GUIDE FOR USING THE PROGRAMS TRAMO AND SEATS

(BETA VERSION: DECEMBER 1997)

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Documento de Trabajo nº 9805

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Abstract

The present document details, step by step, an efficient and simple way to construct the input file for the programs TRAMO ("Time Series Regression with ARIMA Noise Missing Observations, and Outliers") and SEATS ("Signal Extraction in ARIMA Time Series") for all possible cases and applications. First, we describe a fully automatic procedure where all parameters are set by the program. Then, for a more general use, the case of joint or separate application of the programs is described, as well as the case of a simple series or a large number of them. Special attention is paid to the construction of regression variables. Finally, the appendix contains some recommendations for increasing robustness of the results when an automatic procedure is followed.

INDEX

1 INTRODUCTORY NOTE

The present document provides a guide for the setting of the input parameters for the programs TRAMO ("Time Series Regression with ARIMA Noise, Missing Observations, and Outliers") and SEATS ("Signal Extraction in ARIMA Time Series"). It complements the manual Instructions for the User, which contains a relatively complete description of the programs, of their characteristics and options, as well as several examples. In this document we only address the issue of the construction of the input file.

The complete INPUT FILE consists of three main parts.

The first part is the actual numerical values of the series to be treated. The second part contains the input parameters for the model and the type of application. We shall refer to this set of parameter values as the **INPUT namelist**. Since the program sets all parameters by default, the INPUT namelist only needs to contain the parameters set at non-default values.

When the INPUT namelist specifies IREG>0, regression variables have to be entered as well as their associated parameter values. We shall refer to the set of specified regression parameters as the **REG namelist.**

In this document we describe the construction of the INPUT namelist and of the (perhaps several) REG namelist. This construction reflects an efficient way to apply the programs in all their possible options. (It may also provide the basis for the development of a user-friendly interface.)

2 GENERAL ATTRIBUTES OF THE SERIES

NAME: Name of the series (or id. #).
NZ: Number of observations.
NYEAR: Starting year.
NPER: Starting period (in first year).

Let [k] denote the default value (k) of a parameter. When the default value is not changed there is no need to enter any value for the parameter.

An Example

To illustrate the general structure of the input file, an example of the file for MS-DOS is provided. The structure is the following:

NAME
NZ NYEAR NPER

Numerical values of the series (some observations are missing; they are identified by the number -99999.)

INPUT namelist

The input namelist specifies that the procedure should be one of the fully automatic options (RSA=6; see Section 3).

Since IREG=4, a sequence of REG namelists follows, with the corresponding parameters and regression variables (see Section 9).

```
ipiex
158 1983 2
            83.300    90.600    84.500    89.300   -99999.    82.800    49.900    87.800    86.800    88.900    86.600
   86.500   87.200    89.900    81.600    89.800    85.600    85.800    53.300    85.400    91.600    90.200    82.600
   88.600   84.600    89.200    84.800    90.600    83.800    89.500    52.400    88.300    99.000    92.900    86.200
   88.400   88.000    87.500    94.600    91.200    92.500    93.700    50.400    92.100   100.300    94.900    88.100
   87.600   91.900   -99999.   -99999.    96.300    97.300   102.900    53.100    98.400   102.000   101.100    92.100
   90.200   96.500   103.400    95.000   101.200   100.300    99.600    56.400   100.800   100.900   105.800    94.500
  100.700   98.700   103.400   102.100   104.800   107.700   104.600    60.000   105.000   107.300   108.800    97.700
  105.000   98.900   108.400    96.000   107.100   107.100   104.400    59.800   102.400   105.700   109.200    97.400
  103.700   99.000    96.800   102.200   -99999.   102.300   104.500    58.900   102.800   111.800   106.100    95.300
  100.300  101.100   104.300    98.300   100.300   102.800   104.500    58.800    98.900   100.700    97.300    86.700
   88.200   90.300    98.000    90.200    95.300    96.800    97.500    56.900    97.100    97.000    99.500    92.000
   91.100   95.200   103.500    97.000   102.100   105.500   102.700    64.200   104.900   104.400   109.200    99.900
  104.200  101.500   113.900    97.400   112.000   112.700   106.200    67.400   105.600   108.100   110.400    95.200
  102.700  102.400   106.400
$INPUT Rsa=6 ireg=4 $
$REG  iuser=1 ilong=182 regeff=5 $
   18.1000   17.3000   15.1000   13.9000   17.3000   19.3000   16.5000
   16.5000   16.8000   15.9000   18.9000   21.6000   20.8000   22.5000
   24.0000   22.1000   22.2000   20.3000   18.5000   17.3000   18.3000
   16.4000   15.1000   14.7000   13.5000   12.9000   13.2000   12.9000
   12.5000   12.9000   12.1000   12.3000   12.2000   12.1000   12.3000
   12.5000   14.0000   13.8000   13.0000   11.1000   10.0000   10.3000
   10.2000   10.2000   10.5000   11.4000   12.3000   11.8000   12.2000
   12.5000   12.3000   11.6000   11.6000   11.6000   11.9000   12.4000
   12.6000   14.7000   17.5000   20.7000   18.5000   18.1000   17.5000
   17.4000   16.1000   14.6000   13.9000   13.1000   12.1000   11.3000
   11.0000   11.0000   10.4000   10.7000   10.5000   10.9000   11.8000
   11.9000   12.8000   13.2000   14.0000   14.5000   14.4000   14.4000
   14.7000   15.5000   15.3000   15.1000   15.0000   15.3000   15.9000
   15.5000   15.3000   15.1000   14.8000   14.9000   14.9000   14.8000
   14.8000   14.9000   14.8000   14.8000   15.0000   14.9000   14.7000
   14.0000   13.6000   13.1000   12.7000   12.8000   12.7000   12.6000
   12.7000   12.7000   12.8000   12.8000   12.7000   12.5000   12.4000
   12.5000   12.5000   12.8000   13.3000   14.1000   14.0000   14.3000
   15.4000   14.6000   14.7000   15.7000   14.4000   13.7000   11.5000
   12.0000   10.8000   10.2000    9.8000    9.5000    9.2000    9.1000
    8.8000    8.2000    8.0000    7.7000    7.6000    7.6000    7.6000
    7.5000    7.5000    7.5000    7.8000    8.4000    8.3000    9.2000
    8.9000    9.0000    9.5000    9.5000    9.5500    9.5200    9.5700
    9.6000    9.5600    9.5800    9.6100    9.5500    9.6500    9.6300
    9.6100    9.6400    9.5900    9.6200    9.6600    9.6400    9.6800
    9.6000    9.6700    9.6200    9.6600    9.7000    9.7200    9.6900
$REG iuser=-1 nser=2 regeff=2 ilong=182 $
holy
$REG iseq=1 delta=.8 regeff=3 $
142 1
```

The input parameters specify (as shall be seen later) that the full automatic model identification and outlier correction procedure are to be performed, as well as pretesting for trading day (with a 6 parameter specification) and easter effect. Missing observations will be interpolated and 24 forecasts computed. Further, TRAMO will produce a file ready for SEATS.

