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REGRESSION PROJECTION PROGRAMS WITH MULTIPLE OPTIONS FOR USE ON MS-DOS MICROCOMPUTERS

A. Master Projections

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REGRESSION PROJECTION PROGRAMS WITH MULTIPLE OPTIONS FOR USE ON MS-DOS MICROCOMPUTERS

A. Master Projections

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SECTION I

INTRODUCTION

The Fortran computer model for Master Regression Projections contained herein represents direct adaptation of the corresponding Fortran IV program for mainframe computer previously published by the Kansas State University Food and Feed Grains Institute under predecessor agreements with the U. S. Agency for International Development. The compiled microcomputer version of the Regression Projection Program incorporates all features of the latest version of the mainframe program while providing additional flexibility to the microcomputer user.

Differences between the mainframe version and the current microcomputer version include the following:

1. The Master Projection Model for microcomputer does not develop prorate projections; a separate Prorate Projection Model and accompanying manual are available for this purpose. The MASTERPJ model includes a companion front program (MASTER1) to read the command instructions and titles from the keyboard and create an input file for MASTERPJ to read and follow in making the projections.

2. These programs are operated from menus which indicate instructions on the screen, and the user enters the control commands and information for his problem through the keyboard. Default values for the entries are presented on the screen to serve as pattern to the user. Those default values which are applicable for the run can be accepted by keying <return> at the appropriate point.

3. Input steps for command instructions and data input are modified to better suit microcomputer users, especially those familiar with popular electronic spreadsheet software such as LOTUS 1-2-3.

4. Results of computational routines can be stored in disk files for access by subsequent runs and/or programs, so that user options are enhanced.

5. The Alternative Math library used to link the current programs facilitates rapid computation with sufficient accuracy for accounting purposes better than other math libraries and can operate on all IBM-compatible hardware, whether or not an 8087 coprocessor is available.

6. The micro version is dimensioned for up to 200 rows (periods) by 18 columns (components), or vice versa, rather than the 250 rows by 20 columns of the mainframe version because of capacity limits of the Heath Fortran 77 DOS compiler. Rarely will the user find this limitation to be a problem.

Each program in the microcomputer version of the family of computer programs for feasible agribusiness development is being published as a separate manual,

replacing Volume II, Computer Programs, for mainframe computers. At this writing four other manuals are available in this form. They are "IRR Feasibility Analysis Program for Use on MS-DOS Microcomputers", "Information for Using Fortran Programs with MS-DOS Microcomputers", "Proforma Financial Analysis Program for Use on MS-DOS Microcomputers", and "Transportation Linear Program for Use on MS-DOS Microcomputers". The manuals are available with or without the corresponding program and instructional diskettes. Volume I containing text and charts of Special Report No. 2, "User's Guide to Computerized System for Feasible Agribusiness Development", is equally appropriate for microcomputer and mainframe analysis.

The regression projection programs operate on any MS-DOS microcomputer with at least 164 K bytes of memory. The programs were compiled with the Heath Fortran 77 Compiler without 8087 Coprocessor and with ALTMATH.LIB. They can handle up to a total of 200 time periods by 18 components, or vice versa, and up to eight different variables per run. Output is formatted for 130 columns so that a wide printer or condensed print is needed for the hard copy output. A sample BASIC program file, 17PITCH.OKI, is included on the MPJ Master diskette for converting Okidata printers to typesize of 17 characters per inch. Similar BASIC programs can be written for making this kind of conversion on other printers which are not controlled directly.

The user data input for the MASTERPJ program is read from the logged drive as file MPJDATA.RUN on the same disk with the linked program file, MASTERPJ.EXE. As provided, the program disk contains four sample data files, MPJData.One, MPJData.Sec, MPJData.Pan and MPJData.Agr, any of which can be used as pattern in preparing your user data file. Use the MPJData.One pattern if you plan to make straight projections, the MPJData.Sec pattern for food security analysis, the MPJData.Pan pattern for Y-estimation problems, and the MPJData.Agr pattern for superimposed transition problems. The desired pattern file can be copied to your work disk with COPY, renamed with REName to MPJDATA.RUN, and by editing with EDLIN, changed to the data file for your user problem. Then it can be copied to the program disk with COPY as MPJDATA.RUN for running your problem. Alternatively, LOTUS 123 can be used to create input data files for the projection programs, as explained in Section IV of the Manual.

When you are ready to make the master projection run, simply type x:MASTER1, where x is the drive containing the disk with the program and data files. The program menu then will be displayed, and you will be prompted for the information and commands for your run. Default values are provided as patterns for your entries. When the commands have been entered ready for program execution, you will be reminded that the program will now prepare the INPUT.MPJ file for the master projection run. Upon completion of this step, the program will prompt you to call MASTERPJ to make the projections ordered.

To make a trial run, REName one set of the files, say INPUT.ONE and MPJDATA.ONE, to INPUT.MPJ and MPJDATA.RUN, respectively, and then type MASTERPJ and <return>. After you have made the run, don't forget to rename the files back to INPUT.ONE and MPJDATA.ONE. Otherwise when you copy back the data file for your own problem from the work disk to the program disk, the original will be lost as it is replaced by your INPUT.MPJ and MPJDATA.RUN files. This same procedure should be followed to retain input data files for problems you have run in the

past, retaining them as INPUT.III and MPJDATA.III, INPUT.IV and MPJDATA.IV, etc., for example, so that INPUT.MPJ and MPJDATA.RUN always are open for the current run, and no data file will be lost by over copying.

The sequential steps for the Master Projection program input are as follows:

1. Prepare your data file in tabular format with rows from 1 to n for the n accounting periods and columns for the period sequence, period identification, and then data columns for each of the components or columns in the master table to be projected.

2. Select a default file to serve as pattern for your commands, e.g., DEFAULT.ONE, and rename the file to DEFAULT.VAL. Be sure this file is on the same disk as your MASTER1.EXE file, if necessary by copying it over with the DOS resident command, COPY.

3. Logged in the drive containing these files and enough empty capacity for the program to write the INPUT.MPJ file, type MASTER1 <return>.

4. Follow the screen Menu prompts to enter the information and commands for your problem. You can follow the menu in any order, and can make changes any time up until the program execution command.

5. Upon completion of the MASTER1 run, you will be prompted to call the MASTERPJ program to make the projections. Before doing so be sure that the three disk files, MASTERPJ.EXE, MPJDATA.RUN (from Step 1) and INPUT.MPJ (from Step 4) all are on the active disk drive.

6. Initiate the master projection run by typing MASTERPJ <return>.

7. You will be reminded to prepare your printer or disk file to receive the program output before execution of the program. Remember that the output needs 130 columns, so plan for wide paper or small type size. As indicated by the screen prompt at this point, type Ctrl P to echo the output to your printer, or use the > key and drive and file identification to route the output to disk file for later printing.

8. When the execution screen appears on your monitor and all is ready, the program is executed by keying <return>.

SECTION II

GENERAL DESCRIPTION OF THE REGRESSION PROJECTION PROGRAMS

The MASTERPJ and (PRORATPJ) regression projection programs are multipurpose tools for developing projections of market potentials, market prices, production potentials, input requirements, and other items needed for development planning and feasibility analysis. Alternative regression model forms can be specified for use in developing the projections from historical time series data. Regression coefficients are computed to assist the user in selecting the most reliable model and set of projections for the purpose at hand. Historical data for making the projections at both the master (MASTERPJ) and prorate (PRORATPJ) levels can be read into the program directly, or alternatively can be estimated as dependent variables from historical observations of related independent variables. Special routines within the MASTERPJ program are designed for analysis of food security issues, for generating projected cash flow schedules from input-output data and unit prices, for plotting trends and deviation patterns, and for other specialized applications.

Master Projection Program

The analytical package consists of two distinct programs, MASTERPJ.EXE and PRORATPJ.EXE. MASTERPJ is the Master Projection package for developing projections of aggregate "master table" statistics period by period into the future as far as the economic horizon of planners may extend. Each column of data in the master tables is fitted and projected separately from corresponding data in other columns in the same tables. For example, a master table containing annual winter wheat production by state in the U. S. A. would contain separate and independent columns of data for each state plus a total column representing the horizontal sums of the state columns for each year. For many kinds of application, the master table projections are all that is needed. Use of the MASTERPJ program is described in this manual.

Accompanying the MASTERPJ program is a preparatory program for reading input from the keyboard in response to screen prompts, MASTER1. This program creates the file of commands to be read by MASTERPJ called INPUT.MPJ. This file together with the file of historical data which serves as basis for the projections, MPJDATA.RUN, provides the total input to the MASTERPJ program for making a run to obtain the requested master table projections.

Prorate Projection Program

As its name implies, the PRORATPJ program is used for developing projections of components or prorated data based on one or more single columns in the corresponding master table. For example, a prorate table might contain historical and projected winter wheat production by county for a single state in the master table, e.g., Kansas. As developed by PRORATPJ, both the historical and the projected prorate (county) data are fitted to and forced to sum to the corresponding column in the master table. In this manner one is assured that the components (counties) sum exactly to the master (state) total. For problems of this kind, the user commands MASTERPJ to create a data file so

that the proration projections can be developed with PRORATPJ in a subsequent run after the master projection run has been completed. Use of the PRORATPJ program is described in a companion manual.

Accompanying the PRORATPJ program is a preparatory program for reading input from the keyboard in response to screen prompts for the prorations, PRORATE1. This program creates the file of commands to be read by PRORATPJ called INPUT.PPJ. This file together with the file of the corresponding master projections created by a previous MASTERPJ run, OUTPUT.MPJ, provides the total input to the PRORATPJ program for making a run to obtain the requested proration projections.

Sequence of Analytical Routines

There are some differences in the analytical routines of MASTERPJ and PRORATPJ, but the same general steps and processes are followed in the two programs. First, the read programs, MASTER1 and PRORATE1, read a series of user-supplied command instructions and factors, together with titles, column headers and footnotes, and set up the problem for analysis in the respective run files, INPUT.MPJ and PRORATE.VAL. Following this, the user calls MASTERPJ (or PRORATPJ) to read the input files and historical base data and run the problem. In these programs, a short main program first reads the logical unit numbers for accessing input and directing output, as well as the total size of the problem, and then sets up the dimensions for the analytical routines in the projection subprogram. The programs then read the command instructions and historical data input from the previously prepared disk files. After this, each of the programs conducts the special things ordered by the user (setting up period designations, rearranging columns in the table, application of cyclic factors, setting up of subordinate analysis, etc.). Next, the programs call the REGression Subroutine to fit the statistical time trends and then use the coefficients to make the projections ordered. At this point the MASTERPJ program will plot the graphs, compute the y-estimates, make conversion tables, and/or complete other special analysis requested by the user.

If used for routine proration problems (JCOUTY = 1), the PRORATPJ program will also make analysis for y-estimates and/or make conversion tables, but will not plot graphs nor conduct the special food security analyses at the proration level. If used for superimposing multi-dimensioned transition or growth patterns (JCOUTY = 2), PRORATPJ will develop the resulting overall transition patterns at this point. The last step in each program is to convert the output to integer numbers and print the output and disk files ordered for the run.

Both programs read the command instructions, titles, and data supplied by the user from a specified and formatted microcomputer disk file. The basic read format is I3, 1X, I4, 8 F 9.0 for comparability with electronic spreadsheet formats such as those of LOTUS. These files must be set up in advance of the run. In addition to the MASTERPJ.EXE file, master projection runs need the basic input file, MPJDATA.RUN and, if it is requested, the output file needed for proration, OUTPUT.MPJ. Proration runs need PRORATPJ.EXE, OUTPUT.MPJ and PPJDATA.RUN.

Uses and Options of the Programs

The most common application of the projection programs has been for developing schedules of expected future quantities of supply and/or demand of specific commodities at specific markets. Such schedules are needed for many kinds of economic feasibility analysis and economic development planning. They are useful for estimating market potentials and future economic opportunities to exploit comparative advantages which may not be apparent at present. Because of their versatility in applying alternative time-trend models and approaches, they are useful in helping reduce uncertainties of future conditions which depend upon trends now in place. This is particularly true of projections which can be prorated to reliable aggregates with assurance that the prorated components (subareas, market shares, subproducts, trade components, labor components, or whatever the subunits may be) will balance to the reliable master projections.

Other uses of the programs may be more subtle. Often those working with several tables find the need for cell by cell addition, subtraction, multiplication, division or more complex treatment. These kinds of manipulations can be done handily with database management software or with electronic spreadsheets. However, if several steps are involved, and particularly if y-estimates, charts, conversion tables, prorate tables, and other analyses are to come later, the MASTERPJ and PRORATPJ programs become attractive alternative software for these kinds of applications. This can be true even when none of the kinds of projection uses outlined in the previous paragraph are evident. Where the user has no need for the intermediate tables normally created by MASTERPJ, the NOPRT option can be used to bypass these and proceed directly to the final tables desired.

Specific Options for Master Projections

Major master projection options in the order that the command instructions are read by the MASTERPJ program include the following:

Option	Program Step	Variable	Implementation Command
Y Estimates	0-7	NFAC	Integer greater than 1
Base Time Period	1-2	NU	Integer < = total periods
Exponential Model	1-3	IX1, IX2	Non-zero integer
Projection Horizon	1-5	NP	Non-zero integer
Regression Form	1-7	IFORM	Integer of 1(+) to 4(/)
Logarithmic Model	1-9	LPRJ	Integer of 1
Given Growth Rate	1-10	KRATE	Integer of 1
Reflect Cycles	2-1	ICYC	Integer of 1
Omit Total Column	2-2	NOTL	Integer of 1
Disk File of Main Table	2-4	KARDM	Integer of 1
Disk File of 2nd Table	2-5	KARDT	Integer of 1
Spanish Output	2-7	NLANG	Integer of 1
French Output	2-7	NLANG	Integer of 2
Project Negative Nos.	2-9	NEGNO	Integer of 1

Option	Program Step	Variable	Implementation Command
Ignore Negatives	2-10	NONEG	Integer of 1
Annual Periods	3-1	IANN	Integer of 1
Quarterly Periods	3-2	IQTR	Integer of 1
Monthly Periods	3-3	IMON	Integer of 1
Rearrange Columns	3-9	IMOVE	Integer of 1
No. of Input Sets	5-1	NCS	Integer value
No. of Output Pages	6-1	INO	Integer value
Conversion Table	7-1	IFEED	Integer of 1
Make Graph of Trends	7-3	IPLOT	Integer of 1
Prorate Projections	7-4	JCOUTY	Integer of 1
Multiple Transition	7-4	JCOUTY	Integer of 2
Table of Estimates	7-5	JEST	Integer of 1
Deviations from Trend	7-7	NDEV	Integer of 1
Fit Trend (if NP = 0)	7-8	NFIT	Integer of 1
Food Security Anal.	9-1	ISTOCK	Integer of 1 or 2

Specific Options for Proration Projections

Major options subject to user control within the PRORATPJ program include the following, also in the general order in which the commands read by program:

Option	Program Step	Variable	Implementation Command
Master Column	1-1	ISTATE	Integer greater than 2
Exponential Proration	1-2	IX1, IX2	Non-zero integer
First Prorate Year	1-6	ICYEAR	Specified integer
Log Prorate Model	1-7	LPRJ	Integer of 1
Y-Estimate Prorates	1-8	IYES	Integer of 1
Cumulative Transition	1-8	IYES	Integer of 2
Bypass Prorate Trend	2-2	ISINGL	Integer of 1
Conversion Tables	2-3	IFEED	Integer of 1
Omit Disclosing Model	2-4	NOMOD	Integer of 1
Disk File of Proration	2-5	ICARDM	Integer of 1
Disk File of Conversion	2-6	ICARDS	Integer of 1
Subtotals by District	3-1	IDIST	Non-zero integer in second field
Override Y-Estimates	5-1	NOEXCP	Non-zero integer

Special Routines for Food Security Analysis

The special routines for projections and analysis of food security issues included in MASTERPJ are implemented by inserting 1 or 2 for the ISTOCK command at Step 9-1 of the input to the MASTER1 program. When this is done, the related commands at the same step enable the user to activate the specific routines needed for specific analysis. The full use of these routines is described in KSU Food and Feed Grain Institute Special Report No. 9, ASEAN Food Security

Reserves: How They Might Have Worked from 1960 to 1977. The routines operate to determine food security options from historical and projected annual patterns of food grain supply and utilization for a country and region. Projected trends and deviations from the trends together with allowable targeted deviation bands are used as base. From this base the steps are as follows:

1. Determine needed transactions for security and stability
2. Determine stabilizing trade potentials
3. Determine security reserve requirements
4. Determine in-country reserve balances and transactions
5. Determine regional reserve balances and transactions.

In brief, the commands and procedures for implementing these steps are:

Food Security Step	Step 9 Command	Analysis Performed
Needed transactions:		
a. NRTR run	ISTOCK=1,NRTR=1	Allowed deviation quantities
b. Y-table run	none	Actual minus allowed deviations
Stabilizing trade	ISTOCK=1,IMPORT=1*	Net trade adjustments possible
Security reserves	none	Needed transactions - stab. trade
In-country reserves:		
a. Transactions	ISTOCK = 1	Constrained + and - transactions
b. Balances	ISTOCK = 2	Constrained cumulative balances
Regional reserves:		
a. Needs (Y-table)	none	Security needs minus in-country
b. Balances	ISTOCK=1,IREG=1	Cumulative balances by country

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* This step requires FACTO1 and FACTO2 values, where FACTO1 is fraction of trade adjustment effective current year and FACTO2 is fraction carried to succeeding year.

SECTION III

CONCEPT OF TIME TREND ANALYSIS AND PROJECTION

Statistical fitting and projection of historical time trends are among the most widely used procedures for looking into the future. Simple time trends sometimes provide basis for more realistic long-term projections than more complex mathematical models. Time trends reflect a host of forces impacting the variable of interest so that the trend variable in estimating equations often picks up most of the causal factors impacting the variable which one is interested in projecting. The phenomenon is so common that one usually can expect past trends to continue unless specific forces can be identified which will change these trends in the future. Even in such cases, there seems to be a tendency for analysts to overestimate the influence of forces which cause long-run trends to change and to underestimate the continuing influence of those factors which the historical time trend reflects.

Measuring Long-Term Trends

Long-term trends of demand and supply shifters for most resources, products and services can be fitted and tested statistically for use in making projections into the future. These trends may or may not be constant through time. Some may be constant in percentage terms rather than in absolutes. Others may be changing at increasing or at decreasing rates. For these reasons, the selection of the mathematical form of the time trend model needs to be given careful thought.

Often projections for products of interest are dependent upon several underlying factors, each of which is subject to a different kind of time trend. For example, the projected volume of demand for a product--rice, for instance--is a function of the projected human population of concern (usually by segment) and the average per capita consumption. Projected average per capita consumption in each population segment is a function of projected per capita income, projected relative prices and preference patterns. In such cases more accurate and reliable projections can be determined by developing separate projections of the components (say population, per capita income, etc.), and then combining these in functional form to obtain the projections for the commodity of interest--say rice. Once this has been done, the projections for this commodity can be used as basis for projections of derived products (say rice mills or small plastic bags in which to market polished rice).

Sometimes structural changes occur to modify the shape and/or slope of trend lines for some variables. For example, such changes took place to substantially increase the rate of growth in nitrogen fertilizer use in the USA in the early to mid 1950s. In such cases, the base period for projections into the future needs to reflect the relevant historical period after the structural change rather than to lap back into the pre-change period.

Time trends for some variables are clouded by cyclic and other shorter term patterns as well as by random fluctuations around long-term trends. In such cases, cyclic and seasonal patterns need to be identified and reflected in the

projection models in order to obtain statistically significant and reliable projections of these variables.

Projection Alternatives

All of these kinds of forces and differences enter into the choice of projection options available to the user of MASTERPJ and PRORATPJ. These can be summarized under (1) type of time-trend model, (2) direct or dependent variable projection, (3) historical base period for model, (4) application of cycle factors, and (5) master versus prorate projections.

Type of Time-Trend Model

Different models fitted to the same historical base can give quite different projections, and the reliability of such projections may differ as well. The MASTERPJ and PRORATPJ programs provide several model options, and will output values for R-squared, Sb and other statistical parameters as well as plot graphs to assist the user in choice of model. The types of time-trend models in the program include the following, where Y is the value projected and T is the time period:

- Linear model of the form Y = a + bT
- Natural log model of the form LOGe Y = a + b LOGe T
- Exponential model of the form Y = a + bT*, where * represents exponential values ranging from -1.0 to 3.0
- Specified rate model of the form Y = a + rT, where r represents specified exogenously determined change rate.

Model specification comes at Step 1 of MASTER1 and MASTERPJ through IX1, IX2, LPRJ, or KRATE. Graphic options come at Steps 7 and 8.

Direct or Dependent Variable Projections

Projections of key variables of interest can be developed as Y-table functions of related variables or as V-tables of the variable of concern directly. The Y-tables can be functions of up to eight independent variables, each of which may have its own type of time-trend model. Such projections by MASTERPJ provide separate output for each independent variable as well as for the Y variable. Those by PRORATPJ provide projections of the Y variable only.

Y-table specification comes at NFAC (Step 0) and IFORM (Step 1) of MASTER1 and at NOLOOP (Step 2) and ATRCEP and BCOEF (Step 4) of PRORATE1.

Historical Base Period for Model

The number of historical base periods (counting backward from the last time period of data input) as basis for fitting the model is read at NU (Step 1) by MASTER1 and at NK (Step 1) by PRORATE1. The value can be any number up to and including the total number of periods of data read in (NA at Step 1 of MASTER1). If needed to detect structural inflection points, graphic options are requested at NPLOT in Step 8 of MASTER1.

Application of Cycle Factors

For cases involving variables which exhibit cyclic patterns such as hog production and pork slaughter, cycles are indicated at ICYC in Step 2 and cycle factor multipliers are entered as VECTORs at Step 10 of MASTER1. Such factors are used by the program to adjust the historical data for the cycles first, then fit the trend to the adjusted data, project this trend of adjusted data, and finally apply the cycle factors for cyclic-adjusted projections to be printed in the output tables. The cycle factors need to be determined exogenously and imputed as a vector array for the total periods (NI + NP) at Step 10.

No cycle factors are used in PRORATPJ, but of course if cyclic adjusted values are included in the master table, then these same factors are reflected in the corresponding prorate tables.

Master Versus Prorate Projections

For many applications, the user has choice of developing master projections from available historical data, or of developing prorate projections from the same historical data but prorating to more aggregate and reliable master data of which the prorate data are integral parts. Unless there is reason to believe that the historical subtable data are of equal or greater reliability than the more aggregate master tables, the proration method is likely to yield more dependable projections. In any case this method insures internal consistency between projections in the aggregate master table and the sum of component projections in the subtables. This is not necessarily true if the component projections are made as independent master projections.

Illustrative Cases Included in the Manual

It is not feasible to include cases here to illustrate all of the different options provided by the projection programs. After a little experience in using MASTERPJ (and PRORATPJ) the user will be able to see how to introduce modifications in commands to specify options for alternatives of interest. Most of them can be activated by changing a few commands from those given for one of the illustrative cases included in the manual which is most nearly like that which the user desires to formulate.

Four illustrative cases are included. They are MPJCase.One, MPJCase.Sec, MPJCase.Pan, and MPJCase.Agr.

MPJCase.One

MPJCase.One illustrates relatively straight forward projections of rice consumption by country for ASEAN using a natural logarithm model. The case includes plotting the results for all five countries and outputing a conversion master table.

MPJCase.Sec

MPJCase.Sec illustrates use of the special routines for food security analysis, using ASEAN country data. Included are computations of needed transactions for

targeted stability levels, annual transactions with security reserves and year-end balances in reserves.

MPJCase.Pan

MPJCase.Pan includes data for rice production in Panama. It illustrates projection of Y-table data, in this case annual production as a function of projections for harvested areas and average yields. It also illustrates use oF PRORATPJ to develop subtable projections of areas harvested by district within one of the provinces in Panama.

MPJCase.Agr

MPJCase.Agr illustrates the use of MASTERPJ to superimpose transition patterns in land use and in crop yields for projected combined net farm income schedules of land development alternatives. It is based on data for medium irrigation schemes in Rajasthan, India.

SECTION IV

BUILDING HISTORICAL DATA FILES FOR THE PROJECTIONS

The historical data files which serve as basis for time-trend projections need to be constructed in tabular form, with one line for each period, starting with the oldest and extending to the most recent. The first two left-most columns of the table are for the sequential designation of the periods and the period identification, respectively. Each input file can contain up to eight columns of data for the components making up the table. When there are more than eight components, then the historical table is divided into sections or "pages", each carrying the period sequence and identification followed by up to eight components. For example, a table of historical data on wheat by county in Kansas would need to be divided into at least 14 sections or pages, because there are 105 counties in the state. Usually the counties are grouped by crop reporting district or in some other meaningful way when formulating the subtables for an extended master table such as one with 105 counties or components. When this is done, time trends can be fitted and projections made for each of the components separately, for meaningful subgroups of the components, as well as for the total of all components in the data set.

The projection programs read the table titles, column header identifications, and footnotes to the tables from keyboard input in response to screen prompts. These are stored in separate electronic files along with user commands for the options requested for a set of projections. The inputing and changing of this kind of information is described in Section V.

Construction of the Input Data File

The historical numbers in the table are read from a separate data file containing nothing but the numbers, numbers which are tabulated in a predetermined format and specified order. This tabulation may be thought of in a table of n periods by m components, with the periods forming the rows and the components the columns the table. Each section or page of the table is up to 80 spaces wide and 60 lines long. The spaces are divided into 3 for the period sequence, 1 blank space, 4 for the period identification, and then eight data fields, each of which is 9 spaces wide. Such tabular format is described as I3, 1X, I4, 8 F 9.0, where I represents integer numbers, F represents floating point or real numbers, X represents spacer, the numbers proceeding the letters indicate the number of fields, and the numbers following the letters indicate the number of spaces in each field. The .0 in the floating point field indicates that the decimal point is understood to be at the right edge of the field (0 spaces back to the left of the right edge) unless the decimal point is entered with the data.

To set such format in a spreadsheet software program such as LOTUS 123, one sets the column width of Column 1 to 3, that of Column 2 to 5, and leaves that of the remaining columns at the default value of 9. The type of numbers would be set to integers for the first two columns and to decimal numbers with 0 decimal places for the remaining columns.

This format is illustrated by the following sample table of two parts. The first section has eight components, and the second has five, each with eleven periods.

The format represents that followed for the historical data input for both the master projection program and the prorate projection program. The period numbers appear in sequence, and continue from the first period to the last one. The period identification may be years as in the example shown, or may be quarters, months or other identification. Quarters would be identified as 0188, etc. and months as 0690, etc., for example. The data by component of the table are entered in as many of the eight fields as needed, each of which is nine spaces wide.

No.	Ident	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
1	1980	20.	30.	40.	50.	60.	70.	80.	90.
2	1981	17.	32.	38.	55.	59.	67.	81.	90.
3	1982	18.	31.	38.	54.	61.	69.	79.	92.
4	1983	19.	33.	40.	53.	59.	71.	82.	93.
5	1984	21.	31.	42.	54.	66.	73.	82.	92.
6	1985	23.	33.	44.	54.	65.	75.	84.	95.
7	1986	24.	32.	43.	56.	65.	76.	83.	96.
8	1987	25.	34.	44.	55.	66.	77.	88.	95.
9	1988	24.	34.	45.	56.	66.	78.	87.	97.
10	1989	25.	35.	46.	57.	65.	79.	88.	98.
11	1990	26.	35.	47.	58.	67.	79.	89.	101.
1	1980	52.	58.	71.	82.	91.			
2	1981	55.	59.	67.	81.	90.			
3	1982	54.	61.	69.	79.	92.			
4	1983	53.	59.	71.	82.	93.			
5	1984	54.	66.	73.	82.	92.			
6	1985	54.	65.	75.	84.	95.			
7	1986	56.	65.	76.	83.	96.			
8	1987	55.	66.	77.	88.	95.			
9	1988	56.	66.	78.	87.	97.			
10	1989	57.	65.	79.	88.	98.			
11	1990	56.	68.	78.	90.	99.			

Using EDLIN to Create Input Data Files

The data files to serve as input to MASTERPJ or PRORATPJ as basis for the projections to be made can be typed with the DOS editor program, EDLIN, or with a data base or word processor program, or they can be created with an electronic spreadsheet program such as LOTUS. Two examples are illustrated in this section, (1) using the line editor program, EDLIN, and (2) using LOTUS 123.

Purpose

One can use the MS-DOS program, EDLIN, to prepare user data input for MPJ and PPJ problems. The procedure permits use of one of the text sample problems such as MPJDATA.ONE as format template for the user problem. EDLIN is used to edit the sample problem line by line, thus converting it from the text sample problem to the user data input. Use MPJData.One or MPJData.Sec as the format template if the user problem has no proration requirements, for example. Use MPJData.Pan as the pattern if the user problem involves standard proration projections. Use

MPJData.Agr as the pattern for projection problems involving superimposed transition patterns to full development.

Step 1

The first step in preparing the user input data is to print the file you will use to represent the format template, say MPJDATA.ONE. This can be done with the DOS PRINT command directed to the configured PRN device, e.g. PRINT MPJDATA.ONE>PRN and key <Return>. It also can be done by echoing to the printer with <Ctrl> P, using TYPE and <Return>.

Step 2

The second step in preparing the user data input is to assemble the data for entering to the computer with EDLIN. The step must be completed precisely, following the sequential steps one by one, and the exact format of the MPJDATA.XXX (and/or PPJDATA.XXX) template. Step 2 is completed by writing the new data just above the corresponding data as printed on the sample template. Remember that both vertical and horizontal spaces are significant in the template. They should be retained as they are unless specific changes are needed to fit the user problem.

Step 3

Use COPY to transfer the template master to your work disk, e.g., COPY MPJDATA.ONE B: <Return>; use RENAME to rename the file, e.g., REN B:MPJDATA.ONE MPJDATA.NEW and key <Return>.

Step 4

Set up the template file for editing with EDLIN, e.g., EDLIN B:MPJDATA.NEW <Return>. The EDLIN prompt, *, should appear with flashing cursor, _, in the upper left corner of the screen. To list a reasonable number of lines for the file to appear on the screen, type 1 20 L <Return>.

Step 5

Starting with Line 1, use EDLIN to replace template information and data, proceeding until the entire file is changed. Type 1 to recall line 1; use <F1> to copy a character to the edited line; type in corrections in the appropriate locations. Key <Return> to accept changed line and move to the next line. When the process is completed, type E to accept to the file all changes made with EDLIN.

At points where the MPJDATA.NEW contains several lines of input which are more like the previous line of MPJDATA.NEW than like that on the present line of the MPJDATA.ONE template, it will be faster to move to EDLIN's insert mode by typing the number of the next line, say 23 and I <Return>. Now the previous line of MPJDATA.NEW can be copied with <F1>, <F2> or <F3> and edited as needed as you go. When ready to terminate the insert mode, simply type the next line number followed by <Ctrl> C. Then remaining lines from the MPJDATA.ONE template

which are not needed can be eliminated by typing the inclusive numbers to be deleted followed by D, i.e., 46 59 D and <Return>.

Using LOTUS 123 to Create Input Data Files

Introduction

The LOTUS systems disc contains the Software package for creating and manipulating electronic spreadsheets, or LOTUS Worksheets (WKS or WK1). LOTUS Worksheets can be copied into a print file (LOTUS.PRN) so that they are recognized as standard ASCII files for reading as formatted data files by the MPJ and other Fortran programs.

LOTUS is widely used and recognized, and has many uses in its own right, including file management and graphics as well as electronic spreadsheets. Easy to follow references and manuals have been developed by users and are readily available at local book stores. No one will regret investing the time and energy necessary to become familiar with LOTUS. Now using LOTUS to create data files for other programs adds further to the usefulness of this software.

LOTUS Worksheets are keyed by lettered columns and numbered rows like a road map. Data appearing in cells are stored as formulas, even though they appear as numbers in the displayed worksheet, making it easy to up-date the data files by changing a few base numbers in the formulas. Copy, move, erase, insert, change format, adjust column width, and other worksheet manipulations are relatively easy with LOTUS, so that the user is in no way bound to the standard or default spreadsheet pattern. However, because the standard column width in LOTUS Worksheets is nine spaces, it is convenient to use this pattern as basis for input formatting to the Fortran programs like the MPJ.

Creating File Using MPJData.One Example

The following example of preparation of the input data file, MPJDATA.ONE, for the MPJ Program with LOTUS 1-2-3 is designed to give the user an introduction to this software and how to use it. The steps are listed in numbered sequence for reference and use in self instruction.

1. Bring up LOTUS 1-2-3
   a. Type LOTUS <Return>
   b. When the LOTUS options appear in the screen window, place the cursor on 1-2-3 and Key <Return>
   c. Key <Return> again in response to the prompt Press any Key
   *. An alternative short-cut procedure is to type 123 and key <Return> at Step a.

2. Set up LOTUS Worksheet (Column A at 3 spaces wide and Column B at 5 spaces wide, leaving Columns C..G at the standard 9 spaces)
   a. Put Cursor on Column A with arrow key and type / W C S 3 <Return>
   b. Put Cursor on Column B with arrow key and type / W C S 5 <Return>

3. **Enter Input Data for Step 1 on Row 1**
   a. Put Cursor on A1 cell and type 1 <right arrow> 1970 <right arrow> 119316 <right arrow> 153835 <right arrow> 137888 <right arrow> 109960 <right arrow> 155502 <Return>

4. **Use Data Fill to fill in the rest of the period designations**
   a. Put Cursor on A1 cell and type / D F A1..A18 <Return> 1 <Return> 1 <Return> 18 <Return>
   b. Put Cursor on B1 cell and type / D F B1..B18 <Return> 1970 <Return> 1 <Return> 18 <Return>

5. **Enter the following tabular data to Cells C2..G18 using numeric and entry arrow keys:**

111427	145378	136336	107760	163874
122582	156098	134727	108487	189028
106237	149014	138686	108330	185700
114353	145967	136265	106780	169047
102670	146144	139362	107930	168195
111239	152387	140641	98456	205880
102482	140048	182508	110399	162362
114299	137006	170974	110707	168596
117597	153983	171806	109769	206863
120886	156061	182651	114508	190363
124164	163242	151185	117902	166978
123520	170953	177923	114083	182146
129061	167603	137300	110000	187428
127474	172105	92835	105527	189799
131302	158111	77847	107634	182111
135277	153191	133538	109893	167574
135588	158071	137111	112057	166855

6. **Save the Worksheet File**
   a. Type / F S MPJDATA <Return> R and wait for save to complete

7. **Make and Save the LOTUS Print File**
   a. Type / P[rint] F[ile] MPJDATA <Return>
   b. Type O[ptions] M[argin] L[eft] 1 <Return>
   c. Type M[argin] T[op] 0 <Return>
   d. Type M[argin] R[ight] 132 <Return>
   e. Type O[ther] A[s Displayed] O[ther] U[nformatted] Q[uit]
   f. Type R[ange] A1..J56 <Return>
   g. Type G[o] and wait for file to be created
   h. Type Q[uit] and wait for file to be copied to your disc
   i. If you want to preserve the print (file) settings on your diskette with the worksheet file, you may do so by resaving the worksheet file at this point (/ F S <Return> R)

   (You should now have two new files on your disk, MPJDATA.WKS (or WK1) and MPDJATA.PRN. The first is a Lotus worksheet which can be used

with LOTUS as any other such file. The second is an ASCII data file corresponding to MPJDATA.ONE. After backing out of LOTUS, this MPJDATA.PRN file can be RENamed MPJDATA.RUN to serve as input for running the Master Projection Program, MASTERPJ.EXE.

7. **Quit LOTUS**
   Back out of LOTUS by successive Quit and End commands by typing first letters or by Cursor and <Return>; for example, type
   / Q Y E Y
   The A> or B> signal at the left side of the screen indicates that you are back under DOS control.

<u>Using the MPJData.PRN File as Input to Run MASTERPJ</u>

1. Insert disk with the MASTERPJ.EXE file in Drive A

2. Logged in Drive A type REName MPJDATA.RUN MPJDATA.ONE <Return>

3. Logged in Drive B copy the MPJData.Prn file to Drive A as MPJData.Run as follows:
   Type COPY MPJDATA.PRN A:MPJDATA.RUN and key <Return>

4. Prepare your printer and make the run:
   Type MASTERPJ <Crtl P> and key <Return>

The results should be comparable to those shown for MPJData.One in this Manual.

SECTION V

USING MASTER1 TO PREPARE THE COMMANDS FOR MASTER PROJECTIONS

Nature and Purpose of MASTER1

The MASTER1 Program is a separate computer routine for reading the commands and instructions for making master projection runs with MASTERPJ. The program reads default values from a disk file, DEFAULT.VAL, reads user commands from keyboard input in response to screen prompts, and creates the command input file for the Master Projection Program, INPUT.MPJ.

It should be noted that the file INPUT.MPJ is in the same format as DEFAULT.VAL, so that after one has become familiar with the program, the input can be prepared by editing a copy of DEFAULT.VAL (say with the DOS editor, EDLIN) and then renaming it to INPUT.MPJ for direct reading by that program.

To invoke the MASTER1, two files are needed on the logged drive together with enough disc space for creation of a third. The needed files to run MASTER1 are Master1.Exe and Default.Val. Both of these are provided on the master disc supplied with the Master Projection computer package. The new file to be created by the run is INPUT.MPJ, as indicated above. To initiate the run just type MASTER1 and key <return>.

The program will bring up a series of screen displays on the monitor, each of which shows the default commands at that step, and prompts the user to enter the comparable commands for his problem. Each provides specific instructions as to the number of digits to be entered at each command and the spacing between commands. These instructions must be followed exactly or the run will not be completed, because the commands are read from the keyboard input in specified format. When the requested input at each step has been provided, one proceeds to the next step by keying <Return>.

Until becoming familiar with the screen prompts and keyboard command entries, the user may find it difficult to enter all of the necessary commands to complete the run without making an error and having to start over. A good way to overcome this kind of problem is to make the entries a few steps at a time, accepting the default values for the remaining steps. For example, new commands might be entered at the steps of the Master Screen, Screen 1 and Screen 2, and from there forward the default values can be accepted by keying a series of <return>s until the program runs and the message "COMMAND INSTRUCTIONS READ AND STORED FOR 1 MASTER TABLES" appears on the monitor. The output file created by the run, Input.Mpj, then can be RENamed to Default.Val in preparation for the second pass run with MASTER1, this time to enter the desired values at Screens 3, 4 and 5, for example. Three or four such passes should permit development of the final Input.Mpj file for running the master projections with MASTERPJ. In following this procedure, remember that once a menu has been brought up on the monitor, it is necessary to re-enter the commands shown on that screen, even if they are to remain the same as the default values.

Basic Parameters and Master Menu

Basic Parameters for All Problems in the Run

The first screen to appear on the monitor after calling the MASTER1 Program is that shown on the opposing page. In addition to the brief explanation of the program and how it operates, the requested information at this step includes IROW, ICOL and NFAC. These values must be provided before keying <return> to go on to the next screen.

IROW = Maximum number of periods in the run, counting both historical periods and projected periods. The entry here should be equal to or greater than the longest problem.

ICOL = Maximum number of columns in the run, counting period and total columns as well as data columns. The entry here should be equal to or greater than the largest problem.

NFAC = Number of variables (Master Tables) in the run. Enter 0 if the master data are projected directly. If projecting Y = f(A,B,..N), enter the number of independent variables (up to eight of them).

