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Carrying Out Perturbation Analysis on an Economic
Model Using the TROLL Computer Program

by

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1. Introduction

This paper describes a set of two macros or programs which are designed to carry out perturbation (or multiplier) analysis on large economic models within the overall TROLL computer environment. These macros achieve a notable increase in efficiency compared to the standard TROLL procedures due to the use of certain new facilities available within TROLL. The first of the two macros "PERTURB" is designed to carry out the actual perturbation analysis. The second macro "MULREPOR" is designed to produce a report of the results of the perturbation analysis of the economic model. This macro can also be used to produce a summary comparison of the results from any two model simulations which may or may not have been carried out using the PERTURB macro.

Section 2 of this paper describes the use of the PERTURB macro. Section 3 describes the use of the MULREPOR macro and sections 4 and 5 respectively give a listing of the two macros.

2. Using the PERTURB Macro

This macro carries out a perturbation analysis on the desired model using the standard TROLL task SIMULATE. It uses the new DSETEDIT task to prepare the input DSET for the simulation. This saves time on recompiling the DSET. It allows a wide range of options. In particular endogenous variables can be exogenised (and perturbed), parameters can be changed and a wide variety of types of perturbation can be undertaken on one or a number of variables simultaneously. The model simulation is always dynamic (using the model solution values for lagged endogenous variables in years after the first year). The Gauss Seidel relaxation algorithm is used. It is assumed that the model is annual. If a model with a different periodicity is to be used a PERIOD command should be given before starting and the start year

and period and end year and period should be entered between quotes (e.g., "1967"). The plots are currently configured to appear on a screen in line printer format. The MULREPOR macro is called by PETURB to produce the report of the simulation results.

Files Required:

This macro assumes that a number of different files, related to the model to be analysed, already exist in the TROLL file system. With one exception these are the normal files created in the course of carrying out a simulation on any economic model within TROLL. The files required are:

- (i) The MODEL file as used in the simulation. (This may differ from the MODEL file used for estimation due to the inclusion of "add factors", adjustment for autocorrelation etc.)
- (ii) The constant file (CONST) containing values for all the coefficients and parameters used in the model.
- (iii) The model input data set (DSET) file containing the exogenous variables and the starting values for the endogenous variables used in the model simulations. All perturbations are carried out by altering the specified variables in this DSET file.
- (iv) The output dataset (DSET) file produced by the benchmark or baseline simulation of the model. All the results from the perturbed simulations are compared to the values contained in this data set.
- (v) A MACRO file containing the names of the variables for which results are to be reported using the MULREPOR macro. This standard list of variables may be added to when actually executing the macro MULREPOR.

Input Requested:

The macro operates by prompting the user for the required input file names and other arguments. These prompts can be overridden in the normal way in TROLL by submitting all the necessary arguments on one or more lines. Set out below is a list of the arguments which must be supplied to the macro when it is executed:

- (i) Name of input DSET: this is the name of the DSET containing the values of the exogenous variables and the starting values for the endogenous variables used in the baseline simulation.
- (ii) Name of DSET containing baseline run: this is the name of the DSET containing the simulation results for the baseline simulation.
- (iii) Name for output DSET: this is the name to be given to the DSET created by the simulation using the perturbed data. This data set is a permanent DSET file which may be further examined outside of this set of macros.
- (iv) Name of the model: this is the name of the MODEL file containing the model to be used for simulation.
- (v) Name of the constant file: this is the name of the CONST file containing the coefficients or parameters to be used in the simulation.
- (vi) Start year for the simulation: the simulation using the perturbed data is to begin this year.
- (vii) End year for the simulation: the simulation using the perturbed data is to end this year.
- (viii) Do you want the standard CONOPT: 'YES' or the alternative in inverted commas: this allows the user to specify the convergence and divergence criteria to be used in the model simulation. The standard setting invoked by answering YES is: CONOPT STOP 500 DIVCR 500 CONCR .001.
- (ix) Do you want historic data as the base, 'YES' or 'NO': if you answer YES the endogenous variables used as the basis for the perturbed simulation are the values contained in the input DSET named at (i) above. Naturally values must exist for these variables for the full simulation period.
If you answer NO the value for the exogenous variables and the starting values for the endogenous variables are set equal to their values in the starting year. As a result data need only exist in the input data set for the starting year (and the lagged values needed to simulate that year). This allows multiplier or perturbation analysis to be carried out over periods for which no forecasts of the exogenous variables are available. It may be useful in avoiding the effects on the perturbation results of the economic cycle underlying any historical baseline simulation.
- (x) Input the specifications for the perturbation in inverted commas: this command determines the kind of perturbation to be carried out on the model. The reply to this prompt, stripped of inverted commas, is treated as the input to the NEWVALS command in the DSETEDIT task of TROLL (see K. Molvaersmyr, R. Hedgren, and P. Hollinger, TROLL PROGRAM DSETEDIT, MIT, 1986). Details of the arguments to this command are given in Appendix 1. Set out here are a number of examples:

"ADJUST 1.01 0.0 LPAH 1967 to 1983".

The keyword ADJUST requests that the relevant variable, in this case LPAH, should be multiplied by the first number, in this case 1.01; the second number, 0.0, should be added to the result. This adjustment is to be carried out for the period 1967 to 1983. The result will be a sustained increase in variable LPAH of 1 per cent over the period 1967 to 1983.

"ADJUST 1.0 1.0 LPAH 1967 TO 1983".

This command would result in LPAH being raised by one unit for the year 1967 alone. If it is desired a number of variables can be perturbed simultaneously for example:

"ADJUST 1 1 LPAH 1967 to 1983, ADJUST 0.9 0 FXAM 1967 to 1983".

All of the input should be contained on one line. If this is not possible (for example if a number of variables are to be adjusted simultaneously) the instructions can be entered into a macro file and the macro file passed to the PERTURB macro as input. For example if the instructions are in macro TEMP the input will be: "&TEMP".

- (xi) Do you want plotted output, 'YES' or 'NO': if you want the changes and percentage changes in certain variables plotted answer YES. In this case you will be prompted later for the names of the variables to be plotted.
- (xii) Do you want results for additional variables printed out: 'YES' or 'NO': if you want the change and percentage change in variables other than those in the standard list (see 2.2.v) printed answer YES. If you answer yes you will be prompted later for the names of the variables. Normally it is desirable to request the changes in the variables to be perturbed to check that the correct command was issued under (x) above.
- (xiii) Online printout, 'YES' or 'NO': if you answer YES the results will be displayed on the terminal using four columns. If the answer is NO they will be routed to the printer and will be printed eight variables across the page.
- (xiv) Do you wish to exogenise variables in the model: 'YES' or 'NO': if you wish to exogenise certain endogenous variables in the model (using the NEWDATA command) answer YES. You will be prompted later for further instructions.
- (xv) Do you wish to issue a BINDVAL command: 'YES' or 'NO': if you wish to issue a BINDVAL command answer YES and you will be prompted later for further instructions. This is useful if certain parameters or coefficients are to be changed when simulating the model. It can be used to achieve the same result as the coefficient perturbation option in TESTMOD.

