Simulation with EViews: Swan's Model

Introduction

EViews provides econometric tools on Windows computers. Areas where it can be useful include the Simulation of Economic Models. The immediate predecessor of EViews was MicroTSP, first released in 1981. EViews uses the visual features of modern Windows software with toolbars, pull-down menus and the ability to have (say) Excel and EViews open on your computer's desktop at the same time. Some of the most important basic capabilities of EViews are: Entering, extending, and correcting time series data; Computing a new series, based on a formula of any complexity; Plots of series on your screen or printer, scatter diagrams, bar graphs, and pie charts; Descriptive statistics: correlations, covariances, autocorrelations, cross-correlations, and histograms; Estimation of single equations or systems of equations; Matrix operations; Solution of recursive or simultaneous models.

EViews operates on the basis of 'objects' which you create and place in 'workfiles'. Objects recognised by EViews include:

(i) A time-series of observations on a variable. This could be data on the exogenous variables (in which case we will need data on these variables for all the periods over which we intend to simulate). For simulation purposes it is also necessary to provide the starting values for the lagged endogenous variables. Whichever it is, each series has a name, and you can request operations on all the observations just by mentioning the name of the series. EViews provides convenient visual ways to enter time series from the keyboard or from disk files, to create new series from existing ones, to display and print series, and to carry out statistical analysis of the relations among series;

and

(ii) A model, consisting of one or more equations to be simulated, appropriate parameter values and statements which guide the form which you want the output from the simulation to take.

Using EViews to perform model simulations

We will use as our example the Swan model. This model has 5 equations, 5 endogenous variables and 2 exogenous variables. Swan's equations for aggregate demand components, aggregate output and employment are set out below:

$$C_t = 1.56Y_{t-1} - 0.0006Y_{t-1}^2 - 164$$
$$I_t = 0.4Y_{t-1} - 215$$
$$U_t = 0.3Y_{t-1} + 22 - V_t$$
$$Y_t = C_t + I_t + E_t - U_t$$
$$N_t = 10Y_{t-1} - 871.5\sqrt{0.28Y_{t-1} + 14.44} + 7951$$

Where the endogenous variables are:

C = Aggregate consumption expenditure
I = Private investment
U = Imports
Y = National income
N = Aggregate employment

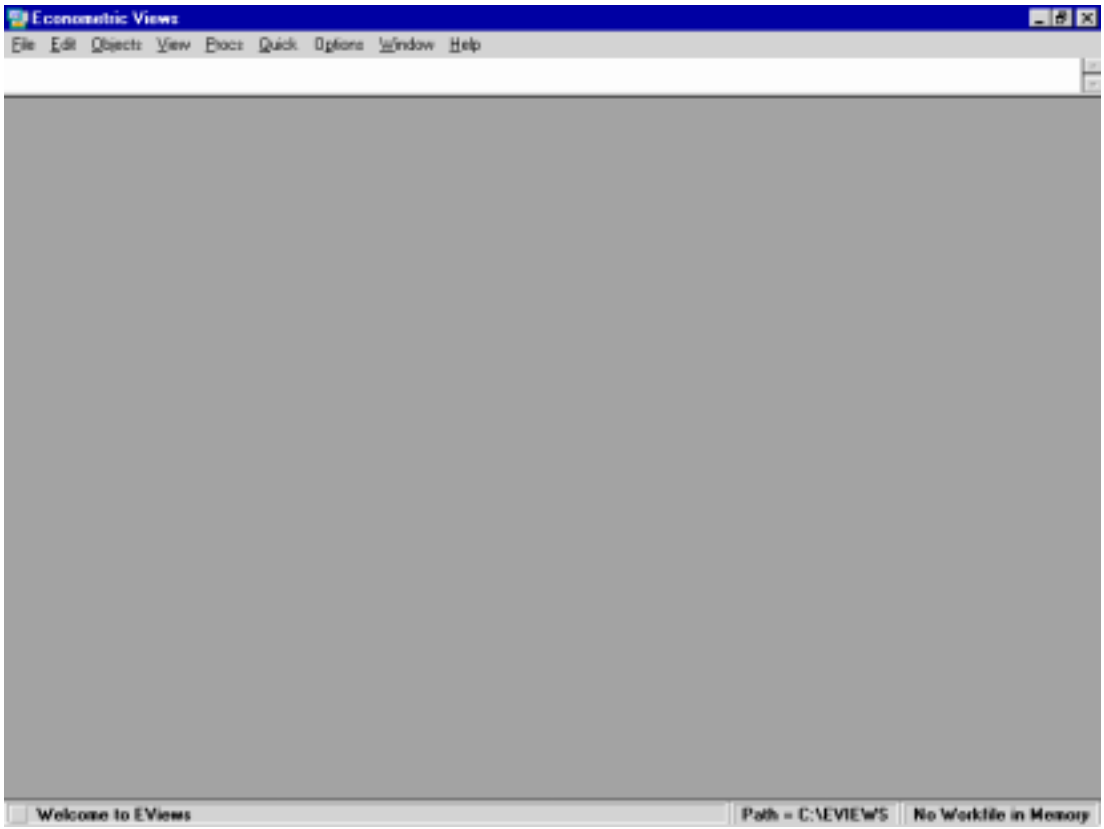
And the exogenous variables are:

E = Exports plus Public Investment
V = A constructed variable tracking changes in the level of imports resulting from changes in overseas conditions.

We have data (provided by Swan) on the values of E and V for the period 1929:3 - 1939:2, data on the value of Y for 1929:2 and data on the actual value of one of the endogenous variables (N) for the period 1929:3 - 1939:2. (This is not needed for the simulation but will enable us to compare simulated and actual values for an important endogenous variable.)

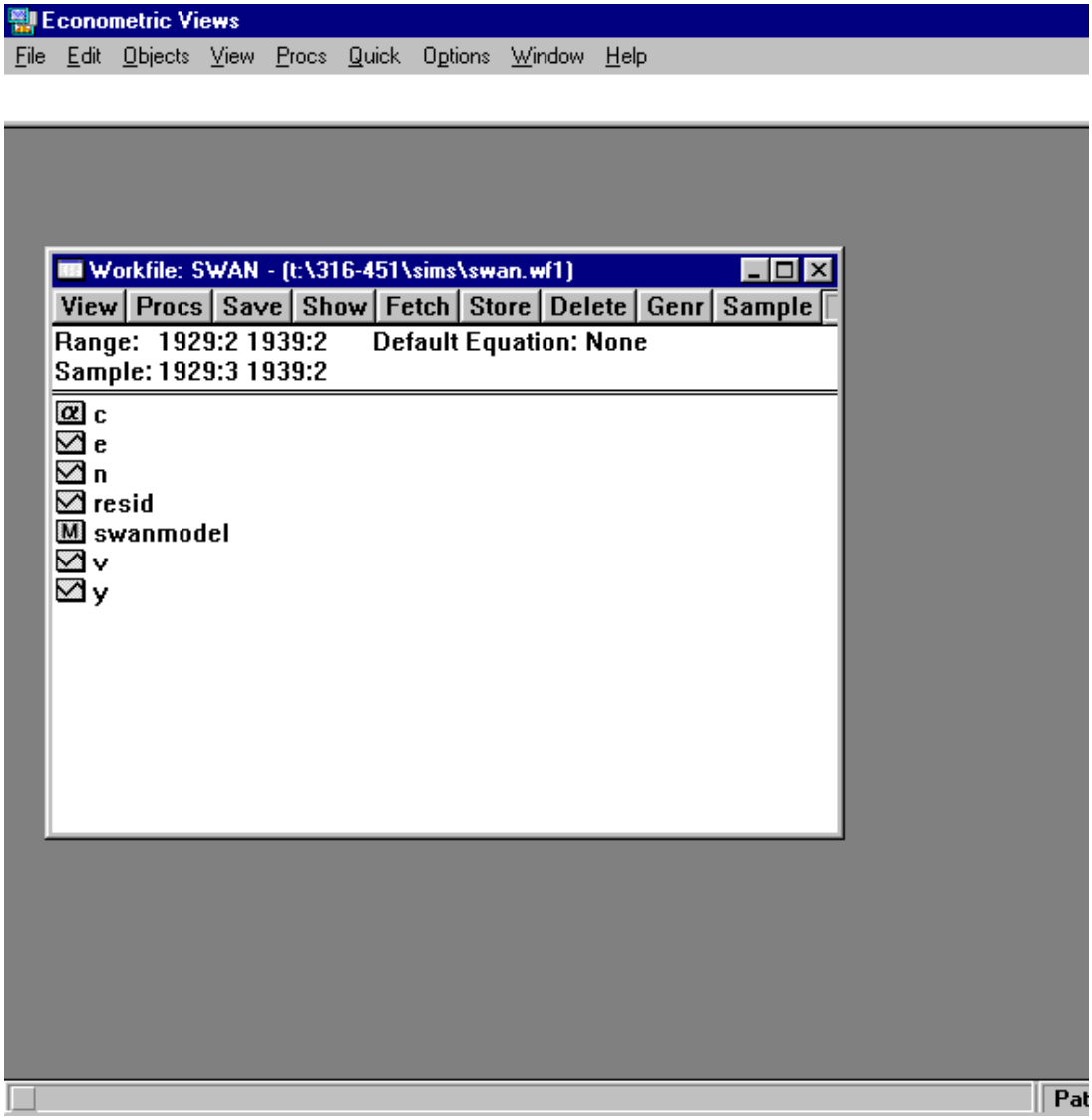
I have created a workfile containing Swan's data and the 5-equation model. The workfile is called Swan.wf1. The remainder of this document tells you how to use EViews to run the model and discusses the results. Before proceeding any further, download the file swan.wfl.