Master Menu for Command Selections

The next screen to appear on the monitor is the Master Menu shown on the opposite page. It represents an index of the different sets of commands used to direct the kinds of projections desired. Entry of a number from 1 to 9 followed by <return> will bring up the corresponding screen. Although the usual practice is to provide the information by screen in numerical sequence, the screens can be selected in any order. In cases for which the default values are to be accepted for all but a few variables on one or two screens, only the number(s) of the screen(s) involved need to be requested from the Master Menu. The default values will be retained for the variables contained on any of the screens not requested by number. It is possible to call the same screen by number more than once if a further change is needed on one or more of the variables contained on that screen.

After making the changes on any of the numbered screens and keying <return>, the Master Screen again will appear on the monitor. When all of the desired changes have been made to the default values, keying <return> to the Master Screen will cause the Program to move on to the next step.

Monitor Display of Basic Parameters

REGRESSION PROJECTION PROGRAM WITH MULTIPLE OPTIONS
Professor Richard Phillips
Department of Agricultural Economics
Kansas State University

* This program reads computational instructions from the screen menu and the historical time series data for N periods from the users disk file in LOTUS 123 print file format.
* The program fits mathematical time trends with specified model and makes projections for M periods into the future.
* Default options to the menu instructions are read from a disk file; they can be replaced in any order by the user any time prior to execution.
* The many options under the program are controlled by keyboard commands given by the user in response to menu prompts.

MAXIMUM NUMBER OF PERIODS FOR RUN: 40 (Enter as 75, etc.)
MAXIMUM NUMBER OF COLUMNS FOR RUN: 40 (Enter as above)
NUMBER OF VARIABLES (MASTER TABLES) IN RUN: 1 (Enter as 1, 3, etc.)

SELECTIONS: (Leave one blank space between entries, and key <return> after all three entries have been made).

40 40 0

Monitor Display of Master Menu

COMMAND VALUES TO BE SPECIFIED FOR THE FINAL PROJECTION

Enter Code Number of Menu Selection and Key <return>.

1 Type of Projection Model and Analysis

2 Special Features Invoked for the Run

3 Commands for Period Designations

4 Commands for Columnar Reorganization of Table

5 Organization of Input Data Sets

6 Organization of Output Data Sets

7 Call for Special and Supplemental Tables

8 Commands for Graphs to Be Plotted

9 Commands for Food Security Analysis and Projection Coefficients

SELECTION:

Model Designation and Special Features

The monitor displays reproduced on the opposite page are for inputing commands designating the type of projection model, and for invoking one or more of the special features available in the program.

Type of Projection Model and Analysis

```
READ (INF,9) NA,NU,IX1,IX2,NP,NC,IFORM,IYIN,LPRJ,KRATE
      (Enter a two-digit number for each command)
```

NA = Number of historical periods to read in
NU = Number of historical periods to use as basis for projections
IX1 = First exponent on time variable (subtract 1.0 from desired exponent before making entry, e.g., exponent of 1.0 entered as 0)
IX2 = Final exponent on time variable, entered as above. Program will make another set of projections for all exponents between first and final in increments of 0.2
NP = Number of periods to project

NC = Number of columns of data to project
IFORM = Mathematical sign for impact of this variable on Y (1 = +, 2 = *, 3 = -, 4 = /)
IYIN = First year of data in the master table
LPRJ = Use natural log rather than exponential projection model
KRATE = Project at a specified rate from period to period

Commands for Special Features Invoked for the Run

```
READ (INF,9) ICYC,NOTL,NOPRT,KARDM,KARDT,NOMOD,NLANG,NCARDS,NEGNO,NONEG
      (Enter 1 for Yes, 0 for No)
```

ICYC = Reflect cyclic patterns in historical and projected numbers
NOTL = Omit total column in master output table
NOPRT = Skip printing master table for this variable

KARDM = Create computer file of master output table
KARDT = Create computer file of conversion output table
NOMOD = Omit designation of type of projection model on printed output

NLANG = Language code for output; 0 = English, 1 = Spanish, 2 = French
NCARDS = Number of data sets per period for input to Feasibility Analysis
NEGNO = Project negative numbers in output
NONEG = Ignore minus signs in data set
ISKIP = Omit printing statistical parameters on output tables

Monitor Display of Screen 1 for Model Designation

1

COMMANDS FOR TYPE OF PROJECTION MODEL AND ANALYSIS:

Enter two-digit value for each command in succession, with one blank between entries.

1	NUMBER OF PERIODS TO READ IN:	15	(Enter as two-digit number)
2	NO. OF PERIODS TO USE FOR PROJECTIONS:	15	(Enter as above)
3	FIRST EXPONENT ON TIME VARIABLE:	0	(Enter as above)
4	LAST EXPONENT ON TIME VARIABLE:	0	(Enter as above)
5	NUMBER OF PERIODS TO PROJECT:	9	(Enter as above)
6	TOTAL NUMBER OF COLUMNS TO PROJECT:	12	(Enter as above)
7	MATHEMATICAL IMPACT OF THIS VARIABLE:	0	(1 = +, 2 = *, 3 = -, 4 = /)
8	FIRST YEAR OF DATA IN TABLE:	1	(Enter as above)
9	USE LOG PROJECTION MODEL:	0	(Enter as above)
10	PROJECT AT SPECIFIED RATE:	0	(Enter as above)

SELECTIONS:

15 15 00 00 09 12 00 01 00 00

Monitor Display of Screen 2 for Special Features

2

COMMANDS FOR SPECIAL FEATURES INVOKED FOR THE RUN:

Enter one-digit integer for each command in succession, with one blank space between entries.

1	REFLECT CYCLIC PATTERNS IN DATA:	0	(Yes = 1, No = 0)
2	OMIT TOTAL COLUMN IN OUTPUT TABLE:	1	(Yes = 1, No = 0)
3	SKIP PRINTING THIS MASTER TABLE:	0	(Yes = 1, No = 0)
4	CREATE FILE OF MASTER OUTPUT TABLE:	0	(Yes = 1, No = 0)
5	CREATE FILE OF CONVERSION OUTPUT TABLE:	0	(Yes = 1, No = 0)
6	OMIT DISPLAYING TYPE OF MODEL:	0	(Yes = 1, No = 0)
7	LANGUAGE CODE FOR OUTPUT: (English = 0, Spanish = 1, French = 2)	0	
8	NUMBER OF DATA SETS PER PERIOD FOR IRR INPUT:	0	(Enter 1-digit number)
9	PROJECT NEGATIVE NUMBERS:	0	(Yes = 1, No = 0)
10	IGNORE MINUS SIGNS IN DATA:	0	(Yes = 1, No = 0)
11	OMIT PRINTING STATISTICAL PARAMETERS	0	(Yes = 1, No = 0)

SELECTIONS:

0 1 0 0 0 0 0 0 0 0 0

Period Designation and Columnar Reorganization

The monitor displays reproduced on the opposite page are for inputing commands for designating the periods, and for columnar reorganization of the master output table.

Commands for Period Designations

```
READ (INF,9) IANN,IQTR,IMON,JQTR,JMON,IMOVE,NYR,NQTR,NMON,ISTART
      (Enter two-digit integer value for each variable,
            except NYR, which needs four digits)
```

IANN - Annual designations provided for periods
IQTR - Quarterly designations provided for periods
IMON - Monthly designations provided for periods

JQTR - Number of quarters in first year
JMON - Number of months in first year
IMOVE - Command to reorganize columns in the master table

NYR - Identification of first year in data set
NQTR - Identification of first quarter in data set
NMON - Identification of first month in data set
ISTART - Base period for projections at a specified rate

Commands for Columnar Reorganization of Table

```
READ (INF,9) JCOL1,JCOL2,JCOL3,JCOL4,JCOL5,JCOL6,IRIGHT,ILEFT,IONE,IFINAL
      (Enter two-digit integer value for each variable)
```

JCOL1 - Number of first data column in table to be removed
JCOL2 - Number of second data column in table to be removed
JCOL3 - Number of third data column in table to be removed

JCOL4 - Number of fourth data column in table to be removed
JCOL5 - Number of fifth data column in table to be removed
JCOL6 - Number of sixth data column in table to be removed

IRIGHT - Shift remaining columns to the right (Yes = 01, No = 00)
ILEFT - Shift remaining columns to the left (Yes = 01, No = 00)
IONE - Number of the first column to be shifted to the right or left
IFINAL - Number of the last column to be shifted to the right or left

Monitor Display of Screen 3 for Period Designations

3

COMMANDS FOR PERIOD DESIGNATIONS:

Enter two (and four) digit integer value for each command in succession, with one blank space between entries.

1	ANNUAL DESIGNATIONS PROVIDED:	1	(Yes = 01, No = 00)
2	QUARTERLY DESIGNATIONS PROVIDED:	0	(Yes = 01, No = 00)
3	MONTHLY DESIGNATIONS PROVIDED:	0	(Yes = 01, No = 00)
4	NUMBER OF QUARTERS IN FIRST YEAR:	0	(Enter as 04, 02, etc.)
5	NUMBER OF MONTHS IN FIRST YEAR:	0	(Enter as 03, 11, etc.)
6	COMMAND TO REORGANIZE COLUMNS IN TABLE:	1	(Yes = 01, No = 00)
7	FIRST YEAR DESIGNATION:	1974	(Enter as 1988, etc.)
8	FIRST QUARTER DESIGNATION:	0	(Enter as 0188, etc.)
9	FIRST MONTH DESIGNATION:	0	(Enter as 0988, etc.)
10	BASE PERIOD FOR PROJECTING AT SPECIFIED RATE:	0	Enter as 1990, etc.).

SELECTIONS:

01 00 00 00 00 01 1974 0000 0000 0000

Monitor Display of Screen 4 for Columnar Reorganization

4

COMMANDS FOR COLUMNAR REORGANIZATION OF TABLE:

Enter two-digit integer values for each command in sequence, with one blank space between entries, and then <return>.

NUMBER OF FIRST DATA COLUMN TO BE REMOVED:	0	(Enter as 03, etc.)
NUMBER OF SECOND DATA COLUMN TO BE REMOVED:	0	(Enter as above)
NUMBER OF THIRD DATA COLUMN TO BE REMOVED:	0	(Enter as above)
NUMBER OF FOURTH DATA COLUMN TO BE REMOVED:	0	(Enter as above)
NUMBER OF FIFTH DATA COLUMN TO BE REMOVED:	0	(Enter as above)
NUMBER OF SIXTH DATA COLUMN TO BE REMOVED:	0	(Enter as above)
SHIFT COLUMNS TO THE RIGHT:	1	(Yes = 01, No = 00)
SHIFT COLUMNS TO THE LEFT:	0	(Yes = 01, No = 00)
NUMBER OF FIRST COLUMN TO BE SHIFTED:	11	(Enter as 04, etc.)
NUMBER OF LAST COLUMN TO BE SHIFTED:	13	(Enter as above.)

SELECTION:

00 00 00 00 00 00 01 00 11 13

Organization of Data Sets for Input and Output

The monitor displays reproduced on the opposite page are for inputing commands to indicate the organization of input data sets and organization of the master output table for the projections.

Organizational Pattern for Input Data Sets

```
READ (INF,9) NCS,(INSET(I),I=1,10)
    (Enter two-digit numbers)
```

NCS = Total number of input data sets for this variable
INSET1 = Number of columns of data in first set
INSET2 = Number of columns of data in second set
INSET3 = Number of columns of data in third set

INSET4 = Number of columns of data in fourth set
INSET5 = Number of columns of data in fifth set
INSET6 = Number of columns of data in sixth set

INSET7 = Number of columns of data in seventh set
INSET8 = Number of columns of data in eighth set
INSET9 = Number of columns of data in ninth set
INSET10 = Number of columns of data in tenth set

Organizational Pattern for Output Data Sets

```
READ (INF,9) INO,(IOUTLI(I),I=1,10)
    (Enter two-digit numbers)
```

INO = Total number of output data tables for this variable
IOUTLI1 = Number of columns of output in first table
IOUTLI2 = Number of columns of output in second table
IOUTLI3 = Number of columns of output in third table

IOUTLI4 = Number of columns of output in fourth table
IOUTLI5 = Number of columns of output in fifth table
IOUTLI6 = Number of columns of output in sixth table

IOUTLI7 = Number of columns of output in seventh table
IOUTLI8 = Number of columns of output in eighth table
IOUTLI9 = Number of columns of output in ninth table
IOUTLI10 = Number of columns of output in tenth table

Monitor Display of Screen 5 for Organization of Input

5

ORGANIZATION OF INPUT DATA SETS:

(Enter two-digit numbers in sequence for the columns included in data sets 1 .. n, and then <return>.

TOTAL NUMBER OF INPUT DATA SETS:	2	(Enter as 03, 10, etc.)
NUMBER OF COLUMNS IN FIRST DATA SET:	8	(Enter as 08, etc.)
NUMBER OF COLUMNS IN SECOND DATA SET:	4	(Enter as above)
NUMBER OF COLUMNS IN THIRD DATA SET:	0	(Enter as above)
NUMBER OF COLUMNS IN FOURTH DATA SET:	0	(Enter as above)
NUMBER OF COLUMNS IN FIFTH DATA SET:	0	(Enter as above)
NUMBER OF COLUMNS IN SIXTH DATA SET:	0	(Enter as above)
NUMBER OF COLUMNS IN SEVENTH DATA SET:	0	(Enter as above)
NUMBER OF COLUMNS IN EIGHTH DATA SET:	0	(Enter as above)
NUMBER OF COLUMNS IN NINTH DATA SET:	0	(Enter as above)
NUMBER OF COLUMNS IN TENTH DATA SET:	0	(Enter as above)

SELECTIONS:

02 08 04 00 00 00 00 00 00 00 00 00

Monitor Display of Screen 6 for Organization of Output

6

ORGANIZATION OF OUTPUT DATA SETS:

Enter two-digit numbers for columns in each output data set in sequence, with one blank space between entries, and then <return>.

TOTAL NUMBER OF OUTPUT DATA SETS:	1	(Enter as 01, 10, etc.)
NUMBER OF COLUMNS IN FIRST OUTPUT SET:	12	(Enter as 08, etc.)
NUMBER OF COLUMNS IN SECOND OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN THIRD OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN FOURTH OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN FIFTH OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN SIXTH OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN SEVENTH OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN EIGHTH OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN NINTH OUTPUT SET:	0	(Enter as above)
NUMBER OF COLUMNS IN TENTH OUTPUT SET:	0	(Enter as above)

SELECTIONS:

01 12 00 00 00 00 00 00 00 00 00

Commands for Special Output and Graphs

The monitor displays reproduced on the opposite page are for inputing calls for special and supplemental output and for indicating the columns of data in the master table for which graphs are to be plotted.

Calls for Special and Supplemental Tables

```
READ (INF,9) IFEED,ISAME,IPLOT,JCOUTY,JEST,LPLOT,NDEV,NFIT,NRATE
      (Enter commands as one-digit numbers, yes = 1; no = 0)
```

IFEED = Make conversion tables from master projection tables
ISAME = Use conversion factor which is constant through time
IPLOT = Create graph of one or more variables in master table

JCOUTY = Create file for making prorate projections
JEST = Provide tables of statistical estimates for historical period
LPLOT = Compress Y-axis on graphs plotted

NDEV = Create table of deviations from fitted trend
NFIT = Fit trend functions even though no projections made
NRATE = Project at a constant rate from period to period

Commands for Plotting Graphs

```
READ (INF,9) (NPLOT(I),I=1,13)
      (Enter commands as one-digit numbers, yes = 1; no = 0)
```

NPLOT1 = Make plot of first data column in master table
NPLOT2 = Make plot of second data column in master table
NPLOT3 = Make plot of third data column in master table

NPLOT4 = Make plot of fourth data column in master table
NPLOT5 = Make plot of fifth data column in master table
NPLOT6 = Make plot of sixth data column in master table

NPLOT7 = Make plot of seventh data column in master table
NPLOT8 = Make plot of eighth data column in master table
NPLOT9 = Make plot of ninth data column in master table

NPLOT10 = Make plot of tenth data column in master table
NPLOT11 = Make plot of eleventh data column in master table
NPLOT12 = Make plot of twelfth data column in master table
NPLOT13 = Make plot of thirteenth data column in master table

Monitor Display of Screen 7 for Special Output

7

CALLS FOR SPECIAL AND SUPPLEMENTAL OUTPUT:

Enter commands as one-digit numbers in sequence, with one blank space between entries, and then <return>.

MAKE CONVERSION TABLES FROM PROJECTED VALUES:	1	(Yes = 1, No = 0)
CONVERSION FACTOR CONSTANT THROUGH TIME:	1	(Yes = 1, No = 0)
CREATE GRAPH OF ONE OR MORE VARIABLES:	1	(Yes = 1, No = 0)
CREATE FILE FOR PRORATE PROJECTIONS: (Include yield transitions = 2)	1	(Yes = 1, No = 0)
PROVIDE TABLES OF STATISTICAL ESTIMATES FOR HISTORICAL PERIOD:	0	(Yes = 1, No = 0)
COMPRESS Y AXIS ON PLOTS:	1	(Yes = 1, No = 0)
CREATE TABLE OF DEVIATIONS FROM TREND:	0	(Yes = 1, No = 0)
FIT TREND FUNCTIONS WITHOUT PROJECTIONS:	0	(Yes = 1, No = 0
PROJECT AT CONSTANT RATE OVER TIME:	0	(Yes = 1, No = 0).

SELECTIONS:

1 1 1 1 0 1 0 0 0

Monitor Display of Screen 8 for Plotting Graphs

8

REQUEST FOR MASTER TABLE COLUMNS TO BE PLOTTED:

Enter request for plots of each desired column in the master table in sequence, with one space between entries, and then <return>.

DO PLOT OF FIRST DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF SECOND DATA COLUMN:	1	(Yes = 1, No = 0)
DO PLOT OF THIRD DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF FOURTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF FIFTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF SIXTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF SEVENTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF EIGHTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF NINTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF TENTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF ELEVENTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF TWELFTH DATA COLUMN:	0	(Yes = 1, No = 0)
DO PLOT OF THIRTEENTH DATA COLUMN:	0	(Yes = 1, No = 0)

SELECTIONS:

0 1 0 0 0 0 0 0 0 0 0 0 0

Commands for Food Security Analysis and Cycle Multipliers

The monitor displays reproduced on the opposite page are for inputing commands for food security analysis and for inserting cycle multipliers when ICYC (Screen 2) = 1.

Commands for Food Security Projections

```
READ (INF,8) ISTOCK,IREG,IMPORT,NRTR,NCAP,ACEPT,CONST,FACTO1,FACTO2,
             WCOEF,WRATE
    (Enter one-digit and four-character decimals as appropriate)
```

ISTOCK = Conduct food security analysis (0 = no, 1 = yes, 2 = reserves)
IREG = Conduct analysis of regional reserves (0 = no, 1 = yes)
IMPORT = Conduct analysis of international trade adjustments (0 = no, 1 = yes)
NRTR = Compute needed transactions with security reserves (0 = no, 1 = yes)
NCAP = Compute needed reserve storage capacity (0 = no, 1 = yes)

ACEPT = Y-Intercept for regression estimates (4-character decimal)
CONST = First period factor for conversion output table (as above)
FACTO1 = Fraction of trade adjustment effective same period (as above)

FACTO2 = Fraction of trade adjustment effective next period (as above)
WCOEF = Regression coefficient for the current variable (as above)
WRATE = Constant rate of change for period to period projections (as above)

Cycle Multipliers if ICYC (Screen 2) = 1

When 1 is inserted for ICYC at Screen 2, the Program will bring up the screens shown on the opposite page, requesting that cycle factor multipliers be entered for each historical and projection period. To accept the default multiplier for a given period, simply key <return>; to change the multiplier, type the decimal value (e.g., 1.033) and then <return>.

Cycle factors normally are used with time series data to reflect patterns resulting from natural or biological phenomenon such as the four-year hog cycle or seasonal harvest patterns in quarterly data. In cases where such patterns exist, much more accurate projections can be made by using the pre-determined multiplier factor applicable to each historical and projected period in the time series to reflect the cyclic pattern properly.

When cycle factors are inserted, MASTERPJ will first multiply the historical value for each period by the corresponding factor, next fit the secular trend to the cycle-adjusted data, and finally apply the appropriate cycle multipliers to the cycle-adjusted projections. The applications are made period by period for all columns in the master table; thus the master table should contain the same kind of data (e.g., prices of 200 to 220 pound butcher hogs) in all columns. Data to which different cycle multipliers apply should be included in separate master tables.

Monitor Display of Screen 9 for Food Security Analysis

9

COMMANDS FOR FOOD SECURITY ANALYSIS AND PROJECTION COEFFICIENTS:

Enter appropriate value for each variable in sequence
with one blank space between entries.

MAKE ANALYSIS OF FOOD SECURITY RESERVES:	0	(Yes = 1, No = 0)
(Reserve balances = 2)		
REGIONAL RESERVE ANALYSIS:	0	(Yes = 1, No = 0)
TRADE ADJUSTMENT ANALYSIS:	0	(Yes = 1, No = 0)
NEEDED TRANSACTIONS WITH SECURITY RESERVES:	0	(Yes = 1, No = 0)
NEEDED RESERVE CAPACITY:	0	(Yes = 1, No = 0)
Y-INTERCEPT FOR REGRESSION ESTIMATES:	.000	
(Enter as 4-character decimal such as 1.10 or .134)		
FIRST PERIOD CONVERSION FACTOR:	.010	(Enter as above)
FRACTION OF TRADE ADJUSTMENT EFFECTIVE FIRST PERIOD:	.000	(Enter as above)
FRACTION OF TRADE ADJUSTMENT EFFECTIVE NEXT PERIOD:	.000	(Enter as above)
REGRESSION COEFFICIENT FOR CURRENT VARIABLE:	1.000	(Enter as above)
RATE OF CHANGE FOR PROJECTION:	.000	(Enter as above).

SELECTIONS:

0 0 0 0 0 .000 .010 .000 .000 1.00 .000

Monitor Display of Cycle Multipliers

CYCLE MULTIPLIERS BY PERIOD:
Type <return> to accept
Type decimal value and <return> to change.

Cycle multiplier for period 0 is 1.023: Use _____.

1.021

Cycle multiplier for period 1 is 1.057: Use _____.

1.060

Cycle multiplier for period 2 is 0.972: Use _____.

0.973

.
.
.

Cycle multiplier for period 20 is 1.023: Use _____.

1.021

Information on Projection Rates, Conversion Rates and Graphs

The monitor displays reproduced on the opposite page are for inserting projection rates, conversion rates, and specifying unit of measure and variable identification for graphs.

Projection Rates if KRATE (Screen 1) = 1 and NRATE (Screen 7) = 0

When 1 is inserted for KRATE at Screen 1 and 0 is inserted for NRATE at Screen 7, the Program will bring up the screens shown on the opposite page, requesting that projection rates be entered for each projection period. To accept the default projection rate for a given period, simply key <return>; to change the rate, type the decimal value (e.g., 0.033) and then <return>.

When projection rates are inserted, MASTERPJ will project the values for each succeeding period by multiplying those for the current period by 1.0 plus the projection rate specified. This feature is used to project demand quantities for a product from combinations of projected population growth rate, the growth rate in per capita income and the coefficient of income elasticity of demand for the product, for example.

Conversion Rates if IFEED (Screen 7) = 1 and ISAME (Screen 7) = 0

When 1 is inserted for IFEED at Screen 7 and 0 is inserted for ISAME at Screen 7, the Program will bring up the screens shown on the opposite page, requesting that conversion rates be entered for each historical and projection period. To accept the default conversion rate for a given period, simply key <return>; to change the rate, type the decimal value (e.g., 1.333) and then <return>.

When conversion rates are inserted, MASTERPJ will produce a conversion output table in addition to the master table. The conversion table will include both the historical and the projected periods matching those in the master table. For example, a conversion table of tons of demand for cattle feeds might be produced from master projections of fed cattle marketed.

Unit of Measure for Graphs if IPLOT (Screen 7) = 1

When 1 is inserted for IPLOT at Screen 7, the Program will bring up the screen shown on the opposite page, requesting that the unit of measure for the graph(s) to be plotted be entered. The entry need be made only once for each master table, regardless of the number of graphs to be plotted.

Identification of Variable Plotted for each NPLOTi (Screen 8) = 1

For each 1 inserted for NPLOTi at Screen 8, the Program will bring up the screen shown on the opposite page, requesting that the identification of the variable plotted be entered (in up to 16 spaces). The name or phrase entered will be printed at the top of the corresponding graph.

Monitor Display of Projection Rates

```
  PROJECTION RATES BY PERIOD:
        Type <return> to accept
        Type decimal value and <return> to change.

Projection rate for period 21 is 0.025: Use _____.

0.024
    .
    .
    .
Projection rate for period 30 is 0.022: Use _____.

0.021
```

Monitor Display of Conversion Rates

```
  CONVERSION RATES BY PERIOD:
        Type <return> to accept
        Type decimal value and <return> to change.

Conversion rate for period  0 is 1.336: Use _____.

1.337
    .
    .
    .
Conversion rate for period 30 is 1.421: Use _____.

1.420
```

Monitor Display of Unit of Measure for Graphs

```
  UNIT OF MEASURE FOR GRAPHS IS LBS. PER HECTARE

        Type in desired unit (up to 16 spaces) and <return>.

LBS. PER HECTARE
```

Monitor Display of Identification of Variable(s) Plotted

```
  IDENTIFICATION FOR VARIABLE PLOTTED IS CHIRIQUI PROV.

        Type in desired identification (up to 16 spaces) and <return>.

CHIRIQUI PROV.
```

Title, Headers, Footnotes and Execution Screen

The monitor displays reproduced on the opposite page are for inputing the title, column headers and footnotes for the master table (and conversion table), and for preparing the operating system for program execution.

Titles, Column Headers and Footnotes

As indicated by the screen on the monitor at this step, the user has two choices, (1) to retain the default title, column headers and footnotes, or (2) to insert new ones in the place of the default listings. The first choice is indicated by typing 0 and <return>; the second choice is indicated by typing 1 and <return>.

When the second option is selected, then a series of lines must be typed from the keyboard, each followed by <return>. The order for these entries is as follows:

1. Ten title lines for the master table in the format 5(20A4/13A4) to be printed as five 132-column lines of title for the master table.
2. If a conversion table is ordered (IFEED at Screen 7 = 1), four more title lines as above for the first two substitute printed title lines for the conversion table (the conversion table will have the same remaining title lines, headers and footnotes as the master table).
3. Four column header lines in the format 2(8A10/5A10) to be printed as two lines for each page of output (INO at Screen 6). The headers may be properly aligned by following the pattern shown by the "SAMPLE HEADERS" on the monitor.
4. Four footnote lines in the format 2(20A4/13A4) to be printed as two 132-column lines as footnotes to the master (and conversion) table.

Proceed to Program Execution by Keying <Return>

The last screen to appear on the monitor before the Input.Mpj file is created is the Execution Screen illustrated on the opposite page. As the screen indicates, the information supplied via the keyboard at Screens 1 through 9 as well as at any of the special screens for cycle factors, projection rates, conversion rates, and unit of measure and identification for graphs to be plotted, and the title, headers and footnote screen, will be incorporated in the output file.

Also as the screen indicates, it is to be noted that if more than one set of projections are to be made (NFAC at Basic Parameters Screen greater than zero), the full set of information will be first included for X1, followed by the full set for X2, and so on, and finally the set for Y will be included. If this in the case, the program will return to the Master Menu with the message "COMMAND VALUES TO BE SPECIFIED FOR X2" so that the various screens can be called and the relevant input provided for this variable. The process is repeated for X3, etc., and lastly for Y. Only then will the MASTER1 Program proceed to execution.

Monitor Display of Title, Headers and Footnotes Screen

TO BYPASS TYPING IN TITLE, HEADERS, AND FOOTNOTES

1. Type 0 to bypass; type 1 to not bypass.

IF NOT BYPASSING THIS STEP:

2. Insert ten title lines for master tables (to make five-line title in 20A4/13A4 format), with <return> at the end of each line.
3. If making conversion table, insert four title lines as above.
4. Insert four column header lines (printed as two-line decked headers, for each page of output (INO), with <return at the end of each line; Format is 8 A 10 / 5 A 10.

SAMPLE HEADERS:

	Site and	Plant	Average	Other	Product	Other	Service
Fixed	Varable	Mkting	Current	Intrest			
Period	Bldings	Equip.	Invntry	Wrk Cap	Sales	Sales	Income
Expense	Expense	Expense	Deprec.	Expense			

5. Insert four footnote lines (to be printed on two lines) with <return> at the end of each line).

Monitor Display of Execution Screen

PROGRAM WILL NOW PREPARE THE INPUT.MPJ FILE FOR THE MASTER PROJECTIONS

The information supplied by keyboard at Screens 1 through 9, the special screens for cycle factors, projection rates and conversion rates (if used), and the Headers Screen will now be prepared in the disk file INPUT.MPJ for reading by the Master Projection program, MASTERPJ. Default values will be included for anything not changed by keyboard entry.

If more than one set of master tables is included in the run (NFAC > 1), complete information and data is read for the first before proceeding to the second, and so on, for all data sets.

Type 1 and <return> to go back to the menu.
Type 0 and <return> or <return> to proceed to program execution.

SELECTION:

0

Normal Completion of MASTER1 Program Run

Following the keying of 0 and <return> or only <return> at the Execution Screen, MASTER1 will proceed to create the disk file, INPUT.MPJ, for the user's problem. It should be noted that if an existing Input.Mpj file is present on the disk in the active drive which should be saved, such file should be RENamed, say to INPUT.1ST, before making the MASTER1 run. Otherwise it will be lost when the new file is written over it.

When the run has been satisfactorily completed the following message will appear on the monitor:

```
COMMAND INSTRUCTIONS READ AND STORED FOR  1 MASTER TABLES

    TO PROCEED WITH THE RUN, TYPE MASTERPJ AND <RETURN>.
```

Following this, the standard end of run message inserted by the FORTRAN compiler will appear, namely:

```
Stop - Program terminated.
```

The complete listing of the Fortran source program for MASTER1 is included in Appendix A of the Manual. As indicated by the comment lines starting with line 55, the sequence of major steps executed by the program is as follows:

1. Read basic parameters for all problems in the run.
2. Read default values from disk file, "Default.Val".
3. Read command values from the screen.
4. Read titles, headers and footnotes for output tables.
5. Create the command file, Input.Mpj, for the run.

SECTION VI

USING MASTERPJ TO DEVELOP PROJECTED MASTER TABLES

Once the data file for the projection problem (MPJDATA.RUN) has been completed as described in Section IV, and the commands and headers entered to create the INPUT.MPJ as outlined in Section V, the master projections are made by calling the MASTFRPJ Program. In order to complete the run the three active disk files, MASTERPJ.EXE, MPJDATA.RUN, and INPUT.MPJ, need to be on the logged disk drive. If your run requires the working disk file, NDISK, and/or the Masterpj output file, OUTPUT.MPJ, then space for this file (or files) needs to be on the same disk drive also. Your master projection problem will use NDISK if you are making exponential projections at more than one exponential value (IX2 is not equal to IX1) Your run will use OUTPUT.MPJ if you ordered computer output files of either the Master projections or the Conversion projections (KARDM = 1 and/or KARDT = 1). It will also use OUTPUT.MPJ if you ordered the output file from which to make Proration projections (JCOUTY = 1. When the files are in order, and if needed space is provided for the additional files, the master projections are made by preparing your printer and then keying MASTERPJ and <Return>.

Sequence of Steps Followed by the MASTERPJ Program

The MASTERPJ Program goes through a sequence of 15 distinct steps in making the requested master projections. The basic steps for reading the input (Steps 1 to 4), for fitting the projections (Step 7), and for printing the master tables (Steps 13 and 15) are completed in all runs. The optional steps each will be executed in sequence in response to the call for that option, but will be bypassed if no call is given in the INPUT.MPJ file.

The sequence of steps followed by the MASTERPJ Program is as follows:

1. Read the basic parameters for all problems in the run from INPUT.MPJ.

2. Read the command values for the run from INPUT.MPJ.

3. Read title, headers and footnotes for the output tables from INPUT.MPJ.

4. Read the input data for the master projection tables from the MASTERPJ.RUN file.

5. If requested, calculate the time period designations.

6. If requested, adjust the master table data by applying cycle factors.

7. Fit the master projections in the manner and over the time frame ordered.

8. Plot the graphs which were requested in the run.

9. If so ordered, zero and/or realign master table data columns as requested.

10. If so ordered, calculate the master Y-table from the X variables.

11. If so ordered, apply the intercept to the Y-table projections.

12. If not overridden, apply zero limits to the master projections.

13. Print headings for the output tables.

14. If requested, prepared the disk output files for PRORATEPJ, and/or for the KARDM and KARDT files.

15. Print the body of the output tables.

Within each of the variables and routines to be completed in a given run, the program will first produce the master projection table, including any graphs, and then the corresponding conversion table, if ordered. If special tables, such as deviations from the regression, are requested, they will be created following the master (and conversion) projections. In the case of projections which include several pages to encompass the total master table, the first page, including conversions and deviations from regression where ordered, will be completed first, followed by the second page, then the third page, and so on until all pages are completed. In case of exponential projections which are to be fitted with more than one exponent, all requested tables for the first exponent will be completed first, and then the program will proceed to complete all requested tables for the second exponent, and so on through the complete set of exponents requested.

In problems for which master projection Y-estimates are made as a function of one or more projected independent variables, the entire run is first completed for the X1 variable, including any of the features outlined above, before proceeding to the next variable. The process then is repeated in sequence for X2, for X3, etc., through all of the specified independent variables. When everything requested has been finished for all of the X variables, the program then will complete the full set of projections ordered for the Y-tables, including conversion tables if ordered.

The complete listing of the Fortran source program for MASTERPJ is included in Appendix B of the Manual. It will be noted that a short main program is used to establish the maximum row and column dimensions for the problem, and that most of the functions of the program are performed by the MPJ Subroutine. Separate subroutines are used to fit time-trend regressions, compute the period designations, print the table title and column headings and print the graphs. In problems for which the OUTPUT.MPJ file is requested, it is created at lines 508 to 526 of the MPJ Subroutine.

Screen Displays by MASTERPJ

Only two screens are displayed on the monitor by MASTERPJ in the process of generating the master projections requested in the run. The first is a Master Screen which outlines the key features and procedures of the program. The second in the Execution Screen stating that the program is ready for execution and reminding the user to prepare the printer to receive the program output for his

problem. A pause is provided following each of the screens, but no additional input needs to be supplied in order to make the run.

Monitor Display of Master Screen

```
                REGRESSION PROJECTION PROGRAM WITH MULTIPLE OPTIONS
                          Professor Richard Phillips
                     Department of Agricultural Economics
                     Kansas State University
   * This program reads computational instructions from the INPUT.MPJ file and
     historical time series data for N periods from the users disk file in
     LOTUS 123 print file format.
   * The program fits mathematical time trends with specified model and makes
     projections for M periods in the future.
   * Command options can be changed by going back to the MASTER1.EXT file and
     creating a new INPUT.MPJ file incorporating the changes.
   * The many options under the program are controlled by keyboard commands
     given by the user in response to menu prompts.

MAXIMUM NUMBER OF COLUMNS FOR RUN:  40
MAXIMUM NUMBER OF PERIODS FOR RUN:  40
NUMBER OF VARIABLES (MASTER TABLES) IN THE RUN:   1

Pause.
Please press <return> to continue.
```

Monitor Display of Execution Screen

```
PROGRAM WILL NOW READ THE HISTORICAL DATA AND MAKE THE PROJECTIONS

      The data input is read from the disk file, MPJDATA.RUN, in  format of I3,
      1X, A4, 8F9.0.  If NCS > 1, data for subsequent sections are read by
      section in sequence, following the same procedure and format.

      If more than one set of master tables is to be included in the run, (NFAC
      > 1), complete information and data is read for the first before proceeding
      to the second, and so on, for all data sets.

NOTE:  Prepare your printer or disk drive to receive the
       output for the run before keying <return> here.

       To direct the output to the printer, type CTRL P; to
       direct output to a disk file type > B:OUTPUT.ONE, etc.
Pause.
Please press <return> to continue.
```

Listing of the Source Program

The complete listing of the Fortran source program for MASTERPJ is included in Appendix B of the Manual. The program consists of 906 statement lines, including comment statements designated by C in the first column. Components of the program include the Main Program, Subroutine MPJ, Subroutine REG, Subroutine

Period, Subroutine Tables and Subroutine Plot. The program was compiled with the Microsoft Heath Compiler and linked with the ALTMATH Fortran Math Library. An 8087 coprocessor chip is not required to run the program.

Main Program

Statements 1 through 43 represent the main program for setting up the dimensions for the problem and establishing how many different variables (master tables) are to be projected in this run. The Main Program calls the MPJ Subroutine, which does most of the projection computations, calling the other subroutines when needed. One disk file, INPUT.MPJ, is called by the Main Program (at line 16).

Subroutine MPJ

The MPJ Subroutine is the principal "work horse" of MASTERPJ, encompassing statements 45 through 622. The commands, title, footnotes and other information for the problem are read from INPUT.MPJ at statements 93-179. The MPJDATA.RUN is opened at statement 201, and the data are read at statements 235-254. Special requests are executed at statements 255-317. The main DO loop for fitting the projections and printing the results starts with number 318. The remaining subroutines are called at appropriate locations by MPJ.

Subroutine REG

The REG Subroutine appears at statements 624-673 in Appendix B. The subroutine is called to fit the master projections. It applies a linear least-squares algorithm in double precision to basic data as converted to exponential values, natural logarithms, etc., depending on the master projection model selected.

Subroutine PERIOD

The PERIOD Subroutine is listed at statements 674-734; it computes the period designations as requested by the user for insertion to the final output tables. It will be recalled that the designation of annual, quarterly or monthly periods in the historical and projected time series data is an option of the MASTERPJ program.

Subroutine TABLES

Subroutine TABLES prints the table titles and column headings for each page of tabular output for the master projections. It comes at statements 736-810 of the MASTERPJ source program.

Subroutine Plot

This last subroutine appears at statements 813-906 of the MASTERPJ program listing in Appendix B. It sets up and prints graphs of those columns in the master table for which plotting has been requested.

SECTION VII

PROJECTIONS OF ASEAN FOOD GRAIN CONSUMPTION (MPJCASE.ONE)

Description of the Case

This MPJCase One involves projections of average per capita consumption of food grains (in milled rice equivalent) by country for the nations in the ASEAN group. Given for the illustrated run are the reported values for 18 successive years and the need to fit time trends and develop projections by country for six years into the futu

Options of MASTERPJ which are exercised in the projections reported herein include the following:

1. Exponential projection model of the form Y = a + T*, where * = 1.20 (IX1 and IX2 at Step 1 are both set equal to 2).

2. Use of most recent 16 years of data to fit the model (NU at Step 1 = 16).

3. Master projections for the 5 countries for 6 years with no totals (At Step 1 NP = 6, NC = 5; at Step 2 NOTL = 1).

4. Plots of trends for all 5 countries with compressed Y-axis. (IPLOT and LPLOT at Step 7 = 1; NPLOT at Step 8 = 1 1 1 1 1).

5. Master table output including statistical parameters YBAR, B, RSQ, SYX, and SB (NOMOD at Step 2 = 0).

6. Conversion master table reporting the same information in units of kilograms per capita per year (at Step 7 IFEED = 1 and ISAME = 1, and at Step 9 CONST = .001)

The data and results for the case are presented on the following pages in the standard order followed throughout the manual, namely:

1. Reproduction of the file of input commands and headings (INPUT.MPJ) created with MASTER1 for the run.
2. Reproduction of the input data file, MPJDATA.RUN, for the run.
3. The output master table and conversion table.
4. Graphic output for each country in the master table in the order that they appear from left to right in the table. *

The table of estimated values for the historical period was not ordered (JEST = 0); neither were output files of the main nor conversion tables (KARDM = 0, KARDT = 0). Had any of these been requested, they would appear following the output conversion table.

