find it also in the Ribbonbar *Graph*, Icon *Cross Scatter Plot*

→ Click on this icon...

As you might expecting, we do have only one chart available on the screen. What we need is a second one → our resulting main chart. A messagebox appears that tells us this:



Right now, we are going to Copy & Paste our chart...

That looks on the screen now:

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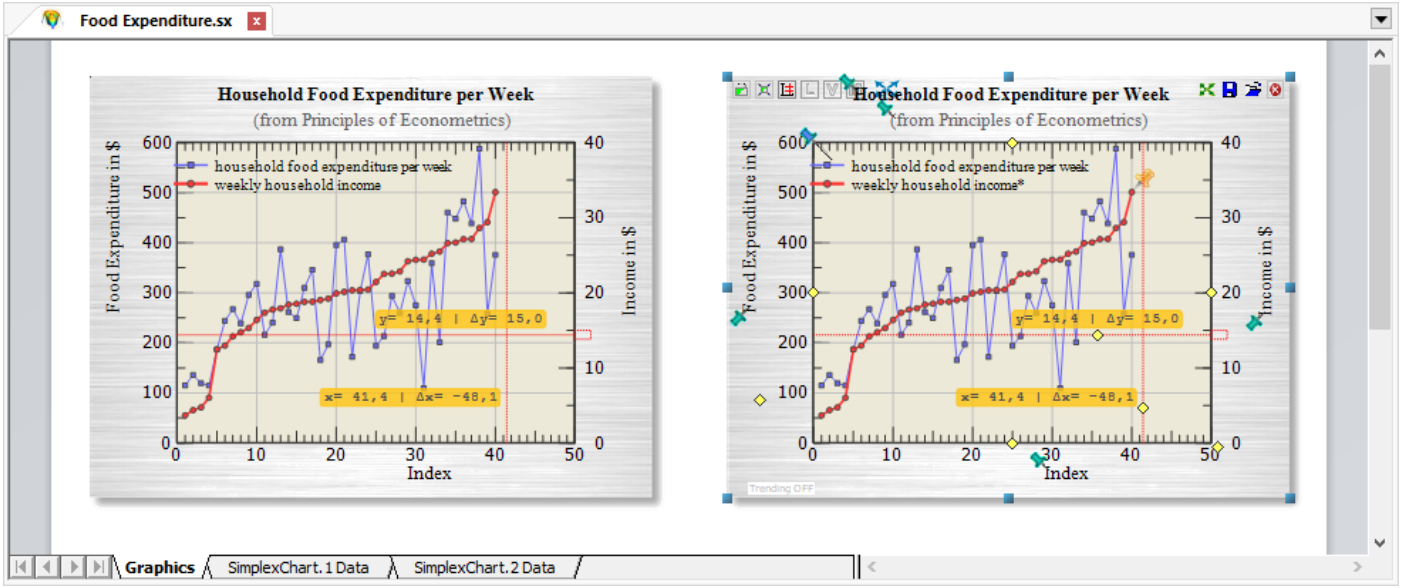
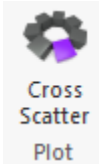