Optional input which is requested depending on the answers to earlier queries:

- (xvi) Binding for constants in inverted commas: the normal arguments for the BINDVAL command are supplied in inverted commas. For example:
"C1 1.95, C2 0"

All instructions must be contained on one line of input. Otherwise the method described under (x) above must be used to input the instructions using a MACRO.

- (xvii) Name of variable to be exogenised or ';' : keep entering the names of the variables to be exogenised. When the list is complete enter a semicolon. These variables will be exognised for the period of the simulation determined by answers to questions (vi) and (vii) above. For example:

CPER PCPER GDPFC ;

- (xviii) Name of variable to be printed or ';' : if results for additional variables are to be printed you will be prompted for their names. Indicate the end of the list of additional variables with a semicolon. For example:

LPAH FXAH ;

- (xix) Name of variable to be plotted or ';' : if some of the results are to be plotted you will be prompted for the names of the relevant variables. Indicate the end of the list of additional variables with a semicolon. For example:

CPER GNP ;

Example 1:

Set out below is an example of the input into the PERTURB macro where the model to be used is HERMES and the variable to be perturbed is LPAH. It is to be raised by one unit. The simulation is to be carried out for the period 1973 to 1977. The output DSET will be called M73.LPAH. Certain parameters are to be changed or specified in the input. The variable LPAH is to be included in the output generated by the report generator and the variables CPER and GNP are to be plotted.

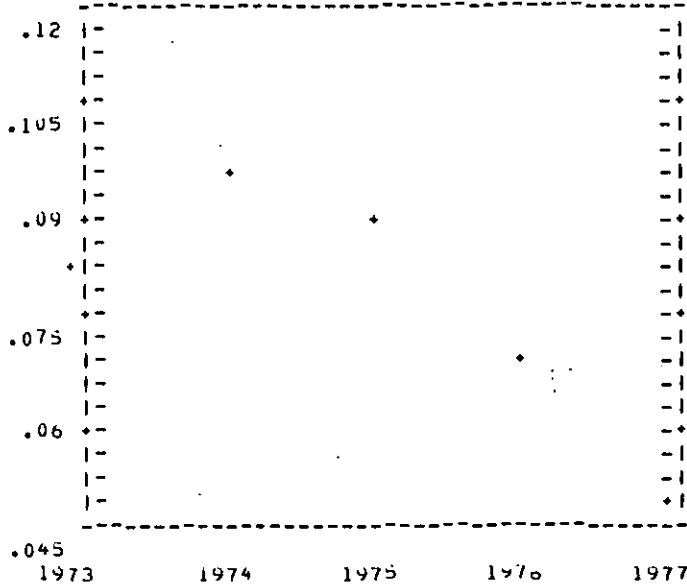
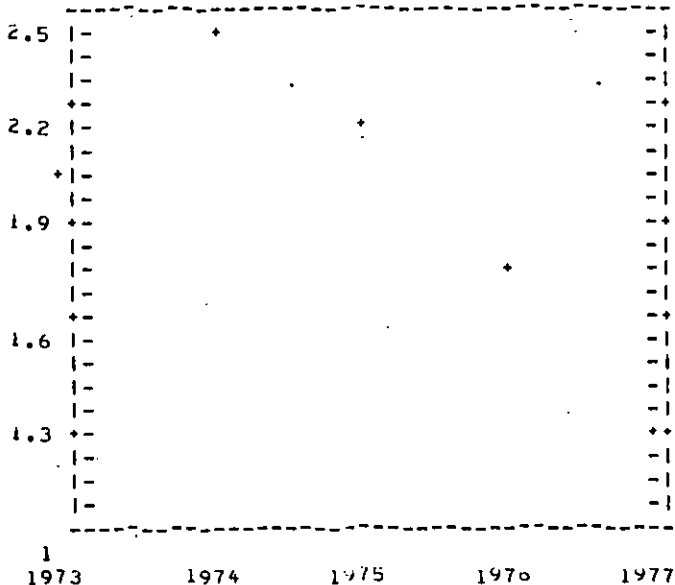
Input:

```
TROLL COMMAND:
>&PERTURB
NAME OF INPUT DSET:
>HERMES
NAME OF DSET CONTAINING BASELINE RUN:
>HERSD
NAME FOR OUTPUT DSET:
>M73.LPAH
NAME OF THE MODEL:
>HERMES
NAME OF THE CONSTANT FILE:
>HERMES
START YEAR FOR THE SIMULATION:
>1973
END YEAR OF SIMULATION:
>1977
DO YOU WANT THE STANDARD CONOPT: 'YES' OR THE ALTERNATIVE IN INV.COMMAS:
>YES
DO YOU WANT TO USE HISTORIC DATA AS THE BASE, 'YES' OR 'NO':
>YES
INPUT THE SPECIFICATIONS FOR THE PERTURBATION IN INVERTED COMMAS:
>"ADJUST 1.0 1.0 LPAH 1973 TO 1977"
```

```

DO YOU WANT PLOTTED OUTPUT, 'YES' OR 'NO' :
>YES
DO YOU WANT RESULTS FOR ADDITIONAL VARS. PRINTED OUT: 'YES' OR 'NO':
>YES
ONLINE PRINTOUT, 'YES' OR 'NO' :
>NO
DO YOU WISH TO EXOGENISE VARIABLES IN THE MODEL, 'YES' OR 'NO' :
>NO
DO YOU WANT TO ISSUE A BINOVAL COMMAND, 'YES' OR 'NO':
>YES
BINDING FOR CONSTANTS IN INVERTED COMMAS:
>"KMFDSW 1.43 4.28 3.VE41 n"
NEW RANGE OF DSET IS: 1949 TO 1977
NAME OF VARIABLE FOR PRINTING OR '!' :
>LPAH
NAME OF VARIABLE FOR PRINTING OR '!' :
>
NAME OF VARIABLE TO BE PLOTTED OR '!' :
>CPER
NAME OF VARIABLE TO BE PLOTTED OR '!' :
>GNP
NAME OF VARIABLE TO BE PLOTTED OR '!' :
>
  
