FE365 MACROECONOMICS

LABORATORY MANUAL

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Section I: INTRODUCTION

This laboratory manual is written for use in the FE365 Macroeconomics course. The assignments use the FAIRMODEL, a 131 equation model of the U.S. economy developed and maintained by Dr. Ray C. Fair of Yale University. At the FAIRMODEL website, a student can access the FAIRMODEL Workbook. This manual is in no way a substitute for that workbook. The workbook examines the nature of macroeconomic models, explains in detail the structure of the FAIRMODEL, lays out all of the equations in the model, provides lists and definitions of all variables, and provides a number of exercises. Every student should, at a minimum, read Chapter 1 of the workbook, in order to understand what a model is, and and sections 2.1 and 2.2 of Chapter 2 to know how to use the workbook to find the names, derivations, and definitions of variables. This manual provides practical instruction on using the model, and on loading FAIRMODEL data into an EXCEL spreadsheet. Most of the manual consists of 20 assignments, each of which can be completed within the two hour weekly laboratory period.

What is the FAIRMODEL?

The FAIRMODEL is a 131 equation model of the U.S. economy. It contains 30 stochastic (i.e. behavioral) equations and 101 identities. Stochastic equations are estimated from historical data. Identities are equations which are true by definition. There are 131 endogenous variables and about 100 exogenous variables. Endogenous variables are explained by the equations - - either the stochastic equations or the identities. Exogenous variables are not explained within the model, but are taken as given by the model. For example, Gross Domestic Product (GDP) - - the total output of the economy - - is endogenous in the model. The model is designed to explain the level of GDP. Federal government spending, on the other hand, is taken as exogenous. The model is not designed to explain the behavior of Congress and the Executive Branch. It is very important to understand the endogenous/exogenous distinction, and to know which variables are exogenous. The reason why this is so important will become clear later.

The dataset for the model is called BASE. It contains actual values for all variables (both endogenous and exogenous), by quarter, from the first quarter of 1952 through the latest available quarter. At this writing, actual data are available through the first quarter of 2001. It also contains forecast values for about four years into the future. At this writing, the forecast period extends through the fourth quarter of 2005. Of course the forecast period has not yet happened. There are no actual data. The values of the exogenous variables are thus, in effect Ray Fair=s best guesses. He decides on the values, which become inputs to the model. The values of the endogenous variables are the results of solving the model. In a number of the experiments you will change an exogenous variable in the forecast period - - in essence, make a different guess than Ray Fair=s guess. Then you will solve the model and compare your endogenous variable results with Ray Fair=s forecast results.

Quarterly vs. Annual Data

Macroeconomic variables are of two types: stocks and flows. Stocks are measured at a point in time. Thus, for example, the number of people unemployed, the population and the money supply are stock variables. Flows are measured over time. GDP and government spending, for example, are flow variables. As mentioned, the FAIRMODEL is a quarterly model; all the variables are quarterly. However, the flow variables, as you will use them, are displayed at annual rates. The concept of Aannual rate@ is best understood by example. The GDP for the first quarter of 2001 was $10,249b., annual rate. This means that if goods and services continue throughout the year 2001 to be produced (i.e. to Aflow@) at the rate at which they were produced in the first quarter, then total production for the year **B** GDP **B** will be $10,249b. For stock variables, the quarterly/annual rate distinction is not relevant. The number of people unemployed in the first quarter of 2001 (measured at whatever point in time in that quarter the estimate was made) was 5.99 million. However, a *change* in a stock variable is a flow variable. The change in the number unemployed between the fourth quarter of 2000 and the first quarter of 2001 was +.38 million, going from 5.61 m. in 2000:4 to 5.99 in 2001:1. This is obviously a quarterly rate. To make it an annual rate, you must multiply this change by four. If unemployment increased all year at the rate that it did for the first quarter, by the end of the year 1.52 million more people would have been unemployed. In interpreting results, it is important to keep this stock-flow distinction in mind.

Sometimes you will want to use annual interval variables (that is, one observation per year) rather than quarterly interval variables. Annual data are easy to work with because the problems associated with interpretation of quarterly data discussed above do not arise. The level of an annual variable is just the average of the four quarterly observations for that year. The change from one annual level to the next is **NOT** equal to the average (or to the sum) of the quarterly changes, however. Nor is the percentage change equal to the average (or to the sum) of the quarterly changes. Thus, if you have quarterly data and need changes in annual values, you must average the quarterly levels for each year to get annual levels, and then calculate changes in those annual levels. The FAIRMODEL software does directly provide annual observations **B** levels, changes, and percentage changes. The FAIRMODEL output of annual data cannot be loaded into spreadsheets in the same way that its output of quarterly data can be loaded. This loading is discussed below in **Section IV**.