The model contains 4 regression variables. The first one has been entered in the file and its effect will be assigned in SEATS to the cyclical component; the next two ones are the columns of a (182 × 2) matrix in a separate file (called "holy") and will be assigned to the seasonal component; the last one is an intervention variable (a transitory change) that will be built by the program and assigned to the irregular component. Notice that the regression variables are extended to cover the forecasting period.

SEATS will decompose the series (and the model) into trend, seasonal, cyclical and irregular components, and will provide forecasts for these components, together with the associated standard errors.

In the DOS version of the programs, the name of the input file, both for TRAMO and for SEATS, should be serie. When used sequentially, only the input file for TRAMO is needed. Execution of TRAMO produces a file called seats.itr that becomes the input file for SEATS, once it has been moved to the SEATS directory and renamed serie. The program ts executes sequentially both programs, performing automatically the previous steps.

3 SIMPLEST, FULLY AUTOMATIC PROCEDURE

We assume there are no regression variables. (If present, they are entered as described in Section 9.)

In the simplest, fully automatic, procedure we recommend, the only parameter that needs to be set is RSA, according to the following options.

RSA = 3 The program tests for the log/level specification, interpolates missing observations (if any), and performs automatic model identification and outlier detection. Three types of outliers are considered: additive outliers, transitory changes, and level shifts; the level of significance is set by the program and depends on the length of the series. The full model is estimated by exact maximum likelihood, and forecasts of the series up to a two-year horizon are computed. The model is decomposed and optimal estimators and forecasts of the components are obtained, as well as their mean squared error. These components are the trend, seasonal, irregular, and (perhaps) cyclical component. If the model does not accept an admissible decomposition, it is replaced by a decomposable one. The full output file is produced.

RSA = 4 As before, but a pretest is made for the presence of Trading Day and Easter effects, with the first effect using a one parameter specification (working-nonworking days).

RSA = 6 As RSA=4, but the Trading Day specification uses 6 parameters (for working days, the day of week -Monday, ..., Friday- is specified).

The procedure is as follows:

a) If MQ ≠ 12 or MQ = 12 but no TD and/or EE are to be considered ⇒ **RSA = 3**.

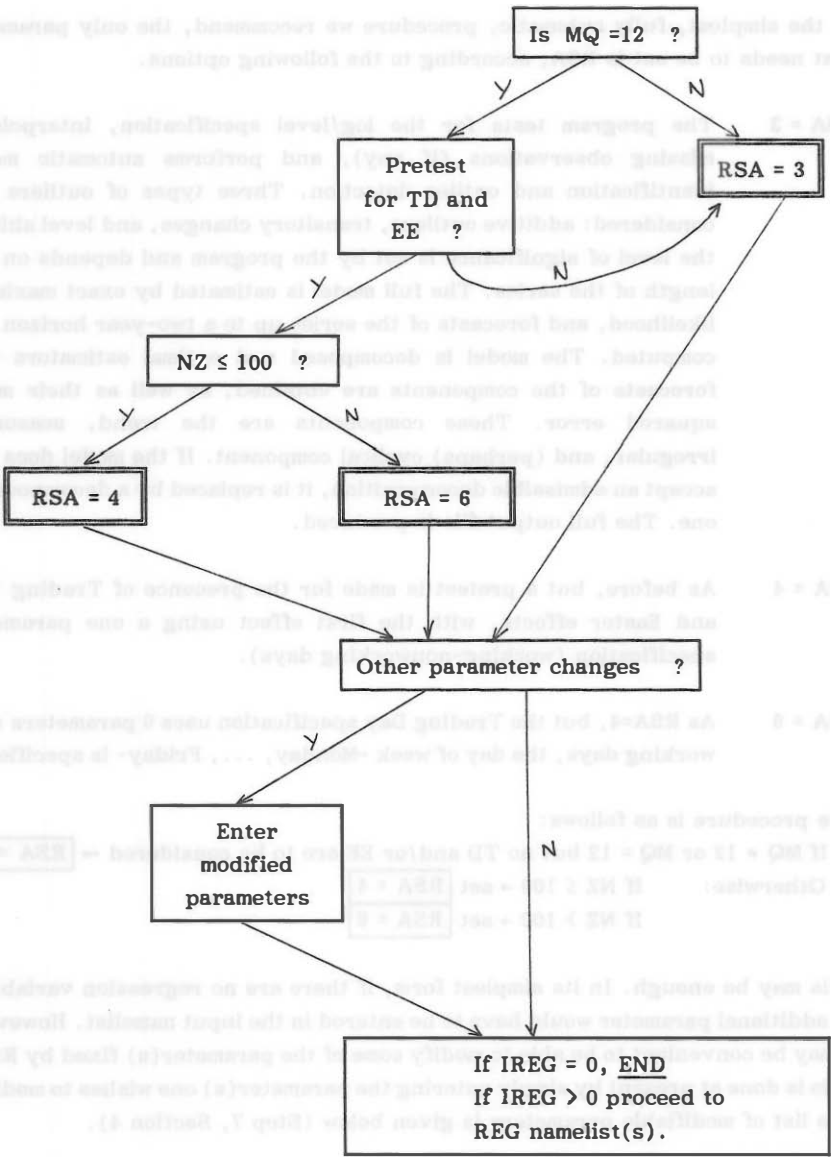
b) Otherwise: If NZ ≤ 100 → set **RSA = 4**
If NZ > 100 → set **RSA = 6**

This may be enough. In its simplest form, if there are no regression variables, no additional parameter would have to be entered in the input namelist. However, it may be convenient to be able to modify some of the parameter(s) fixed by RSA. This is done at present by simply entering the parameter(s) one wishes to modify. The list of modifiable parameters is given below (Step 7, Section 4).

In diagram form, the procedure is the following.

INPUT NAMELIST: Simplified Automatic Procedure

NZ: # of observations in series
MQ: # of observations/year



4 CONSTRUCTION OF THE INPUT NAMELIST: GENERAL PARAMETERS

1) STEP 1 Parameter **ITER**

ITER = [0] **filename** contains one series, one input namelist → Go to Step 2
= 1 **Filename** contains one series to be treated with several input namelists → Go to Step 33
= 2 **Filename** contains several series (at present, up to 4.000) all to be treated with the same input namelist → Go to Step 2
= 3 **Filename** contains several series, each one to be treated with a different input namelist → Go to Step 34
= End of input namelist → Go to Step 8.

