ECOM073: Topics in Financial Econometrics

Queen Mary, University London,
Lecturer: Liudas Giraitis, CB301, L.Giraitis@qmul.ac.uk

Exercise 1.

1.1. Table B.17 (see excel file) contains the quarterly dollar sales (in \$1000) of Marshall Field &Company for the period 1960 through 1975. Use different aspect ratios to plot this time series and comment on which aspect ration is preferable.

1.2. Repeat exercise 1.1 for the outstanding consumer credits data, provided in Table B.9.

1.3. Table B.15 (see excel file) contains the quarterly GDP data in UK for the period 1955 through 1969. Plot the GDP data. Plot the $\log(GDP)$ data. Create superimposed time series plots of GDP and $\log(GDP)$ data. Can the two time series be stationary?

Calculate and plot the log rate growth $\log(GDP_t) - \log(GDP_{t-1})$. Can this time series be stationary?

1.4. Compute the impulse response function

$$x_t = 0.6x_{t-1} - 0.2x_{t-2} + \varepsilon_t, \qquad for \quad t = 0, 1, 2, 3, 4, 5,$$

when we have a single shock $\varepsilon_0 = 1$ at time 0, whereas $\varepsilon_1 = \varepsilon_2 = \cdots = 0$. Assume also that $x_{-1} = 0$ and $x_{-2} = 0$.

Graph x_t and comment on patterns you observe.

Does the impact of shock on x_t decreases with increase of t? How many lags are needed for the impact of shock to be reduced by 50%?

1.5. Compute the impulse response function

$$x_t = \phi x_{t-1} + \varepsilon_t, \qquad for \quad t = 0, 1, 2, 3, 4, 5,$$

when we have a single shock $\varepsilon_0 = 1$ at time 0, whereas $\varepsilon_1 = \varepsilon_2 = \cdots = 0$. Assume also that $x_{-1} = 0$. Consider the following cases:

a) Let $\phi = 0.7$. Graph x_t and comment on patterns you observe.

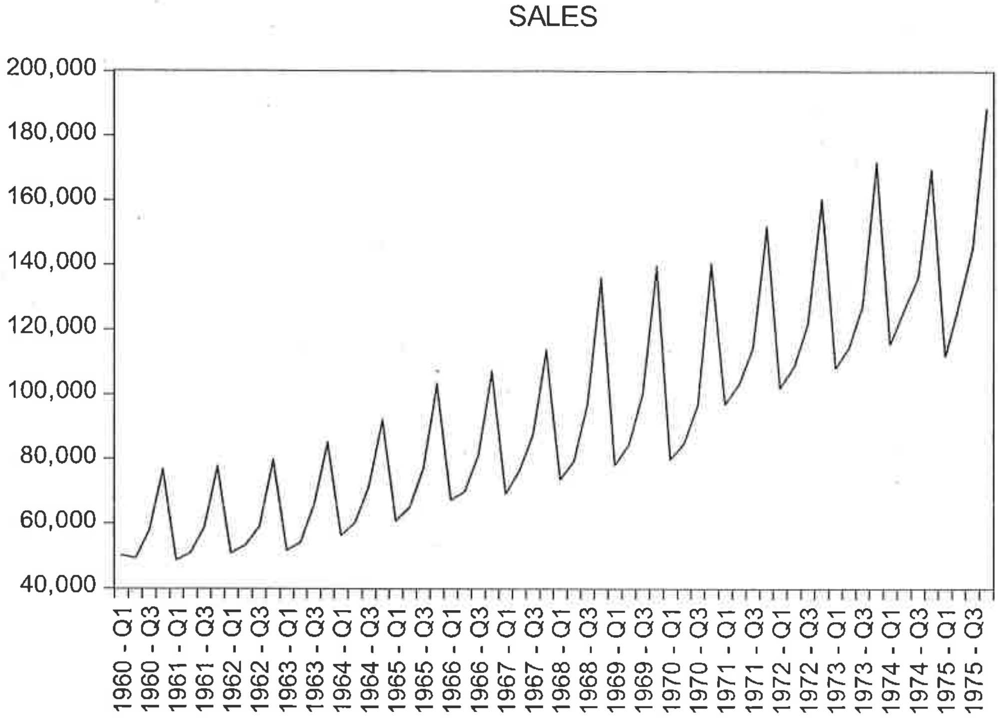
b) Let $\phi = 1$. Graph x_t and comment on patterns you observe.