IF YOU WISH TO USE PERCENTAGE CHANGE VALUES PRESENTED IN THE FAIRMODEL SOFTWARE, PLEASE READ THE FOLLOWING:

Often you will want to examine percentage changes in variables. You can calculate these using a spreadsheet. The FAIRMODEL software will also provide you with percentage changes. You must be careful with your interpretation of this FAIRMODEL output. Again, the stock-flow distinction is important. For stock variables, the FAIRMODEL provides quarterly levels of values and changes in those quarterly levels, as noted above. It also provides quarterly percentage changes. THESE CHANGES ARE IN FACT **ANNUAL** GROWTH RATES. That is, the FAIRMODEL uses a formula that compounds the growth rate, so that the figures presented are slightly larger than four times the quarterly percentage change. For flow variables, FAIRMODEL uses the same formula. Note that the interpretation is tricky, because the calculation relates to the *change* in the flow. Thus, for example,

real GDP first quarter of 2000 was $9103 b. annual rate. For the second quarter, it was $9229 b. annual rate, so the difference is $126 b. If GDP were produced at the second quarter rate for the year, rather than at the first quarter rate, GDP would have been $126 b. larger, or 1.38% [(126/9103)*100]. But if the flow of GDP *changed* at $126 b. each quarter for the year, then the change in GDP would have been 5.69% (four times 1.38, compounded). It is this number given by the FAIRMODEL software as percentage change.

Section II: USING THE FAIRMODEL SOFTWARE

You access the FAIRMODEL at: http://fairmodel.econ.yale.edu/

From this Homepage, click on U.S. Model Solve (left side of the screen). This takes you to the Login Screen.

Login Screen

You are asked to enter the name and password for a dataset. There are several rules and things to watch out for:

$ You must enter a unique name and password. FAIRMODEL stores for nine months datasets with names and passwords entered by people all over the country who use the model.

$ If you enter a name that someone else, somewhere, has used, and do not enter his/her password (which you are obviously unlikely to randomly guess) you will get a black screen with an error message:

Authorization Failed
You entered the wrong password for that data set.

Hit the Back button and enter a different name and password.

$ Your dataset name CANNOT be more than 8 characters long. If you ignore this rule and enter a longer name, the software will appear to accept it, and you will be able to proceed. You will be able to make changes in the model as directed in a lab assignment. Then you will ask the software to solve the model (see below), and it won=t solve. You will get the following error message:

Cannot open error file "LF90.EER", error # 94

So that all the work you have just done will not be wasted, go back to Login and enter a new dataset name of eight or fewer characters. When the Dataset Creation screen comes up (see

below), copy the old dataset with the long name. Then the model will solve.

$ If you enter a name that someone else has used, and happen by chance to guess that person=s password, the software will skip the next Dataset Creation screen and take you directly to the Main Menu. Go back to Login and start again. First of all, you may screw up someone else=s dataset that was being saved for their future use. Second, you have no idea what is in that dataset, so any results you get from using it will probably be wrong. Much more likely, of course, is that you will enter a name and password that you yourself have used before. The same thing will happen. The software will take you to the Main Menu, skipping the Dataset Creation screen. That is fine IF you want to work with the old dataset - sometimes you may specifically want to. That presumes you know what is in that old dataset - exactly what you have done to it in the past. When in doubt **B** create a brand new dataset.

Dataset Creation Screen

When you enter your new dataset name and password, you will get a screen with the following:

> The dataset MYNAVY does not exist. If you would like to create it with a password of HAHA, you have two options:
>
> 1.Copy BASE to create your dataset:
>
> 2.Copy another existing dataset:

As mentioned above, the FAIRMODEL dataset is called BASE. What you will do in most of the lab exercises in this manual is to copy this BASE under your new dataset name. Then you can alter your copied dataset in any way you wish. If you make an unfixable mess out of the dataset (and you probably will, occasionally) you can always go back to Login, come up with a new dataset name, copy BASE and try working the problem again. Finally, if you use a dataset name and password you have used before, the software will skip this screen and go directly to the Main Menu. Unless you consciously want to use the old dataset (and know exactly what is in it), go back to Login and come up with another name.

Main Menu

After you copy the BASE dataset and hit the Proceed button, you will get the Main Menu, called HOME in the software. It consists of nine items:

1.Set prediction period

2.Change assumptions about monetary policy

3.Change exogenous variables

4.Modify equations by the use of add factors

5.Drop or add equations

6.Take equations to begin after the beginning of the prediction period
7.Modify the equations

8.Solve the model and examine the results

9.Examine the results without solving the model (this is generally not recommended)

You will not use #4 or #6 in any of the labs in this manual. The other menu selections will be explained below.

<u>1.Set prediction period</u>

The prediction period is the time period over which the model solves. The default is the so called forecast period **B** the data in the BASE for the time period that has not happened yet, which is nothing more than Ray Fair=s forecast for the economy for the next four or five years. If you change the prediction period, be sure to hit the Commit to Changes button.

$ If the exercise you are doing involves changing an exogenous variable and comparing your result with Ray Fair=s forecast, you DO NOT need to change to prediction period.

$ If the exercise you are doing involves observing what actually happened in the economy in the past, you DO NOT need to change the prediction period.

