

NEREUS

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CGE Models

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Outline

- ✓ Introduction

 - How to carry out a simulation?

 - How to implement the SJ model in GEMPACK?

Overview of GEMPACK Software

- ✓ Introduction

- GEMPACK is a suite of general-purpose economic modelling software especially suitable for general and partial equilibrium models.
- It can handle a wide range of economic behaviour and also contains powerful capabilities for solving intertemporal models
- GEMPACK provides software for calculating accurate solutions of an economic model, starting from an algebraic representation of the equations of the model.

Overview of GEMPACK Software

- ✓ Introduction

- GEMPACK provides:

- a) a simple language in which to describe and document the equations of your economic model;

- b) a program which converts the equations of your model to a form ready for running simulations with the model;

- c) options for varying the choice of exogenous and endogenous variables and the variables shocked;

- d) utility programs to assist in managing the database on which the model is based.

Overview of GEMPACK Software

- ✓ Introduction

- The GEMPACK programs:
 - WinGEM – windows interface to GEMPACK
 - GemEdit – Text editor
 - ViewHAR – for looking in the data in a Header Array File
 - ViewSQL – for looking at Solutions files
 - RunGEM – for automating simulations with models
 - TABmate – text editor for developing TABLO Input files

Outline

Introduction

- ✓ How to carry out a simulation?

How to implement the SJ model in GEMPACK?

Overview of GEMPACK Software

- ✓ How to carry out simulations with models
- In this part we will explain some of the terms used in GEMPACK;

Implementation

Simulation

Levels and percentage-change variables

- ***Implementation:***

A model is implemented in GEMPACK when:

Overview of GEMPACK Software

✓ How to carry out simulations with models

a) the equations describing its economic behaviour are written down in an algebraic form following a syntax. (TABLO Input File)

b) data describing one solution of the model are assembled to be used as a starting point for simulations (ViewHAR)

Overview of GEMPACK Software

✓ How to carry out simulations with models

- ***Simulation:***

➤ Many simulations are the answer to “WHAT IF” question such as:

“If the government were to increase tariffs by 10 percent, how much different would the economy be in 5 years time from what it would otherwise have been?”

Overview of GEMPACK Software

- ✓ How to carry out simulations with models
 - From the original solution supplied as the starting point, a simulation calculates a ***new solution*** to the equations of the model.
 - Within GEMPACK, the results of a simulation are usually reported as percentage changes from the original solution.
 - Solving models within GEMPACK is always done in the context of a simulation.

Overview of GEMPACK Software

- ✓ How to carry out simulations with models
 - The process: there is a specification of the values of certain variables (“the exogenous ones” and the software calculates the values of the remaining variables (“the endogenous ones”).
 - The new values of the exogenous variables are usually given by specifying the percentage changes (increases or decreases) from their values in the original solution given as part of the implementation.

Overview of GEMPACK Software

- ✓ How to carry out simulations with models
- ***Levels and Percentage-Change Variables***
 - When the model is implemented, the equations may be linearized (that is, differentiated).
 - The variables in these linearized equations are usually interpreted as percentage changes in the original variables.
 - The original variables (prices, quantities, etc) are referred as the **levels variables**.

Overview of GEMPACK Software

- ✓ How to carry out simulations with models
- The (usually nonlinear) equations relating these levels variables are called **the levels equations.**

- **Levels equations:**

$$D = PQ$$

- The equation relates the dollar value, D , of a commodity to its prices P (*\$ per ton*) and its quantity Q (*tons*).

Overview of GEMPACK Software

- ✓ How to carry out simulations with models

- **Linearized version:**

$$p_D = p_P + p_Q$$

- The percentage change p_D in the dollar value is equal to the sum of the percentage changes p_P in the price and p_Q in the quantity.

Overview of GEMPACK Software

✓ How to carry out simulations with models

- ***Data:***

- The data for a model often consists of input-output data (giving dollar values) and parameters (including elasticities).
- The data are usually sufficient to read off an initial solution to the levels equations (usually all basic prices are taken as 1 in the initial solution).

Overview of GEMPACK Software

- ✓ How to carry out simulations with models

- ***Example of a simulation using Stylized Johansen***

- Stylized Johansen described in Chapter 3 of Dixon et al (1992) and explained by Prof. Eduardo Haddad.

- Model:
 - Single country

 - Two sectors "s1" and "s2" producing a single commodity

Overview of GEMPACK Software

- ✓ How to carry out simulations with models

One household sector

Two primary factors

- Initial input-output database
- Households consume 4 (millions) dollars' worth of commodity 2 and industry 2 uses 3 (millions) dollars' worth of labor
- Totals are presented in the last row and column.

Overview of GEMPACK Software

Input-output Data Base for Stylized Johansen

			Industry		Households	Total Sales
			1	2		
Sectors	Commodity	1	4.00	2.00	2.00	8.00
	Commodity	2	2.00	6.00	4.00	12.00
Factors	Labor	3	1.00	3.00		
	Capital	4	1.00	1.00		4.00
Total Production			8.00	12.00	6.00	

Overview of GEMPACK Software

Levels Variables of Stylized Johansen

GEMPACK variable	Meaning	DPPW Notation
Y	Value of households income	Y
PC(i)	Price of commodity i	Pi (i = 1,2)
PF(f)	Price of factor f	Pf (f = 3, 4)
XCOM(i)	Supply of commodity i	Xi (i = 1,2)
XFAC(f)	Supply of factor f	Xf (f = 3,4)
XH(i)	Household use of commodity i	Xio (i = 1,2)
XC(i,j)	Intermediate input of commodity i to industry j	Xij (i,j = 1,2)
XF(f,j)	Input of factor f to industry j	Xfj (f = 3,4; j = 1,2)
DVCOMIN(i,j)	Dollar values for intermediate inputs	(i, j = 1,2)
DVFACIN(f,j)	Dollar values for factor use by industry	(f = 3,4; j = 1,2)
DVHOUS(i)	Dollar values for household consumption	(i = 1,2)

Overview of GEMPACK Software

- Most of variables have one or more arguments (indicating sectors and/or factors).
- They are **vector variables**.
- Variables which have no arguments (“Y” is the only one here) are referred to as **scalar or macro variables**.
- **Examples:**

Overview of GEMPACK Software

- PC (i) is regarded as a vector variable with 2 components, one for each sector, namely PC("s1") and PC("s2").

- XF(f,j) is regarded as a vector variable with the following 4 components:
 - component 1 XF ("labor", "s1"): input of labor (factor 1) to sector 1.
 - component 2 XF ("capital", "s1"): input of capital (factor 2) to sector 1.
 - component 3 XF ("labor", "s2"): input of labor (factor 1) to sector 2
 - component 4 XF ("capital", "s2"): input of capital (factor 2) to sector 2.