ECOM073: Topics in Financial Econometrics

Solutions

Ex 1.1 Once you open the data set, if you double-click on it you can see the data (the series on sales).

If you type "View" then Graph, you have all the options you need to create a graph.



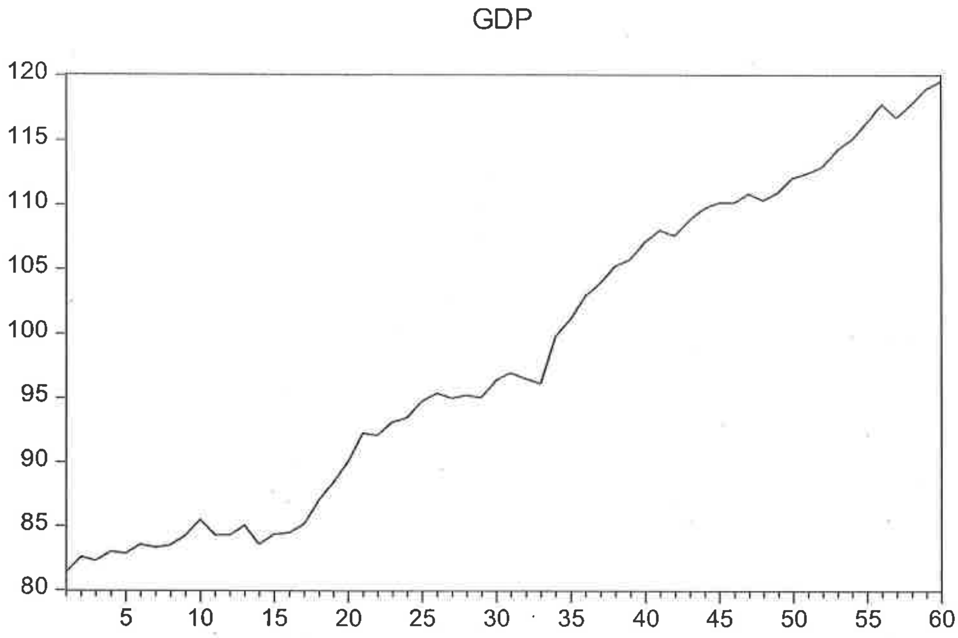
There is a trend and cyclicality on the data.
In the "Graph" option, Frame and Size you can change width and height to get different values of the aspect ratio.

You can also plot a graph of a series using the command "name of the series.line", that is, in our case you should get the same graph as above if you type on the command bar "sales.line" .

Exercise 1.2 (similar to Ex 1.1, so omitted)

Exercise 1.3

Plot the GDP



This time series is clearly not a stationary one.
You can work on graphs, in e-views there are very nice options available to make graphs nicer or more suitable to your needs.