$ If the exercise you are doing involves a counterfactual, you DO need to change the prediction period. For example, if you want to consider what would have happened in the economy if import prices hadn=t gone up sharply in 1973-74 (as they did due to actions by OPEC to restrict the supply of petroleum), then you need to change the prediction period to the time period that interests you **B** say 19731 (first quarter of 1973) through 19804 (fourth quarter of 1980). If you do not change the prediction period, the results of your Asolution@ will be identical to the BASE data **B** what actually happened 1973-1980 **B** because the model will not solve over the time period of interest.

2.Change assumptions about monetary policy

In the FAIRMODEL, monetary policy is endogenous. There is an equation (Equation 30) that predicts how the money supply will change in response to other changes in the economy. In reality, of course, the money supply is determined partly (perhaps largely) by conscious policy decisions of the Federal Reserve Board of Governors (the FED). So in some sense, the money supply in the real world is exogenous. In several of the exercises in this manual you will be asked to change monetary policy **B** making it exogenous to the model. To do this, you drop Equation 30 and solve the model without it. This is done by clicking on Main Menu choice #2. You will then have four choices:

The bill rate (RS) is exogenous.

The money supply (M1) is exogenous.

The level of nonborrowed reserves (UBR) is exogenous.

The amount of federal government securities outstanding (AG) is exogenous

$ No exercise in this manual use the third and fourth choices.

$ U.S. monetary policy today focuses on an interest rate target. That is, the FED manipulates the money supply to set short term interest rates. This policy is represented in the model by Choice #1, making the interest rate on three-month Treasury securities (RS) exogenous.

$ U.S. monetary policy for part of the 1980s focused on a money supply target. This policy is represented in the model by Choice #2, making the M1 money supply exogenous. Note that in the FAIRMODEL there are no M2 or M3 variables, representing broader definitions of the money supply.

After you click Commit to Changes, you will get a screen that allows you to change the values of the variable (RS or M1) that you have just made exogenous.

In the right frame, you see four columns:

$ The first column lists quarters over which the analysis is being done. You have set this when you set the Prediction Period (see above). The quarters begin two years (eight quarters) before the beginning of the Prediction Period you set.

$ The second column, labeled NEW, contains the values of the variable in your data set. You can change these.

$ The third column, labeled BASE, contains the values of the variable in the BASE dataset. You cannot change these.

$ The fourth column, labeled NEW-BASE, contains the difference between the values in the NEW column and the BASE column. Until you change something, that difference will be zero, because your dataset is a copy of the BASE dataset.

In the left frame, you are given choices for changing the variable (RS or M1) you just made exogenous:

$ Replace all existing values with a particular value.

You choose this option if you want to hold the variable constant in absolute terms. Values in the prediction period will change, but the values in the eight quarters leading it will not change. Note that this is not normally very realistic in a growing, changing economy. No exercise in this manual requires this choice.

$ Add a particular value to each of the existing values

Values in the prediction period will change, but the values in the eight quarters leading it will not change. Note that a negative sign will cause the program to subtract the specified value from each existing value.

$ Multiply each of the existing values by a particular value.

Values in the prediction period will change, but the values in the eight quarters leading it will not change. With this option you can obviously introduce a percentage change in a variable

$ In addition to the three options listed above for changing the values in your dataset relative to the BASE dataset, there is an additional option. In the NEW column in the right hand frame, you can change each individual value by typing in the new value.

ONCE YOU HAVE MADE THE CHANGE YOU DESIRE, CLICK ENTER. You will see the values in the NEW column change, as you have specified, and you will see the values in NEW-BASE change to reflect the difference between your dataset and the BASE dataset. **THEN CLICK THE COMMIT TO CHANGES BUTTON** (right frame). If you do not do this, the changes will NOT be made.

Two additional points:

$ If you wish, you can introduce your change for a part of the period of analysis rather than for the whole period by changing the date in the left hand frame. For example, you might want to raise the RS interest rate relative to the BASE for one year, and then let it revert to the BASE level.

$ Second, in some exercises, you will be told to click on Commit to Changes (left frame) without changing anything. This leaves the values in your dataset exactly equal to the values in the BASE dataset. But remember, in the regular version of the FAIRMODEL, RS and M1 are endogenous. When you solve the model, these values can change. In your dataset, you have made one of them exogenous, requiring that it remain equal to the values in the BASE dataset, no matter what else changes. Suppose you make RS exogenous and then sharply increase government spending (see below) relative to the BASE. In the regular version of the FAIRMODEL, sharply increasing government spending will push interest rates (RS) up automatically (endogenously), so that RS will be high relative to the BASE. However, by making RS exogenous and equal to the BASE, you prevent this endogenous reaction from taking place.

3.Change exogenous variables

There are about 100 exogenous variables in the FAIRMODEL. The values for these variables are actual values for historical data, and Ray Fair=s best guesses for the forecast period. In the exercises in this manual, you will often be asked to change a particular exogenous variable. When you click Main Menu choice #3 you will get a screen that lists exogenous variables (right frame) and several choices for changing the variable you make exogenous (left frame).