Step 8 determines the regression (REG) namelists (if any) that should be added after the INPUT namelist. If the "End of input namelist" is chosen and no regression variable is to be added, the parameter in the present step and all remaining parameters are set to their default values. The input file is then ready and typing ts would execute both programs.

WE CONSIDER FIRST THE TWO CASES ITER = 0 and 2,
that only require one input namelist

---

2) STEP 2 Parameter **MQ**

This parameter indicates the series periodicity

MQ = [12] monthly → Go to Step 3
= Other acceptable values: 1,2,3,4,5,6 → Go to Step 3
= End of input namelist → Go to Step 8.

---

3) STEP 3 Joint or Separate Use

Decide which program(s) are to be executed.

TRAMO and SEATS → Go to Step 4
TRAMO only → Go to Step 22
SEATS only → Go to Step 26
End of input namelist → Go to Step 8.

Example:

As an example, if

in Step 1: One accepts the default (ITER=0),

in Step 2: MQ = 4,

in Step 3: End of input namelist,

one would apply both programs to a single quarterly series. TRAMO would estimate the default ARIMA model and obtain forecasts of the series; SEATS would decompose the series and its forecasts into trend, seasonal, and irregular components. Both programs would provide full output files.

Note: When there are **missing values** in the series, no parameter needs to be entered for interpolation; it will be done automatically by TRAMO.

5 CASE OF JOINT USE OF TRAMO AND SEATS

General Comment

Leaving for now the case in which there are regression variables, the user will have to take very few decisions. The basic one is:

AUTOMATIC or PERSONALIZED use.

a) If the **automatic option** is chosen:
- for non-monthly series no more needs to be set,
- for monthly series, one still has the option of pretesting or not for Trading Day and Easter effects.

b) If the **personalized option** is chosen, the basic decisions are:
- whether to pretest or not,
- whether to use the Automatic Model Identification (AMI) procedure or to enter a particular model,
- whether to perform or not Automatic Outlier Correction (AOC).

Of course, there may be a few additional parameters that the user may wish to change.

(Only when both programs are used)

4) STEP 4 Automatic or Personalized use

Automatic use of the programs → Go to Step 5
Pseudo-automatic use → Go to Step 10
Personalized use → Go to Step 11
End of input parameters → Go to Step 8.

Example:

Ending the input parameters at this step would be equivalent to setting RSA = 3 (see Section 3).

---

5) STEP 5 Decision on Trading Day and Easter Effect.

- If MQ ≠ 12 → set [RSA = 3] → Go to Step 6.
- If MQ = 12 → next decision: PRETEST FOR TRADING DAY AND EASTER EFFECTS?

NO Pretesting → set [RSA = 3] → Go to Step 6.

YES to Pretesting ⇒

TRADING DAY SPECIFICATION
a) one parameter → Set [RSA = 4]
b) six parameters → Set [RSA = 6]
c) seven parameters → Set [RSA = 8]

→ Go to Step 6.

---

6) STEP 6 Decision to modify or add some parameter

No modification of parameters → Go to Step 8.
Some parameter will be modified → Go to Step 7.

---

7) STEP 7 Modified or added parameters

Enter the parameters to be modified:
parameter = new value

Here we list the most important ones, the value they take under the RSA configuration (this value is surrounded by a square), and alternative possible values. If the parameter is not entered, it assumes the value inside the square.

OUT	= [0]	Full output file.
	= 1	Reduced output file.
	= 2	Very brief summary.
	= 3	No output file.

LAM	= 1	No transformation of data.
	= 0	Take logs of data.
	= **-1**	The program tests for the log-level specification.
INCON	= 0	Exact maximum likelihood estimation.
	= 1	Unconditional least squares.
INIT	= **0**	Starting values for parameters computed by the program.
	= 1	Starting values for parameter input.
	= 2	Values for parameter input and no parameter estimation is done.
VA	= **3.5**	(real number > 2). Used to set the critical value for outlier detection. The default value depends on NZ. For NZ≤50, VA=3; for 50<NZ≤250, VA=3.5; for 250<NZ≤500, VA=3.8; for NZ>500, VA=4.
AIO	= 1	All outliers are treated as additive outliers or transitory changes (in this way the level of the series is preserved).
	= **2**	Additive Outliers, Transitory Changes and Level Shifts are considered.
	= 3	Only Level Shifts and Additive Outliers are considered.
INT2	= **0**	Outliers detected and corrected for all periods.
	< 0	(negative integer). Detection but not correction for outliers in the last (-INT2) observations.
IMVX	= **0**	The fast method of Hannan-Rissanen is used for parameter estimation in the automatic detection and correction of outliers.
	= 1	Maximum likelihood estimation is used for parameter estimation in the automatic detection and correction of outliers.
	= 2	First, unconditional least squares and then exact maximum likelihood is used in the estimation of the unit roots in the automatic model identification. Then estimation of outliers is made with the Hannan-Rissanen procedure.

	= 3	As IMVX=2, but outliers correction is made with the exact maximum likelihood procedure. This procedure, although relatively time consuming, may be of interest when the series contains many outliers.
IDUR	= 6	(positive integer < 15). Duration of easter affecting period (# of days).
SEATS	= 0	No input file for SEATS is created.
	= 2	Creates input file for SEATS. The name of this file will be **SEATS.ITR**.
XL	= .98	(real number .5<XL<1). In SEATS, when the modulus of an estimated root falls in the range (XL,1), it is set equal to 1 if root is in the AR polynomial. If root is in MA polynomial, it is set equal to XL.
EPSPHI	= 3	(0 ≤ real number ≤ 15). When $\Phi_p(B)$ contains a complex root, it is allocated to the seasonal if its frequency differs from one of the seasonal frequencies by less than EPSPHI (measured in degrees). Otherwise, it goes to the cycle.
MAXBIAS	= k	(A positive real number). When the average of the absolute value of the differences between the annual means of the (stochastic) series and the (stochastic) seasonally adjusted series, is larger than k, a correction is automatically made so that, for every year, the two means are identical. k is expressed in % of the level of the series. (ONLY WHEN LAM=0).
	= .5	
RMOD	= k	(0 ≤ real number ≤ 1) Cutting point for the modulus of an AR real root. If modulus <k it goes to cycle; if >k, to trend.
	= .5	

The "Automatic Option" is oriented towards using very few parameters. Thus with the RSA options very few parameters should be changed. Otherwise it is possibly preferable to use the "personalized" option.