```

PLOTS OF REQUESTED VARIABLES

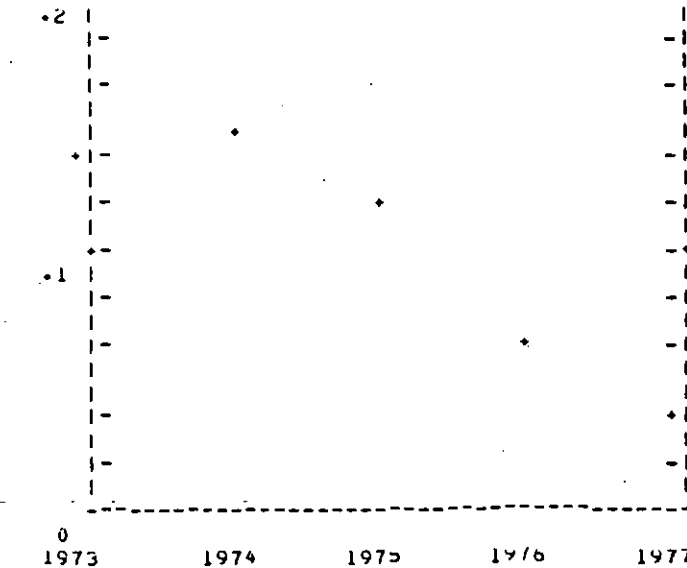
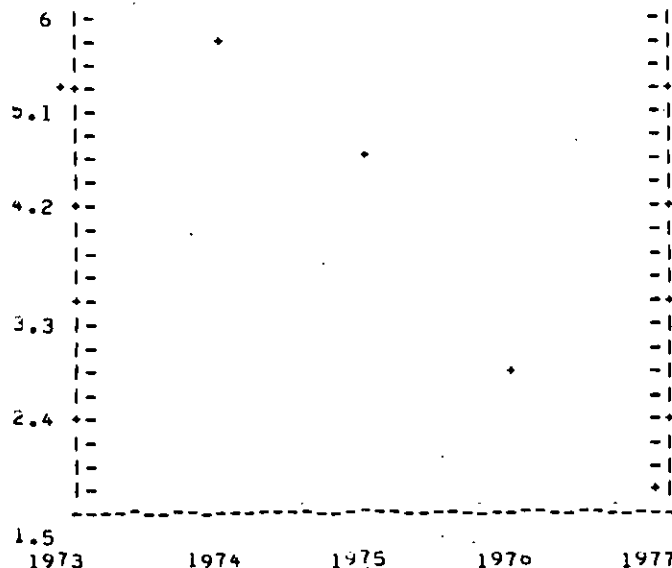


1973 1974 1975 1976 1977

1973 1974 1975 1976 1977

SYMBOL VARIABLE

SYMBOL VARIAELE



1973 1974 1975 1976 1977

1973 1974 1975 1976 1977

SYMBOL VARIABLE

SYMBOL VARIAELE

• M73.LPAH_ER_GNP

• M73.LPAH_PPER_UNP

THE PERTURBATIONS IN THIS RUN ARE ADJUST 1.0 1.0 FROM 1973 TO 1977
 THE BINDINGS USED IN THIS RUN ARE: KMFUSW 1.23 4.29 3.9E41 0

TABLE OF PERTURBATION RESULTS FOR REQUESTED VARIABLES

	LPAN_ER	LPAN_PCEW
1973	1.00000	1.81618
1974	1.00000	1.72414
1975	1.00000	1.86667
1976	1.00000	1.56250
1977	1.00000	1.53846

TABLE OF PERTURBATION RESULTS FOR STANDARD LIST OF VARS

	GNPDOT_ER	SDPMDOT_ER	PODPFCOT_ER	PCPERDOT_ER	GDGDPH_ER	GOMM_ER	BPVM_ER	UR_ER
1973	0.14772	0.15249	0.00210	0.00830	0.00493	-0.05711	-0.05195	-0.12120
1974	0.00725	0.01411	0.16444	0.14954	-0.02247	-0.03904	-0.12429	-0.08440
1975	-0.02462	-0.01678	-0.03500	-0.01573	0.05517	-0.05115	-0.09809	-0.05277
1976	-0.05474	-0.04758	-0.12427	-0.09413	0.22662	-0.07387	-0.02493	-0.03243
1977	-0.02042	-0.02108	-0.09606	-0.09451	0.33547	-0.09069	0.05878	-0.04916

	GNPDOT_PCEW	SDPMDOT_PCEW	PODPFCOT_PCEW	PCPERDOT_PCEW	GDGDPH_PCEW	GOMM_PCEW	BPVM_PCEW	UR_PCEW
1973	3.34335	2.74497	0.01300	0.07144	0.01034	0.83102	1.51807	-2.57314
1974	0.22260	0.43597	1.92500	0.94720	-0.04149	0.30001	1.30369	-1.81174
1975	6.53422	-14.14790	-0.12609	-0.06528	0.09523	0.30108	7.38481	-0.82852
1976	-2.30097	-1.44793	-0.79404	-0.49977	0.37380	-0.67254	0.50526	-0.41589
1977	-0.59413	-0.35565	-0.50200	-0.70807	0.55308	0.89067	-1.18436	-0.65015

	ECMMU_ER	LCMMU_ER	ECMMU_ER	IFCMMU_ER	LOMBLK_ER	KORBLK_ER	KORSMLK_ER	LONSMLK_ER
1973	0.00903	-0.00209	0.01000	0.05805	-0.00003	0.00005	0.00027	-0.00002
1974	-0.30713	-0.14638	0.06909	0.57104	-0.00003	0.00128	0.00671	-0.00046
1975	-0.45313	-0.23901	0.10913	0.57275	-0.00002	0.00114	0.00706	-0.00041
1976	-0.47900	-0.24390	0.11104	0.13037	-0.00011	0.00025	0.00212	-0.00014
1977	-0.20782	-0.11108	0.00604	-1.02148	0.00074	-0.00189	-0.00575	0.00043

	ECMMU_PCEW	LCMMU_PCEW	ECMMU_PCEW	IFCMMU_PCEW	LOMBLK_PCEW	KORBLK_PCEW	KORSMLK_PCEW	LONSMLK_PCEW
1973	0.00071	-0.00084	0.00310	0.02020	-0.01141	0.01326	0.01756	-0.00736
1974	-0.02308	-0.05763	0.02000	0.19278	-0.27301	0.32945	0.43630	-0.18017
1975	-0.03341	-0.09289	0.03310	0.18745	-0.22013	0.26001	0.40069	-0.16542
1976	-0.03414	-0.09428	0.03310	0.03942	-0.04205	0.00170	0.13371	-0.05520
1977	-0.01833	-0.04272	0.00200	-0.30347	0.29901	-0.35793	-0.39347	0.16342

	OMMU_ER	LCMMU_ER	EMMU_ER	IFMMU_ER	ECOMPHE_ER	COUMMU_ER	LB_ER	IFB_ER
1973	0.16455	0.01106	0.05170	0.07520	-0.00006	0.00016	0.17679	0.22910
1974	-0.44214	-0.11137	0.03107	0.28023	-0.00140	-0.00009	0.25734	0.35458
1975	-0.89257	-0.23268	-0.02307	0.29895	-0.00077	-0.00037	0.11633	-0.03712
1976	-1.25552	-0.28372	-0.10916	-0.01367	-0.00027	-0.00066	-0.04749	-0.31424
1977	-0.50439	-0.17690	-0.08500	-0.60645	0.00066	-0.00023	-0.10063	-0.44165

	OMMU_PCEW	LCMMU_PCEW	EMMU_PCEW	IFMMU_PCEW	ECOMPHE_PCEW	COUMMU_PCEW	LB_PCEW	IFB_PCEW
1973	0.01245	0.00453	0.01700	0.02913	-0.01408	0.01750	0.19533	0.96315
1974	-0.04488	-0.04395	0.01100	0.12123	-0.30509	-0.00025	0.26452	1.00365
1975	-0.09664	-0.09382	-0.00810	0.12148	-0.24753	-0.00008	0.13071	-0.17568

Example 2:

In this exercise the variable WMMU is to be exogenised. It is to be perturbed by 5 per cent and the results are to be printed online.

