PROGRAM TSW

REVISED

REFERENCE MANUAL

July 2004

Gianluca Caporello and Agustín Maravall

Banco de España

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Abstract

Program TSW is a Windows extension of programs Tramo and Seats [Gómez and Maravall (1996)]. A first manual for TSW was contained in Caporello, Maravall and Sánchez (2001). Since then, a considerable amount of changes and additions have been added, that affect many important input parameters, as well as the output obtained. Therefore, the original Reference Manual needs to be replaced with the Revised Manual contained in this paper. One relevant new expansion has been the capacity to treat many series at once. This feature is illustrated with a set of 1422 series of foreign trade indicators provided by Eurostat. The example illustrates, in turn, the performance of the purely automatic TRAMO-SEATS procedure.

1 Introduction

Program TSW is a Windows application based on programs TRAMO and SEATS and developed at the Bank of Spain by Gianluca Caporello and Agustín Maravall. TRAMO and SEATS are, in turn, two programs developed by Víctor Gómez and Agustín Maravall [Gómez and Maravall (1996)], with the programming support of Gianluca Caporello, for time series analysis of data with a monthly or lower frequency of observations. Víctor left the team at the end of 1999, and the programs have been continued and maintained by Gianluca and Agustín, at the Bank of Spain. At present they are used by many national statistical offices, central banks, international institutions, and data-producing agencies in general, as well as at universities, research centers or private companies.

TRAMO ("Time Series Regression with ARIMA Noise, Missing Observations and Outliers") is a program for estimation and forecasting of regression models with possibly nonstationary (ARIMA) errors and any sequence of missing values. The program interpolates these values, identifies and corrects for several types of outliers, and estimates special effects such Trading Day and Easter and, in general, intervention variable type of effects. Fully automatic model identification and outlier correction procedures are available.

SEATS ("Signal Extraction in ARIMA Time Series") is a program for estimation of unobserved components in time series following the ARIMA-model-based method. The Trend, Seasonal, Irregular and Transitory components are estimated and forecasted with signal extraction techniques applied to ARIMA models. The standard errors of the estimates and forecasts are obtained and the model-based structure is exploited to answer questions of interest in short-term analysis of the data.

The two programs are structured so as to be used together, both for in depth analysis of a few series or for automatic routine applications to a large number of them. When used for seasonal adjustment, TRAMO preadjusts the series to be adjusted by SEATS.

TSW (and TRAMO) contains an application to the problem of quality control of data: program TERROR (TRAMO for ERRORS), designed to handle large sets of time series. For each series, the program automatically identifies an ARIMA model and detects and corrects for several types of outliers. It also interpolates missing observations if there are any. Next, the one-period-ahead forecast of the series is computed and compared with the new observation (not used for estimation). When the absolute value of the forecast error is larger than some a priori specified limit, the new observation is identified as a possible error.

In non-production (non large-scale) applications, TSW perhaps is at present the most widely used application. We try to maintain the Windows and DOS versions simultaneously updated, though at any given time, some difference may show up. Although for very large-scale applications the Windows version is not the most appropriate, it can comfortably handle sets of (for example) a few thousand series.

The programs are freely available at the Bank of Spain web site: www.bde.es (→ "Services to the Public" or "Professionals" → "Software Distribution" → "Statistics and Econometric Programs"). An Excel macro (Xlsts.xls), developed by Jorge Carrillo and Agustín Maravall at the Bank of Spain is also provided that permits the user to transform easily an Excel file with (nearly) any arbitrary format into an Excel file ready for TSW (or a text file ready for TSW, TRAMO or SEATS). Some additional macros and interfaces of Tramo and SEATS can also be obtained, as well as a considerable amount of documentation and some additional information.

The present document contains the Revised Manual for TSW. The manuals for the DOS versions are not fully updated anymore, and new facilities, new parameters, or changes with respect to already existing procedures, are reflected in the manual for TSW.

About three years ago the first manual for TSW (a "Reference Manual") appeared as "Documento de Trabajo 0112" of the Bank of Spain series. Since then, several modifications and facilities have been incorporated, that affect substantially the user instructions, both, in terms of the parameters that are input, and in terms of the interpretation of the new output produced. As a consequence, the previous Reference Manual has to be replaced by the present Revised Manual. The present manual is basically self-contained, although the need to explain some of the new features while preserving the length of the document has forced the removal of parts of the original manual, such as the "Brief Description of the Programs" (available as a separate document in the web site). Thus, in some respects, the revised and old manuals are complementary. Given that the project started with TRAMO-SEATS will continue and hopefully several new features will be introduced, the previous consideration applies to future revisions in the Manual.

One feature of TSW (and of TRAMO-SEATS) that has been strongly reinforced is the capacity to treat many series in just one run. This capacity is illustrated with a set of 1422 monthly series of Foreign Trade Indicators provided by Eurostat, also available in the same web site. This example serves also to illustrate the performance of the program when used in a purely automatic manner.

2 Installation

A) Local installation

For local installation, copy in a directory, say TEMPTSW, the eight files Data.Cab, Data1.Cab,..., Data6.Cab, and TSW.msi. Then, execute TSW.msi. The program autoinstalls itself. By default, the program is installed in the directory PROGRAM FILES\TSW; the output files of the program will be deposited in PROGRAM FILES\TSW\OUTPUT, and the arrays for the graphs in PROGRAM FILES\TSW\GRAPH (all in text format). For future updates, uninstall first the previous version and then proceed as before.

To execute the program follow the steps:

"Start → Programs → Seats Tramo Windows → TSW".

Note: Every time the program is restarted, the OUTPUT directory is emptied.

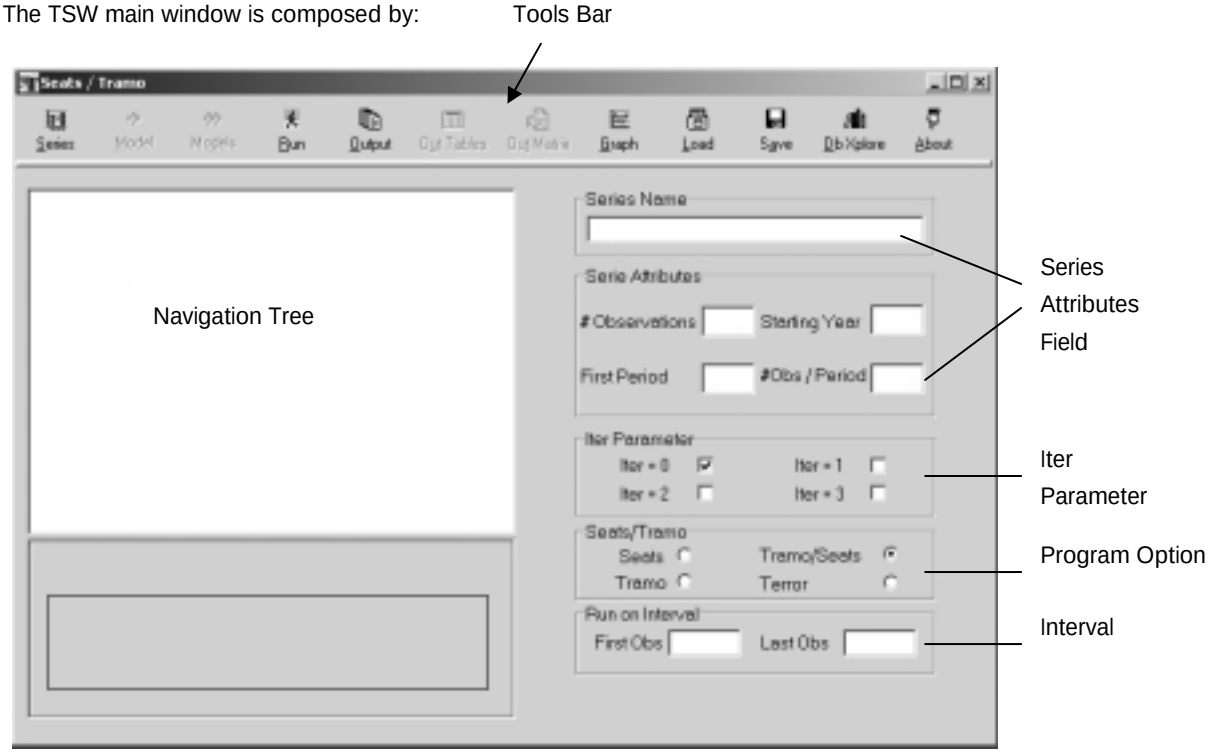
B) Network installation

The directory NETINSTALL contains the file "netinstall.exe" which is a small program for installation of TSW in a network. To do this, first, TSW should be installed in the server, and then each user should execute the program netinstall.exe from their own PC (the program resides in the server). The only information the user should supply is the name of the local destination directory of TSW on the user PC. In this PC several directories will be created (OUTPUT, GRAPH, BIN,...) where the output files of TSW will be deposited (the programs will remain in the server).

3 User instructions

3.1 Main Window

The TSW main window is composed by:



Tools Bar

The Tools Bar contains the following buttons:

- ✓ **Series** permits to load a single series file or a list of files
- ✓ **+ Model** permits to specify an input model for the selected series
- ✓ **++ Model** permits to specify an input model (the same) for all the series loaded in the navigation tree
- ✓ **Run** executes Seats/Tramo
- ✓ **Output, Out-Tables,** and **Out-Matrix** present the Seats/Tramo output files
- ✓ **Graph** shows the graphs computed by the programs
- ✓ **Save** permits to freeze the navigation tree, saving it on a binary proprietary output file (*.gbf)
- ✓ **Load** loads a working tree saved
- ✓ **DbXplore** is the manager of a small data base (Db) facility
- ✓ **About** shows the release information of the program

Series Attributes

- ✓ Name
- ✓ #of Observations (NZ; it includes missing values)
- ✓ Starting Year
- ✓ Starting Period of the year (ex: for monthly series, 1 if first observation is Jan., 2 if Feb, ...)
- ✓ Parameter **MQ**: #obs/year (12 if monthly, 4 if quarterly, ...)

Iter Parameter

Iter = 0 One series, one model specification

= 1 One series, several model specifications

= 2 Many series, one model specification common to all of them (the specification can simply be an automatic procedure)

= 3 Several series, one model specification for each series

The last 3 cases will be explained below; for now we proceed with Iter = 0

Program option

Seats:	Only SEATS will be executed
Tramo:	Only TRAMO will be executed
Tramo/Seats:	Both programs will be executed (the usual case).
Terror:	Program TERROR will be executed

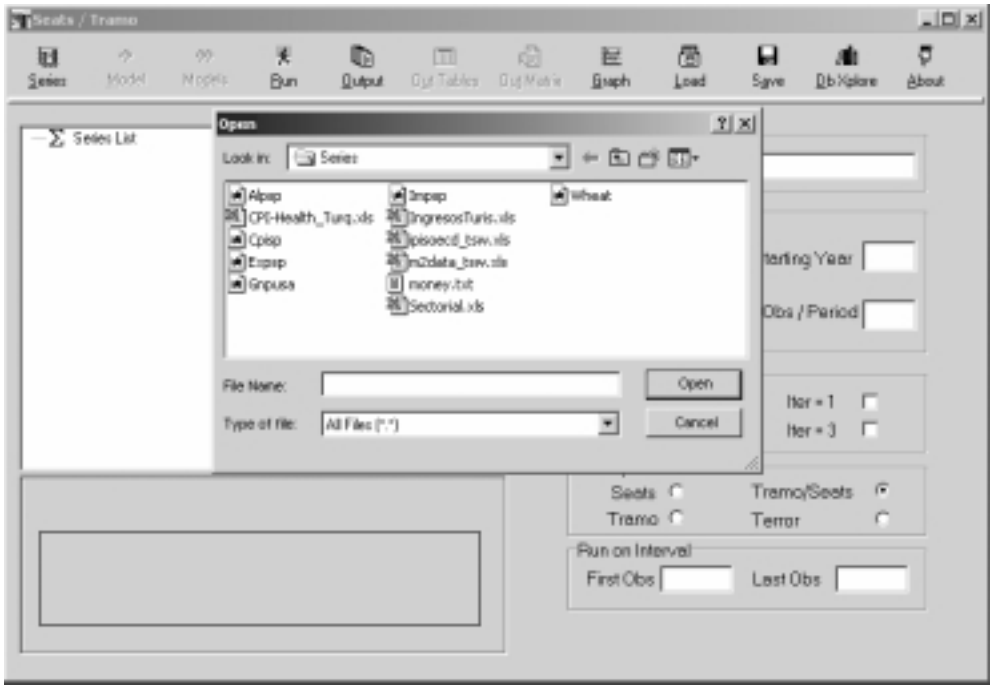
Interval

For a series with observations t = 1,….,NZ, it is possible to apply TSW only to an interval of the sample period. The interval starts at observation “First Ob” and ends at “Last Obs”.