➡ Go to Step 8

---

8) STEP 8 Parameter IREG

IREG = [0] No regression variable ➡ Go to Step 9.
= k (a positive integer; for its value, see Note after step 1R in Section 9) ⇒ Go to Step 9.

---

9) STEP 9 End

END OF INPUT NAMELIST

5.2 TRAMO AND SEATS; PSEUDO AUTOMATIC USE

10) STEP 10

- If MQ ≠ 12 ➡ set [RSA = 1] ➡ Go to Step 6.
- If MQ = 12 ➡ next decision: PRETEST FOR TRADING DAY AND EASTER EFFECT?

NO Pretest ➡ set [RSA = 1] ➡ Go to Step 6.

YES to Prestesting ➡ Next decision:

TRADING DAY SPECIFICATION
a) one parameter ➡ Set [RSA = 2]
b) six parameters ➡ Set [RSA = 5]
c) seven parameters ➡ Set [RSA = 7]
➡ Go to Step 6.

The pseudo-automatic procedure consists of using always the default model for preadjustment in TRAMO and, if the residuals fail the Ljung-Box Q-test, SEATS tries a sequence of 4 models and choses the one that provides the best fit.

The pseudo-automatic procedure is rough, reliable, and fast. As the full automatic procedure has become faster and more reliable, the usefulness of the pseudo-automatic one has become smaller and smaller.

5.3 TRAMO AND SEATS; PERSONALIZED USE

11) STEP 11 (Parameter SEATS)

Set Parameter SEATS = 2 ➡ Go to Step 12.

---

12) STEP 12 Pretest for log/level.

Set LAM	=	[0]	➡ Go to Step 13
	=	1	➡ Go to Step 13
	=	-1	➡ Go to Step 13
	=	9	End of input namelist ➡ Go to Step 8.

---

13) STEP 13 Decision on Trading Day and Easter Effects

- If MQ ≠ 12 ➡ Go to Step 14

- If MQ = 12 No TD, no EE ➡ Go to Step 14
Otherwise, Set the following 3 parameters

IEAST	= [0]	No Easter effect.
	= 1	Easter effect adjustment.
	= -1	The program pretests for Easter effect.
IDUR	= [6]	Duration of easter affecting period (# of days).
	= k	k a positive integer.
ITRAD	= [0]	No Trading Day effect is estimated.
	= 1	# of (M, T, W, Th, F) - # (Sat, Sun) $\times \frac{5}{2}$.
	= 2	As the previous case, but with length-of-month correction.
	= 6	# M - # Sun, # T - # Sun, ..., # Sat - # Sun.
	= 7	As the previous case, but with length-of-month correction.
	= -1	As ITRAD = 1, but a pretest is made.
	= -2	As ITRAD = 2, but a pretest is made.
	= -6	As ITRAD = 6, but a pretest is made.
	= -7	As ITRAD = 7, but a pretest is made.

➡ Go to Step 14

---

14) STEP 14 Model Identification

No automatic model identification → Go to Step 16
Automatic model identification → Go to Step 17
End of input file →Go to Step 8.

---

15) STEP 15 Automatic Model Identification

Set
INIC = 3
IDIF = 3
plus, if desired,
TSIG = [1] minimum t for significant mean
= k k a real number $0 \leq k \leq 2$.
→ Go to Step 17.

---

16) STEP 16 ARIMA model is entered by user.

IMEAN	= 0	No mean correction
	= [1]	Mean correction
D	= [1]	# of non-seasonal differences
	= 0, 2	
P	= [0]	# of non-seasonal autoregressive terms
	= 1, 2, 3	
BD	= [1]	# of seasonal differences
	= 0	
BP	= [0]	# of seasonal autoregressive terms
	= 1	
Q	= [1]	# of non-seasonal moving average terms.
	= 0, 2, 3	
BQ	= [1]	# of seasonal moving average terms.
	= 0	

The following parameters only have to be entered when some coefficients are fixed (see below) or initial estimates are provided (INIT=1). Default

TH = Q initial estimates of the regular moving average parameters (not input if INIT=0 and JQR(I)=0 for all I). All -.1

BTH = BQ initial estimates of the seasonal moving average parameters (not input if INIT=0 and JQS(I)=0 for all I). All -.1

PHI = P initial estimates of the regular autoregressive parameters (not input if INIT=0 and JPR(I)=0 for all I). All -.1

BPHI = BP initial estimates of the seasonal autoregressive parameters (not input if INIT=0 and JPS(I)=0 for all I). All -.1

JPR(I) = 1 Parameter number I in the regular autoregressive polynomial fixed to the value set in PHI(I) (it is not estimated).

= [0] Parameter not fixed.

JPS(I) = 1 Parameter number I in the seasonal autoregressive polynomial fixed to the value set in PHI(I) (it is not estimated)

= [0] Parameter not fixed.

JQR(I) = 1 Parameter number I in the regular moving average polynomial fixed to the value set in TH(I) (it is not estimated.)

= [0] Parameter not fixed.

JQS(I) = 1 Parameter number I in the seasonal moving average polynomial fixed to the value set in BTH(I) (it is not estimated).

= [0] Parameter not fixed.

➡ Go to Step 17.

---

17) STEP 17 Correction for outliers. Parameter IATIP.

IATIP = [0] No correction for outliers ➡ Go to Step 19.

= 1 Automatic detection and correction for outliers ➡ Go to Step 18.

End of input file ➡ Go to Step 8.

---

18) STEP 18 Automatic Outlier Detection and Correction (for their meaning, see Step 7)

Set the following parameters:

VA = [4]
= k a positive real number > 2.

IMVX = [0]
= 1

AIO = 1
= [2]
= 3

Two integer parameters, INT1 and INT2, can be used to define the interval (INT1, INT2) over which outliers have to be searched. By default

INT1 = 1; INT2 = NZ.

When INT2 = k < 0, outliers are automatically detected and corrected in the interval (INT1, NZ+k). Then, the detection procedure is applied to the last -k observations, and if some outlier is detected a warning is printed, but no correction is made.

➡ Go to Step 19.

---

19) STEP 19 Model Estimation. Parameter INCON.

INCON = [0] Exact Maximum Likelihood ➡ Go to Step 20
= 1 Least Squares (unconditional) ➡ Go to Step 20
End of Input File ➡ Go to Step 8.

---

20) STEP 20 Change of parameters in SEATS

No modification with respect to default values.

➡ Go to Step 8.

Changes are desired in some of SEATS parameters.