Input:

```

TROLL COMMAND:
>&PERTURB
NAME OF INPUT DSET:
>HERMES
NAME OF DSET CONTAINING BASELINE RUN:
>HERSD
NAME FOR OUTPUT DSET:
>M66.7
NAME OF THE MODEL:
>HERMES
NAME OF THE CONSTANT FILE:
>HERMES
START YEAR FOR THE SIMULATION:
>1973
END YEAR OF SIMULATION:
>1975
DO YOU WANT THE STANDARD CONOPT: 'YES' OR THE ALTERNATIVE IN INV.COMMAS:
>YES
DO YOU WANT TO USE HISTORIC DATA AS THE BASE, 'YES' OR 'NO':
>YES
INPUT THE SPECIFICATIONS FOR THE PERTURBATION IN INVERTED COMMAS:
>"ADJUST 1.05 0 WMMU 1973 TO 1975"
DO YOU WANT PLOTTED OUTPUT, 'YES' OR 'NO' :
>YES
DO YOU WANT RESULTS FOR ADDITIONAL VARS. PRINTED OUT: 'YES' OR 'NO':
>YES
ONLINE PRINTOUT, 'YES' OR 'NO' :
>YES
DO YOU WISH TO EXOGENISE VARIABLES IN THE MODEL, 'YES' OR 'NO' :
>YES
DO YOU WANT TO ISSUE A BINDVAL COMMAND, 'YES' OR 'NO':
>YES
BINDING FOR CONSTANTS IN INVERTED COMMAS:
>"KMFDSW 1.23 4.28 3.VE41 6"
NEW RANGE OF DSET IS: 1949 TO 1975
NAME OF VARIABLE TO BE EXOGENISED OR '!' :
>WMMU
NAME OF VARIABLE TO BE EXOGENISED OR '!' :
>
THE PERTURBATIONS IN THIS RUN ARE:ADJUST 1.05 0 WMMU 1973 TO 1975
THE BINDINGS USED IN THIS RUN ARE: KMFDSW 1.23 4.28 3.VE41 6
VARIABLE EXOGENISED IN THIS RUN :WMMU.
NAME OF VARIABLE FOR PRINTING OR '!' :
>ECOMP
NAME OF VARIABLE FOR PRINTING OR '!' :
>

```

TABLE OF PERTURBATION RESULTS FOR REQUESTED VARIABLES

	ECOMP_ER	ECOMP_PCER
1973	-0.00118	-0.12473
1974	-0.00068	-0.06991
1975	-0.00010	-0.01039

TABLE OF PERTURBATION RESULTS FOR STANDARD LIST OF VARS

	GNPDOT_ER	ODPMDOT_ER	PGDPFCDT_ER	PCPERDOT_ER
1973	0.10185	0.10471	0.36210	0.20924
1974	0.02975	0.03471	0.09222	0.24099
1975	-0.12981	-0.12008	0.11602	0.13275

	GNPDOT_PCER	ODPMDOT_PCER	PGDPFCDT_	PCPERDOT_
--	-------------	--------------	-----------	-----------

Etc.

	CGSNMV_PCER	SUBT_PCER	GEXPC_PCER	GEXPK_PCER
1973	0.16616	0.21078	0.18979	0.70836
1974	0.24122	0.25050	0.42004	0.80999
1975	0.30831	0.26618	0.62140	0.92954

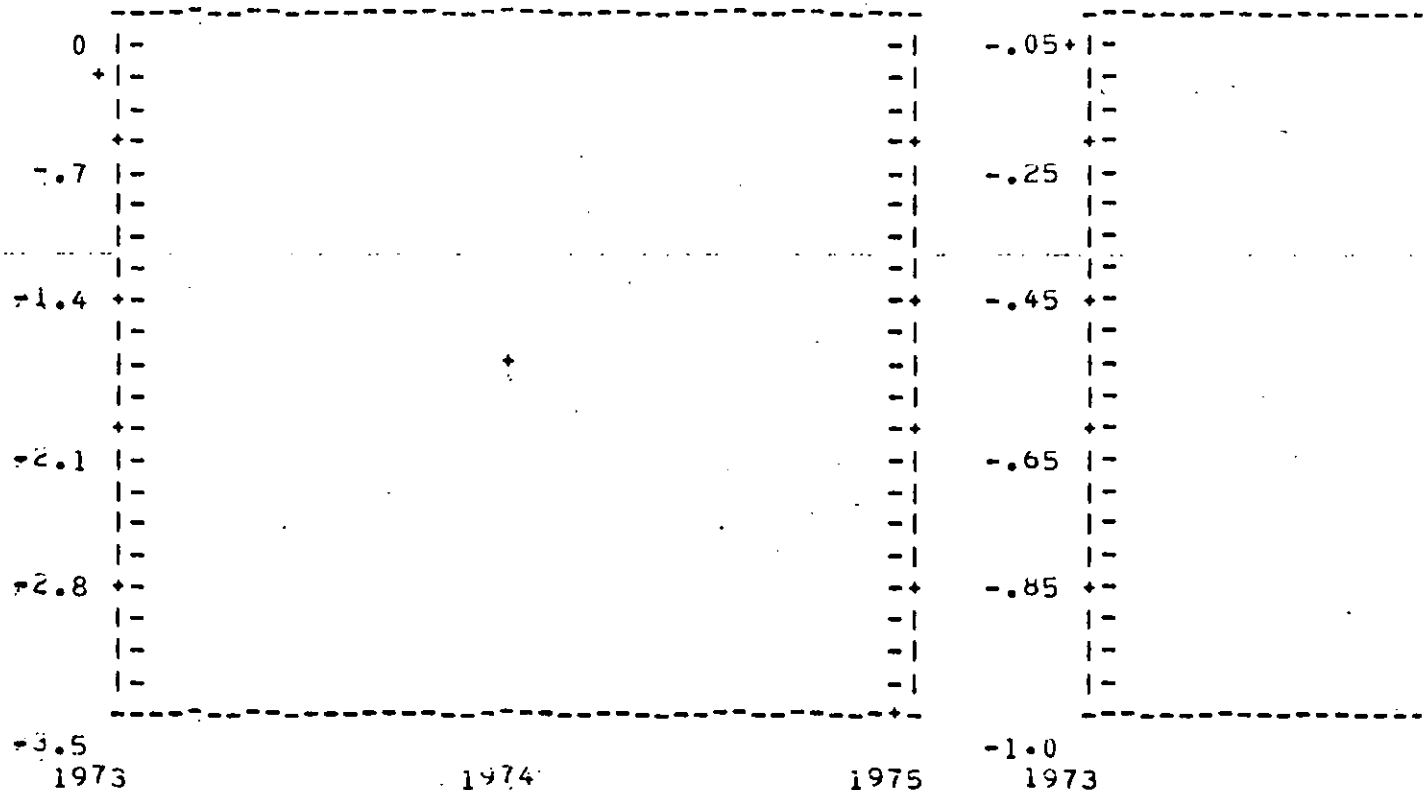
NAME OF VARIABLE TO BE PLOTTED OR ; ; ; :