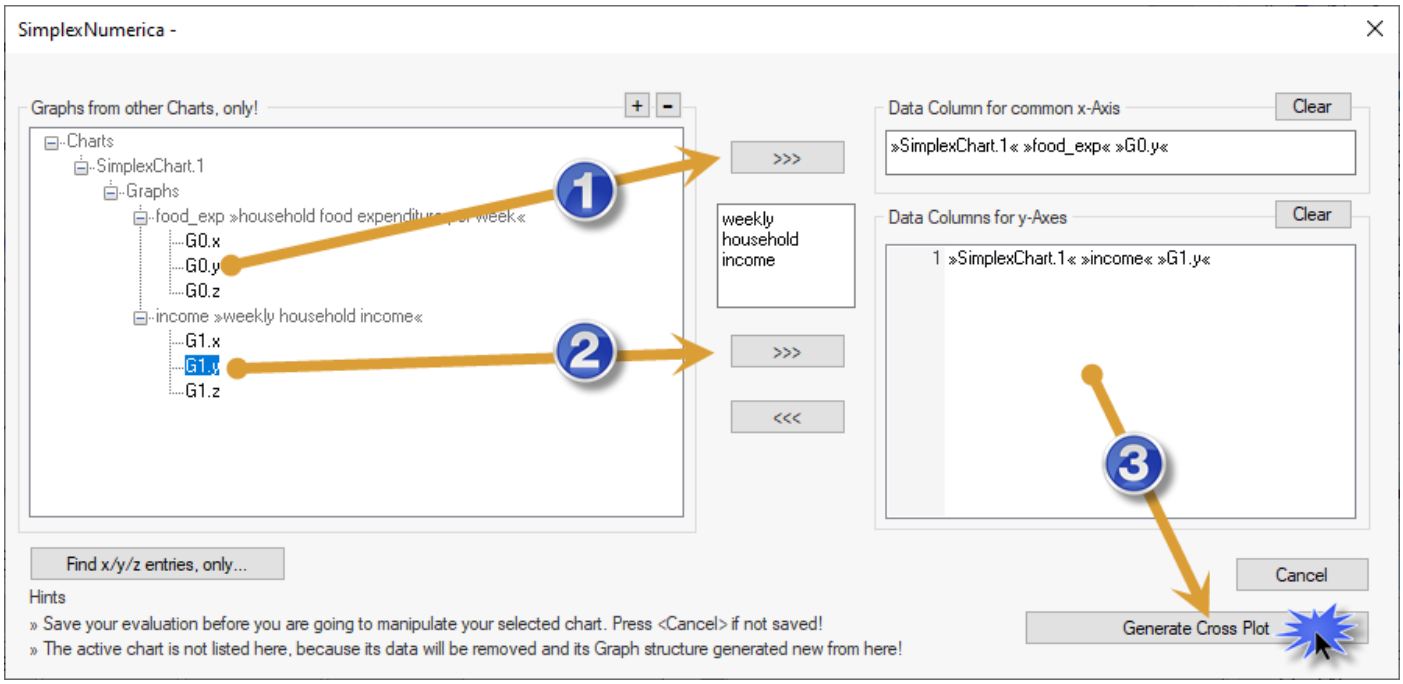
→ Please select the right chart to identify it as the main chart with the focus!



Then press again the icon on the left.

Yes, our goal was to plot food expenditures on the y-Axis and weekly Income on the x-Axis…

Let's do that in the following dialog:



Click on the left tree control on a array name (x/y/z) and then on the >>> button to the data column for the x-Axis (only one) or y-Axes (more than one – if you like). Then press the button ***Generate Cross Plot***.

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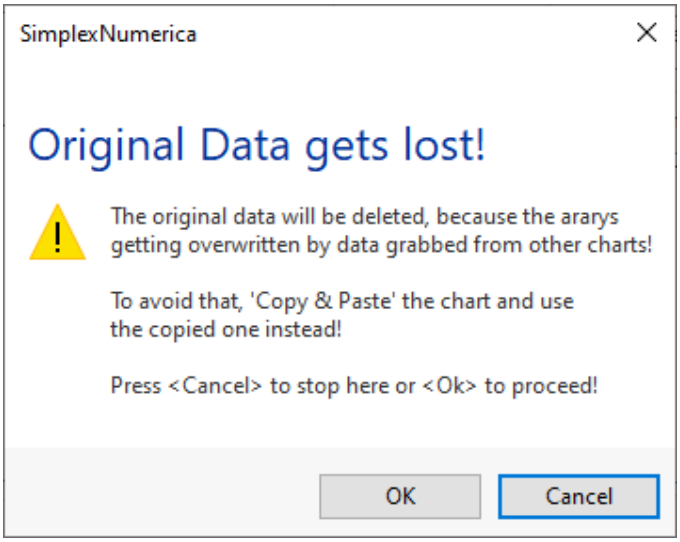
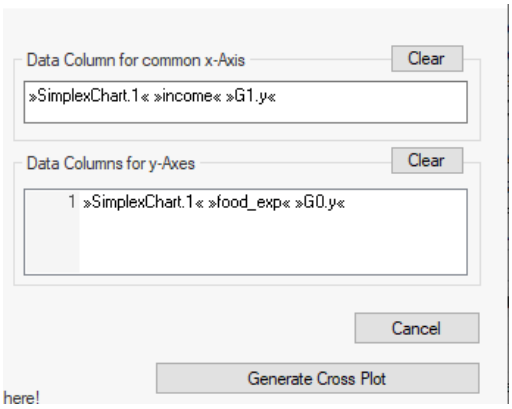
Before the program executes the re-arrangement (and removing of previous data) the program pops up the following messagebox:



Here you can cancel and hence stopping the internal procedure - before '*Hence with it*'. ☹

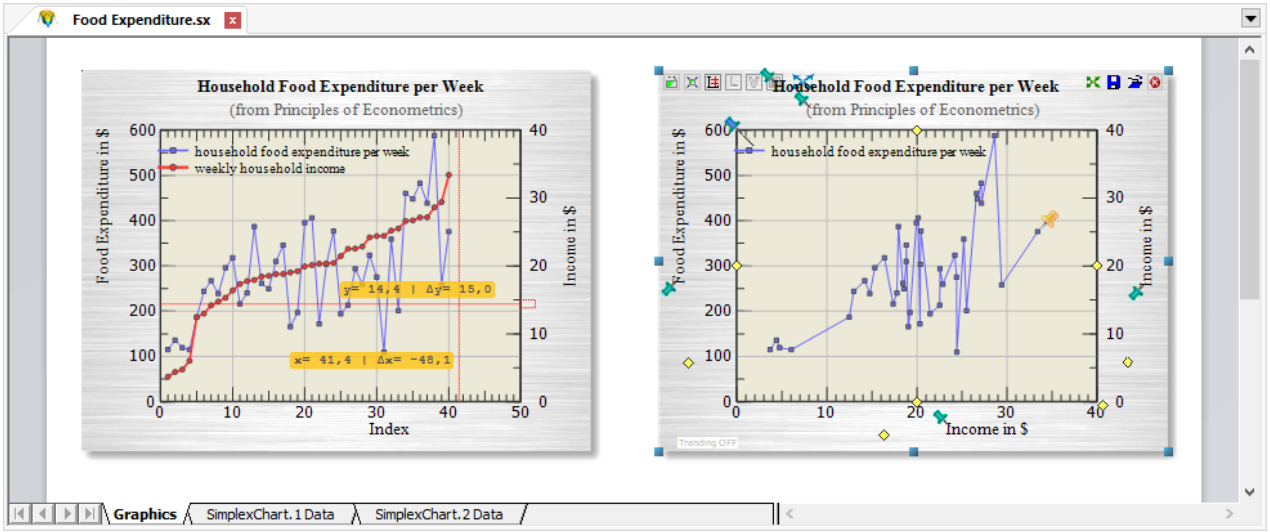
→ To proceeded, please press Ok…

➔ *The result is strange! What did we make wrong? Yes, 'income' was put on the y-Axis instead on the x-Axis and vice versa.*



→ So, please correct that and repeat the last steps…

As you can see, be careful with that what you do with sensitive measurement data and their resulting implications.