We begin by opening EViews. You should then see the EViews desktop. A 'screenshot' is set out below.



At the top left hand corner is the word 'File'. Click on it and then choose 'Open' and 'workfile' from the menu. Scroll down the list of directories until you come to the folder which contains the file (Swan.wf1) we want. Once you have found it, "double-click" on the name 'Swan.wfl' and the workfile will then open up on the EViews desktop (the 'Open dialog box' will close automatically).

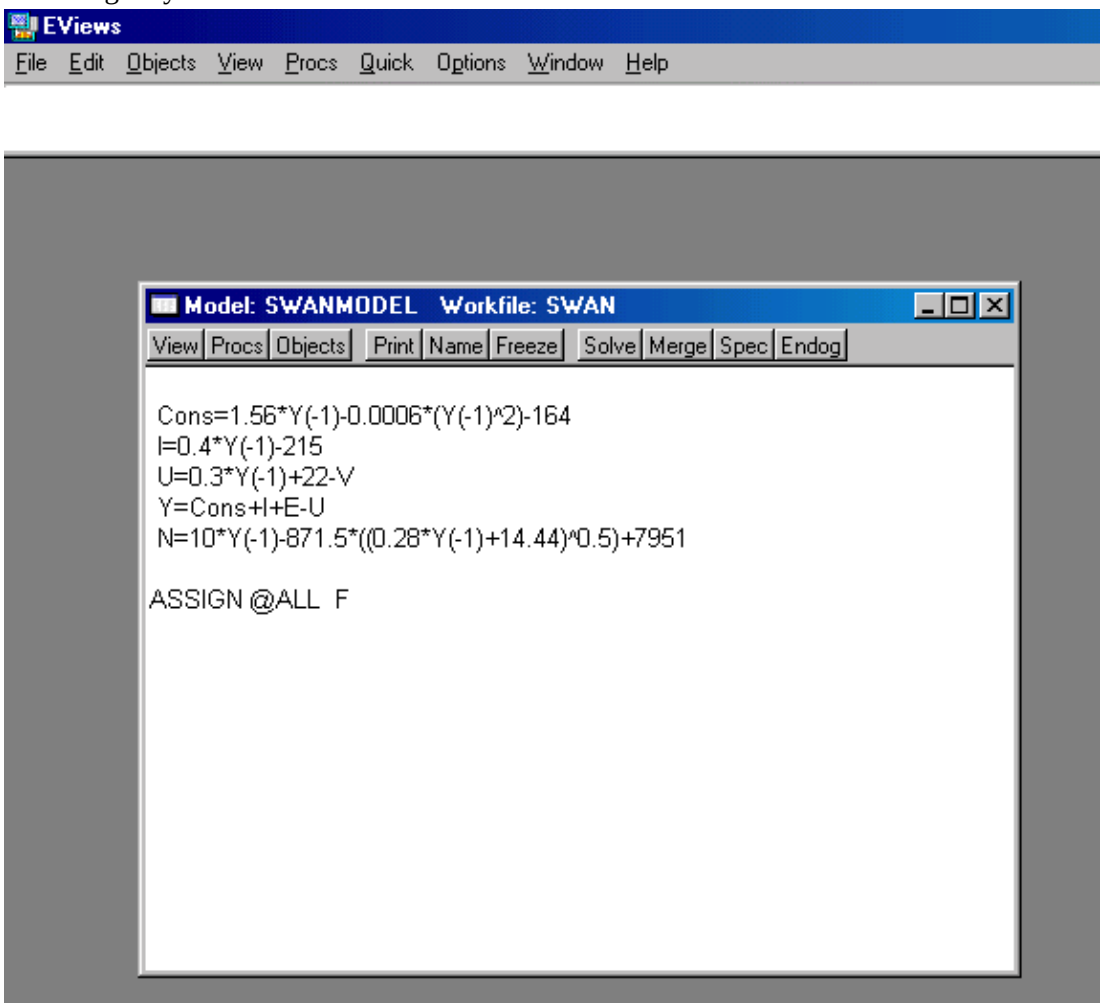
On the EViews desktop you will see the open workfile containing the various objects which I have created in order to get EViews to simulate Swan's model. Your screen should now look like the picture set out below.



Notice that at the top of the workfile we are given the 'range' of the data and the sample. The sample has to be less than the range if there are lagged variables in the model.

The little boxes and labels in the workfile each refers to 'an object'. The boxes labelled c and resid are of no interest to us. They are automatically placed in every workfile by EViews. Simply disregard them. The boxes labelled e and v have the data on the two exogenous variables in them. The box labelled y has the single 'starting value' for the lagged endogenous variable (y) in it. The box labelled n has the observed values for employment in it. If you were to use the mouse pointer to double-click on any of these objects a box will open up with dates, some numbers and some N/A entries in them. If you were to click on the word 'View' (it is at the left end of the Object's toolbar) you would be given a menu which would enable you to have the data series displayed as a spreadsheet or a line simply by clicking on the name in the menu.

The box labelled 'swanmodel' has in it the equations which are to be simulated and various bits and pieces of information about the simulation. If you were to highlight this name and double click on it the model box would open up on the screen and you would see the following on your screen:



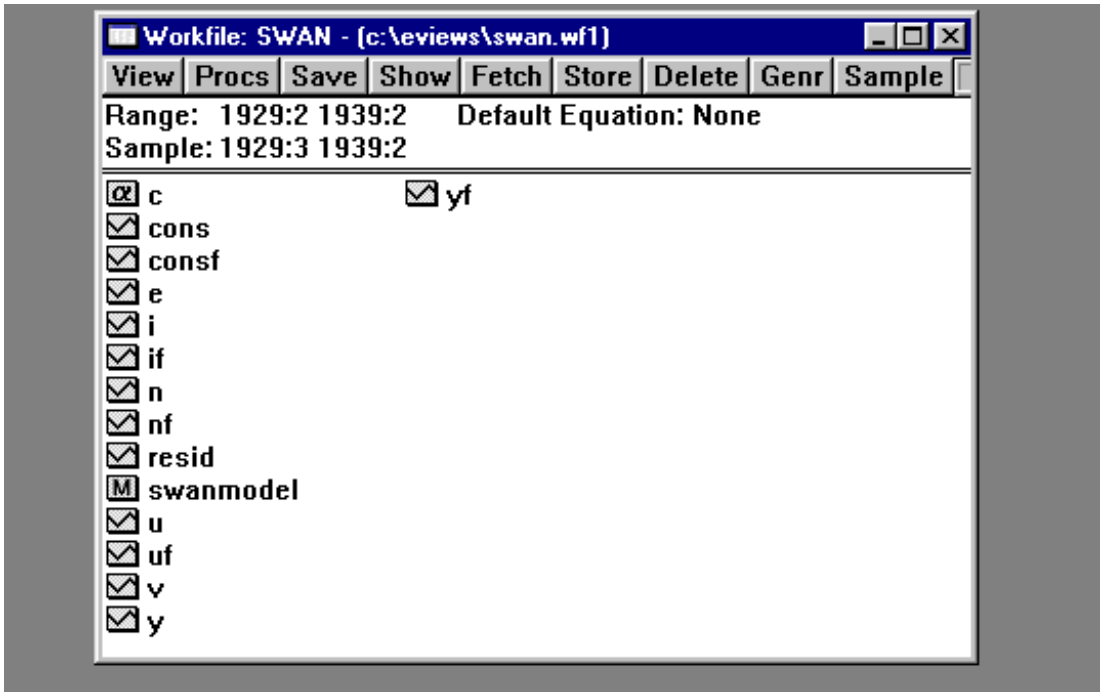
The first five lines contain the equations of the model. Note that I have written the numerical values of the parameters into the equations. I could instead have labelled them alpha, beta, a, b, or whatever and then separately typed in a line saying alpha=1.56 or whatever. Also notice that I have used the label CONS for consumption. This is because C and CON are 'reserved words' in EViews (and many other econometric packages).

The line beginning with the word ASSIGN tells EViews to store the simulated values for all the endogenous variables as time series objects labelled yf, nf, Consf, etc. If I didn't tell it to do this it would store the simulated values for N in the object box where I have placed the actual values of N. By using the ASSIGN statement I keep the historical data which I have given to it separate from the simulated values it will generate.

To run the model you must make sure the 'model' object is open on the desktop and then click on the 'Solve' button (this is slightly to the right of the middle of the model's toolbar). You will then be given a dialog box which will ask you to choose, amongst other things, between a dynamic simulation and a static simulation. The difference is in the treatment of the lagged values of the endogenous variables during the simulation. Dynamic simulation uses historical data for lagged endogenous variables if they are dated prior to the first period of the simulation. Thereafter it uses the values forecasted by the model itself. Static simulation uses actual values for all lagged variables even if they are endogenous to the

