# Chapter 2
# Plots and Tables

Plots and tables can be made quickly and easily with MODLER. You can often obtain a good preliminary result with a single command, relying on defaults for layout and labeling. Whenever you wish to go further and produce presentation results, there are a host of display enhancement facilities, including those that provide titles, footnotes, and other annotations.

This chapter provides sufficient information to allow you to produce a wide variety of graphs and tables, ranging from plain to presentation, but the treatment is non-specialist. For a more advanced discussion of the plot and table-making options, including macro commands, see the relevant sections of MODLER's online help facility.

Simple Screen Plots

The first step in plot production is to specify the data source: before it can plot a series, MODLER must be able to access a Data Bank or Memory File. It is generally also a good idea to select an observation frequency and a date range. Once these choices have been made, from the Central Control screen, click on the **View** category of the main menu and then **Plot**, which causes the display of the dialogue box shown in Figure 2-1. Simply fill in the name of a series and press OK. Should you have any question which series are available to plot, note the **Index** and **Find** buttons on this form. As described in the previous chapter, these buttons potentially provide a wealth of detail on the data available in the currently open data sources, and can also be used to visually select the one or more series to be plotted.
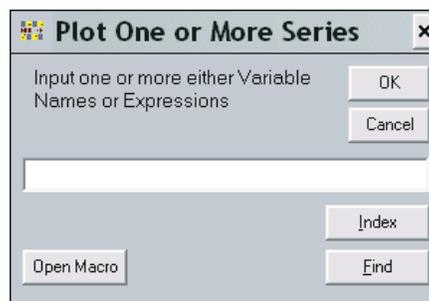


Figure 2-1. Plot Dialogue Box

   Alternatively, starting from the same screen,  a series can be plotted against time simply by typing the word "PLOT" in the command space followed by the series' name; for instance:

**PLOT GNP**

after which you must press the <Enter> key.

   Whichever method you use, the effect  is to produce a plot, since MODLER automatically searches the open data bank(s) and any Memoryfile, finds the series and immediately displays the plot on the screen.  The plot is actually produced in the context of its own specialized screen (or window), as shown in Figure 2-2. Depending upon the pixel resolution of your monitor and the operating system, this initial display may be small, but you will find that you can control the amount of screen the plot covers, either by stretching the plot screen with your mouse, or by clicking on the maximize button at the corner.
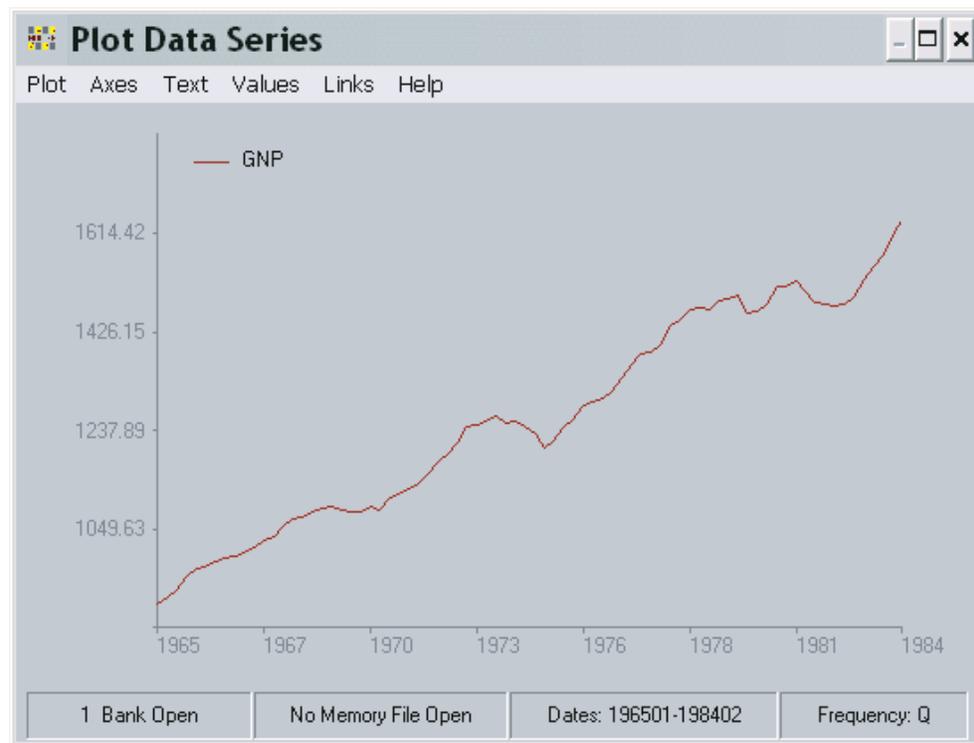


Figure 2-2.  A Simple Time Plot

   Note the menu bar near the top of the plot screen and the status bar at the bottom. These provide information but also give you the capability to change and enhance the plot in various obvious and not-so-obvious ways.  Initially, it might be best to focus on the non-apparent.  In particular, whenever no other operation is pending, if you press the F1 function key  MODLER will present context-specific help.  This

help facility, via hyperlinks, can provide  the answer to virtually any question you may have concerning the program's graphics facilities.  Secondly, if you point your mouse at the plot and press the left mouse button, the dialogue form shown in Figure 2-1 will immediately re-appear and allow you to change the variable(s) plotted, should you wish.   If you press the right mouse button instead, you will be asked if you wish to copy the plot to the Clipboard, from which it can be pasted into other applications.  If you have also installed the SnagIt software,  as described in the MODLER *Getting Started and Maintenance Guide*, you can in addition capture the plot and produce JPEG, GIF, BMP, and other file formatted displays of MODLER plots.  Finally,  to make the plot vanish, press the <Esc> keyboard key, although you can also select **Quit** under the **Graph** menu item.

  A further, multiple series selection capability is associated with the Index button on the Plot Dialogue box shown in Figure 2-1.   While this form is on your screen, press **Index** and choose **Brief Index**, thus displaying the variables stored in a data bank or Memoryfile.  Then, using your mouse and double-clicking, you can individually highlight particular series' mnemonics.  Do this for two or more series sequentially: as each is individually highlighted, press the <A> key on your keyboard, then highlight the next and again press the <A> key.  MODLER will capture these mnemonics, place commas between them, and when you click the **OK** button on the Index form, immediately copy the entire string to the command space of the Plot Dialogue box.  Press its **OK** button or the <Enter> key and a plot will appear displaying multiple series.    MODLER is able to plot as many as 7 variables simultaneously.

  But you can do more than just plot multiple series.  Presuming the data are quarterly, consider instead a command of the form:

<div align="center">

**PLOT  APCT(GNP),0**

</div>

The function APCT automatically calculates annualized percent changes and PLOT instantly puts these results on the screen, including a suitable vertical scale, as is illustrated in Figure 2-3; the "0" following the comma draws the horizontal zero line shown.  More generally, any scalar number included on its own as a term in the plot command causes a horizontal line to be drawn corresponding to its value, given of course that this value is compatible with the range of the series plotted.

*Onscreen Plot Control Facilities*
  As suggested earlier, a strength of MODLER's plotting facilities is the  ease with which you can set up and alter displays.  Plots can be used as a tool for scanning and analysing data without the need for prior preparation.  We have already considered two plots: the first the simple plot of a series, GNP, the second a plot of its annualized percent change; in the latter case, we specified a horizontal line at the value 0, so as to clearly mark positive and negative changes.
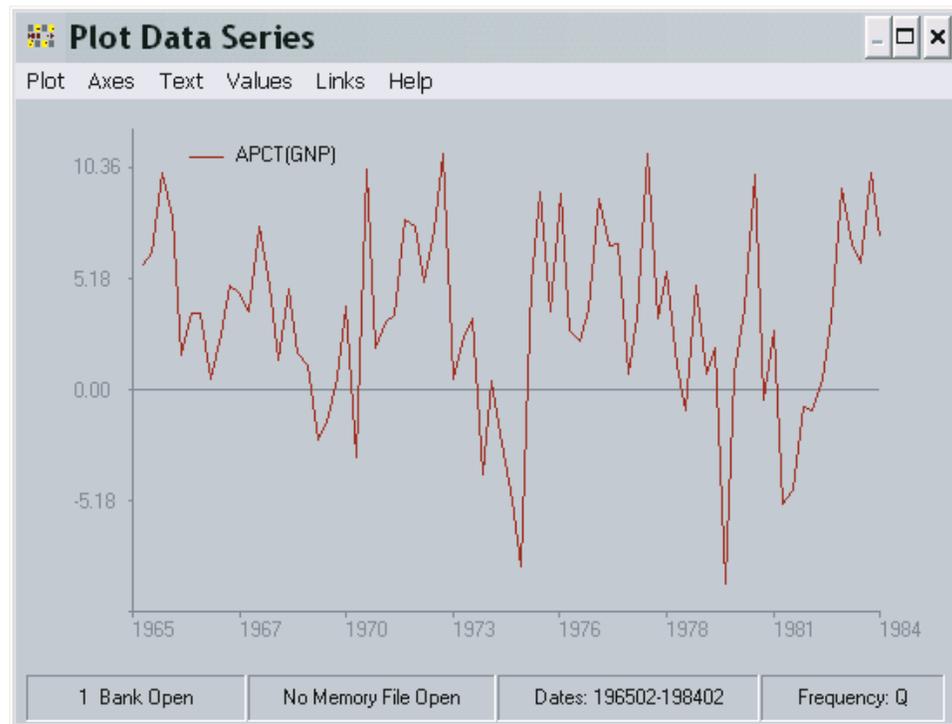
Figure 2-3.  Simple Plot with Transformation

  As a start, one of these plots might be satisfactory, but for many purposes you may prefer a more finished, possibly even extensively annotated plot.  The easiest way to begin to develop a more finished plot is to make use of the menu facility near the top of the Plot screen.

  On the menu bar, the keywords are **Graph**, **Axes**, **Text**, **Values**, **Links**, and **Help**, the last two referring of course not to characteristics of the graph but instead links to other software environments and online help respectively; these were described in the previous chapter and will be ignored here.

  The menu items can all be selected using the mouse.  However, it is  also possible to select using the first letter of each keyword. The items are selected using a combination of the <Alt> key and first letter, in the usual way.