---

* In the normal order for printing of output by MASTERPJ, the main master output table follows the graphs which have been ordered in the run.

Commands and Headings for the Case

The commands and headings for MPJCase One as contained in the INPUT.MPJ fil developed in the MASTER1 run are listed below. The ten rows of numbers in I4 forma represent the input information and commands for Steps 0 through 9. The "GRAMS PE CAPITA" entry is the unit of measure for the graphs to be plotted; it is followe by the table title, column headings and footnotes for the tables. The fiv countries represent identification for each of the five graphs.

```
 40  40   1   1   0   1   1
 18  16   2   2   6   5   0   1   0   0
  0   1   0   0   0   0   0   0   0   0
  1   0   0   0   0   01970   0   0   0
  0   0   0   0   0   0   0   0   0   0
  1   5   0   0   0   0   0   0   0   0   0
  1   5   0   0   0   0   0   0   0   0   0
  1   1   1   0   0   1   0   0   0
  1   1   1   1   1   0   0   0   0   0   0   0   0
  0   0   0   0   0 .0000 0.0010  .0000  .0000 1.0000  .0000
GRAMS PER CAPITA
DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987

   (Grams per Capita per Year, Milled Rice Equivalent)

         With Statistical Projections to 1993

     TABLE 4.  ALL FOODGRAINS (RICE, WHEAT, CORN)


DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987

  (Kilograms per Capita per Year, Milled Rice Equivalent)

  PERIOD

 NO. YEAR INDONESIA  MALAYSIA SINGAPORE PHILIPPINES THAILAND

Values in Table 2 divided by those in Table 3.


INDONESIA
MALAYSIA
SINGAPORE
PHILIPPINES
THAILAND
```

Table of Input Data for the Case

The table of input data for MPJCase One as contained in the MPJDATA.RUN file for the case is listed below. The input is contained in an ASCII file in the format I3, 5X, 8F9.0. The file was created using the DOS editor, EDLIN, or LOTUS 123 as outlined in Section IV.

The input represents 18 consecutive years of historical data on computed average per capita consumption of food grains by ASEAN country. The data is reported in units of grams per capita per year. From left to right the five columns of data are for Indonesia, Malaysia, Singapore, Philippines and Thailand, respectively.

1	119316	153835	137888	109960	155502
2	111427	145378	136336	107760	163874
3	122582	156098	134727	108487	189028
4	106237	149014	138686	108330	185700
5	114353	145967	136265	106780	169047
6	102670	146144	139362	107930	168195
7	111239	152387	140641	98456	205880
8	102482	140048	182508	110399	162362
9	114299	137006	170974	110707	168596
10	117597	153983	171806	109769	206863
11	120886	156061	182651	114508	190363
12	124164	163242	151185	117902	166978
13	123520	170953	177923	114083	182146
14	129061	167603	137300	110000	187428
15	127474	172105	92835	105527	189799
16	131302	158111	77847	107634	182111
17	135277	153191	133538	109893	167574
18	135588	158071	137111	112057	166855

Using this input, the MASTERPJ program was used to fit an exponential time trend for each country and develop projections for six years into the future, following the steps outlined in Section VI. The resulting output is shown on the pages which follow.

The statistical parameters shown at the bottom of Table 4 are calculated by the MPJ program. If these parameters are not desired on the printed output, 1 is entered for ISKIP at Screen 2 of MASTER1. Ybar is the mean or average per capita consumption over the 18-year period for each country. The regression coefficient, b, shows the change in consumption as the independent variable, time to the 1.2 power, is increased by one unit. The coefficient of determination or rsq indicates the fraction of variation in total year-to-year consumption associated with the regression. The Syz (Syx) or standard deviation from regression indicates the annual variation in consumption not associated with the regression; the smaller this value relative to Ybar, the closer the fit of the regression line. Graphically Syz defines a band of "average" variation above and below the trend line. The coefficient sb is the standard deviation of regression coefficient, b. Other things equal, the greater the ratio of b to sb, the more significant the b value.

Master Table and Conversion Table Projections

DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987
(Grams per Capita per Year, Milled Rice Equivalent)
With Statistical Projections to 1993

EXPONENT IS 1.20

TABLE 4. ALL FOODGRAINS (RICE, WHEAT, CORN)

PERIOD NO.	YEAR	INDONESIA	MALAYSIA	SINGAPORE	PHILIPPINES	THAILAND
1	1970	119316	153835	137888	109960	155502
2	1971	111427	145378	136336	107760	163874
3	1972	122582	156098	134727	108487	189028
4	1973	106237	149014	138686	108330	185700
5	1974	114353	145967	136265	106780	169047
6	1975	102670	146144	139362	107930	168195
7	1976	111239	152387	140641	98456	205880
8	1977	102482	140048	182508	110399	162362
9	1978	114299	137006	170974	110707	168596
10	1979	117597	153983	171806	109769	206863
11	1980	120886	156061	182651	114508	190363
12	1981	124164	163242	151185	117902	166978
13	1982	123520	170953	177923	114083	182146
14	1983	129061	167603	137300	110000	187428
15	1984	127474	172105	92835	105527	189799
16	1985	131302	158111	77847	107634	182111
17	1986	135277	153191	133538	109893	167574
18	1987	135588	158071	137111	112057	166855
19	1988	141337	168426	122050	112571	175595
20	1989	143587	169836	119736	112891	175074
21	1990	145858	171261	117399	113213	174548
22	1991	148152	172699	115039	113539	174016
23	1992	150466	174150	112658	113868	173480
24	1993	152801	175614	110256	114200	172939
	Ybar	119920.70	154999.00	144084.90	109528.90	180557.80
	b	1034.77	648.75	-1064.62	146.[illegible]9	-239.76
	rsq	.6937	.3031	.0967	.08[illegible]	.0216
	Syz	6138.70	8782.66	29053.48	4270.43	14395.46
	sb	183.74	262.88	869.63	127.82	430.88

SOURCE:
Values in Table 2 divided by those in Table 3.

DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987
(Kilograms per Capita per Year, Milled Rice Equivalent)
With Statistical Projections to 1993

EXPONENT IS 1.20

TABLE 4. ALL FOODGRAINS (RICE, WHEAT, CORN)

PERIOD NO.	YEAR	INDONESIA	MALAYSIA	SINGAPORE	PHILIPPINES	THAILAND
1	1970	119	154	138	110	156
2	1971	111	145	136	108	164
3	1972	123	156	135	108	189
4	1973	106	149	139	108	186
5	1974	114	146	136	107	169
6	1975	103	146	139	108	168
7	1976	111	152	141	98	206
8	1977	102	140	183	110	162
9	1978	114	137	171	111	169
10	1979	118	154	172	110	207
11	1980	121	156	183	115	190
12	1981	124	163	151	118	167
13	1982	124	171	178	114	182
14	1983	129	168	137	110	187
15	1984	127	172	93	106	190
16	1985	131	158	78	108	182
17	1986	135	153	134	110	168
18	1987	136	158	137	112	167
19	1988	141	168	122	113	176
20	1989	144	170	120	113	175
21	1990	146	171	117	113	175
22	1991	148	173	115	114	174
23	1992	150	174	113	114	173
24	1993	153	176	110	114	173

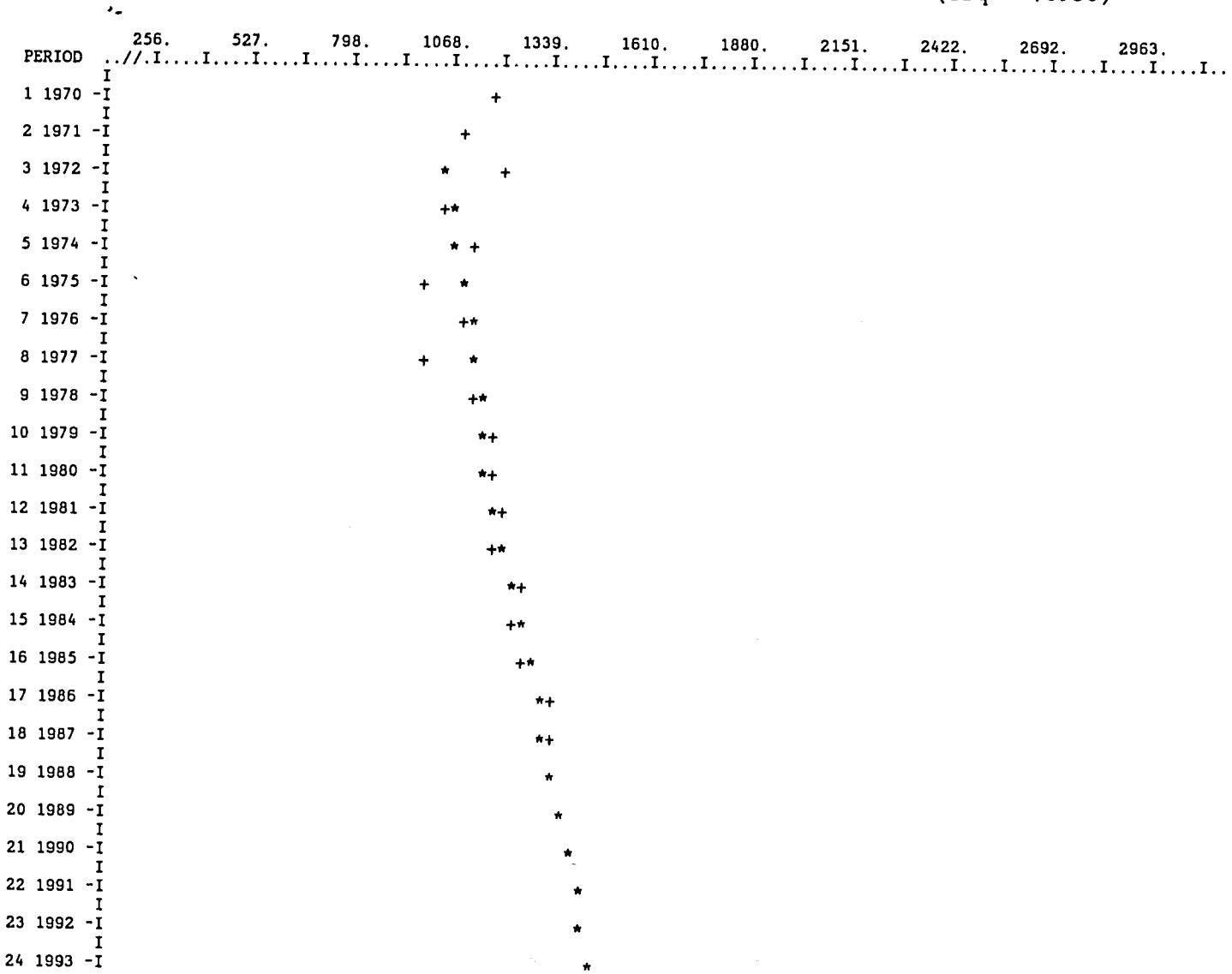
SOURCE:
Values in Table 2 divided by those in Table 3.

Graphic Output by Country

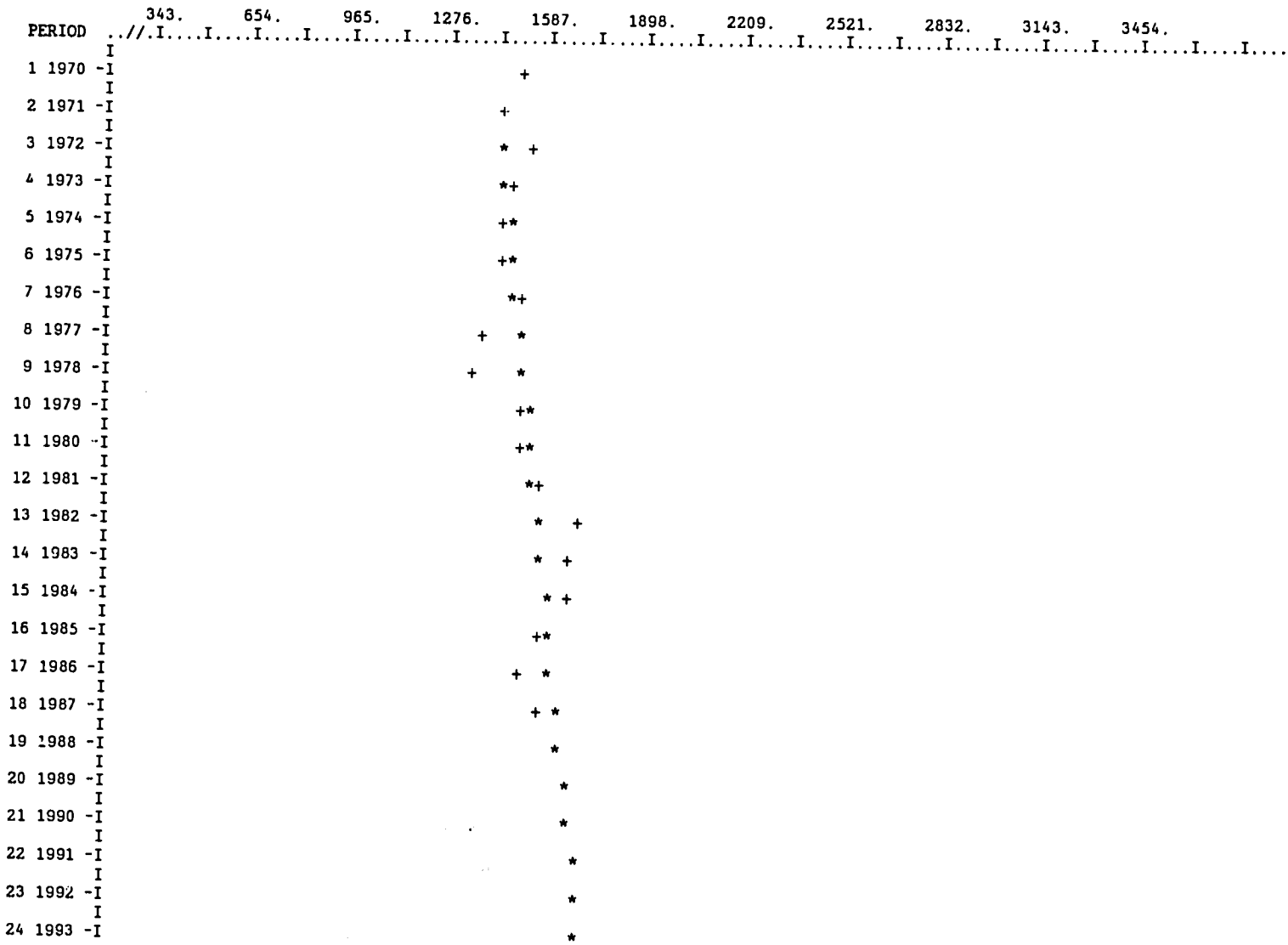
The graphic output for each of the five ASEAN countries as obtained in the run is shown on the following pages.

DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987

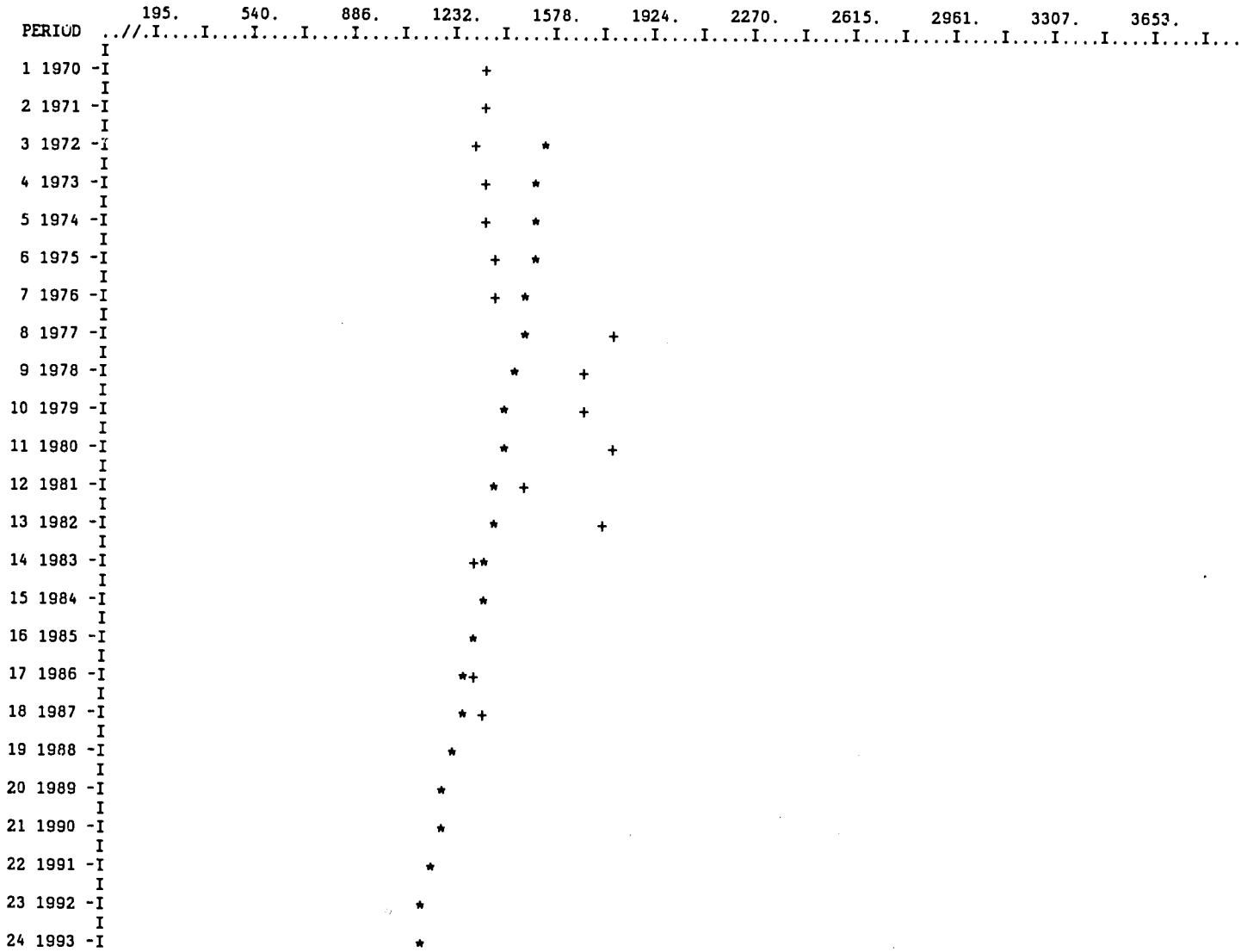
INDONESIA UNIT IS GRAMS PER CAPITA X 100 (rsq = .6938)



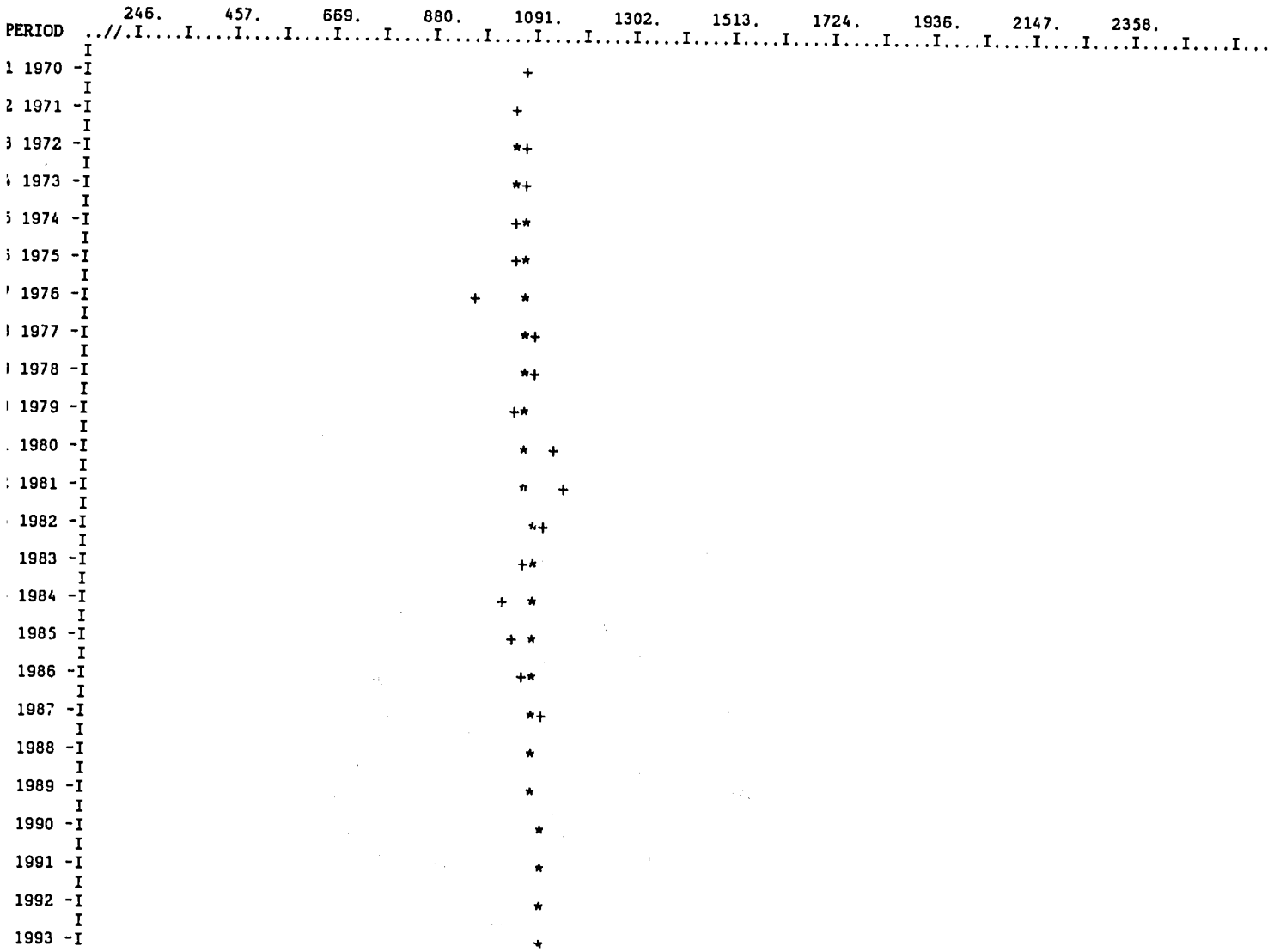
DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987
MALAYSIA UNIT IS GRAMS PER CAPITA X 100 (rsq = .3031)



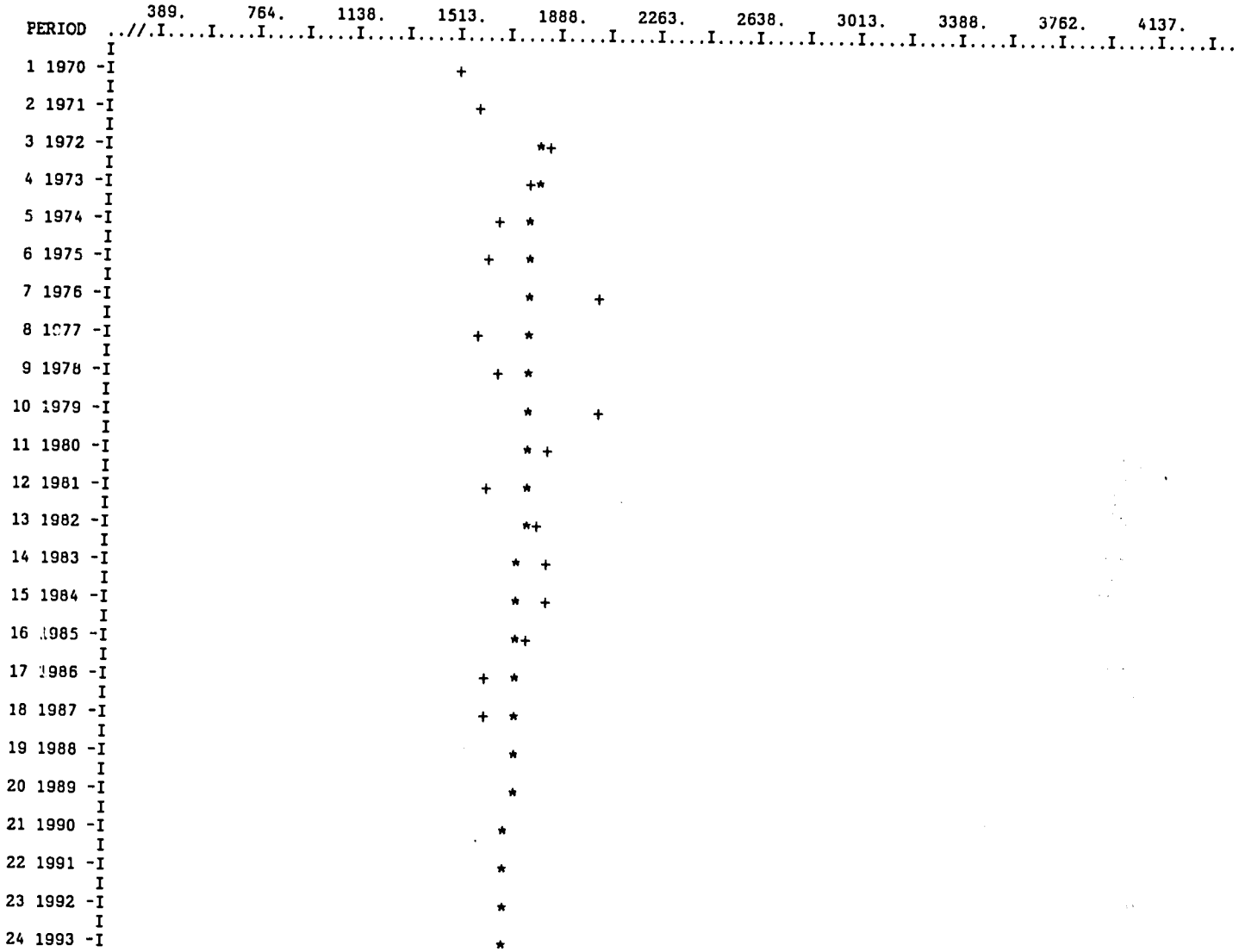
DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987
SINGAPORE UNIT IS GRAMS PER CAPITA X 100 (rsq = .0967)



DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987
PHILIPPINES UNIT IS GRAMS PER CAPITA X 100 (rsq = .0863)



DOMESTIC FOODGRAIN CONSUMPTION BY COUNTRY, ASEAN, 1970-1987
THAILAND UNIT IS GRAMS PER CAPITA X 100 (rsq = .0216)



SECTION VIII

ILLUSTRATION OF FOOD SECURITY ANALYSIS (MPJCASE.SEC)

Concept of Food Security Analysis

The basis for much of the analysis of food security needs in a country or region depends upon the long-term trends and year-to-year deviation patterns in available supplies of staple foods. For this reason, the MASTERPJ program is well suited for food security analysis. However, as indicated earlier starting on page 8 of the Manual, special routines and special commands are needed to tailor the projection program for analysis of food security. The food security case for the ASEAN nations illustrates how this is done.

A total of 18 distinct steps are needed to complete simulation of food stabilization with trade adjustments and food security reserves based on reported food grain supply and utilization patterns for a number of years in the past. These steps (and corresponding output tables) are as follows:

Number	Content	Representation
1.	Annual Supply-Utilization Balance Sheets	S1+S2+S3 = U1+U2+U3+U4 *
2.	Annual Net Food Supplies	U1 = S1+S2+S3-U2-U3-U4 *
3.	Annual Net Food Supplies per Capita	Tab. 2 / Midyear Population
4.	Statistical Trend in per Capita Supplies	S(est) = f(time)
5.	Annual Deviations from Trend	S(obs) - Q(est)
6.	Total Annual Deviation Quantities	Table 5 * Population
7.	Annual Deviations Outside Target Band	Table 6 - Target Band
8.	Needed Stability Transactions for Targets	Table 7 * (-1)
9.	Potential Trade Adjustments	Table 8 * FACTO1, FACTO2
10.	Needed Security Reserve Transactions	Table 8 - Table 9
11.	Simulated In-Country Reserve Transactions	Table 10 with constraints
12.	In-Country Reserve Balances	Cumulative totals, Table 11
13.	Cumulative Storage Capacity In-Country	+ Cumulatives from Table 12
14.	Transactions with Regional Reserves	Table 10 - Table 11
15.	Regional Reserve Balances	Cumulative totals, Table 14
16.	Cumulative Regional Storage Capacity	+ Cumulatives from Table 15
17.	Variable Costs for Security Program	Unit costs * T9, T11, T14
18.	Fixed Costs for Security Program	Unit costs * Capacities

---

* Each S and U quantity carrying an ijk subscript to reflect crop year i, food grain j and country k.

It is apparent from this listing of steps in simulated food security analysis that some are achieved by "standard" MASTERPJ runs while others require special routines and commands. Table 1 is a straight supply-utilization balance sheet for each of the crop years included, involving no projections (NP = 0). Table

2 is similar but reordered to highlight supply quantities for human consumption, and may combine several countries into a common master table. Table 3 is a Y-table obtained by dividing Table 2 by midyear population figures. Table 4 is a standard run for fitting the relevant time trend model to the Table 3 data. If no projections are to be made, then NFIT at Step 7 is set equal to 1. This step is illustrated by the MPJCase One example starting on page 43.

Once the time trend has been fitted, the deviations can be plotted as in MPJCase One. Table 5 reporting the deviations can be produced by another run for which NDEV at Step 7 = 1. Table 6 is produced as a Y table by multiplying Table 5 by the midyear population figures. Table 7 is a modified Y table, obtained by subtracting the absolute value of figures for the target stabilization band from those in Table 6, and assigning the result the sign of the corresponding Table 6 value. In the same run Table 8 can be produced as a conversion table, using a conversion multiplier at Step 9 of -1.000.

Table 9 of simulated stabilizing trade adjustments is accomplished by a special routine in the program activated by setting ISTOCK = 1 and IMPORT = 1. It is an X1 run requiring two complete sets of Table 8 data back to back followed by one blank line. It also needs to have non-zero decimal fractions for FACTO1 and FACTO2 at Step 9 (which by definition should sum to 1.0). Once Table 9 is completed, Table 10 is produced as a straight Y table by subtracting Table 9 from Table 8.

The simultaneous computation of Table 11 and Table 12 is illustrated by the MPJCase Sec presented in the following pages. The run is in the nature of a special Y table, with Y as a function of X1. For X1, ISTOCK is set to 1, and for Y it is set equal to 2. The X1 data includes the Table 10 data followed by the data on storage stock limits and then one line of data for carry-in stocks for the first year in the series. No additional data are needed for the Y-table calculation.

Table 13 is calculated from Table 12 by setting ISTOCK = 1 and NCAP = 1 (Step 9) so that needed storage capacity will increase but not decrease with subsequent changes in levels of simulated storage stocks. Table 14 is a Y table computed by subtracting Table 11 from Table 10. Table 15 is computed from Table 14 by setting ISTOCK = 1 and IREG = 1. Then Table 16 is computed in the same manner as Table 12 , but from Table 15 data, by setting ISTOCK = 1 and NCAP = 1.

Total variable costs estimates for the food security program are computed as the sum of stabilizing trade adjustments, transactions with in-country reserves and transactions with regional reserves, each quantity being multiplied by its relevant unit cost. One component of fixed cost is associated with storage capacity, and is computed in similar fashion from the capacity tables, 13 and 16. Other fixed costs are associated with average inventory levels and are computed by applying appropriate unit costs to the values from Table 12 and Table 15. The final fixed cost component of food security programs, that for administration, is not impacted directly by volumes simulated under different stability program assumptions.

Description of the ASEAN Food Security Case

This food security case involves computation of simulated transactions and year-end balances for food security reserves (in rice equivalent) by country for the nations in the ASEAN group. The computations are just two of the 18 distinct steps in simulating food security programs as outlined in the previous section. These Steps 11 and 12 come after the needs for stability have been determined and trade adjustments computed. They serve as basis for computing transactions with regional security reserves and subsequent steps as outlined. Given for the illustrated run are the computed Table 10 values for successive years and the need to fit the security reserves by country to reasonable constraints on inventory levels of the security reserve stocks.

Options of MASTERPJ which are exercised in the simulations reported here include the following:

1. Structuring the problem as a special Y-table run with X1 producing Table 11 and Y producing Table 12.

2. Use of ISTOCK options at Step 9; ISTOCK = 1 for X1, and = 2 for Y.

3. Providing three data sets with X1 (Table 10 data for 18 years, then maximum storage capacities for the 18 years, and finally carryover storage inventories at the start of the first year), and no additional data for the Y table.

4. Setting KARDM at Step 2 = 1 for both X1 and Y in order to make a computer file of both Table 11 and Table 12 data.

5. Setting NFAC = 1 (Step 0), NA and NU = 18, NC = 5 and IYIN = 1 (Step 1), NOMOD = 1 (Step 2), IANN = 1 (Step 3), and NCS = 1 (Step 5) for both X1 and Y.

6. Setting NEGNO at Step 2 = 1 for both X1 and Y.

The data and results for the case are presented on the following pages in the standard order followed throughout the manual, namely:

1. Reproduction of the file of input commands (INPUT.MPJ) created with MASTER1 for the run.

2. Reproduction of the input data file, MPJDATA.RUN, for the case.

3. The output master table for X1, Table 11.

4. The output conversion table for X1, Table 11A.

5. The output master table for Y, Table 12.

6. The output conversion table for Y, Table 12A.

7. Image of the computer file of the data in Table 11 and Table 12.

Commands and Headings for the Case

The commands and headings for MPJCase Sec as contained in the INPUT.MPJ file developed in the MASTER1 run are listed below. The nine rows of numbers in I4 format represent the input information and commands for Steps 0 through 8. The entries on line 9 activate the ISTOCK option and provide the conversion factor for conversions from milled rice to rough rice equivalent. The remaining entries provide the table title, column headings and footnotes for the output tables.

The commands and headings for X1 are entered first, followed by those for Y. All of the steps except Step 0 need to be re-entered for Y. The commands are identical for X1 and Y except for ISTOCK at Step 9 which is entered as 1 for X1 and as 2 for Y. The table titles and footnotes for the Y tables differ from those of the X1 tables.

Commands and Headings for X1

```
 40  40   1   1   0   1   1
 18  18   0   0   0   5   0   1   0   0
  0   1   0   1   0   1   0   0   0   1
  1   0   0   0   0  01970   0   0   0
  0   0   0   0   0   0   0   0   0   0
  1   5   0   0   0   0   0   0   0   0   0
  1   5   0   0   0   0   0   0   0   0   0
  1   1   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0
  1   0   0   0   0 .0000 1.5385  .0000  .0000 1.0000  .0000
                  TABLE 11. RICE ONLY

       (1000 METRIC TONS, MILLED RICE EQUIVALENT)

   COMPUTED ANNUAL TRANSACTIONS WITH IN-COUNTRY RESERVES

  BY ASEAN COUNTRY, 1970-1987, ASSUMING IMPORT ADJUSTMENTS


                  TABLE 11A. RICE ONLY

       (1000 METRIC TONS, ROUGH RICE EQUIVALENT)

  PERIOD

 NO. YEAR INDONESIA  MALAYSIA SINGAPORE PHILIPPINES THAILAND

TABLE 10 DATA, SUBJECT TO THE CONSTRAINTS THAT TABLE 12 FIGURES BE NO LESS

THAN ZERO AND NO MORE THAN MAXIMUMS BASED ON DEVIATIONS IN TABLE 6.
```

Commands and Headings for Y

```
18  18   0   0   0   5   0   1   0   0
 0   1   0   1   0   1   0   0   0   1
 1   0   0   0   0   01970   0   0   0
 0   0   0   0   0   0   0   0   0   0
 1   5   0   0   0   0   0   0   0   0   0
 1   5   0   0   0   0   0   0   0   0   0
 1   1   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0
 2   0   0   0   0 .0000 1.5385  .0000  .0000 1.0000  .0000
                 TABLE 12. RICE ONLY
```

(1000 METRIC TONS, MILLED RICE EQUIVALENT)

COMPUTED YEAR-END BALANCES FOR IN-COUNTRY RESERVES

BY ASEAN COUNTRY, 1970-1987, ASSUMING IMPORT ADJUSTMENTS

TABLE 12A. RICE ONLY

(1000 METRIC TONS, ROUGH RICE EQUIVALENT)

PERIOD

NO. YEAR INDONESIA MALAYSIA SINGAPORE PHILIPPINES THAILAND

CUMULATIVE TOTALS FROM TABLE 11, STARTING WITH BEGINNING RESERVES EQUAL TO ONE STANDARD DEVIATION (SEE TABLE 6).

Table of Input Data for the Case

The table of input data for MPJCase Sec as contained in the MPJDATA.RUN file for the case is listed below. The input is contained in an ASCII file in the format I3, 5X, 8F9.0. The file was created using the DOS editor, EDLIN, or LOTUS 123 as outlined in Section IV.

The input represents 18 consecutive years of historical data on computed needed reserve transactions and maximum security reserves by ASEAN country. The data are reported in units of 1,000 metric tons. From left to right the five columns of data are for Indonesia, Malaysia, Singapore, Philippines and Thailand, respectively.

1	453	0	1	0	-194
2	-150	-5	-1	0	8
3	433	11	-10	0	110
4	-249	-6	15	0	10
5	96	3	-21	0	-30
6	-341	9	10	0	-31
7	-92	-4	-22	-132	394
8	-443	-56	5	66	-352
9	63	2	5	-33	110
10	-32	-1	-2	17	347
11	16	0	26	21	-59
12	-8	16	18	70	-107
13	4	18	36	-9	53
14	-2	0	-18	4	14
15	1	38	-17	-16	78
16	0	-19	-34	8	-39
17	32	-16	17	-4	-166
18	-16	5	-7	2	-141
1	836	53	45	103	391
2	871	55	46	106	403
3	903	57	47	109	416
4	920	59	47	112	429
5	956	61	48	116	442
6	994	63	48	119	456
7	1024	64	48	123	471
8	1061	65	49	127	486
9	1100	66	48	131	506
10	1140	67	48	134	517
11	1182	68	48	138	539
12	1221	70	47	141	539
13	1271	72	47	145	575
14	1320	75	47	149	592
15	1369	77	46	153	609
16	1420	79	46	157	625
17	1472	80	45	161	642
18	1527	83	45	165	662
-1	418	27	23	52	196

Using this input, the MASTERPJ program was used to compute annual transactions and year-end balances for in-country reserves as shown on the following pages.

Master Projection Tabular Output

The tabular output for the illustrated food security case includes computed annual transactions with in-country reserves (Table 11) and computed year-end balances in the reserves (Table 12).

Computed Annual Transactions with In-Country Reserves

The computed annual transactions with in-country reserves are based on previously computed transactions needed to maintain targeted stability levels in annual supplies of food grains (Table 10). They are subject to the constraint that reserve stock levels be no less than zero and no more than specified maximums.

TABLE 11. RICE ONLY
(1000 METRIC TONS, MILLED RICE EQUIVALENT)

		COMPUTED ANNUAL TRANSACTIONS WITH IN-COUNTRY RESERVES BY ASEAN COUNTRY, 1970-1987, ASSUMING IMPORT ADJUSTMENTS					
PERIOD NO.	YEAR	INDONESIA	MALAYSIA	SINGAPORE	PHILIPPINES	THAILAND	ASEAN TOTAL
1	1970	418	0	1	0	-194	225
2	1971	-150	-5	-1	0	8	-148
3	1972	217	11	-10	0	110	328
4	1973	-249	-6	15	0	10	-230
5	1974	96	3	-21	0	-30	48
6	1975	-341	9	10	0	-31	-353
7	1976	-92	-4	-17	-52	394	229
8	1977	-317	-35	5	66	-352	-633
9	1978	63	2	5	-33	110	147
10	1979	-32	-1	-2	17	296	278
11	1980	16	0	26	21	-59	4
12	1981	-8	16	13	70	-107	-16
13	1982	4	18	0	-9	53	66
14	1983	-2	0	-18	4	14	-2
15	1984	1	38	-17	-16	78	84
16	1985	0	-19	-12	8	-39	-62
17	1986	32	-16	17	-4	-166	-137
18	1987	-16	5	-7	2	-141	-157

SOURCE:
TABLE 10 DATA, SUBJECT TO THE CONSTRAINTS THAT TABLE 12 FIGURES BE NO LESS THAN ZERO AND NO MORE THAN MAXIMUMS BASED ON DEVIATIONS IN TABLE 6.