Overview of GEMPACK Software

- Corresponding to each of these variables, there is an associated percentage change variable.
- TABLO adds the prefix “p_” to the name of the levels variable to indicate a percentage change.
- For example, p_XF is the percentage change in the levels variable XF.

Overview of GEMPACK Software

- Simulation:
- We have to choose a closure:
 - Supply of the two factors, labor and capital, are the exogenous variables
- Thus we will specify the percentage changes in the variable XFAC, namely p_XFAC , and solve the model to find the percentage changes in all the other variables.

Overview of GEMPACK Software

- For this simulation, we increase the supply of labor by 10 per cent and hold the supply of capital fixed

- The starting point for any simulations with Stylized Johansen model are:
 - the TABLO Input file (called SJ. TAB) and
 - the data file (called SJ.DAT)

Outline

Introduction

How to carry out a simulation?

- ✓ How to implement the SJ model in GEMPACK?

Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Starting WinGEM:

In Windows, double click on the WinGEM icon to start GEMPACK.

This should give the main WinGEM menu

File Simulation HAFiles OtherTasks Program Options Window Help

Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Preparing a Directory for Model SJ

To keep all example files for the SJ model together in one area, we show you how to create a separate directory \SJ for these files and how to copy the relevant files into this directory.

(a) To copy these files within Windows.

- Change to Explorer in Windows by the usual Windows method.

- Use Explorer to create a new folder or subdirectory called \sj and copy all the sj*.* files to it.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

- Preparing a Directory for Model SJ
 - Return to WinGEM to continue the examples.

- Setting the Working Directory
 - Choose a working directory.
 - For SJ model the working directory needs to be the directory \SJ you have just created.
 - To set this, first click on **File** in the main WinGEM menu.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
- Setting the Working Directory
 - In the drop-down menu, click on the menu item

Change both default directories...

- So the sequence of clicks (first File then Change both default directories) is

File|Change both default directories...

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

- Looking at the Data Directly using ViewHAR
 - The input-output data used in SJ model are contained in the data file ***SJ.DAT***.
 - This is a special GEMPACK binary file – ***called Header Array file.***
 - Thus to look at SJ.DAT you have to use a special program to read Header Array files, called ViewHAR.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
- Looking at the Data Directly using ViewHAR

HA Files | View VIEWHAR

- The viewHAR window will appear.
- Click on ***File|Open...*** and selected the file SJ.DAT
- This will open the file SJ.DAT and show the contents on the Contents screen.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
- Looking at the Data Directly using ViewHAR

- Each of the rows corresponds to a different array of data on the file. Look at the column under the heading Name to see what data are in these arrays.

	Header	Type	Dimension	Name
1	CINP	RE	SECT*SECT	Intermediate inputs of commodities to industries - dollar values
2	FINP	RE	FAC*SECT	Intermediate inputs of primary factors - dollar values
3	HCON	RE	SECT	Household use of commodities - dollar values

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
- Looking at the Data Directly using ViewHAR
 - The first array is the “Intermediate inputs of commodities to industries – dollar values”
 - The Header CINP is just a label for this array. (Headers can have up to 4 characters).
 - The array is of Type RE. The R means this is an array of real numbers. The E means that this array has set and element labelling.
 - Double click on CINP to see the numbers in this array.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
- Looking at the Data Directly using ViewHAR

DVCOMIN	1 s1	2 s2	Total
1 s1	4.000	2.000	6.000
2 s2	2.000	6.000	8.000
Total	6.000	8.000	14.000

- Compare this numbers with the Input-Output data for SJ model.
- To return to Contents Screen, click on **Contents** in the ViewHAR menu.

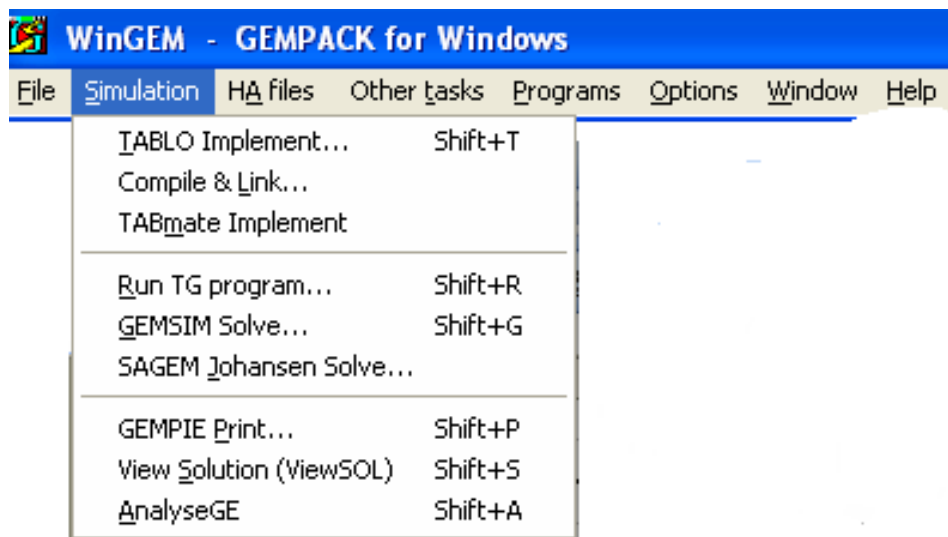
Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
- Looking at the Data Directly using ViewHAR
 - Look at the other Header Arrays called FINP and HCON to see where their numbers fit in the input-output data base.
 - Close ViewHAR in the normal Windows way by selecting