The variables in the variable list are organized into five parts: important federal government variables (ex. government spending); important state government variables; important foreign sector variables (ex. volume of exports); other exogenous variables, which includes additional government and foreign sector variables as well as many other things; and a set of Anormally@ endogenous variables. **IT MAKES NO SENSE TO CHANGE THE NORMALLY ENDOGENOUS VARIABLES UNLESS YOU ALSO DROP THE EQUATION ASSOCIATED WITH THEM - MAIN MENU CHOICE #5.** When you select one of the variables, the right frame changes giving you four columns:

$ The first column lists quarters over which the analysis is being done. You have set this when you set the Prediction Period (see above). The quarters begin two years (eight quarters) before the beginning of the Prediction Period you set.

$ The second column, labeled NEW, contains the values of the variable in your data set. You can change these.

$ The third column, labeled BASE, contains the values of the variable in the BASE dataset. You cannot change these.

$ The fourth column, labeled NEW-BASE, contains the difference between the values in the NEW column and the BASE column. Until you change something, that difference will be zero,

because your dataset is a copy of the BASE dataset.

In the left frame, you are given choices for changing the variable you just made exogenous:

$ Replace all existing values with a particular value.

You choose this option if you want to hold the variable constant in absolute terms. Values in the prediction period will change, but the values in the eight quarters leading it will not change. Note that this is not normally very realistic in a growing, changing economy. No exercise in this manual requires this choice.

$ Add a particular value to each of the existing values

Values in the prediction period will change, but the values in the eight quarters leading it will not change. Note that a negative sign will cause the program to subtract the specified value from each existing value.

$ Multiply each of the existing values by a particular value.

Values in the prediction period will change, but the values in the eight quarters leading it will not change. With this option you can obviously introduce a percentage change in a variable

$ In addition to the three options listed above for changing the values in your dataset relative to the BASE dataset, there is an additional option. In the NEW column in the right hand frame, you can change each individual value.

ONCE YOU HAVE MADE THE CHANGE YOU DESIRE, CLICK ENTER. You will see the values in the NEW column change, as you have specified, and you will see the values in NEW-BASE change to reflect the difference between your dataset and the BASE dataset. **THEN CLICK THE COMMIT TO CHANGES BUTTON** (right frame). If you do not do this, the changes will NOT be made.

Two additional points:

$ If you wish, you can introduce your change for a part of the period of analysis rather than for the whole period by changing the date in the left hand frame. For example, you might want to raise government spending (COG) relative to the BASE for one year, and then let it revert to the BASE level.

$ You can change more than one exogenous variable before solving the model. Simply follow the steps above again.

<u>5.Drop or add equations</u>

Main Menu option #5 permits you to drop any of the 30 stochastic equations from the model, enabling you to make exogenous some of the variables that are otherwise endogenous in the model. Once you have dropped an equation, you can go to Main Menu option #3 and make changes in the values for that variable. For example, you can make the volume of imports exogenous. Then you can make exogenous changes in imports.

7.Modify the equations

Main Menu option #7 enables you to change the coefficients on the independent variables in any of the 30 stochastic equations. Suppose, for example, you wanted to make Investment in Residential Housing more sensitive to interest rates than it is in the FAIRMODEL, When you select an equation, you will get a screen showing the independent variables and their associated coefficients. Simply change the coefficient by typing in the new number and click Save Changes. You can also change the equations in other ways, but you will not be asked to do so in any exercise in this manual.

8.Solve the model and examine the results

When you have made all the changes you wish to make in your data set, you click Main Menu choice #8. The model solves iteratively, quarter-by-quarter. Read the Workbook for a discussion of what that means. The next screen you see shows the number of iterations for each quarter. This will normally be of little interest to you. Sometimes, however, you may get a message telling you that the number of iterations exceeded a specified limit and that while the model solved, the results may not be reliable. As you proceed to the output screen, you should at least keep in mind this warning when you are interpreting your results.

Of greater concern would be the following message:

The model will not solve. Possible reasons are:

1. Extreme exogenous variables values.
2. Extreme add factors.
3. Extreme coefficient values.

If you get this message when doing any of the labs in this manual, you have probably made some mistake. Go back to Login, choose a new dataset name, and take the whole thing from the top. If you get this message when you are making changes of your own design, you will have to go back and make your changes less extreme, then try again.

You may also get the following message:

Cannot open error file "LF90.EER", error # 94

This probably means you chose a dataset name of more than eight characters. All your work is wasted. Go back to Login, choose a new dataset name, and take it from the top. Occasionally, this or a similar error message will occur even if your dataset has an acceptable name. You will still have to go back to Login and start again. You can try copying the same data set with a new name and running it.

9.Examine the results without solving the model (this is generally not recommended)

When you are using the FAIRMODEL site as a source of historical data on the US economy rather than as a model to forecast or simulate the behavior of the economy, you select Main Menu choice #9. You are asked to do this in the earlier exercises in this manual. The software will take you directly to the Output Screen, explained below.