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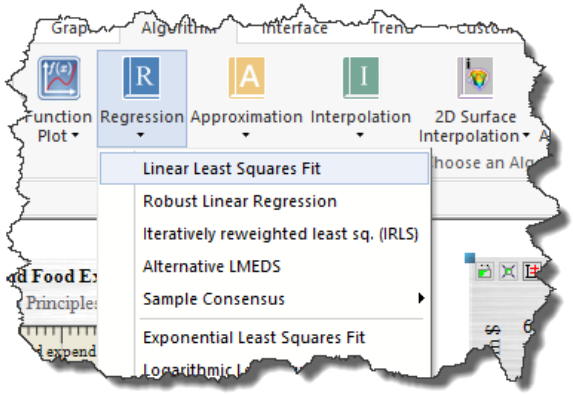
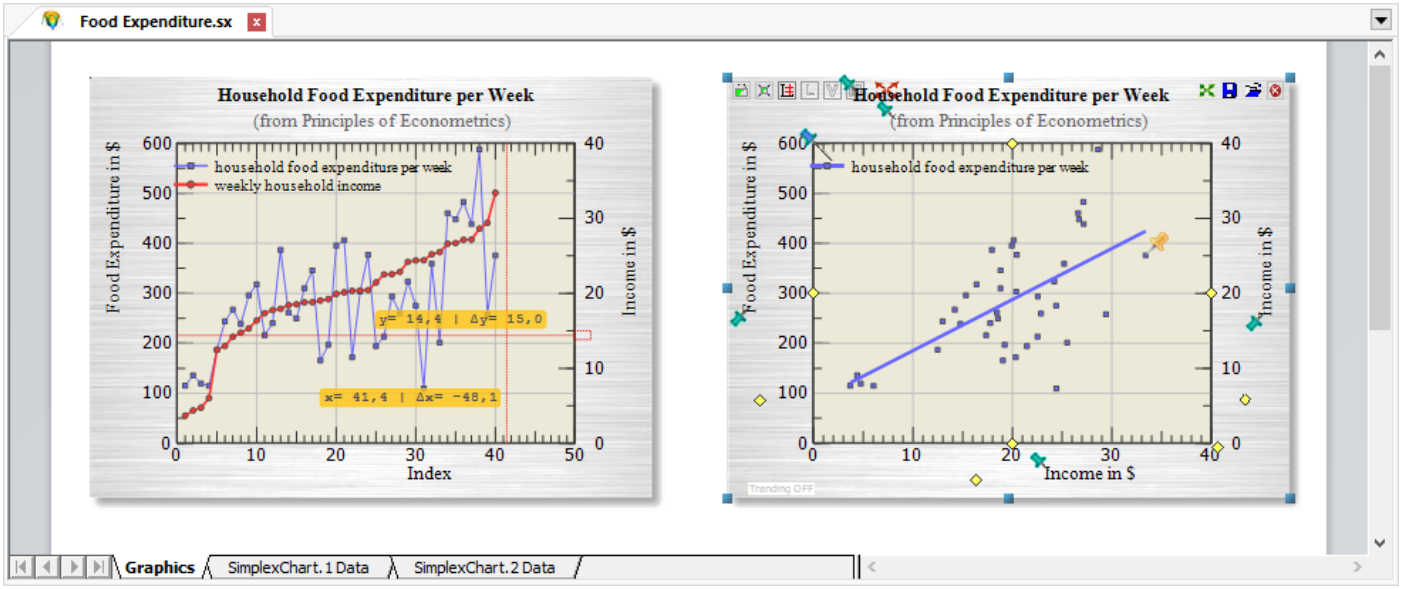
Simple Linear Regression

Here we will use a simple linear regression model as an example - which is estimated using the principle of least squares – to fit the data of the right chart.





By the way: Use the Ribbonbar ***Graph*** to change the appearance of the data graphs.

Dealing with Econometric Data

Time-series Filter

All (new and existing) Time-series Filter in *SimplexNumerica* separate a time series into its trend and cyclical components. In *SimplexNumerica*, trends are usually in the x/y-Arrays (GraphTable x/y columns) and the cyclical component in the x/z-Arrays (GraphTable x/z columns).

The trend component may contain a deterministic or a stochastic trend. The stationary cyclical component is driven by stochastic cycles at the specified periods.