➡ Go to Step 21.

---

21) STEP 21 Parameters in SEATS (for their meaning, see Step 7).

The following parameters can be modified:

EPSPHI = [2]
= k

MAXBIAS = [.5]
= k (% points; k≥0)

RMOD = [.5]
= k

➡ Go to Step 8.

---

6 CASE WHEN ONLY TRAMO IS USED

22) STEP 22

Automatic use of TRAMO → Go to Step 23
Personalized use ⇒ Go to Step 24
End of input parameters → Go to Step 8.

---

23) STEP 23 Automatic use

It is exactly as before, that is:

Step 5, Step 6, Step 7, Step 8 and Step 9, with three modifications :

a) In Step 7 the parameters that are specific of SEATS can be removed from the list of parameters that can be modified. These SEATS parameters are:
XL, EPSHI, MAXBIAS, RMOD.

b) In Step 7 an additional value for AIO is available, namely
AIO = 0 Four types of outliers are considered: additive outliers, transitory changes, level shifts, and innovational outliers.

c) In Step 5, when the RSA parameter is assigned one of the values (3, 4, 6, 8), the following should be added in all cases
SEATS = 0.

---

24) STEP 24 Personalized use

It is exactly as before, more precisely:

Step 12, Step 13, Step 14, Step 15, Step 16, Step 17, Step 18, and Step 19.

The only modification affects Step 19, where the messages

"Go to Step 20
Go to Step 20
Go to Step 8".

should be modified to:

"Go to Step 25
Go to Step 25
Go to Step 8".

Further, in order to obtain the k-period ahead forecast function, the parameter

NPRED = k, k a positive integer,

will have to be specified.

---

25) STEP 25 Out-of-sample forecast test
Parameter NBACK

NBACK	= 0	No forecast test ➡ Go to Step 8.
	= -k < 0	When NBACK<0, then (-NBACK) observations are omitted from the end of the series. The model is estimated for the shorter series, one-period-ahead forecast errors are sequentially computed for the last (-NBACK) periods (without reestimation of the model), and an F-test is performed that compares the out-of-sample forecasts errors with the in-sample residuals. ➡ Go to Step 8.

---

7 CASE WHEN ONLY SEATS IS USED

26) STEP 26

The default ARIMA model is entered → Go to Step 28
Some ARIMA model parameters need to be changed → Go to Step 27
End of input namelist → Go to Step 9.

---

27) STEP 27 ARIMA model parameters (for their meaning, see Step 16).

Set the parameters that need to be changed:

LAM = [0], 1

IMEAN = 0, [1]

D = [1], 0, 2

P = [0], 1, 2, 3

Q = [1], 0, 2, 3

BD = [1], 0

BP = [0], 1

BQ = [1], 0

→ Go to Step 28.

---

28) STEP 28 Estimate or fix model coefficients

INIT = [0] → Go to Step 31
= 2 → Go to Step 29
End of input namelist → Go to Step 9.

---

29) STEP 29 Fixed coefficients

Set

TH = Q values for the regular MA parameters.
BTH = BQ values for the seasonal MA parameters.
PHI = P values for the regular AR parameters.
BPHI = BP values for the seasonal AR parameters.

→ Go to Step 30

---

30) STEP 30 Allows to decompose a model; no series is entered

NOSERIE = [0] Usual case; a series is entered → Go to Step 31.

= 1 No series is used. An ARIMA model is decomposed.
→ Go to Step 32.
(The only other parameters in SEATS that can be changed are EPSPHI and RMOD).

---

31) STEP 31 Type of estimation

TYPE = [0] Maximum likelihood estimation → Go to Step 32
= 1 Constrained Least Squares → Go to Step 32
End of input namelist → Go to Step 9.

---

32) STEP 32 Change other parameters in SEATS?

No change of parameters → Go to Step 9
Change some parameters → Go to Step 33.

---

33) STEP 33 Parameters that can be changed (for meaning, see Step 7).

OUT = [0], 1, 2, 3

XL = [.98] When the modulus of an estimated root falls in the range (XL,1), it is set equal to 1 if root is in AR polynomial. If root is in MA polynomial, it is set equal to XL.

= k A real number, $.5 \leq k < 1$.

EPSPHI = [3], k

MAXBIAS = [.5], k

RMOD = [.5], k

IQM = 24 Number of autocorrelations used in computing Ljung-Box Q-statistics. The default value depends on MQ. For MQ = 12 it is equal to 24; for MQ = 2, 3, 4, 5, 6 it is equal to 4MQ; for MQ=1 it is equal to 8.

= k A positive number.

➞ Go to Step 9.

THIS COMPLETES THE INPUT NAMELIST for the case when only SEATS is used.

Since, in this case, there are no regression variables, this is the complete input file.

8 CASE ITER ≠ 0,2

33) CASE ITER = 1

In this case filename contains one series, and several INPUT namelists have to be added, some of which may contain REG namelists. The first one can be constructed as described before and, once reached the END of the first input namelist (and associated REG namelists, if any), simply proceed to the next one.

---

34) CASE ITER = 3

In this case filename contains several series, each one associated with a different INPUT namelist (perhaps with some REG namelists added). After reading each series, the appropriate namelists should be constructed as described before, after which the next series is read and the corresponding namelist, in turn, constructed.

---

9 CONSTRUCTION OF THE REG NAMELIST; ENTERING REGRESSION VARIABLES (Case IREG > 0)

After the INPUT NAMELIST, when IREG > 0 and regression variables have to be included, the series containing the regression variable and the appropriate input parameters for that variable have to be entered. This should be done as follows:

REGNAMELIST

1R) STEP 1R Type of Regression Variable. (Parameter IUSER)

Enter IUSER according to the following options available:

IUSER
- = 1 The user will enter a series for this regression variable → Go to Step 6R.
- = -1 The program will read NSER series from the file whose name is written after the present namelist REG. There must be NSER columns of length ILONG in this file separated by blanks, containing the NSER series → Go to Step 2R.
- = [0] The user does not provide any series → Go to Step 3R.
- = 2 The user specifies the presence of some outliers → Go to Step 4R.
- = -2 Holidays are incorporated in an external file → Go to Step 5R.

Note on the Parameter IREG

When regression variables (and REG namelists) are to be added, the INPUT namelist should contain the parameter:

IREG = k (k a positive integer).

The value k is computed as follows:

k = # of regression variables entered by the user (REG namelists with IUSER = 1)

+ NSER for each set of (NSER) variables entered as a matrix (REG namelist with IUSER = -1)

+ # of "a priori" specified outliers (REG namelist with IUSER = 2)

+ 6 for the holiday variable when ITRAD = 6, 7, -6, -7; or + 1 for the holiday variable when ITRAD = 1, 2, -1, -2 (REG namelist with IUSER=-2).