*First Main Menu Category: Graph*

  Each of the first four main menu bar categories will be considered in turn, beginning with the leftmost one, "**Graph**."  If you click on this category, when the dropdown menu initially appears, it is the first item in this category that is highlighted.  As can be seen in Figure 2-4, the first five are **Type**, **Size**, **Gridlines**, **Legend**, and **Background.**  The effect of selecting any of the first four of these is generally to
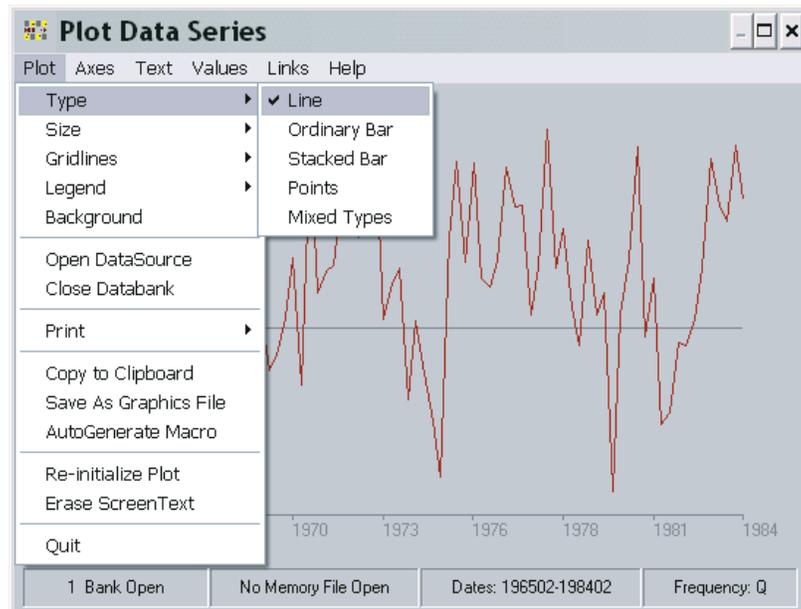
Figure 2-4.  Graph Menu Category Display

cause a secondary menu list to appear, providing additional choices.  Figure 2-4 shows the result of choosing **Type**, revealing that there are five possible secondary choices associated with this selection.

   As is almost self-evident, **Type** refers to the way in which the plotted variables are displayed: as a line graph, a bar graph, a graph displaying unconnected points, or a mixed graph; a mixed graph is one in which each of two or more variables' representation can be individually selected. In fact, there are more choices than these. Evidently, the choice of Bar as a type provides you with a further choice, between Ordinary Bar and Stacked Bar.  Similarly, if this were a XY-Graph (a plot of one or more variables against some other), instead of a time plot, there would be a choice of "Dates" instead of "Bars;" but for the moment, ignore such potential complications.

   The next item under **Graph** is **Size**.  This option provides three choices, as shown in Figure 2-5: Fullscreen, Halfscreen or Quarterscreen.  You can choose whether the graph should fill the screen or share the screen with a scrollable column table of data values.  That is, both Halfscreen and Quarterscreen permit you to look at the numbers at the same time as the graph.  Moreover, if you have plotted four or more variables, you will find that the left and right cursor keys allow you to pan left and right in order to see all the data.  The purpose of the Quarterscreen, as opposed to Halfscreen, may not be immediately apparent, until you capture the screen as an image, at which point you will find that this option gives you some control over the size of this copy at a given resolution.
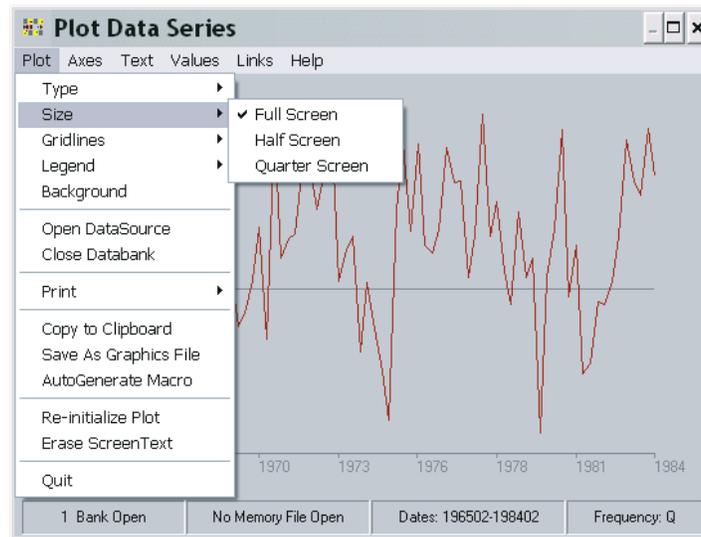
Figure 2-5.  Size of Plot

   The next possible GRAPH choice is to draw **Gridlines**.  Vertical or horizontal lines can be produced, either separately or together, as is indicated by the secondary choices shown in Figure 2-6.  Whichever particular choice of gridlines type is made—assuming that gridlines are to be produced—a Gridlines dialogue box will next appear.  This box is illustrated at the top of the next page.  Using it, the next choice is between Density, Style, and Color.  **Density** refers to the number of tickmarks per gridline; the default is 1, for both vertical and horizontal tickmarks. **Style** refers to line styles, of which there are 6 basic choices. **Color** refers to the color of the gridlines, of which there are a number of choices. You can make your choice among these characteristics in any order you choose.
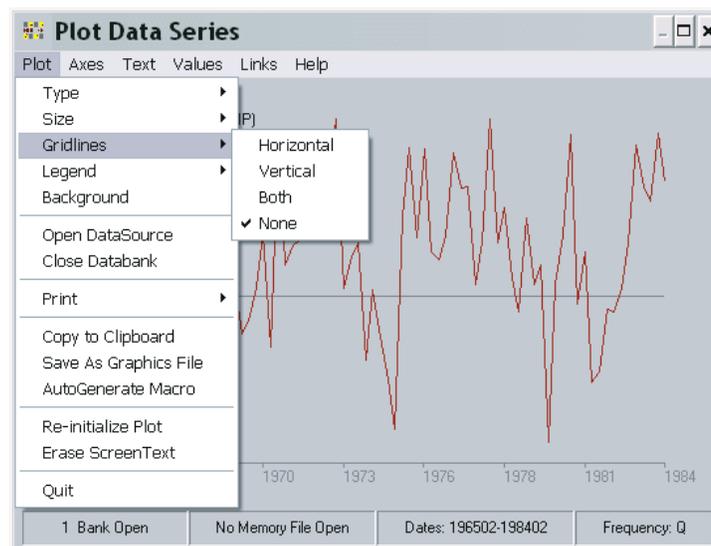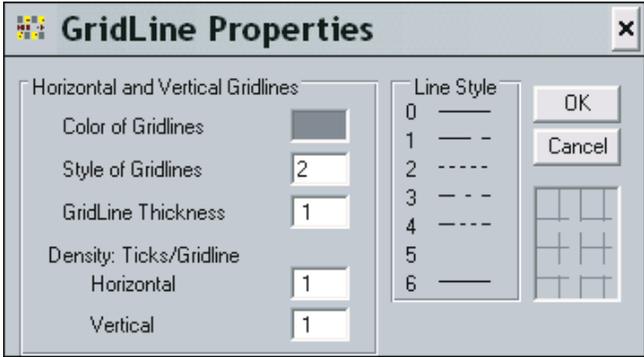


Figure 2-6.  Gridlines Selection

The next GRAPH option is the **LEGEND**, which identifies the plotted variables and can be placed almost anywhere on the screen. As illustrated in Figure 2-7, the first Legend choice to be made is whether to display the current default ("**Default**"), to make some change ("**Options**"), or to omit it ("**None**"). Assuming that the choice made is **Options**, there are a number of possible further choices, as shown by the Legend dialogue box in Figure 2-8, which appears if you click on **Options**: The choice categories are, generally, Placement, Content, and Border, although these concepts are not all made explicit by the dialogue box. *Placement* refers to where the Legend should be put, whether inside or outside the axes of the graph, or anywhere on the screen ("**Where It Fits**"); the last of these can provide sophisticated effects, but can involve some complexity, since space must often be allocated. The "**Outside**" choices automatically clear space at the top, bottom, or one of the sides of the graph.
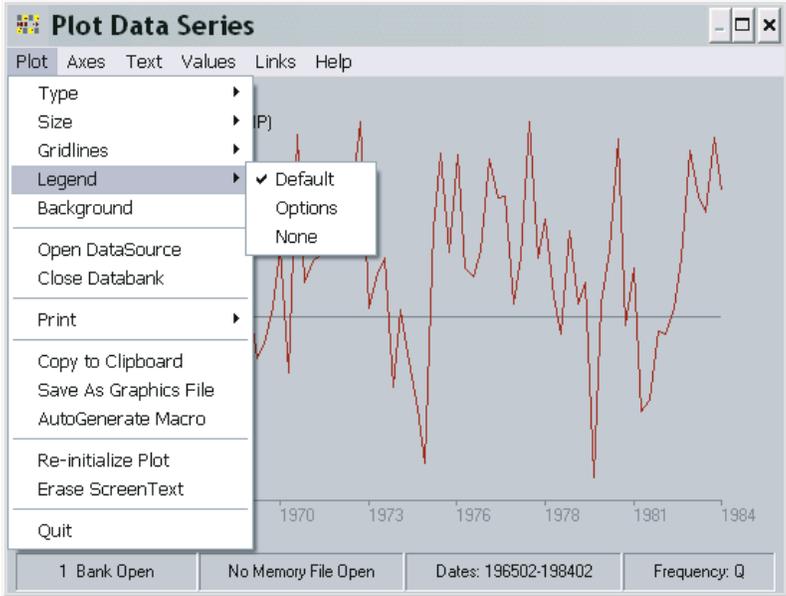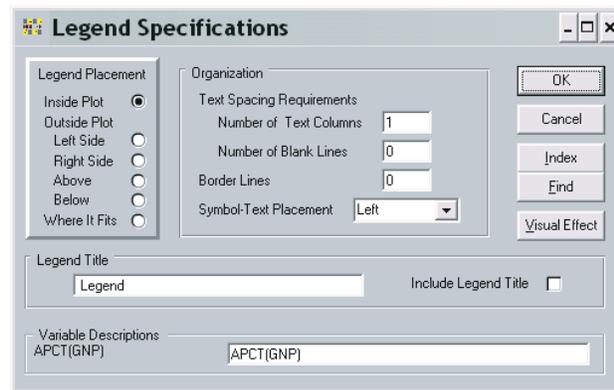


Figure 2-7. Legend Choices

Figure 2-8. Legend Dialogue Box

*Contents* refers to five essential attributes of the legend: legend title, the descrip-tions of the graphed variables ("**Variable Descriptions"**), whether or not one or more blank lines should appear between these descriptions ("**Number of Blank Lines**"), where the symbols should be placed relative to the text descriptions ("**Symbols-Text Placement"**), and the number of columns that the descriptions should form **("Number of Text Columns**"). The last three of these are included under the title *Organization*. As shown, the original defaults are: no legend title, only the series mnemonic names (or expressions), no blank lines, symbols on the left, and one column. To include a legend title, click the box **Include Legend Title**; the default is then the word "Legend."