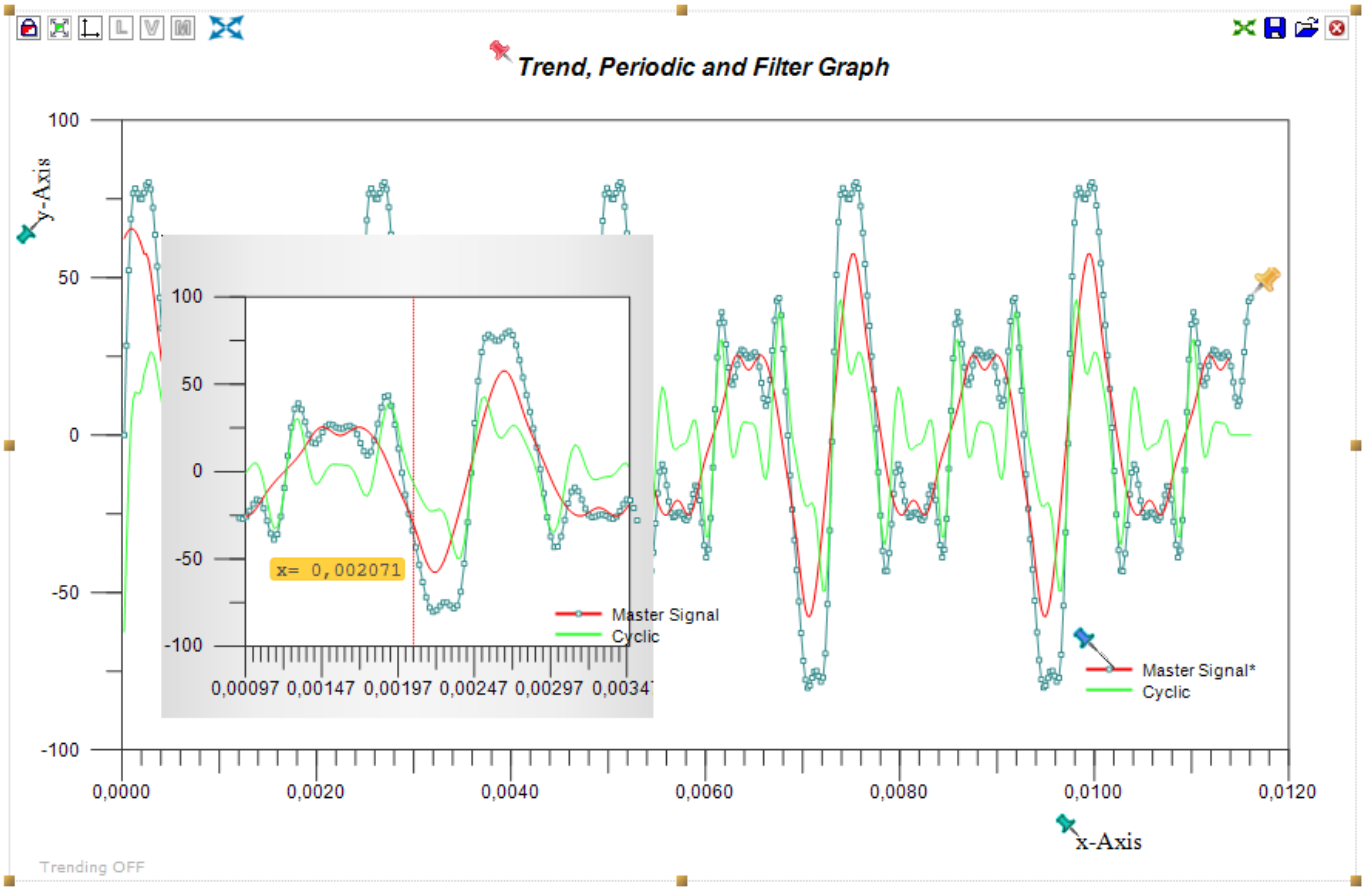
Many time series contain trends and are thus nonstationary. Fitting nonstationary time series to statistical models can be difficult. Some researchers use filters to remove the trends and analyze the stationary components that the filters leave behind.

This new version of *SimplexNumerica* implements e.g. the Baxter–King, Butterworth, Christiano–Fitzgerald (in future release), and Hodrick–Prescott filters commonly used for this purpose.