The computed master table (Table 11) appears first, followed by the corresponding conversion table (Table 11A). The latter is converted from milled rice to rough rice equivalent on the assumption that rice security reserves would be stored in rough rice form.

TABLE 11A. RICE ONLY
(1000 METRIC TONS, ROUGH RICE EQUIVALENT)

		COMPUTED ANNUAL TRANSACTIONS WITH IN-COUNTRY RESERVES BY ASEAN COUNTRY, 1970-1987, ASSUMING IMPORT ADJUSTMENTS					
PERIOD NO.	YEAR	INDONESIA	MALAYSIA	SINGAPORE	PHILIPPINES	THAILAND	ASEAN TOTAL
1	1970	643	0	2	0	-298	347
2	1971	-231	-8	-2	0	12	-229
3	1972	334	17	-15	0	169	505
4	1973	-383	-9	23	0	15	-354
5	1974	148	5	-32	0	-46	75
6	1975	-525	14	15	0	-48	-544
7	1976	-142	-6	-26	-80	606	352
8	1977	-488	-54	8	102	-542	-974
9	1978	97	3	8	-51	169	226
10	1979	-49	-2	-3	26	455	427
11	1980	25	0	40	32	-91	6
12	1981	-12	25	20	108	-165	-24
13	1982	6	28	0	-14	82	102
14	1983	-3	0	-28	6	22	-3
15	1984	2	58	-26	-25	120	129
16	1985	0	-29	-18	12	-60	-95
17	1986	49	-25	26	-6	-255	-211
18	1987	-25	8	-11	3	-217	-242

SOURCE:
TABLE 10 DATA, SUBJECT TO THE CONSTRAINTS THAT TABLE 20 FIGURES BE NO LESS THAN ZERO AND NO MORE THAN MAXIMUMS BASED ON DEVIATIONS IN TABLE 6.

Computed Year-End Balances for In-Country Reserves

The computed year-end balances for in-country reserves are based on the computed annual transactions and the ending balances for the previous year. The computation is simultaneous with the computed transactions since the constraint on stock levels is applied to the annual transactions.

TABLE 12. RICE ONLY
(1000 METRIC TONS, MILLED RICE EQUIVALENT)

COMPUTED YEAR-END BALANCES FOR IN-COUNTRY RESERVES
BY ASEAN COUNTRY, 1970-1987, ASSUMING IMPORT ADJUSTMENTS

PERIOD NO.	YEAR	INDONESIA	MALAYSIA	SINGAPORE	PHILIPPINES	THAILAND	ASEAN TOTAL
1	1970	836	27	24	52	2	941
2	1971	686	22	23	52	10	793
3	1972	903	33	13	52	120	1121
4	1973	654	27	23	52	130	891
5	1974	750	30	7	52	100	939
6	1975	409	39	17	52	69	586
7	1976	317	35	0	0	463	815
8	1977	0	0	5	66	111	182
9	1978	63	2	10	33	221	329
10	1979	31	1	8	50	517	607
11	1980	47	1	34	71	458	611
12	1981	39	17	47	141	351	595
13	1982	43	35	47	132	404	661
14	1983	41	35	29	136	418	659
15	1984	42	73	12	120	496	743
16	1985	42	54	0	128	457	681
17	1986	74	38	17	124	291	544
18	1987	58	43	10	126	150	387

SOURCE:
CUMULATIVE TOTALS FROM TABLE 11, STARTING WITH BEGINNING RESERVES EQUAL TO ONE STANDARD DEVIATION (SEE TABLE 6).

As with the X1 tables, the computed master Y-table (Table 12) appears first, followed by the corresponding conversion table (Table 12A). The average conversion rate to convert from milled rice to rough rice equivalent in ASEAN over the period considered is 1.5385. This corresponds to an average milling rate for rice of 65 per cent.

TABLE 12A. RICE ONLY
(1000 METRIC TONS, ROUGH RICE EQUIVALENT)

COMPUTED YEAR-END BALANCES FOR IN-COUNTRY RESERVES
BY ASEAN COUNTRY, 1970-1987, ASSUMING IMPORT ADJUSTMENTS

PERIOD NO.	YEAR	INDONESIA	MALAYSIA	SINGAPORE	PHILIPPINES	THAILAND	ASEAN TOTAL
1	1970	1286	42	37	80	3	1448
2	1971	1055	34	35	80	15	1219
3	1972	1389	51	20	80	185	1725
4	1973	1006	42	43	80	200	1371
5	1974	1154	46	11	80	154	1445
6	1975	629	60	26	80	106	901
7	1976	488	54	0	0	712	1254
8	1977	0	0	8	102	171	281
9	1978	97	3	15	51	340	506
10	1979	48	2	12	77	795	934
11	1980	72	2	52	109	705	940
12	1981	60	26	72	217	540	915
13	1982	66	54	72	203	622	1017
14	1983	63	54	45	209	643	1014
15	1984	65	112	18	185	763	1143
16	1985	65	83	0	197	703	1048
17	1986	114	58	26	191	448	837
18	1987	89	66	15	194	231	595

SOURCE:
CUMULATIVE TOTALS FROM TABLE 11, STARTING WITH BEGINNING RESERVES EQUAL TO ONE STANDARD DEVIATION (SEE TABLE 6).

Reproduction of Data Files Created

Computer File of Table 11 Data

1	1970	418.	0.	1.	0.	-194.
2	1971	-150.	-5.	-1.	0.	8.
3	1972	217.	11.	-10.	0.	110.
4	1973	-249.	-6.	15.	0.	10.
5	1974	96.	3.	-21.	0.	-30.
6	1975	-341.	9.	10.	0.	-31.
7	1976	-92.	-4.	-17.	-52.	394.
8	1977	-317.	-35.	5.	66.	-352.
9	1978	63.	2.	5.	-33.	110.
10	1979	-32.	-1.	-2.	17.	296.
11	1980	16.	0.	26.	21.	-59.
12	1981	-8.	16.	13.	70.	-107.
13	1982	4.	18.	0.	-9.	53.
14	1983	-2.	0.	-18.	4.	14.
15	1984	1.	38.	-17.	-16.	78.
16	1985	0.	-19.	-12.	8.	-39.
17	1986	32.	-16.	17.	-4.	-166.
18	1987	-16.	5.	-7.	2.	-141.

Computer File of Table 12 Data

1	1970	836.	27.	24.	52.	2.
2	1971	686.	22.	23.	52.	10.
3	1972	903.	33.	13.	52.	120.
4	1973	654.	27.	28.	52.	130.
5	1974	750.	30.	7.	52.	100.
6	1975	409.	39.	17.	52.	69.
7	1976	317.	35.	0.	0.	463.
8	1977	0.	0.	5.	66.	111.
9	1978	63.	2.	10.	33.	221.
10	1979	31.	1.	8.	50.	517.
11	1980	47.	1.	34.	71.	458.
12	1981	39.	17.	47.	141.	351.
13	1982	43.	35.	47.	132.	404.
14	1983	41.	35.	29.	136.	418.
15	1984	42.	73.	12.	120.	496.
16	1985	42.	54.	0.	128.	457.
17	1986	74.	38.	17.	124.	291.
18	1987	58.	43.	10.	126.	150.

SECTION IX

PROJECTIONS OF RICE PRODUCTION IN PANAMA (MPJCASE.PAN)

Description of the Case

This Panama rice production case involves master projections of yields, areas harvested and production of rice in Panama for the period 1989 through 1997 plus creation of computer files for prorate projections of harvested areas by district within Chiriqui Province.

The MASTERPJ problem is structured with logarithmic projections of average yields for the first harvest as X1, exponential (1.3) projection of rice areas as X2, and the product of these two for estimates of rice production as Y. Charts of yield trends are made for the country as a whole and for two provinces, one with increasing yields and one with decreasing yields. Area trends are charted for two master columns, Los Santos Province with declining areas and Cocle Province with increasing production areas for rice. A table of regression trend estimates is requested for the area trends. The production estimates are reported in units of metric tons of rough rice.

Options of MASTERPJ which are exercised in the projections reported here include the following:

1. As X1, logarithm projections of rice yields for the nine provinces plus first and second crop totals for the country as a whole (NFAC at Step 0 = 2).

2. Plot of yield trends for the country as a whole, for Chiriqui Province and for Los Santos Province, all with expanded Y axis (LPLOT at Step 7 = 0).

3. As X2, exponential projections at 1.3 of areas in rice for the nine provinces plus a total column (NOTL at Step 2 = 0) plus a table of regression estimates (JEST at Step 7 = 1).

4. Rice area plots for two provinces, Los Santos and Cocle, with expanded Y axis (LPLOT at Step 7 = 0).

5. Computer file of OUTPUT.MPJ for X2 for proration use (JCOUTY at Step 7 = 1).

6. Master Y table of rice production for 22 years, periods 3 ... 24.

The data and results for the case are presented on the following pages in the standard order followed throughout the manual, namely:

1. Reproduction of the file of MASTERPJ input commands and headers (INPUT.MPJ) for the run, starting with those for X1 (yields), followed by those for X2 (areas), and then those for Y (production).

2. Reproduction of the data input file, MPJDATA.RUN, containing the time series data by province in Panama, first for rice yields and second for areas harvested.

3. The output master table for X1, Table 2, Average Yields of Rough Rice in Panama.

3. Graphic output for each requested column for the X1 master table in the order that they appear from left to right in the table. *

4. The output master table for X2, Table 3A, Areas Planted to Rice in Panama.

5. The requested regression estimates for Table 3A.

6. Graphic output for requested columns from the X2 master table in the order that they appear in the table. *

7. The output master table for Y, Table 1A, Projected Production of Rice in Panama.

8. Image of the MASTERPJ computer output file for X2, OUTPUT.MPJ, for use in making proration projections by district.

---

* In the normal order printing of output by MASTERPJ, the main master output table follows the corresponding graphs which have been ordered for the run.

Commands and Headings for the Case

The commands and headings for the Panama rice production case are listed separately for X1, for X2, and for Y.

Commands and Headings for X1

The commands for X1 are designed to make logarithmic projections of rice yields by province in Panama for nine years, through 1997. Graphs will be plotted for two of the provinces, Chiriqui and Los Santos, and for the first crop rice for the country as a whole.

```
 40  40   1   1   0   1   2
 15  15   0   0   9  12   2   1   1   0
  0   1   0   0   0   0   0   0   0   0   0
  1   0   0   0   0   01974   0   0   0
  0   0   0   0   0   0   0   0   0   0
  2   8   4   0   0   0   0   0   0   0   0
  1  12   0   0   0   0   0   0   0   0   0
  0   0   1   0   0   0   0   0   0
  0   1   0   0   1   0   0   0   0   0   0   1   0
  0   0   0   0   0 .0000 1.0000  .0000  .0000 1.0000  .0000
 LBS. PER HECTARE
```

TABLE 2. AVERAGE YIELDS OF ROUGH RICE FOR FIRST HARVEST IN PANAMA PER YEAR 1974-1988, WITH PROJECTIONS THROUGH 1997

(UNIT IS POUNDS PER HECTARE)

PROVINCE

YEAR	BOCAS DEL TORO	CHIRIQUI	VERAGUAS	HERRERA	LOS SANTOS	COCLE	PANAMA	COLON	DARIEN	FOR THE REPUBLIC TOTAL	2ND CROP	1ST CROP

Estadistica Panamena, Información Agropecuaria. Superficie Sembrada, y Producción de Arroz, Maiz y Frijol, 1974-1988.
Dirección de Estadística y Censo.

CHIRIQUI PROV.
LOS SANTOS PROV.
PANAMA 1ST CROP

Commands and Headings for X2

The commands for X2 are designed to make projections through 1997 of areas planted to first crop rice by province in Panama, using an exponent of 1.3 on the time variable. With the JEST command set to 1, the program will create an additional table of the regression estimates for areas planted over the historical and projected period. Graphs of the trends in planted areas are to be plotted for two provinces, Los Santos and Cocle. With the JCOUTY command set to 1, the program will create a disk file of the X2 projections for later use in making prorations of the projections down to the district level.

```
 13  13   3   3   9   9   2   3   0   0
  0   0   0   0   0   0   0   0   0   0   0
  1   0   0   0   0   01976   0   0   0
  0   0   0   0   0   0   0   0   0   0
  2   8   1   0   0   0   0   0   0   0   0
  1   9   0   0   0   0   0   0   0   0   0
  0   0   1   1   1   1   0   0   0
  0   0   0   0   1   1   0   0   0   0   0   0   0
  0   0   0   0   0 .0000 1.0000  .0000  .0000 .04545  .0000
100 HECTARES
```

TABLE 3A. AREA PLANTED TO RICE IN PANAMA,

FIRST CROP

UNIT = 100 HECTARES

PER YEAR 1976 THROUGH 1988, WITH PROJECTIONS

THROUGH 1997

PROVINCE

YEAR	BOCAS DEL TORO	PANAMA CHIRIQUI	VERAGUAS	HERRERA	LOS SANTOS	COCLE	PANAMA
COLON	DARIEN	TOTAL					

Estadistica Panamena, Información Agropecuaria, Superficie Sembrada, y Producció
n de Arroz, Maiz y Frijol, 1974-1988.
Dirección de Estadística y Censo.

LOS SANTOS PROV.
COCLE PROV.

Commands and Headings for Y

The commands for the Y table take the historical plus projected values of yields and areas planted as 22 periods of historical data, so that no additional projections are necessary. The commands will create a conversion Y-table from the corresponding master table, converting from units of metric tons of rough rice to units of metric tons in milled rice equivalent. The milling rate of 61.5 per cent is used for this purpose.

```
22  22  0  0  0  9  2  3  0  0
 0   0  0  0  0  0  0  0  0  0  0
 1   0  0  0  0  01976  0  0  0
 0   0  0  0  0  0  0  0  0  0
 2   8  1  0  0  0  0  0  0  0  0
 1   9  0  0  0  0  0  0  0  0  0
 1   1  0  0  0  0  0  0  0
 0   0  0  0  0  0  0  0  0  0  0  0  0
 0   0  0  0  0 .0000  .615  .0000  .0000  1.000  .0000
```

PANAMA, FIRST CROP

TABLE 1A. PROJECTED PRODUCTION OF RICE IN METRIC TONS OF ROUGH RICE PER YEAR 1966 THROUH 1987 WITH PROJECTIONS TO 1997

PROVINCE

PANAMA, FIRST CROP

TABLE 1B. PROJECTED PRODUCTION OF RICE IN IN MILLED RICE EQUIVALENT (METRIC TONS)

YEAR	BOCAS DEL TORO	PANAMA CHIRIQUI	VERAGUAS	HERRERA	LOS SANTOS	COCLE	PANAMA
COLON	DARIEN	TOTAL					

Y-Table estimates based on yields in Table 2 and areas harvested in Table 3A.

Tables of Input Data for the Case

Although in the same MPJDATA.RUN file, the input tables for the Panama rice production case are shown below separately for X1 and for X2. There is no additional data input for the Y output.

Input Data for X1

The input data for X1 cover 15 years and 12 columns of average yield data. The columns are for the different provinces in Panama plus three national average yields. The latter include the total of both crops plus separate average yields for the first and second crops.

1	1880	2500	3000	3540	2530	1800	2570	1440
2	1750	2880	3170	2880	2330	1700	2240	1720
3	840	2490	2640	2800	2440	1840	1860	1450
4	1700	2780	2280	2460	2630	1620	2280	1780
5	1020	2920	2080	2920	2450	2000	2440	1930
6	990	3100	2010	2830	2290	1830	2200	1820
7	1630	2700	2270	2750	2580	1610	1800	2070
8	1550	3270	2510	2840	1780	2140	2040	1940
9	1500	2830	2210	2440	2110	1920	2400	1580
10	1500	3710	2360	2620	2180	2070	1950	1680
11	1350	3960	2600	3030	2200	2640	1750	1750
12	1360	4360	2400	2580	2370	2770	1700	1530
13	600	4290	1890	1970	2020	3500	1880	1460
14	600	4620	2030	2330	2050	3700	1790	1580
15	1000	4980	1680	1870	1960	2580	1450	1930
1	2750	2630	2670	2280				
2	2980	2650	2740	1970				
3	2650	2380	2440	2130				
4	3900	2390	2480	2010				
5	3300	2430	2450	2270				
6	3250	2370	2380	2280				
7	3030	2330	2340	2230				
8	3100	2510	2560	2090				
9	3140	2350	2380	2100				
10	3130	2570	2570	2540				
11	3200	2800	2780	2840				
12	3200	2900	2940	2580				
13	2020	2920	2870	3240				
14	2020	3150	3050	3700				
15	2080	2830	2830	2830				

Input Data for X2

The input data for X2 covers 13 years and nine columns, one for each of the province in Panama. These data on areas planted to first crop rice are listed in units of 10 hectares. These numbers, and projections based on the statistical trends, will b multiplied by the corresponding average yield figures to obtain the estimates of firs crop rice production by province in Panama.

1	3	151	228	71	94	77	74	23
2	2	162	247	70	98	98	89	29
3	4	181	266	77	106	100	82	28
4	7	171	256	86	127	95	101	32
5	9	221	274	118	127	112	126	39
6	5	232	358	116	117	135	127	40
7	5	226	356	113	120	131	132	49
8	5	248	369	97	105	127	118	40
9	3	222	310	116	114	172	110	38
10	4	261	300	95	102	186	90	36
11	5	226	197	63	68	178	63	19
12	5	213	186	53	65	178	67	22
13	5	266	216	52	75	208	86	22
1	16							
2	18							
3	21							
4	33							
5	36							
6	43							
7	49							
8	46							
9	38							
10	38							
11	12							
12	12							
13	12							

Output Projections for Rice Yields

Projected Tabular Output

TABLE 2. AVERAGE YIELDS OF ROUGH RICE FOR FIRST HARVEST IN PANAMA PER YEAR 1974-1988, WITH PROJECTIONS THROUGH 1997

(UNIT IS POUNDS PER HECTARE)

LOGARITHM PROJECTION

		PROVINCE											
											FOR THE REPUBLIC		
	YEAR	BOCAS DEL TORO	CHIRIQUI	VERAGUAS	HERRERA	LOS SANTOS	COCLE	PANAMA	COLON	DARIEN	TOTAL	2ND CROP	1ST CROP
1	1974	1880	2500	3000	3540	2530	1800	2570	1440	2750	2630	2670	2280
2	1975	1750	2880	3170	2880	2330	1700	2240	1720	2980	2650	2740	1970
3	1976	840	2490	2640	2800	2440	1840	1860	1450	2650	2380	2440	2130
4	1977	1700	2780	2280	2460	2630	1620	2280	1780	3900	2390	2480	2010
5	1978	1020	2920	2080	2920	2450	2000	2440	1930	3300	2430	2450	2270
6	1979	990	3100	2010	2830	2290	1830	2200	1820	3250	2370	2380	2280
7	1980	1630	2700	2270	2750	2580	1610	1800	2070	3030	2330	2340	2230
8	1981	1550	3270	2510	2840	1780	2140	2040	1940	3100	2510	2560	2090
9	1982	1500	2830	2210	2440	2110	1920	2400	1580	3140	2350	2380	2100
10	1983	1500	3710	2360	2620	2180	2070	1950	1680	3130	2570	2570	2540
11	1984	1350	3960	2600	3030	2200	2640	1750	1750	3200	2800	2780	2840
12	1985	1360	4360	2400	2580	2370	2770	1700	1530	3200	2900	2940	2580
13	1986	600	4290	1890	1970	2020	3500	1880	1460	2020	2920	2870	3240
14	1987	600	4620	2030	2330	2050	3700	1790	1580	2020	3150	3050	3700
15	1988	1000	4980	1680	1870	1960	2580	1450	1930	2080	2830	2830	2830
16	1989	864	4910	1879	2121	1975	3220	1618	1712	2377	2913	2865	3165
17	1990	829	5152	1831	2065	1943	3382	1575	1713	2322	2954	2897	3270
18	1991	794	5407	1785	2011	1912	3553	1534	1715	2268	2996	2929	3380
19	1992	761	5674	1739	1958	1881	3733	1494	1716	2215	3039	2962	3493
20	1993	730	5954	1695	1906	1851	3921	1455	1718	2164	3082	2995	3610
21	1994	700	6248	1651	1856	1821	4119	1417	1719	2114	3126	3028	3731
22	1995	671	6557	1609	1807	1792	4328	1380	1721	2065	3170	3062	3856
23	1996	643	6880	1568	1760	1763	4546	1344	1722	2017	3215	3096	3985
24	1997	616	7220	1528	1714	1735	4776	1308	1724	1970	3260	3130	4118
Log	Ybar	7.0998	8.1132	7.7453	7.8731	7.7180	7.6827	7.6007	7.4382	7.9612	7.8643	7.8721	7.7964
	b(%)	-.0422	.0482	-.0258	-.0267	-.0162	.0493	-.0265	.0009	-.0235	.0141	.0110	.0329
	rsq	.2579	.8551	.4671	.5390	.4210	.6869	.5527	.0011	.2870	.4371	.3375	.6402
	Syz	.3325	.0921	.1281	.1145	.0882	.1545	.1107	.1221	.1716	.0741	.0718	.1145
	sb	.0199	.0055	.0077	.0068	.0053	.0092	.0066	.0073	.0103	.0044	.0043	.0068

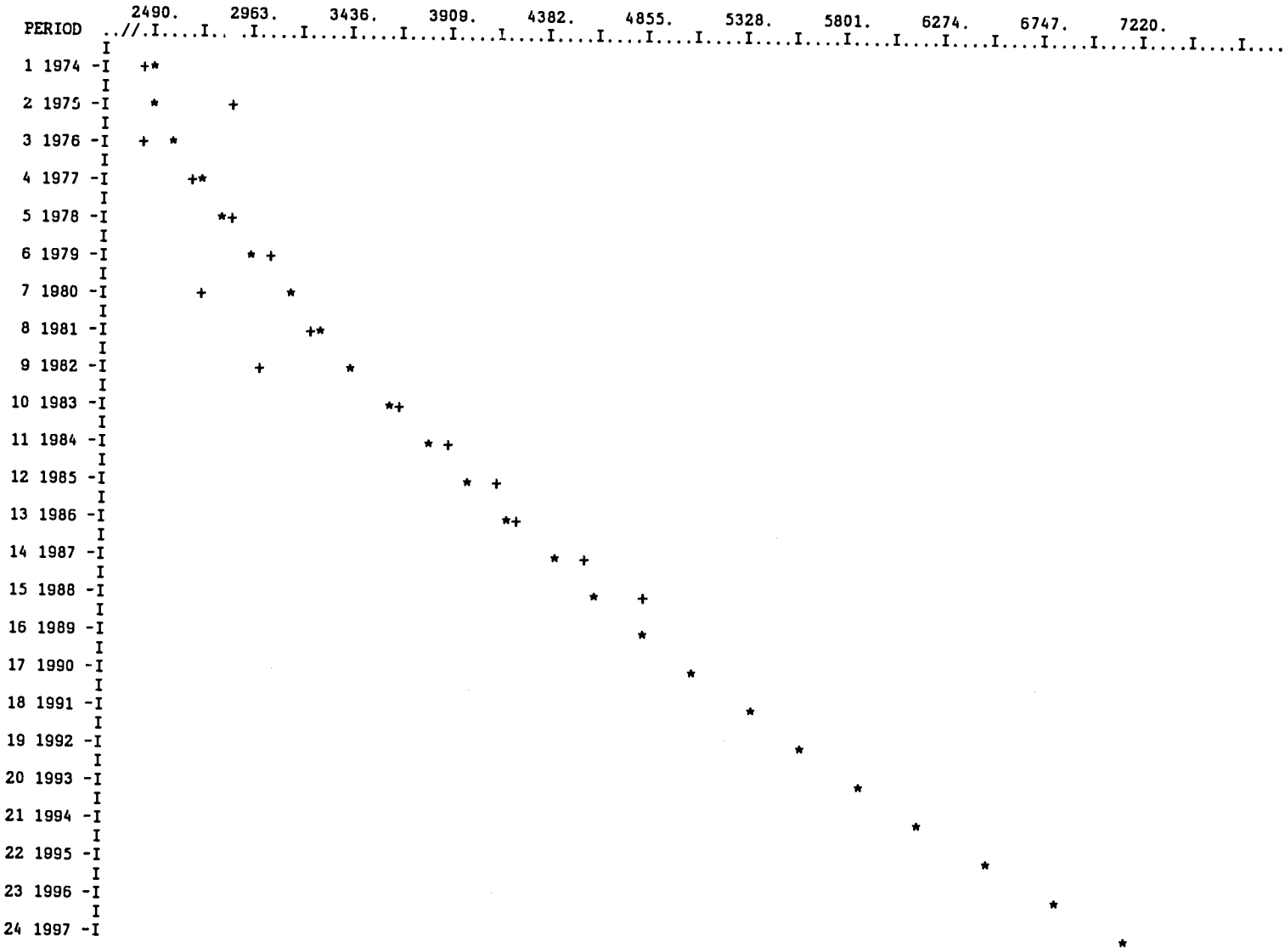
SOURCE:
Estadistica Panamena, Información Agropecuaria, Superficie Sembrada, y Producción de Arroz, Maíz y Frijol, 1974-1988. Dirección de Estadística y Censo.

Note: See page 24 for brief explanation of the statistical coefficients displayed.

Graphic Output for Chiriqui Province

PLOT OF OBSERVED AND ESTIMATED DATA

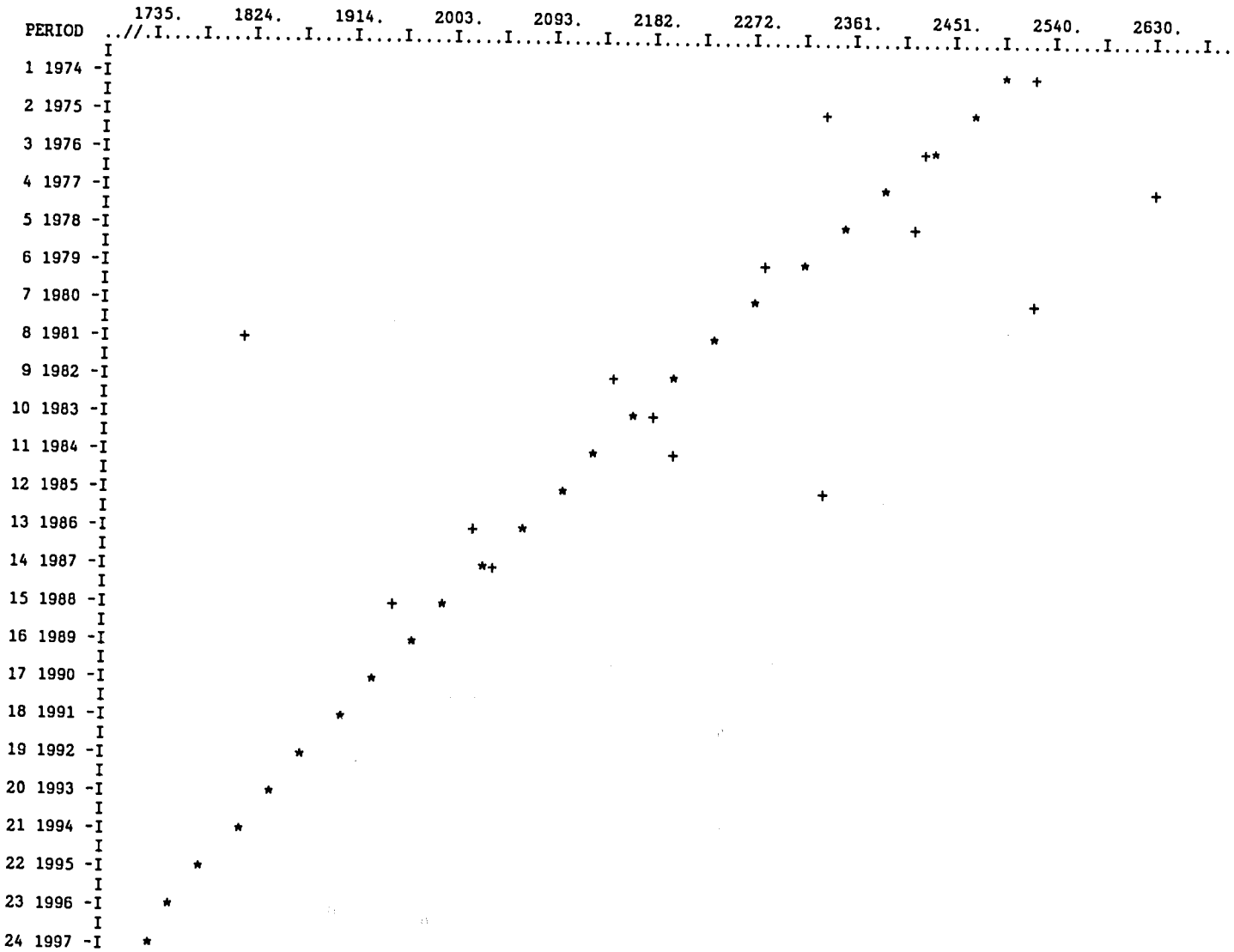
TABLE 2. AVERAGE YIELDS OF ROUGH RICE FOR FIRST HARVEST IN PANAMA
CHIRIQUI PROV. UNIT IS LBS. PER HECTARE X 1 (rsq = .8551)



Graphic Output for Los Santos Province

PLOT OF OBSERVED AND ESTIMATED DATA

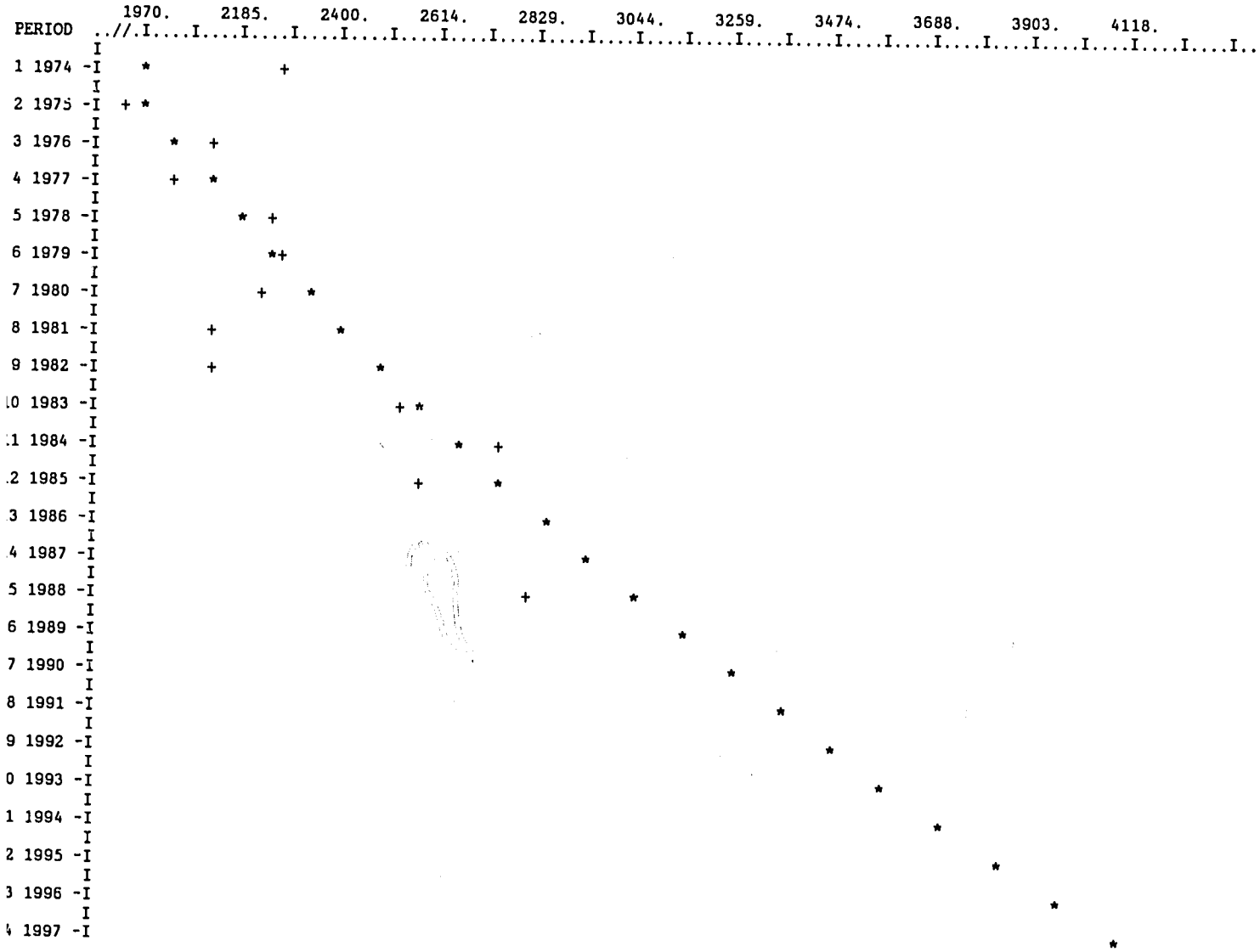
TABLE 2. AVERAGE YIELDS OF ROUGH RICE FOR FIRST HARVEST IN PANAMA
LOS SANTOS PROV. UNIT IS LBS. PER HECTARE X 1 (rsq = .4210)



Graphic Output for Panama 1st Crop

PLOT OF OBSERVED AND ESTIMATED DATA

TABLE 2. AVERAGE YIELDS OF ROUGH RICE FOR FIRST HARVEST IN PANAMA
PANAMA 1ST CROP UNIT IS LBS. PER HECTARE X 1 (rsq = .6402)



Output Projections for Rice Areas Planted

Master Table Output

TABLE 3A. AREA PLANTED TO RICE IN PANAMA, FIRST CROP
UNIT = 100 HECTARES

PER YEAR 1976 TO 1988, WITH PROJECTIONS THROUGH 1997

EXPONENT IS 1.30

		PROVINCE									
	YEAR	BOCAS DEL TORO	CHIRIQUI	VERAGUAS	HERRERA	LOS SANTOS	COCLE	PANAMA	COLON	DARIEN	PANAMA TOTAL
3	1976	3	151	228	71	94	77	74	23	16	737
4	1977	2	162	247	70	98	98	89	29	18	813
5	1978	4	181	266	77	106	100	82	28	21	865
6	1979	7	171	256	86	127	95	101	32	33	908
7	1980	9	221	274	118	127	112	126	39	36	1062
8	1981	5	232	358	116	117	135	127	40	43	1173
9	1982	5	226	356	113	120	131	132	49	49	1181
10	1983	5	248	369	97	105	127	118	40	46	1155
11	1984	3	222	310	116	114	172	110	38	38	1123
12	1985	4	261	300	95	102	186	90	36	38	1112
13	1986	5	226	197	63	68	178	63	19	12	831
14	1987	5	213	186	53	65	178	67	22	12	801
15	1988	5	266	216	52	75	208	86	22	12	942
16	1989	5	271	248	73	76	218	86	28	24	1029
17	1990	5	281	244	71	72	231	85	27	23	1039
18	1991	5	291	239	68	68	245	83	27	22	1048
19	1992	5	301	235	66	63	258	81	26	22	1057
20	1993	5	311	231	64	59	272	79	25	21	1067
21	1994	5	321	226	61	54	286	77	25	20	1075
22	1995	5	331	221	59	50	301	75	24	19	1085
23	1996	5	342	216	56	45	315	73	23	18	1093
24	1997	5	352	212	53	41	330	71	22	17	1103
	Ybar	4.77	213.85	274.08	86.69	101.38	138.23	97.31	32.08	28.77	
	b	.02	3.27	-1.47	-.78	-1.44	4.53	-.62	-.23	-.27	
	rsq	.0071	.6223	.0460	.0828	.3710	.9299	.0545	.0501	.0301	
	Syx	1.8595	23.7337	62.5041	24.3049	17.4037	11.5727	23.8804	9.2600	14.3401	
	sb	.06	.77	2.02	.79	.56	.37	.77	.30	.46	

SOURCE:
Estadistica Panamena, Información Agropecuaria, Superficie Sembrada y Producción de Arroz, Maíz y Frijol, 1976-1988.
Dirección de Estadística y Censo.

Note: See page 24 for brief explanation of the statistical coefficients displayed.