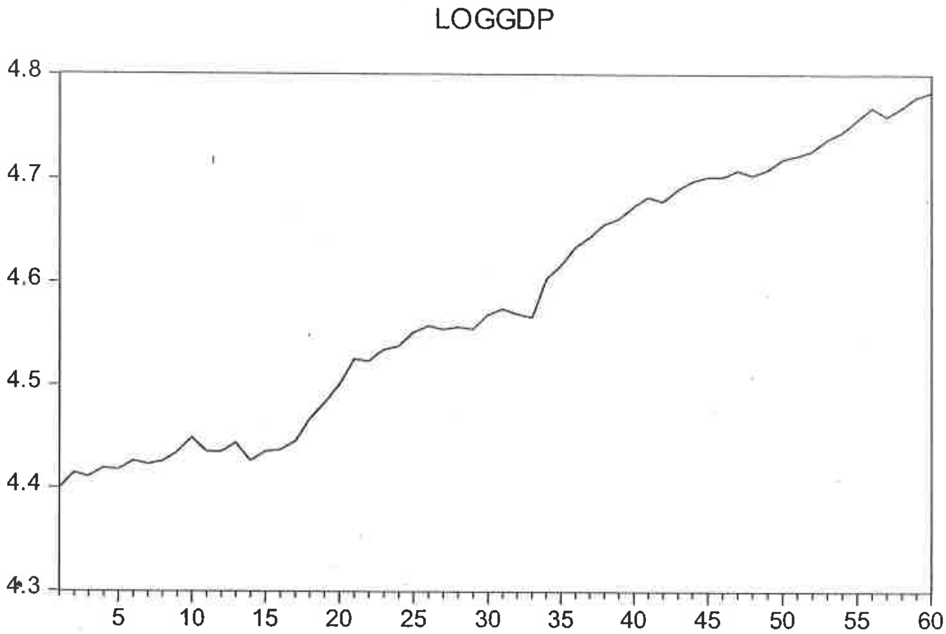
If you type "Graph" and then "View" as before you can see a complete menu with the options "Graph type", "Frame and Size", "Axes and Scaling", "Legend", "Graph Eelements", "Quick Fonts", Templates and Objects".

Each of these has a sub-menu with various useful options. In the graphs and Symbols you may change as you like the colour of the lines and the symbols that characterize them. This is particularly useful when you have more than one series to plot in the same graph.
If we for instance generate the log(GDP) then we can plot these series in different graphs as well as in the same graph as follows.

To generate a variable in E-Views you should use the command "genr". For instance, let's generate the log(GDP).
Type on the command bar: "genr NAME = log(gdp)", where NAME is a name that you give to the variable you want to generate (generally is better to create a name that reminds you what the new variable is). In this case let's call the variable "loggdp", so the command will be:

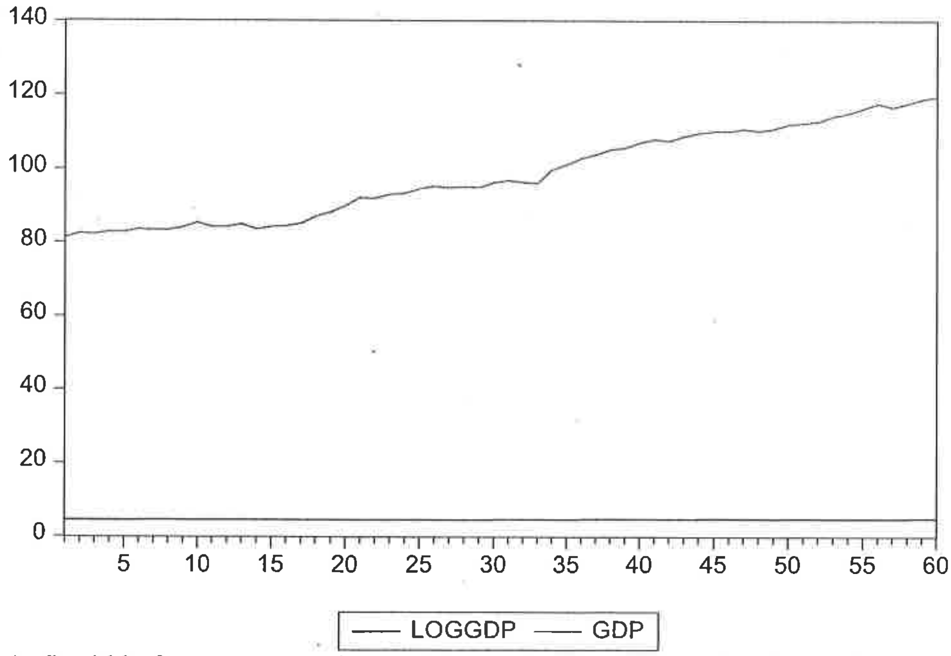
genr loggdp = log(gdp)

if you click enter you should get a new variable generated in the workfile with the name you chose.