3.2 Loading a series

Series Button

Clicking on the button **Series** the program opens a standard dialog window. The following screen is displayed

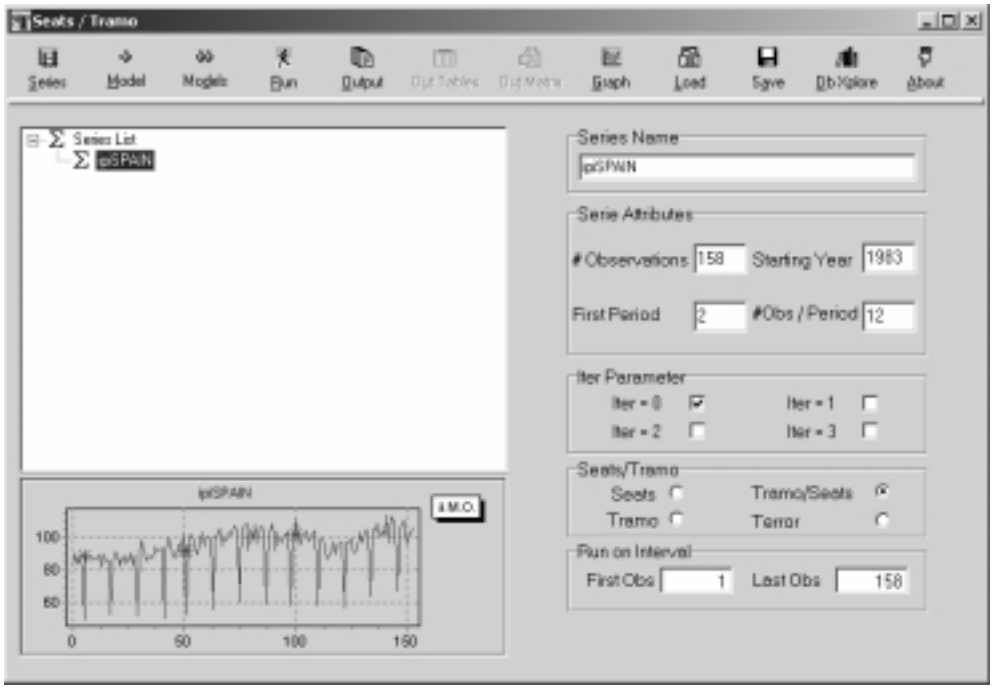


By default, the series in the directory PROGRAM FILES\TSW\SERIES are listed.

One or many series can be loaded. We shall look first at the case of ONLY ONE SERIES.

- If the series of interest appears in the screen,
  – clicking with the right mouse button (r.m.b), the file can be opened and edited.
  – clicking with the left mouse button (l.m.b), the series is loaded to the Navigation Tree.
  (in what follows, when no button is specified, it refers to the l.m.b).

The selected series is incorporated to the Navigation Tree, the Main window shows



3.3 Input File Format

3.3.1 EXCEL

An Excel macro (Xlsts.xls) is provided with the programs (in www.bde.es) that transforms an Excel file in practically any format, into an appropriate Excel (and/or text) input file for program TSW. This format is the following.

Assume there are k series (k = 1, 2, …). Then the j-th column of the file (j = 1, … , k) should have the following structure:

Row 1: j-th series name

Row 2: NZ SY SP MQ ,

Where **NZ** = number of observations (including missing values).

SY = Starting year.

SP = Starting period of the year (for monthly data, 1 if the first observation is a January, 2 if a February, etc.).

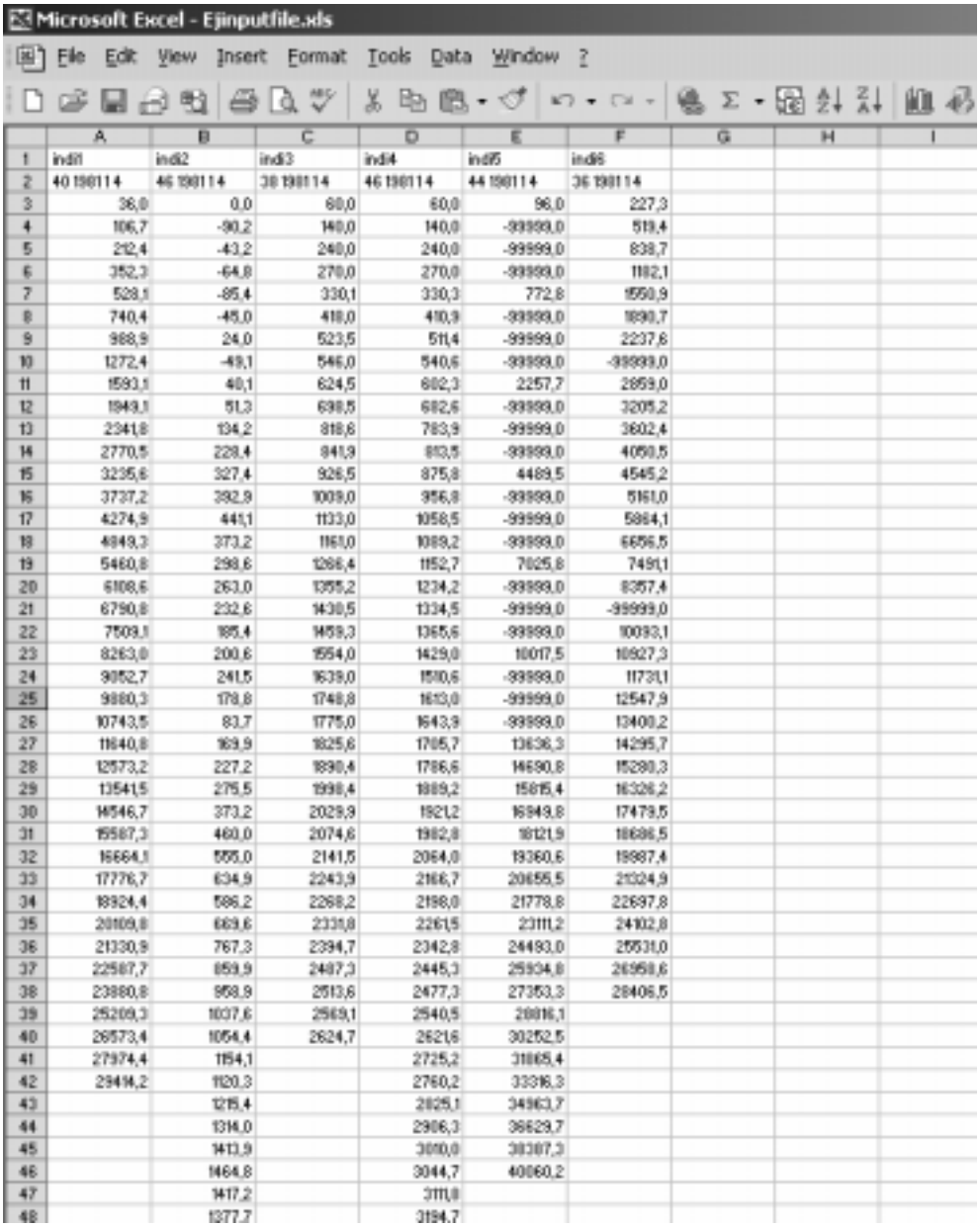
MQ = number of observations per year (12 if series is monthly, 4 if quarterly, …).

These four parameters may vary for the different series in the file.

Row 3 and those following: Observations. Row 3 will contain the most distant observation, Row (NZ + 2) will contain the most recent one.

Missing observations should be entered as –99999.

Example of EXCEL Input File:



	A	B	C	D	E	F	G	H	I
1	ind1	ind2	ind3	ind4	ind5	ind6			
2	40 190114	46 190114	38 190114	46 190114	44 190114	36 190114			
3	36,0	0,0	60,0	60,0	96,0	227,3			
4	106,7	-90,2	140,0	140,0	-99999,0	519,4			
5	212,4	-43,2	240,0	240,0	-99999,0	838,7			
6	352,3	-64,8	270,0	270,0	-99999,0	1182,1			
7	528,1	-85,4	330,1	330,3	772,8	1550,9			
8	740,4	-45,0	418,0	410,9	-99999,0	1930,7			
9	988,9	24,0	523,5	511,4	-99999,0	2237,6			
10	1272,4	-49,1	546,0	540,6	-99999,0	-99999,0			
11	1593,1	40,1	624,5	602,3	2257,7	2859,0			
12	1949,1	51,3	698,5	682,6	-99999,0	3205,2			
13	2341,8	134,2	818,6	783,9	-99999,0	3602,4			
14	2770,5	228,4	941,9	913,5	-99999,0	4050,5			
15	3235,6	327,4	926,5	875,8	4489,5	4545,2			
16	3737,2	392,9	1009,0	956,8	-99999,0	5161,0			
17	4274,9	441,1	1133,0	1058,5	-99999,0	5864,1			
18	4849,3	373,2	1161,0	1089,2	-99999,0	6656,5			
19	5460,8	298,6	1266,4	1152,7	7025,8	7491,1			
20	6108,6	263,0	1355,2	1234,2	-99999,0	8357,4			
21	6790,8	232,6	1430,5	1334,5	-99999,0	-99999,0			
22	7509,1	185,4	1459,3	1365,6	-99999,0	10093,1			
23	8263,0	200,6	1554,0	1429,0	10017,5	10927,3			
24	9052,7	241,5	1639,0	1510,6	-99999,0	11731,1			
25	9880,3	178,8	1748,8	1613,0	-99999,0	12547,9			
26	10743,5	83,7	1775,0	1643,9	-99999,0	13400,2			
27	11640,8	169,9	1825,6	1705,7	13636,3	14295,7			
28	12573,2	227,2	1890,4	1786,6	14690,8	15280,3			
29	13541,5	275,5	1998,4	1889,2	15815,4	16326,2			
30	14546,7	373,2	2029,9	1921,2	16949,8	17479,5			
31	15587,3	460,0	2074,6	1982,8	18121,9	18686,5			
32	16664,1	555,0	2141,5	2064,0	19360,6	19987,4			
33	17776,7	634,9	2243,9	2166,7	20655,5	21324,9			
34	18924,4	586,2	2268,2	2196,0	21778,8	22697,8			
35	20109,8	669,6	2331,8	2261,5	23111,2	24102,8			
36	21330,9	767,3	2394,7	2342,8	24493,0	25531,0			
37	22587,7	859,9	2487,3	2445,3	25934,8	26958,6			
38	23880,8	958,9	2513,6	2477,3	27353,3	28406,5			
39	25209,3	1037,6	2569,1	2540,5	28816,1				
40	26573,4	1054,4	2624,7	2621,6	30252,5				
41	27974,4	1154,1		2725,2	31865,4				
42	29414,2	1120,3		2760,2	33316,3				
43		1215,4		2825,1	34863,7				
44		1314,0		2906,3	36529,7				
45		1413,9		3010,0	38387,3				
46		1464,8		3044,7	40060,2				
47		1417,2		3111,8					
48		1377,7		3194,7					

3.3.2 TEXT

Standard text input files for TRAMO and SEATS containing only one series can be used in TSW.

First line: Series name

Second line: NZ SY SP MQ (same as before).

Third and following lines: Observations. (Free format and read from left to right, with the first observation corresponding to the most distant date.)

Example of TEXT Input File:

```
SERIESNAME
35 1996    1   4
      13998      12294      12093      10616
      10743       9121       8743       7333
       7604       5951       7649       4411
       5149       6911       8048      11231
      15167      18097      21356      26452
      37497      50568      50187      50776
      81589      76967      83796     110400
     130361     144905     158743     165967
     175078     177505     173685
```

3.3.3 REGRESSION VARIABLES

Regression variables are entered as column vectors of numbers (the first line is the first value) in text or Excel format. The variable should be extended over the forecasting horizon (see section 2.5.1).