>LI

NAME OF VARIABLE TO BE PLOTTED OR ; ; ; :

>;

PLOTS OF REQUESTED VARIABLES



SYMBOL

VARIABLE

+ M66.7_ER_LI

SYMBOL

VARIABLE

+ M66.7_PCER_

Example of macro HERMES containing standard list of variables to be printed:

GNPDOT GDPMDOT PGDPFCDT PCPERDOT GDGDPH GBRR BPVR UR
QCMMU LCMMU ECMMU IFCMMU LORBLR KORBLK KORSMRK LORSMRK
OMMU LMMU EMMU IFMMU ECOMPHE CUOMMU LB IFB
OAFF USM USNM US OPA OI OB GDPFC
LAFF LSM LSNM LS LPA LI LNA L
WAFFIMP WSM WSNM WS WPA WI WNA WEDGE
YAFF YWSM YWSNM YWS YWPA YWI YWNA YCI
IFAFF IFSM IFSNM IFS IFPA IFI IFT IH
CPER CPERV CG IIT XGS XGSM MGS MGSV
PCPER PIH PGDPFC PTET PSUBT POAFF POMMU PUSM
GNP GNPV YPERU YRPERD GDPH U NMA BPV
TEU TAV TET TYT GREVC TINC TYTOTR GBR
TRU TRDIF TRDID CGV CGSNMV SUBT GEXPC GEXPK

3. Using the MULREPOR Macro

This macro uses the CRDMAT command to create a matrix with the results for the required variables. This matrix is then printed using the matrix printing function. This approach achieves a very considerable saving in computer time compared to the PRTDSET command. The results are also formatted in a manner which helps the user by presenting the changes in a number of variables side by side. By choosing the order in which the variables are printed (using the MACRO file containing the names of the standard variables for printing) rapid analysis of the results can be facilitated. For the standard variables the errors (difference between baseline and perturbed simulations) are printed for four or eight variables (depending on whether online or offline printing is requested) immediately followed by the percentage errors for the same variables. While this macro is specially designed to present the results from use of the PERTURB macro it can also be used to compare the results from any two DSETS produced using the normal SIMULATE task. This can be useful where a rapid comparison of two complicated scenarios is required. The plots produced by this MACRO are configured for a line printer. Plots are presented for both the change and the percentage change in the requested variables.

Files Required:

Before executing this macro three files must be present in the users file-system:

- (i) the baseline dataset (DSET). This file may have been produced by the PERTURB macro or by direct use of the SIMULATE task.
- (ii) the dataset file (DSET) from the perturbed simulation. This file may have been produced by the PERTURB macro or by direct use of the SIMULATE task.
- (iii) a macro file containing the names of the variables for which results are to be reported. This standard list of variables may be added to when actually executing the macro.

Input Required:

As with the macro PERTURB this macro prompts the user for the required input. Set out below is a list of the arguments which must be supplied to the macro on execution:

- (i) Start year of range of years to be printed out: this need not be the start year of the DSET.
- (ii) End year of range of years to be printed out: this need not be the end year of the DSET.
- (iii) Macro file of variable names for printing, name: the name of the macro file containing the standard list of variables to be printed out. For convenience in use it may be desirable to give this macro the same name as that of the model.
- (iv) Do you want a full printout of all endogenous variables? 'YES' or 'NO': If yes is chosen the changes (or differences) and percentage changes in all the endogenous variables in the second DSET named (see ix below) compared to the first DSET named (see viii below) are printed out. If this option is used the standard list of variables are not printed out.
- (v) Do you want plots 'YES' or 'NO': if you want plots enter YES otherwise no. If YES, you will be prompted later for the names of the variables to be plotted.
- (vi) Do you want results for additional variables printed out: 'YES' or 'NO': if you want the change and percentage change in variables other than those in the standard list answer YES. If you answer yes you will be prompted later for the names of the variables.
- (vii) Online printout, 'YES' or 'NO': if you answer YES the results will be displayed on the terminal over four columns. If the answer is NO they will be routed to the printer and will be printed eight across the page.
- (viii) Name of baseline DSET: Name of baseline dataset.
- (ix) Name of perturbed DSET: name of second dataset whose results are to be compared to the results from the baseline dataset.

Optional Input which is requested depending on the answers to earlier queries.

- (x) Name of variable to be printed or ';' : if results for additional variables are to be printed you will be prompted for their names. Indicate the end of the list of additional variables with a semicolon. For example:
LPAH FXAH ;

- (xi) Name of variable to be plotted or ';' : if some of the results are to be plotted you will be prompted for the names of the relevant variables. Indicate the end of the list of additional variables with a semicolon. For example:

CPER GNP ;

Example:

Set out below is an example of the input into the MULREPOR macro where the baseline DSET is HERSD, the perturbed dataset is M73.LPAH. The results are to be printed for the years 1973 to 1975. The standard list of variables to be printed is contained in the macro HERMES. Plots are to be produced for the variables CPER and GNP. The results for the variable LPAH are to be presented. All output is to be routed to the screen.

Input:

```
TRDLL-COMMAND:
>&MULREPOR
START YEAR OF RANGE OF YEARS TO BE PRINTED OUT
>1973
END YEAR OF RANGE OF YEARS TO BE PRINTED OUT
>1976
MACRO FILE OF VARIABLE NAMES FOR PRINTING, NAME:
>HERMES
DO YOU WANT A FULL PRINTOUT OF ALL ENDOGENOUS VARS.?: 'YES' OR 'NO'
>NO
DO YOU WANT PLOTS, 'YES' OR 'NO'?:
>YES
DO YOU WANT RESULTS FOR ADDITIONAL VARS. PRINTED OUT: 'YES' OR 'NO'
>YES
ONLINE PRINTOUT, 'YES' OR 'NO'?:
>YES
NAME OF BASELINE DSET:
>HERSD
NAME OF PERTURBED DSET:
>M73.LPAH
NAME OF VARIABLE FOR PRINTING OR ';' :
>LPAH
NAME OF VARIABLE FOR PRINTING OR ';' :
>;
NAME OF VARIABLE TO BE PLOTTED OR ';' :
>CPER
NAME OF VARIABLE TO BE PLOTTED OR ';' :
>GNP
NAME OF VARIABLE TO BE PLOTTED OR ';' :
>;
```

Output:

TABLE OF PERTURBATION RESULTS FOR REQUESTED VARIABLES

	LPAH-CR	LPAH-PCER
1973	0.55000	1.00000
1974	0.59000	1.00000
1975	0.60001	1.00001
1976	0.64001	1.00002

TABLE OF PERTURBATION RESULTS FOR STANDARD LIST OF VARS

	GNPDDT_ER	GDPDDT_ER	PSOPFCDT_ER	PCPERDDT_ER
1973	-0.07925	0.03133	0.00143	0.00610
1974	0.01087	0.01478	0.03713	0.08106
1975	-0.04025	-0.00563	0.00362	-0.00191
1976	-0.03042	-0.02532	-0.09630	-0.05045

Etc.