The well-known Butterworth filter is a high-pass filter, meaning that it only removes the low-frequency components. High-pass filters can be used to make band-pass filters, but here we will just look at the high-pass results. The Butterworth filter has a tuning parameter called the order of the filter. Band-pass filters, like the Baxter–King, remove components below the minimum frequency or above the maximum frequency.

But we will use a 'Simple Moving Average' for our next demo.

Here the chart with the results:



The inner side chart is a zoom of the outer one in a certain range.

So, we will start with the measurement data.

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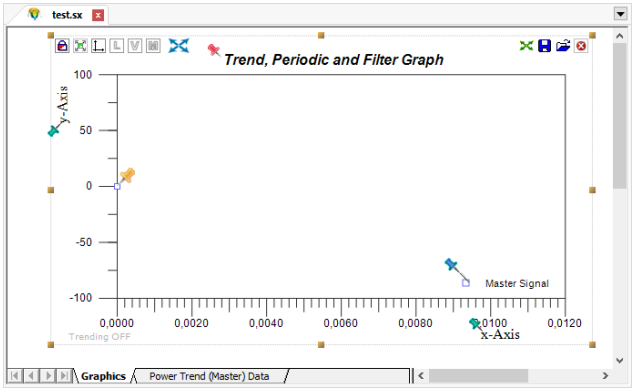
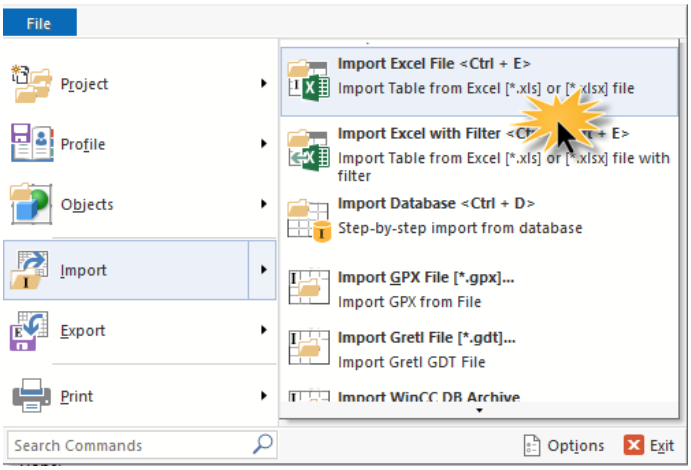
Let's start with an empty Physics chart as shown above (→Thumbnail Window)



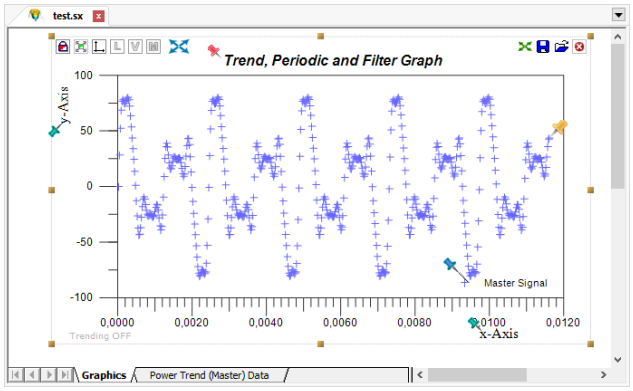


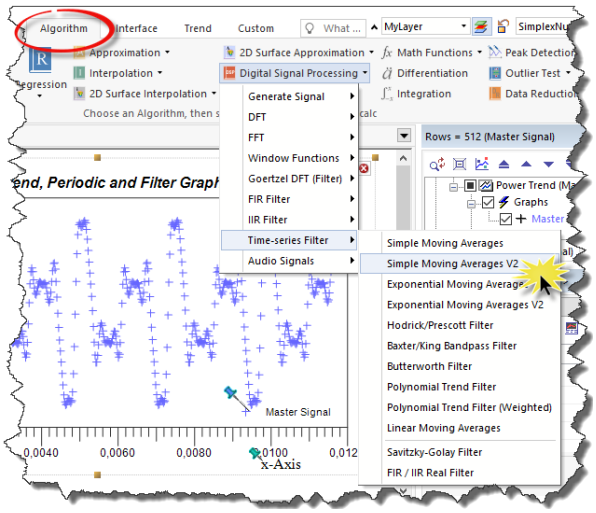
Import a sample Excel file from your SimplexNumerica user directory and choose the file:

```
…\Sample Data\Econometric Analysis\
                    Time-series data.xls
```