*Border* of course generally refers to any ruling line or other visual element that sets off the legend from the plot. By default, there is no obvious border, but if you wish to change this, click **Visual Effect**, which will cause an additional dialogue box to appear, entitled *Other Legend Visual Effects*. The characteristics of the border, if visible, are: Line Style, Color, Thickness, and Background. The defaults are: no border line and a legend background the same as that of the plot itself.
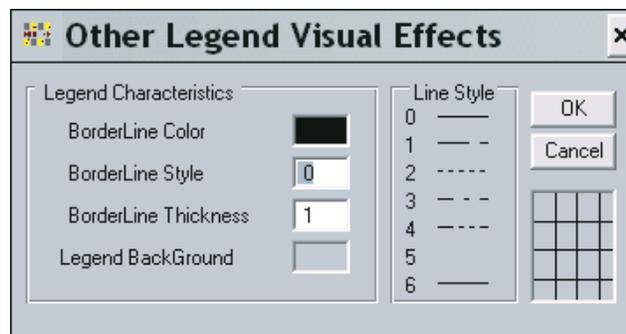
   In order to discover how to get the exact effects that you like, you will need to experiment with the legend settings.   However, there are several things that need to be taken into account:

- Concerning the variable descriptions, the longest text for any single variable description implicitly controls the width of the legend, including the amount of space available for any legend title; thus the title must be no longer than the longest varible description.  However, you can type these descriptions with embedded backward slashes ("\") in order to specify that the description should appear on two or more lines.  For example, if you were to type:

  **Gross\National\Product**

  the effect would be to place each of these words on a separate line, resulting in:

  **Gross**
  **National**
  **Product**

- Choosing **Blank Lines** to have a value other than zero permits you to specify the number of blank lines *between* text desciptions—but, there must be two or more variables described in the legend for any such blank lines to appear.

- With reference to the option **Symbol-Text Placement**, the word "Symbol" here can refer to a line symbol, a box (in the case of a bar chart), or a point symbol.  The purpose of each symbol is obviously to visually link the variable's text description to its graphical representation.

- Line Style setting 6 is actually the only one that permits the thickness of the border to be changed.   Although settings 0 and 6 visually look the same, the specific purpose of the latter is to permit changes in line thickness.

- Finally, the number of **columns** that actually appear in a legend will depend upon the number of variables graphed.  The number of columns must be a positive number less than or equal to this number of variables.

The final **Graph** option that directly affects the appearance of a plot is **Background**. This term refers to the screen background color against which the plot appears. There is a rich choice of background colors, the actual number depending upon the operating system used and your specific hardware configuration. But, in general, when you select **Background**, you are shown a color chart.

The **Graph** options considered so far pertain to characteristics of a plot. In contrast, the remaining ones are much more general in their effect, allowing you to do such things as open or close data banks, for instance, or to "print" the plot. The latter option provides you with a choice: to print it as a line graph, at the resolution of the particular printer you use, or to produce essentially a screendump; this WYSIWYG screendump usually reproduces best if the legend is suppressed. Alternatively, choose **Copy to Clipboard** to capture the graph, including the legend, as a clipboard graphic; the graph can then be pasted into word processing documents and other such external environments. As mentioned earlier, it is also possible to indicate that a plot should be copied to the Clipboard by pointing to it and clicking the right mouse button, so that there are in fact two distinct ways to accomplish this operation.

A particular **Graph** option that is extremely useful is **Autogenerate Macro**. To use it requires only that you provide a name for the macro. To understand it, you need to be aware that, corresponding to the menu options being described here that determine the characteristics of a plot, are a set of behind-the-scenes commands. Collected into a macro file, these permit the characteristics of a particular plot to be reproduced. However, many of these commands are rather non-intuitive, particularly in comparison with their corresponding menu equivalents—although they are described in detail in the online help facility. Fortunately, when you choose to Autogenerate a macro, in the process giving it a name, MODLER will compile for you the particular set of commands that will allow you to reproduce the plot at some later time. Moreover, you can then change it and Autogenerate a new macro.

But be aware that such macros exclusively include the commands that define a plot's characteristics, including the PLOT command that directly causes MODLER to display it. They do *not* include the associated data on the variables. Consequently, to reproduce a plot, you must first open a data bank or Memoryfile containing these data, then execute any autogenerated macros. This requirement is not, however, a weakness, but actually just the opposite, for this approach allows you to update and revise a data base over time, then with an absolute minimum of effort reproduce any number of plots without changing the associated macros.

The effects of the choices **Re-Initialize Graph** and **Erase ScreenText** are described on page 49 below. Generally, when a plot is re-initialized, the default settings are immediately re-imposed, so that the purpose of the first of these options is to re-establish all the default settings. However, the concept *ScreenText* has not yet been introduced, so that it is better to leave this topic until later.
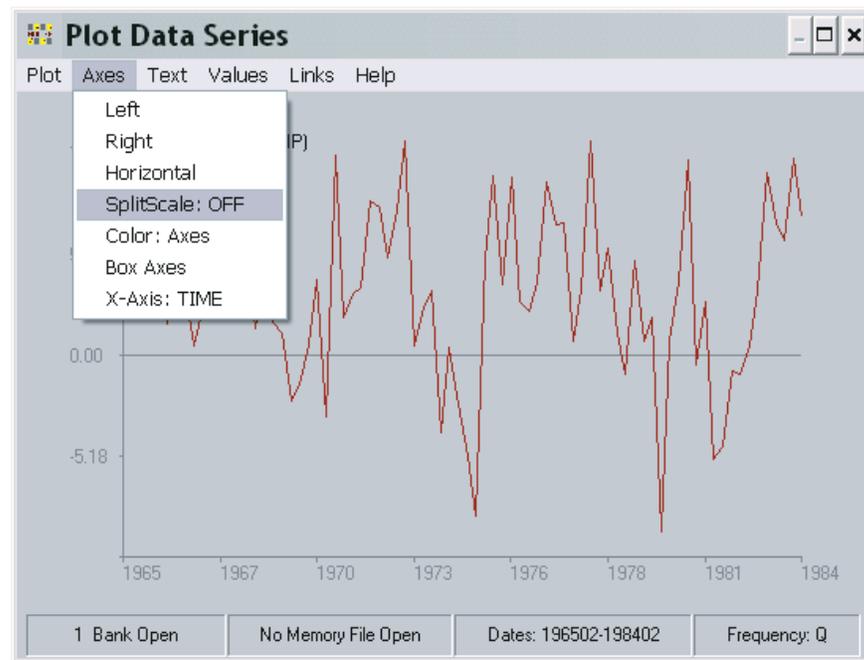
Figure 2-9. Axis Options

*Second Main Menu Category: Axes*

The second main menu category, **Axes**, gives you control over the appearance of each axis, as well as the number of axes. As you will see from Figure 2-9, above, the axes controlled consist of the left and right vertical (or y-axes) plus the horizontal (or x-axis). You can also control which of the two vertical axis any variable is plotted against ("**Splitscale**"). Finally, other options include control of the color of the axes, whether the axes box the graph, and what variable is plotted on the x-axis: TIME or a particular variable or expression. If a particular variable or expression is plotted on the horizontal axis, the plot of course becomes a scatterplot.

The first choice, **Left**, refers to the left-hand vertical axis of a plot. If you make this choice, the result is to cause the display of the dialogue box shown on the next page as Figure 2-10. Essentially, this dialogue box controls two aspects of a plot axis: the numeric annotations and the value range that these numbers express.

Considering the latter aspect first, the **Range** is set by default initally, based upon the computed range of all the variables appearing in the plot. When two or more variables are plotted, this range is calculated so that the maximum value is marginally greater than the maximum value of any variable and the minimum value is marginally smaller than the minimum value of any variable. If you wish, you can change the Range, but your option is only to widen it; it cannot be set more narrowly than the default.
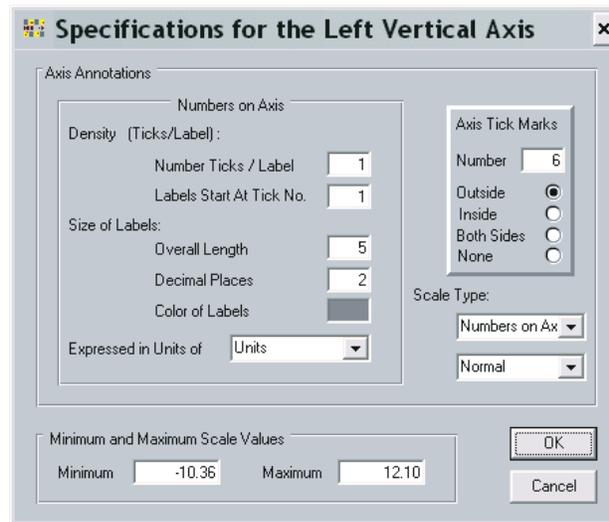
Figure 2-10.  Axis Specifications

   The **Scale Type**  has two aspects each of which have two settings: the first is
Numbers on Axis versus Blank Labels. The second is Normal versus Log Scale.  The
defaults are shown in Figure 2-10.  If instead **Blank Lables** is chosen, this choice
does not change the effect of the other choice; it simply omits the associated Axis
display.  Log Scale of course refers to a logarithmic scale, base 10.  The scale values
(referred to as axis "labels") are always shown in normal form, but when **Log Scale**
is chosen, the data are plotted logarithmically.  Note, in particular, that this choice
requires all the variable values plotted against that scale to be *strictly positive*.

   **Tick Marks** can face out from the axis, away from the plotted values ("**Outside**"),
inside, towards the plotted values ("**Inside**"), or in both directions ("**Both Sides**").
The default is Outside.  The number of tick marks is also under your control, more
or less.  Obviously, since each numeric label next to a tick mark has a certain vertical
size, an arbitrarily large number of marks cannot be fitted into a given space on the
computer screen. Note also that since the plot can be expanded to cover the entire
screen or contracted to cover only part of it, you will not necessarily see the same
number of tick marks displayed in each case.  The number of tick marks is thus more
a matter of their density on the scale than it is the specific number; that is, 15 tick
marks are three times the density of 5 tick marks.

   **Labels** refers to the numbers on the axis scale, as indicated earlier.  There are three
aspects: Units, Density, and Format or *Size*.  **Units**  refers to the scale of the values
displayed.  For example, the original scale numbers might be 4 digits or more
(5000,10000,15000,20000,25000); these can be scaled to a minimum of a single
digit (5,10,15,20,25) by the choice of units—here 1000.0.  The units value chosen
should be chosen so that the product of it and the values show will equal the original
data values.  The **Density** of the labels is stated with reference to Tick Marks.  The

default is to put a label on each tick mark.  However, you can choose to place a label every $k^{th}$ tick mark, beginning at the $n^{th}$ one.  Incidentally, the zeroth tick mark on the vertical scale is the one corresponding to the horizontal axis; by default, the label for this is left blank.