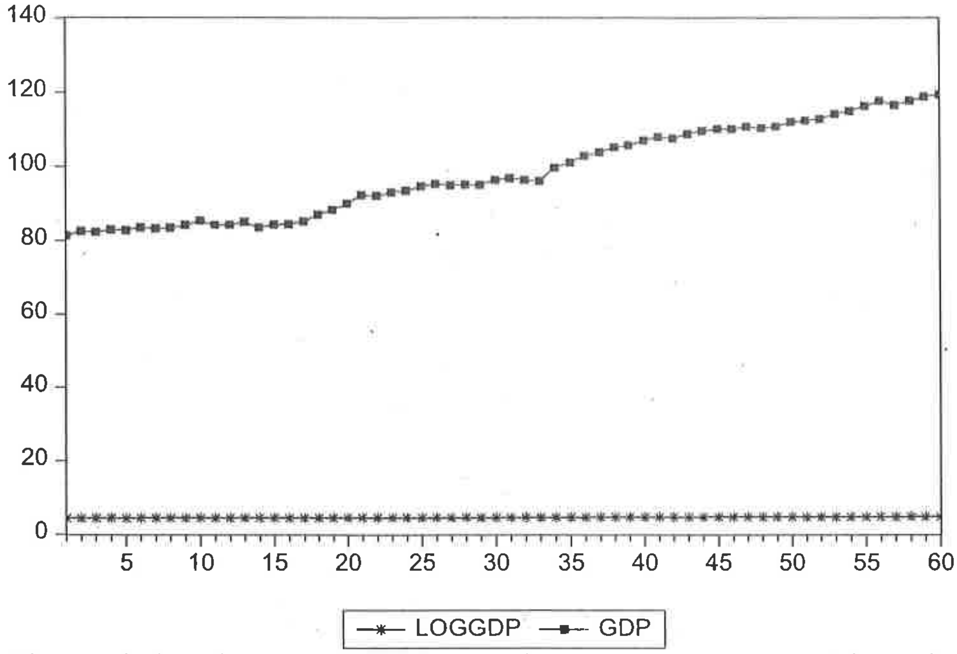


As expected, this series is not stationary either, even though it ranges between 4.4 and 4.8 because we took logs.

To plot them together, type: "Quick", then "Graph". Insert the name of the series you want to plot, in our case, type "loggdp gdp" and you get:



As I said before you may change this graph as you like using the options mentioned above. You may get something like:



Changes in loggdp are not so evident as changes in gdp because of the scale.

If you want to freeze a graph, use the option:
"freeze(NAME) SERIESNAME.line"

Assume you want to keep a copy of the gdp graph, then type in the command bar:

"freeze(graphgdp) gdp.line".
You should get a green copy of the graph in the workfile.

To calculate the log difference $\log(GDP_t) - \log(GDP_{t-1})$ type on the command bar:

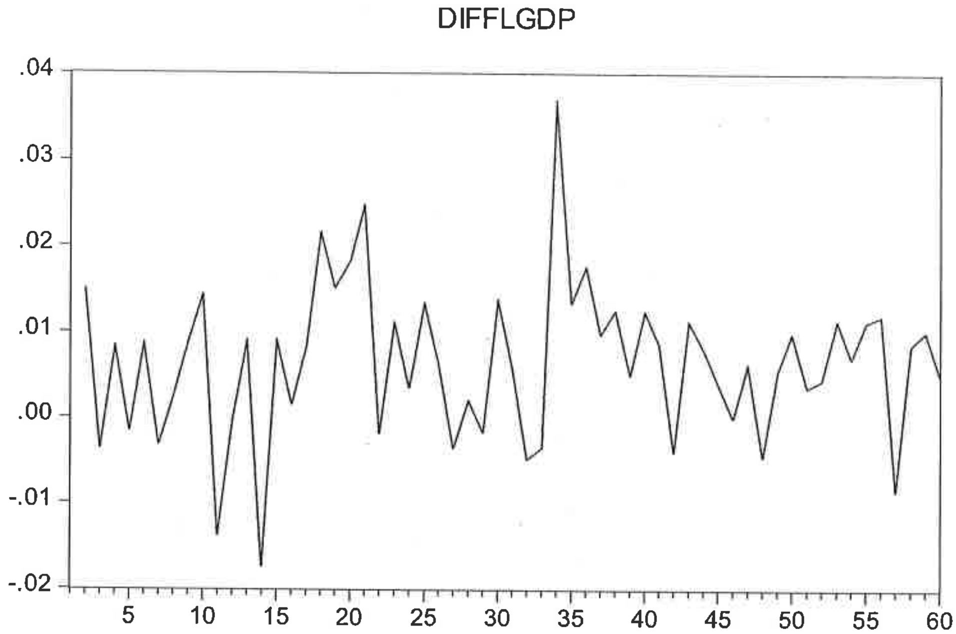
"genr difflgdp = d(loggdp)", where difflgdp is the name you choose.