Tabular Output of Regression Estimates

TABLE 3A. AREA PLANTED TO RICE IN PANAMA, FIRST CROP
UNIT = 100 HECTARES

REGRESSION ESTIMATES [N = 13 - 0 = 13]
PER YEAR 1976 TO 1988, WITH PROJECTIONS THROUGH 1997

EXPONENT IS 1.30

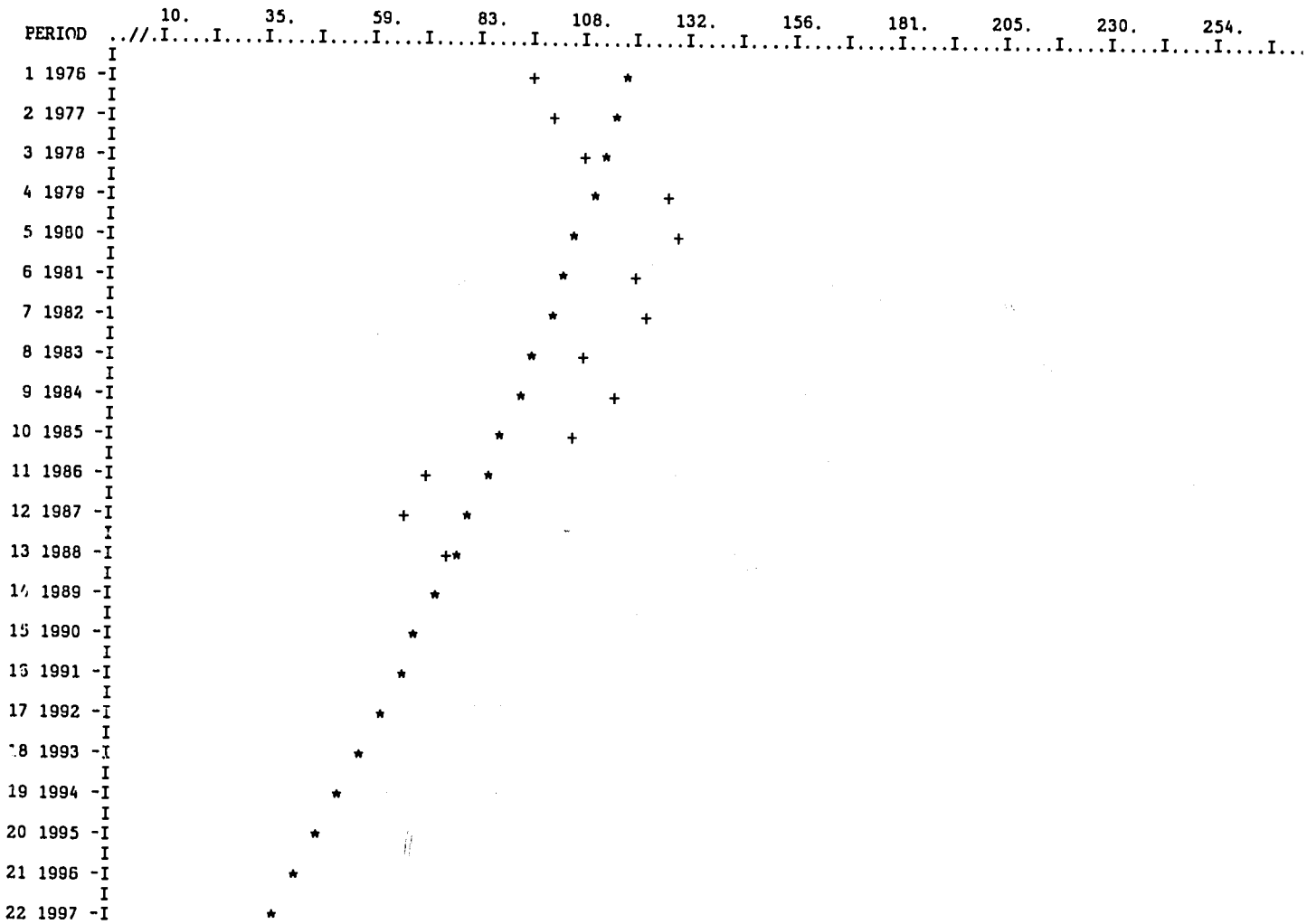
		PROVINCE									
	YEAR	BOCAS DEL TORO	CHIRIQUI	VERAGUAS	HERRERA	LOS SANTOS	COCLE	PANAMA	COLON	DARIEN	PANAMA TOTAL
3	1976	5	174	292	96	119	83	105	35	32	941
4	1977	5	178	290	95	117	89	104	35	32	945
5	1978	5	184	288	94	114	97	103	34	31	950
6	1979	5	190	285	92	112	105	102	34	31	956
7	1980	5	197	282	91	109	115	101	33	30	963
8	1981	5	204	279	89	106	125	99	33	30	970
9	1982	5	211	275	87	102	135	98	32	29	974
10	1983	5	219	272	85	99	146	96	32	28	982
11	1984	5	227	268	83	95	157	95	31	28	989
12	1985	5	236	264	81	92	168	93	31	27	997
13	1986	5	244	260	79	88	180	92	30	26	1004
14	1987	5	253	256	77	84	193	90	29	26	1013
15	1988	5	262	252	75	80	205	88	29	25	1021
16	1989	5	271	248	73	76	218	86	28	24	1029
17	1990	5	281	244	71	72	231	85	27	23	1039
18	1991	5	291	239	68	68	245	83	27	22	1048
19	1992	5	301	235	66	63	258	81	26	22	1057
20	1993	5	311	231	64	59	272	79	25	21	1067
21	1994	5	321	226	61	54	286	77	25	20	1075
22	1995	5	331	221	59	50	301	75	24	19	1085
23	1996	5	342	216	56	45	315	73	23	18	1093
24	1997	5	352	212	53	41	330	71	22	17	1103
	Ybar	4.77	213.85	274.08	86.69	101.38	138.23	97.31	32.08	28.77	
	b	.02	3.27	-1.47	-.78	-1.44	4.53	-.62	-.23	-.27	
	rsq	.0071	.6223	.0460	.0828	.3710	.9299	.0545	.0501	.0301	
	Syx	1.8595	23.7337	62.5041	24.3049	17.4037	11.5727	23.8804	9.2600	14.3401	
	sb	.06	.77	2.02	.79	.56	.37	.77	.30	.46	

SOURCE:
Estadistica Panamena, Información Agropecuaria, Superficie Sembrada y Producción de Arroz, Maíz y Frijol, 1976-1988.
Dirección de Estadística y Censo.

Graphic Output for Los Santos Province

PLOT OF OBSERVED AND ESTIMATED DATA

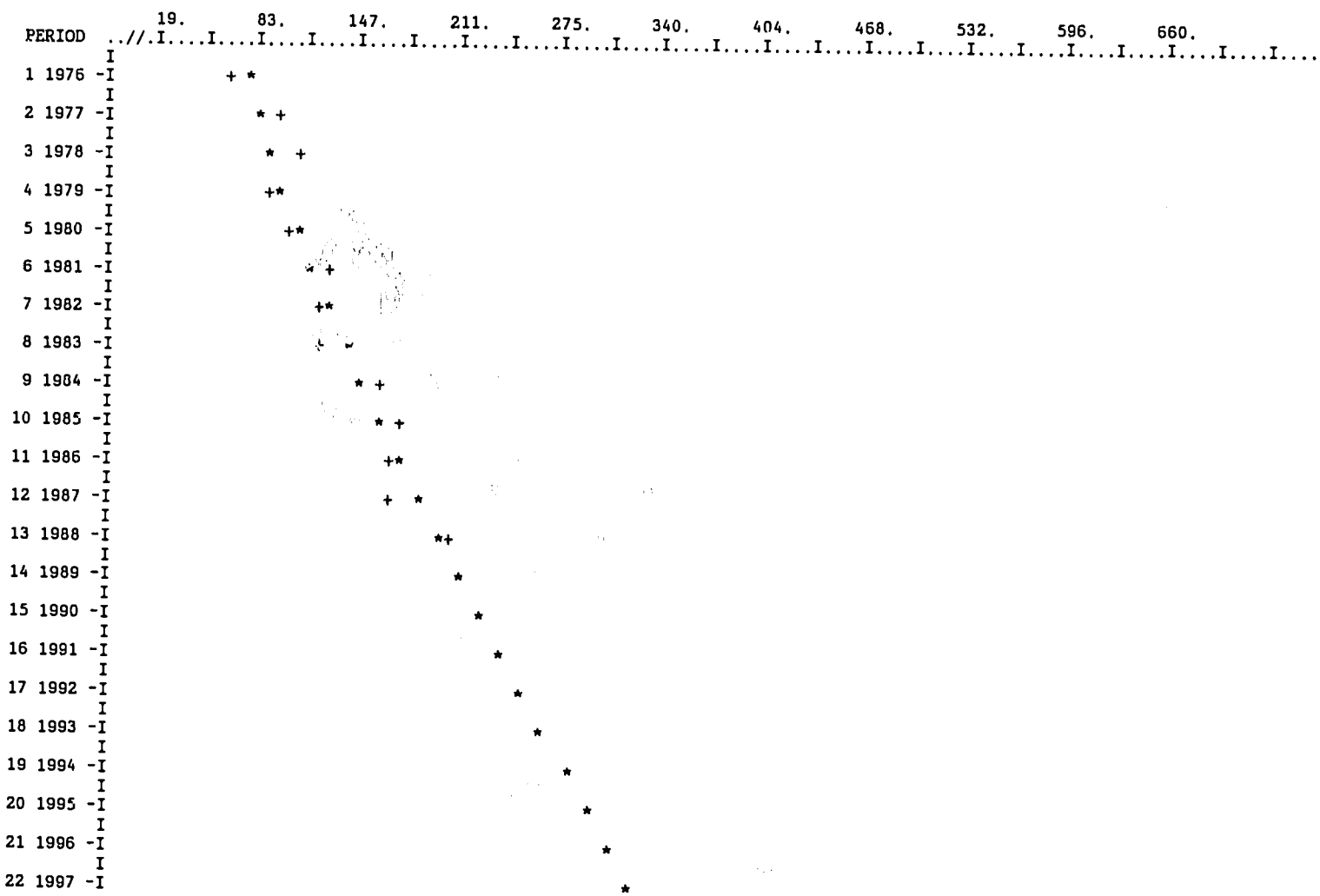
TABLE 3A. AREA PLANTED TO RICE IN PANAMA, FIRST CROP
LOS SANTOS PROV. UNIT IS 100 HECTARES X 1 (rsq = .3710)



Graphic Output for Cocle Province

PLOT OF OBSERVED AND ESTIMATED DATA

TABLE 3A. AREA PLANTED TO RICE IN PANAMA, FIRST CROP
COCLE PROV. UNIT IS 100 HECTARES X 1 (rsq = .9299)



Output Estimates of Rice Production

Master Y-Table Output

TABLE 1A. PROJECTED PRODUCTION OF RICE IN PANAMA, FIRST CROP
METRIC TONS OF ROUGH RICE

PER YEAR 1976 TO 1987

WITH PROJECTIONS TO 1997

	YEAR	PROVINCE									
		BOCAS DEL TORO	CHIRIQUI	VERAGUAS	HERERRA	LOS SANTOS	COCLE	PANAMA	COLON	DARIEN	PANAMA TOTAL
0	1976	115	17089	27357	9035	10424	6439	6256	1516	1927	80158
1	1977	155	20469	25596	7826	11714	7216	9223	2346	3191	87736
2	1978	185	24021	25147	10219	11803	9090	9094	2456	3150	95165
3	1979	315	24093	23387	11062	13218	7901	10099	2647	4875	97597
4	1980	667	27120	28269	14749	14892	8196	10308	3669	4958	112828
5	1981	352	34480	40840	14973	9465	13131	11775	3527	6058	134601
6	1982	341	29069	35758	12531	11508	11432	14399	3519	6993	125550
7	1983	341	41818	39580	11551	10404	11948	10458	3054	6544	135698
8	1984	184	39956	36633	15975	11399	20638	8749	3022	5527	142083
9	1985	247	51720	32724	11140	10987	23417	6954	2503	5527	145219
10	1986	136	44066	16922	5641	6243	28315	5383	1261	1102	109069
11	1987	139	44726	17161	5613	6056	29933	5451	1580	1102	111758
12	1988	227	60207	16493	4420	6681	24390	5668	1930	1134	121150
13	1989	199	60577	21192	7026	6831	31898	6356	2183	2591	138853
14	1990	193	65792	20295	6627	6353	35530	6062	2133	2448	145433
15	1991	186	71421	19424	6241	5882	39489	5776	2082	2309	152810
16	1992	181	77493	18577	5866	5417	43801	5499	2030	2173	161037
17	1993	175	84039	17754	5503	4959	48491	5230	1977	2040	170168
18	1994	169	91089	16956	5151	4509	53388	4970	1923	1912	180267
19	1995	164	98680	16182	4811	4066	59119	4717	1868	1786	191393
20	1996	159	106848	15431	4483	3630	65118	4473	1813	1665	203620
21	1997	154	115531	14703	4165	3202	71618	4236	1756	1547	217012

SOURCE:
Y-Table estimates based on yields in Table 2 and areas harvested in Table 3A.

Conversion Y-Table Output

TABLE 1B. PROJECTED NET PRODUCTION OF RICE IN PANAMA, FIRST CROP
IN MILLED RICE EQUIVALENT, (METRIC TONS)

PER YEAR 1976 TO 1987

WITH PROJECTIONS THROUGH 1997

	YEAR	PROVINCE: BOCAS DEL TORO	CHIRIQUI	VERAGUAS	HERERRA	LOS SANTOS	COCLE	PANAMA	COLON	DARIEN	PANAMA TOTAL
0	1976	70	10510	16825	5557	6411	3960	3847	932	1185	49297
1	1977	95	12588	15741	4813	7204	4438	5672	1443	1962	53956
2	1978	114	14773	15465	6285	7259	5590	5593	1511	1937	58527
3	1979	194	14817	14383	6803	8129	4859	6211	1628	2998	60022
4	1980	410	16679	17385	9070	9159	5040	6339	2257	3049	69388
5	1981	217	21205	25117	9208	5821	8075	7242	2169	3726	82780
6	1982	210	17877	21991	7707	7077	7030	8855	2164	4301	77212
7	1983	210	25718	24342	7104	6398	7348	6432	1878	4024	83454
8	1984	113	24573	22529	9824	7010	12692	5381	1859	3399	87380
9	1985	152	31808	20125	6851	6757	14401	4277	1540	3399	69310
10	1986	84	27100	10407	3469	3839	17414	3311	775	678	67077
11	1987	84	27506	10554	3452	3725	18409	3352	972	678	68732
12	1988	140	37027	10143	2718	4109	15000	3486	1187	698	74508
13	1989	122	37255	13033	4321	4201	19618	3909	1342	1594	85395
14	1990	118	40462	12482	4076	3907	21851	3728	1312	1506	89442
15	1991	115	43924	11946	3838	3617	24286	3552	1280	1420	93978
16	1992	111	47658	11425	3607	3332	26938	3382	1249	1336	99038
17	1993	107	51684	10919	3384	3050	29822	3217	1216	1255	104654
18	1994	104	56020	10428	3168	2773	32956	3056	1183	1176	110864
19	1995	101	60688	9952	2959	2500	36358	2901	1149	1099	117707
20	1996	98	65711	9490	2757	2232	40048	2751	1115	1024	125226
21	1997	95	71113	9042	2562	1969	44045	2605	1080	951	133462

SOURCE:
Y-Table estimates based on yields in Table 2 and areas harvested in Table 3A.

Listing of OUTPUT.MPJ File for Proration Projections

3	1976	3.	151.	228.	71.	94.	77.	74.	23.	16.
4	1977	2.	162.	247.	70.	98.	98.	89.	29.	18.
5	1978	4.	181.	266.	77.	106.	100.	82.	28.	21.
6	1979	7.	171.	256.	86.	127.	95.	101.	32.	33.
7	1980	9.	221.	274.	118.	127.	112.	126.	39.	36.
8	1981	5.	232.	358.	116.	117.	135.	127.	40.	43.
9	1982	5.	226.	356.	113.	120.	131.	132.	49.	49.
10	1983	5.	248.	369.	97.	105.	127.	118.	40.	46.
11	1984	3.	222.	310.	116.	114.	172.	110.	38.	38.
12	1985	4.	261.	300.	95.	102.	186.	90.	36.	38.
13	1986	5.	226.	197.	63.	68.	178.	63.	19.	12.
14	1987	5.	213.	186.	53.	65.	178.	67.	22.	12.
15	1988	5.	266.	216.	52.	75.	208.	86.	22.	12.
16	1989	5.	271.	248.	73.	76.	218.	86.	28.	24.
17	1990	5.	281.	244.	71.	72.	231.	85.	27.	23.
18	1991	5.	291.	239.	68.	68.	245.	83.	27.	22.
19	1992	5.	301.	235.	66.	63.	258.	81.	26.	22.
20	1993	5.	311.	231.	64.	59.	272.	79.	25.	21.
21	1994	5.	321.	226.	61.	54.	286.	77.	25.	20.
22	1995	5.	331.	221.	59.	50.	301.	75.	24.	19.
23	1996	5.	342.	216.	56.	45.	315.	73.	23.	18.
24	1997	5.	352.	212.	53.	41.	330.	71.	22.	17.

SECTION X

ILLUSTRATION OF AGRICULTURAL DEVELOPMENT ANALYSIS (MPJCASE.AGR)

Concept of Agricultural Development Analysis

Many kinds of potential agricultural irrigation and land reclamation development projects have characteristics which warrant special application of the MASTERPJ program. In particular, several different kinds of transitions toward full development and full production need to be superimposed in order to obtain realistic estimates of the time flow of benefits and costs for such projects.

Benefits from agricultural development projects are estimated by comparing projected total net incomes of benefited farmers after the project with the projected total net incomes of the same farmers without the project. Added net incomes of benefited farmers depend upon (a) the increased hectarages they are able to crop, and (b) the increased yields they are able to obtain on hectarages already cropped. In computing benefits from the two sources, care must be taken not to credit the project with increased farm incomes brought about by factors other than the project, but to give full credit to the increases resulting from the project.

Components of Project Benefits

There are three components of added farm incomes from agricultural development projects when interactions of hectarages and yields are considered. They are:

1. Added hectarage multiplied by existing yields
2. Existing hectarage multiplied by added yields
3. Added hectarage multiplied by added yields.

Total added agricultural production is determined by the sum of added area times existing yield plus existing area times added yield plus added area times added yield. Because added yield is common to the last two of these terms, and because total project area equals existing area plus added area, the expression for total project impact can be restated as added areas times existing yields (area effect) plus total areas times added yields (yield effect).

Added production cannot be aggregated across years (i), types of cultivation (j), seasons (k), nor crops (l), because added areas, existing yields, total project areas and added yields vary with each one. The computations of agricultural benefits need to be made separately by ijkl cell, with aggregation across the jkl cells after applying farm prices and production costs for added net crop revenues. Aggregation across years is not done, because benefits are needed by year (i) in order to employ present value analysis. The methods for projecting agricultural benefits are designed accordingly.

Separate tables are needed for summarizing land area and intensity impacts (Benefits A) and for summarizing yield impacts (Benefits B) of the project. Potential total annual benefits from the respective sources are summations of the projected added net farm revenue for all types of cultivation, all seasons and all crops. These potential benefits are a function of the development schedule, and need not be

carried beyond the time when full development is reached. The values reflect multiplication of per hectare values by numbers of hectares developed by ijkl category.

The other information needed to project annual benefits is the schedule of transition to full yield potentials once the development reaches the farm. Transition factors appropriate to the source of agricultural benefit and type of development project can be established in the planning process. Such factors reflect expected shifts in land use and cropping patterns as well as the increase in yields through time.

Sequential Steps in Projecting Agricultural Benefits

Some 12 distinct steps are needed to complete projections of benefits from agricultural land development projects. These steps (and corresponding output tables) are as follows:

Number	Content	Variables*
1.	Annual Transition to Increased Production	Type of Development, A, B
2.	Land Area to Be Developed	ijk; c,b
3.	Per Hectare Production Costs	jkl; a,c
4.	Potential per Hectare Crop Yields	jkl; a,c
5.	Projected Real Farm Prices	market, border; l
6.	Labor Requirements per Hectare	jkl; a,c
7.	Projected Cropping Pattern	jkl; c,b; i-transition
8.	Gross Income per Hectare	jkl; a,c
9.	Developed Areas for Cropping	jkl; c,b
10.	Net Farm Income per Hectare	jkl; a,c
11.	Potential Net Farm Income Added by Project	jkl; A, B
12.	Added Net Farm Income After Transition	A, B

* A - Hectarage benefit, B - Yield benefit.
ijkl: i - year, j - type of cultivation, k - season, l - crop.
abc: a - without project, b - with project, c - added by project.

The first seven of the sequential steps are determined from the land development plan and the physical characteristics together with agro-economic conditions for the project area. They serve as data input to the master projections. To illustrate the construction of such tables, examples are included for the MPJCase.Agr based on Medium Irrigation Schemes in Rajasthan, India. Sequential steps 8 through 12 are completed by computation based on data for the first seven steps.

The gross income per hectare (Table 8) is obtained by multiplying projected volume of production per hectare for each crop by the corresponding real farm-gate price. A separate Table 8 is developed for each season and type of cultivation combination, with each such table containing separate columns by crop. For the hectarage (A) benefits the without project (a) yields are used; for the yield (B) benefits the added by project (c) yields are used. The MASTERPJ run is set up as a Y-table run with Y = X1 * X2.

The developed areas for cropping (Table 9) also are projected as a Y-table run with MASTERPJ, using Y = X1 * X2, where X1 represents the land areas to be developed and X2 represents the projected cropping pattern. The time transition in cropping pattern is reflected in a JCOUTY = 2 conversion table to accompany the master Y-table. A separate Table 9 also is generated for each season-type of cultivation combination. For the hectarage (A) benefit the added (c) areas are used; for the yield (B) benefit the with project (b) areas are used.

The net farm income per hectare (Table 10) is obtained as a Y-table projection with MASTERPJ, using Y = X1 - X2, where X1 represents gross income per hectare and X2 represents the corresponding production cost per hectare. In the accompanying case the run is modified by applying a b-coefficient multiplier less than 1.00 to X1 reflecting net income after deducting variable expense, and by using as X2 total labor requirements in man days and applying a b-coefficient on this variable corresponding to the opportunity-cost wage rate for farm labor. As with gross farm income per hectare, the A benefit reflects without project (a) yields and the B benefit reflects added by project (c) yields.

The potential net farm income added by the project (Table 11) also is obtained as a Y-table projection using Y = X1 * X2. In this case X1 represents the developed areas for cropping (Table 9) and X2 represents the net farm income per hectare (Table 10). As with the previous tables, a separate Table 11 is generated for each season-type of cultivation combination. Each Table 11 contains columns for each crop plus a total column. Separate Tables 11 also are generated for the A benefits and the B benefits. Tables 11A reflect added (c) hectarages and without project (a) yields; Tables 11B reflect with project (b) hectarages and added by project (c) yields.

The added net farm income after yield transition (Table 12) is set up as a Y-table run with MASTERPJ, using Y = X1 + X2 + ... + Xn, where X1 through Xn represent the Tables 11 for the individual season-type of cultivation combinations. The master Y-table is the Table 11 total for all seasons and types of cultivation. The corresponding Table 12 is developed as a special transition conversion table, using JCOUTY = 2 for yield transitions and entering the transition factors at the step for CONVRT multipliers. As with Table 11, separate Tables 12A and 12B are generated. If desired the two can be aggregated in another Y-table run where Table 12 = Table 12A + Table 12B.

Components of Project Costs

The methodology for projecting components of capital and operating costs for agricultural land development projects is not unique. For most such projects the major cost components include those for major works, those for distribution networks, and those for on-farm development. Standard methods can be used for developing cost estimates for all three components.

The Rajasthan Agricultural Land Development Case

General Description

The examples from the Gudha Medium Irrigation Project in Rajasthan, India illustrate the computation of the last two steps for measurement of benefits for land

development cases, Table 11 and Table 12. For information, examples of the tables for the first seven steps for the case are included, but the data in these tables are not used directly. Rather the starting point for the projections illustrated for the case is represented by Table 9 showing the developed hectarages for cropping and Table 10 showing the net farm income per hectare. The case is based on USAID-supported technical assistance by the Kansas State University Food and Feed Grains Institute to the State of Rajasthan and the Government of India some years ago.*

Two examples of computational steps taken from the Gudha Project are included in the manual. Example 1 represents the computation of Table 11A for a particular season-type of cultivation combination, Flow Plus Well Irrigation for the Rabi Season. The run is set up as a Y-table run, with the potential added net farm income from the added area (A) benefit (Table 11A) equal to the developed hectarages added for each crop by season and type of cultivation (Table 9) multiplied by projected with project net farm income for each crop by season and type of cultivation (Table 10). In this example, the Table 10 figures are constant through time because constant real prices are assumed for each crop. The Table 9 data reflect the transition in cropping pattern of 0 percent change the first year, 60 percent change the second year and 100 percent change the third year from the time the new cropping pattern is introduced.

Example 2 for the Gudha Project represents computation of Table 12B for the summation of all season-type of cultivation combinations for the 14 projected periods, 1988 through 2001. It also is a Y-table run, with the 11B total table equal to the sum of the corresponding Tables 11B for the six different season-type of cultivation combinations, ranging from Rabi Season, Irrigated Plus Wells (X1) to Kharif Season, Rainfed Cultivation (X6). The 12B table is generated in the same run from the 11B master Y-table as a conversion table using the JCOUTY = 2 option and inserting CONVRT multiplier factors for each of the 14 periods with the Y-table commands. The example serves to illustrate the development of superimposed transitions using the JCOUTY option of MASTERPJ, in this case the transition in areas developed and the cropping pattern transition (derived from Table 9) plus the yield transition applied to each crop.

The information tables for the case are presented first in numerical sequence from Table 1 through Table 7 just as they were used in the Gudha Project analysis. Following this the computational examples for the case are illustrated.

---

* See Mehta, U.R., and Phillips, Richard. Guidelines for Economic Evaluation of Medium Irrigation Projects, Including IRR Calculations. State of Rajasthan. Jaipur. 1982.

Information Tables for the Case

Table 1. Annual Transition to Total Increase in Agricultural Production (Fraction of Full Impact)

Year Following Development	New Projects		Full Modernization		Partial Modernization	
	A. Area	B. Yield	A. Area	B. Yield	A. Area	B. Yield
0	.80	.00	.75	.00	.85	.00
1	.82	.08	.775	.10	.90	.15
2	.84	.20	.825	.30	.95	.40
3	.88	.40	.90	.60	.98	.75
4	.92	.60	.95	.80	1.00	.90
5	.96	.80	1.00	1.00	1.00	1.00
6	.99	.95	1.00	1.00	1.00	1.00
7	1.00	1.00	1.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00	1.00

Table 2. Schedule of Land Area to Be Developed Annually by Use
Hectares

(c) Added by Project

GUDHA PROJECT

Period		Rabi Season			Kharif Season		
No.	Year	Surface & Wells	Surface Only	Rainfed	Surface & Wells	Surface Only	Rainfed
0	1988	24	374	75	82	0	25
1	1989	52	324	-230	29	190	20
2	1990	52	324	-230	28	190	21
3	1991	52	324	-230	28	190	22
4	1992	58	335	-240	34	197	22
5	1993	52	311	-231	30	190	21
6	1994	0	0	0	0	0	0
7	1995	0	0	0	0	0	0
8	1996	0	0	0	0	0	0

Source:
Rabi Season data excludes hectares of sugar cane included in Kharif.

Table 3A. Estimated Variable Farm Production Cost
(Including Farm Labor)

Farm Input	Percent of Gross Crop Revenue	Example for Irrigated Wheat (Rs/Ha)*
Organic fertilizer	6.5	201.5
Chemical fertilizer	8.9	275.9
Bullock expense**	7.0	217.0
Implement expense	2.7	83.7
Farm maintenance	3.0	93.0
Plant protection measures	1.0	31.0
Farm labor***	5.0	155.0
Total	34.1	1,057.1

* Based on yield of 25 quintals per hectare and projected real price of Rs 124 per quintal (1980 = 1.0).

** Net of manure credit of 3 percent of gross revenue, which is included in organic fertilizer.

*** At real wage of Rs 5.00 per day (1980 = 1.00).

Table 4. Projected Potential Crop Yields per Hectare
Gudha Project
(QQ/Ha)

Season, Category and Crop	Without Project	With Project	Added by Project
I. Rabi			
A. Flow + Well Irrigation:			
Wheat	20.0	30.0	10.0
Barley	not applicable		
Oilseeds	9.0	18.0	9.0
Pulses	9.0	14.0	5.0
Vegetables	125.0	145.0	20.0
Fodder	170.0	210.0	40.0
Condiments	8.5	12.0	3.5
B. Flow Irrigation Only:			
Wheat	15.0	18.0	3.0
Barley	15.0	17.0	2.0
Oilseeds	8.0	9.0	1.0
Pulses	8.0	9.0	1.0
Vegetables	75.0	100.0	25.0
Fodder	150.0	190.0	40.0
Condiments	7.5	8.0	0.5

Table 4. Projected Potential Crop Yields per Hectare, continued
Gudha Project
(QQ/Ha)

Season, Category and Crop	Without Project	With Project	Added by Project
I. Rabi (continued)			
C. Dryland Cultivation:			
Wheat	9.0	10.0	1.0
Barley	12.0	14.0	2.0
Oilseeds	7.0	8.0	1.0
Pulses	7.0	8.0	1.0
Condiments	5.0	6.0	1.0
II. Kharif			
A. Flow + Well Irrigation:			
Maize	19.0	25.0	6.0
Sorghum	17.0	20.0	3.0
Oilseeds	9.0	10.0	1.0
Pulses	8.0	9.0	1.0
Vegetables	110.0	130.0	20.0
Paddy	37.0	40.0	3.0
Sugar Cane	500.0	700.0	200.0
B. Flow Irrigation Only:			
Maize	15.0	19.0	4.0
Sorghum	14.0	18.0	4.0
Oilseeds	7.0	9.0	2.0
Pulses	7.0	8.0	1.0
Vegetables	80.0	100.0	20.0
Paddy	27.0	32.0	5.0
Sugar Cane	250.0	400.0	150.0
C. Rainfed Cultivation:			
Maize	10.0	12.0	2.0
Sorghum	10.0	12.0	2.0
Oilseeds	5.0	6.0	1.0
Pulses	6.0	8.0	2.0
Fodder	110.0	120.0	10.0

Table 5. Projected 1990 Farm Prices for Rajasthan
Unit = Rupees per Quintal in Real Terms (1980 = 1.00)

Commodity	(1) Market	(2) Border	(3) (2)/(1)
Rabi Crops:			
Wheat	124	164	1.323
Barley	97	128	1.320
Pulses	180	194	1.078
Vegetables	50	65	1.300
Oilseeds	280	287	1.025
Fodder (irrigated)	10	13	1.300
Condiments	416	473	1.137
Kharif Crops:			
Maize	117	152	1.299
Sorghum	130	166	1.277
Pulses	180	194	1.078
Vegetables	50	65	1.300
Oilseeds	280	287	1.025
Paddy	160	173	1.081
Sugar cane	13	17	1.308
Fodder (rainfed)	10	11	1.100
Cotton	400	470	1.175
Farm Inputs:			
Nitrogen	499	474	0.950
Phosphate	458	435	0.950
Potash	185	175	0.950
Organic fertilizer	3.23	2.58	0.950
Farm labor (hired) Rs/day	5.00	6.50	1.300

Column (1) prices from Department of Agriculture, Government of Rajasthan.
Column (2) prices from World Bank Report 2529a-IN, Vol. 1, Table T-20, adjusted to Rs. 8.00 = US $1.00.

Table 6. Projected Farm Labor Requirements per Hectare
Gudha Project
(Man Days/Hectare)

Season, Category and Crop	Without Project	With Project	Added by Project
I. Rabi			
A. Flow + Well Irrigation:			
Wheat	135	150	15
Barley	80	90	10
Oilseeds	75	85	10
Pulses	70	75	5
Vegetables	70	80	10

Table 6. Projected Farm Labor Requirements per Hectare, continued
Gudha Project
(Man Days/Hectare)

Season, Category and Crop	Without Project	With Project	Added by Project
Fodder	130	140	10
Condiments	60	65	5
B. Flow Irrigation Only:			
Wheat	120	145	25
Barley	70	80	10
Oilseeds	60	70	10
Pulses	65	70	5
Vegetables	50	60	10
Fodder	110	130	20
Condiments	50	60	10
C. Dryland Cultivation:			
Wheat	90	105	15
Barley	70	90	20
Oilseeds	35	40	5
Pulses	50	60	10
Condiments	40	50	10
II. Kharif			
A. Flow + Well Irrigation:			
Maize	75	90	15
Sorghum	75	85	10
Oilseeds	60	70	10
Pulses	75	80	5
Vegetables	60	70	10
Paddy	165	180	15
Sugar Cane	360	425	65
B. Flow Irrigation Only:			
Maize	65	70	5
Sorghum	65	80	15
Oilseeds	55	65	10
Pulses	65	70	5
Vegetables	50	60	10
Paddy	145	160	15
Sugar Cane	265	310	45
C. Rainfed Cultivation:			
Maize	55	65	10
Sorghum	55	65	10
Oilseeds	50	60	10
Pulses	50	60	10
Fodder	45	50	5

Table 7. Projected Cropping Pattern
Gudha Project
(Hectares per 1000 Hectares Cropped)

Season, Category and Crop	Without Project	With Project
I. Rabi		
A. Flow + Well Irrigation:		
Wheat	655	385
Barley		
Pulses	10	
Vegetables	50	100
Oilseeds	135	265
B. Flow Irrigation Only:		
Wheat	667	535
Barley	42	
Pulses	128	158
Vegetables	14	30
Oilseeds	64	134
Fodder	57	76
Condiments	28	67
C. Dryland Cultivation:		
Wheat	265	285
Barley	26	
Pulses	641	428
Oilseeds	23	
Condiments	170	287
II. Kharif		
A. Flow + Well Irrigation:		
Maize	140	180
Sorghum	76	50
Pulses	60	28
Vegetables	75	100
Oilseeds	70	100
Paddy	37	
Sugar Cane	542	542
B. Flow Irrigation Only:		
Maize	146	171
Sorghum	103	103
Pulses	167	151
Vegetables	42	69
Oilseeds	42	60
Paddy		
Sugar Cane	500	446
C. Rainfed Cultivation:		
Maize	413	435
Sorghum	45	57
Pulses	69	217
Oilseed	92	237
Fodder	381	144

Example 1. Increased Net Farm Income from Additional Area Cropped

Example 1 represents the computation of Table 11A, Combined Net Farm Income Added by Project through Benefit A, for a particular season-type of cultivation combination, Flow Plus Well Irrigation for the Rabi Season. The run is set up as a Y-table run, with the potential increased net farm income from the added area (A) benefit equal to the developed hectarages added for each crop by season and type of cultivation (Table 9) multiplied by projected with project net farm income for each crop by season and type of cultivation (Table 10). In this example, the Table 10 figures are constant through time because constant real prices are assumed for each crop.

Listing of the INPUT.MPJ File for the Example

The commands and headings for the MPJCase.Agr, Example 1, as contained in the INPUT.MPJ file developed in the MASTER1 run are listed below. The ten rows of numbers represent input commands for Steps 0 through 9. This is followed by the title lines, column headers and footnotes for the table.

Three sets of input data are provided for the case. The first set applies to X1, the Table 9 data. The second set applies to X2, the Table 10 data. The third set of command data applies to the Y table, Table 11A, which is to be generated as the product of the other two tables.

```
 40  40   1   2   0   1   3
  9   9   0   0   0  11   2   1   0   0
  0   0   0   0   0   1   0   0   1   0
  1   0   0   0   0   01988   0   0   0
  0   0   0   0   0   0   0   0   0   0
  2   8   3   0   0   0   0   0   0   0   0
  1  11   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0 .000001.00000 .00000 .000001.00000 .00000
```

Table 9. Developed Areas for Each Crop by Seas
on and Type of Cultivation

Unit = 0.1 Hectares

GUDHA PROJECT

Rabi Season, Irrigated Surface P
lus Wells
D. Added by Project

Listing of the INPUT.MPJ File for the Example, continued

Period

Sugar

Total

No. Year Wheat Barley Pulses Oilseeds Vegetables Paddy Cane
Condiments Fodder Cotton Other All Crops
Based on Cropping Pattern from Table 7 for the Project.

Transition from Existing to Projected: 0% in Year 1, 60% in Year 2 and 100% in Y
ear 3.

```
 9  9  0  0  0 11  2  1  0  0
 0  0  0  0  0  1  0  0  1  0
 1  0  0  0  0  01988  0  0  0
 0  0  0  0  0  0  0  0  0  0
 2  8  3  0  0  0  0  0  0  0  0
 1 11  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0 .000001.00000 .00000 .000000.00100 .00000
```

Table 10. Projected Net Farm Inco
me

Rupees per Hectare

GUDHA PROJECT

Rabi Season, Irrigated Surface P
lus Wells

B. Projected without Project

Period

Sugar

Total

No. Year Wheat Barley Pulses Oilseeds Vegetables Paddy Cane
Condiments Fodder Cotton Other All Crops
Table 8 multiplied by factor of 0.709 minus Table 6 times wage rate of Rs. 5.00
per day.
Projected Total Without Project figures are net of fixed costs from Table 3B.

```
 9  9  0  0  0 11  2  1 -0  0
 0  0  0  1  0  1  0  0  1  0
 1  0  0  0  0  01988  0  0  0
 0  0  0  0  0  0  1  0 11 13
 2  8  3  0  0  0  0  0  0  0  0
 1 11  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0 .000001.00000 .00000 .000001.00000 .00000
```

Table 11A. Combined Net Farm Income Added by P

Listing of the INPUT.MPJ File for the Example, continued

roject through Benefit A

Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Irrigated Surface P
lus Wells

Period

Sugar

Total

No. Year Wheat Barley Pulses Oilseeds Vegetables Paddy Cane
Condiments Fodder Cotton Other All Crops
Per hectare added net farm income (added gross income less production cost and t
otal labor cost)
multiplied by the developed hectarages from Table 9.

Table of Input Data for the Example

The table of input data for Example 1 as contained in the MPJDATA.RUN file for the case is listed below. The input represents an ASCII file in the format of I3, 1X, I4, 8F9.0. The file contains the data for X1 first, followed by the data for X2.

The input for each of the X variables represents nine consecutive years of projections applicable to the Rabi Season under flow plus well irrigation for the Gudna Project in Rajasthan, India. The data columns from left to right represent the different crops. Wheat, barley, pulses, oilseeds, vegetables, paddy, sugar cane and condiments are included in the first group of eight columns. Fodder, cotton and other crops are included in the second group of three data columns.

0	1988	187	0	2	16	4	0	0	7
1	1989	543	0	6	78	24	0	0	33
2	1990	808	0	7	194	66	0	0	77
3	1991	1034	0	7	331	118	0	0	129
4	1992	1307	0	8	473	171	0	0	183
5	1993	1521	0	8	618	226	0	0	237
6	1994	1333	0	2	727	272	0	0	275
7	1995	1261	0	0	768	290	0	0	290
8	1996	1261	0	0	768	290	0	0	290

Table of Input Data for the Example, continued

0	1988	24	0	0				
1	1989	76	0	0				
2	1990	128	0	0				
3	1991	180	0	0				
4	1992	238	0	0				
5	1993	290	0	0				
6	1994	290	0	0				
7	1995	290	0	0				
8	1996	290	0	0				
0	1988	290	0	142	842	3324	0	0	1574
1	1989	290	0	142	842	3324	0	0	1574
2	1990	290	0	142	842	3324	0	0	1574
3	1991	290	0	142	842	3324	0	0	1574
4	1992	290	0	142	842	3324	0	0	1574
5	1993	290	0	142	842	3324	0	0	1574
6	1994	290	0	142	842	3324	0	0	1574
7	1995	290	0	142	842	3324	0	0	1574
8	1996	290	0	142	842	3324	0	0	1574
0	1988	-75	0	0				
1	1989	-75	0	0				
2	1990	-75	0	0				
3	1991	-75	0	0				
4	1992	-75	0	0				
5	1993	-75	0	0				
6	1994	-75	0	0				
7	1995	-75	0	0				
8	1996	-75	0	0				

Using this input for Example 1, the MASTERPJ program was used reproduce the multiplier tables, X1 and X2, and to create and print the corresponding Y table for the same number of years into the future, following the sequence of steps outlined Section VI. The resulting output for the case is shown on the following pages.

Listing of the X1 Output for Example 1

Table 9. Developed Areas for Each Crop by Season and Type of Cultivation
Unit = 0.1 Hectares

GUDHA PROJECT

Rabi Season, Irrigated Surface Plus Wells

). Added by Project

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crops
1	1988	187	0	2	16	4	0	0	7	24	0	0	240
2	1989	543	0	6	78	24	0	0	33	76	0	0	760
3	1990	808	0	7	194	66	0	0	77	128	0	0	1280
4	1991	1034	0	7	331	118	0	0	129	180	0	0	1799
5	1992	1307	0	8	473	171	0	0	183	238	0	0	2380
6	1993	1521	0	8	618	226	0	0	237	290	0	0	2900
7	1994	1333	0	2	727	272	0	0	275	290	0	0	2899
8	1995	1261	0	0	768	290	0	0	290	290	0	0	2899
9	1996	1261	0	0	768	290	0	0	290	290	0	0	2899

OURCE:
ased on Cropping Pattern from Table 7 for the Project.
ransition from Existing to Projected: 0% in Year 1, 60% in Year 2 and 100% in Year 3.

Listing of the X2 Output for Example 1

Table 10. Projected Net Farm Income
Rupees per Hectare

GUDHA PROJECT

B. Projected without Project

Rabi Season, Irrigated Surface Plus Wells

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crop
1	1988	290	0	142	842	3324	0	0	1574	-75	0	0	6097
2	1989	290	0	142	842	3324	0	0	1574	-75	0	0	6097
3	1990	290	0	142	842	3324	0	0	1574	-75	0	0	6097
4	1991	290	0	142	842	3324	0	0	1574	-75	0	0	6097
5	1992	290	0	142	842	3324	0	0	1574	-75	0	0	6097
6	1993	290	0	142	842	3324	0	0	1574	-75	0	0	6097
7	1994	290	0	142	842	3324	0	0	1574	-75	0	0	6097
8	1995	290	0	142	842	3324	0	0	1574	-75	0	0	6097
9	1996	290	0	142	842	3324	0	0	1574	-75	0	0	6097

SOURCE:
Table 8 multiplied by factor of 0.709 minus Table 6 times wage rate of Rs. 5.00 per day.
Projected Total Without Project figures are net of fixed costs from Table 3B.