   Finally, **Format** refers to the size of the label, the number of decimal places shown, and the label color:  for example, a label could be six characters wide, of which 2 are decimal places.  In general, MODLER automatically computes the number of spaces required for a label, based upon the size of the values and the appropriate number of decimal places, but you can choose to override this calculation.  If stars appear as scale labels ("******"), the numbers are too big to fit into the space allocated for the labels; in this case you will of course need to increase the number of spaces allowed for the labels.  If you click on the **Color of Lables** textbox a color chart will appear that will allow you to specify visually the color of these.

   Another axis characteristic is the Caption. Because these are textual in nature, captions are one of the text items that are considered later under the main menu category **Text**. Nevertheless, **Caption** refers to the description, if any, that appears to the left of the scale labels, such as "Billions of Dollars." The vertical axis captions can be displayed level or rotated in 90 degree increments.   They can also be placed at any of several points along the axis.  The default is a blank caption.

   The right vertical axis can be the mirror image of the left vertical axis, or it can have an independent existence.  Initially, if **Right** is selected, the axis specification dialogue box looks superficially like that shown in Figure 2.10, except that most of the display cannot be changed.  There are certain exceptions to this rule, the most obvious being Scale Type.  On this form, **Scale Type** displays 3 options:  No Right Axis, Duplicate Left Axis, and Index Multiple of Left.  **No Right Axis** is the default, and refers to the absence of a right axis scale.  **Duplicate Left Axis** indicates that the right axis should be a replica of the left axis.  **Index Multiple of Left**, in turn, causes the right axis to repeat the left axis, except that if you choose this option, you will be permitted to express the right scale values as a real value multiple of the left axis scale values, using a text box that appears when you click on this choice.

   In fact, if either Duplicate Left Axis or Index Multiple of Left Axis is selected,  the right scale will not necessarily be precisely a replica of the left scale.  Labels, caption, and to some degree tick marks can be independently specified.  The aim is to permit some level of variation in appearance even when the two scales are essentially the same.  However, the tip off in this case is that the Axes window shows **Splitscale Off**.  A *SplitScale* plot is a particular type. In contrast to the case in which the right and left scales are essentially mirror images, this type occurs because it is possible to plot two or more series or expressions that involve non-comparable scales.  For example, you may wish to plot simultaneously two very different series, say Gross National Product and the Unemployment Rate.  The first of these generally will be

expressed in units of Millions of Dollars, whereas the second will be expressed as a rate, normally varying between 4 and 12 percent. The two series cannot be plotted on the same scale in any meaningful way. However, if the left scale is used to plot GNP in millions of dollars, and the right scale used to plot unemployment, as a percent, the two series become visually comparable, as illustrated in Figure 2.11.

The **Splitscale** option operates as a toggle, changing from Off to On and back again whenever this option is invoked, provided that 2 or more series or expressions have been plotted. When Splitscl is **On**, the right axis is independent of the left, giving
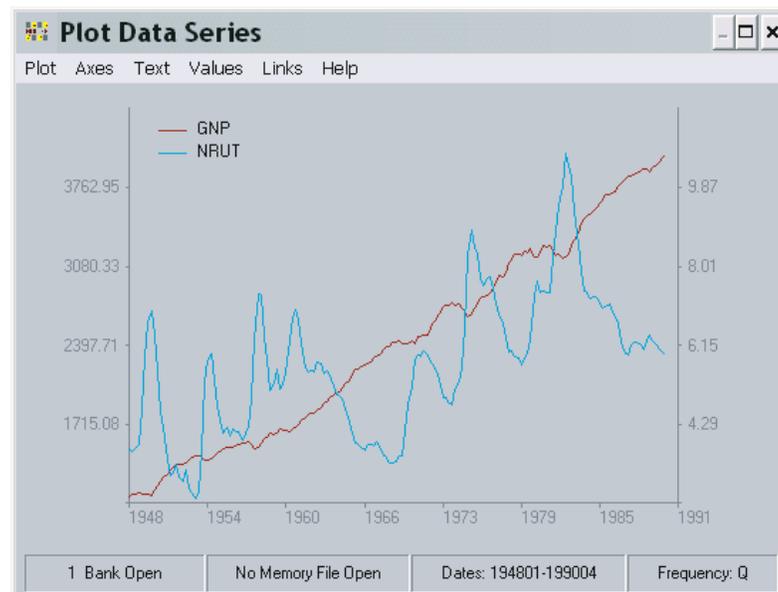


Figure 2-11.  Example SplitScale Plot

you the same degree of control of its characteristics as you have for the left axis.
The final **Axes** options consist of three specific controls: Color, Axes Unboxed (or Boxed), and X-axis. Selecting the **Color** option causes a color scale to appear that allows you to choose the color of the axes; this affects the axes themselves, not the labels, which are controlled by the Text Color option that is described later. The **Axes Unboxed/Boxed** option operates as a toggle, allowing you to display the axes either as an open L or U (depending upon the number of y-axes) or completely boxed.

**X-Axis**, in contrast, is much more than visual in effect. This option controls the values that are plotted on the x-axis: either TIME or an ordinary variable or an evaluated expression. When TIME (the default) is plotted on this axis, the scale is defined in terms of the current date range setting. When an ordinary variable is plotted on this axis, all plots made are plots against that variable. In this case, the horizontal axis scale is defined in terms of the values of that variable, in the same

way that the y-axis is in terms of the variables that are plotted on it.  In this case, for example, the x-axis scale can be specified as a normal scale (the default) or as a log scale.

  Reflecting the values measured on the X-axis, the **Horizontal** axes option has two modes.  If X-axis has been used to specify the name of an ordinary varible or an expression, then selecting Horizontal results in choices similar to those in the case of the left y-axis:  Range, Scale Type, Tick Marks, Labels, and Caption.  What differences exist exist because of the orientation; for example, labels appear parallel to this axis, not perpendicular to it.

  If, in contrast, the x-axis measures TIME, then superfically the  Horizontal option offers the same choices as in the other case, but the interpretation is different.  In this case, **Range** refers to a date range and **Scale Type** offers the choice between Dates (the default) and User Given; in the latter case, you can impose your own labels in place of the ordinary date labels.  Similarly, while  **Tick Marks** offers the same choices as before, the **Label** option is different, offering the choices: Placement, Density, and Format.  **Placement** specifically refers to the placement of the labels relative to the tick marks, and whether or not the labels are staggered or aligned. **Density** gives you the ability to vary the number of ticks per label.  **Format** refers to the format of the date labels, whether these should show just years or year and period; even then the format will depend upon the current observation frequency.


*Third Main Menu Category: Text*

  The **Text** menu option controls textual information, such as titles, captions, and footnotes, as illustrated by Figure 2.12.  **Titles** and **Footnotes** can be entered successively, once these options have been selected.  You can provide a maximum of 2 title lines and 6 footnote lines.  This text is entered free format using dialogue boxes that appear when these options are selected.  Among the text characteristics you can specify in each case are the font, font size, placement, and style.

  **Axis Captions** permits captions to be entered for each plot axis.  As in the case of Titles and Footnotes, you can control font, font size, style, and placement. However, in addition, for the vertical axes you can also control the rotation of the text.

  **Fetch Variable Descriptions** is a consequence of the fact that data series are commonly documented in the context of MODLER.  Turning this feature on (Yes) results in the descriptions of the series plotted automatically being retrieved with the observations from the relevant Memory File or data bank. Obviously, the usefulness of this facility depends on the quality of the series documentation.  Note also that when expressions are plotted, the expression itself becomes the "description."
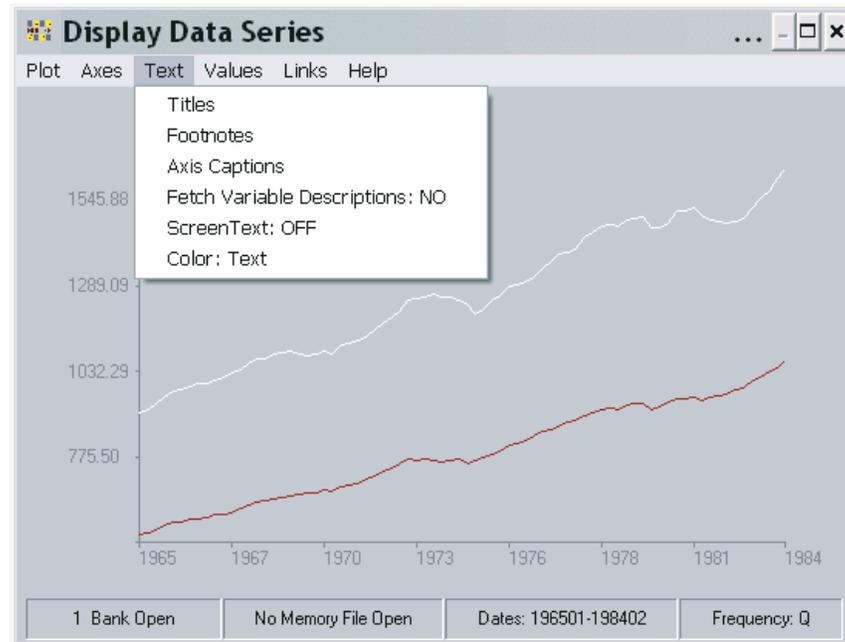
Figure 2-12. Text

The fifth text option, **Screen Text**, is one of MODLER's special features. When this option is chosen, the menu categories **Graph**, **Axes**, and **Values** will become greyed-out (disabled) and even within the **Text** category **Screen Text: On** will be the only one enabled. The cursor will display as an I-beam. Using your mouse, you will be able to click on any part of the screen, at the point of click leaving a small insertion mark. If you then begin typing, you will see that what you type is placed on the screen at that point and to the right, character by character. You can move the mouse, clicking elsewhere, and in the process change the location on the screen of what you next type.

The <Enter> and <Esc> keys have a particular reserved use in this context, but the other keys can be used in normal fashion for text entry. The <Enter> key causes a normal carriage-return line-feed, but brings the next point of entry to one line immediately below the previous line's initial point of entry. The <Esc> key cancels the entry of Screen Text; alternatively, clicking on the text menu item **Screen Text: On** causes the same cancelling action. Text typed onto the screen during this operation remains until either the plot is reinitialized (**Re-Initialize Graph**) or the text is cleared by clicking on the **Graph** option **Erase ScreenText**.

Finally, the **Color** option in turn permits you to specify the color of the text. whenever this option is selected, a color chart appears that shows the choices available, including the ability to "mix" your own colors..