Output Screen

If you have successfully solved the model (Main Menu choice #8), or have chosen to examine the data without solving the model (Main Menu choice #9), you will get the Output Screen as shown below.

The Output Screen has six parts:

- **$** Output Format
- **$** Variable Values
- **$** Display Period
- **$** Comparison Dataset
- **$** List of Variables for Output
- **$** US Variables

1. Output Format

Output Format - Graphs

The graphing capability of the FAIRMODEL software is quite limited, and you are likely to want to use your spreadsheet to construct more revealing, interesting graphs. However, with care, you can use the FAIRMODEL graphics to present some results. Several points to keep in mind:

$ The horizontal axis is always time. Thus you cannot use this software to plot, say, the percentage change in GDP against the change in the unemployment rate.

$ You can plot your variables in levels, changes, or percentage changes. See **Section I** for interpretation of changes and percentage changes as presented by FAIRMODEL

$ The data plotted are quarterly observations. That means there are lots of possible data points.

The graphs are small. Thus if you plot a variable for the entire period covered by the dataset (1952-2005), you will not be able to see what happened to the values in a given year or years with any precision at all.

$ If you plot more than one variable on a graph, pay particular attention to the scale. If you plot the **levels of** GDP against the spending on consumer durables (CD) over a 10 year period, your graph will show you nothing of interest. Both variables will appear to be nearly linear plots. They are not, but because CD is only about one tenth of GDP, the scale doesn=t permit the viewer to get much sense of the volatility of these variables. If you plot **changes of** GDP and CD, you will see that both variables are subject to considerable quarterly fluctuation. Only if you plot **percentage changes of** GDP and CD will you see that CD fluctuates sharply relative to GDP.

$ If your printer doesn=t have a color ribbon, plotting more than one variable yields a graph that is quite hard to read.

Output Format - Tables

The FAIRMODEL software will print tables of data in one of three ways:

Quarterly intervals (**NOTE:** this is quarterly intervals, not rates)
Annual intervals
Fiscal year intervals

$ You will often be interested in Quarterly intervals. This is quarterly data at annual rates, as explained earlier. The GDP for the first quarter of 2000, annual rate, was $9752b. This means that if goods and services were produced throughout the year at the rate that they were produced in the first quarter, GDP would have been $9752b. For the year 2000. In fact, in 2000, GDP was produced at a faster rate in later quarters. The GDP for the fourth quarter of 2000, annual rate was $10114b. The actual GDP for 2000 is just the average of the four quarterly figures, which was $9963b.

$ For some exercises in this manual, you will want Annual intervals. This provides one data point per year, and it is the average of the four quarterly observations.

$ The federal government=s fiscal year starts on October 1. Thus the fiscal year 2000 included the last calendar quarter of 1999 and the first three quarters of calendar 2000. The fiscal year intervals option provides one data point per fiscal year. The value is the average of the four relevant quarterly values.

Output Format - For Spreadsheets

You will often want to copy your output into a spreadsheet.

$ If you are using EXCEL, you can, if you wish, copy and paste, column by column, from the FAIRMODEL tables instead of using this For Spreadsheets feature. If you are using Quattro, on the other hand, copying from the FAIRMODEL tables will result in your numbers being in text format instead of numerical format, and converting them is time consuming, to say the least.

$ If you use this For Spreadsheets feature, **ALWAYS USE ANNUAL RATES.** These data are the same numbers as those called Quarterly intervals, above. They are quarterly data at annual rates. The other option, Quarterly Rates, displays quarterly data at quarterly rates. This will not be useful for any of the exercises in this manual.

$ When you ask for spreadsheet data at annual rates, you will get the data in rows, which will appear to be hard to read. However, the data will load directly and coherently into your spreadsheet. Details as to how to do this are below in Section IV of this manual.

Output Format - For Text Editor

You will not need this feature for any of the exercises in this manual.

2.Variable Values

FAIRMODEL will display variable levels, changes or percentage changes. These can be graphed or shown on tables. You can display tables of levels and changes, or levels and percentage changes together. The default is levels.

$ Note that the first data point is the first quarter of 1952. Therefore, if you ask for changes or percentage changes in quarterly interval data from the first quarter of 1952, there is no fourth quarter 1951 data from which to calculate a change. Therefore, the value for the LEVEL for 1952:1 is presented **B** not, presumably, the number in which you are interested. Therefore, begin calculations of changes or percentage changes with the second quarter of 1952, at the earliest.

$ For the same reason, if you are interested in changes or percentage changes using annual interval data, begin with 1953 at the earliest.

$ Percentage changes are presented as **annual** growth rates. Be sure you know what that means if you use these numbers. See **Section I** for further discussion of changes and percentage changes.

$ Levels and Changes together, or Levels and Percentage Changes together, will only work for

the FAIRMODEL output format (i.e. Tables). It will not work for spreadsheet output format. If you ask for Levels and Changes (or Levels and Percentage Changes) for spreadsheet output, you will get only the Levels. To get the Changes or Percentage Changes for spreadsheet output, you must ask for them separately.