Listing of the Y Output for Example 1

Table 11A. Combined Net Farm Income Added by Project through Benefit A
Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Irrigated Surface Plus Wells

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crops
1	1988	54	0	0	13	13	0	0	11	-2	0	0	89
2	1989	157	0	1	66	80	0	0	52	-6	0	0	350
3	1990	234	0	1	163	219	0	0	121	-10	0	0	728
4	1991	300	0	1	279	392	0	0	203	-14	0	0	1161
5	1992	379	0	1	398	568	0	0	288	-18	0	0	1616
6	1993	441	0	1	520	751	0	0	373	-22	0	0	2064
7	1994	387	0	0	612	904	0	0	433	-22	0	0	2314
8	1995	366	0	0	647	964	0	0	456	-22	0	0	2411
9	1996	366	0	0	647	964	0	0	456	-22	0	0	2411

OURCE:
er hectare added net farm income (added gross income less production cost and total labor cost)
ultiplied by the developed hectarages from Table 9.

Commands and Headings for Example 2, Increased Net Farm Income from Added Yields

The commands and headers for Example 2 of the MPJCase.Agr contained in the INPUT.MPJ file developed in the MASTER1 run are listed below. The entries are listed separately for each of the six X-variables and for the Y-table to be developed. The first line of numbers appears only once for the entire run; all other commands and information are repeated for each of the variables in succession.

Entries for X1

The entries for X1 include commands for 14 periods of projected net farm income data by crop for the Rabi Season, Irrigated Surface Plus Wells. The table was created in a previous MASTERPJ run comparable to Example 1 for this case. As the commands indicate, the results in this table are to be added to comparable results for the other season and type of cultivation runs to produce the combined estimates of project benefits through the increased yield impacts of the agricultural development project.

```
 40  40   1   1   0   1   7
 14  14   0   0   0  11   1   1   0   0
  0   0   0   0   0   1   0   0   1   0
  1   0   0   0   0  01988   0   0   0
  0   0   0   0   0   0   0   0   0   0
  2   8   3   0   0   0   0   0   0   0   0
  1  11   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0 .000001.00000 .00000 .000001.00000 .00000
```

Table 11B. Combined Net Farm Income Added by Project through Benefit B

Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Irrigated Surface Plus Wells

Period													
No.	Year	Wheat	Barley	Pulses	Total Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	All Crops

Per hectare added net farm income (added gross income less production cost and total labor cost)
multiplied by the developed hectarages from Table 9.

Entries for X2

The entries for X2 include commands for 14 periods of projected net farm income data by crop for the Rabi Season, Irrigated Surface Only. The table was created in a previous MASTERPJ run comparable to Example 1 for this case. This table too is to be added to the comparable tables for the other seasons and types of cultivation to produce the combined estimates of project benefits through the increased yield impacts of the agricultural development project.

The X2 table and the other X tables reflect the per hectare net farm income by crop for the season and type of cultivation multiplied by the hectarages in Table 9, as indicated by the footnotes included with this X2 entry. The areas in Table 9 were derived from the development calendar for the project and the cropping pattern projected for surface irrigation in the Rabi season in the project area.

```
14  14   0   0   0  11   1   1   0   0
 0   0   0   0   0   1   0   0   1   0
 1   0   0   0   0   01988   0   0   0
 0   0   0   0   0   0   0   0   0   0
 2   8   3   0   0   0   0   0   0   0   0
 1  11   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0 .000001.00000 .00000 .000001.00000 .00000
```

Table 11B. Combined Net Farm Income Added by P
roject through Benefit B

Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Irrigated Surfac
e Only

Period														
No.	Year	Wheat	Barley	Pulses	Total Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	All Crops

Per hectare added net farm income (added gross income less production cost and t
otal labor cost)
multiplied by the developed hectarages from Table 9.

Entries for X3

The entries for X3 include commands for 14 periods of projected net farm income data by crop for the Rabi Season, Dryland Cultivation. The table was created in a previous MASTERPJ run comparable to Example 1 for this case. This table too is to be added to the comparable tables for the other seasons and types of cultivation to produce the combined estimates of project benefits through the increased yield impacts of the agricultural development project.

The X3 table and the other X tables reflect the per hectare net farm income by crop for the season and type of cultivation multiplied by the hectarages in Table 9, as indicated by the footnotes included with this X3 entry. The per hectare net income by crop for dryland cultivation in the Rabi Season was determined by subtracting farm production costs and farm labor input from the corresponding gross farm income projected for this season and type of cultivation.

```
 14  14   0   0   0  11   1   1   0   0
  0   0   0   0   0   1   0   0   1   0
  1   0   0   0   0   01988   0   0   0
  0   0   0   0   0   0   0   0   0   0
  2   8   3   0   0   0   0   0   0   0   0
  1  11   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0 .000001.00000 .00000 .000001.00000 .00000
```

Table 11B. Combined Net Farm Income Added by Project through Benefit B

Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Dryland Cultivation

Period										
No.	Year	Wheat	Barley	Pulses	Total Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder
Cotton	Other	All Crops								

Per hectare added net farm income (added gross income less production cost and total labor cost)
multiplied by the developed hectarages from Table 9.

Entries for X4

The entries for X4 include commands for 14 periods of projected net farm income data by crop for the Kharif Season, Irrigated Surface Plus Wells. The table was created in a previous MASTERPJ run comparable to Example 1 for this case. This table too is to be added to the comparable tables for the other seasons and types of cultivation to produce the combined estimates of project benefits through the increased yield impacts of the agricultural development project.

The X4 table and the other X tables reflect the per hectare net farm income by crop for the season and type of cultivation multiplied by the hectarages in Table 9, as indicated by the footnotes included with this X4 entry. The per hectare net income by crop for surface plus well irrigated cultivation in the Kharif Season comes from the corresponding Table 10; the values in Table 10 were obtained by multiplying the gross farm income figures in Table 8 by the factor of 0.709 (to deduct variable production cost), and then subtracting the farm labor requirement (from Table 6) times a opportunity-cost wage rate of Rs 5.00 per day.

```
14  14   0   0   0  11   1   1   0   0
 0   0   0   0   0   1   0   0   1   0
 1   0   0   0   0   01988   0   0   0
 0   0   0   0   0   0   0   0   0   0
 2   8   3   0   0   0   0   0   0   0   0
 1  11   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0 .000001..00000 .00000 .000001.00000 .00000
```

Table 11B. Combined Net Farm Income Added by P
roject through Benefit B

Unit = Rs. 100

GUDHA PROJECT

Kharif Season, Irrigated Surface P
lus Wells

Period												
No.	Year	Wheat	Barley	Pulses	Total Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	All Crops

Per hectare added net farm income (added gross income less production cost and t
otal labor cost)
multiplied by the developed hectarages from Table 9.

Entries for X5

The entries for X5 include commands for 14 periods of projected net farm income data by crop for the Kharif Season, Irrigated Surface Only. The table was created in a previous MASTERPJ run comparable to Example 1 for this case. This table too is to be added to the comparable tables for the other seasons and types of cultivation to produce the combined estimates of project benefits through the increased yield impacts of the agricultural development project.

The X5 table and the other X tables reflect the per hectare net farm income by crop for the season and type of cultivation multiplied by the hectarages in Table 9, as indicated by the footnotes included with this X5 entry. The areas in Table 9 were derived from the annual schedule of land area to be developed for surface irrigation in the Kharif Season in the project area, together with the projected cropping pattern for this season and type of cultivation.

```
 14  14   0   0   0  11   1   1   0   0
  0   0   0   0   0   1   0   0   1   0
  1   0   0   0   0   01988   0   0   0
  0   0   0   0   0   0   0   0   0   0
  2   8   3   0   0   0   0   0   0   0   0
  1  11   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0 .000001.00000 .00000 .000001.00000 .00000
```

Table 11B. Combined Net Farm Income Added by Project through Benefit B

Unit = Rs. 100

GUDHA PROJECT

Kharif Season, Irrigated Surface Only

Period

Entries for X5, continued

Sugar

No.	Year	Wheat	Barley	Pulses	Total Oilseeds	Vegetables	Paddy	Cane	Condiments	Fodder	Cotton	Other	All Crops

Per hectare added net farm income (added gross income less production cost and total labor cost)
multiplied by the developed hectarages from Table 9.

Entries for X6

The entries for X6 include commands for 14 periods of projected net farm income data by crop for the Kharif Season, Rainfed Cultivation. The table was created in a previous MASTERPJ run comparable to Example 1 for this case. This table too is to be added to the comparable tables for the other seasons and types of cultivation to produce the combined estimates of project benefits through the increased yield impacts of the agricultural development project. The entry of 1 in the seventh field of the first entry line indicates that the values for this variable are to be added to those of X1 .. X5 to obtain values for the master Y-table.

The X6 table as the other X tables reflects the per hectare net farm income by crop for the season and type of cultivation multiplied by the hectarages in Table 9, as indicated by the footnotes included with this X6 entry.

```
14  14   0   0   0  11   1   1   0   0
 0   0   0   0   0   1   0   0   1   0
 1   0   0   0   0  01988   0   0   0
 0   0   0   0   0   0   0   0   0   0
 2   8   3   0   0   0   0   0   0   0   0
 1  11   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0 .000001.00000 .00000 .000001.00000 .00000
```

Table 11B. Combined Net Farm Income Added by Project through Benefit B

Unit = Rs. 100

GUDHA PROJECT

Kharif Rainfed

Period No.	Year	Wheat	Barley	Pulses	Total Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	All Crops

Per hectare added net farm income (added gross income less production cost and total labor cost)
multiplied by the developed hectarages from Table 9.

Entries for Y

The entries in the INPUT.MPJ file for the Y-table to be generated by the run parallel those for the X variables, except that the table headings and footnotes differ, and commands are included to produce a conversion Y-table to reflect the transition to full potential yield increases once the development of a given area has been completed. The conversion table request is indicated by the command of 1 in the first position of the seventh entry line; the application of multiple-period transition factors is indicated by the entry of 2 at the fourth position on the same line.

The yield transition factors starting the year after an area has been developed are indicated by the CONVRT values of 0.000, 0.100, 0.200, etc., for periods 1 through 14, respectively, following the ninth line of command entries for this Y variable. The four lines of entry for the two title lines for the conversion table are included in the INPUT.MPJ file immediately following the ten title line entries for the master Y-table.

With these commands, a special routine is used in the program to project the transition in added net income due to the increase in yields. This routine applies the cumulative effect through time to each crop cell in the table, even though it takes several years (in this case seven) to reach the full yield potential of the first area developed for that crop. Areas developed in the sixth year would not reach 100 percent yield potential until project year 13.

```
14  14   0   0   0  11   1   1   0   0
 0   0   0   0   0   1   0   0   1   0
 1   0   0   0   0   01988   0   0   0
 0   0   0   0   0   0   0   0   0   0
 2   8   3   0   0   0   0   0   0   0   0
 1  11   0   0   0   0   0   0   0   0   0
 1   0   0   2   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0 .000001.00000 .00000 .000001.00000 .00000
 0.000
 0.100
 0.200
 0.300
 0.200
 0.200
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
 0.000
```

Entries for Y, continued

Table 11B. Combined Net Farm Income Added by P
roject through Benefit B
Before Reflecting Table 1 Yield Tr
ansition

GUDHA PROJECT

Unit = Rs. 100

Total of All Cultivation in Both Rabi and
Kharif Seasons

Table 12B. Total Net Farm Income Added by the P
roject from Benefit B
After Reflecting Table 1 Yield Tr
ansition

Period									
No.	Year	Wheat	Barley	Pulses	Total Oilseeds	Vegetables	Paddy	Sugar Cane	
Condiments		Fodder	Cotton	Other	All Crops				

Summation of Tables 11B by season and type of cultivation for Benefit B.

Transition to full production based on the schedule in Table 1.

Table of Input Data for Example 2, Increased Net Farm Income from Added Yields

The table of input data for MPJCase.Agr, Example 2, as contained in the MPJDATA.RUN file for the case is listed below. Separate sets of input data are included in sequence for X1, X2, ..., X6 in a continuous ASCII file in the format of I3, 1X, I4, 8F9.0. The file was created using the DOS editor, EDLIN, or LOTUS 123 as outlined in Section IV.

The input represents 14 consecutive years of projected data on computed net farm income added by the project through increased yields resulting from land improvement. The data are reported in units of 100 Indian Rupees. Reading from left to right, the data columns in the first data set represent added income from wheat, from barley, from pulses, from oilseeds, from vegetables, from paddy rice, from sugar cane, and from condiments. The three data columns in the second data set represent added yield income from fodder, from cotton, and from other crops.

X1 Data

0	1988	3198	0	31	575	50	0	0	154
1	1989	2569	0	15	1678	225	0	0	381
2	1990	2164	0	3	2500	355	0	0	550
3	1991	2287	0	3	2661	378	0	0	585
4	1992	2441	0	3	2828	401	0	0	621
5	1993	2554	0	3	2998	426	0	0	659
6	1994	2452	0	1	3127	447	0	0	685
7	1995	2413	0	0	3175	455	0	0	695
8	1996	2413	0	0	3175	455	0	0	695
9	1997	2413	0	0	3175	455	0	0	695
10	1998	2413	0	0	3175	455	0	0	695
11	1999	2413	0	0	3175	455	0	0	695
12	2000	2413	0	0	3175	455	0	0	695
13	2001	2413	0	0	3175	455	0	0	695
0	1988	119	0	0					
1	1989	128	0	0					
2	1990	136	0	0					
3	1991	144	0	0					
4	1992	153	0	0					
5	1993	161	0	0					
6	1994	161	0	0					
7	1995	161	0	0					
8	1996	161	0	0					
9	1997	161	0	0					
10	1998	161	0	0					
11	1999	161	0	0					
12	2000	161	0	0					
13	2001	161	0	0					

X2 Data

0	1988	7910	334	864	76	488	0	0	21
1	1989	6691	145	1088	907	1310	0	0	294
2	1990	5917	16	1253	1490	1891	0	0	485
3	1991	6103	16	1294	1540	1954	0	0	501
4	1992	6299	16	1336	1590	2017	0	0	517
5	1993	6468	16	1375	1641	2080	0	0	534
6	1994	6384	4	1386	1688	2125	0	0	549
7	1995	6352	0	1390	1705	2143	0	0	555
8	1996	6352	0	1390	1705	2143	0	0	555
9	1997	6352	0	1390	1705	2143	0	0	555
10	1998	6352	0	1390	1705	2143	0	0	555
11	1999	6352	0	1390	1705	2143	0	0	555
12	2000	6352	0	1390	1705	2143	0	0	555
13	2001	6352	0	1390	1705	2143	0	0	555
0	1988	470	0	0					
1	1989	816	0	0					
2	1990	1064	0	0					
3	1991	1099	0	0					
4	1992	1134	0	0					
5	1993	1169	0	0					
6	1994	1187	0	0					
7	1995	1195	0	0					
8	1996	1195	0	0					
9	1997	1195	0	0					
10	1998	1195	0	0					
11	1999	1195	0	0					
12	2000	1195	0	0					
13	2001	1195	0	0					

X3 Data

0	1988	15	9	685	83	0	0	0	388
1	1989	13	8	598	73	0	0	0	339
2	1990	11	7	511	62	0	0	0	289
3	1991	9	6	424	52	0	0	0	240
4	1992	7	5	332	40	0	0	0	188
5	1993	5	3	245	30	0	0	0	138
6	1994	5	3	245	30	0	0	0	138
7	1995	5	3	245	30	0	0	0	138
8	1996	5	3	245	30	0	0	0	138
9	1997	5	3	245	30	0	0	0	138
10	1998	5	3	245	30	0	0	0	138
11	1999	5	3	245	30	0	0	0	138
12	2000	5	3	245	30	0	0	0	138
13	2001	5	3	245	30	0	0	0	138

0	1988	0	0	0
1	1989	0	0	0
2	1990	0	0	0
3	1991	0	0	0
4	1992	0	0	0
5	1993	0	0	0
6	1994	0	0	0
7	1995	0	0	0
8	1996	0	0	0
9	1997	0	0	0
10	1998	0	0	0
11	1999	0	0	0
12	2000	0	0	0
13	2001	0	0	0

X4 Data

0	1988	844	362	171	37	548	339	13682	0
1	1989	1109	263	100	50	884	344	13864	0
2	1990	1292	197	51	58	1115	348	14045	0
3	1991	1309	200	52	59	1130	353	14225	0
4	1992	1328	203	53	60	1145	358	14448	0
5	1993	1346	206	54	61	1162	363	14646	0
6	1994	1353	203	52	61	1170	363	14646	0
7	1995	1355	202	51	61	1173	363	14646	0
8	1996	1355	202	51	61	1173	363	14646	0
9	1997	1355	202	51	61	1173	363	14646	0
10	1998	1355	202	51	61	1173	363	14646	0
11	1999	1355	202	51	61	1173	363	14646	0
12	2000	1355	202	51	61	1173	363	14646	0
13	2001	1355	202	51	61	1173	363	14646	0
0	1988	0	0	0					
1	1989	0	0	0					
2	1990	0	0	0					
3	1991	0	0	0					
4	1992	0	0	0					
5	1993	0	0	0					
6	1994	0	0	0					
7	1995	0	0	0					
8	1996	0	0	0					
9	1997	0	0	0					
10	1998	0	0	0					
11	1999	0	0	0					
12	2000	0	0	0					
13	2001	0	0	0					

X5 Data

0	1988	0	0	0	0	0	0	0	0
1	1989	99	75	67	9	78	136	2259	0
2	1990	253	171	120	57	252	191	4279	0
3	1991	442	280	165	132	489	191	6139	0
4	1992	633	390	211	207	728	194	8048	0
5	1993	823	500	255	283	967	192	9902	0
6	1994	913	534	232	350	1128	55	9498	0
7	1995	949	547	224	376	1191	0	9338	0
8	1996	949	547	224	376	1191	0	9338	0
9	1997	949	547	224	376	1191	0	9338	0
10	1998	949	547	224	376	1191	0	9338	0
11	1999	949	547	224	376	1191	0	9338	0
12	2000	949	547	224	376	1191	0	9338	0
13	2001	949	547	224	376	1191	0	9338	0
0	1988	0	0	0					
1	1989	0	0	0					
2	1990	0	0	0					
3	1991	0	0	0					
4	1992	0	0	0					
5	1993	0	0	0					
6	1994	0	0	0					
7	1995	0	0	0					
8	1996	0	0	0					
9	1997	0	0	0					
10	1998	0	0	0					
11	1999	0	0	0					
12	2000	0	0	0					
13	2001	0	0	0					

X6 Data

0	1988	3062	287	151	1123	0	0	0	0
1	1989	1181	2142	1686	1682	0	0	0	0
2	1990	-48	3264	2618	1993	0	0	0	0
3	1991	-66	3058	2453	1860	0	0	0	0
4	1992	-81	2847	2284	1726	0	0	0	0
5	1993	-80	2637	2116	1597	0	0	0	0
6	1994	89	2452	1963	1536	0	0	0	0
7	1995	154	2381	1904	1512	0	0	0	0
8	1996	154	2381	1904	1512	0	0	0	0
9	1997	154	2381	1904	1512	0	0	0	0
10	1998	154	2381	1904	1512	0	0	0	0
11	1999	154	2381	1904	1512	0	0	0	0
12	2000	154	2381	1904	1512	0	0	0	0
13	2001	154	2381	1904	1512	0	0	0	0

0	1988	1124	0	0
1	1989	554	0	0
2	1990	176	0	0
3	1991	158	0	0
4	1992	140	0	0
5	1993	128	0	0
6	1994	178	0	0
7	1995	197	0	0
8	1996	197	0	0
9	1997	197	0	0
10	1998	197	0	0
11	1999	197	0	0
12	2000	197	0	0
13	2001	197	0	0

Listing of the Output for Example 2, Increased Net Farm Income from Added Yields

The MASTERPJ output for Example 2 of the Rajasthan Agricultural Development case is reproduced on pages 113 to 120. The individual output for increased net farm income from added yields by season-type of cultivation combination (the output of X1 through Xn) was generated in a previous run comparable to that illustrated by Example 1. The master Y table on page 119 represents the straight cell-by-cell addition of the individual tables for the six independent variables. As with the X tables, it represents the potential full-development benefit from this source after the full yield transition has taken place.

In contrast, the conversion Y table on page 120 shows the projected year-by-year increase in net farm income due to the yield effects after the transition in crop yields has been reflected. It is the table to be used along with the comparable one for benefits from the added hectarages effects as the projected schedule of agricultural benefits for the Gudha Medium Irrigation Development Project.

Output for X1

Table 11B. Combined Net Farm Income Added by Project through Benefit B
Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Irrigated Surface Plus Wells

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crops
1	1988	3198	0	31	575	50	0	0	154	119	0	0	4127
2	1989	2569	0	15	1678	225	0	0	381	128	0	0	4996
3	1990	2164	0	3	2500	355	0	0	550	136	0	0	5708
4	1991	2287	0	3	2661	378	0	0	585	144	0	0	6058
5	1992	2441	0	3	2828	401	0	0	621	153	0	0	6447
6	1993	2554	0	3	2998	426	0	0	659	161	0	0	6801
7	1994	2452	0	1	3127	447	0	0	685	161	0	0	6873
8	1995	2413	0	0	3175	455	0	0	695	161	0	0	6899
9	1996	2413	0	0	3175	455	0	0	695	161	0	0	6899
10	1997	2413	0	0	3175	455	0	0	695	161	0	0	6899
11	1998	2413	0	0	3175	455	0	0	695	161	0	0	6899
12	1999	2413	0	0	3175	455	0	0	695	161	0	0	6899
13	2000	2413	0	0	3175	455	0	0	695	161	0	0	6899
14	2001	2413	0	0	3175	455	0	0	695	161	0	0	6899

SOURCE:
Per hectare added net farm income (added gross income less production cost and total labor cost) multiplied by the developed hectarages from Table 9.

Output for X2

Table 11B. Combined Net Farm Income Added by Project through Benefit B
Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Irrigated Surface Only

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Cro
1	1988	7910	334	864	76	488	0	0	21	470	0	0	10163
2	1989	6691	145	1088	907	1310	0	0	294	816	0	0	11251
3	1990	5917	16	1253	1490	1891	0	0	485	1064	0	0	12116
4	1991	6103	16	1294	1540	1954	0	0	501	1099	0	0	12507
5	1992	6299	16	1336	1590	2017	0	0	517	1134	0	0	12909
6	1993	6468	16	1375	1641	2080	0	0	534	1169	0	0	13283
7	1994	6384	4	1386	1688	2125	0	0	549	1187	0	0	13323
8	1995	6352	0	1390	1705	2143	0	0	555	1195	0	0	13340
9	1996	6352	0	1390	1705	2143	0	0	555	1195	0	0	13340
10	1997	6352	0	1390	1705	2143	0	0	555	1195	0	0	13340
11	1998	6352	0	1390	1705	2143	0	0	555	1195	0	0	13340
12	1999	6352	0	1390	1705	2143	0	0	555	1195	0	0	13340
13	2000	6352	0	1390	1705	2143	0	0	555	1195	0	0	13340
14	2001	6352	0	1390	1705	2143	0	0	555	1195	0	0	13340

SOURCE:
Per hectare added net farm income (added gross income less production cost and total labor cost) multiplied by the developed hectarages from Table 9.

Output for X3

Table 11B. Combined Net Farm Income Added by Project through Benefit C
Unit = Rs. 100

GUDHA PROJECT

Rabi Season, Dryland Cultivation

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crops
1	1988	15	9	685	83	0	0	0	388	0	0	0	1180
2	1989	13	8	598	73	0	0	0	339	0	0	0	1031
3	1990	11	7	511	62	0	0	0	289	0	0	0	880
4	1991	9	6	424	52	0	0	0	240	0	0	0	731
5	1992	7	5	332	40	0	0	0	188	0	0	0	572
6	1993	5	3	245	30	0	0	0	138	0	0	0	421
7	1994	5	3	245	30	0	0	0	138	0	0	0	421
8	1995	5	3	245	30	0	0	0	138	0	0	0	421
9	1996	5	3	245	30	0	0	0	138	0	0	0	421
10	1997	5	3	245	30	0	0	0	138	0	0	0	421
11	1998	5	3	245	30	0	0	0	138	0	0	0	421
12	1999	5	3	245	30	0	0	0	138	0	0	0	421
13	2000	5	3	245	30	0	0	0	138	0	0	0	421
14	2001	5	3	245	30	0	0	0	138	0	0	0	421

OURCE:
er hectare added net farm income (added gross income less production cost and total labor cost)
ultiplied by the developed hectarages from Table 9.

Output for X4

Table 11B. Combined Net Farm Income Added by Project through Benefit B
Unit = Rs. 10J

GUDHA PROJECT

Kharif Season, Irrigated Surface Plus Wells

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crop
1	1988	844	362	171	37	548	339	13682	0	0	0	0	15983
2	1989	1109	263	100	50	884	344	13864	0	0	0	0	16614
3	1990	1292	197	51	58	1115	348	14045	0	0	0	0	17106
4	1991	1309	200	52	59	1130	353	14225	0	0	0	0	17328
5	1992	1328	203	53	60	1145	358	14448	0	0	0	0	17595
6	1993	1346	206	54	61	1162	363	14646	0	0	0	0	17838
7	1994	1353	203	52	61	1170	363	14646	0	0	0	0	17848
8	1995	1355	202	51	61	1173	363	14646	0	0	0	0	17851
9	1996	1355	202	51	61	1173	363	14646	0	0	0	0	17851
10	1997	1355	202	51	61	1173	363	14646	0	0	0	0	17851
11	1998	1355	202	51	61	1173	363	14646	0	0	0	0	17851
12	1999	1355	202	51	61	1173	363	14646	0	0	0	0	17851
13	2000	1355	202	51	61	1173	363	14646	0	0	0	0	17851
14	2001	1355	202	51	61	1173	363	14646	0	0	0	0	17851

SOURCE:
Per hectare added net farm income (added gross income less production cost and total labor cost) multiplied by the developed hectarages from Table 9.

Output for X5

Table 11B. Combined Net Farm Income Added by Project through Benefit B
Unit = Rs. 100

GUDHA PROJECT

Kharif Season, Irrigated Surface Only

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crops
1	1988	0	0	0	0	0	0	0	0	0	0	0	0
2	1989	99	75	67	9	78	136	2259	0	0	0	0	2723
3	1990	253	171	120	57	252	191	4279	0	0	0	0	5323
4	1991	442	280	165	132	489	191	6139	0	0	0	0	7838
5	1992	633	390	211	207	728	194	8048	0	0	0	0	10411
6	1993	823	500	255	283	967	192	9902	0	0	0	0	12922
7	1994	913	534	232	350	1128	55	9498	0	0	0	0	12710
8	1995	949	547	224	376	1191	0	9338	0	0	0	0	12625
9	1996	949	547	224	376	1191	0	9338	0	0	0	0	12625
10	1997	949	547	224	376	1191	0	9338	0	0	0	0	12625
11	1998	949	547	224	376	1191	0	9338	0	0	0	0	12625
12	1999	949	547	224	376	1191	0	9338	0	0	0	0	12625
13	2000	949	547	224	376	1191	0	9338	0	0	0	0	12625
14	2001	949	547	224	376	1191	0	9338	0	0	0	0	12625

OURCE:
er hectare added net farm income (added gross income less production cost and total labor cost)
ultiplied by the developed hectarages from Table 9.

Output for X6

Table 11B. Combined Net Farm Income Added by Project through Benefit B
Unit = Rs. 100

GUDHA PROJECT

Kharif Rainfed

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crop
1	1988	3062	287	151	1123	0	0	0	0	1124	0	0	5747
2	1989	1181	2142	1686	1682	0	0	0	0	554	0	0	7245
3	1990	-48	3264	2618	1993	0	0	0	0	176	0	0	8003
4	1991	-66	3058	2453	1860	0	0	0	0	158	0	0	7463
5	1992	-81	2847	2284	1726	0	0	0	0	140	0	0	6916
6	1993	-80	2637	2116	1597	0	0	0	0	128	0	0	6398
7	1994	89	2452	1963	1536	0	0	0	0	178	0	0	6218
8	1995	154	2381	1904	1512	0	0	0	0	197	0	0	6148
9	1996	154	2381	1904	1512	0	0	0	0	197	0	0	6148
10	1997	154	2381	1904	1512	0	0	0	0	197	0	0	6148
11	1998	154	2381	1904	1512	0	0	0	0	197	0	0	6148
12	1999	154	2381	1904	1512	0	0	0	0	197	0	0	6148
13	2000	154	2381	1904	1512	0	0	0	0	197	0	0	6148
14	2001	154	2381	1904	1512	0	0	0	0	197	0	0	6148

SOURCE:
Per hectare added net farm income (added gross income less production cost and total labor cost) multiplied by the developed hectarages from Table 9.

Output for the Y Master Table

Table 11B. Combined Net Farm Income Added by Project through Benefit B
Before Reflecting Table 1 Yield Transition

GUDHA PROJECT

Unit = Rs. 100
Total of All Cultivation in Both Rabi and Kharif Seasons

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Crops
1	1988	15029	992	1902	1894	1086	339	13682	563	1713	0	0	37200
2	1989	11652	2633	3554	4399	2497	480	16123	1014	1498	0	0	43860
3	1990	9589	3655	4556	6160	3613	539	18324	1324	1376	0	0	49136
4	1991	10084	3560	4391	6304	3951	544	20364	1326	1401	0	0	51925
5	1992	10627	3461	4219	6451	4291	552	22496	1326	1427	0	0	54850
6	1993	11116	3362	4048	6610	4635	555	24548	1331	1458	0	0	57663
7	1994	11196	3196	3879	6792	4870	418	24144	1372	1526	0	0	57393
8	1995	11228	3133	3814	6859	4962	363	23984	1388	1553	0	0	57284
9	1996	11228	3133	3814	6859	4962	363	23984	1388	1553	0	0	57284
10	1997	11228	3133	3814	6859	4962	363	23984	1388	1553	0	0	57284
11	1998	11228	3133	3814	6859	4962	363	23984	1388	1553	0	0	57284
12	1999	11228	3133	3814	6859	4962	363	23984	1388	1553	0	0	57284
13	2000	11228	3133	3814	6859	4962	363	23984	1388	1553	0	0	57284
14	2001	11228	3133	3814	6859	4962	363	23984	1388	1553	0	0	57284

SOURCE:
Summation of Tables 11B by season and type of cultivation for Benefit B.
Transition to full production based on the schedule in Table 1.

Output for the Y Conversion Table

Table 12B. Total Net Farm Income Added by the Project from Benefit B
After Reflecting Table 1 Yield Transition

GUDHA PROJECT

Unit = Rs. 100
Total of All Cultivation in Both Rabi and Kharif Seasons

Period No.	Year	Wheat	Barley	Pulses	Oilseeds	Vegetables	Paddy	Sugar Cane	Condiments	Fodder	Cotton	Other	Total All Cro
1	1988	0	0	0	0	0	0	0	0	0	0	0	0
2	1989	1503	99	190	189	109	34	1368	56	171	0	0	3719
3	1990	4172	461	735	819	467	116	4348	214	493	0	0	11825
4	1991	7800	1191	1738	2064	1186	252	9162	504	952	0	0	24849
5	1992	9431	2075	2796	3561	2084	374	13274	815	1207	0	0	35617
6	1993	11295	2880	3758	5013	3019	490	17781	1111	1479	0	0	46826
7	1994	10512	3354	4188	5954	3729	533	19953	1264	1426	0	0	50913
8	1995	10466	3473	4255	6429	4214	536	21811	1331	1428	0	0	53941
9	1996	10939	3365	4093	6578	4509	506	23163	1342	1462	0	0	55857
10	1997	11076	3263	3962	6708	4734	455	23847	1360	1501	0	0	56906
11	1998	11199	3191	3874	6796	4878	413	24129	1373	1529	0	0	57382
12	1999	11222	3146	3827	6846	4943	375	24016	1385	1548	0	0	57308
13	2000	11229	3134	3814	6860	4961	364	23984	1389	1554	0	0	57289
14	2001	11229	3134	3814	6860	4961	364	23984	1389	1554	0	0	57289

SOURCE:
Summation of Tables 11B by season and type of cultivation for Benefit B.
Transition to full production based on the schedule in Table 1.