Swap to the Graphics View (key <F3>)

It should look like:





Goto to the Ribbonbar *Algorithm* and select *Digital Signal Processing*

From the popup menu *Time-series Filter* select the entry *Simple Moving Average V2*

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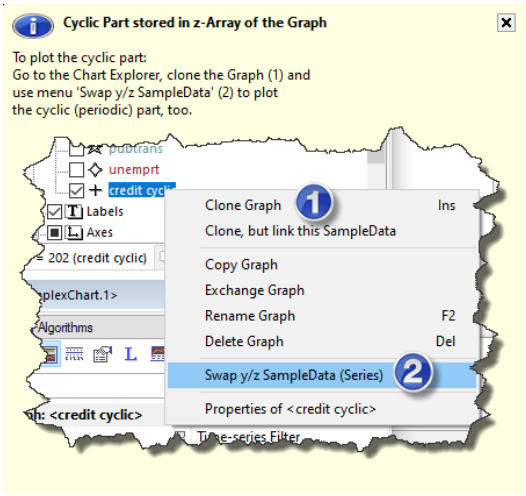
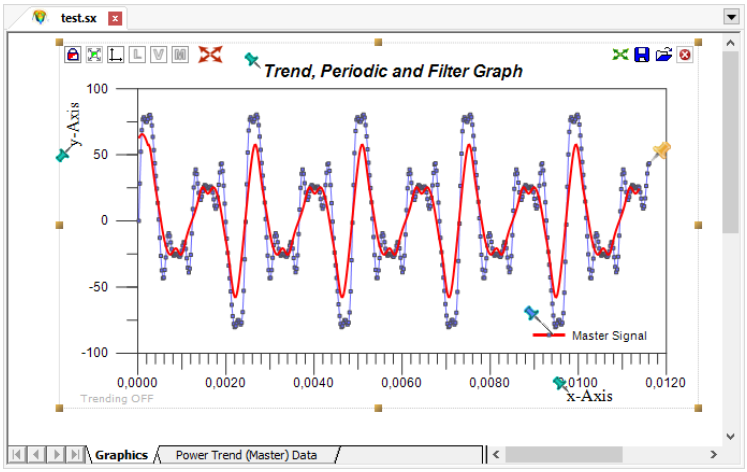


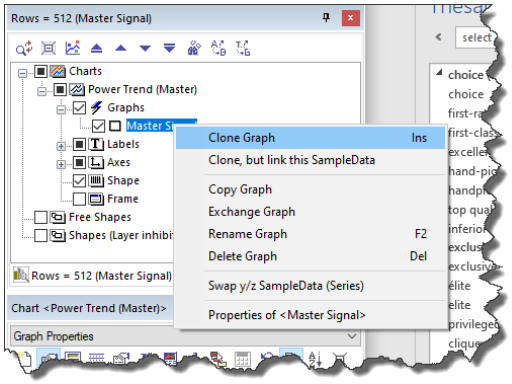
SimplexNumerica calculates the function, then…

…immediately you will get this info box.

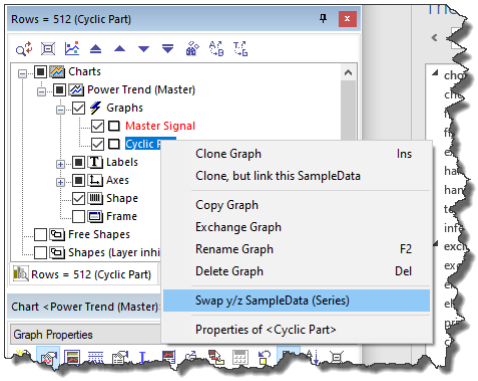
It tells you that the Cyclic Part is stored in the z-Array (third column in the GraphTable) of the Graph.