3. Display Period

This section permits you to decide the time period of the data to be displayed. The default is the prediction period.

$ If you are using the FAIRMODEL site as a data source, without solving the model, as you will for a number of the exercises in this manual, you need to type in the quarters for the years of interest. Be sure to click the button for AFrom Quarter ___ To Quarter ___.@ There are two exceptions to this statement. First, you can use the default if you changed the prediction period on the Main Menu (choice #1). There is no reason to change the prediction period if you are only using the model as a data source, however. Second, you obviously can use the default if you are interested in the forecast time period, because that is the default prediction period.

$ When you actually solve the model, it is important to use Main Menu choice #1 to set a prediction period. This selection determines the time period over which the model is solved. If you do not set a prediction period, then the model is solved over the forecast period only. The default output display period is that same time period.

$ If you want to display the solution values over only part of the prediction period, you can select the other display period option, and type in the time period of interest to you.

$ You must type in a year and a quarter, even if you are interested in annual interval data. If you do not type in a quarter, you will get a black screen and an error message. You may set the quarter off with a colon: 1990:1, but you need not do so. Typing 19901 will do just as well.

$ If you want annual interval data, you can type in any quarter within a year to get that year. That is, typing 19901 will give you the same annual interval value as 19903.

$ You can type in dates outside the prediction period, if you wish. The software will then display values from the BASE dataset. Remember that the model will be solved only over the years that you specify as the prediction period.

4. Comparison Dataset

You have three choices: No comparison datset (the default); the BASE dataset as a comparison; and another dataset you have created as the comparison.

$ If you are using the FAIRMODEL site as a data source, without solving the model, you will have no comparison dataset, because there are no results to compare. Your dataset is just a copy of the BASE.

$ If you solve the model, you will usually use the BASE as a comparison. For example, you change an exogenous variable, like federal government spending, run the model, and look at the results to see what effect your change in government spending had on the economy. The differences between the BASE (without your change) and your dataset (which was a copy of the BASE until you changed government spending) reflect the effect of changing government spending. The values of the endogenous variables in the model will all be different.

$ Occasionally, you will be asked to compare results from running the model with results you obtained on a previous run. To do this, you type in the name and password for the other, earlier dataset.

$ When you ask the software for a comparison, three columns will be displayed (six if you ask for levels and changes or levels and percentage changes). The first column contains your results, the second contains the comparison data **B** either from the BASE dataset, or from another dataset; the third, which is labeled 1-2, shows the difference between your values and the comparison dataset values.

5. List of Variables for Output
6. US Variables

You may type in the variable names you wish to display or go to the variable list at the bottom of the screen titled US Variables, scroll down and click on a desired variable to highlight it, then click on the Add to Current List bar. When typing in names yourself note that:

$ There is no case sensitivity. You can use upper or lower case or any mixture of the two.

$ You can separate the variable names with one or more spaces, with commas or with slashes

$ The variables can be in one row, or in columns.

$ If you misspell a variable name, you will get a black screen with an error message noting the variable name the software cannot find.

You can save lists of variables. Points to be noted:

$ You can save a list of variable names you have created by clicking on the Save-this-list-of-

names bar. You will be asked to name the list, and you will not be permitted to use a name already used by someone. This list is stored at the FAIRMODEL site and not in your computer or on the LAN. If you want to use the list again later, you had better remember the name. There is no list of files for you to access.

- You can call up anyone=s saved variable list. No password is necessary.

- Once you have saved a list under a name, say, Test1, you cannot alter it. If you want to change the list, you will have to call up Test1, make whatever additions or subtractions you wish, and then save it under a new name - say Test1a.

- You can, of course, copy a list of variables to your PC clipboard for use on subsequent runs, and if you wish, save your variable list locally, for use on later labs.

Section III: TYPES OF EXERCISES

This manual contains three types of exercises to be completed using the FAIRMODEL: historical data exercises; *ex ante* simulations; and *ex post* simulations.

FAIRMODEL as a Data Source

The FAIRMODEL site is a convenient source of quarterly macroeconomic data from the first quarter of 1952 through the most recent quarter of data available (as of this writing, the 2nd quarter of 2001). Many of exercises in this manual use the site as a source of historical data. These exercises could, of course, be completed using the same data drawn from other sources. They do not use the model itself, but instead merely involve extracting data from the BASE dataset, then examining and analyzing what actually happened. To complete any of these exercises:

1. Copy the BASE dataset

2. Select Main Menu choice #9.Examine the results without solving the model (this is generally not recommended)

Note: You do not need to set a prediction period (Main Menu choice #1)

NOTE: DO NOT SOLVE THE MODEL. If you solve the model (Main Menu choice #8), the values of the endogenous variables will not be historical values but will instead be model solution values. These numbers are NOT what you want. If you make this mistake, go back to Login and start all over again.