APPENDIX A

LISTING OF THE MASTER1 SOURCE PROGRAM

```
C
C       PROGRAM TO READ COMMAND INPUT FOR MASTER PROJECTIONS
C                          (MASTER1)
C                 PROFESSOR RICHARD PHILLIPS
C            DEPARTMENT OF AGRICULTURAL ECONOMICS
C                  KANSAS STATE UNIVERSITY
C
C     This program reads default values from commands to the MASTERPJ
C  Program from a disk file, DEFAULT.VAL, and reads user commands in
C  response to screen prompts, and creates the command input file for
C  the Master Projection Program, INPUT.MPJ.
C     It should be noted that the file INPUT.MPJ is in the same format
C  as DEFAULT.VAL, so that after one has become familiar with the pro-
C  gram, the input can be prepared by editing a copy of DEFAULT.VAL
C  (say with the DOS editor, EDLIN) and then renaming it to INPUT.MPJ
C  for direct reading by that program.
C
      DIMENSION RESBAL(40),BRATE(72),CHANGE(180),CONVRT(180),
     1CMULT(180),VECTOR(180)
      DIMENSION LPWH(4),IOUTLI(10),INSET(10)
      DIMENSION KUNIT(4),KPWH(13,4),MPWH(13,4),NPLOT(60),JDOC(80),
     1JHEAD (80),IPEROD(180),IHEAD(200),IPWH(800)
    2 FORMAT (2(I2,1X),I1)
    3 FORMAT (7I4)
    8 FORMAT (5I4,6F7.5)
    9 FORMAT (13I4)
   96 FORMAT (20A4)
   98 FORMAT (4A4,64X)
  103 FORMAT (F9.4)
      INF = 2
      MTRIP = 1
      ISTOCK = 0
      IDENT = 0
      OPEN (2,FILE='DEFAULT.VAL',STATUS='OLD')
C
C   I. READ BASIC PARAMETERS FOR ALL PROBLEMS IN THE RUN
C      0. Read problem size, logical units and number of master
C         tables.          FORMAT is 7 I 4
C
    1 READ (INF,3,END=300) LROW,LCOL,NREAD,NPUNCH,NPRINT,NDISK,NFAC
      WRITE (0,151) LROW,LCOL,NFAC
  151 FORMAT (/15X,'REGRESSION PROJECTION PROGRAM WITH MULTIPLE OPTIONS'
     1 /26X,'Professor Richard Phillips'/21X,'Department of Agricultural
     2 Economics'/27X,'Kansas State University'//5X,'* This program read
     3s computational instructions from the screen menu'/7X,'and the his
     4torical time series data for N periods from the users'/7X,'disk fi
     5le in LOTUS 123 print file format.'/5X,'* The program fits mathema
     6tical time trends with specified model'/7X,'and makes projections
```

```
     7for M periods into the future.'/5X,'* Default options to the menu
     8instructions are read from a disk file; they'/7X,'can be replaced
     9in any order by the user any time prior to execution.'/5X,'* The m
     Aany options under the program are controlled by keyboard commands'
     B/7X,'given by the user in response to menu prompts.'//' MAXIMUM NU
     CMBER OF PERIODS FOR RUN:',9X,I4,1X,'(Enter as 75, etc.)'/' MAXIMUM
     D NUMBER OF COLUMNS FOR RUN:',9X,I4,1X,'(Enter as above)'/' NUMBER
     EOF VARIABLES (MASTER TABLES) IN RUN:',I4,1X,'(Enter as 1, 3, etc.)
     F'//' SELECTIONS: ',5X,'(Leave one blank space between entries, and
     G key <return>'/18X,'after all three entries have been made).'/)
      READ (0,2) LROW,LCOL,NFAC
      IF (NFAC.EQ.0) NFAC = 1
  190 ICONCU = 0
      ICODE = 0
      NI = 1
      IPAST = IYIN
      IDENT = IDENT + 1
      IMENU = 0
C
C   II. READ DEFAULT VALUES FROM DISK FILE, "DEFAULT.VAL"
C
C     1. Read Commands for Type of Projection Model and Analysis
  195 READ (INF,9,END=300) NA,NU,IX1,IX2,NP,NC,IFORM,IYIN,LPRJ,KRATE
C
C     2. Read Commands for Special Features Invoked for the Run
      READ (INF,9) ICYC,NOTL,NOPRT,KARDM,KARDT,NOMOD,NLANG,NCARDS,
     1NEGNO,NONEG,ISKIP
C
C     3. Read Commands for Period Designations
      READ (INF,9) IANN,IQTR,IMON,JQTR,JMON,IMOVE,NYR,NQTR,NMON,ISTART
C
C     4. Read Commands for Columnar Reorganization of Table
      READ (INF,9) JCOL1,JCOL2,JCOL3,JCOL4,JCOL5,JCOL6,IRIGHT,ILEFT,IONE
     1,IFINAL
C
C     5. Read Organizational Pattern for Input Data Sets
      READ (INF,9) NCS,(INSET(I),I=1,10)
C
C     6. Read Organizational Pattern of Output Data Sets
      READ (INF,9) INO,(IOUTLI(I),I=1,10)
C
C     7. Read Calls for Special and Supplemental Tables
      READ (INF,9) IFEED,ISAME,IPLOT,JCOUTY,JEST,LPLOT,NDEV,NFIT,NRATE
C
C     8. Read Commands for Plotting Graphs
      READ (INF,9) (NPLOT(I),I=1,13)
C
C     9. Read Commands for Food Security Analysis and Projection
C        Coefficients
      READ (INF,8) ISTOCK,IREG,IMPORT,NRTR,NCAP,ACEPT,CONST,FACTO1,
     1FACTO2,WCOEF,WRATE
      IF (MTRIP.EQ.NFAC) ICODE = 1
```

```
C
C   III. READ COMMAND VALUES FROM THE SCREEN
C
  141 WRITE (0,48)
   48 FORMAT (20(/))
      IF (ICODE.EQ.1) WRITE (0,156)
  156 FORMAT (/' COMMAND VALUES TO BE SPECIFIED FOR THE FINAL PROJECTION
     1'//)
      IF (ICODE.EQ.0) WRITE (0,153) IDENT
  153 FORMAT (/' COMMAND VALUES TO BE SPECIFIED FOR X',I1,//)
      PAUSE
  142 WRITE (0,157)
  157 FORMAT (' Enter Code Number of Menu Selection and Key <return>.'//
     110X,'1  Type of Projection Model and Analysis'//10X,'2  Special Fe
     2atures Invoked for the Run'//10X,'3  Commands for Period Designati
     3ons'//10X,'4  Commands for Columnar Reorganization of Table' //10X
     4,'5  Organization of Input Data Sets'//10X,'6  Organization of Out
     5put Data Sets'//10X,'7  Call for Special and Supplemental Tables'/
     6/10X,'8  Commands for Graphs to Be Plotted'//10X,'9  Commands for
     7Food Security Analysis and Projection Coefficients'//' SELECTION:
     8 ',I2/)
      READ (0,154) IVALUE
  154 FORMAT (I1)
      IF (IVALUE.EQ.0) GOTO 150
      GOTO (201,202,203,204,205,206,207,208,209),IVALUE
  201 WRITE (0,41)NA,NU,IX1,IX2,NP,NC,IFORM,IYIN,LPRJ,KRATE
   41 FORMAT ('  COMMANDS FOR TYPE OF PROJECTION MODEL AND ANALYSIS:'///
     15X,' Enter two-digit value for each command in succession, with on
     2e blank'/6X,'between entries.'//' 1  NUMBER OF PERIODS TO READ IN:
     3',11X,I4,3X,'(Enter as two-digit number)'    /' 2  NO. OF PERIODS
     4TO USE FOR PROJECTIONS:  ',I4,3X,'(Enter as above)'/' 3  FIRST EXP
     5ONENT ON TIME VARIABLE:',8X,I4,3X,'(Enter as above)'//' 4  LAST EX
     6PONENT ON TIME VARIABLE:',9X,I4,3X,'(Enter as above)'/' 5  NUMBER
     7OF PERIODS TO PROJECT:',11X,I4,3X,'(Enter as above)'/' 6  TOTAL NU
     8MBER OF COLUMNS TO PROJECT:',5X,I4,3X,'(Enter as above)'//' 7  MAT
     9HEMATICAL IMPACT OF THIS VARIABLE:',5X,I2,3X,'(1 = +, 2 = *, 3 = -
     A, 4 = /)'/' 8  FIRST YEAR OF DATA IN TABLE:',12X,I4,3X,'(Enter as
     Babove)'/' 9  USE LOG PROJECTION MODEL:',15X,I4,3X,'(Enter as above
     C)'/' 10 PROJECT AT SPECIFIED RATE:',14X,I4,3X,'(Enter as above)'//
     D' SELECTIONS: '/)
      READ (0,10) NA,NU,IX1,IX2,NP,NC,IFORM,IYIN,LPRJ,KRATE
   10 FORMAT (11(I2,1X))
      IF (IYIN.GT.5) IYIN = IYIN + 1900
      GOTO 142
  202 WRITE (0,42) ICYC,NOTL,NOPRT,KARDM,KARDT,NOMOD,NLANG,NCARDS,NEGNO,
     1NONEG,ISKIP
   42 FORMAT (/' COMMANDS FOR SPECIAL FEATURES INVOKED FOR THE RUN:'///5
     1X,'Enter one-digit integer for each command in succession, with on
     2e'/5X,'blank space between entries.'//' 1  REFLECT CYCLIC PATTERNS
     3 IN DATA:',13X,I2,4X,'(Yes = 1, No = 0)'/' 2  OMIT TOTAL COLUMN IN
     4 OUTPUT TABLE:',11X,I2,4X,'(Yes = 1, No = 0)'/' 3  SKIP PRINTING T
     5HIS MASTER TABLE:',13X,I2,4X,'(Yes = 1, No = 0)'//' 4  CREATE FILE
```

```
     6 OF MASTER OUTPUT TABLE:',10X,I2,4X,'(Yes - 1, No - 0)'/' 5  CREAT
     7E FILE OF CONVERSION OUTPUT TABLE:',6X,I2,4X,'(Yes - 1, No - 0)'/'
     8 6  OMIT DISPLAYING TYPE OF MODEL:',15X,I2,4X,'(Yes - 1, No - 0)'/
     9/' 7  LANGUAGE CODE FOR OUTPUT:',20X,I2/5X,'(English - 0, Spanish
     A- 1, French - 2)'/' 8  NUMBER OF DATA SETS PER PERIOD FOR IRR INPU
     BT:',I2,4X,'(Enter 1-digit number)'/' 9  PROJECT NEGATIVE NUMBERS:'
     C,20X,I2,4X,'(Yes - 1, No - 0)'/' 10 IGNORE MINUS SIGNS IN DATA:',1
     D8X,I2,4X,'(Yes - 1, No - 0)'/' 11 SKIP PRINTING STAT. PARAMETERS:'
     E,14X,I2,4X,'(Yes - 1, No - 0)'//' SELECTIONS: '/)
      READ (0,11) ICYC,NOTL,NOPRT,KARDM,KARDT,NOMOD,NLANG,NCARDS,NEGNO,
     1NONEG,ISKIP
   11 FORMAT (13(I1,1X))
      GOTO 142
  203 WRITE(0,43)IANN,IQTR,IMON,JQTR,JMON,IMOVE,NYR,NQTR,NMON,ISTART
   43 FORMAT (/' COMMANDS FOR PERIOD DESIGNATIONS:'///5X,'Enter two (and
     1 four) digit integer value for each command in succession,'/5X,'wi
     2th one blank space between entries.'//' 1  ANNUAL DESIGNATIONS PRO
     3VIDED: ',18X,I1,3X,'(Yes - 01, No - 00)'/' 2  QUARTERLY DESIGNATIO
     4NS PROVIDED: ',15X,I1,3X,'(Yes - 01, No - 00)'/' 3  MONTHLY DESIGN
     5ATIONS PROVIDED: ',17X,I1,3X,'(Yes - 01, No - 00)'//' 4  NUMBER OF
     6 QUARTERS IN FIRST YEAR:',14X,I2,3X,'(Enter as 04, 02, etc.)'/' 5
     7 NUMBER OF MONTHS IN FIRST YEAR: ',15X,I2,3X,  '(Enter as 03, 11,
     8etc.)'/' 6  COMMAND TO REORGANIZE COLUMNS IN TABLE:',8X,I2,3X,'(Ye
     9s - 01, No - 00)'//' 7  FIRST YEAR DESIGNATION:',22X,I4,3X,'(Enter
     A as 1988, etc.)'/' 8  FIRST QUARTER DESIGNATION:',19X,I4,3X,'(Ente
     Br as 0188, etc.)'/' 9  FIRST MONTH DESIGNATION:',21X,I4,3X,'(Enter
     C as 0988, etc.)'/' 10 BASE PERIOD FOR PROJECTING AT SPECIFIED RATE
     D:',I4,3X,'Enter as 1990, etc.).'//' SELECTIONS: '/)
      READ (0,12) IANN,IQTR,IMON,JQTR,JMON,IMOVE,NYR,NQTR,NMON,ISTART
   12 FORMAT (6(I2,1X),4(I4,1X))
      GOTO 142
  204 IF (IMOVE.EQ.1) GOTO 244
      WRITE (0,54)
   54 FORMAT('1',' NO COLUMNAR REORGANIZATION REQUESTED UNDER "IMOVE"'/)
      PAUSE
      GOTO 142
  244 WRITE (0,44) JCOL1,JCOL2,JCOL3,JCOL4,JCOL5,JCOL6,IRIGHT,ILEFT,
     1IONE,IFINAL
   44 FORMAT (/' COMMANDS FOR COLUMNAR REORGANIZATION OF TABLE:'//5X,'En
     1ter two-digit integer values for each command in sequence, with'/5
     2X,  'one blank space between entries, and then <return>.'//' NUMBE
     3R OF FIRST DATA COLUMN TO BE REMOVED:  ',I2,4X,'(Enter as 03, etc.
     4)'/' NUMBER OF SECOND DATA COLUMN TO BE REMOVED: ',I2,4X,'(Enter a
     5s above)'/' NUMBER OF THIRD DATA COLUMN TO BE REMOVED:  ', I2,4X,'
     6(Enter as above)'//' NUMBER OF FOURTH DATA COLUMN TO BE REMOVED: '
     7,I2,4X,'(Enter as above)'/' NUMBER OF FIFTH DATA COLUMN TO BE REMO
     8VED:  ',I2,4X,'(Enter as above)'/' NUMBER OF SIXTH DATA COLUMN TO
     9BE REMOVED:  ',I2,4X,'(Enter as above)'//' SHIFT COLUMNS TO THE RI
     AGHT: ',16X,I2,4X,'(Yes - 01, No - 00)'/' SHIFT COLUMNS TO THE LEFT
     B:',18X,I2,4X,'(Yes - 01, No - 00)'/' NUMBER OF FIRST COLUMN TO BE
     CSHIFTED: ',6X,I2,4X,'(Enter as 04, etc.)'/' NUMBER OF LAST COLUMN
     DTO BE SHIFTED: ',7X,I2,4X,'(Enter as above.)'//' SELECTION: '/)
```

```
      READ (0,10) JCOL1,JCOL2,JCOL3,JCOL4,JCOL5,JCOL6,IRIGHT,ILEFT,
     1IONE,IFINAL
      GOTO 142
  205 WRITE (0,45) NCS,(INSET(I),I=1,10)
   45 FORMAT(/' ORGANIZATION OF INPUT DATA SETS:'///5X,'(Enter two-digit
     1 numbers in sequence for the columns'/5X,'included in data sets 1
     2.. n, and then <return>.'//' TOTAL NUMBER OF INPUT DATA SETS: ',6X
     3,I2,4X,'(Enter as 03, 10, etc.)'/' NUMBER OF COLUMNS IN FIRST DATA
     4 SET:   ',I2,4X,'(Enter as 08, etc.)'/' NUMBER OF COLUMNS IN SECON
     5D DATA SET:  ',I2,4X,'(Enter as above)'/' NUMBER OF COLUMNS IN THI
     6RD DATA SET:   ',I2,4X,'(Enter as above)'/' NUMBER OF COLUMNS IN F
     7OURTH DATA SET:  ',I2,4X,'(Enter as above)'/' NUMBER OF COLUMNS IN
     8 FIFTH DATA SET:   ',I2,4X,'(Enter as above)'/' NUMBER OF COLUMNS
     9IN SIXTH DATA SET:   ',I2,4X,'(Enter as above)'/' NUMBER OF COLUMN
     AS IN SEVENTH DATA SET: ',I2,4X,'(Enter as above)'/' NUMBER OF COLU
     BMNS IN EIGHTH DATA SET:  ',I2,4X,'(Enter as above)'/' NUMBER OF CO
     CLUMNS IN NINTH DATA SET:   ',I2,4X,'(Enter as above)'/' NUMBER OF
     DCOLUMNS IN TENTH DATA SET:   ',I2,4X,'(Enter as above)'//' SELECTI
     EONS: '/)
      READ (0,10) NCS,(INSET(I),I=1,10)
      GOTO 142
  206 WRITE (0,46) INO,(IOUTLI(I),I=1,10)
   46 FORMAT (/' ORGANIZATION OF OUTPUT DATA SETS:'///5X,'Enter two-digi
     1t numbers for columns in each output data set in sequence,'/5X,'wi
     2th one blank space between entries, and then <return>.'//' TOTAL N
     3UMBER OF OUTPUT DATA SETS: ',7X,I2,4X,'(Enter as 01, 10, etc.)'/'
     4NUMBER OF COLUMNS IN FIRST OUTPUT SET:   ',I2,4X,'(Enter as 08, et
     5c.)'/' NUMBER OF COLUMNS IN SECOND OUTPUT SET:  ',I2,4X,'(Enter as
     6 above)'/' NUMBER OF COLUMNS IN THIRD OUTPUT SET:   ',I2,4X,'(Ente
     7r as above)'/' NUMBER OF COLUMNS IN FOURTH OUTPUT SET:  ',I2,4X,'(
     8Enter as above)'/' NUMBER OF COLUMNS IN FIFTH OUTPUT SET:   ',I2,4
     9X,'(Enter as above)'/' NUMBER OF COLUMNS IN SIXTH OUTPUT SET:   ',
     AI2,4X,'(Enter as above)'/' NUMBER OF COLUMNS IN SEVENTH OUTPUT SET
     B: ',I2,4X,'(Enter as above)'/' NUMBER OF COLUMNS IN EIGHTH OUTPUT
     CSET:  ',I2,4X.'(Enter as above)'/' NUMBER OF COLUMNS IN NINTH OUTP
     DUT SET:   ',I2,4X,'(Enter as above)'/' NUMBER OF COLUMNS IN TENTH
     EOUTPUT SET:   ',I2,4X,'(Enter as above)'//' SELECTIONS: '/)
      READ (0,10) INO,(IOUTLI(I),I=1,10)
      GOTO 142
  207 WRITE (0,47) IFEED,ISAME,IPLOT,JCOUTY,JEST,LPLOT,NDEV,NFIT,NRATE
   47 FORMAT (/' CALLS FOR SPECIAL AND SUPPLEMENTAL OUTPUT:'///5X,'Enter
     1 commands as one-digit numbers in sequence, with one blank space'/
     25X,'between entries, and then <return>.'///' MAKE CONVERSION TABLE
     3S FROM PROJECTED VALUES:',I2,4X,'(Yes = 1, No = 0)'/' CONVERSION F
     4ACTOR CONSTANT THROUGH TIME:',5X,I2,4X,'(Yes = 1, No = 0)'/' CREAT
     5E GRAPH OF ONE OR MORE VARIABLES:',7X,I2,4X,'(Yes = 1, No = 0)'/'
     6CREATE FILE FOR PRORATE PROJECTIONS:',9X,I2,4X,'(Yes = 1, No = 0)'
     7/5X,'(Include yield transitions = 2)'/' PROVIDE TABLES OF STATISTI
     8CAL ESTIMATES'/12X,'FOR HISTORICAL PERIOD:',12X,I2,4X,'(Yes = 1, N
     9o = 0)'//' COMPRESS Y AXIS ON PLOTS:',20X,I2,4X,'(Yes = 1, No = 0)
     A'/' CREATE TABLE OF DEVIATIONS FROM TREND:',7X,I2,4X,'(Yes = 1, No
     B = 0)'/' FIT TREND FUNCTIONS WITHOUT PROJECTIONS:',5X,I2,4X,'(Yes
```

```
     C= 1, No = 0'/' PROJECT AT CONSTANT RATE OVER TIME: ',9X,I2,4X,'(Ye
     Ds = 1, No = 0).'//' SELECTIONS: '/)
      READ (0,11) IFEED,ISAME,IPLOT,JCOUNTY,JEST,LPLOT,NDEV,NFIT,NRATE
      GOTO 142
  208 WRITE (0,58) (NPLOT(I),I=1,13)
   58 FORMAT (/' REQUEST FOR MASTER TABLE COLUMNS TO BE PLOTTED:'///5X,'
     1Enter request for plots of each desired column in the master table
     2'/5X,'in sequence, with one space between entries, and then <retur
     3n>.'//' DO PLOT OF FIRST DATA COLUMN:',6X,I2,4X,'(Yes = 1, No = 0)
     4', /' DO PLOT OF SECOND DATA COLUMN:',5X,I2,4X,'(Yes = 1, No = 0)'
     5, /' DO PLOT OF THIRD DATA COLUMN:',6X,I2,4X,'(Yes = 1, No = 0)',
     6 /' DO PLOT OF FOURTH DATA COLUMN:',5X,I2,4X,'(Yes = 1, No = 0)',
     7 /' DO PLOT OF FIFTH DATA COLUMN:',6X,I2,4X,'(Yes = 1, No = 0)',
     8 /' DO PLOT OF SIXTH DATA COLUMN:',6X,I2,4X,'(Yes = 1, No = 0)',
     9 /' DO PLOT OF SEVENTH DATA COLUMN:',4X,I2,4X,'(Yes = 1, No = 0)',
     A /' DO PLOT OF EIGHTH DATA COLUMN:',5X,I2,4X,'(Yes = 1, No = 0)',
     B /' DO PLOT OF NINTH DATA COLUMN:',6X,I2,4X,'(Yes = 1, No = 0)',
     C /' DO PLOT OF TENTH DATA COLUMN:',6X,I2,4X,'(Yes = 1, No = 0)',
     D /' DO PLOT OF ELEVENTH DATA COLUMN:',3X,I2,4X,'(Yes = 1, No = 0)'
     E, /' DO PLOT OF TWELFTH DATA COLUMN:',4X,I2,4X,'(Yes = 1, No = 0)'
     F,/' DO PLOT OF THIRTEENTH DATA COLUMN: ',I2,4X,'(Yes = 1, No = 0)'
     G//' SELECTIONS: '/)
      READ (0,11) (NPLOT(I),I=1,13)
      GOTO 142
  209 WRITE (0,49) ISTOCK,IREG,IMPORT,NRTR,NCAP,ACEPT,CONST,FACTO1,
     1FACTO2,WCOEF,WRATE
   49 FORMAT(/' COMMANDS FOR FOOD SECURITY ANALYSIS AND PROJECTION COEFF
     1ICIENTS:'///5X,'Enter appropriate value for each variable in seque
     2nce'/5X,'with one blank space between entries.'//' MAKE ANALYSIS O
     3F FOOD SECURITY RESERVES:',15X,I2,4X,'(Yes = 1, No = 0)'/32X,'(Res
     4erve balances = 2)'/' REGIONAL RESERVE ANALYSIS:',29X,I2,4X,'(Yes
     5= 1, No = 0)'/' TRADE ADJUSTMENT ANALYSIS:',29X,I2,4X,'(Yes = 1, N
     6o = 0)'/' NEEDED TRANSACTIONS WITH SECURITY RESERVES:',12X,I2,4X,
     7'(Yes = 1, No = 0)'/' NEEDED RESERVE CAPACITY:',31X,I2,4X,'(Yes =
     81, No = 0)'//' Y-INTERCEPT FOR REGRESSION ESTIMATES:',15X,F5.3/ 3X
     9,'(Enter as 4-character decimal such as 1.10 or .134)'/' FIRST PER
     AIOD CONVERSION FACTOR: ',20X,F5.3,4X,'(Enter as above)'/' FRACTION
     B OF TRADE ADJUSTMENT EFFECTIVE FIRST PERIOD:', F5.3,4X,'(Enter as
     Cabove)'/' FRACTION OF TRADE ADJUSTMENT EFFECTIVE NEXT PERIOD: ', F
     D5.3,4X,'(Enter as above)'/' REGRESSION COEFFICIENT FOR CURRENT VAR
     EIABLE: ',7X,F5.3,4X,'(Enter as above) '/' RATE OF CHANGE FOR PROJE
     FCTION: ',21X,F5.3,4X,'(Enter as above).'//' SELECTIONS: '/)
      READ (0,13) ISTOCK,IREG,IMPORT,NRTR,NCAP,ACEPT,CONST,FACTO1,
     1FACTO2,WCOEF,WRATE
   13 FORMAT (5(I1,1X),6F5.5)
      GOTO 142
C
C  10. Read Cycle Multipliers if ICYC at Step 2 = 1
C
  150 LIM = NA + NP
      IF (IFEED.EQ.0.AND.ICYC.EQ.0.AND.KRATE.EQ.0) GOTO 443
      IF (ICYC.EQ.0) GOTO 444
```

```
      WRITE (0,50)
   50 FORMAT ('1 CYCLE MULTIPLIERS BY PERIOD:'/10X,'Type <return> to acc
     lept'/10X,'Type decimal value and <return> to change.'/)
   14 FORMAT (' ',' Cycle multiplier for period ',I2,' is ',F5.3,':  Use
     1 ____.')
      DO 422 I = 1,LIM
      CHANGE(I) = 0.0
      READ (INF,103) VECTOR(I)
      WRITE (0,14) I,VECTOR(I)
      READ (0,103) CHANGE(I)
      IF (CHANGE(I).NE.0) VECTOR(I) = CHANGE(I)
  422 CONTINUE
  444 IF (KRATE.EQ.0) GOTO 448
C
C  11. Read Projection Rates if KRATE at Step 1 = 1 and NRATE at
C      Step 7 = 0
C
      WRITE (0,40)
   40 FORMAT ('1 PROJECTION RATES BY PERIOD: '/10X,'Type <return> to acc
     lept'/10X,'Type decimal value and <return> to change.'/)
   81 FORMAT (' ','Projection rate for period ',I2,' is ',F5.3,':  Use _
     1____.')
      NQ = ISTART - IYIN
      I5 = NQ - 1
      DO 51 I = NQ,LIM
      CHANGE(I) = 0.0
      BRATE(I) = WRATE
      I5 = I5 + 1
      IF (NRATE.EQ.1) GOTO 52
      READ (INF,103) BRATE(I)
      WRITE (0,81) I5,BRATE(I)
      READ (0,103) CHANGE(I)
      IF (CHANGE(I).NE.0) BRATE(I) = CHANGE(I)
   52 CONTINUE
   51 CONTINUE
  448 CONTINUE
      IF (IFEED.EQ.0) GOTO 443
C
C  12. Read Conversion Rates if IFEED at Step 7 = 1 and ISAME
C      at Step 7 = 0
C
      WRITE (0,84)
   84 FORMAT ('1 CONVERSION RATES BY PERIOD: '/10X,'Type <return> to acc
     lept'/10X,'Type decimal value and <return> to change.'/)
   83 FORMAT (' ','Conversion rate for period ',I2,' is ',F5.3,':  Use _
     1 ____.')
      DO 87 I = 1,LIM
      CONVRT(I) = CONST
      IF (ISAME.EQ.1) GOTO 86
      CHANGE(I) = 0.0
      READ (INF,103) CONVRT(I)
      WRITE (0,83) I,CONVRT(I)
```

```
      READ (0,103) CHANGE(I)
      IF (CHANGE(I).NE.0) CONVRT(I) = CHANGE(I)
   87 CONTINUE
   86 CONTINUE
  443 CONTINUE
      IF (IPLOT.EQ.0) GOTO 449
C
C  13. Read Unit of Measure for Graphs if IPLOT at Step 7 = 1
C
  450 FORMAT ('1 UNIT OF MEASURE FOR GRAPHS IS ',4A4,//10X, 'Type in des
     lired unit (up to 16 spaces) and <return>.'/)
  451 FORMAT ('1',' IDENTIFICATION FOR VARIABLE PLOTTED IS ',4A4,//10X,
     1'Type in desired identification (up to 16 spaces) and <return>.'/)
      READ (INF,98) (KUNIT(J),J=1,4)
      WRITE (0,450) (KUNIT(J),J=1,4)
      READ (0,98) (LPWH(J),J=1,4)
      DO 97 J = 1,4
      IF (LPWH(1).NE.0) KUNIT(J) = LPWH(J)
   97 CONTINUE
  449 IF (IMENU.EQ.1) GOTO 210
C
C  14. Read Table Titles, including Two Title Lines for
C       Conversion Table if IFEED at Step 7 = 1
C
      READ (INF,96) IHEAD
      IF (IFEED.EQ.1) READ (INF,96) JHEAD
C
C  15. Read Column Headers for INO Pages of Output (Step 6)
C
      DO 405 I = 1,INO*2
      IN3 = (I-1)*40+1
      IN4 = IN3 + 39
      READ (INF,96) (IPWH(L),L=IN3,IN4)
  405 CONTINUE
C
C  16. Read Footnotes for the Master Tables
C
      READ (INF,96) JDOC
      IF (IPLOT.EQ.0) GOTO 339
      DO 349 I = 1,13
      IF (NPLOT(I).EQ.0) GOTO 349
C
C  17. Read Identification for Variable Plotted on each
C       NPLOT(i) Graph (Step 8)
C
      READ (INF,98) (KPWH(I,J),J=1,4)
      WRITE (0,451) (KPWH(I,J),J=1,4)
      READ (0,98) (MPWH(I,J),J=1,4)
      DO 338 J = 1,4
      IF (MPWH(I,1).NE.0) KPWH(I,J) = MPWH(I,J)
  338 CONTINUE
  349 CONTINUE
```

```
  339 CONTINUE
C
C   IV. READ TITLES, HEADERS AND FOOTNOTES FOR OUTPUT TABLES
C
  210 WRITE (0,92)
   92 FORMAT (/' TO BYPASS TYPING IN TITLE, HEADERS, AND FOOTNOTES'//5X,
     1'1. Type 0 to bypass; type 1 to not bypass.'//' IF NOT BYPASSING T
     2HIS STEP:'/ 5X,'2. Insert ten title lines for master tables (to ma
     3ke five-line title in'/8X,'20A4/13A4 format), with <return> at the
     4 end of each line.'/5X,              '3. If making conversion tabl
     5e, insert four title lines as above.'/5X,'4. Insert four column he
     6ader lines (printed as two-line decked headers,'/8X,'for each page
     7 of output (INO), with <return at the end of each line;'/8X,'Forma
     8t is 8 A 10 / 5 A 10.',/' SAMPLE HEADERS:'/11X,'Site and    Plant
     9    Average    Other    Product    Other    Service'/'    Fixed
     A Varable   Mkting   Current   Intrest'/'   Period   Bldings    Equ
     Bip.    Invntry   Wrk Cap    Sales     Sales    Income'/'   Expense
     C   Expense   Expense   Deprec.   Expense'/5X,'5. Insert four footn
     Dote lines (to be printed on two lines) with'/8X,'<return> at the e
     End of each line).'/)
      READ (0,152) IPASS
  152 FORMAT (I1)
      IF (IPASS.EQ.0) GOTO 65
      READ (0,96) IHEAD
      IF (IFEED.EQ.1) READ (0,96) JHEAD
      DO 91 I = 1,INO*2
      IN3 = (I-1)*40+1
      IN4 = IN3+39
      READ (0,96) (IPWH(L),L=IN3,IN4)
   91 CONTINUE
      READ (0,96) JDOC
   65 CONTINUE
      WRITE (0,32)
   32 FORMAT (/' PROGRAM WILL NOW PREPARE THE INPUT.MPJ FILE FOR THE MAS
     1TER PROJECTIONS'//5X,'The information supplied by keyboard at Scre
     2ens 1 through 9, the'/5X,'special screens for cycle factors, proje
     3ction rates and conversion'/5X,'rates (if used), and the Headers S
     4creen will now be prepared in'/5X,'the disk file INPUT.MPJ for rea
     5ding by the Master Projection program,'/5X,'MASTERPJ.  Default val
     6ues will be included for anything not changed'/5X,'by keyboard ent
     7ry.'//5X,'If more than one set of master tables is included in the
     8 run'/5X,'(NFAC > 1), complete information and data is read for th
     9e first'/5X,'before proceeding to the second, and so on, for all d
     Aata sets.'//5X,'Type 1 and <return> to go back to the menu.' /5X,'
     BType 0 and <return> or <return> to proceed to program execution.'/
     C/' SELECTION: '/)
      READ (0,152) IMENU
      WRITE (0,48)
      IF (IMENU.EQ.1) GOTO 141
   66 CONTINUE
C
C   V. CREATE THE COMMAND FILE, INPUT.MPJ, FOR THE RUN
```

```
C
      IF (NI.LT.NA) NI = NA
      IF (MTRIP.EQ.1) GOTO 226
      IDIF = IABS(IPAST-IYIN)
      IDOT = IDIF + 1
      GOTO 228
  226 IDOT = 1
  228 CONTINUE
      IF (MTRIP.EQ.1) OPEN (1,FILE='INPUT.MPJ',STATUS='NEW')
      IF (MTRIP.EQ.1) WRITE (NDISK,3) LROW,LCOL,NREAD,NPUNCH,NPRINT,
     1NDISK,NFAC
      WRITE (NDISK,9) NA,NU,IX1,IX2,NP,NC,IFORM,IYIN,LPRJ,KRATE
      WRITE (NDISK,9) ICYC,NOTL,NOPRT,KARDM,KARDT,NOMOD,NLANG,NCARDS,
     1NEGNO,NONEG,ISKIP
      WRITE (NDISK,9) IANN,IQTR,IMON,JQTR,JMON,IMOVE,NYR,NQTR,NMON,
     1ISTART
      WRITE (NDISK,9) JCOL1,JCOL2,JCOL3,JCOL4,JCOL5,JCOL6,IRIGHT,
     1LEFT,IONE,IFINAL
      WRITE (NDISK,9) NCS,(INSET(I),I=1,10)
      WRITE (NDISK,9) INO,(IOUTLI(I),I=1,10)
      WRITE (NDISK,9) IFEED,ISAME,IPLOT,JCOUTY,JEST,LPLOT,NDEV,NFIT,
     1NRATE
      WRITE (NDISK,9) (NPLOT(I),I=1,13)
      WRITE (NDISK,8) ISTOCK,IREG,IMPORT,NRTR,NCAP,ACEPT,CONST,
     1FACTO1,FACTO2,WCOEF,WRATE
      IF (IFEED.EQ.0.AND.ICYC.EQ.0.AND.KRATE.EQ.0) GOTO 39
      IF (ICYC.EQ.0) GOTO 37
      DO 38 I = 1,LIM
   38 WRITE (NDISK,103) VECTOR(I)
   37 IF (KRATE.EQ.0) GOTO 36
      IF (NRATE.EQ.1) GOTO 36
      NQ = ISTART - IYIN
      I5 = NQ - 1
      DO 35 I = NQ,LIM
      I5 = I5 + 1
   35 WRITE (NDISK,103) BRATE(I5)
   36 CONTINUE
      IF (IFEED.EQ.0) GOTO 39
      DO 34 I = 1,LIM
      WRITE (NDISK,103) CONVRT(I)
      IF (ISAME.EQ.0) GOTO 33
   34 CONTINUE
   33 CONTINUE
   39 IF (IPLOT.EQ.1) GOTO 61
      GOTO 63
   61 WRITE (NDISK,98) (KUNIT(J),J=1,4)
   63 WRITE (NDISK,96) IHEAD
      IF (IFEED.EQ.1) WRITE (NDISK,96) JHEAD
      DO 64 I = 1,INO*2
      IN3 = (I-1)*40+1
      IN4 = IN3+39
   64 WRITE (NDISK,96) (IPWH(L),L=IN3,IN4)
```

```
      WRITE (NDISK,96) JDOC
      IF (IPLOT.EQ.0) GOTO 69
      DO 62 I = 1,13
      IF (NPLOT(I).EQ.0) GOTO 62
      WRITE (NDISK,98) (KPWH(I,J),J=1,4)
   62 CONTINUE
   69 MTRIP = MTRIP + 1
      IF (NFAC.EQ.1.OR.MTRIP.GT.NFAC) GOTO 67
      KABLY = 0
      GOTO 190
   67 WRITE (0,48)
      WRITE (0,57) NFAC
   57 FORMAT (/' COMMAND INSTRUCTIONS READ AND STORED FOR ',I2,' MASTER
     1TABLES'//5X,'TO PROCEED WITH THE RUN, TYPE MASTERPJ AND <RETURN>.'
     2/)
  300 CONTINUE
      STOP
      END
```