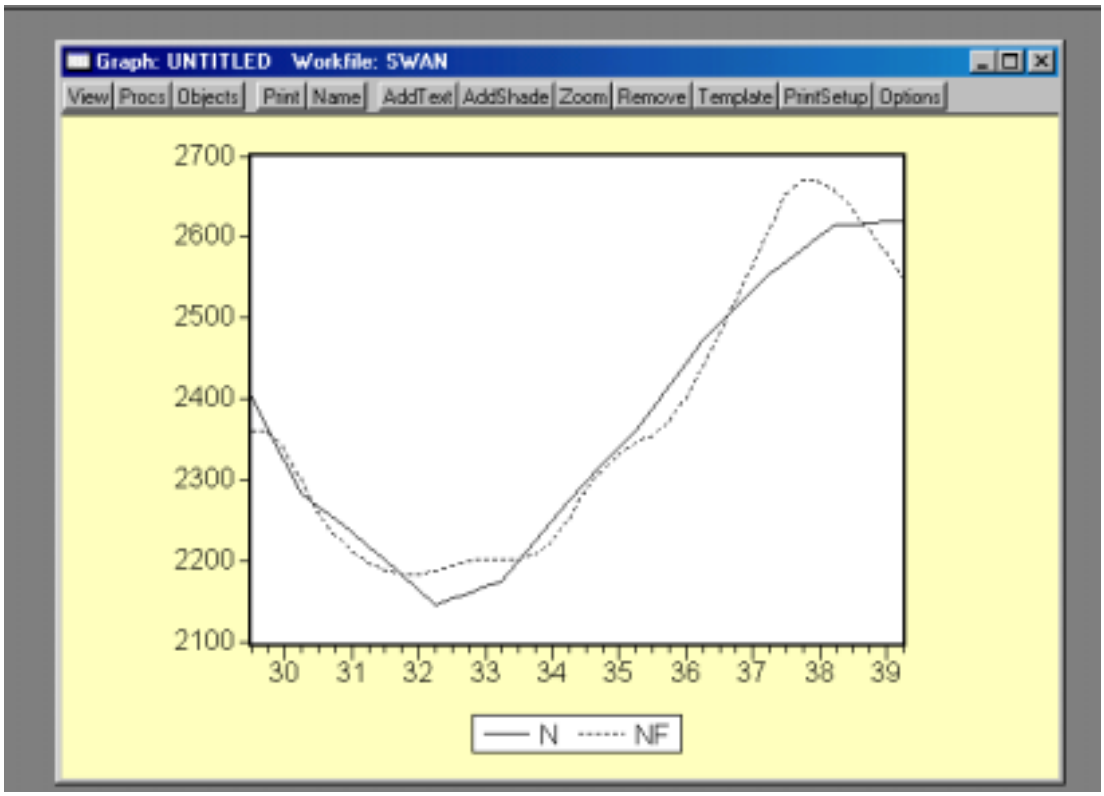
model. When the simulation is over several periods, static simulation gives a series of one-period ahead forecasts. We are also able to choose the maximum number of iterations and the tolerance level. The default is a maximum of 150 iterations. You may use the Max Iterations option to increase the number of iterations. You may use the Convergence option to change the convergence criterion. Convergence occurs when the percent change in each variable is less than the criterion. The default value for the criterion is .00001 or .001 percent, but you may make it smaller if you want more accurate results or larger if you want the procedure to run faster and are willing to accept lower accuracy.

When you are ready to go you simply click on the 'OK' button in the Model Solution dialog box. EViews, like Micro-TSP (but unlike 'big' TSP) solves all models, linear or non-linear, recursive or simultaneous, using the iterative Gauss-Seidel algorithm. For most models it will converge rapidly and give you the solutions without any problems. When EViews has solved the model it will give you a message that it has converged in the bottom left-hand corner of the screen. (A linear model, and especially a linear and recursive model, will converge very quickly.) The solved values will be 'written to' the workfile with the data series for each endogenous variable stored as an 'object'. Once convergence has occurred you can close down the model box and look at the 'objects' containing the output in the workfile. If you run the Swanmodel the workfile will end up looking like the picture below.



Notice that the workfile now has a number of new objects in it. These are the boxes containing the simulated values of the endogenous variables (consf, if, nf, uf and yf).

If you want to see a time series plot of the values for nf (say) simply click it's box open and 'View' the line graph. If you want to see a time series graph for both n and nf, you would highlight both series (by highlighting one and holding <Shift> down when you click on the other); you would then put the mouse pointer over the word 'Quick' in the tollbar at the top of the screen, click it open and then click on 'Graph', followed by 'OK' and 'OK' again. This would result in the following graph being displayed on the screen.



Graphs and series files can be printed simply by clicking on the Print button.

When you have finished, close down all the boxes except the workfile. You can then save the workfile to your floppy before you close the workfile down and then close EViews.

Some final remarks

1. Remember to avoid reserved words like C, CON and D for variables.

2. EViews has an excellent HELP facility. Help pages related to model simulation include: Solving models, Creating a model, More on solving models, Options in solving models, The assign statement, and; Other solution control statements.

3. You can use the Swan Workfile (or any of the others I have supplied for you) as a 'template' to be copied and replaced by your own write up of other models.

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