1973	0.00413	0.02333	0.14211	0.01310
1974	0.05250	0.05240	0.22071	0.07995
1975	0.04203	0.05202	0.22621	0.06215
1976	0.01713	0.03563	0.20187	0.03107

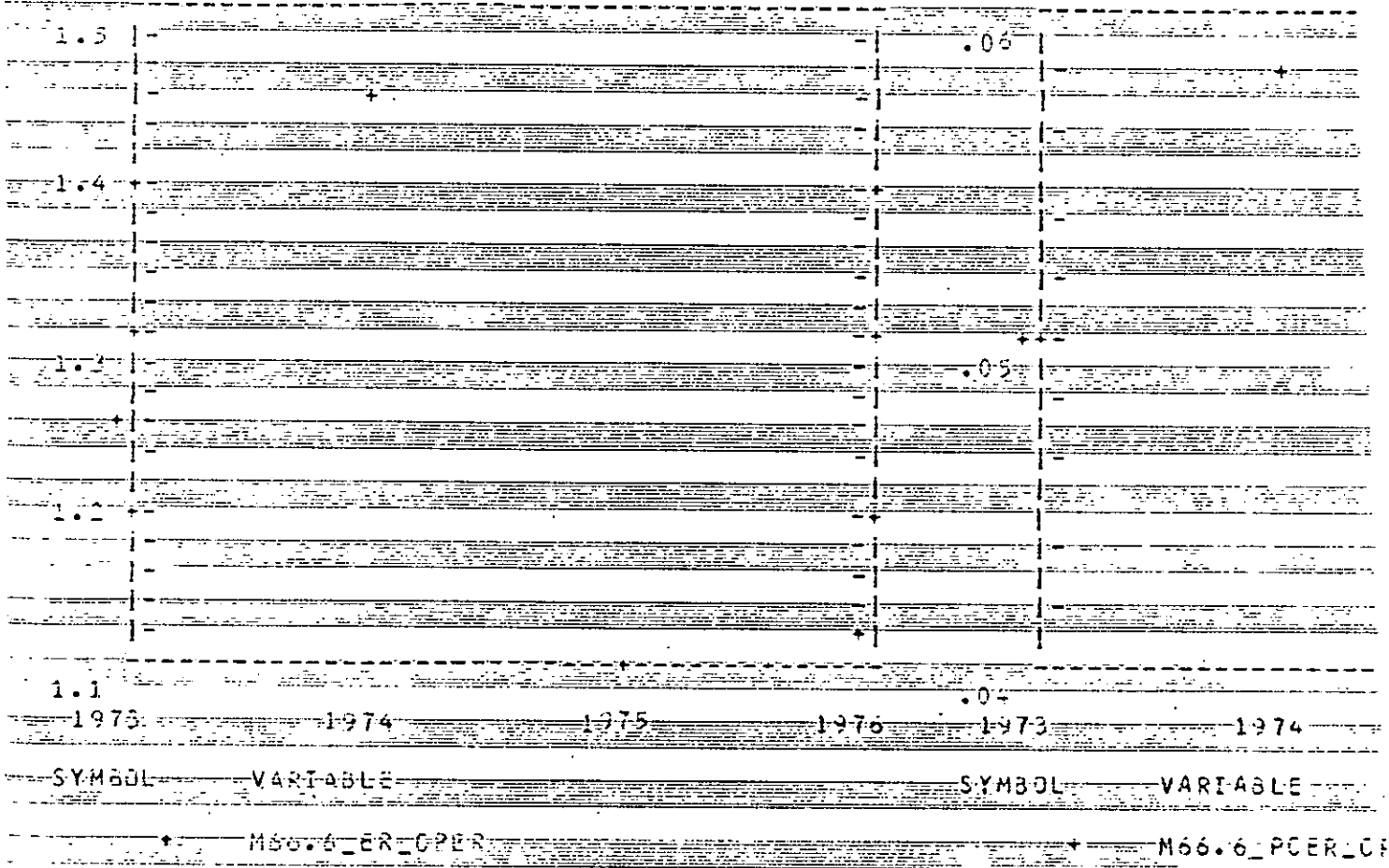
NAME OF VARIABLE TO BE PLOTTED OR '':

XCPER

NAME OF VARIABLE TO BE PLOTTED OR '':

>

PLOTS OF REQUESTED VARIABLES



4. MACRO PERTURB

Set out below is the MACRO:

```
&ERROR &IGNORE
&GET
&14"NAME OF INPUT DSET:"
&1"NAME OF DSET CONTAINING BASELINE RUN:"
&2"NAME FOR OUTPUT DSET:"
&7"NAME OF THE MODEL:"
&8"NAME OF THE CONSTANT FILE:"
&3"START YEAR FOR THE SIMULATION:"
&4"END YEAR OF SIMULATION:"
&18"DO YOU WANT THE STANDARD CONOPT: 'YES' OR THE ALTERNATIVE IN INV.COMMAS:"
&5"DO YOU WANT TO USE HISTORIC DATA AS THE BASE, 'YES' OR 'NO':"
&6"INPUT THE SPECIFICATIONS FOR THE PERTURBATION IN INVERTED COMMAS:"
&15"DO YOU WANT PLOTTED OUTPUT, 'YES' OR 'NO' : "
&9"DO YOU WANT RESULTS FOR ADDITIONAL VARS. PRINTED OUT: 'YES' OR 'NO':"
&11"ONLINE PRINTOUT, 'YES' OR 'NO' : "
&16"DO YOU WISH TO EXOGENISE VARIABLES IN THE MODEL, 'YES' OR 'NO' : "
&12"DO YOU WANT TO ISSUE A BINDVAL COMMAND, 'YES' OR 'NO':" &END
&10 &12 CEV NO &GOTO L3 &IFEND
&GET
&13"BINDING FOR CONSTANTS IN INVERTED COMMAS:" &END
&L3:
COPYD DSET &14 &2.;
DO IFARG(1)=&3+1..IFARG(2)=1;
DSETEDIT &2. NEWRANGE TOP TO &4;
&IF &5 CEV YES &GOTO L1 &IFEND
NEWVALS EXTRAP 1 0 ALL &IFARG(1) TO &4;
&L1:
NEWVALS &6;
FILE;
USEMOD &7; BINDVAL CONST &8; USEDSET &2.;
&IF &12 CEV NO &GOTO L2 &IFEND
BINDVAL &13;
&L2:
&IF &18 CEV YES &GOTO L5 &IFEND
CONOPT &18;
&GOTO L7
&L6:
CONOPT STOP 500 DIVCR 500 CONCR .001;
&L7:
SIMULATE RELAX;
&IF &16 CEV NO &GOTO L4 &IFEND
NEWDATA &3 TO &4.DSET
&GET &CIFARG(&IFARG(2))"NAME OF VARIABLE TO BE EXOGENISED OR ' ; ' : "&END
&CIFARG(&IFARG(2))
&WHILE &CIFARG(&IFARG(2)) ONE " ; "
&LET &IFARG(2)=&IFARG(2)+1 &END
&GET &CIFARG(&IFARG(2))"NAME OF VARIABLE TO BE EXOGENISED OR ' ; ' : "&END
&CIFARG(&IFARG(2))
&WHILEND
&LET &IFARG(2)=&IFARG(2)-1 &END
&L4:
SIMALG GAUSS;
SIMSTART &3;
DOFIL &4;
FILESIMD &2;
&IF &11 CEV NO &PRINTOFF &IFEND
&PRINTA
THE PERTURBATIONS IN THIS RUN ARE:&6 &END
&IF &12 CEV YES &PRINTA THE BINDINGS USED IN THIS RUN ARE: &13 &END
&IF &16 CEV NO &GOTO L5 &IFEND
&FOR &IFARG(3)=1 UNTIL &IFARG(2)
&PRINTA VARIABLE EXOGENISED IN THIS RUN :&CIFARG(&IFARG(3)). &END
&FOREND
&L5:
&MULREPOR &3 &4 &7 NO &15 &9 &11 &1 &2
&PRINTON
DELETE DSET &2.;
```