As before, you should get a new variable in the workfile.

We expect this series to be stationary now (taking differences is generally used to de-trend series) because we are doing the following:

$$\log(GDP_t) = \log(GDP_{t-1}) + \varepsilon_t$$
$$\log(GDP_t) - \log(GDP_{t-1}) = \varepsilon_t$$

which is a series that follows the characteristics of the error term.
If we plot the variable we get indeed the following graph:


DIFFLGDP
.04
.03
.02
.01
.00
-.01
-.02
5
10
15
20
25
30
35
40
45
50
55
60

1.4. Compute the impulse response function

$$x_t = 0.6x_{t-1} - 0.2x_{t-2} + \varepsilon_t, \qquad for \quad t = 0, 1, 2, 3, 4, 5;$$

when we have a single shock $\varepsilon_0 = 1$ at time 0, whereas $\varepsilon_1 = \varepsilon_2 = \cdots = 0$. Assume also that $x_{-1} = 0$ and $x_{-2} = 0$.

Graph x_t and comment on patterns you observe.

Does the impact of shock on x_t decreases with increase of t? How many lags are needed for the impact of shock to be reduced by 50%?

Solution. Compute x_0, then x_1, x_2 and so on as follows:

$$\begin{aligned}
x_0 &= 0.6x_{-1} - 0.2x_{-2} + \varepsilon_0 \\
&= 0.6(0) - 0.2(0) + 1 = 1; \\
x_1 &= 0.6x_0 - 0.2x_{-1} + \varepsilon_1 \\
&= 0.6(1) - 0.2(0) + 0 = 0.6; \\
x_2 &= 0.6x_1 - 0.2x_0 + \varepsilon_2 \\
&= 0.6(0.6) - 0.2(1) + 0 = 0.36 - 0.2 = 0.16; \\
x_3 &= 0.6x_2 - 0.2x_1 + \varepsilon_3 \\
&= 0.6(0.16) - 0.2(0.6) + 0 = 0.096 - 0.12 = -0.0240; \\
x_4 &= 0.6x_3 - 0.2x_2 + \varepsilon_4 \\
&= 0.6(-0.0240) - 0.2(0.16) + 0 = -0.0144 - 0.0320 = -0.0464; \\
x_5 &= 0.6x_4 - 0.2x_3 + \varepsilon_5 \\
&= 0.6(-0.0464) - 0.2(-0.0240) + 0 = -0.0278 + 0.0048 = -0.0230.
\end{aligned}$$

We see that the impulse response function is tending to zero fast as t increases, and impulse response function is taking both positive and negative values.

The impulse response function x_t for $t = 0$ is $x_0 = 1$. The decrease of the impact of the shock at time 0 after 1 lag is

$$\frac{x_0 - x_1}{x_0} \times 100\% = \frac{1 - 0.6}{1} \times 100\% = 40\%.$$

The decrease of the impact of the shock at time 0 after 2 lags is

$$\frac{x_0 - x_2}{x_0} \times 100\% = \frac{1 - 0.16}{1} \times 100\% = 86\%.$$

So the impact of shock will be reduced by 50% after two lags.