+ # intervention variables built by the program (REG namelist with IUSER=0, ISEQ>0).

Important note: If outliers are entered with IUSER=-2, then IATIP should be zero.

2R) STEP 2R Variables are the columns of a matrix

NSER = k (k a positive integer) number of series entered by the user in an external file (if IUSER=-1).

→ Go to Step 6R.

3R) STEP 3R Intervention Variable generated by program

ISEQ = k (k a positive integer). The program will generate one intervention variable of length ILONG (see Step 6R) consisting of k sequences of ones separated by zeroes.

= [0] The program will generate no regression variable.

DELTA = δ ($0<\delta\leq 1$); the filter $1/(1-\delta B)$ will be applied to the k-sequences of ones generated by the program. (Default value=0).

DELTAS = δ_s ($0<\delta_s\leq 1$); the filter $1/(1-\delta_s B^s)$, $s = MQ$, will be applied to the k-sequences of ones generated by the program. (Default value=0).

ID1DS = 1 The program will apply the filter $1/(1-B)(1-B^s)$, $s = MQ$, to the k-sequences of ones generated by the program (Default value=0).

→ Go to Step 7R.

4R) STEP 4R Pre-specified outliers.

NSER = k Number of outliers specified a priori.
→ Go to Step 8R.

5R) STEP 5R Holiday effect.

- When ITRAD = 6, 7, -6, -7.
  Set
  NSER = 6 → Go to Step 6R

- When ITRAD = 1, 2, -1, -2
  Set
  NSER = 1 → Go to Step 6R

6R) STEP 6R Length of regression variable

- If SEATS will be used after TRAMO
  Set
  ILONG = NZ + MAX(2MQ,8)

- If only TRAMO is used
  Set
  ILONG = NZ + NPRED

  NPRED = k (integer ≥ 0). # of multistep forecasts to compute when only TRAMO is used; otherwise MAX(2MQ,8) forecasts are computed.

→ Go to Step 7R

7R) STEP 7R Allocation of regression effects to the components

If IUSER ≠ 2 or ≠ -2, → Go to Step 8R

Otherwise, set

REGEFF = [0] The regression effect is a separate additional component; it is not included in the seasonally adjusted series.

= 1 Regression effect assigned to trend.

= 2 Regression effect assigned to seasonal component.

= 3 Regression effect assigned to irregular component.

= 4 Regression effect is assigned to the seasonally adjusted series, but as an additional separate component.

= 5 Regression effect is assigned to cycle.

➞ Go to Step 8R.

8R) STEP 8R End of REG - Namelist

END OF INPUT PARAMETERS
FOR
REG - NAMELIST

➞ Go to Step 9R

9R) STEP 9R Numerical values for the regression variables

- If IUSER = 1: After the present REG namelist, the user will write the series X(I):I=1, ILONG (free format) ➞ Go to Step 10R

- If IUSER = -1: After the present REG namelist, the name (and path) of a file should be written. This file contains an (ILONG × NSER) matrix and its columns are the regression variables. ➞ Go to Step 10R.

- If IUSER = 0: After the present REG namelist, a new line should be added containing k pairs of numbers (free format); the k-th pair indicates the time index where the k-th sequence of ones is to begin and its length, respectively ➞ Go to Step 10R.

- If IUSER = 2: After the present REG namelist, a new line should be added containing a sequence of pairs of number-letters (free format): $t_1\ j_1\ t_2\ j_2 \ldots\ t_{NSER}\ j_{NSER}$, where $t_1 \ldots t_{NSER}$ denote the position of the outlier (t = 1, ..., T), and $j_1, \ldots, j_{NSER}$ denote the type of outlier according to the following code:

j_i = IO Innovation outlier
= AO Additive outlier
= LS Level shift
= TC Temporary change.

→ Go to Step 10R.

- If IUSER = 2: After the present REG namelist, the user will enter the series with the holidays, X(I): I=1, ILONG.
→ Go to Step 10R.

10R) STEP 10R End of REG namelists

Proceed to next REG namelist. If none, END

THIS COMPLETES THE ENTIRE INPUT PARAMETER NAMELIST

= INPUT namelist + (possibly) REG namelist(s)

Note:

When only TRAMO is used, the regression variables are entered in the same way, with one minor modification. The construction of the REG namelist is done following the steps:

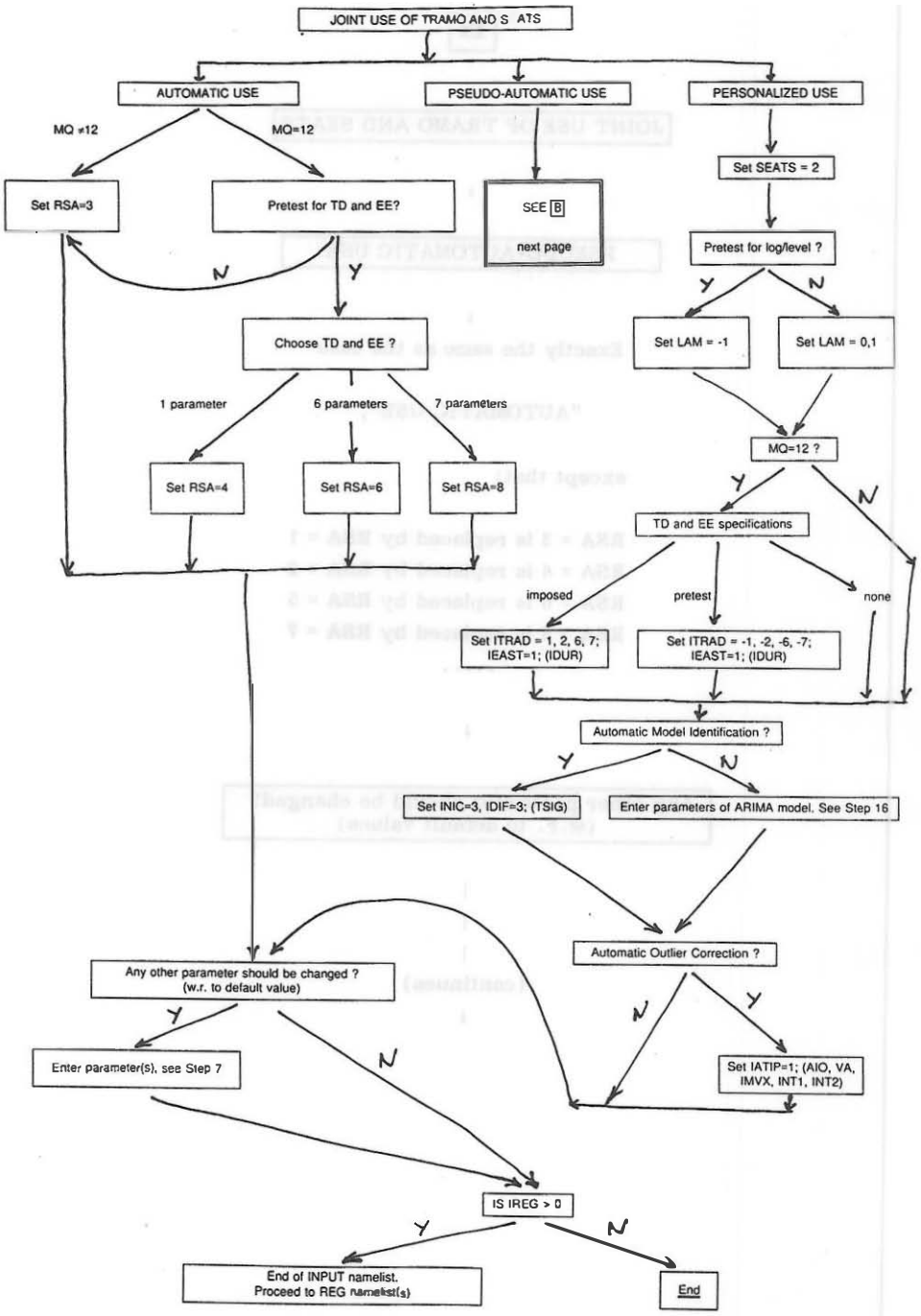
Step 1R, Step 2R, Step 3R, Step 4R, Step 5R, Step 6R