5. MACRO MULREPOR

Set out below is the MACRO:

```
&GET
&1"START YEAR OF RANGE OF YEARS TO BE PRINTED OUT"
&2"END YEAR OF RANGE OF YEARS TO BE PRINTED OUT"
&17"MACRO FILE OF VARIABLE NAMES FOR PRINTING,NAME:"
&7"DO YOU WANT A FULL PRINTOUT OF ALL ENDOGENOUS VARS.?: 'YES' OR 'NO'"
&12"DO YOU WANT PLOTS, 'YES' OR 'NO' :'"
&3"DO YOU WANT RESULTS FOR ADDITIONAL VARS. PRINTED OUT: 'YES' OR 'NO'"
&8"ONLINE PRINTOUT, 'YES' OR 'NO' :'"
&5"NAME OF BASELINE DSET:"
&6"NAME OF PERTURBED DSET:"
&END
&LET &9="PKTMAT" &END
&LET &10="UPRIMAT" &END
&LET &18=4 &END
OUTOPT TABWIDTH 4 FPFIELD 12 DECIMALS 5 SIGPLACES 0;
&IF &8 CEQ YES &GOTO L8 &END &IFEND
&LET &18=8 &END
&LET &9=&10 &END
OUTOPT TABWIDTH 8 FPFIELD 12 DECIMALS 5 SIGPLACES 0;
&L8:
SEARCH DATA_TEMP. W;
&IF &7 CEQ NO &GOTO L1 &IFEND
CRUMAT PCER LABELS,DSETS &5 &6,RANGE &1 TO &2,VARIABLES ENDOGENOUS;
DO &9(&6_PCER,&6_ROW'L,&6_COL'L);
&GOTO L10
&L1:
&LET &IFARG(1)=0 &END
CRUMAT ER PCER LABELS,DSETS &5 &6,RANGE &1 TO &2,VARIABLES
&CALL &17
&IF &3 CEQ NO &GOTO L2 &IFEND
&L3:
&GET FROM TERMINAL &11"NAME OF VARIABLE FOR PRINTING OR ';' :'" &END
&IF &11 CEQ ; &GOTO L2 &IFEND
&LET &IFARG(1)=&IFARG(1)+1 &END
&11
&GOTO L3
&L2:
;
DOCORE
IFARG(2)=NUC(&6_ER),
IFARG(3)=IFARG(2)-IFARG(1),
IFARG(4)=ROUNDUP(IFARG(2)/&18),
X.2=CRMAT(IFARG(4),&18,NA),
X.2=MATREP(X.2,SEQ(1,IFARG(2))),
X.3=IF X.2 GT IFARG(3) THEN NA ELSE X.2,&*"COLUMN NUMBERS FOR USUAL VAR
X.3=SQUEEZE(MATCOMB(X.3,X.3+IFARG(2))),
Z.1'L=LCOMBINE(LABFORM(<A,'_ER'>,0,&6_COL'L),LABFORM(<A,'_PCER'>,
0,&6_COL'L)),
Z.2'L=LCOMBINE(<TABLE OF PERTURBATION RESULTS FOR STANDARD LIST OF VARS>
),
X.4=MATCOMB(&6_ER,&6_PCER),
&IF &3 CEQ NO &GOTO L7 &IFEND
X.2=IF X.2 LE IFARG(3) THEN NA ELSE X.2,&*"COLUMN NUMBERS FOR NEW VARS.
X.2=SQUEEZE(MATCOMB(X.2,X.2+IFARG(2))),
Z.2'L=LCOMBINE(<TABLE OF PERTURBATION RESULTS FOR REQUESTED VARIABLES>
),
```

```
&9(X.4,&6_ROW'L,Z.1'L,0,X.2,8,Z.2'L,1),
&L7:
&9(X.4,&6_ROW'L,Z.1'L,0,X.3,8,Z.3'L,1);
&L10:
&IF &I2 CEW NU &GOTO L9 &IFEND
&LET &IFARG(1)=0 &END
CRDATA ER PCER,DSETS &5 &6,RANGE &1 TO &2,VARIABLES
&L5:
&LET &IFARG(1)=&IFARG(1)+1 &END
&GET FROM TERMINAL
  &CIFARG(&IFARG(1))"NAME OF VARIABLE TO BE PLOTTED OR ' ; ' : "
&END
&IF &CIFARG(&IFARG(1)) CEW ; &GOTO L4 &IFEND
&CIFARG(&IFARG(1))
&GOTO L5
&L4:
;
&LET &IFARG(2)=0 &END
PLOT;
SEI POPT TIMELINE OFF GRID OFF DATALEGEND OFF;
FRAME 2 2;
PAGETITLE <PLOTS OF REQUESTED VARIABLES>;
&L10:
&LET &IFARG(2)=&IFARG(2)+1 &END
&IF &IFARG(2) EQ &IFARG(1) &GOTO L6 &IFEND
TIM &6_ER_&CIFARG(&IFARG(2));
TIM &6_PCER_&CIFARG(&IFARG(2));
&GOTO L10
&L6:
QUIT;
&L9:
DELSEARCH DATA_TEMP. W;
DELETE DATA TEMP._>;
```

APPENDIX 1

6 NEWVALS

Replace values in DSET.

```
FORMAT: NEWVALS valspec [,newvalspec] ... ;

valspec      = [how] varspec... [timespec]

newvalspec   = [how] [varspec...] [timespec]
              (Defaults are values from last
              valspec/newvalspec)

how          = BINDING
              FROMDSET dsetname
              UPDATE [VERIFY]
              VALUE x
              CHANGE oldvalue newvalue
              ADJUST m [s]
              EXTRAP m [s]
              PCFDADJ p

timespec     = MAXRANGE      (TOP to BOTTOM,
                             NAFAL to BOTTOM for EXTRAP)
              [startspec] stopspec
              startspec [stopspec]

startspec    = date          (Default: NAFAL)

stopspec     = TO date      (Default: FOR 1)
              FOR n

date         = year [period]
              TOP
              NALBF      (Last NA-value Before FIRSTDEF)
              FIRSTDEF  (First non-NA value for the
                          variable)
              LASTDEF   (Last non-NA value for the
                          variable)
              NAFAL     (First NA-value After LASTDEF)
              BOTTOM

varspec      = see Explanation of Common Arguments

x, m, s, p  = real numbers
```

USAGE: Low-level command

NEWVALS replaces values within the range of the DSET you are editing. NEWVALS must include at least one *varspec*; default values for *how* and *timespec* are then used.