*Fourth Main Menu Category:  Values*

Figure 2.13 displays the options available in the **Values** category, specifically for the case of a time plot.  The subordinate categories differ for a scatterplot.
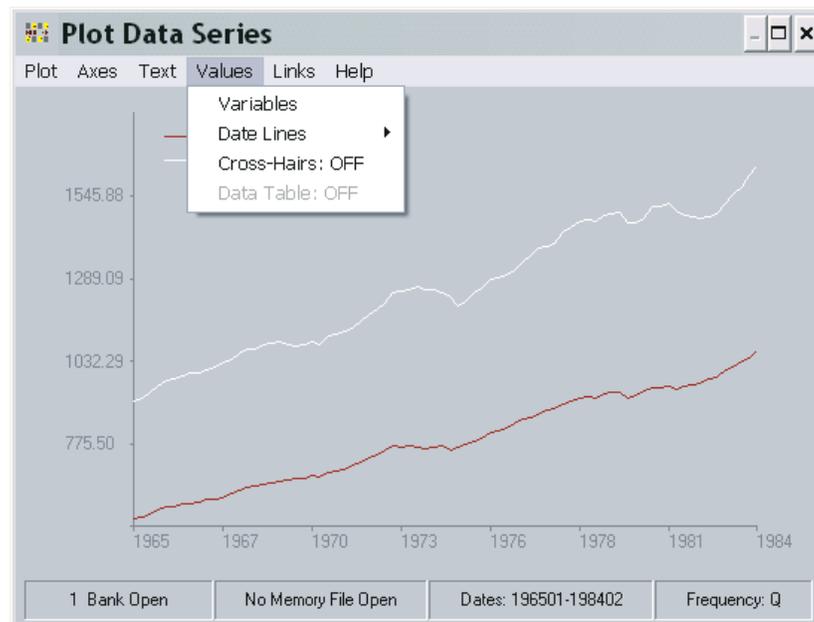


Figure 2-13. Plotted Values Characteristics

The first choice, **Variables**, permits you to control various aspects of the way in which variable values are plotted.  In the case of a simple time plot, with either a single y-axis or a replicated right axis, this option offers you two choices for each series plotted: you can control the **Style** of the plotted line, bars, or points and you can control their **Color**.  Alternatively, if Splitscl is *On* and if Type is specified as *Mixed*, you will have two further choices: you can control the **Axis** against which each series is plotted and you can control **Type** individually—whether that series is plotted as a line, bars, or points.  Note in Figure 2.14 that all these characteristics are always shown in this display for each series—but you will be able to change only those that are "live."  The variation in the case of an XY-plot (with an ordinary series plotted on the x-axis) is that Bars is not an option—*Dates* replace Bars in this case.



Figure 2-14.  Variables Characteristics

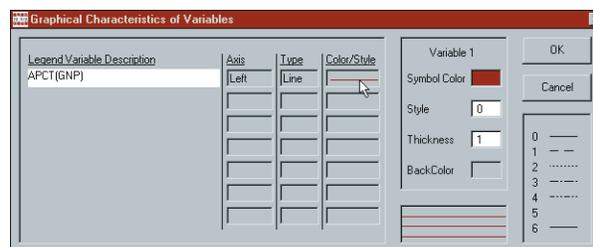In the case of a Time Plot, the second option under **Values** is **Date Lines**: vertical lines each of which marks a particular observation date. These lines are commonly used to separate forecasts from history or to mark cyclical phases. As many as 40 date lines can be used simultaneously.

In the case of an XY-Plot, in contrast, instead of Date Lines, you have the option of displaying a **Bi-secting Ray**. Especially when this line forms a ray from the origin at an angle of 45 degrees, it marks the locus of equal value plotted points. However, you may have to set one or more of the scales to achieve this precise result.

When plotting series against time, the third item is **Cross-hairs**, which toggles On and Off. When this option is toggled On, if you point your mouse at the graph, within the axes, and press the left-button, a small cross-hairs symbol will appear on the plot. Beside it will be the value of the left y-axis at that spot. You must turn off Cross-hairs subsequently by re-clicking on the menu item.

In the case of an XY-plot, instead of Cross-hairs, the option will be **Quadrants**. When invoked, Quadrants causes the graph to be shown with its "face" marked into quadrants, as a scatterplot evaluation aid.

Finally, in the case of a time plot, if **Size** is selected as Quarterscreen or Half-screen and/or in the case of regression and other specialist plots, the entry **Data Table: ON** will appear as the final item. It may also appear some other times, but be greyed-out. Whenever its an option, this choice is toggled On and Off. It causes a data table of values to appear or disappear from the right hand side of the plot. Arguably, the effect of its use is the same as changing the size of a plot from fullscreen to half-screen or quarterscreen, but in some cases this option will provide you more flexibility.

# Creating and Using Tables

Tables can be created and displayed in either of two ways. The first uses MODLER's indigenous facilities only and might be regarded as producing draft-quality tables. The other uses MODLER's capability to write directly to the worksheet cells of a standard spreadsheet program, such as Excel, Lotus 123, or Quattro Pro; properly enhanced, these tables will be of presentation quality. This particular implementation of the second choice is new to MODLER, during the past 10 years, and is a result of the development of the Windows version in the early to mid 1990s. The first method will be familiar to users of the DOS version.

Because it is more visual in approach, the process of creating worksheet-based tables will be considered first. This discussion will lead naturally to a consideration of the other type of table. As will be discussed, both types of tables can be generated using legacy table templates originally created using DOS versions of MODLER.

Spreadsheet-Generated MODLER Tables

In order to produce worksheet-based tables, the first requirement is that you must have previously designated the spreadsheet package you wish to use. If not done before, this can be done within MODLER by clicking on the **Settings** menu item of the Central Control screen. Then Click on **Directories** and fill in the details, as explained in the MODLER *Getting Started and Maintenance Guide* or, more briefly, at the end of Chapter 1 of this document.

The second requirement is that one or more data banks or a Memoryfile must be open for access; later, we will learn that data can instead be retrieved from a model solution file. If, in particular, you wish to produce the examples shown in this Chapter on your own screen, you will first need to open the demonstration data bank, Demobank.BNK, shipped with your copy of MODLER.

The actual process of creating a table begins by clicking on the **Reports** category of the Central Control screen menu then **Create Spreadsheet Table**, as illustrated on the next page by Figure 2-15. If there is a data source open, the second click displays the dialogue box shown subsequently as Figure 2-16. Note that this form has several buttons down its right hand side including, most obviously, a large button at the bottom right. In this representation it is labelled "Excel." If you use Excel as your designated spreadsheet package, the form shown on your screen will be the same; however, if you use Lotus or Quattro Pro, then the name that appears on the button will be one of these. Note also that the button just above it is labelled "Help."
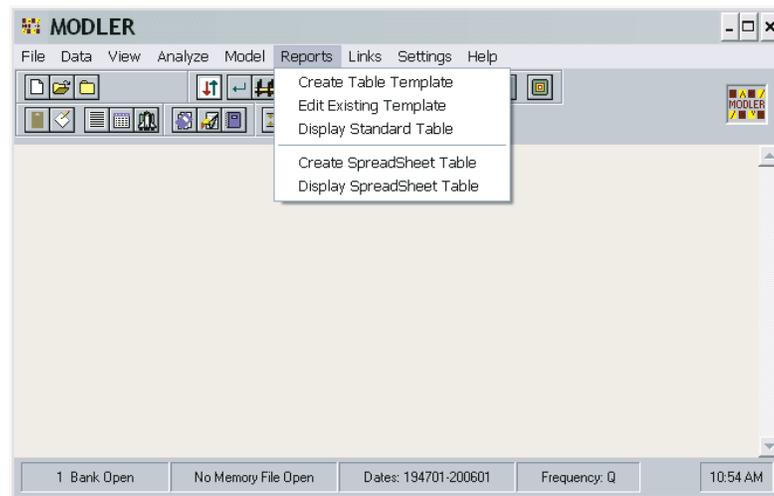
Figure 2-15. Reports: Creating Spreadsheet Table

Clicking **Help** will provide you with both context specific help and additional information to that provided here. Furthermore, near the top of this form will be a textbox labelled "Worksheet" containing the word "None."  Insofar as this is the first attempt to create a spreadsheet table, this textbox can be ignored for the time being; if filled in, the filename should be that of an existing worksheet that you wish to modify.

  A large portion of the form is entitled "Series Selection."  Within this area are text boxes and several buttons.  Proceding clockwise from the top, just below the **Load Series** button, note the **Find**, **Index**, and **Dates/Frequency** buttons.   Respectively, these permit you to search for series in any open data bank by specifying a keyword, but also to provide access to the data bank index(es), and allow you to specify the date range and frequency of the data to be placed in the spreadsheet table.   Initially, you will do best if you set the date range so as to provide a table with only a few observations per series; the frequency should be that of the series to be displayed in the spreadsheet table.   In the example, note that the frequency has not been set previously, so that the dates and frequency will need to be specified.
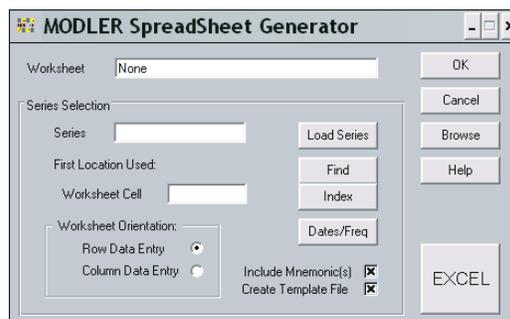


Figure 2-16.  Spreadsheet Manager Form

Next, look at the check boxes, which are labelled "Include Mnemonic(s)" and "Create Template File."  The purpose of the first of these will be discussed in more detail later, but it evidently refers to whether or not the data placed in the worksheet should include a mnemonic series name (or, if an expression, the expression itself) as well as the numeric observations.  The second, if checked, causes a template file to be generated automatically as you create the initial table.  If created, this template can be saved to reproduce the table subsequently. Finally, should you, at this point, have a model loaded, you may also see a reference to the use of a solution file.  These are all topics the details of which are best left to the side  for the moment.

You will see in addition a sub-section of the form entitled "Worksheet Orientation" with radio buttons that allow you to choose whether to enter the data by row or by column.   Obviously, this choice permits you to create tables that either track horizontally across the screen, or display as column oriented tables.  The location that you will fill in just above, "First Location Used," determines the row and column placement of the first observation on each series (or expression),  the remaining observations flow across the worksheet or down, depending upon the  Orientation chosen.

Finally, the textbox labelled "Series" is where you will progressively place the mnemonic for each series to be displayed in the table.   Often it will be simply a series mnemonic.  However, as indicated, you are free to enter instead an expression that can include operators and implicit functions, as well as mnemonic names.   To choose a familiar example, certain rows or columns of the table can display the percent change for series.  At least initially, you would be wise to restrict yourself to simple expressions, but in principle any expression that obeys MODLER's rules is permissible.

However, before you actually start to enter series or expressions, the step you must next take is to launch your spreadsheet program.  To do this, press the button labelled "Excel" (or, alternatively, "Lotus" or "Quattro").   Figure 2-17 illustrates the effect of pressing the **Excel** button.  Note in particular that a blank worksheet is displayed and that the MODLER form floats above  it.  You can, however, move this form around your screen, so as to obtain the best view of the underlying worksheet for particular operations.  Initially, you might wish to move the form to the bottom right of your screen, by clicking on the top of it  and dragging. Incidentally, should this form ever disappear behind the spreadsheet program display, you can make it reappear by clicking on your *Windows* status bar (*not* the MODLER status bar).