File| Exit

Overview of GEMPACK Software

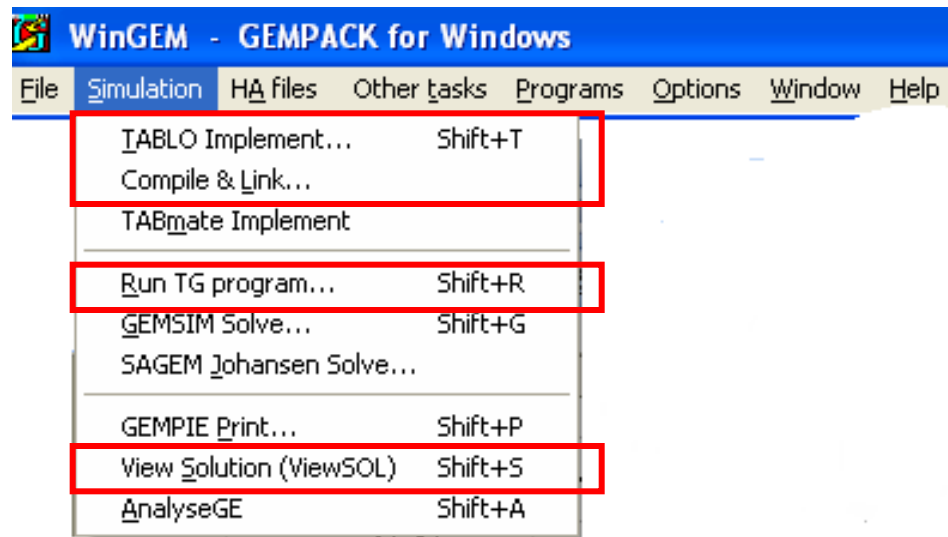
- How to implement the SJ model in GEMPACK?
 - The Example Simulation using a TABLO-generated Program.
 - From the WinGEM menu at the top of the screen choose ***Simulation***.
 - In the drop-down menu the choices are



Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- The items from this menu you will be using in this simulation are



Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- In the TABLO-generated program method, the GEMPACK program TABLO is used to convert the algebraic equations of the economic model into a Fortran program specific to your model.

- This Fortran program (which is referred to as the TABLO-generated program or TG Program in the menu) is compiled and linked to a library of GEMPACK subroutines.

- The executable image of the TABLO-generated program produced by the compiler is used to run simulations on the model.

Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- There are three steps involved in carrying out a simulation using GEMPACK

STEP 1 – Implement the model

STEP 2 – Solve the equations of the model

STEP 3 – View the results

- WinGEM and RunGEM will guide you through these steps and indicate what to do next.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

STEP 1 – Implement the model SJ using TABLO

Step 1 (a) – Run TABLO to create the TABLO-generated program

The TABLO Input file is called ***SJ.TAB***. It contains the theory of the SJ model.

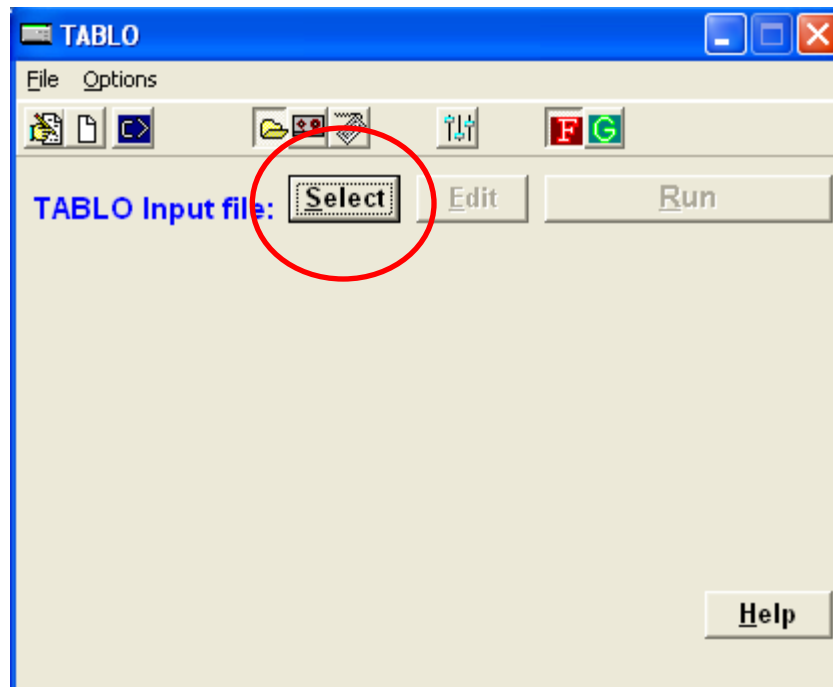
Choose

Simulation | TABLO Implement....

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

A window for TABLO will appear



Overview of GEMPACK Software

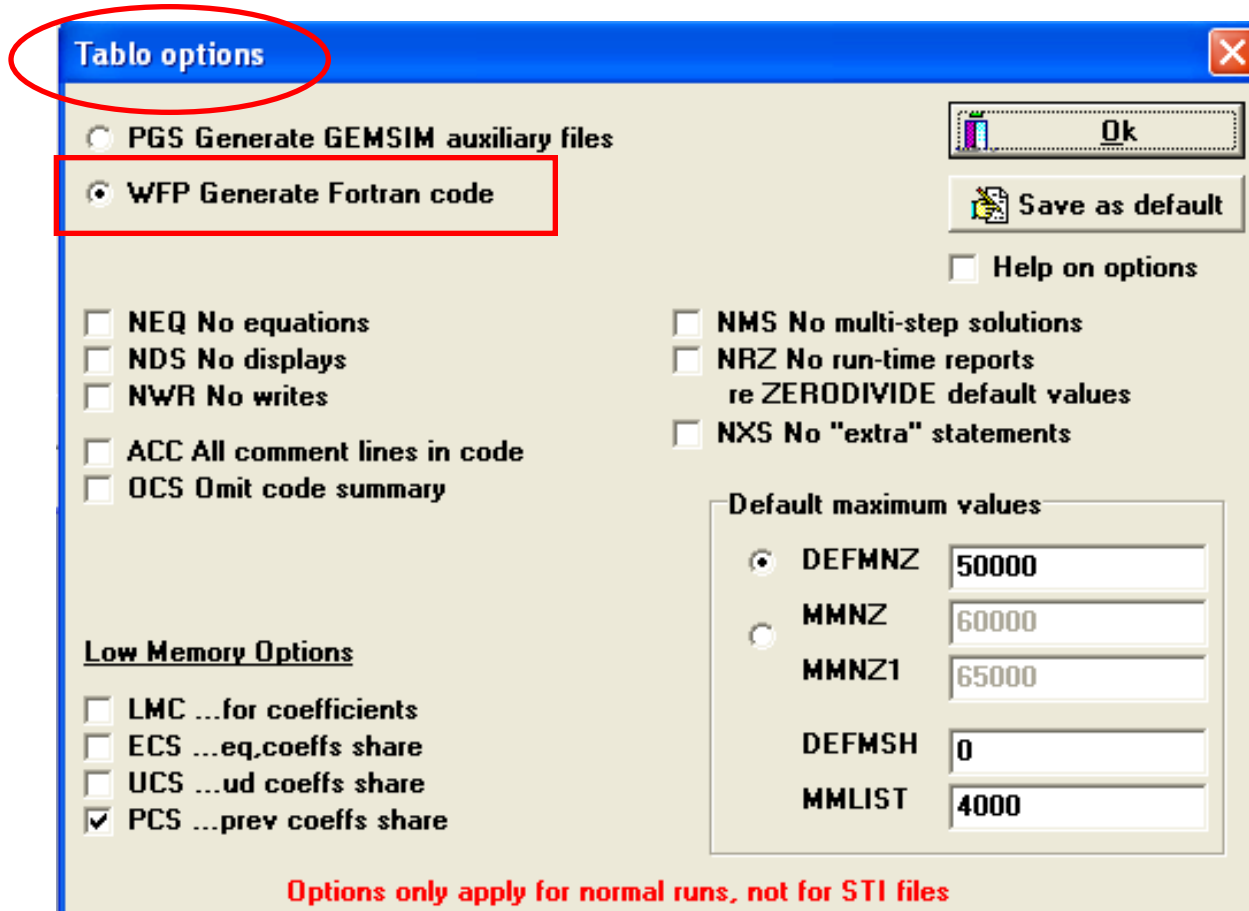
- How to implement the SJ model in GEMPACK?
 - Click on the **Select** button to select the name of the TABLO Input file SJ.TAB. This is all TABLO need to implement a model.
 - In the menu for the TABLO window, select **Options** menu item. Then in this menu choose