The modification is that, in Step 6R, the sentence
"→ Go to Step 7R"
should be changed to
"→ Go to Step 8R".
Then, one continues

Step 8R, Step 9R, Step 10R.

In this way, the complete input file can be constructed. The following diagrams summarize the full procedure

---


JOINT USE OF TRAMO AND S ATS
AUTOMATIC USE
PSEUDO-AUTOMATIC USE
PERSONALIZED USE
MQ ≠12
MQ=12
Set RSA=3
Pretest for TD and EE?
SEE B
next page
Set SEATS = 2
Pretest for log/level ?
Y
N
Choose TD and EE ?
Set LAM = -1
Set LAM = 0,1
1 parameter
6 parameters
7 parameters
Set RSA=4
Set RSA=6
Set RSA=8
MQ=12 ?
TD and EE specifications
imposed
pretest
none
Set ITRAD = 1, 2, 6, 7; IEAST=1; (IDUR)
Set ITRAD = -1, -2, -6, -7; IEAST=1; (IDUR)
Automatic Model Identification ?
Set INIC=3, IDIF=3; (TSIG)
Enter parameters of ARIMA model. See Step 16
Automatic Outlier Correction ?
Any other parameter should be changed ? (w.r. to default value)
Enter parameter(s), see Step 7
Set IATIP=1; (AIO, VA, IMVX, INT1, INT2)
IS IREG > 0
End of INPUT namelist. Proceed to REG namelist(s)
End

B

JOINT USE OF TRAMO AND SEATS

↓

PSEUDO-AUTOMATIC USE

↓

Exactly the same as the case

"AUTOMATIC USE",

except that:

RSA = 3 is replaced by RSA = 1
RSA = 4 is replaced by RSA = 2
RSA = 6 is replaced by RSA = 5
RSA = 8 is replaced by RSA = 7
.....

↓

Any other parameter should be changed?
(w.r. to default values)

|
|
|
(continues)

↓

ONLY TRAMO IS USED

The diagram remains the same, except that in all cases the parameter SEATS should be 0, that innovational outliers can be included, that the parameter REGEFF disappears from the REG namelist, and that the parameters

NBACK	(see Step 25)
NPRED	(see Step 24)

should be considered.

ONLY SEATS IS USED

[•] indicates the **default** value of a parameter.