When IUSER = -1, several regression variables can be jointly entered as a matrix in text format or as several columns in an Excel file. Then,

1st column: 1st regression variable

2nd column: 2nd regression variable

…

and so on.

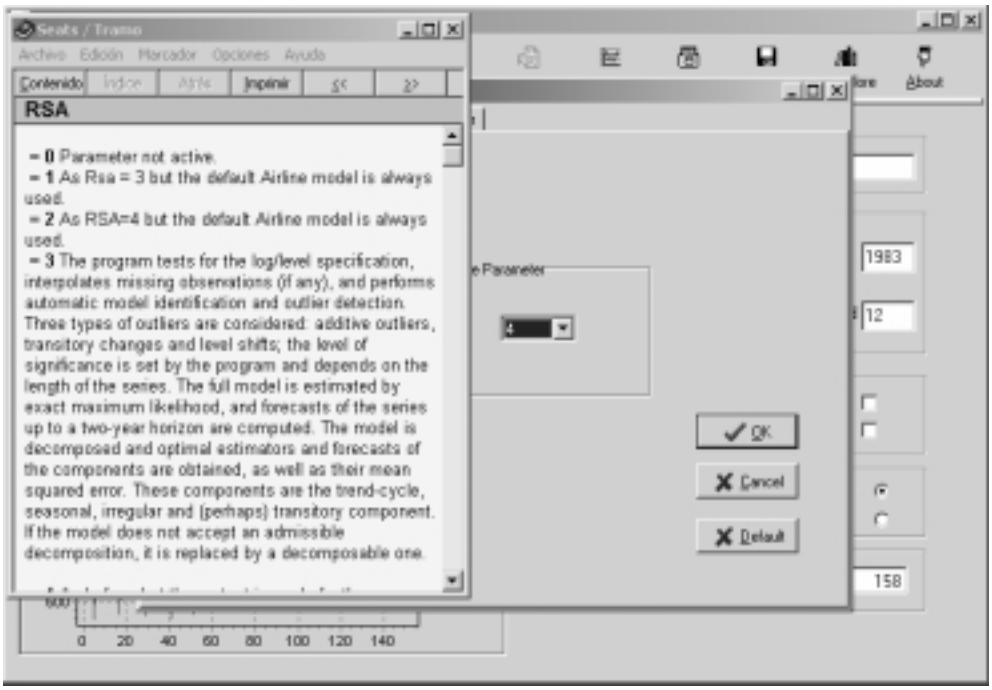
3.4 Model Specification

Having selected a series, one proceeds to enter the model.

3.4.1 +MODEL BUTTON

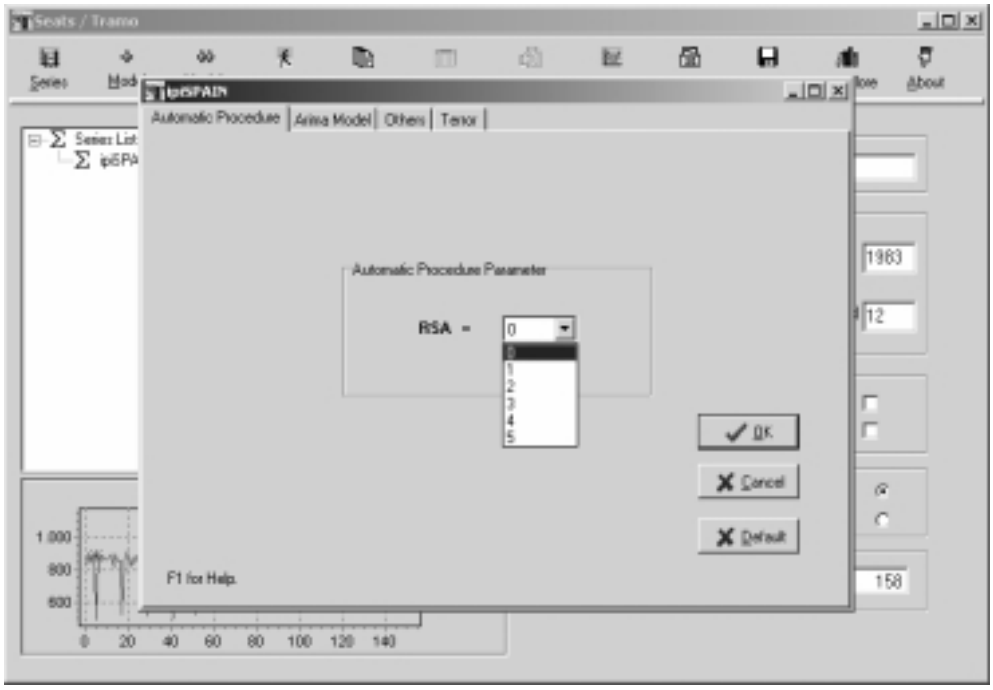
Clicking the button (active only if a series on the navigation tree has been selected) the program shows a Tabsheet Set Window structure (with the appearance of notebook dividers) which permits to set the Seats/Tramo input parameters.

The window contains several pages with the **input parameters**. For the parameter meaning, click in its entry, then use **F1** for **Help.** A description of the parameters is contained in section 3.

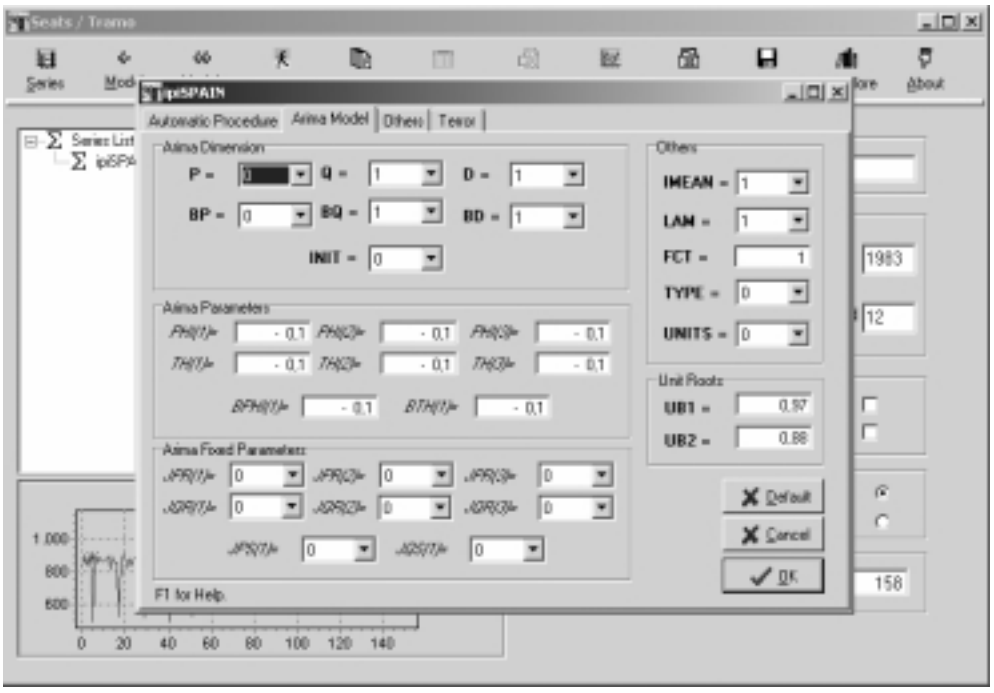


The **Cancel Button** permits to exit from the form without saving the model. The **Default button** resets the parameter values to their Default. The **OK button** exits and saves the model associating it to the selected series.

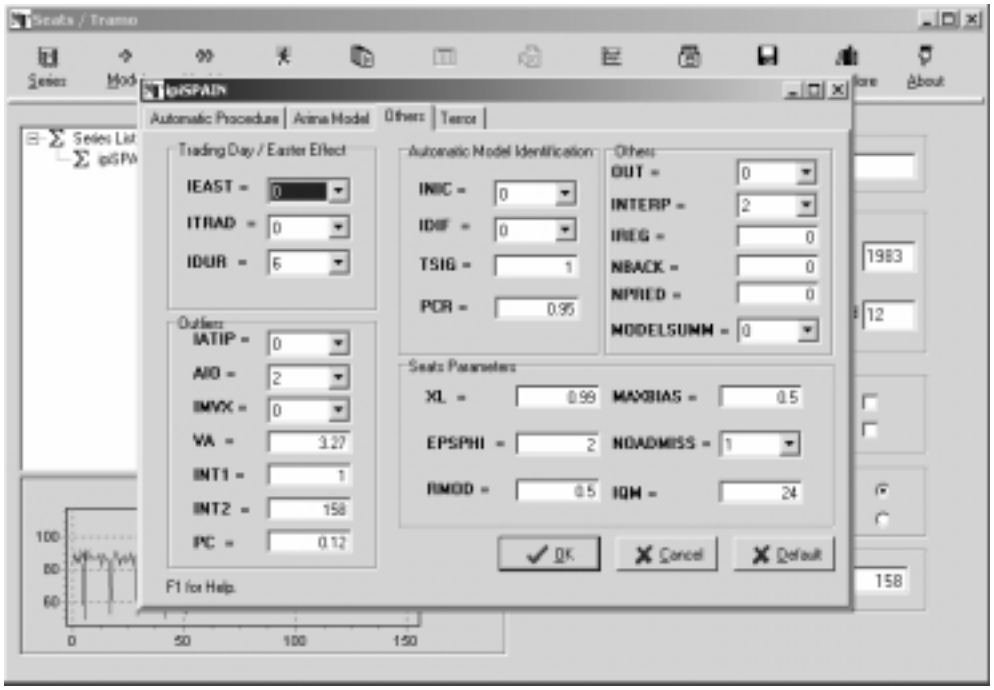
The first page contains the purely **Automatic Procedure** controlled by the parameter RSA.



The second page contains the **ARIMA Model parameters** for non-automatic use, or to modify some parameter in the automatic configuration selected (see section 3.1).



The third page contains parameters related to forecasting, calendar effects, outliers, automatic procedures, regression variables, and to the SEATS decomposition.

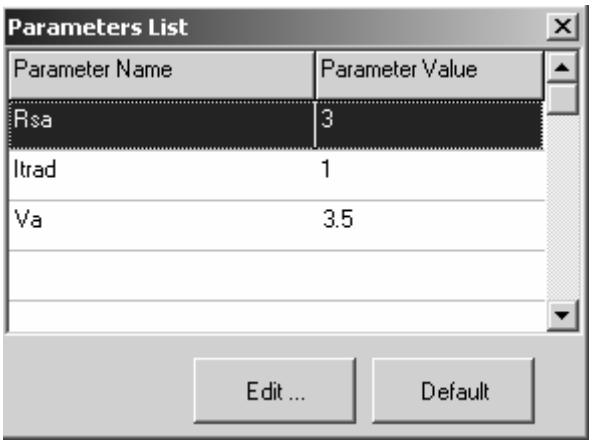


The fourth page contains the parameters for a TERROR application (see section 2.12).