1.5. Compute the impulse response function

$$x_t = \phi x_{t-1} + \varepsilon_t, \qquad for \quad t = 0, 1, 2, 3, 4, 5,$$

when we have a single shock $\varepsilon_0 = 1$ at time 0, whereas $\varepsilon_1 = \varepsilon_2 = \cdots = 0$. Assume also that $x_{-1} = 0$. Consider the following cases:

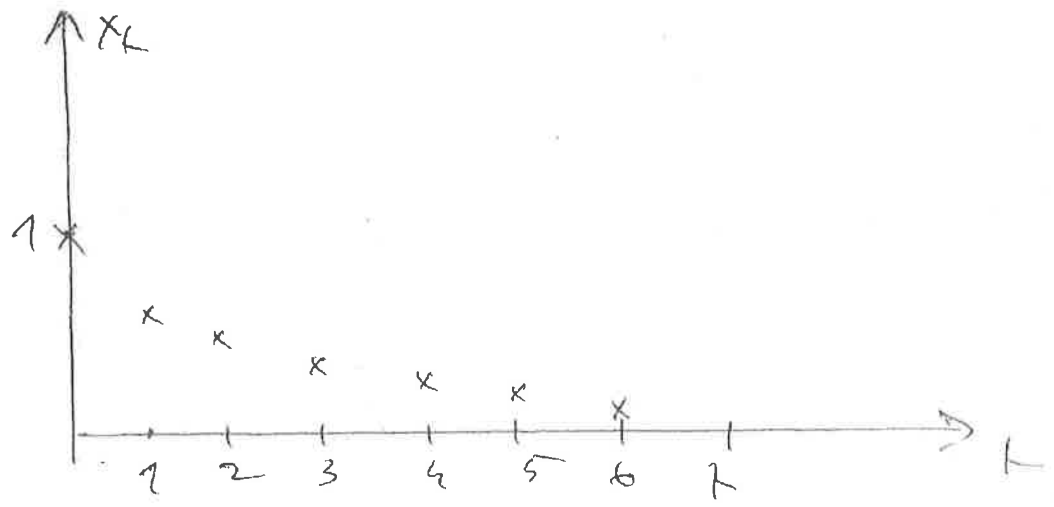
a) Let $\phi = 0.7$. Graph x_t and comment on patterns you observe.

b) Let $\phi = 1$. Graph x_t and comment on patterns you observe.

Solution. Case a) Compute x_0, then x_1, x_2 and so on as follows:

$$\begin{aligned}
x_0 &= 0.7x_{-1} + \varepsilon_0 = 0.7(0) + 1 = 1;\\
x_1 &= 0.7x_0 + \varepsilon_1 = 0.7(1) + 0 = 0.7;\\
x_2 &= 0.7x_1 + \varepsilon_2 = 0.7(0.7) + 0 = 0.49;\\
x_3 &= 0.7x_2 + \varepsilon_3 = 0.7(0.49) + 0 = 0.3430;\\
x_4 &= 0.7x_3 + \varepsilon_4 = 0.7(0.3430) + 0 = 0.2401;\\
x_5 &= 0.7x_4 + \varepsilon_5 = 0.7(0.2401) + 0 = 0.1681.
\end{aligned}$$

The impulse response x_t tends to zero fast, monotonically, and is taking nonnegative values. The impact of the shock at time 0 is diminishing very quickly.



Case b) Compute x_0, then x_1, x_2 and so on as follows:

$$\begin{aligned}
x_0 &= x_{-1} + \varepsilon_0 = 0.7(0) + 1 = 1; \\
x_1 &= x_0 + \varepsilon_1 = 1 + 0 = 1; \\
x_2 &= x_1 + \varepsilon_2 = 1 + 0 = 1; \\
x_3 &= x_2 + \varepsilon_3 = 1 + 0 = 1; \\
x_4 &= x_3 + \varepsilon_4 = 1 + 0 = 1; \\
x_5 &= x_4 + \varepsilon_5 = 1 + 0 = 1.
\end{aligned}$$

In this case the impact the shock does not decrease over time, and the shock stays in the system forever.