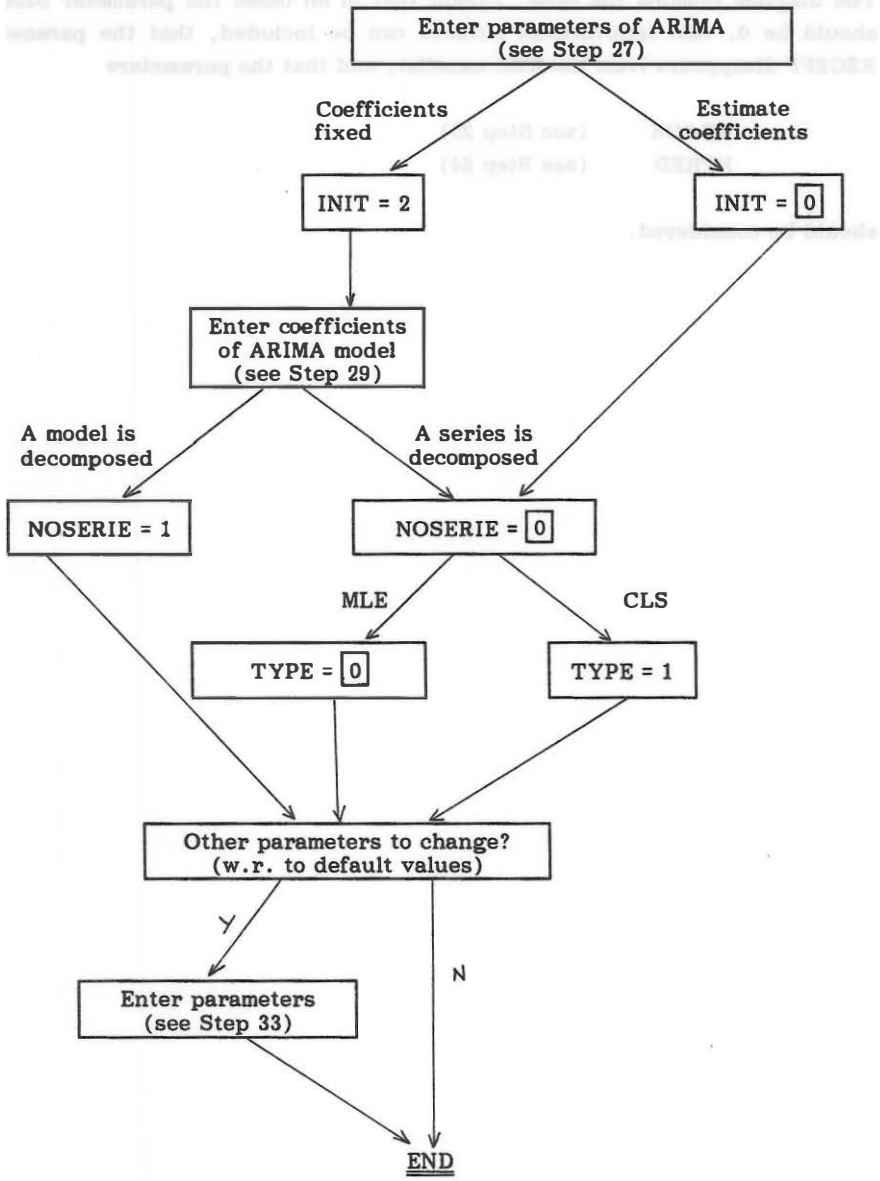
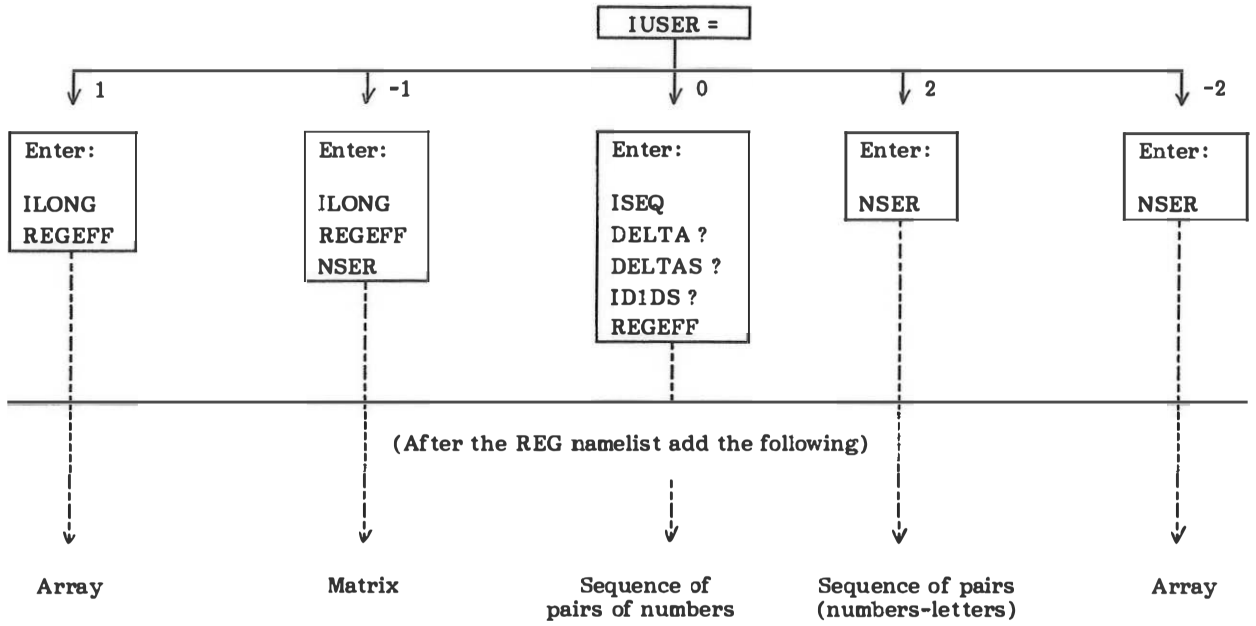


DIAGRAM FOR REG NAMELIST



APPENDIX: ROUTINE AUTOMATIC USE OF TRAMO: HOW TO REDUCE INSTABILITY

The "automatic" use of TRAMO-SEATS month after month has, inevitably, three main sources of instability that are unpleasant.

1) The possibility that the model identified for the series changes.

2) The possibility that the outliers detected and corrected change. Also, correcting or not a possible outlier for the last observation can produce serious differences, with different implications for short term policy

3) The possibility that the pre-testing for Trading Day and Easter Effect changes from month to month.

In order to reduce possible instability, the following recommendations can be helpful.

At the beginning of the year, the model is identified with the automatic procedure, outliers are also detected and corrected automatically, and (if appropriate), the TD and EE pretests are done.

If the results are satisfactory, then for the next months one proceeds as follows:

A) Fix the parameters: LAM, IMEAN, and the orders of the models (p, d,q) (bp, bd, bq).

B) Fix the type and location of the outliers by using IUSER=2 or by transforming the outliers into regression variables (IUSER = 0, ISEQ = 1); see Section 1R and 9R.

C) Fix the Trading Day and Easter effects (ITRAD = 1,2,6 or 7, preferably 1 or 6, and IEAST = 1).

Then, the next month this model is reestimated (without automatic model or outlier identification and without pretests). But the parameter coefficients are all reestimated. This reestimation is extremely fast, and changes in the coefficients typically introduce very little instability in the results of SEATS, while they allow the model to continue to provide good results in TRAMO. The instability

associated with detection of an outlier for the last observation is sometimes an ugly problem, and it does not have a clear solution. The basic issue is that, when an outlier is detected for the last observation, at that time it is impossible for the program to know wether it is an additive outlier, a level shift, or a transitory change. Ultimately, the program can only treat the last observation as an additive outlier. This roughly means that the observation will be ignored, and the trend and the forecast will remain at the previous level, so to speak. If one month latter the outlier is identified as a Level Shift, then the trend will move to the new level and so will the forecast.

Unless one has a-priori information to discriminate between a Level Shift and an Additive Outlier for the last observation, we have found out that it is better to use the parameter INT2 = -1, so that, for the last observation, the outlier may be detected but is not corrected. (One could also use INT2 = -2).

Finally, a nasty feature of the instabilities mentioned above is that they tend to induce large revisions in the data. Proceeding as we suggest reduces revisions considerably. Of course, reestimation of parameter coefficients (keeping the structure of the model fixed) will imply the persistence of some revision. But this "remaining noise" in the revision is usually small and the rule of fixing the factor after, say, 3 years, can still be applied with very little damage.

The number of months for which the model (orders, outliers, regression variables) is kept fixed and only coefficients are reestimated may vary with the application. We recommend, as a general rule, to redo the full identification once-a-year, or whenever there is clear evidence of misspecification.

In summary, one should store:

* the parameters IMEAN, LAM, P, D, Q, BP, BD, BQ

* the outliers as fixed outliers (IUSER=2) or as regression variables (IUSER = 0).

* The output value of the parameters ITRAD and IEAST.

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