TABLO Options.....

- A new TABLO Options window will appear....

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

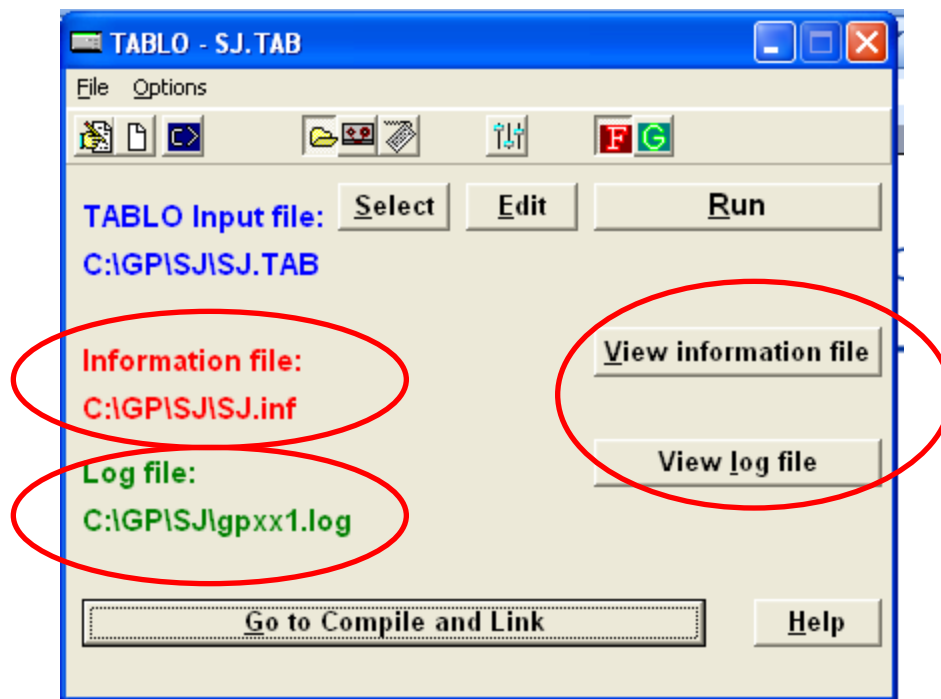


Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
 - We will choose the option **WFP.....**. Because we want you to create the TABLO-generated Fortran program.
 - Then click on **Ok** button to return to the TABLO window.
 - Click on **Run** button
 - The program runs TABLO in a DOX box and when complete, returns to the TABLO window with the names of files it has created: the information file SJ.INF and Log file.
 - To look at files click on **View** buttons beside them.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

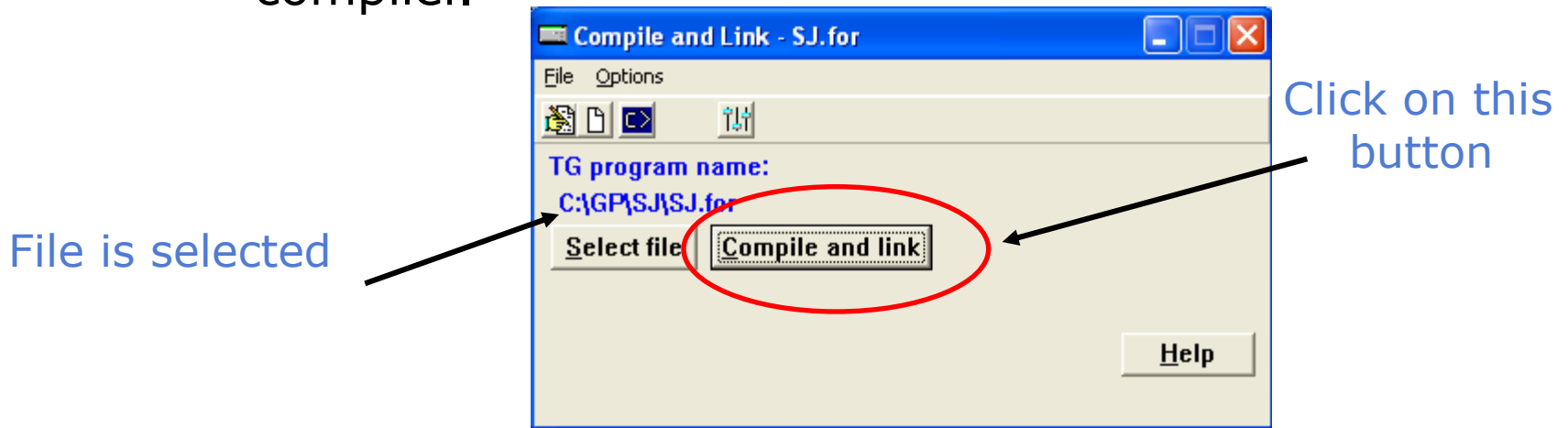


Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Step 1 (b) Compile and Link the TABLO-generated Program

- Click on the **Go to compile and Link** button at the bottom of the TABLO window to run the Fortran compiler.