It is important to realize that at this point you actually have *full control* of all the operations of the spreadsheet program, notwithstanding the MODLER Spreadsheet Manager Form.  Independently of MODLER, you can enter either text or values into cells—or do anything else you might wish that obeys the protocols of your spreadsheet program.  In particular, you can create titles for the table, or set aside particular
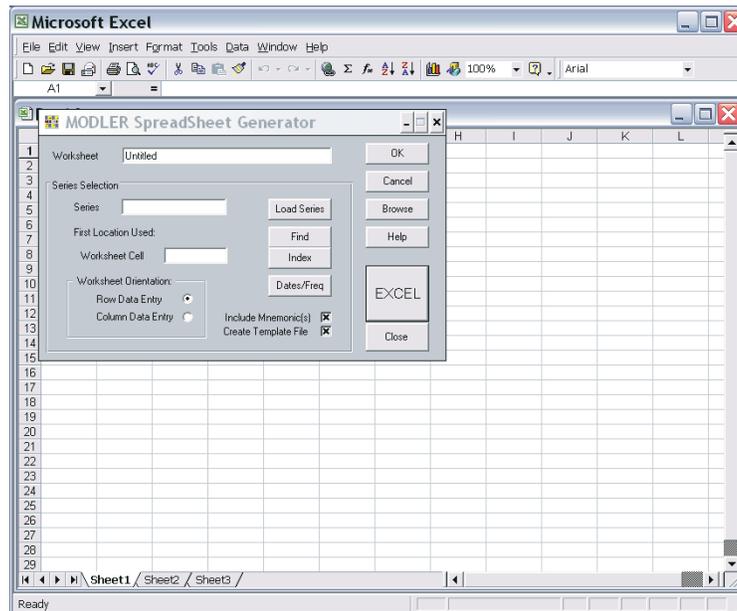
Figure 2-17. Launch Spreadsheet Program

rows or columns for subtitles.   What the MODLER form uniquely permits you to do is to retrieve observations from a MODLER data source and write selectively to specified rows or columns of the worksheet.  Otherwise, you are in an Excel, or Lotus, or Quattro Pro world, assuming that your spreadsheet package is one of these.

  The benefit of being able to write selectively to worksheet cells is that once the table has been created and enhanced with titles and other embellishments, and the worksheet named and saved, you can later recreate it using a revised set of observations from MODLER.  Or you can reset the dates to some other time period and (within limits, depending exactly on how you fashion the spreadsheet table) produce a table for an entirely different date range.

  In contrast, the restriction that selective writing to worksheet cells imposes is that any subsequent changes you make to the row/column organization of the worksheet table may need to be made correspondingly to the MODLER template file as well (if created and saved) before it can be used later to recreate the table successfully. These issues will be considered again below.

*A Worked Example*

  At this point, an example might help.  To set this up, first open the bank Demo-bank.BNK for access and then set the frequency to quarterly and the date range to 198101 to 198304.  Once you have launched your spreadsheet program, as described earlier, you should be looking at a display very similar to, or exactly like, Figure 2-17.
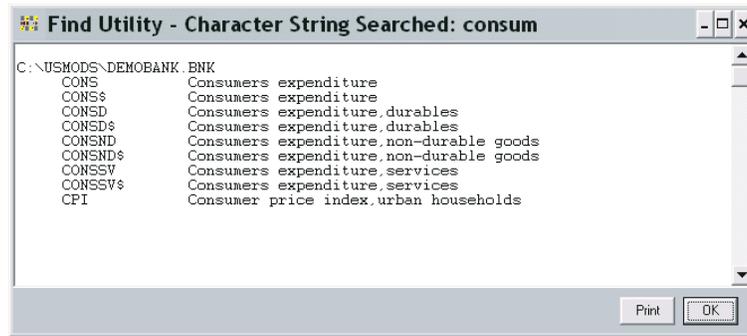
Figure 2-18.  Find Utility Display

   Assume that the purpose is to create a table containing data on Consumption Expenditures, and that the bank you are using, Demobank.BNK, is not very familiar to you.  In order to discover the data it contains on consumption expenditures, press the **Find** button on the MODLER Spreadsheet Manager Form, which will cause the program to ask you to provide a search string. Enter as this string, the text "consum." When you press the OK button on the string specification form, you should next see on your screen the Find Utility display shown as Figure 2-18.   You may discover, depending upon where you put the MODLER Spreadsheet Manager Form, that this Find display is partially hidden behind the MODLER form, but if you move it out where you can see it, it should look exactly like the one shown here.

   Moving your mouse down the display, double click on the mnemonic name CONS$.  The characters CONS$ should now appear in the textbox labelled "Series" on the MODLER Spreadsheet Manager Form.  Alternatively, you could of course have entered CONS$ yourself, or found the name using the **Index** button instead of the **Find** button.

    Next enter R2C1 in the textbox labelled "Worksheet Cell" just below; R2C1 obviously implies Row 2 Column 1.   Then press the button **Load Series** on the Spreadsheet Manager Form.  You should instantly see observations on this variable begin to populate the second row of your worksheet, with the mnemonic CONS$ located in the first column and the observations to the right of it.  Next put CONSD$ into the Series textbox on the Spreadsheet Manager Form and R3C1 into the first location textbox.  Press **Load Series**.

   The use of the codes R2C1 and R3C1 to designate the originating worksheet cell may strike you as being unconventional.   This terminology will not necessarily match that used in your spreadsheet package, but it does clearly designate which row and column location is to be the first one.   Given the location of this cell, MODLER uses the dates setting and frequency to determine the remaining locations automatically.
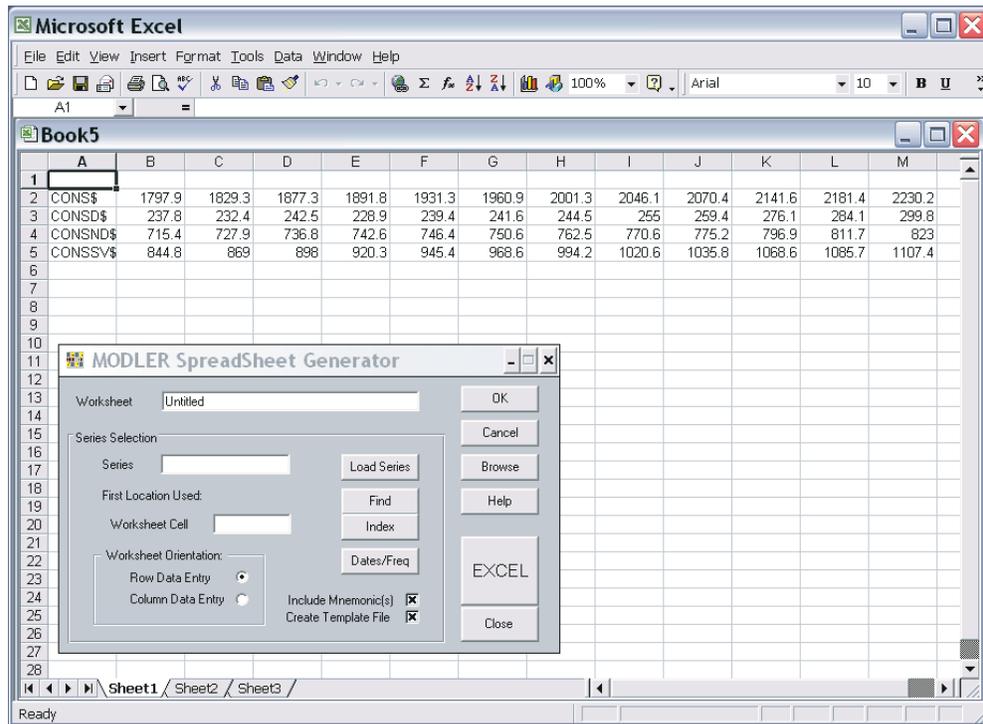
  If you have been working through  the examples so far, in Rows 2 and 3 of your worksheet you should now see observations on the two variables CONS$ and CONSD$. In this case, repeat the process of successively providing a series name and first location, but for the two additional series use the names CONSND$ and CONSSV$, and instead for first location respectively enter R4C1 and R5C1 respectively. Press **Load Series** in between. The final result, in the context of the worksheet, should be a simple table displaying four series.   If you wish you could add as the first row a table title, using your spreadsheet's protocols to do this.  Obviously you could do much more to enhance the table, but that is left to your imagination, as pertaining to the spreadsheet package rather than MODLER.

  There are, however, certain points that need to be made.  The process of entering the series mnemonics and the first observation locations, followed by **Load Series** each time, is designed so that it can be accomplished rapidly, without lifting your fingers from the keys.  If you experiment, you will discover that if you press the <Enter> key immediately after entering the mnemonic, the cursor immediately moves down to the First Location textbox.  If you enter the Row/Column code and press <Enter>, the **Load Series** button can then be "pressed" by pressing the <Enter> key once more.   Simultaneously, the observations will begin to appear across the worksheet and the cursor will move at the end of this to the Series textbox, ready for another sequence.   Thus, once you have picked up the rythm you should be able to produce tables quite rapidly, assuming of course that you know the mnemonic name of each series you wish to display in a table.

The second point has to do with the checkbox on the Spreadsheet Manager Form labelled **Include Mnemonic(s)**. If you remove the check, you will discover that the First Location textbox now refers to the first observation on each series copied to the worksheet. One of the reasons this option exists is that, for instance, you might wish to leave the first column undisturbed, possibly because you already put there a description of the series, so that there is no point in copying the mnemonic itself to the worksheet. Of course, in this case, the mnemonic will still be used in the context of the Spreadsheet Manager Form to designate a series to be copied.

Finally, it has been mentioned in passing that expressions rather than series names can be used in the **Series** textbox. Not only is this true, but it is also true that if you specify the freqency of the series to be copied as annual, for example, instead of quarterly, and if you have opted for automatic frequency conversion, not only will you be able to use expressions in this context, but frequency transformations will also be made automatically. Of course, you must make sure that the data source from which you retrieve each series correctly specifies the frequency transformation method that is appropriate for it.