When all parameters (different from the default option) have been set, click on the **button OK**

3.4.2 CHECKING INPUT PARAMETERS

By selecting "$\sum$Model 0" in the Navigation Tree, clicking the r.m.b., and then on **Show Parameters List,** a screen (Parameters List) with the parameters that have been entered is displayed. (The other parameters remain at their default values.) For example,

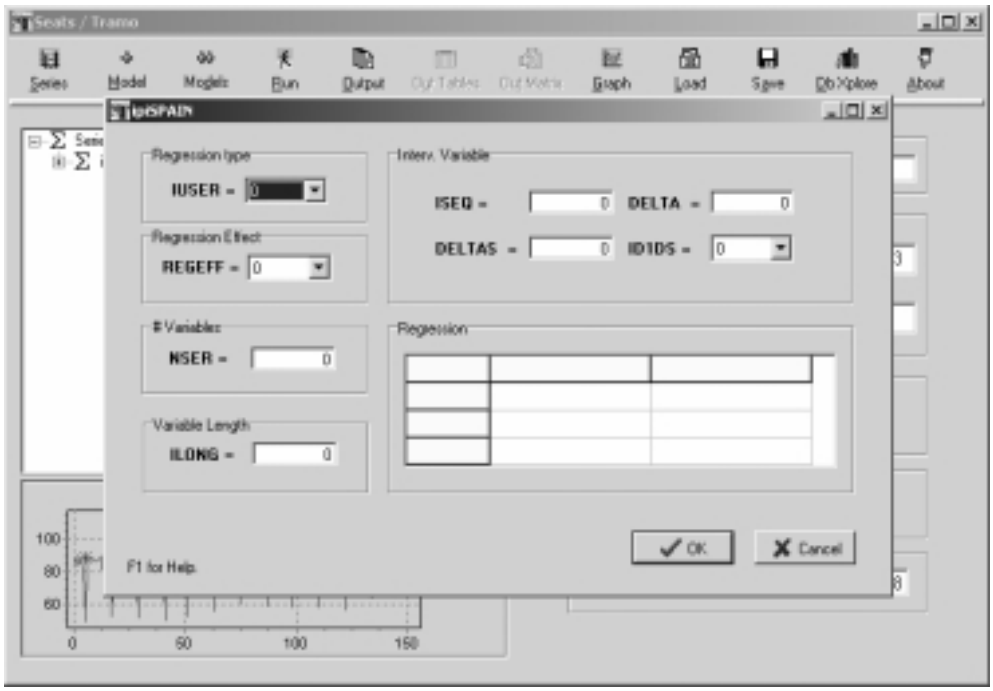


would imply standard automatic model identification, outlier correction, and interpolation, imposing Trading-Day effect, and replacing the default threshold for outlier detection with $V_a = 3.5$ (see section 3.2.3).

3.5 Regression Variables

3.5.1 REGRESSION VARIABLE WINDOW

When, on the third page ("Others…"), IREG = k > 0, a new window is displayed that will set the regression variable(s) parameters.



The parameter **REGEFF** determines to which component in SEATS the effect of the regression variable will be assigned to. **ILONG** is the length of the reg-variable, in all cases it should be equal to

$$ILONG = NZ + FH$$

where FH = Forecast Horizon (see section 3.2.5).

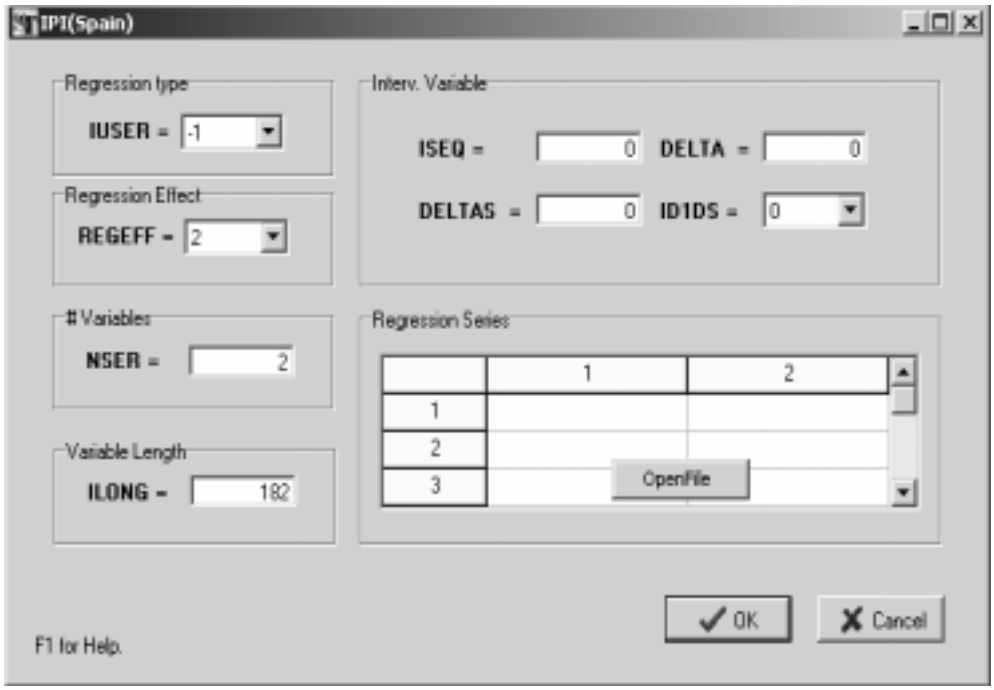
Note: If the regression variable is stochastic (for example, an interest rate) and there are no observations for future periods, an easy way to proceed is to run TRAMO in automatic mode (RSA>0), with NPRED = FH, on the reg-variable, pick up the column "Original Series" from OUT-TABLES, which includes the forecasts (see section 2.7.2), and use it as regressor.

3.5.2 PARAMETER IUSER

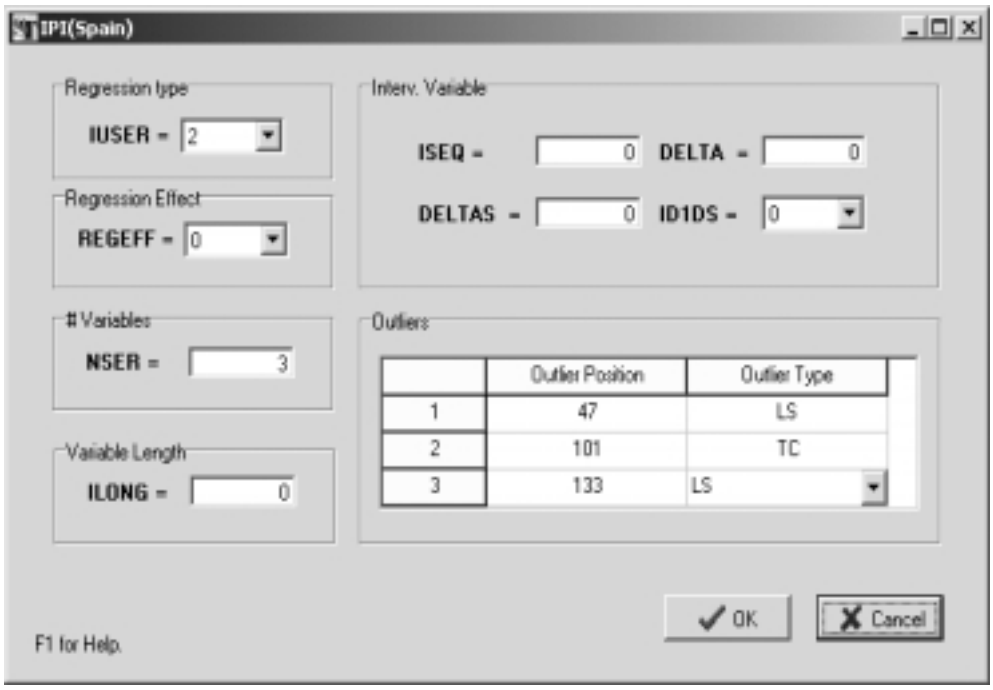
– When **IUSER = 1** the variable is **entered by the user**, observation by observation and, in this case, **NSER** = 1. Clicking inside the "Regression" field, the cells for entering the variable become visible.

– When **IUSER = -1**, the regression variable(s) is (are) **read from a file**. Each column of the file represents a regression variable, and **NSER** = # of columns. Clicking with the r.m.b. inside the "Regression" field, and then on the "OpenFile" command, a window is opened that allows us to load the file from the directory where it is contained.

***Warning**: All variables in the file will share the value of REGEFF (i.e., will be assigned to the same component).*



– When **IUSER = 2**, k **outliers** are fixed (k = 1, 2, …). Only **NSER** = k needs to be entered, and clicking in the blank field, the following screen appears.



For each outlier the position and type (AO: Additive Outlier; TC: Transitory Change; LS: Level shift, in capital letters), has to be entered. REGEFF wil be automatically set by the program (AO and TC to irregular, LS to the trend-cycle).

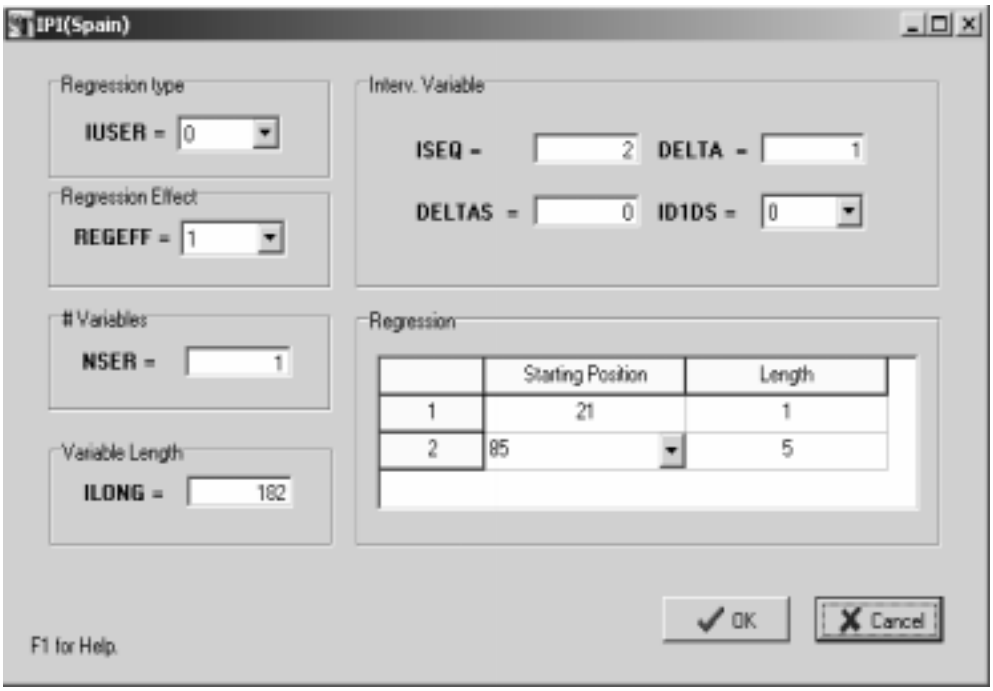
Warning: *All outliers have to be included in a single reg-variable.*

- When **IUSER = -2** the regression variable contains **holidays,** that will be combined with the Trading Day variable. NSER and ILONG need to be set, and clicking in the blank field, the holidays can be entered or read from a file in a directory.

- When **IUSER = 0** the regression variable will be an **intervention variable** built by the program. Each intervention variable has to be entered as a separate regression variable. After setting REGEFF, NSER = 1, and ILONG, the parameter ISEQ = k indicates that the intervention variable will contain k sequences of ones. DELTA = d indicates that the operator $1/(1 - d\,B)$, with $-1 < d \leq 1$, will be applied to these sequences of ones, DELTAS = d_s that the operator $1/(1- d_s\,B^s)$, $-1 < d_s \leq 1$, will be applied to the sequences of ones, and ID1DS = 1 that the operator $1/\nabla\nabla_s$ will be applied to the sequences of ones. Clicking inside the blank area, the starting position and length of the sequences of ones can be entered.

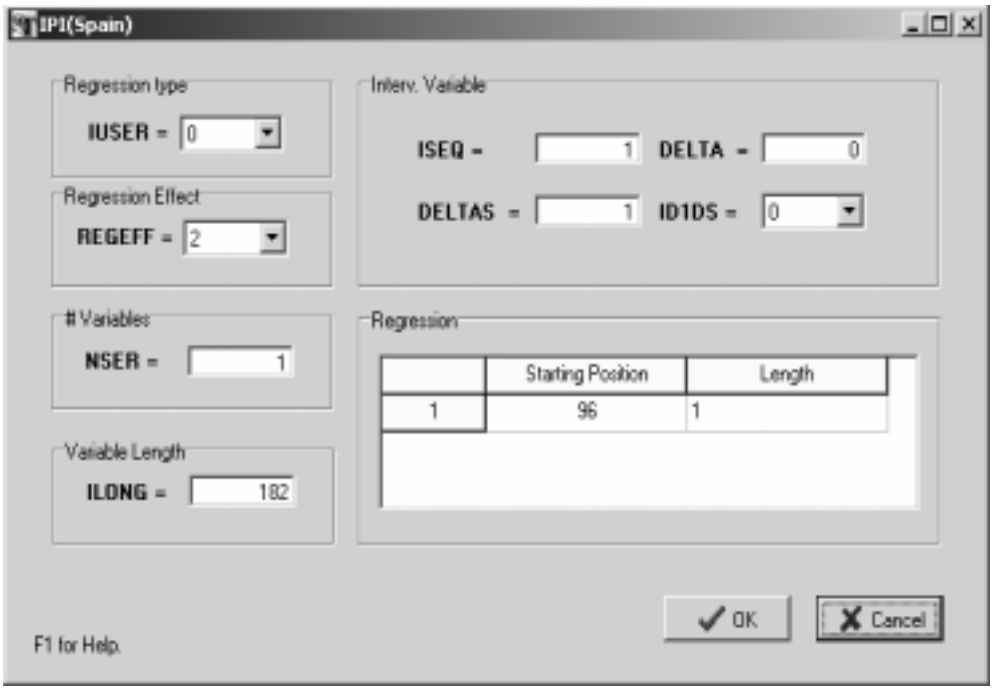
EXAMPLE: Assume a monthly series of a 158 observations. Three intervention variables are included as regressors. For each intervention variable, NSER = 1, and ILONG = 158 + 24 = 182 (24 is the default number of forecasts for monthly series).