3. On the Output screen, under Display Period, click the button for AFrom Quarter ___ To

Quarter ___@ and select the time period in which you are interested.

4. On the Output screen, under Comparison Dataset, use ANone@ (the default). Because you are not running the model, there is nothing to compare.

***Ex ante* simulations**

With this type of exercise, you compare the forecast of the FAIRMODEL over the next few years (a forecast which is based on Ray Fair's best guess of what is going to happen) with what would be forecast to happen if some exogenous variable (like, say, a government policy variable) were changed from Ray Fair's best guess. The point is not to "second guess" Fair, however. Rather the point is to observe the effect of a change in an exogenous variable on the endogenous variables in the model -- i.e. to see how the model works. Assuming the FAIRMODEL is a good model of the economy, this type of exercise will show you how the economy works. To complete any of these exercises:

5. Copy the BASE dataset

6. Make any required changes. These may involve using Main Menu choices #2 Change assumptions about monetary policy, #3Change exogenous variables, #5 Drop or add equations, or #7Modify the equations.

Note: You do not need to select a prediction period (Main Menu choice #1). You will be running the model over the forecast period, which is the default prediction period.

7. Select Main Menu choice #8 Solve the model and examine the results

8. On the Output screen, under Comparison Dataset, select AUse BASE.@ You are comparing your data, which reflect the results of running the model after you have made changes in exogenous variables and/or equations, with the BASE dataset, which reflects Ray Fair=s forecast. The differences you observe are the effects of your changes.

9. On the Output screen, under Display Period, use AUse prediction period@ (the default). It is not meaningful to select any other time period, because the model has not been run for other years.

***Ex post* simulations**

In this type of exercise, you examine historical data and change some variable so that it is different from actual experience. You then run the model and examine the results to see what would have happened (assuming the model is correct) IF .... For example, you might ask the question, AWhat would have happened in the U.S. economy if the oil producing countries hadn=t joined together in OPEC and sharply raised the world price of oil in 1973?@ This is far and away the most difficult type of exercise,

because you must solve the model twice, as explained below. It is extremely important that you understand what is going on when you perform these simulations. Study the next two paragraphs.

If you solve the model over the forecast period and make no changes in the equations or the exogenous variables, then the solution values for the endogenous variables will be exactly the values that are already in the BASE dataset. Remember, the forecast period hasn=t happened yet. The values for the endogenous variables were therefore produced by the model. If you use the same equations and the same values for exogenous variables (recall that these values are Ray Fair=s best guesses), then your solution will result in the same values for the endogenous values as Ray Fair=s solution **B** i.e. the forecast values in the BASE dataset. On the other hand, consider an historic period, prior to the forecast period. There are actual data for both the exogenous and endogenous variables, which are in the BASE dataset. If you solve the model for the historic period, the solution values for the endogenous variables will NOT be the same as the actual, historic values, because the model does not predict perfectly. For some historic periods, the model will Atrack@ what actually happened in the economy quite well. For other periods, the model will perform much less well. For some endogenous variables, the model will Atrack@ consistently across time; for others, it will predict poorly.

Because, as explained in the previous paragraph, the model does not predict perfectly, two runs are necessary to perform an *ex post* simulation. First, you run the model over the historic period of interest, without changing anything. You can compare the solution values for the endogenous variables with the values in the BASE dataset. The differences are prediction errors, showing how well the model predicted what actually occurred. Remember that this solution uses actual historic values for all exogenous variables. Suppose you called your dataset NAVY4ME. This dataset, NAVY4ME, becomes your Abase@ dataset for the second run. On your second run, you start with a new name, say, NAVY4U2, and copy NAVY4ME. You then make whatever changes in exogenous variables and/or equations are required and solve the model. You compare the values of the appropriate endogenous variables in the NAVY4U2 solution with the NAVY4ME solution. The differences reflect the effects of the changes you introduced into the model. If you were to skip generating NAVY4ME and introduce exogenous variable changes in your first run -- in effect generating NAVY4U2 immediately -- and then to compare these NAVY4U2 solution values with the BASE dataset, the differences you observe would be a mixture of prediction errors and the effects of the changes you made. You would have no way of separating the errors from the effects of changing exogenous values. Your results would be useless.

To complete any *ex post* simulation exercises:

10. Copy the BASE dataset, calling it, for example, NAVY4ME

11. Set the Prediction Period to the desired time period (Main Menu choice #1)

12. Select Main Menu choice #8 Solve the model and examine the results DO NOT make any

changes in the model before solving it.

13. If you are interested in the prediction errors, on the Output screen, under Comparison Dataset, select AUse BASE.@

14. On the Output screen, under Display Period, use AUse prediction period@ (the default). It is not meaningful to select any other time period, because the model has not been run for other years.

15. Select a new dataset name, say NAVY4U2, and copy the NAVY4ME dataset.

16. Set the Prediction Period to the desired time period (Main Menu choice #1)

17. Make any required changes. These may involve using Main Menu choices #2 Change assumptions about monetary policy, #3Change exogenous variables, #5 Drop or add equations, or #7Modify the equations.