If, at this point, you click the OK button on the Spreadsheet Manager Form, you should observe on the Windows status bar the slow flash of the status item corresponding to your spreadsheet package. Click on this, and you should be asked whether or not you wish to save the worksheet you have been using. At this stage, you may as well *not* save it, since the worksheet itself will have no further use in the context of this example. However, the next distinct screen that you will see after dealing with your worksheet is that illustrated in Figure 2-19. Assuming that you left the checkbox "Create Template File" checked, the effect will be to cause MODLER to create a table template file.
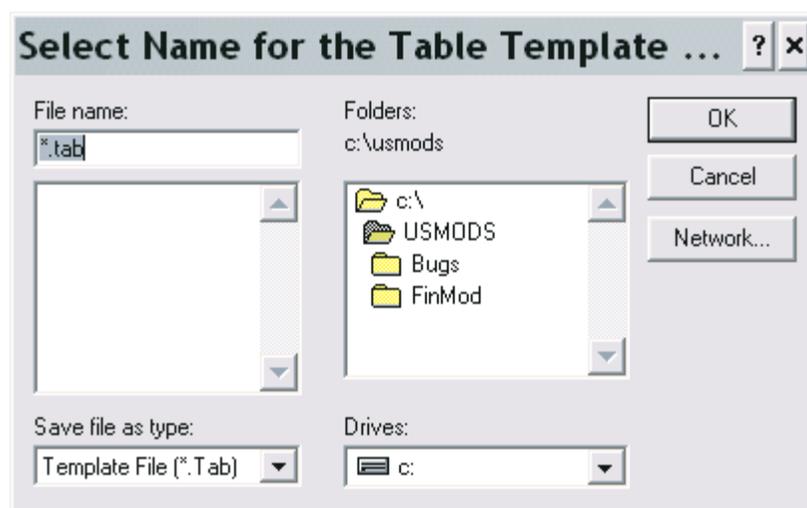


Figure 2-19. Name Table Template File
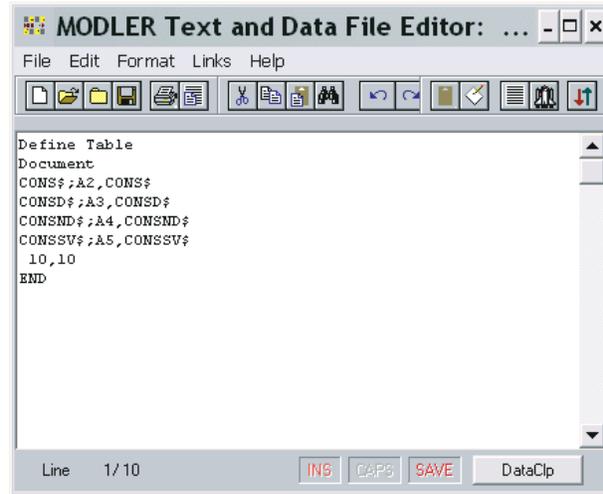
 Figure 2-20.  Table Template File


   The contents of this template file are in turn shown in Figure 2-20.  As will be demonstrated, it can be used subsequently to reproduce the table, exactly as it now appears on your screen.  The rules that govern the organization of template files such as this will be explained later.

   However, looking at the contents of this file, even without considering detail, it is evident that its command lines have some resemblence to the information entered interactively into the textboxes of the Spreadsheet Manager Form.  The template file is obviously generated from that information, to which are added some additional lines, before and after.

   If you now return to the Central Control screen, and then progressively click on **Reports** and the last item **Display Spreadsheet Table**, you will next see a form essentially the same as that shown in Figure 2-21.   Notice that in certain respects
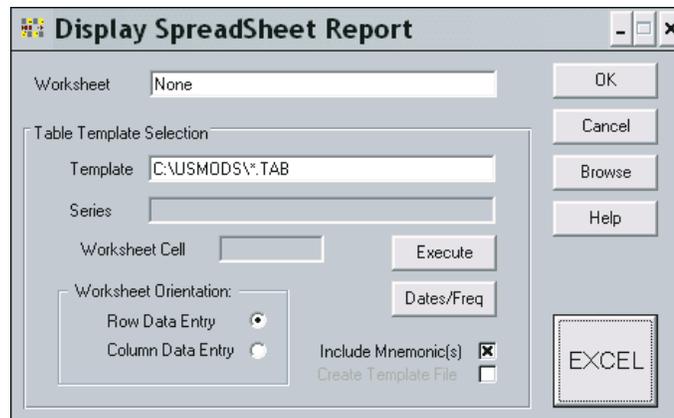


Figure 2-21.  Spreadsheet Regenerator Form

this form is similar to that used to create a worksheet table, but that this one includes in particular a textbox labelled "Template." In addition, certain items are obviously greyed-out.

Initially, look at the textboxes labelled *Worksheet* and *Template*.   The first of these can be ignored—if you were to include a filename here, MODLER would interpret it to refer to an existing file that you wished to modify.   The second, *Template*, must be filled in, using the filename previously given to the template file generated earlier. The next step is to press the large button at the bottom right of the form, which should have the name of your designated spreadsheet onit; the effect of pressing it will be to launch your spreadsheet program.

This example presumes that the date range and frequency are the same as earlier. In this case, if you then press the **Execute** button, you should find that the effect is to re-create exactly the table discussed earlier.   Alternatively, if you change the date range, but the new dates are compatible with those in DEMOBANK.BNK, then the effect should be to produce a table for the different date range.   You can also experiment by changing the observation frequency, choosing annual, for instance, rather than quarterly, as the production frequency of the table—but be sure to turn on automatic frequency conversion, if you attempt this.

As you work, you need to be aware, however, that there is a certain degree of potential for error, should  you do not follow the instructions given carefully, although in almost all cases MODLER will handle this in stride.  In particular if you press the **Execute** button without first displaying the spreadsheet form, you are likely to encounter the error message "Data Entry Error: Destination Worksheet Not Yet Specified."  If you have this experience, no permanent harm has been done. You can recover simply by pressing the large spreadsheet display button and only after that the **Execute** button.   Before you press the worksheet display button, there is no worksheet available into which to load the observations for display.

One of the inferences to be drawn from the foregoing description is that starting from an interactively created table, the ability to generate a template almost automatically has provided a rather flexible way to produce production tables.  Once a template has been created, simply by changing the date range or the observation frequency that template can be made to apply to a variety of distinct tables.

MODLER ASCII Text Tables.

Leaving to the side momentarily the generation of spreadsheet tables, there are also various types of indigenous ASCII Text tables that can be produced using MODLER. A Number of these are displayed in the context of later chapters of this User Guide,

essentially illustrating the results of various operations.  Here, in contrast, the focus is strictly upon the process of producing simple but effective user-designed tables, working with the templates that control their form and structure.  Following from the discussion in the previous section of this chapter, one of the principal aims of this discussion in this section of the chapter is to provide insight into the command structure of table template files. This information can be important when working with worksheet-based tables, particularly if something goes wrong, since it then may be necessary to determine exactly why.  However, in order to clearly distinguish the issues involved, the possibility of using a MODLER table template to generate or display a spreadsheet table will be ignored initially, which removes one level of complexity.

*Your First Text Table*

  In the simpliest case, defining and printing a MODLER table can be as easy as these five steps:

- Click on **Reports** from the Central Control Screen, then choose **Create Table Template**

- In response to the resulting MODLER prompt, provide a filename (say, DEMTAB1.TAB) for the new Template File

- Use the MODLER Template Viewer  and Editor, which appears next, to type the lines:

    **TITLE:** This is our first table
    **ITEMS**: GNP, CONS,GOVP,CAPI,DINV

    [The declaratory keywords, **TITLE** and **ITEMS** ( which are shown in bold simply for identification) must be used here in order to identify the command operations.  However, all that is then required, essentially,  is to provide a title and then a list of variables that should be included in the table.]

- Save and Close the file.

- Click on **Reports** from the Central Control Screen, then choose  **Display Standard Table** and provide the name of the template file just created.

The result should be the table:
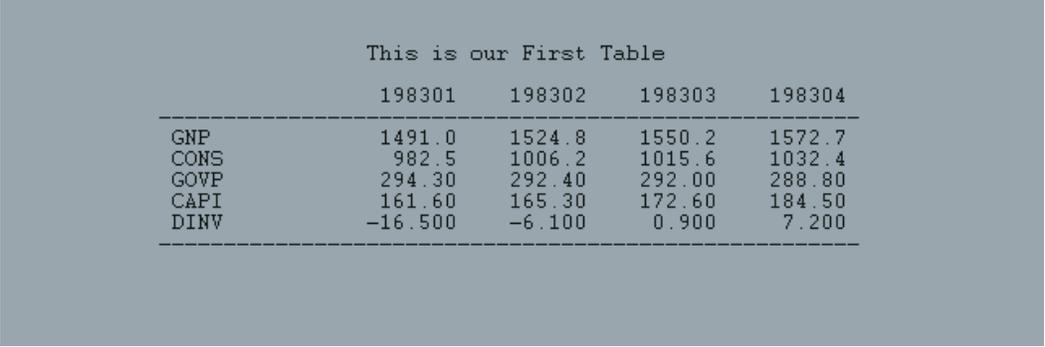
```
                       This is our First Table

                       198301      198302      198303      198304
          ------------------------------------------------------
          GNP           1491.0      1524.8      1550.2      1572.7
          CONS           982.5      1006.2      1015.6      1032.4
          GOVP          294.30      292.40      292.00      288.80
          CAPI          161.60      165.30      172.60      184.50
          DINV         -16.500      -6.100       0.900       7.200
          ------------------------------------------------------
```

Figure 2-22.  A Simple Table

Notice that this table by default uses the series' mnemonic names as descriptors and lets MODLER choose the width of columns and the number of decimal places  for each of the observations.   This level of display crudeness is to be expected, since we have supplied only a table title and a list of variable names.   The virtue of this table is how simply it can be produced and that for anyone familiar with the series mnemonics used it does provide a good bit of information rather quickly.

*Some Elaborations: Descriptions and Subtitles*

  However, the table shown in Figure 2-22 is clearly not ready to be handed out generally.  One of the table's less attrative features is the lack of item descriptions. Fortunately, this lack is easily correctable.  It is possible to create custom descriptions, as well as to specify the fieldwidths for both the descriptions and the observations.

  One method of accomplishing this transformation involves only a slight elaboration of the above table template.  Proceed as follows:

- On the template row immediately after that for ITEMS, put the command DOCUMENT on its own.  MODLER will then expect on successive lines a description for each item in the list, as will be illustrated.

- In addition, the ITEMS command can also include certain keywords, such as SUBTITLE and SKIPLINE, that will considerably improve the table's looks.  SUBTITLE causes the description to be located as a centered subtitle; SKIPLINE causes a blank line to be inserted in the table.

The net effect of these changes is to create a revised template that might take the form:

> **TITLE:**This is our second table
> **ITEMS:**SKIPLINE,SUBTITLE,GNP,CONS,GOVP,CAPI,DINV
> **DOCUMENT**
> (billion real dollars)
> Gross National Product
> Consumer Spending
> Government Spending
> Fixed Investment
> Inventory Investment
> 26,10

Evidently, the first 6 lines following the **DOCUMENT** line are the item descriptions, although there is no description needed for the first item ("SKIPLINE") and the second line "(billion real dollars)" must be inferentially recognized as a SUBTITLE.
 .
  However,  it may not be immediately obvious to you what the final line is.  This line specifies the width of the description field (26) and the data fields (10).  Only one number is needed for the data fields because these are assumed to be all the same width.   The description field width must be at least the width (in characters) of the longest description, and you probably will want some white space as well. The data field width should be at least as wide as the widest number; 10 is usually safe on this score, and values greater than 10 usually result in additional white space.