If the screen with the input data for the **first variable** is set as



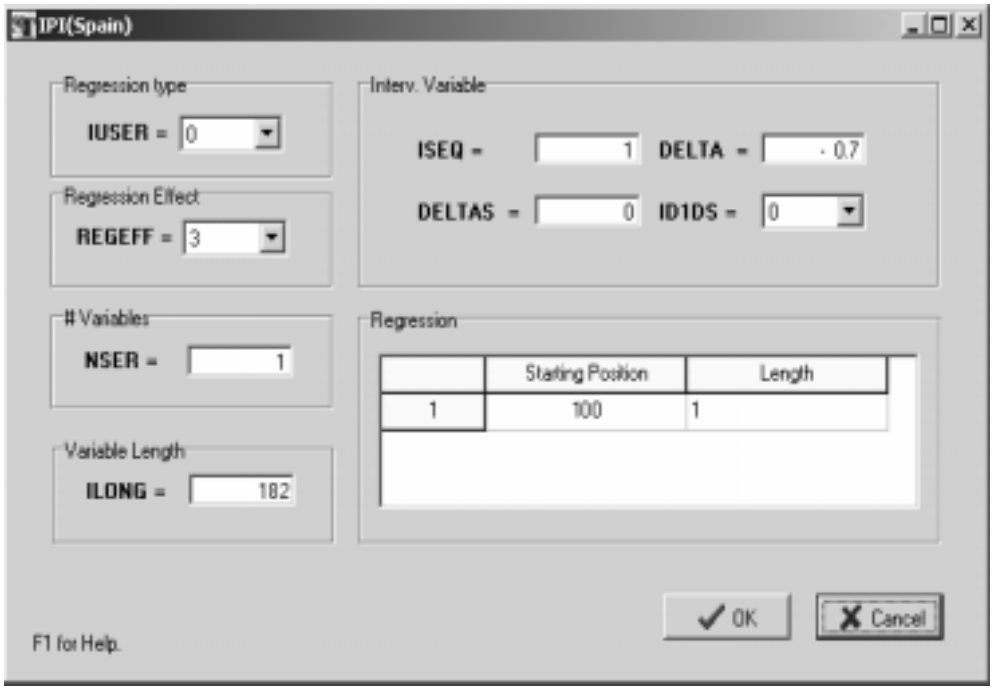
it indicates that the variable presents a level shift at observation 21, and that, starting at period 85, there is a ramp effect lasting 5 periods. The variable will be assigned to the trend-cycle component (REGEFF=1).

If the screen for the **second variable** is set as



it indicates that the intervention variable consists of isolated spikes every 12 months, starting at period 96 (a "Seasonal Level Shift"). It will be centered by SEATS and assigned to the seasonal component (REGEFF=2); the mean effect will go to the trend-cycle.

If the screen for the **third variable** is set as



it indicates that, starting at period 100, there will be a transitory effect, similar to a Transitory Change but with alternating signs. In SEATS it will be assigned to the irregular component (REGEFF=3).

3.6 Execution of the Programs

Once the model has been specified, to execute TRAMO and SEATS, mark the name of the series in the Navigation Tree, and click in the **RUN icon** (when running, the program shows an Hour Glass). When estimation is finished, the expanded Navigation Tree looks as follows.

The part above "∑ **Preadjusted Series**" refers to TRAMO; the part below refers to SEATS. The first time the series name appears it refers to the original series; the second time, to the preadjusted (or linearized) series, and the series in the graph at the bottom of the main window changes when TRAMO has made some correction. The first *Model 0* contains the input file for TRAMO, the second *Model 0* contains the input file created for SEATS.

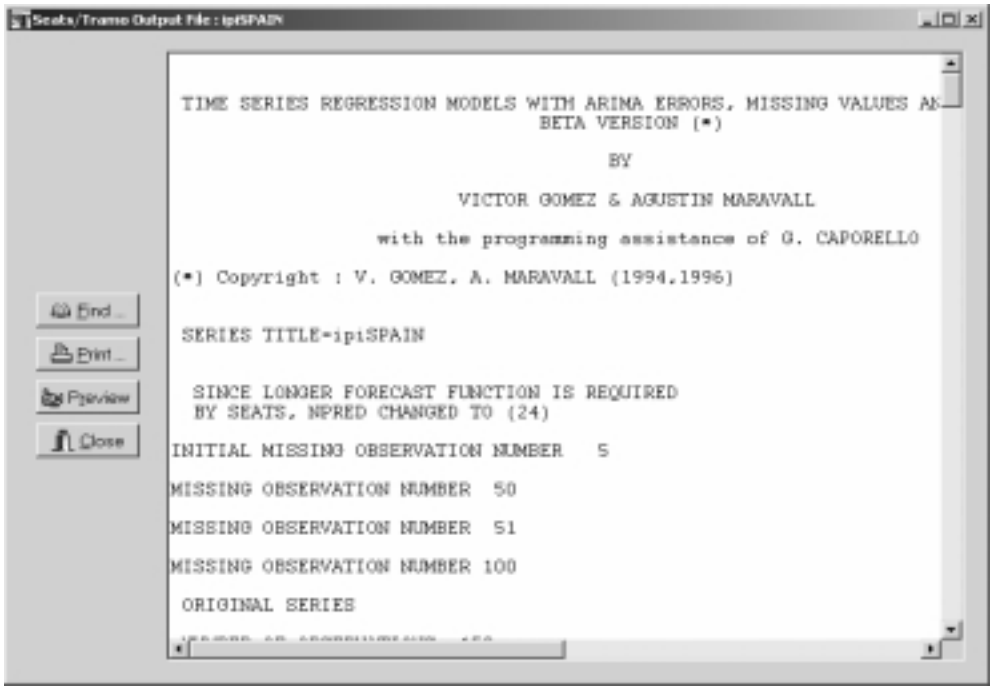
***Warning**: When trying different models for a series, it is not recommended that the icon **+MODEL** be used to enter the new model because it is likely to eventually create confusion. A better procedure is to edit "Model 0" in the Navigation Tree, saving the cases of interest.*

3.7 Output Files: One Series (Iter = 0)

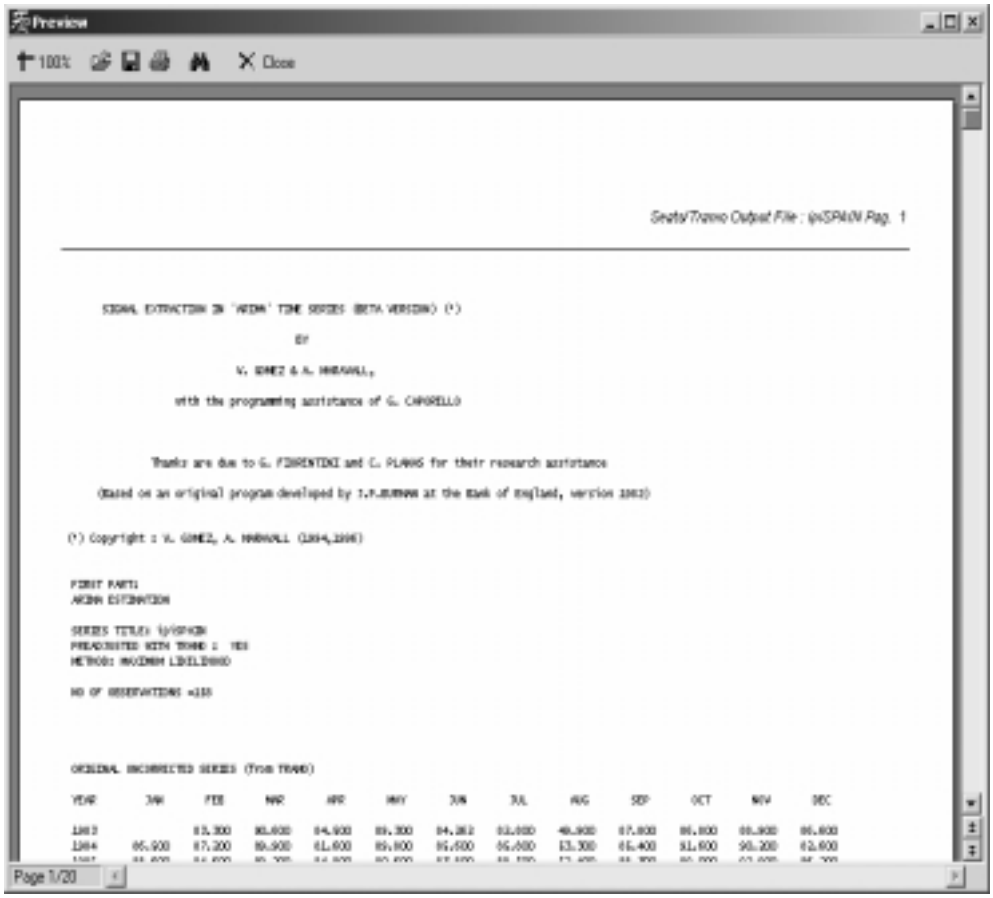
All output files generated by TSW will be deposited in subdirectories inside PROGRAM FILES \ TSW. In what follows, all reference to directories will ignore these first two elements of the path.

3.7.1 MAIN OUTPUT FILES

When the series name in the top part of the Navigation Tree is marked, clicking on the **OUTPUT icon**, the output file of TRAMO is obtained



When the series name in the bottom part is marked, clicking on the OUTPUT icon, the output file of SEATS is obtained. The following screen shows the Preview.



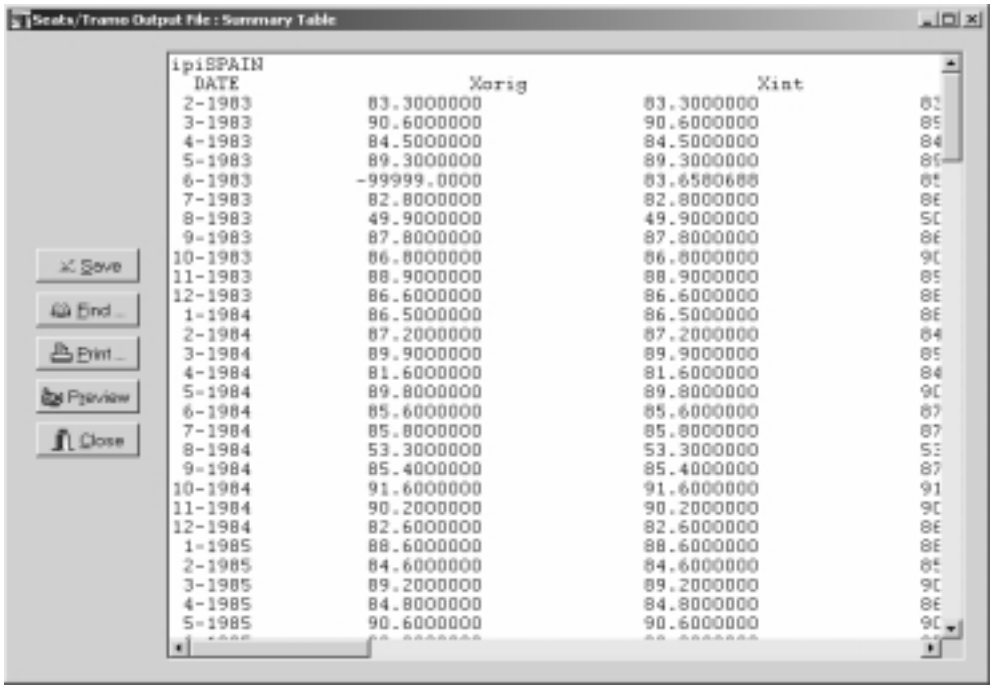
The two output files can also be found in the directories OUTPUT\TRAMO and OUTPUT\SEATS, both under the same name: *"seriesname.out".*