18. Select Main Menu choice #8 Solve the model and examine the results

19. On the Output screen, under Comparison Dataset, select AUse Dataset _____@ Type in the name of your first stage dataset, (here, NAVY4ME) and its associated password.

20. On the Output screen, under Display Period, use AUse prediction period@ (the default). It is not meaningful to select any other time period, because the model has not been run for other years.

Section IV: USING EXCEL TO PRESENT AND PROCESS FAIRMODEL DATA

You will often want to load FAIRMODEL output into a spreadsheet and process the data with that software. In most of the exercises in this manual, you are specifically asked to put the data in a spreadsheet. Because EXCEL is the spreadsheet provided to midshipmen, the discussion below will focus on that software. The spreadsheet provides flexibility on presenting data. You can develop graphs that present data much more clearly and meaningfully than is possible with the FAIRMODEL software. You can name columns, move them, and eliminate superfluous information with the spreadsheet B things you cannot do with the FAIRMODEL output. More important, you can use the spreadsheet to make calculations and to perform statistical analyses. Suppose, for example, you were interested in the labor force participation rate of working age males. The BASE dataset contains data on the size of the labor force of males 25-54 (variable L1), and the size of the male population of that age (variable POP1). However, the FAIRMODEL software provides no way of calculating a labor force participation rate: L1/POP1.

This section of the manual explains how to load FAIRMODEL output into EXCEL, and get the data ready for use. It does not explain statistical and graphing functions in EXCEL. Refer to your EXCEL

manual.
There are two ways of loading FAIRMODEL output into EXCEL. Refer to the Output Format box on the Output screen.

1. The most straightforward way to load output into EXCEL is to produce FAIRMODEL output by clicking one of the three buttons under Tables: Quarterly intervals, Annual intervals, Fiscal year intervals, whichever you desire for the problem at hand. Then copy and paste, column by column, from the resulting FAIRMODEL tables. This method may be the easiest thing to do when you are dealing with small amounts of data.

Points to note:

$ If you copy more than one column at a time from the FAIRMODEL output, the numbers will paste into a single column in EXCEL. You probably will not want that, so you will have to rearrange your spreadsheet.

$ The variable names and dataset names in the FAIRMODEL output will not copy satisfactorily. All the variable names and dataset names copy together. You cannot copy just one of them. They then paste in successive rows. Further, if you copy variable and dataset names, you will find that when you try to copy a particular column of values, you will also be copying the values in all columns to the left of that column. These in turn will paste in a single column in EXCEL, as noted above. You CAN, however, copy any single column of values if you do not try to copy to variable name.

$ If you are using a Quattro-Pro spreadsheet, copying from the FAIRMODEL tables will result in your numbers being in text format instead of numerical format, which you will find very unsatisfactory.

2. The FAIRMODEL software has a feature designed to produce output for spreadsheets. On the Output screen, Output Format, under For spreadsheets, click the button: Annual rates. If you use this For Spreadsheets feature, **ALWAYS USE ANNUAL RATES.** They are quarterly data at annual rates. The other option, Quarterly Rates, displays quarterly data at quarterly rates. This will not be useful for any of the exercises in this manual. If you are working with relatively large amounts of FAIRMODEL output, you will want to use this For spreadsheets feature rather than copying column by column, because this feature will put all of the data in spreadsheet format in one operation.

$ When you ask for spreadsheet data your output will appear in rows, and will seem to be hard to read. Do not be concerned. Proceed to the next step.

$ Save the file. FAIRMODEL will give it a default name of output10.cgi. You can rename it if you wish. Note that if you give it and xls extension (replacing cgi) you may have an easier time finding it when you call up EXCEL and hit the AOpen@ button.

- **$** If the EXCEL Text Import Wizard appears, you can click on Finish, rather than going through the steps. The data will appear in rows in your EXCEL spreadsheet. The data are spaced -- every other row is blank. You will want to delete the blank rows (or do so after you have transposed the data into columns.

- **$** You will probably want your data in columns instead of rows. To transpose your data from rows to columns:(1) highlight the data you want to transpose; (2) copy it to the Clipboard; (3) open a new notebook, or go to an open area of your spreadsheet; (4) go to Edit - Paste Special; (5) in the dialog box that comes up, check Transpose, and click OK.

- **$** One drawback of using the For spreadsheet feature is that the data are not available at Annual intervals (annual data at annual rates), as they are with the FAIRMODEL output. They are only available for Quarterly intervals (quarterly data at annual rates). Thus, using the spreadsheet feature, you will necessarily have four observations per calendar year. For many exercises, you will want these four observations. However, when you want annual intervals for data displayed as levels - one observation per calendar year - simply average the four quarterly observations. Alternatively, you can directly copy and paste the FAIRMODEL output of annual interval data, as explained above. When your data are displayed as changes or percentage changes, however, averaging the four observations will not yield the same value as using annual data. See the discussion of changes and percentage changes in **Section I** above.