  Once having supplied the titles and number of columns, and saved the modified template file, under the name DEMTAB2.TAB, you can print the table in at least two ways.  One is by clicking on **Reports** and then following the **Print Standard Table** sequence, as before.  Alternatively, the table can be produced by a command line from the Central Control screen, using the command:

>   **PRINT TABLE** DEMTAB2.TAB

You can often type directly onto the blotter portion of this screen.  Alternatively, you can click on **File** and then on the element **Issue Command**.

  A table produced by this method is shown in Figure 2-23.  It is clearly an improvement on the first table.  The essence of the change is of course the addition of descriptions, as well as a subtitle.  However, a number of the characteristics of the table are still provided by default.

```
                              This is our second table

                            198301      198302      198303      198304
          ------------------------------------------------------------------
                            (billion real dollars)
          Gross National Product      1491.0      1524.8      1550.2      1572.7
          Consumer Spending            982.5      1006.2      1015.6      1032.4
          Government Spending         294.30      292.40      292.00      288.80
          Fixed Investment            161.60      165.30      172.60      184.50
          Inventory Investment       -16.500      -6.100       0.900       7.200
          ------------------------------------------------------------------
```

 Figure 2-23.  Simple Table With Descriptions


*Storing a Table Definition: Making a Template*

  It is worth pausing at this point to emphasize that templates allow the essence of a table to be stored for later use.  In this context,  "Template" specifically refers to the set of commands, like those above, that define the characteristics of a table. Notice that the series observations are not included; they are always retrieved from the Memory File or a data bank each time the table is printed.  This facility allows a table to be produced repeatedly without having to define it each time: the same tables can be produced at periodic intervals as new series observations become available; simply change the dates and reprint the tables.

  Notice also that although MODLER incorporates a text editor, the process of making a template is not bound to MODLER.  In particular, another way of making a template file is simply to use a third-party text processor, such as Notepad or Wordpad, or even a full-fledged word processor, provided that the templates you create are *always* created as text only files.  Do not use Tab characters or any control characters when you create these files.  Also, do not give them a TXT extent, unless you are prepared to always use this extent when you refer to your template file. MODLER will, by default, always assume the extent to be TAB unless you explicitly tell it otherwise.   Using TXT as an extent will also prevent MODLER from recognizing such files as table templates (TAB files), which means that you will then need to manage these files yourself.


*Specifying the Dates*

  If you explore assiduously the relevant portion of the MODLER help file that pertains to table templates, you will discover that a dates command can be included within a template.  However, in general, as has been done above, dates and obser-vation frequency are usually best controlled separately, by setting them in advance

of creating or using a table.   When this is done, MODLER adjusts each table to fit the date range.

  In the examples given above, the date limits were set purposefully to permit the tables to fit on a single screen.  However, if  a wider date interval is chosen and if there are too many dates to fit across the screen, MODLER automatically breaks the table display into sub-period sub-tables.  The table will also be subdivided for display if there are too many rows (more than can fit on a single hardcopy page), at least if you use the just-described ITEMS command.

  The range of dates displayed can be changed  by re-setting the dates before reissuing the PRINT TABLE command, or otherwise displaying the table using the menu equivalent.  Another option is to supply a list of selected dates for the columns of a particular table, such as:

**DLIST** 198301 198302 198401 198402
**PRINT TABLE** templatename

The DLIST option is actually very powerful, since it allows dates to be chosen that refer to spaced observations; for example, every other year, once every five years, or once every ten years.  However, if you use DLIST in this way, make sure to have previously set the date range  for the entire date interval, including, at minimum, all the dates specified by DLIST.

*Decimal Places*

  If you were to apply extensively the table template facilities shown so far, it would not be too long before you began to realize that letting MODLER control the decimal places displayed is asking too much of the program.  For example, it is sometimes desirable to display the same number of decimal places for each of the observations shown in a table whereas, by default, MODLER will treat each number separately when determining the location of the decimal.

  You can control the maximum number of decimal places for the display of numbers in tables with the global command:

**SET DECIMALS**=k     where k is in the range 0 to 5

It is important to note that both the strength and the weakness of using this command is that it applies to the entire table uniformly.

However, you can fix the number of decimal places in each row individually by putting a suitable number (0 to 5) followed by a comma in front of the text documentation for that row, for example:

     1,Gross National Product

This local command works in the absence of a global SET DECIMALS command. It also locally overrides the global command for the specific table rows in which it is used.   As an example, consider the table template:

```
TITLE:DEMONSTRATION TABLE
ITEMS:SUBTITLE,CONS,GOVP,CAPI,GNP,SKIPLINE,SUBTITLE,TRBAL$,
GOVBAL$,SKIPLINE,SUBTITLE,WPIND,CPI,SKIPLINE,EMPL,UNRATE
DOCUMENT
(billion 1972 dollars)
0,Consumer spending
0,Govt purchases
0,Fixed investment
0,GNP
(billion current dollars)
0,Trade balance
0,Govt budget balance
(indexes 1967=100)
1,Wholesale prices
1,Consumer prices
2,Civil employment    (mil)
1,Unemployment rate     (%)
25,8
END
```

This particular file has already been created and is supplied among the MODLER installation files.  It is called DEMOTAB3.TAB.  Thus you can quickly produce the corresponding table using the commands:

     **SET DATES**=198302-198402
     **PRINT TABLE DEMOTAB3**

or by clicking on **Reports** and then **Display Standard Table**, having chosen the template file DEMOTAB3. The resulting table is shown on the next page.

  Incidentally, the commands to display tables, set dates, set decimals, etc, are illustrated partially in order to let you know that there is an alternative to the menus. However, these commands can also be included in macros, so that knowing the commands can be very useful.   At the moment, your focus is presumably upon the step-by-step production of tables.   Ultimately, you are quite likely to be interested in organizing your work so that a single command is capable of producing a number of related tables.   At that time, these commands will become more pertinent.

```
Standard Table                                                    - □ ×
                        DEMONSTRATION TABLE                            ▲

                   198302  198303  198304  198401  198402
        ---------------------------------------------------------------
                     (billion 1972 dollars)
        Consumer spending      1015    1032    1044    1064     0.
        Govt purchases          292     288     289     302     0.
        Fixed investment        172     184     193     202     0.
        GNP                    1550    1572    1610    1638     0.

                     (billion current dollars)
        Trade balance           -16     -29     -51     -58     0.
        Govt budget balance    -133    -129    -107    -109     0.

                     (indexes 1967=100)
        Wholesale prices       317.0   318.4   320.5   323.3    0.0
        Consumer prices        299.8   303.1   306.8   309.6    0.0

        Civil employment (mil) 101.50  102.50  103.70  105.10   0.00
        Unemployment rate (%)    9.5     8.5     7.9     7.5     0.0
        ---------------------------------------------------------------
                                                                      ▼
                                                        Print    OK
```

Figure 2-24.  Table Produced Using DEMOTAB3.TAB

An Alternative Template Style

The process of beginning with a table title and a list of variables, as we did,  and then progressively providing documentation and other embellishments in order to generate progressively more attractive tables permits intuition to lead the way up the learning curve.  However, the use of an item list is ultimately limiting, since at some stage it will be desirable to move beyond displaying variables alone.

Consider instead a template that has the following form:

**TITLE**:This is our alternative second table
**DOCUMENT**
HEADLINE;
SKIPLINE;
SUBTITLE;(billion real dollars)
GNP;Gross National Product
CONS;Consumer Spending
GOVP;Government Spending
CAPI;Fixed Investment
DINV;Inventory Investment
SAVE
26,10

Notice three things in particular.  First, the absence of an ITEMS list, and that instead the contents of the former ITEMS list are individually now the initial elements of each document line; there is also a new item, HEADLINE, that causes dates to be printed across the top of the table.   Second, the use of a semi-colon to separate the variable name or keyword from the description.  Third, the word SAVE that appears on the next line after the last variable in the table ("DINV").   The reason for the word SAVE is that, in the absence of an ITEMS list, MODLER needs some way to tell which is the last item in the body of the table.

  The template file containing these commands is ALTDEMO2.TAB and you can produce the corresponding table using the command:

**PRINT ALTDEMO2.TAB**

with the exception of the slight change in the title, you should find that this table is the same as our second table.  If, in addition, you thereafter click on **Reports** and then choose **Display Spreadsheet Table**, subsequently entering ALTDEMO2.TAB as the template file,  and finally click on Execute, you should not be surprised to find that this template will also generate a worksheet-based table.  In fact, by clicking on **Display Spreadsheet Table**, instead of clicking on **Print Standard Table**, all the table templates illustrated so far can be used to produce worksheet based tables.  The difference is that if a Row-Column reference is omitted, MODLER will simply produce a table starting in the upper left hand corner of the worksheet and work down row by row and column by column.

*Other Table Making Options*

  As well as the options just described, MODLER permits you to create tables that display mixed frequency data and incorporate row transformations.  These options can be used together or separately.  Mixed frequency tables can contain as many as three observation frequencies.  The row transformations allowed include most of MODLER's implicit functions and most operations; however, there are limitations concerning the command length.  The command length does not prohibit the creation of tables with complex transformations: alternatively, transformations may be stored in the Memory File and retrieved during the table printing process.

  There are in fact a number of options in addition to these, including the capability to retrieve historical and forecast data from a  model solution file.  All these options are described in  later chapters of this User Guide or in the relevant section of the online help.

Appendix

# Template DEMTAB3A.TAB

The template file DEMTAB3.TAB shown in the body of this chapter will not display properly as a Spreadsheet table. To use it in this context you must change it as illustrated below. In the following, note the omission of the ITEMS command and the inclusion of the items themselves in the lines following DOCUMENT, in each case followed by a Semi-Colon. The ITEMS command can only be used in the context of Spreadsheet tables if the item documentation is limited to just a description of each item. Including Skiplines, Subtitles, and decimal controls is incompatible with the ITEMS approach.

```
title:DEMONSTRATION TABLE
DOCUMENT
SUBTITLE;(billion 1972 dollars)
CONS;0,Consumer spending
GOVP;0,Govt purchases
CAPI;0,Fixed investment
GNP;0,GNP
SKIPLINE;
SUBTITLE;(billion current dollars)
TRBAL$;0,Trade balance
GOVBAL$;0,Govt budget balance
SKIPLINE;
SUBTITLE;(indexes 1967=100)
WPIND;1,Wholesale prices
CPI;1,Consumer prices
SKIPLINE;
EMPL;2,Civil employment   (mil)
UNRATE;1,Unemployment rate    (%)
25,8
END
```