***Warning**: Every time TSW is initialized, these output files are erased. If they are to be used later, they should be stored in some ad-hoc directory before exiting.*

3.7.2 OUT-TABLES (OUTPUT SERIES)

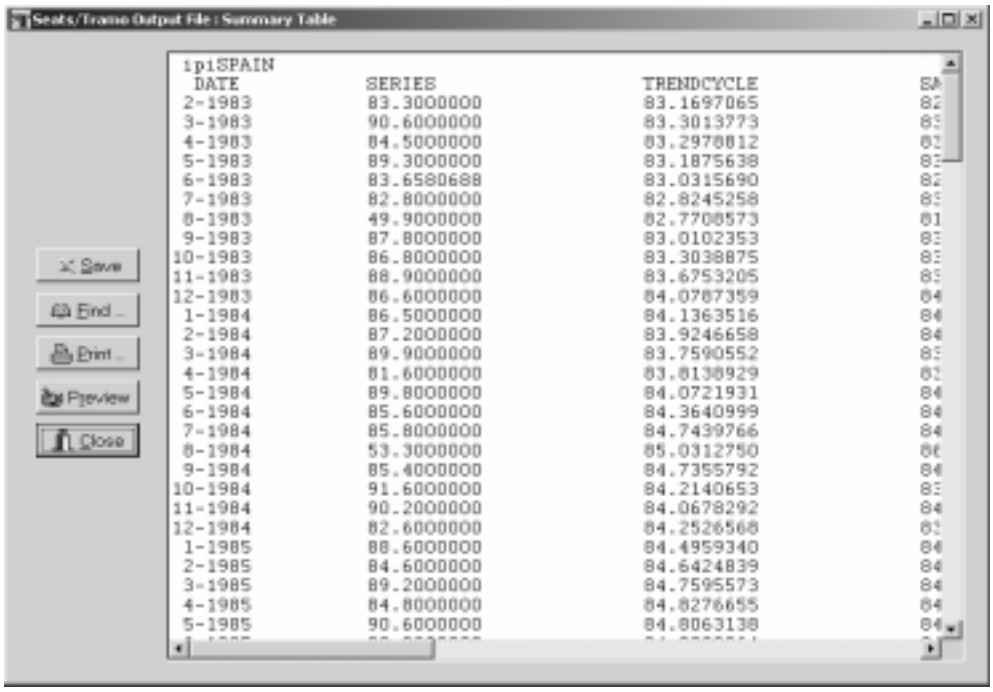
- When the series name at the top is marked, clicking on the **OUT-TABLES icon**, a file is displayed that contains the variables produced by TRAMO extended with the forecasts. The columns contain the following variables

  1st column: *Date of observation*
  2nd column: *Original series*
  3rd column*: Interpolated series*
  4th column*: Linearized series*
  5th column*: (TRAMO) Residuals*
  6th column*: Deterministic mean*
  7th column: *Trading day effect (and Leap-year effect, if present)*
  8th column: *Easter effect*
  9th column: *Additive Outliers*
  10th column: *Transitory Changes*
  11th column: *Level shifts*



- When the series name marked is the one appearing at the bottom, clicking on the **OUT-TABLES icon**, a file is displayed with the series produced by SEATS, extended over the forecasting period. The columns contain the following series:

  1st column: *Original series*
  2nd column: *Final Trend-cycle*
  3rd column: *Final Seasonally Adjusted series*
  4th column: *Final seasonal component (or factor)*
  5th column: *Calendar effect* (Trading Day effect + Easter effect + Leap-Year effect + Holiday effect)
  6th column: *Transitory-irregular component* (combined effect of transitory and irregular components or factors)
  7th column: *Preadjustment component*
  8th column: *Extended residuals* (computed by SEATS).



1piSPAIN

DATE	SERIES	TRENDCYCLE	SA
2-1983	83.3000000	83.1697065	82
3-1983	90.6000000	83.3013773	83
4-1983	84.5000000	83.2978812	83
5-1983	89.3000000	83.1875638	83
6-1983	83.6580688	83.0315690	82
7-1983	82.8000000	82.8245258	83
8-1983	49.9000000	82.7700573	81
9-1983	87.8000000	83.0102353	83
10-1983	86.8000000	83.3038875	83
11-1983	88.9000000	83.6753205	83
12-1983	86.6000000	84.0787359	84
1-1984	86.5000000	84.1363516	84
2-1984	87.2000000	83.9246658	84
3-1984	89.9000000	83.7590552	83
4-1984	81.6000000	83.8138929	82
5-1984	89.8000000	84.0721931	84
6-1984	85.6000000	84.3640999	84
7-1984	85.8000000	84.7439766	84
8-1984	53.3000000	85.0312750	86
9-1984	85.4000000	84.7355792	84
10-1984	91.6000000	84.2140653	83
11-1984	90.2000000	84.0678292	84
12-1984	82.6000000	84.2526568	82
1-1985	88.6000000	84.4959340	84
2-1985	84.6000000	84.6424839	84
3-1985	89.2000000	84.7595573	84
4-1985	84.8000000	84.8276655	84
5-1985	90.6000000	84.8063138	84

The two files can be found in text format in the directories OUTPUT\TRAMO and OUTPUT\SEATS, under the names *table-t.out* and *table-s.out*. They can also be saved as Excel files in which case they are deposited in the directory SAVED.

3.7.3 Summary Output for each Series

In the case ITER=0 (one series, one input file) the files **Summaryt.txt** and **Summanrys.txt** are available in OUTPUT. They contain the following summary of the TRAMO and SEATS results.

a) Results from TRAMO (Summaryt.txt):

Input Parameters

Specifies the parameters entered by the user for the present run.

Model Fit

Nz:	Number of observations in series.
Lam:	0 if logs have been taken; 1 if levels.
Mean:	0 if model has no mean; 1 if it has a mean.
p,d,q,bp,bd,bq:	Orders (P, D, Q) $(BP, BD, BQ)_s$ of the fitted ARIMA model.
SE(res):	Standard Error of Residuals.
BIC:	Bayesian Information Criterion.
Q-val:	Ljüng-Box-Pierce Q statistics for residual autocorrelation.
N-test:	Bowman-Shenton test for Normality of the residuals.
SK(t):	t-value for Ho: Skewness of residuals = 0
Kur(t):	t-value for Ho: Kurtosis of residuals = 3
QS:	Pierce Qs-test for seasonal autocorrelation in residuals (*).
Q2:	Q-statistics for autocorrelation in squared residuals.
Runs:	t-test for runs (randomness) in signs of residuals.

(*) when the lag-12 autocorrelation is negative, QS is unrelated to seasonality and the value "0." is printed.

ARMA Parameters

The order is the following:
Estimate of the regular AR polynomial $(1+\phi_1 B+\phi_2 B^2+\phi_3 B^3)$
Estimate of the seasonal AR polynomial $(1+\Phi_s B^s)$
Estimate of the regular MA polynomial $(1+\theta_1 B+\theta_2 B^2+\theta_3 B^3)$
Estimate of the seasonal MA polynomial $(1+\Theta_s B^s)$
The associated t-values are also given.

Deterministic Effect (total)

TD:	Number of Trading Day variables (including Leap Year)
EE:	Presence / absence of Easter effect
# OUT:	Total number of Outliers
AO:	Number of Additive Outliers
TC:	Number of Transitory Change outliers
LS:	Number of Level Shift outliers
REG:	Number of (additional) regression variables
MO:	Number of missing observations

Calendar Effect

TD1, …. , TD6:	Estimators of Trading Day variable effects
LY:	Estimator of Leap-Year effect
EE:	Estimator of Easter effect

The associated t-values are also provided.

Outliers

Detected and corrected outliers are listed; first Additive Outliers, then, Transitory Changes, and finally, Level Shifts. For each outlier, the date and assoc. t-value are given.

Regression variables

The regression variables (their total number equal to lREG) are listed in the order in which they were entered. The coefficient estimators and assoc. t-values are printed.

b) Results from SEATS (Summarys.txt):

General

Preadj. :	Preadjusted with TRAMO (Y / N)
Model Changed:	Model passed by TRAMO has been changed by SEATS (Y / N)
Approx. to NA:	The model used to decompose the series is an approximation to an original model that provided a non-admissible decomposition. (Y / N).
Model:	The ARIMA model used by SEATS. On occasion, SEATS changes the model passed by TRAMO (for example, when the latter does not accept an admissible decomposition).
SD(at):	Standard Deviation of the SEATS residuals.

Spect. factor: Spectral Factorization that provides the model decomposition (0 = OK / E = ERROR).

Check on ACF: Check on the comparison of variances among the theoretical component, theoretical estimator, and empirical estimate (0 / E).

Check on CCF: Check on the comparison of covariances between theoretical estimator and empirical estimate (0 / E).

Determ. Compon. Modif.: The stochastic SEATS component is modified by some of the deterministic effects captured by TRAMO (Y / N).

Decomposition: Standard Errors (Parameters I)

SD (innov): Standard deviation of the component innovation, expressed in units of the series (LAM = 1) or of the logged series (LAM = 0). The components are: TC = Trend-cycle; S = Seasonal component; Trans = Transitory component; U = Irregular component; SA = Seasonally Adjusted Series.

SE est (conc.): Standard Error of the concurrent estimator (TC and SA series).

SE rev (conc.): Standard Error of the total revision error in the concurrent estimator (TC and SA series).

SE: Rates of Growth: Standard Error of the rates of growth of the estimated component (in per cent points).

T11: Period-to-period rate of growth (TC and SA series)

T1 Mq: Annual rate of growth, centered at the last available observation and extended with forecasts (TC, SA, and Original Series).

(For an additive decomposition, "rate-of-growth" should be replaced by "growth", expressed in the series units.)

Decomposition: Properties (Parameters II)

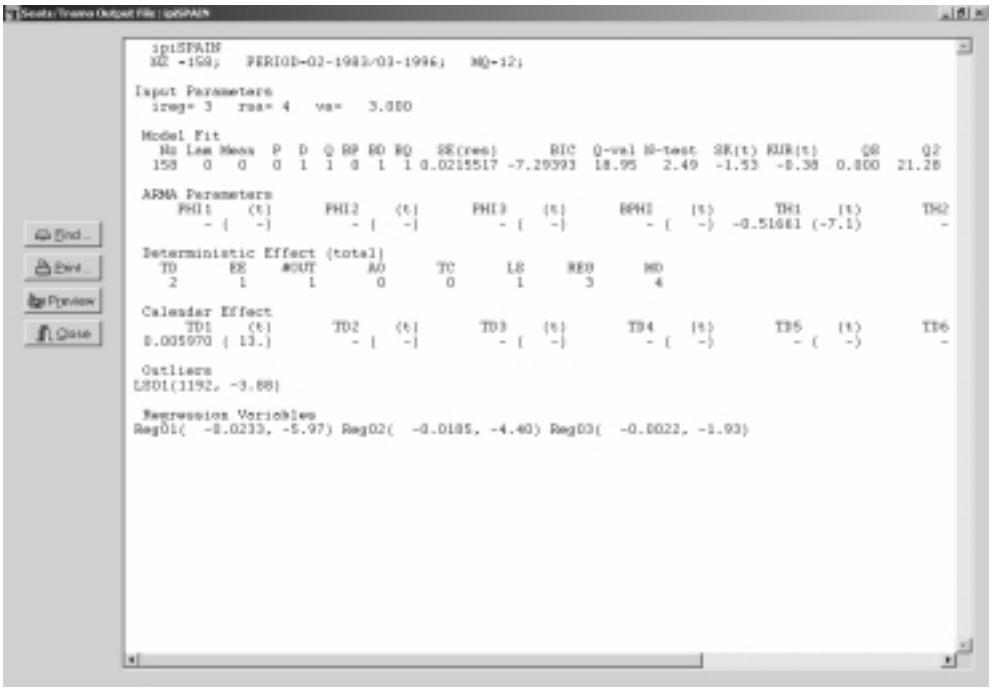
Convergence: (in %) % reduction in the variance of the revision error of the concurrent estimator after 1 and 5 years of additional data are available (TC and SA series).