APPENDIX B

LISTING OF THE MASTERPJ SOURCE PROGRAM

```
C
C        MASTER PROJECTION PROGRAM WITH MULTIPLE OPTIONS
C
C                PROFESSOR RICHARD PHILLIPS
C            DEPARTMENT OF AGRICULTURAL ECONOMICS
C                  KANSAS STATE UNIVERSITY
C
      REAL MATRIX,MATRIN
      DIMENSION MATRIX(3600),MATRIN(3600),STATPJ(3600)
      COMMON/AREA 1/IANN,IDONE,IFEED,IMON,INF,INOUT,IPOSI,IQTR,ISAME,
     1IX1,IX2,JMON,JQTR,KRATE,LIM,LPLOT,LPRJ,MPER,NCARDS,ND,NDISK,
     2NFAC,NFIT,NK,NLANG,NMON,NOEXCP,NOLOOP,NOMOD,NP,NPRINT,NPUNCH,
     3NQTR,NREAD,NT,NYR,IPEROD(180)
      INF = 2
    3 FORMAT (7I4)
      OPEN (2,FILE='INPUT.MPJ',STATUS='OLD')
C
C      I. READ BASIC PARAMETERS FOR ALL PROBLEMS IN THE RUN
C
C         0. Read problem size, logical units and number of master
C            tables.        FORMAT is 7 I 4
    1 READ (INF,3,END=99) IROW,ICOL,NREAD,NPUNCH,NPRINT,NDISK,NFAC
      WRITE (0,48)
   48 FORMAT (20(/))
      WRITE (0,151) IROW,ICOL,NFAC
  151 FORMAT (/15X,'REGRESSION PROJECTION PROGRAM WITH MULTIPLE OPTIONS'
     1 /26X,'Professor Richard Phillips'/21X,'Department of Agricultural
     2 Economics'/27X,'Kansas State University'/5X,'* This program reads
     3 computational instructions from the INPUT.MPJ file'/7X, 'and hist
     4orical time series data for N periods from the users'/7X,'disk fil
     5e in LOTUS 123 print file format.'/5X,'* The program fits mathemat
     6ical time trends with specified model'/7X,'and makes projections f
     7or M periods in the future.'/5X,'* Command options can be changed
     8by going back to the MASTER1.EXE file'/7X,'and creating a new INPU
     9T.MPJ file incorporating the changes.'/5X,          '* The many
     Aoptions under the program are controlled by keyboard commands'/7X,
     B'given by the user in response to menu prompts.'//' MAXIMUM NUMBER
     C OF PERIODS FOR RUN:',13X,I4,/' MAXIMUM NUMBER OF COLUMNS FOR RUN:
     D',13X,I4,/' NUMBER OF VARIABLES (MASTER TABLES) IN THE RUN:',I4,/)
      PAUSE
    2 CALL MPJ (IROW,ICOL,MATRIX,MATRIN,STATPJ)
   99 STOP
      END
C
      SUBROUTINE MPJ (IROW,ICOL,MATRIX,MATRIN,STATPJ)
      REAL MATRIX,MATRIN
      DIMENSION MATRIX(IROW,ICOL),MATRIN(IROW,ICOL),STATPJ(IROW,ICOL)
      DIMENSION RESBAL(40),BRATE(72),LDOC(80),CMULT(180),CONVRT(180),
```

```
     1VECTOR(180)
      DIMENSION INSET(10),IOUTLI(10),IHOLD(180),IHOLD2(180),ISEQ(180)
      DIMENSION IPRT(180),JPRT(180),STAT(5,72)
      COMMON/AREA 1/IANN,IDONE,IFEED,IMON,INF,INOUT,IPOSI,IQTR,ISAME,
     1IX1,IX2,JMON,JQTR,KRATE,LIM,LPLOT,LPRJ,MPER,NCARDS,ND,NDISK,
     2NFAC,NFIT,NK,NLANG,NMON,NOEXCP,NOLOOP,NOMOD,NP,NPRINT,NPUNCH,
     3NQTR,NREAD,NT,NYR,IPEROD(180)
      COMMON/AREA 2/NU,A,B,RSQ,SB,SYX,YBAR,X(180),Y(180),YEPLOT(180),
     1YPLOT(180)
      COMMON/AREA 3/NFORM,CONST,LEST,W,WRATE,KUNIT(4),KPWH(4),
     1IHEAD1(80),JPWH(80),NPLOT(60),IHEAD(200),IPWH(800)
C
    4 FORMAT (' ',132('_'))
    5 FORMAT ('/')
    6 FORMAT (20I4)
    8 FORMAT (5I4,6F7.5)
    9 FORMAT (13I4)
   17 FORMAT (' ',5X,'Ybar',12F10.2)
   18 FORMAT (' ',8X,'b',12F10.2)
   19 FORMAT (' ',6X,'rsq',12F10.4)
   20 FORMAT (' ',6X,'Syx',12F10.2)
   21 FORMAT (' ',7X,'sb',12F10.2)
   24 FORMAT (' ',33A4)
   25 FORMAT (' ',5X,'Ybar',12F10.4)
   26 FORMAT (' ',6X,'Syz',12F10.4)
   27 FORMAT (' ',1X,'Log Ybar',12F10.4)
   28 FORMAT (' ',5X,'b(%)',12F10.4)
   29 FORMAT (' ',7X,'sb',12F10.4)
   72 FORMAT (' ','SOURCE:')
   73 FORMAT (' ','FUENTE:')
   75 FORMAT ('1',' TERMINACION NORMAL DEL PROGRAMA ')
   76 FORMAT ('1',' FIN NORMALE DU PROGRAMME ')
   77 FORMAT (' ',I3,2X,I4,12I10)
   78 FORMAT (' ',I3,1X,I4,12F9.0)
   79 FORMAT (I4,I4,8(1X,I8))
   80 FORMAT (' ',I3,1X,I4,12I9)
   82 FORMAT (' ',8X,'N',12F10.0)
   96 FORMAT (20A4)
   98 FORMAT (4A4,64X)
   99 FORMAT (8X,8F9.0)
  103 FORMAT (F9.2)
  105 FORMAT (13X,I4,F9.4)
  111 FORMAT ('1','NORMAL END OF PROGRAM')
  402 FORMAT (8X,2F9.4,6(5X,I4)/4X,I4,4(5X,I4))
  512 FORMAT (8X,8(5X,I4)/4X,I4,8(5X,I4))
      MTRIP = 0
      KABLY = 0
      ICUE = 0
      ISTOCK = 0
  190 ICONCU = 0
      NI = 1
      IPAST = IYIN
```

```
      IF (KABLY.EQ.0) GOTO 195
      KABLY = 0
      MTRIP = 0
C
C   II. READ COMMAND VALUES FROM DISK FILE, "INPUT.MPJ"
C
C     1. Read Commands for Type of Projection Model and Analysis
  195 READ (INF,9,END=333) NA,NU,IX1,IX2,NP,NC,IFORM,IYIN,LPRJ,KRATE
      NC = NC + 2
C
C     2. Read Commands for Special Features Invoked for the Run
      READ (INF,9) ICYC,NOTL,NOPRT,KARDM,KARDT,NOMOD,NLANG,NCARDS,
     1NEGNO,NONEG,ISKIP
C
C     3. Read Commands for Period Designations
      READ (INF,9) IANN,IQTR,IMON,JQTR,JMON,IMOVE,NYR,NQTR,NMON,ISTART
C
C     4. Read Commands for Columnar Reorganization of Table
      READ (INF,9) JCOL1,JCOL2,JCOL3,JCOL4,JCOL5,JCOL6,IRIGHT,ILEFT,IONE
     1,IFINAL
C
C     5. Read Organizational Pattern for Input Data Sets
      READ (INF,9) NCS,(INSET(I),I=1,10)
C
C     6. Read Organizational Pattern of Output Data Sets
      READ (INF,9) INO,(IOUTLI(I),I=1,10)
C
C     7. Read Calls for Special and Supplemental Tables
      READ (INF,9) IFEED,ISAME,IPLOT,JCOUTY,JEST,LPLOT,NDEV,NFIT,NRATE
C
C     8. Read Commands for Plotting Graphs
      READ (INF,9) (NPLOT(I),I=1,13)
C
C     9. Read Commands for Food Security Analysis and Projection
C        Coefficients
      READ (INF,8) ISTOCK,IREG,IMPORT,NRTR,NCAP,ACEPT,CONST,FACTO1,
     1FACTO2,WCOEF,WRATE
  150 LIM = NA + NP
      IF (IFEED.EQ.0.AND.ICYC.EQ.0.AND.KRATE.EQ.0) GOTO 443
      IF (ICYC.EQ.0) GOTO 444
      DO 422 I = 1,LIM
      READ (INF,103) VECTOR(I)
  422 CONTINUE
  444 IF (KRATE.EQ.0) GOTO 448
      NQ = ISTART - IYIN
      I5 = NQ-1
      DO 51 I = NQ,LIM
      I5 = I5 + 1
      BRATE(I5) = WRATE
      IF (NRATE.EQ.1) GOTO 52
      READ (INF,103) BRATE(I5)
   52 CONTINUE
```

```
   51 CONTINUE
  448 IF (IFEED.EQ.0) GOTO 443
      ICONCU = 1
      DO 86 I = 1,LIM
      CONVRT(I) = CONST
      IF (ISAME.EQ.1) GOTO 87
      READ (INF,103) CONVRT(I)
   87 CONTINUE
   86 CONTINUE
  443 IF (IPLOT.EQ.0) GOTO 449
      READ (INF,98) KUNIT
C
C   III. READ TITLES, HEADERS AND FOOTNOTES FOR OUTPUT TABLES
C
  449 READ (INF,96) IHEAD
      IF (IFEED.EQ.1) READ (INF,96) IHEAD1
      DO 405 I = 1,INO*2
      IN3 = (I-1)*40+1
      IN4 = IN3 + 39
      READ (INF,96) (IPWH(L),L=IN3,IN4)
  405 CONTINUE
      READ (INF,96) LDOC
   91 CONTINUE
   65 CONTINUE
      IF (MTRIP.GE.1) GOTO 66
      WRITE (0,48)
   48 FORMAT (20(/))
      WRITE (0,32)
   32 FORMAT (/' PROGRAM WILL NOW READ THE HISTORICAL DATA AND MAKE THE
     1PROJECTIONS'//5X,'The data input is read from the disk file, MPJDA
     2TA.RUN, in format of'/5X,'I3, 1X, A4, 8F9.0.  If NCS > 1, data for
     3 subsequent sections are read'/5X,  'by section in sequence, follo
     4wing the same procedure and format.'//5X,'If more than one set of
     5master tables is to be included in the run,'/5X'(NFAC > 1), comple
     6te information and data is read for the first'/5X,'before proceedi
     7ng to the second, and so on, for all data sets.',
     8                                //' NOTE:  Prepare your printer or d
     9isk drive to receive the'/8X,'output for the run before keying <re
     Aturn> here.'//8X,'To direct the output to the printer, type CTRL P
     B; to'/8X,'direct output to a disk file type > B:OUTPUT.ONE, etc.')
      PAUSE
   66 CONTINUE
      IF (NI.LT.NA) NI = NA
      IF (NFAC.EQ.0) NFAC=1
      IF (MTRIP.EQ.0) GOTO 226
      IDIF = IABS(IPAST-IYIN)
      IDOT = IDIF + 1
      GOTO 228
  226 IDOT = 1
      OPEN (1,FILE='MPJDATA.RUN',STATUS='OLD')
C
C     Note: For computations of Reserve Stocks, Assemble as follows:
```

```
C           1. Steps 1 through 11, annual transactions
C           2. Data on needed transactions with reserves
C           3. Data on maximum size of reserves
C           4. Beginning reserve balance
C           5. Steps 13 on through
C           6. Steps 1 to 11 and 13 onward for reserve balance tables
C              For the latter only, enter 2 for ISTOCK at Step 4C)
C
  228 IF (NCARDS.EQ.0) NCARDS = 1
      IF (WCOEF.EQ.0.) WCOEF = 1.0
      IF (NC.EQ.0) NC=10
      IX1 = IX1 + 1
      IX2 = IX2 + 1
      NT = NC - 2
      NK = NI
      ND = NI - NU + 1
      NPRO = NI + 1
      NC2 = NC - 1
      NE = NI-NU
      LIM = NI+NP
      LIMO = LIM + IDIF
      ICN9=0
      IF (ISTOCK.EQ.2.OR.NFAC.GT.1.AND.MTRIP+1.EQ.NFAC) GOTO 406
      DO 55 I=1,LIM
      DO 55 J=1,NC2
   55 MATRIX(I,J) = 0.0
      DO 56 MP = 1,NCS
      ICN8 = ICN9+1
      ICN9 = ICN9+INSET(MP)
      DO 57 I = 1,NI
C
C   IV. READ INPUT DATA FOR MASTER PROJECTION TABLES
C
C       Read Master Table input data, assembled as follows:
C           Data set No. 1, All periods
C           ...  ...  ...
C           Data set No. n, All periods
C                   FORMAT is I3, 5X, 8 F 9.0
C
      READ (NREAD,99) (MATRIX(I,J),J=ICN8,ICN9)
      DO 211 J = ICN8,ICN9
  211 IF(NONEG.EQ.1.AND.MATRIX(I,J).LT.0.0) MATRIX(I,J)=MATRIX(I,J)*(-1)
   57 CONTINUE
      IF (ISTOCK.EQ.0) GOTO 56
      IF (IREG.EQ.1.OR.NCAP.EQ.1) GOTO 59
      DO 53 I=1,NI
   53 READ (NREAD,99) (MATRIN(I,J),J=ICN8,ICN9)
      IF (NRTR.EQ.1) GOTO 56
   59 READ (NREAD,99) (RESBAL(J),J=ICN8,ICN9)
   56 CONTINUE
  406 CONTINUE
C
```

```
C   V. CALCULATE TIME PERIODS AND TIME PERIOD DESIGNATIONS
C
      MPER = 0
      DO 401 I = 1,LIM
  401 ISEQ(I) = IYIN+I-1
      IF (IANN.EQ.0.AND.IQTR.EQ.0.AND.IMON.EQ.0) GOTO 4001
      CALL PERIOD
 4001 DO 1088 I=1,LIM
 1088 IF (MPER.EQ.0) IPEROD(I)=0
      IF (ISTOCK.NE.1) GOTO 1081
      DO 5558 I=1,NI
      DO 5558 J=1,NT
      IF (IREG.EQ.1) GOTO 5564
      IF (IMPORT.EQ.1) GOTO 5560
      IF (NCAP.EQ.1) GOTO 5567
      IF (MATRIX(I,J).LT.0.0) GOTO 5563
      IF (NRTR.EQ.1) GOTO 5565
      IF (I.EQ.1) MATRIN(I,J)=MATRIN(I,J)-RESBAL(J)
      IF (I.GT.1) MATRIN(I,J)=MATRIN(I,J)-MATRIN(I-1,J)
 5565 IF (MATRIX(I,J).GT.MATRIN(I,J)) MATRIX(I,J)=MATRIN(I,J)
      GOTO 5559
 5563 IF (NRTR.EQ.1) GOTO 5566
      IF (I.EQ.1) MATRIN(I,J)=RESBAL(J)
      IF (I.GT.1) MATRIN(I,J)=MATRIN(I-1,J)
 5566 IF (MATRIX(I,J)*(-1).GT.MATRIN(I,J))MATRIX(I,J)=MATRIN(I,J)*(-1)
      IF (MATRIN(I,J).EQ.0.0) MATRIX(I,J)=0.0
 5559 IF (NRTR.EQ.1) GOTO 5558
      IF (I.EQ.1) MATRIN(I,J)=RESBAL(J)+MATRIX(I,J)
      IF (I.GT.1) MATRIN(I,J)=MATRIN(I-1,J)+MATRIX(I,J)
      GOTO 5558
 5560 IF (I.EQ.1) MATRIX(I,J)=MATRIN(I,J)*FACTO3
      IF (I.GT.1) MATRIN(I,J)=MATRIN(I,J)+(MATRIN(I-1,J)*FACTO4)
      IF (I.GT.1)MATRIX(I,J)=(MATRIN(I,J)*FACTO3)+(MATRIN(I-1,J)*FACTO4)
      GOTO 5558
 5564 IF (I.EQ.1) MATRIX(I,J) = RESBAL(J)+MATRIX(I,J)
      IF (I.GT.1) MATRIX(I,J) = MATRIX(I-1,J)+MATRIX(I,J)
      GOTO 5558
 5567 IF (I.EQ.1.AND.MATRIX(I,J).LT.RESBAL(J)) MATRIX(I,J)=RESBAL(J)
      IF (I.GT.1.AND.MATRIX(I,J).LT.MATRIX(I-1,J)) MATRIX(I,J) = MATRIX
     1(I-1,J)
 5558 CONTINUE
 1081 CONTINUE
C
C.  VI. ADJUST MASTER TABLE DATA BY APPLYING CYCLE FACTORS
C
      IF (ICYC.EQ.0) GOTO 214
      DO 213 I=1,NI
      DO 213 J=1,NT
  213 MATRIX(I,J) = MATRIX(I,J)*VECTOR(I)
      GOTO 2116
  214 DO 215 I=1,LIM
  215 VECTOR(I)=1.0
```

```
 2116 IF (IX1.EQ.IX2) GOTO 2114
      OPEN (1,FILE='NDISK',STATUS='NEW',ACCESS='SEQUENTIAL',FORM='UNFORM
     1ATTED')
      DO 2115 I=1,NI
 2115 WRITE (NDISK)(MATRIX(I,J),J=1,NT)
 2114 LK = 0
      IF (JCOUTY.GT.0) GOTO 420
      IF (KARDM.EQ.0.AND.KARDT.EQ.0) GOTO 420
      OPEN (2,FILE='OUTPUT.MPJ',STATUS='NEW')
  420 CONTINUE
  216 DO 60 KK=IX1,IX2,2
      LK = LK+1
      LX = IX1 - LK
      INOUT = 0
      JIN = 0
      IF (LK.EQ.1.OR.ICUE.EQ.1) GOTO 2117
      REWIND NDISK
      DO 2118 I=1,NI
 2118 READ (NDISK) (MATRIX(I,J),J=1,NT)
 2117 W = 1.+FLOAT(KK-1)/10.
      IDONE = 0
      LEST = 0
      IF (ISTOCK.EQ.2.OR.NFAC.GT.1.AND.MTRIP+1.EQ.NFAC) GOTO 479
C
C   VII. FIT THE MASTER PROJECTIONS AS ORDERED
C
   34 IF (ICUE.EQ.1) GOTO 3400
      IF (NP.EQ.0.AND.NFIT.EQ.0) GOTO 130
 3400 IF (ICUE.EQ.0.AND.KRATE.EQ.1) GOTO 630
      DO 10 I=1,NT
      DO 11 J=ND,NI
      IF (LPRJ.EQ.0.AND.MATRIX(J,I).EQ.0.) MATRIX(J,I)=0.1
      IF (LPRJ.EQ.1.AND.MATRIX(J,I).EQ.0.) MATRIX(J,I)=0.5
  334 Y(J-NE) = MATRIX(J,I)
      IF (LPRJ.EQ.1) Y(J-NE) = ALOG(Y(J-NE))
      IF (LPRJ.EQ.1) X(J-NE) = J-NE
   11 IF (LPRJ.EQ.0) X(J-NE) = FLOAT(J-NE)**W
      CALL REG
      STAT(1,I) = YBAR
      STAT(2,I) = B
      STAT(3,I) = RSQ
      STAT(4,I) = SYX
      STAT(5,I) = SB
      DO 7 J=1,NI
    7 YPLOT(J) = MATRIX(J,I)
      DO 3 J=1,LIM
      IF (LPRJ.EQ.0) YEPLOT(J+NE) = A+B*FLOAT(J)**W
      IF (LPRJ.EQ.1) YEPLOT(J+NE) = EXP(A+B*FLOAT(J))
      IF (VECTOR(J+NE).EQ.0.0) GOTO 336
      YEPLOT(J+NE) = YEPLOT(J+NE)/VECTOR(J+NE)
  336 IF (J.LE.NE) STATPJ(J,I) = MATRIX(J,I)
      IF (J.GT.NE) STATPJ(J,I) = YEPLOT(J+NE)
```

```
      IF(NDEV.EQ.1.AND.J.GT.NE.AND.J.LE.NI)MATRIX(J,I)=MATRIX(J,I)-STATP
     1J(J,I)
      IF (J.GT.NI) MATRIX(J,I) = STATPJ(J,I)
    3 CONTINUE
      IF (NPLOT(I).EQ.0.OR.ICUE.EQ.1) GOTO 10
      CALL PLOT
   10 CONTINUE
C
C   VIII. PLOT THE GRAPHS REQUESTED IN THE RUN
C
      GOTO 130
  630 CONTINUE
      NR = NQ + 1
      DO 631 I = NR,LIM
      IO = I - 1
      CMULT(I) = (1.0+BRATE(IO))
      DO 635 J = 1,NT
  635 MATRIX(I,J) = MATRIX(IO,J)*CMULT(I)
  631 CONTINUE
  130 CONTINUE
C
C   IX. ZERO AND RE-ALIGN DATA COLUMNS IF ORDERED
C
  408 IF (IMOVE.EQ.0) GOTO 439
      IRT = IONE+IRIGHT
      ILF = IONE-ILEFT
      JRT = IFINAL+IRIGHT
      KRT = IRT-1
      JLF = IFINAL-ILEFT
      KLF = JLF+1
C
C       A. XERO OUT SPECIFIED DATA COLUMNS IN MATRIX
C
      DO 430 I=1,LIM
      IF (JCOL1.NE.0) MATRIX(I,JCOL1)=0.0
      IF (JCOL2.NE.0) MATRIX(I,JCOL2)=0.0
      IF (JCOL3.NE.0) MATRIX(I,JCOL3)=0.0
      IF (JCOL4.NE.0) MATRIX(I,JCOL4)=0.0
      IF (JCOL5.NE.0) MATRIX(I,JCOL5)=0.0
      IF (JCOL6.NE.0) MATRIX(I,JCOL6)=0.0
C
C       B. SHIFT SPECIFIED COLUMNS TO THE RIGHT OR LEFT
C       C. ZERO OUT FIELDS VACATED BY SHIFT
C
      IF (IRIGHT.EQ.0) GOTO 436
      JZ = JRT+1
      DO 431 J=IRT,JRT
      JZ = JZ-1
  431 MATRIX(I,JZ) = MATRIX(I,JZ-IRIGHT)
      DO 433 J=IONE,KRT
  433 MATRIX(I,J) = 0.0
  436 IF (ILEFT.EQ.0) GOTO 430
```

```
      DO 432 J=ILF,JLF
  432 MATRIX(I,J) = MATRIX(I,J+ILEFT)
      DO 434 J=KLF,IFINAL
  434 MATRIX(I,J) = 0.0
  430 CONTINUE
  439 CONTINUE
C
C   X. CALCULATE MASTER Y-TABLES FROM X-VARIABLES, IF ORDERED
C
      IF (NFAC.EQ.1) GOTO 407
      IF (MTRIP.GT.0) GOTO 450
      DO 440 I = 1,LIM
      DO 440 J = 1,NT
      MATRIN(I,J) = WCOEF*MATRIX(I,J)
  440 CONTINUE
      MTRIP = 1
      GOTO 407
  450 CONTINUE
      MTRIP = MTRIP+1
      DO 455 I = 1,NT
      JDOT = IDIF
      DO 454 J = 1,LIMO
      JDOT = JDOT+1
      IF (IFORM.EQ.4.AND.MATRIX(JDOT,I).EQ.0.) MATRIX(JDOT,I) = .0001
      IF(IFORM.EQ.1.AND.IYIN.GE.IPAST)MATRIN(J,I)=MATRIN(J+IDIF,I)+(WCOE
     1F*MATRIX(J,I))
      IF(IFORM.EQ.2.AND.IYIN.GE.IPAST)MATRIN(J,I)=MATRIN(J+IDIF,I)*(WCOE
     1F*MATRIX(J,I))
      IF(IFORM.EQ.3.AND.IYIN.GE.IPAST)MATRIN(J,I)=MATRIN(J+IDIF,I)-(WCOE
     1F*MATRIX(J,I))
      IF(IFORM.EQ.4.AND.IYIN.GE.IPAST)MATRIN(J,I)=MATRIN(J+IDIF,I)/(WCOE
     IF*MATRIX(J,I))
      IF(IFORM.EQ.1.AND.IYIN.LT.IPAST)MATRIN(J,I)=MATRIN(J,I)+(WCOEF*MAT
     1RIX(JDOT,I))
      IF(IFORM.EQ.2.AND.IYIN.LT.IPAST)MATRIN(J,I)=MATRIN(J,I)*(WCOLF*MAT
     1RIX(JDOT,I))
      IF(IFORM.EQ.3.AND.IYIN.LT.IPAST)MATRIN(J,I)=MATRIN(J,I)-(WCOEF*MAT
     1RIX(JDOT,I))
      IF(IFORM.EQ.4.AND.IYIN.LT.IPAST)MATRIN(J,I)=MATRIN(J,I)/(WCOEF*MAT
     1RIX(JDOT,I))
  454 CONTINUE
  455 CONTINUE
      GOTO 407
C
C   XI. APPLY INTERCEPT FOR MASTER Y TABLES
C
  479 KABLY = 1
      DO 474 I = 1,LIM
      DO 474 J = 1,NT
      MATRIN(I,J) = ACEPT + MATRIN(I,J)
      MATRIX(I,J) = MATRIN(I,J)
  474 MATRIN(I,J) = 0.0
```

```
C
C   XII. APPLY 0 LIMITS TO MASTER PROJECTIONS
C
  407 IF (NFAC.GT.1.OR.ISTOCK.GT.0) GOTO 232
      DO 404 I = 1,LIM
      DO 404 J = 1,NT
      MATRIN(I,J) = 0.0
  404 CONTINUE
  232 DO 2319 J = 1,NT
      IPRT(J) = 0
 2319 JPRT(J) = 0
      IF (IDONE.EQ.1) GOTO 113
      IF (NP.EQ.0.OR.NEGNO.EQ.1) GOTO 113
      IF (MTRIP.EQ.NFAC OR.NDEV.EQ.1) GOTO 113
      IF (ISTOCK.EQ.2) GOTO 113
      DO 112 I = 1,LIM
      DO 112 J = 1,NT
      IF (MATRIX(I,J).LT.0.) MATRIX(I,J) = 0.0
  112 CONTINUE
  113 CONTINUE
      IF (ICONCU.EQ.0.OR.IDONE.EQ.1) GOTO 224
      IDONE = 1
      GOTO 232
  224 IDONE = 0
      INOUT = INOUT+1
      IF (IDONE.EQ.1) GOTO 201
      JIM = JIN + 1
      JIN = JIN + IOUTLI(INOUT)
  201 CONTINUE
      IF (INOUT.GT.INO) GOTO 409
C
C   XIII. PRINT HEADINGS FOR OUTPUT TABLES
C
   35 LEST = LEST+1
      IF (IDONE.EQ.0.AND.NOPRT.EQ.1) GOTO 409
   36 CALL TABLES
      DO 247 J = JIM,JIN
      IPRT(J) = 0
  247 JPRT(J) = 0
      IF (JCOUTY.NE.1.AND.KARDM.EQ.0.OR.JIM.GT.1) GOTO 246
C
C   XIV. PREPARE OUTPUT DISK FILES FOR PRORATPJ, IF ORDERED
C
      OPEN (1,FILE='OUTPUT.MPJ',STATUS='NEW')
  246 IF (JCOUTY.NE.1) GOTO 229
      WRITE (NPUNCH,6) IROW,ICOL,NREAD,NPUNCH,NPRINT,NDISK,NREAD
      WRITE (NPUNCH,6) NA,NU,IX1-1,IX2-1,NP,NC,NCS,IYIN,NFAC,LPRJ,
     1NOTL,IFORM,NOPRT,KRATE,KARDM,KARDT,NOMOD,JCOUTY,JEST
      WRITE (NPUNCH,6) NCS,(INSET(I),I=1,NCS)
      WRITE (NPUNCH,6) INO,(IOUTLI(I),I=1,INO)
      WRITE (NPUNCH,96) IHEAD
      WRITE (NPUNCH,96) (IPWH(L),L=IN3,IN4)
```

```
      WRITE (NPUNCH,96) LDOC
  229 IF (KARDM.EQ.0.AND.JCOUTY.NE.1) GOTO 242
  243 DO 244 I = 1,LIM
      WRITE (NPUNCH,78) ISEQ(I),IPEROD(I),(MATRIX(I,J),J=JIM,JIN)
  244 CONTINUE
  242 IF (KARDT.EQ.0) GOTO 245
      DO 241 I = 1,LIM
      WRITE (NPUNCH,78) ISEQ(I),IPEROD(I),(MATRIX(I,J)*CONVRT(I),J=JIM,
     1JIN)
  241 CONTINUE
C
C       PRINT THE BODY OF THE OUTPUT TABLES
C
  245 DO 13 I = 1,LIM
      ISUM = 0
      IF (INOUT.GT.1) GOTO 231
      IHOLD(I) = 0
      IHOLD2(I) = 0
  231 DO 234 J = JIM,JIN
      IF (IDONE.EQ.1) GOTO 2313
      IF (MATRIX(I,J).GE.0.0) IPRT(J) = MATRIX(I,J)+.5
      IF (MATRIX(I,J).LT.0.0) IPRT(J) = MATRIX(I,J)-.5
      ISUM = ISUM+IPRT(J)
      GOTO 234
 2313 IF (JCOUTY.NE.2) GOTO 180
      JPRT(J) = 0
      DO 170 K = 1,I
      II = I-K+1
      IF (MATRIX(II,J).GE.0.0) JPRT(J)=JPRT(J)+(MATRIX(II,J)*CONVRT(I-II
     1+1))+.5
      IF (MATRIX(II,J).LT.0.0) JPRT(J)=JPRT(J)+(MATRIX(II,J)*CONVRT(I-II
     1+1))-.5
  170 CONTINUE
      GOTO 181
  180 IF (MATRIX(I,J).GE.0.0) JPRT(J) = (MATRIX(I,J)*CONVRT(I))+.5
      IF (MATRIX(I,J).LT.0.0) JPRT(J) = (MATRIX(I,J)*CONVRT(I))-.5
  181 ISUM = ISUM+JPRT(J)
  234 CONTINUE
      IF (IDONE.EQ.0) IHOLD(I) = IHOLD(I)+ISUM
      IF (IDONE.EQ.1) IHOLD2(I) = IHOLD2(I)+ISUM
      IZ1 = ISEQ(I)
      IZ2 = IPEROD(I)
      IF (NOTL.EQ.1) GOTO 253
      IF (INOUT.LT.INO) GOTO 253
      IF (IDONE.EQ.0) WRITE(NPRINT,77) IZ1,IZ2,(IPRT(J),J=JIM,JIN),
     1IHOLD(I)
      IF (IDONE.EQ.1) WRITE(NPRINT,77) IZ1,IZ2,(JPRT(J),J=JIM,JIN),
     1IHOLD2(I)
      GOTO 1507
  253 IF (IDONE.EQ.0) WRITE (NPRINT,77) IZ1,IZ2,(IPRT(J),J=JIM,JIN)
      IF (IDONE.EQ.1) WRITE (NPRINT,77) IZ1,IZ2,(JPRT(J),J=JIM,JIN)
 1507 IF (I.EQ.I/5*5) WRITE (NPRINT,5)
```

```
   13 CONTINUE
  160 IF (IDONE.EQ.1) GOTO 1601
      IF (NOPRT.EQ.1) GOTO 409
 1601 IF (IDONE.EQ.1) GOTO 161
      IF (NP.EQ.0.AND.NFIT.EQ.0) GOTO 161
      IF (KABLY.GT.0.OR.ISTOCK.EQ.2) GOTO 161
      IF (ISKIP.EQ.1.OR.KRATE.EQ.1) GOTO 161
      WRITE (NPRINT,4)
      IF (LPRJ.EQ.1) GOTO 115
      WRITE (NPRINT,17) (STAT(1,J),J=JIM,JIN)
      WRITE (NPRINT,18) (STAT(2,J),J=JIM,JIN)
      WRITE (NPRINT,19) (STAT(3,J),J=JIM,JIN)
      IF (LX.EQ.0) WRITE (NPRINT,20) (STAT(4,J),J=JIM,JIN)
      IF (LX.NE.0) WRITE (NPRINT,26) (STAT(4,J),J=JIM,JIN)
      WRITE (NPRINT,21) (STAT(5,J),J=JIM,JIN)
      GOTO 161
  115 IF (LPRJ.EQ.0) WRITE (NPRINT,25) (STAT(1,J),J=JIM,JIN)
      IF (LPRJ.EQ.1) WRITE (NPRINT,27) (STAT(1,J),J=JIM,JIN)
      WRITE (NPRINT,28) (STAT(2,J),J=JIM,JIN)
      WRITE (NPRINT,19) (STAT(3,J),J=JIM,JIN)
      WRITE (NPRINT,26) (STAT(4,J),J=JIM,JIN)
      WRITE (NPRINT,29) (STAT(5,J),J=JIM,JIN)
  161 WRITE (NPRINT,4)
      IF (NLANG.EQ.0) WRITE (NPRINT,72)
      IF (NLANG.EQ.1) WRITE (NPRINT,73)
      IF (NLANG.EQ.2) WRITE (NPRINT,72)
      WRITE (NPRINT,24)(LDOC(I),I=1,33)
      WRITE (NPRINT,24)(LDOC(I),I=41,73)
  409 CONTINUE
      IF(KRATE.EQ.0.AND.JEST.EQ.1.AND.LEST.EQ.1) GOTO 501
      IF (ICONCU.EQ.0) GOTO 410
      IF (IDONE.EQ.1) GOTO 410
      IDONE = 1
      LEST = 1
      GOTO 35
  501 LEST = (-1)
      DO 503 I = ND,LIM
      DO 503 J = JIM,JIN
  503 MATRIX(I,J) = STATPJ(I,J)
      IDONE = 0
      GOTO 35
  410 CONTINUE
      IF (INOUT.EQ.INO) GOTO 60
      IDONE = 0
      LEST = 0
      GOTO 224
   60 CONTINUE
      IF (IREG.EQ.1.OR.IMPORT.EQ.1) GOTO 30
      IF (NRTR.EQ.1.OR.NCAP.EQ.1) GOTO 30
      ISTOCK = ISTOCK + 1
   30 GOTO 190
  333 IF (NLANG.EQ.0) WRITE (NPRINT,111)
```

```
      IF (NLANG.EQ.1) WRITE (NPRINT,75)
      IF (NLANG.EQ.2) WRITE (NPRINT,76)
  505 CONTINUE
      RETURN
      END
C
      SUBROUTINE REG
C
      COMMON/AREA 2/NU,A,B,RSQ,SB,SYX,YBAR,X(180),Y(180),YEPLOT(180),
     1YPLOT(180)
      DOUBLE PRECISION C,D,E,SSYX
      SUMXY = 0.
      SUMY = 0.
      SUMX = 0.
      SUMXX = 0.
      SUMYY = 0.
      N = NU
      DO 1 I=1,N
      SUMXY = SUMXY+X(I)*Y(I)
      SUMY = SUMY+Y(I)
      SUMX = SUMX+X(I)
      SUMXX = SUMXX+X(I)*X(I)
    1 SUMYY = SUMYY+Y(I)*Y(I)
      IF (N.EQ.0) GOTO 2
      T = FLOAT(N)
      XBAR = SUMX/T
      YBAR = SUMY/T
      GOTO 3
    2 XBAR = 0.
      YBAR = 0.
    3 C = SUMXY-SUMY*XBAR
      D = SUMXX-SUMX*XBAR
      IF (D.EQ.0.) GOTO 4
      B = C/D
      A = YBAR-B*XBAR
      E = SUMYY-SUMY*YBAR
      IF (E.EQ.0.) GOTO 5
      RSQ = C*C/(D*E)
      R = SQRT(RSQ)
      U = FLOAT(N-2)
      IF (U.LE.0.)GOTO 6
      F = C*C/D
      SSYX = (E-F)/U
      IF (SSYX.LT.0.) GOTO 6
      SYX = DSQRT(SSYX)
      IF(D.LT.0.) D=D*(-1)
      G = DSQRT(D)
      SB = SYX/G
      RETURN
    4 B = 0.
      A = YBAR
    5 RSQ = 0.
```

```
      RETURN
    6 SB = 0.
      SYX = 0.
      RETURN
      END
      SUBROUTINE PERIOD
C
C   THIS SUBROUTINE COMPUTES THE PERIOD DESIGNATIONS
C
      COMMON/AREA 1/IANN,IDONE,IFEED,IMON,INF,INOUT,IPOSI,IQTR,ISAME,
     1IX1,IX2,JMON,JQTR,KRATE,LIM,LPLOT,LPRJ,MPER,NCARDS,ND,NDISK,
     2NFAC,NFIT,NK,NLANG,NMON,NOEXCP,NOLOOP,NOMOD,NP,NPRINT,NPUNCH,
     3NQTR,NREAD,NT,NYR,IPEROD(180)
      IF (IANN.EQ.1) GOTO 1075
      IF (IQTR.EQ.1) GOTO 1077
      IF (IMON.EQ.1) GOTO 1079
      GOTO 1800
 1075 DO 1076 I=1,LIM
 1076 IPEROD(I) = NYR+I-1
      GOTO 1084
 1077 NCQ = 0
      KQTR = NQTR
      LQTR = NQTR
      DO 1078 I = 1,LIM
      IPEROD(I) = LQTR
      LQTR = LQTR+1
      NCQ = NCQ+1
      IF (NCQ.EQ.JQTR) GOTO 1082
      IF (NCQ.EQ.4) GOTO 1083
      IF (NCQ.LT.4) GOTO 1078
 1082 LQTR = KQTR+JQTR-4
      LQTR = LQTR+100
      KQTR = LQTR
      NCQ = 0
      JQTR = 0
      GOTO 1078
 1083 LQTR = KQTR
      LQTR = LQTR+100
      KQTR = LQTR
      NCQ = 0
 1078 CONTINUE
      GOTO 1084
 1079 NCM = 0
      KMON = NMON
      LMON = NMON
      DO 1087 I = 1,LIM
      IPEROD(I) = LMON
      LMON = LMON + 1
      NCM = MCM+1
      IF (NCM.EQ.JMON) GOTO 1085
      IF (NCM.EQ.12) GOTO 1086
      IF (NCM.LT.12) GOTO 1087
```

```
 1085 LMON = KMON+JMON-12
      LMON = LMON+100
      KMON = LMON
      NCM = 0
      JMON = 0
      GOTO 1087
 1086 LMON = KMON
      LMON = LMON+100
      KMON = LMON
      NCM = 0
 1087 CONTINUE
 1084 MPER = 1
 1800 RETURN
      END
C
      SUBROUTINE TABLES
C   THIS SUBROUTINE PRINTS TABLE TITLES AND COLUMN HEADINGS
C
      COMMON/AREA 1/IANN,IDONE,IFEED,IMON,INF,INOUT,IPOSI,IQTR,ISAME,
     1IX1,IX2,JMON,JQTR,KRATE,LIM,LPLOT,LPRJ,MPER,NCARDS,ND,NDISK,
     2NFAC,NFIT,NK,NLANG,NMON,NOEXCP,NOLOOP,NOMOD,NP,NPRINT,NPUNCH,
     3NQTR,NREAD,NT,NYR,IPEROD(180)
      COMMON/AREA 3/NFORM,CONST,LEST,W,WRATE,KUNIT(4),KPWH(4),
     1IHEAD1(80),JPWH(80),NPLOT(60),IHEAD(200),IPWH(800)
    3 FORMAT (' ',132('='))
    4 FORMAT (' ',132('-'))
    5 FORMAT ('/')
   23 FORMAT (' ',2(33A4,/))
   24 FORMAT (' ',33A4)
   26 FORMAT ('1')
   27 FORMAT (' ',100X,'(Continued)')
   50 FORMAT(' ',24X,'REGRESSION ESTIMATES [N =',I3,' -',I2,' =',I3,']')
   51 FORMAT (' ',20X,'CALCULOS DE LOS ESTADISTICOS [N =',I3,' -',I2,' =
     1',I3,']')
   52 FORMAT(' ',20X,'LES ESTIMATIONS DE RGRESSION [N =',I3,' -',I2,' ='
     1,I3,']')
  100 FORMAT (' LOGARITHM PROJECTION ')
  101 FORMAT (' EXPONENT IS ',F5.2)
  105 FORMAT (' L ''EXPOSANT EST ',F5.2)
  107 FORMAT (' ANNUAL GROWTH RATE IS ',F5.4)
  108 FORMAT (' LE TAUX DE CROISSANCE ANNUEL EST ',F5.4)
  109 FORMAT (' PREVISION LOGARITHMIQUE ')
  509 FORMAT (' ',11X,121('-'))
 1200 FORMAT (' PROYECCION LOGARITHMICA ')
 1201 FORMAT (' EXPONENTE ES ',F5.2)
 1202 FORMAT (' TASA DE CRECIMIENTO ANUAL ES ',F5.4)
      WRITE (NPRINT,26)
      NE = ND-1
      NU = NK+1-ND
      IF (INOUT.GT.1) WRITE (NPRINT,27)
      IF (IDONE.EQ.0) GOTO 102
      WRITE (NPRINT,23) (IHEAD1(I),I=1,33),(IHEAD1(I),I=41,73)
```

```
      GOTO 103
  102 WRITE (NPRINT,23) (IHEAD(I),I=1,33),(IHEAD(I),I=41,73)
  103 IF(LEST.EQ.0.AND.NLANG.EQ.0) WRITE (NPRINT,50) NK,NE,NU
      IF(LEST.EQ.0.AND.NLANG.EQ.1) WRITE (NPRINT,51) NK,NE,NU
      IF(LEST.EQ.0.AND.NLANG.EQ.2) WRITE (NPRINT,52) NK,NE,NU
      WRITE (NPRINT,24) (IHEAD(I),I=81,113)
      IF (NP.EQ.0.AND.NFIT.EQ.0) GOTO 39
      IF (NOMOD.EQ.1) GOTO 39
      IF (LPRJ.EQ.1) GOTO 38
      IF (ICUE.EQ.0.AND.KRATE.EQ.1) GOTO 42
      IF (NLANG.EQ.0) WRITE (NPRINT,101) W
      IF (NLANG.EQ.1) WRITE (NPRINT,1201) W
      IF (NLANG.EQ.2) WRITE (NPRINT,105) W
      GOTO 39
   42 IF (NLANG.EQ.0) WRITE (NPRINT,107) WRATE
      IF (NLANG.EQ.1) WRITE (NPRINT,1202) WRATE
      IF (NLANG.EQ.2) WRITE (NPRINT,108) WRATE
      GOTO 39
   38 IF (NLANG.EQ.0) WRITE (NPRINT,100)
      IF (NLANG.EQ.1) WRITE (NPRINT,1200)
      IF (NLANG.EQ.2) WRITE (NPRINT,109)
   39 WRITE (NPRINT,3)
      WRITE (NPRINT,24) (IHEAD(I),I=121,153)
      WRITE (NPRINT,24) (IHEAD(I),I=161,193)
      WRITE (NPRINT,509)
      IF (ICUE.EQ.1) GOTO 245
      IN3 = (INOUT-1)*80+1
      IN4 = IN3+32
      IN5 = IN3+40
      IN6 = IN5+32
      WRITE (NPRINT,24) (IPWH(I),I=IN3,IN4)
      WRITE (NPRINT,24) (IPWH(I),I=IN5,IN6)
      GOTO 625
  245 WRITE (NPRINT,24) (JPWH(I),I=1,33)
      WRITE (NPRINT,24) (JPWH(I),I=41,73)
  625 WRITE (NPRINT,4)
      WRITE (NPRINT,5)
      RETURN
      END

C
C   THIS SUBROUTINE PLOTS THE GRAPHS OF MASTER TABLES IF ORDERED
C
      SUBROUTINE PLOT
C
      DIMENSION KGRAPH(117),GPLOT(12)
      COMMON/AREA 1/IANN,IDONE,IFEED,IMON,INF,INOUT,IPOSI,IQTR,ISAME,
     1IX1,IX2,JMON,JQTR,KRATE,LIM,LPLOT,LPRJ,MPER,NCARDS,ND,NDISK,
     2NFAC,NFIT,NK,NLANG,NMON,NOEXCP,NOLOOP,NOMOD,NP,NPRINT,NPUNCH,
     3NQTR,NREAD,NT,NYR,IPEROD(180)
      COMMON/AREA 2/NU,A,B,RSQ,SB,SYX,YBAR,X(180),Y(180),YEPLOT(180),
     1YPLOT(180)
```

```
      COMMON/AREA 3/NFORM,CONST,LEST,W,WRATE,KUNIT(4),KPWH(4),
     1IHEAD1(80),JPWH(80),NPLOT(60),IHEAD(200),IPWH(800)
      K = 0
      NF = NU+1
      READ (INF,1001) KPWH
 1001 FORMAT (4A4,64X)
      DO 20 I = 1,NK
      K = K+1
      IF (K.EQ.1) YMIN = YPLOT(I)
      IF (K.EQ.1) YMAX = YPLOT(I)
      IF (K.GT.1.AND.YPLOT(I).LT.YMIN) YMIN = YPLOT(I)
      IF (K.GT.1.AND.YPLOT(I).GT.YMAX) YMAX = YPLOT(I)
   20 CONTINUE
      DO 22 I = NF,LIM
      IF (YEPLOT(I).GT.YMAX) YMAX = YEPLOT(I)
      IF (YEPLOT(I).LT.YMIN) YMIN = YEPLOT(I)
   22 CONTINUE
      IF (LPLOT.EQ.1) YMAX = YMAX*2.0
      IF (LPLOT.EQ.1) YMIN = YMIN*0.25
      RANGE = YMAX-YMIN
      IF (RANGE.LE.0.0) RANGE = 1.0
      PFAC = 100./RANGE
      QFAC = RANGE/10.
      IF (YMAX.LT.0.0) YMAX = YMAX*(-1)
      IF (YMAX.LE.100.) MPLOT = 1
      IF (YMAX.GT.100.) MPLOT = 2
      IF (YMAX.LE.9999.) YFAC = 1.0
      IF (YMAX.GT.9999.0.AND.YMAX.LT.100000.) YFAC = 10.0
      IF (YMAX.GE.100000.0.AND.YMAX.LT.1000000.) YFAC = 100.0
      IF (YMAX.GE.1000000.0.AND.YMAX.LT.10000000.) YFAC = 1000.0
      IF (YMAX.GE.10000000.) YFAC = 10000.0
      MFAC = YFAC
      RFAC = QFAC/YFAC
      DO 39 I = 1,11
      IF (I.EQ.1) GPLOT(I) = YMIN/YFAC
   39 IF (I.GT.1) GPLOT(I) = GPLOT(I-1)+RFAC
      IF (NLANG.EQ.0) WRITE (NPRINT,85)
      IF (NLANG.EQ.1) WRITE (NPRINT,84)
      IF (NLANG.EQ.2) WRITE (NPRINT,83)
   84 FORMAT ('1',37X,'UN GRAFICO DE LOS DATOS ACTUALES Y LOS DATOS CALC
     1ULADOS')
   85 FORMAT ('1',48X,'PLOT OF OBSERVED AND ESTIMATED DATA')
   83 FORMAT ('1',38X,'LE TRACE DES DONNEES OBSERVEES ET DES DONNEES PRE
     1VUES')
      WRITE (NPRINT,23) (IHEAD(J),J=1,33)
   23 FORMAT (/33A4)
      WRITE (NPRINT,86) (KPWH(J),J=1,4),(KUNIT(J),J=1,4),MFAC,RSQ
   86 FORMAT (' ',36X,4A4,1X,'UNIT IS ',4A4,' X ',I6,4X,'(rsq =',
     1F6.4,')')
      IF (MPLOT.EQ.1) WRITE (NPRINT,10) (GPLOT(J),J=1,11)
      IF (MPLOT.GT.1) WRITE (NPRINT,11) (GPLOT(J),J=1,11)
   10 FORMAT ('0',13X,11(F5.2,5X))
```

```
11 FORMAT ('0',13X,11(F5.0,5X))
   WRITE (NPRINT,12)
12 FORMAT (' ',2X,'PERIOD'2X,'..//.',23('I....'))
   DO 4 I = 1,LIM
   IF (I.LT.ND) GOTO 3
   IEST = ((YEPLOT(I)-YMIN)*PFAC)+.5
   IF (IEST.LT.1) IEST = 1
   IF (IEST.GT.117) IEST = 117
 3 IF (I.GT.NK) GOTO 5
   IOBS = ((YPLOT(I)-YMIN)*PFAC)+.5
   IF (IOBS.LT.1) IOBS = 1
   IF (IOBS.GT.117) IOBS = 117
 5 IN = 0
   DO 6 J = 1,117
   IN = IN + 1
   KGRAPH(J) = '    '
   IF (IN.EQ.IEST) KGRAPH(J) = '*   '
 6 CONTINUE
   IF(I.LT.ND) WRITE(NPRINT,2) I,IPEROD(I)
 2 FORMAT (' ',10X,'I'/2(I4,1X),'-I')
   IF(I.GE.ND) WRITE (NPRINT,8) I,IPEROD(I),(KGRAPH(J),J=1,117)
 8 FORMAT (' ',10X,'I'/2(I4,1X),'-I',4X,117A1)
   IF (I.GT.NK) GOTO 4
   JN = 0
   DO 7 J = 1,117
   JN = JN + 1
   KGRAPH(J) = '    '
   IF (JN.EQ.IOBS) KGRAPH(J) = '+    '
 7 CONTINUE
   WRITE (NPRINT,9) (KGRAPH(J),J=1,117)
 9 FORMAT ('+',15X,117A1)
 4 CONTINUE
   RETURN
   END
```