The *how*, *varspec*, and *timespec* must be given in strict order. Each *varspec* is executed as soon as a comma or semicolon is read, updating the edited DSET. After each comma, the last *how*, *varspec*, and *timespec* given are taken as default values. "," and ";;" are not allowed though, and will not cause repeated execution.

The *how* keywords declare how the new values should be computed.

If BINDING (which is default) is given, the values for each of the variables specified are replaced with values from corresponding DATA files. The DATA files must have the same periodicity and at least one time period common to the given range.

If UPDATE is given, new values are taken from DATA files just as for BINDING, but for UPDATE values are retrieved only from DATA files that have been updated since the DSET was created. For each *varspec*, the system prints the number of variables updated. If the option VERIFY is given, the system also prints the names of each variable being updated.

If FROMDSET is given, another DSET is read from disk and values in the DSET being edited are replaced with values from the new DSET for each of the variables specified within the given range. If you have inadvertently erased values during editing you may, instead of using QUIT and re-editing, restore specified values from the same DSET as you are editing, since the original remains unchanged on disk until overwritten by FILE or SAVE.

If VALUE is given, any real constant value x (including NA) may be inserted into the specified part of the DSET.

If CHANGE is given, the *newvalue* is inserted for every time period within the specified part of the DSET having a value equal to *oldvalue*.

If ADJUST is given, the old values are multiplied by m and s is added giving the new values to be inserted. NA values are ignored.

If EXTRAP is given, the value in the previous time period is multiplied by m and then incremented by s to give the new value, and this extrapolation continues through the *timespec*. If the value in the time period preceding the first time period specified by *timespec* equals NA for a variable, an error message will occur and nothing will be done for that variable. If the EXTRAP is specified to start at TOP (or the date equivalent to TOP), the first value inserted is actually the second of the DSET. In all other cases, the first value inserted is the first value specified.

If PCFDADJ is given, then each variable's PerCent-First-Difference will be adjusted by p for each period in the range. For example, if a variable increases at 5% per period for 8 periods and then at 3% per period for another 8 periods, then specifying "PCFDADJ 1" for that range will give the variable a 6% growth rate for the first 8 periods and a 4% growth rate for the next 8 periods.

If the *varspec* ALL is given, values for all CONSTRUCT, DEFINITION, ENDOGENOUS, EXOGENOUS, and POLICY variables in the DSET are replaced. If a

variable type is given, values for all variables of that variable type in the DSET are replaced. If a suffix is included, values of all variables declared with that suffix are replaced. Otherwise, values of the individual variables specified in the command are replaced.

If the default *timespec* MAXRANGE is used, the time range will be TOP to BOTTOM, except for EXTRAP, where time range in this case will be NAFAL to BOTTOM. NAFAL is defined as the time period following LASTDEF (if any). LASTDEF is defined as the time period of the last non-NA value for a variable (if any). FIRSTDEF is defined as the time period of the first non-NA value for a variable (if any). NALBF is defined as the time period previous to FIRSTDEF (if any).

To illustrate this, let a variable in a DSET with time bounds 1985 1 to 1987 1 have the following values:

time period	value	"date"
1985 1	NA	← TOP
1985 2	NA	
1985 3	NA	← NALBF
1985 4	14	← FIRSTDEF
1986 1	15	
1986 2	16	← LASTDEF
1986 3	NA	← NAFAL
1986 4	NA	
1987 1	NA	← BOTTOM

If there are no NA-values at end of DSET, NAFAL is undefined for this variable, and LASTDEF is then equal to BOTTOM.

If there are no NA-values at start of DSET, NALBF is undefined for this variable, and FIRSTDEF is then equal to TOP.

If there are only NA-values for a variable, NAFAL is defined as TOP, NALBF as BOTTOM, while FIRSTDEF and LASTDEF are undefined.

If any of the *dates* given are undefined for a variable, WARNING 30031 NO LEGAL RANGE DEFINED FOR THIS VARIABLE:, will appear. This warning will also appear if *stopspec* precedes *startspec* for a variable. No action will then be taken for this variable.

NOTES:

If you use superquit (^) to abort a NEWVALS command, you also abort the DSETEDIT task and lose the work you have done. If you have mistyped any part of a *valspect*, you can, before typing comma or semicolon (which executes the command), type slash (/). All you have done after last comma is then forgotten and you can retype the last *valspect*.

EXAMPLES:

1. NEWVALS EXTRAP 1.05 X1 X2 X3 1987 2 FOR 3;
2. NEWVALS EXTRAP 1.05 X1 X2 X3 FOR 3, EXTRAP 1.07, EXTRAP 1.1;
3. NEWVALS ADJUST 1.02 &EXPORT 1985 TO BOTTOM, ADJUST 1.03 &IMPORT;
4. NEWVALS ADJUST 1 100 EXOGENOUS;
5. NEWVALE VALUE 123.45 TAX_A1 TOP, EXTRAP 1.01 TOP TO 1999 4;
6. NEWVALS FROMDSET YOURDSET 'N 1985 1 TO BOTTOM, UPDATE X1;
7. NEWVALS ALL;

Example 1 extrapolates each of the variables X1, X2, and X3, giving a 5% growth with base 1987 1, for 3 periods. This will produce new values for the time periods 1987 2 to 1987 4.

Example 2 extrapolates each of the variables X1, X2, and X3, giving a 5% growth with base LASTDEF for each variable, for 3 periods. The same variables are then given a 7% growth for another 3 periods, followed by a 10% growth for another 3 periods.

Example 3 increases existing annual values by 2% for 1985 through the end of the DSET, for each variable listed in the MACRO &EXPORT. Then all variables listed in the MACRO &IMPORT are adjusted 3% over the same time range.

Example 4 increases all values of all exogenous variables by 100.

Example 5 gives the variable TAX_A1 the value 123.45 for the first time period in the DSET and then extrapolates from that period through the fourth period of 1999 at a steady growth rate of 1% per period.

Example 6 replaces values for periods of 1985 1 until the end of the DSET for all variables with the suffix 'N with the values of corresponding variables in the DSET named YOURDSET. Then values in the same time range for the variable X1 are replaced with values from the DATA file X1, if this DATA file is revised later than the edited DSET.

Example 7 replaces all values for all variables in DSET with values of corresponding DATA series.