Signif. Season: (95%) number of periods per year for which seasonality is significantly different from 0 (at the 95% level). Given that the estimation errors vary, significance is assessed for:

- Historical estimation (Hist.)
- Last observed year (Prel.)
- One-year-ahead Forecast Function (Fore.)

DAA: Difference in annual means: Average of the absolute value of the differences between the annual averages of the original series, SA series, and TC (in %).

An example of a TRAMO summary file is the following:

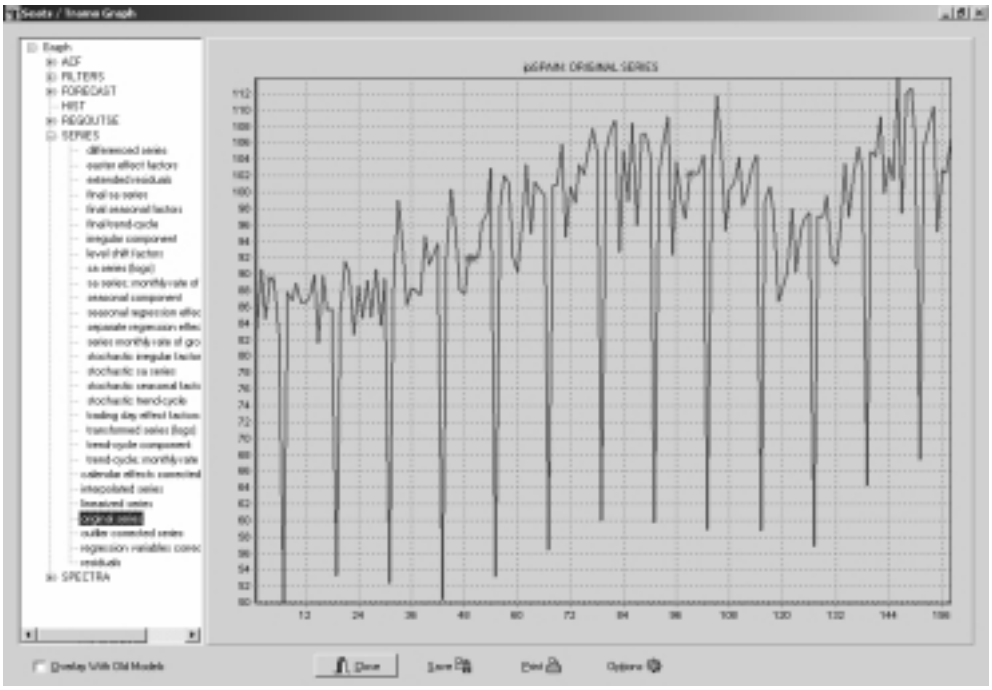


3.8 Graph

Clicking on the **GRAPH icon** it is possible to visualize, print, or save the graphs produced by the program.

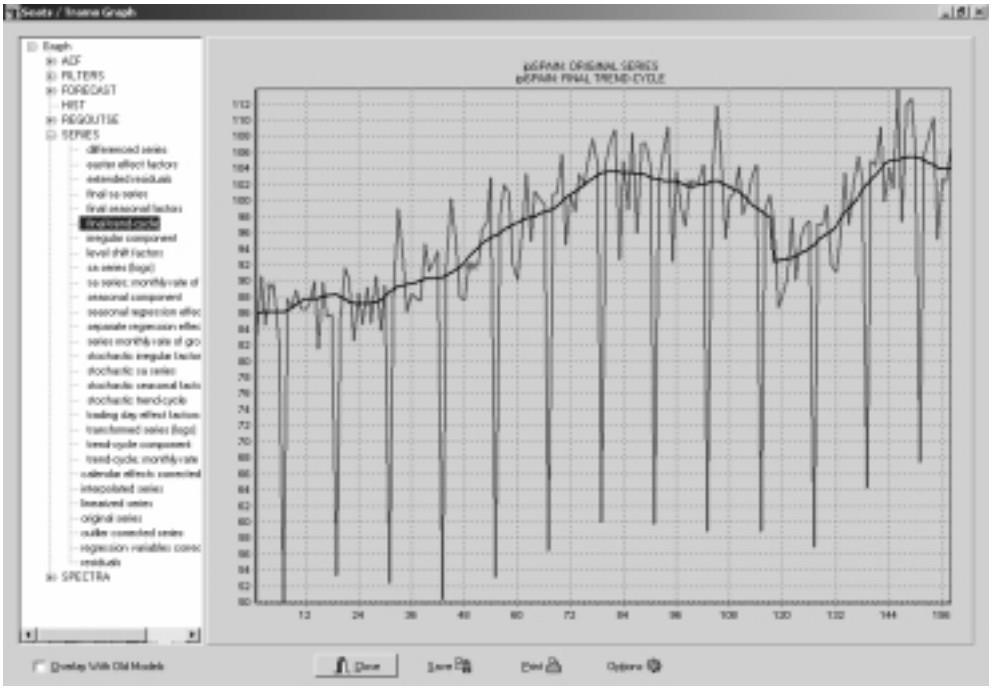
The window is divided into a **Navigation Tree** and a **Plotting Area**. The graphs are divided into sub-trees: **SERIES, ACF, FILTERS, SPECTRA, FORECAST**, **REGOUTSE**, and **HIST.**

Clicking on **+ SERIES**, for example, the graphs available show up in the Navigation Tree. The main graph functionalities are the following:



✓ **Plot**: Select a node on the tree and double-click on it to plot the graph. A new graph will be plotted in the same way.

✓ **Overlay**: Select a node and click with the r.m.b.: a menu will appear. Click on **Add** in order to overlay the new graph with the one in the plot area.



✓ **Zoom In**: Drag a rectangle on the plot area starting from the left-top corner.

✓ **Zoom Out**: Drag a rectangle on the plot area starting from the right-bottom corner.

✓ **(x,y) coordinate**: it is possible to visualize the (x, y) coordinate of a point on the graph using the Shift+Left-mouse button combination.

- ✓ **Graph Panning**: Clicking the r.m.b. (with the cursor on the plot area) and moving the mouse pointer will produce a horizontal or vertical scroll of the graph according to the mouse pointer movement.
- ✓ **Save**: Clicking on this button it is possible to save the plot area in two different formats: Bitmap (*.bmp) or Windows Meta File (*.wmf). Both are standard format and it is then possible to include the graph in Word, Excel,… documents.
- ✓ **Options**: the option button permits to personalize the look of a graph (point and line format, color, and width).

It is also possible to:

Transform the graph into a 3D graph.
Change the fonts and the color of the title.
Change the printer options. It is possible to print in Portrait/Landscape and define the quantity of subplots to put in a single sheet (2 Max on the Xsheet-axis; 4 Max on the Ysheet-axis).
Change the X-Y Scale.
Backup the graphs in order to overlay them with those of a new model. To do that, click on the option **Backup**. Then run the same series with another model, click on graph and on the square **Overlay with Old Models**. Double click on the selected graph, and the graphs for the last and previous models are plot (maximum: 3 graphs).

***Warning**: Backups will not be erased automatically, thus care should be taken to click on **Clean Backup** before starting any new application.*

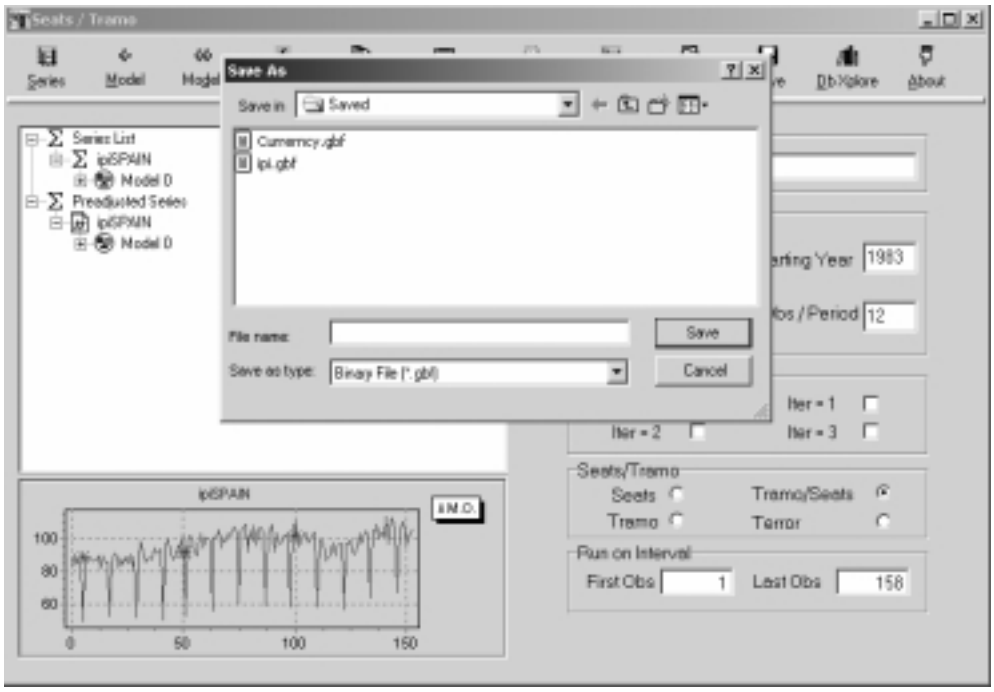
The arrays of the graphs in text format are stored in the directory GRAPH, from which they can be easily imported to other programs, such as GAUSS or MATLAB.

3.9 Save / Load

Clicking on the **SAVE icon**, the navigation tree is saved on a binary proprietary output file (*.gbf). In this way, series with their models can be saved. (The file is stored in the directory SAVED).

Clicking on the **LOAD icon**, the .gbf files in the directory SAVED are displayed and can be restored in the Navigation Tree. (If the saved file was moved to another working directory, it can be accessed in the usual manner).

When saving as Excel files the files in out-Tables or out-Matrix, the .xls files are also stored by default in the SAVED directory.