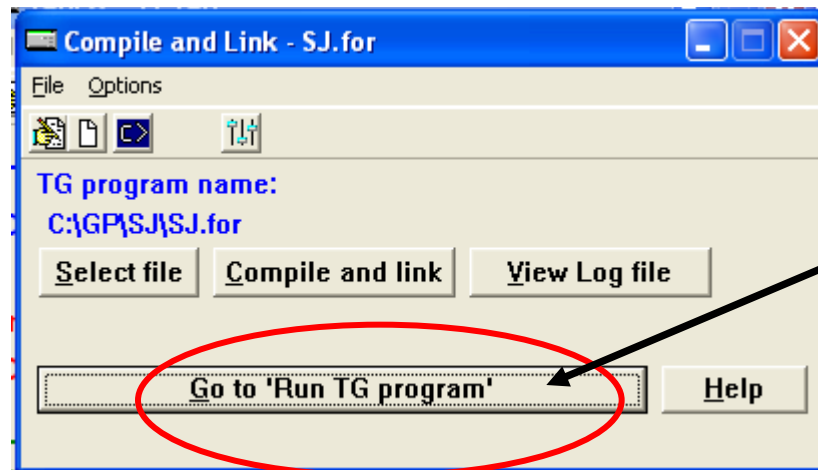


Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- The compiler converts the Fortran file SJ.FOR into the executable image SJ.EXE.

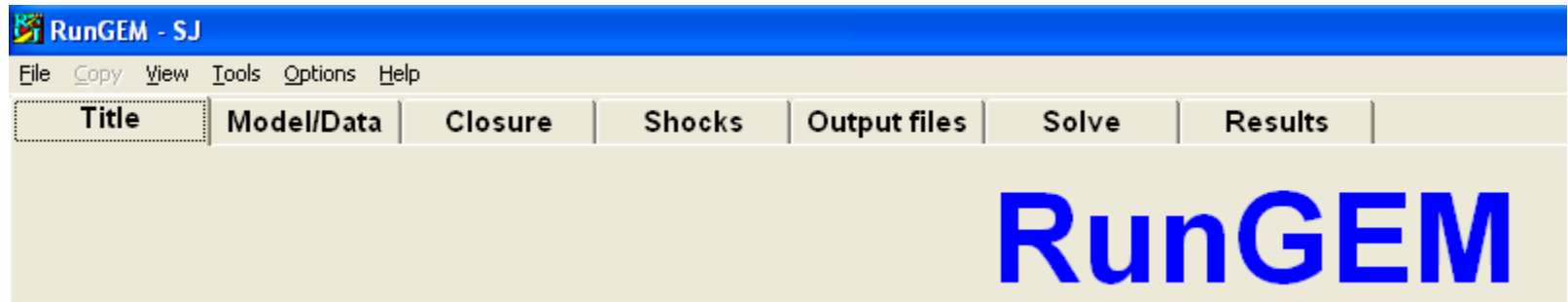
- When finished click on the button Go to '**Run TG program**' or go to **RunGEM module**



Click on this button or go to RunGEM module

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
 - STEP 2 – Solve the equations of the model
 - Starting RunGEM
 - Double click on RunGEM icon to start RunGEM module. This is the first part of RunGEM



Overview of GEMPACK Software

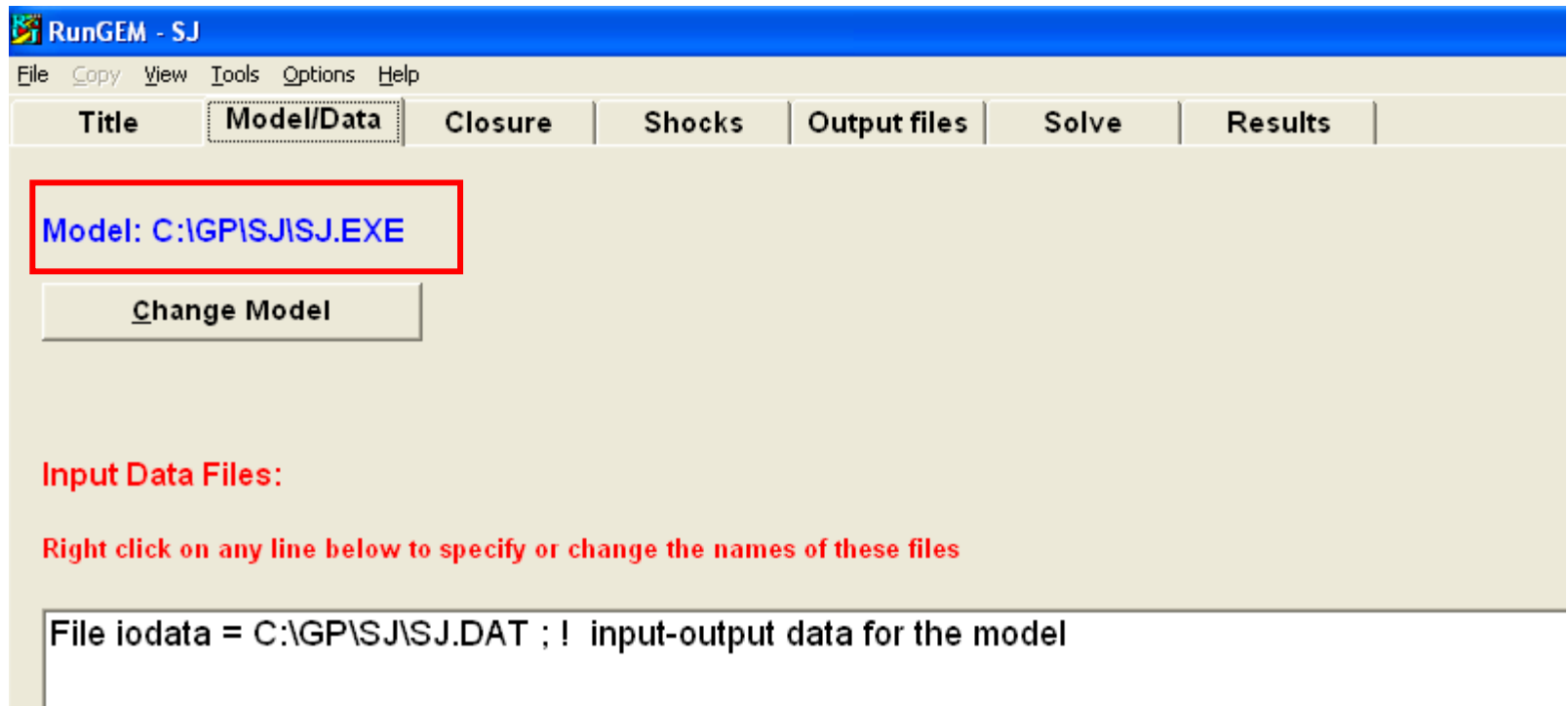
- How to implement the SJ model in GEMPACK?