Now you can see the fit as a curve in the cartesian coordinate system.



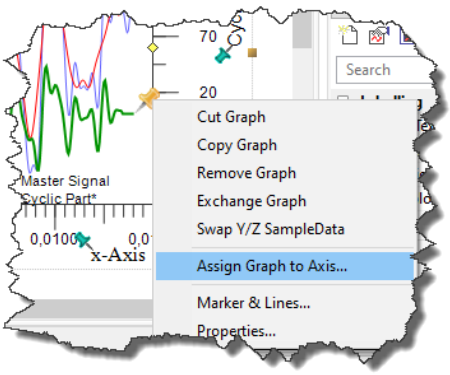


To show the cyclic part, you can clone the Graph.



And then right mouse click on the new (already manually renamed) Graph and select the entry *Swap y/z SampleData*

Assign the cyclic graph to the right y-Axis
(click on the yellow pin)



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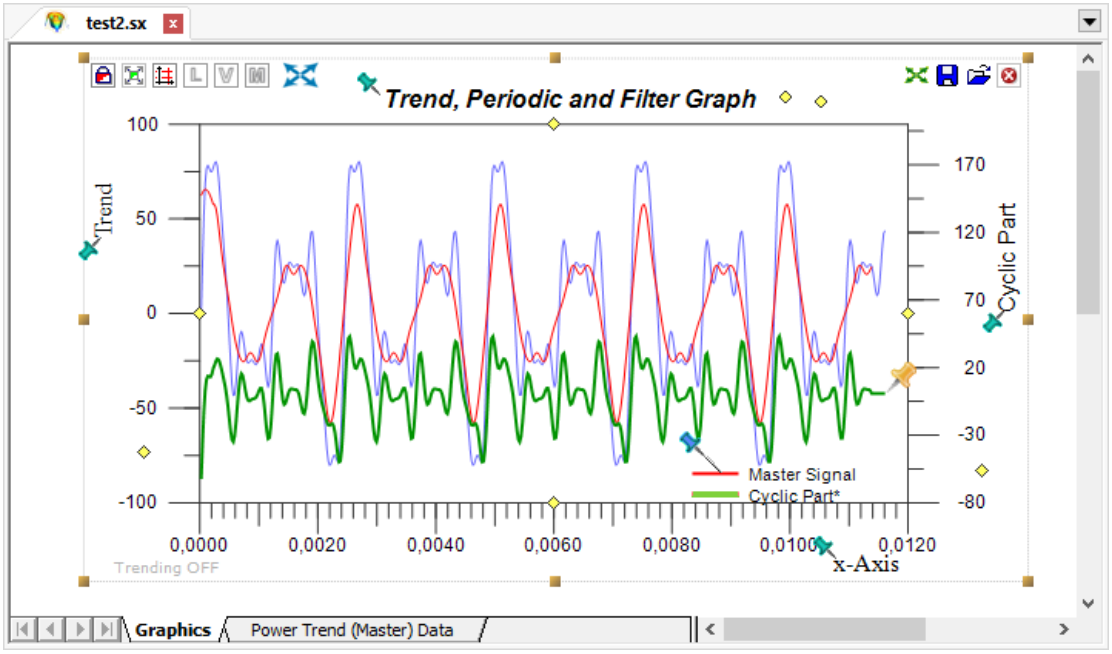
And finally, the result is achieved:



Here is the **blue curve** (the original trend) the original measurement data, connected with straight lines (polylines or when closed, this is called a polygon). These data points are fitted (filtered) with a 'Simple Moving Average' algorithm and gets the **red curve** (a fitted/filtered trend). Altogether, measurement data, polylines and red curve are belonging to one Graph, here the so-called Master Signal.

The **green curve** is a separate Graph (here so-called the Cyclic or Periodic Part) that shows us only the curve and hides the data/polylines behind, because it was adjusted in the settings like that.