 - Starting RunGEM
 - To change from Title to Model/Data for example is only necessary to click on the names.

 - Select the Model
- Go to **Model/Data** page by clicking on its tab.
- Click on button **Change Model** do select your model.
- Select the file SJ.EXE.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?



Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Starting RunGEM

- Select the Data File

In the white box headed ***Input Data File*** a single line of text will appear.

Input Data Files:

Right click on any line below to specify or change the names of these files

```
File iodata = C:\GP\SJ\SJ.DAT ; ! input-output data for the model
```

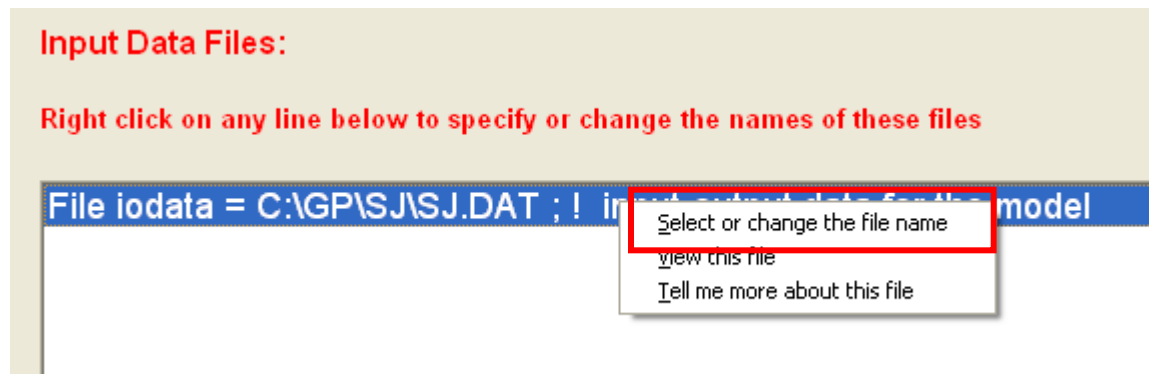
Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Select the Data File

Select the line (in blue) by right clicking on it

Select on the menu the option **Select or change the file name**

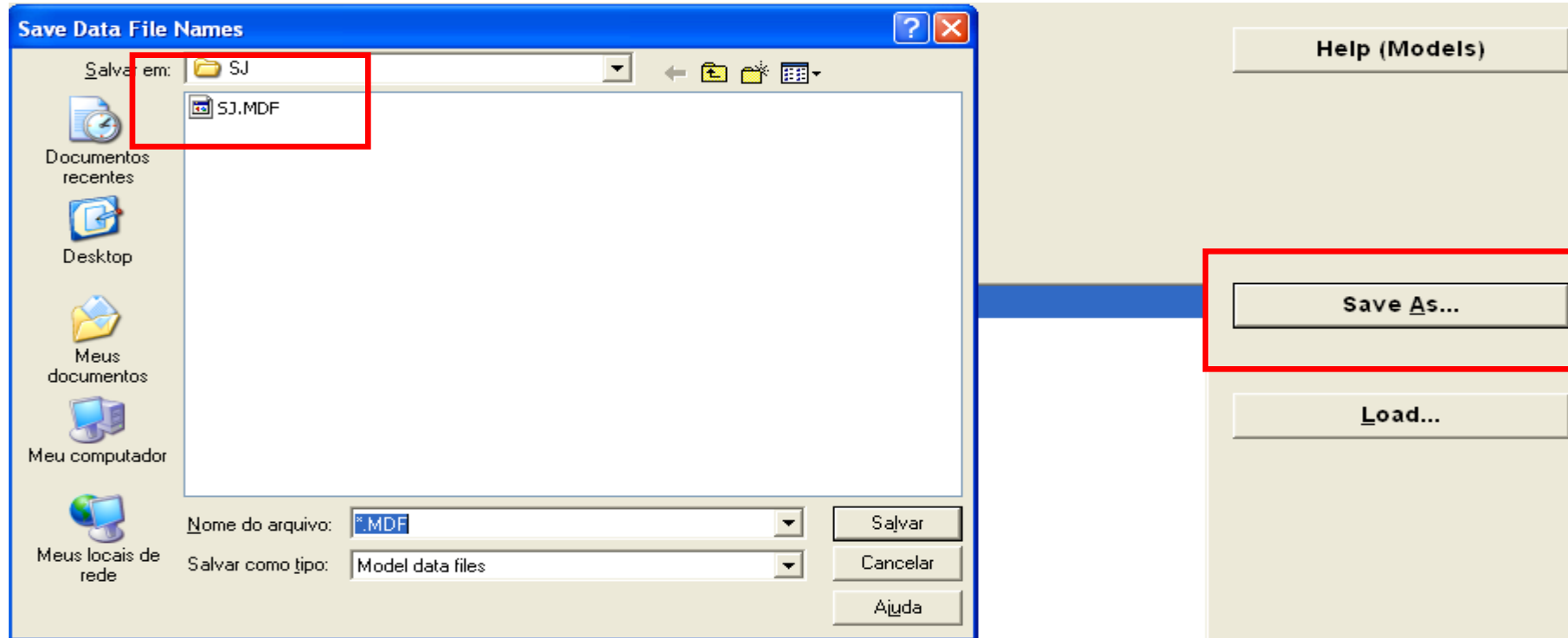


Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Select the Data File

Click on the **save as** button



Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Load Closure

Select the **Closure** link

Select the link **Load Closure** (as you have a closure saved in the SJ directory the GEMPACK will automatic open it).

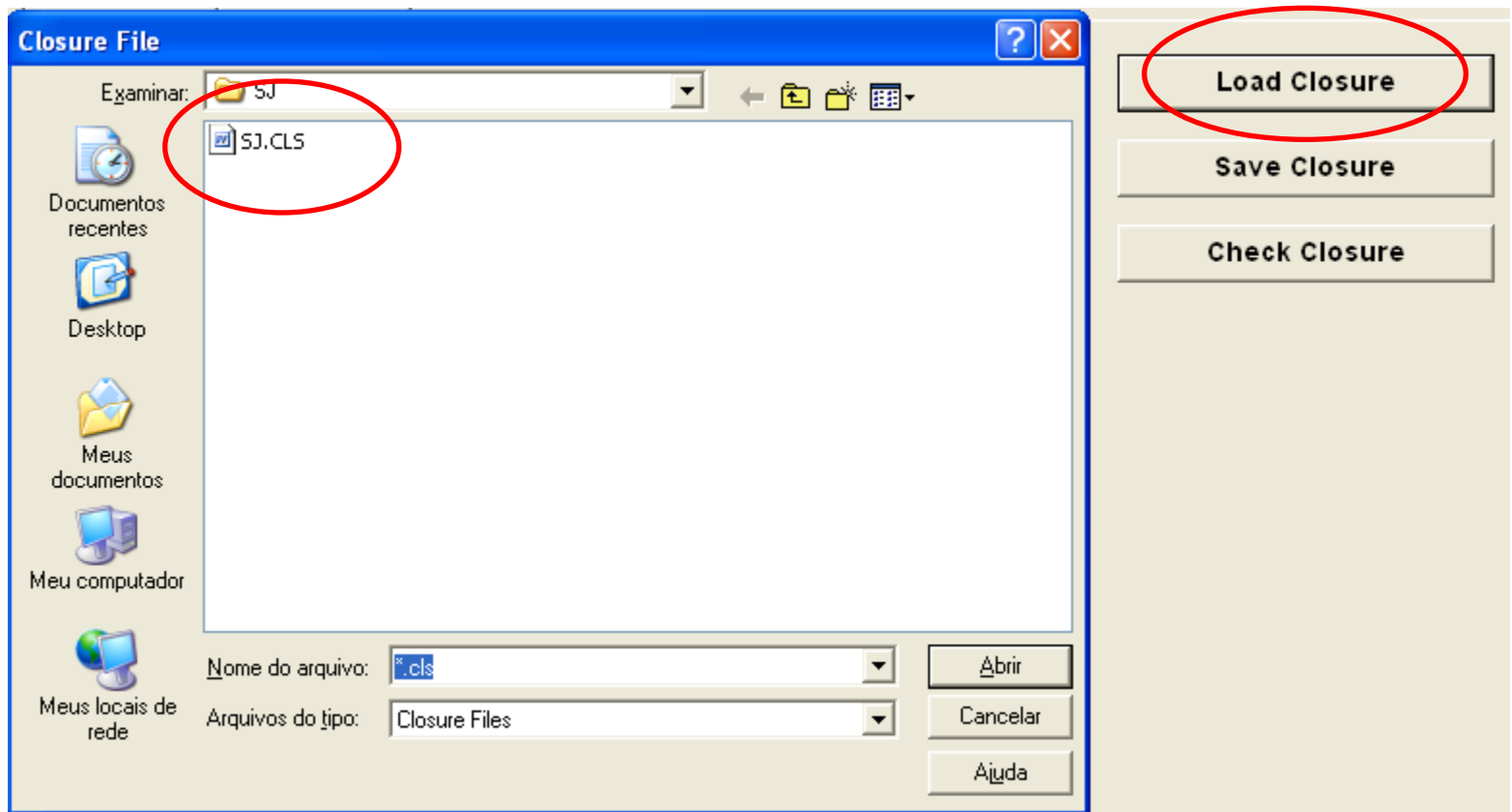
If you do not have the file .CLS you can type the closure and save it.

exogenous p_FAC;

rest endogenous:

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?
 - Load Closure



Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Load Closure

You also have the opportunity to check the closure. Thus click on the button **Check Closure** and RunGEM will check if this is a valid closure for the SJ model

- Select the Shocks

Click on **Shocks** tab, and in the box labelled **Variable to shock**, click on the small arrow on the right hand side to get a drop-down list of exogenous variables.

Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Select the Shocks

For the closure chosen in the SJ model we have only one exogenous variable (p_XFAC).

Click on this line to select p_XFAC and in the ***Elements to Shock*** box click on the arrow and select "labor".

Thus in this simulations you are shocking just one component of p_XFAC, the labor supply.

Type in the next box the value of shock – 10.

Click on the button ***Add to shock list***

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

The screenshot shows the RunGEM - SJ software interface with the Shocks tab selected. The interface includes a menu bar (File, Copy, View, Tools, Options, Help) and a tabbed interface with tabs for Title, Model/Data, Closure, Shocks, Output files, Solve, and Results. The Shocks tab is active, displaying three input fields: Variable to Shock (p_XFAC LV=XFAC), Elements to Shock (labor), and Value of Shock (10). A red box highlights the 'Add to Shock List' button. The text 'Shock p_XFAC("labor") = 10;' is displayed in red. The bottom status bar shows the command 'Shock p_XFAC("labor") = 10;'. To the right of the input fields, there is a description: 'Total demand for (or supply of) factor f' and 'Dimensions: FAC'. A 'Type of' label is partially visible on the right side.

RunGEM - SJ

File Copy View Tools Options Help

Title Model/Data Closure Shocks Output files Solve Results

Variable to Shock p_XFAC LV=XFAC

Elements to Shock labor

Value of Shock 10

Total demand for (or supply of) factor f
Dimensions: FAC

Type of

Shock p_XFAC("labor") = 10;

Add to Shock List Load File of Shocks Save File of Shocks Clear Shocks

Shock p_XFAC("labor") = 10;

Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Output Files

Click on ***Output files*** tab

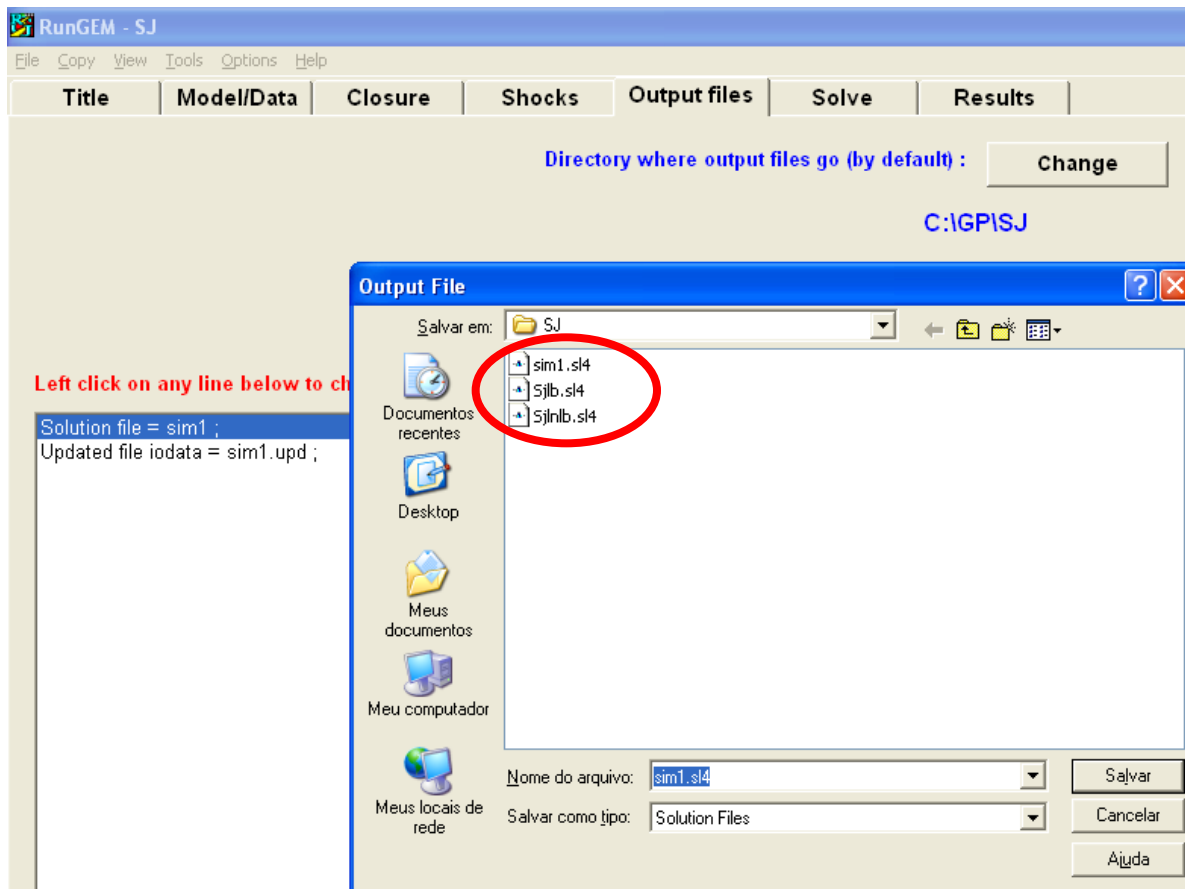
To change the names of the output files, click (left click on this time) on the first line in the lower box:

Solution file = sim1.

Change the name of the Solution file to SJLB,SL4

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?



Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Carry out a simulation

Select the next page **Solve** and type in some verbal description to say

SJ. Standard closure – 10 percent increase in the labor supply

You need to select the solution method and steps.

Click on the **Change** button to the right of the text "Solution method".

Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Carry out a simulation

Select "Gragg's method with 2,4,6 steps calculations [One subinterval, not automatic accuracy]

Click on the **Solve** button and the RunGEM will calculate a solution.

Overview of GEMPACK Software

- How to implement the SJ model in GEMPACK?

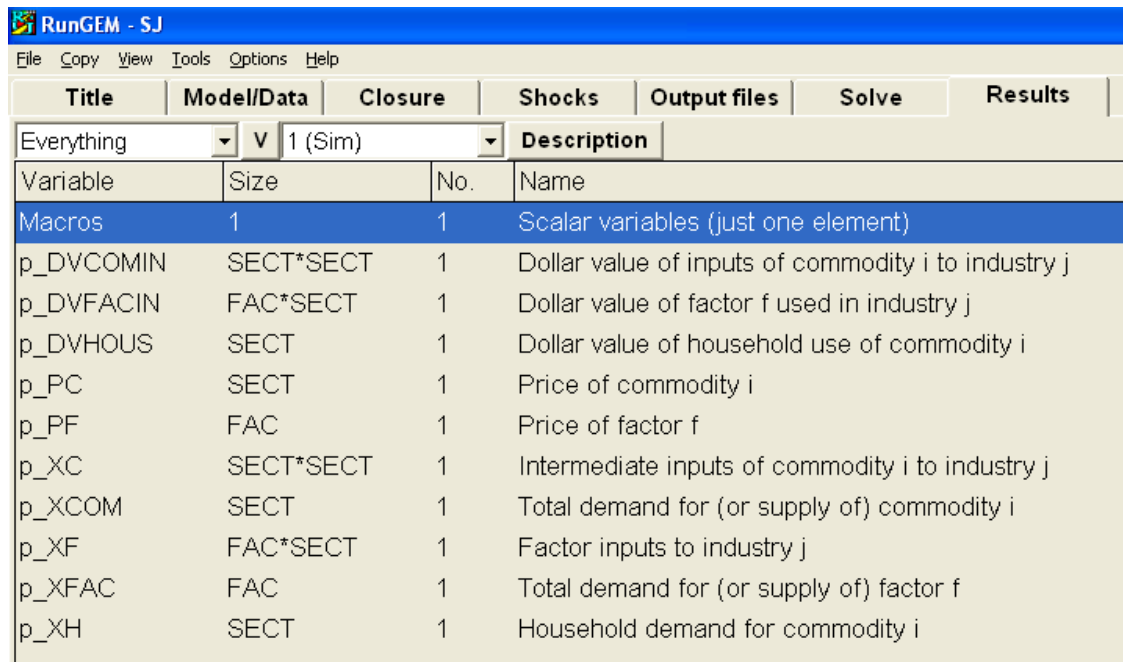
The screenshot displays the RunGEM - SJ software interface. The main window has a menu bar (File, Copy, View, Tools, Options, Help) and a toolbar with buttons for Title, Model/Data, Closure, Shocks, Output files, Solve, and Results. The 'Solution method' is currently set to 'Johansen: 1 step', and a 'Change' button is highlighted with a red box. Below this, the 'Verbal Description' field contains the text 'SJ. Standard closure – 10 percent increase in the labor supply', also highlighted with a red box. A 'Solve' button is highlighted with a red box. A 'Choose Solution Method' dialog box is open, showing the 'Gragg' method selected with a radio button, and '3 solutions' chosen. The 'Steps per solution' are set to 2, 4, and 6. The 'Sub-intervals' are set to 1. The 'Automatic Accuracy' checkbox is unchecked. The dialog box has 'OK', 'Cancel', and 'Help' buttons.

Overview of GEMPACK Software

➤ How to implement the SJ model in GEMPACK?

- Look at the results:

Click on **Results** tab



Variable	Size	No.	Description
Macros	1	1	Scalar variables (just one element)
p_DVCOMIN	SECT*SECT	1	Dollar value of inputs of commodity i to industry j
p_DVFACIN	FAC*SECT	1	Dollar value of factor f used in industry j
p_DVHOUS	SECT	1	Dollar value of household use of commodity i
p_PC	SECT	1	Price of commodity i
p_PF	FAC	1	Price of factor f
p_XC	SECT*SECT	1	Intermediate inputs of commodity i to industry j
p_XCOM	SECT	1	Total demand for (or supply of) commodity i
p_XF	FAC*SECT	1	Factor inputs to industry j
p_XFAC	FAC	1	Total demand for (or supply of) factor f
p_XH	SECT	1	Household demand for commodity i