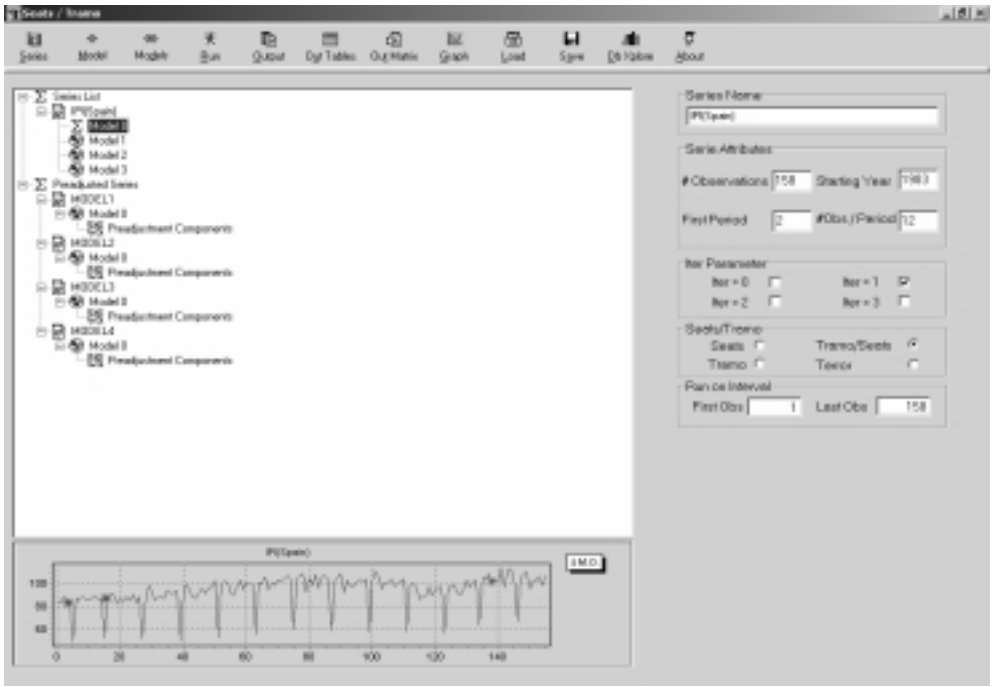


3.10 Many Series and/or Models

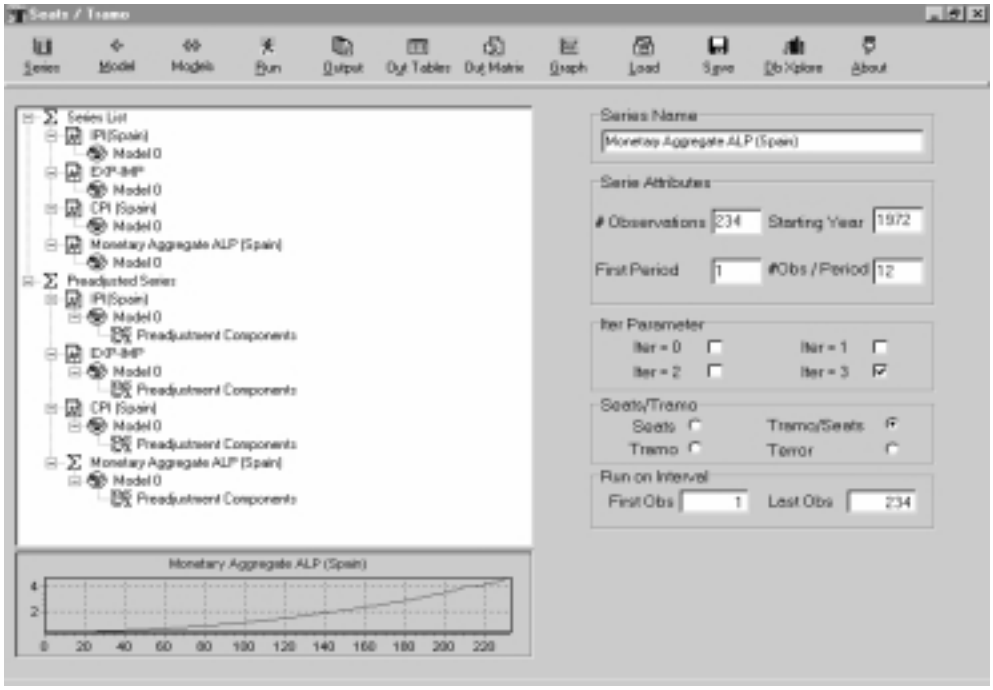
3.10.1 THE ITER PARAMETER

The previous pages refer the case ITER = 0, in which a single series is treated with a single input specification.

- **ITER = 1 One series; several specifications**. Having set Iter = 1 and selected a series, the models are entered by clicking on the **MODEL+** button. Clicking on **RUN**, all cases are estimated. The extended Navigation Tree looks like



- **ITER = 2 Several series; one model specification.** Having set Iter = 2, pressing the Ctrl key several series can be selected. Clicking on **MODEL+** (or **MODEL++**) a model specification is entered that will be common to all series. Clicking on **RUN**, all series are treated, and the following Navigation Tree is produced



EXAMPLE: Assume one wishes to treat 20 monthly series that may well be affected by Trading Day effect, and then to compare the parsimonious working/nonworking day specification (ITRAD=4) with the day-of-week specification (ITRAD=7). Setting ITER=2, one can mark the first series, click on ***MODEL+****, and enter RSA=4. The summary results stored in Out-Matrix can be saved. Then, clicking on Model 0 in the Navigation Tree, and changing RSA to 5, the new summary matrices can be compared to the previous ones. Assume that, for the sixth series, the results are not good. One can set ITER=0, mark the sixth series, and enter another model for the series by clicking on* ***MODEL+****.*

- **ITER = 3 Several series, each one with a different model.** Having set Iter = 3, several series can be selected. For each series, **MODEL+** sets the model specification.

3.10.2 MULTIPLE-SERIES OUTPUT FILES

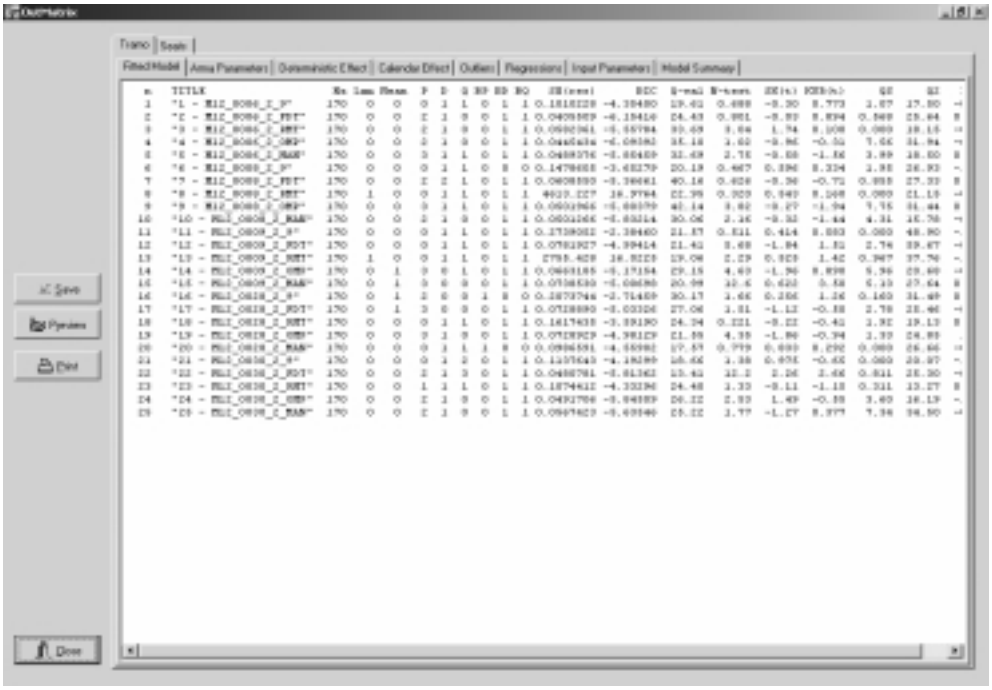
When OUT = 0 (full output), the main output files from TRAMO and SEATS (section 2.7.1) for all series are produced. (To see a particular one, select the series in the Navigation Tree and click on OUTPUT.) Further the tables with the series produced by the program (section 2.7.2) can be visualized by clicking in OUT-TABLES (the tables corresponding to the variables in the input file are listed sequentially). The tables can be saved in Excel, in which case each series results are stored in one page of the file.

When the application contains many series, the sum of all the previous output files can become extremely large. When ITER>0, new files are created that summarize the information for each series.

a) Matrices

The summary results of TRAMO and SEATS are stored as matrices that can be visualized clicking in **Out-Matrix**. The series are numbered, and the first two columns of each matrix display the series number and title.

Each matrix corresponds to one of the rows of the Summaryt and Summarys files, with the rows of the matrix referring to one of the series / models in the input. The following is an example.



The matrices can be stored as Excel files. In text format they are available at OUTPUT\TRAMO, under the names

tparams.m : Input parameters.
tfit.m : Model fit.
tarmapar.m : ARMA parameters.
tdeterm.m : Deterministic effect (total).
tcalend.m : Calendar effect.
toutlier.m : Outliers.
tregvar.m : Regression variables.

And in OUTPUT\SEATS under the names

sgeneral.m : General information.
sparami.m : Decomposition: Standard Errors.
sparamii.m : Decomposition Properties.

b) Aggregate Summary Results

When MODELSUMM = 1, a file with the aggregate summary results for the set of treated series is produced (OUTPUT\TRAMO\sumodels.out), which can be visualized, by clicking on OUT-MATRIX, as the last page of the TRAMO summary results ("Model Summary").

c) Graphs

Files with ITER > 0 will generate a very reduced set of graphs for each series, namely:

Original series
Final SA series
Final Trend-Cycle
Final Transitory component
Linearized series,

as well as their Forecasts.

When MODELSUMM = 1, a set of histograms for the main characteristics and diagnostics of the group of series treated is available in HIST.

A more complete description of the output in multiple-series applications is contained in the document **terror.pdf**, also available in the same web site.

***Warning**: The Aggregate Summary Results file, as well as the histograms, requires that all series in the file have the same frequency of observation. The asymptotic distributions in the graphs are obtained by averaging the degrees of freedom for all series.*

3.10.3 AGGREGATE SUMMARY RESULTS

The file contains 5 tables that summarize the aggregate results for the set of series treated. An example is presented that corresponds to a set of 1422 series of foreign trade indicators provided by Eurostat. The automatic procedure with parsimonious TD specification RSA = 4 was applied to all of them.

Table 1 (GENERAL FEATURES) shows the proportion of series modeled in logs and in levels, the proportion that requires regular and/or seasonal differences, the proportion of stationary and nonstationary series, the proportion of series with a purely regular model, the proportion of series with not enough observations for the complete automatic modeling procedure, and the proportion of series for which the default (Airline) model was identified.

Table 2 (DIFFERENCES) shows the number of series associated with all possible differencing combinations.

Table 3 (ARMA PARAMETERS) shows the % of series associated with the different orders of the ARMA model, and the average number of parameters per model.

Table 4 (MISSING VALUES AND REGRESSION) shows the % of series with missing observations, the % of series with outliers (split into additive outliers, transitory changes, and level shifts), and the % of series subject to Trading Day and Easter effects. The average, maximum, and minimum number of MO and outliers (per series) is also provided.

Table 5 (SUMMARY STATISTICS) shows the mean, SD, maximum and minimum values of the series length, of the number of ARMA parameters and of outliers, and of a set of residual diagnostics (Q: lack of autocorrelation; N: Normality; SK: Skewness; Kur: Kurtosis; QS: residual seasonality; Q2: lack of autocorrelation in squared residuals; Runs: randomness in sign of residuals).

For each diagnostic statistics, the approximate 1% Critical Value is printed, as well as the % of series that exceed this critical value and the % of series that pass the test.

Foreign Trade Series (Basics)

Input Parameters :

rsa= 4 modelsumm= 1

SERIES IN FILE : 1422

SERIES PROCESSED : 1422

SUMMARY RESULTS

TABLE 1: GENERAL FEATURES

	# of series	%
Levels	48	3,38
Logs	1374	96,62
Regular diff	1337	94,02
Seasonal diff	1163	81,79
Stationary	30	2,11
Non stationary	1392	97,89
Purely regular	137	9,63
Nz too small for complete AMI	30	2,11
Default (Airline model)	828	58,23

TABLE 2: DIFFERENCES

	D=0	D=1	D=2	Total
BD=0	30	227	2	259
BD=1	55	1102	6	1163
Total	85	1329	8	1422

TABLE 3: ARMA PARAMETERS

	P	Q	BP	BQ	
0	75,3	17,9	92,7	15,4	
1	13,2	76,0	7,3	84,6	
2	7,2	4,9	0,0	0,0	
3	4,4	1,2	0,0	0,0	
Total > 0	24,7	82,1	7,3	84,6	
					Total
Average # of param. per serie	0,4	0,9	0,1	0,8	2.2

TABLE 4: MISSING VALUES AND REGRESSION

	MO	AO	TC	LS	Tot. Outlier	TD	EE	Tot. Calendar
% of series with	0,0	57,9	31,0	35,2	76,2	76,9	25,9	78,2
Average # por serie	0,0	1,1	0,5	0,5	2,0			
Maximum # per series	0,0	13	7,0	6,0	24,0			
Minimum # per series	0,0	0,0	0,0	0,0	0,0			

TABLE 5: SUMMARY STATISTICS

	Mean	SD	Max	Min	Approx 1% CV	Beyond 1% CV	% of series that pass the test (99%)
Length	165,3	9,1	170	50			
# of ARMA param. per serie	2,2	0,8	6	1			
# of outliers per serie	2	2,1	24	0			
Q-Val	23,6	6,9	56,7	8,7	40,3	0,8	99,2
N-Test	3,0	8,0	219,24	0,0	9,21	4,9	95,1
Skewness	0,0	1,2	5,3	-7,1	2,58	3,7	96,3
Kurtosis	0,3	1,2	13,0	-1,9	2,58	3,5	96,5
Qs					9,21	0,2	99,8
Q2	25,1	11,1	135,8	6,2	43,0	5,4	94,6
Runs	-0,1	0,9	3	-3,1	2,58	0,6	99,4

In the example, 1422 monthly series, most of them with 170 observations and no missing values, were treated automatically (with the parsimonious TD representation).

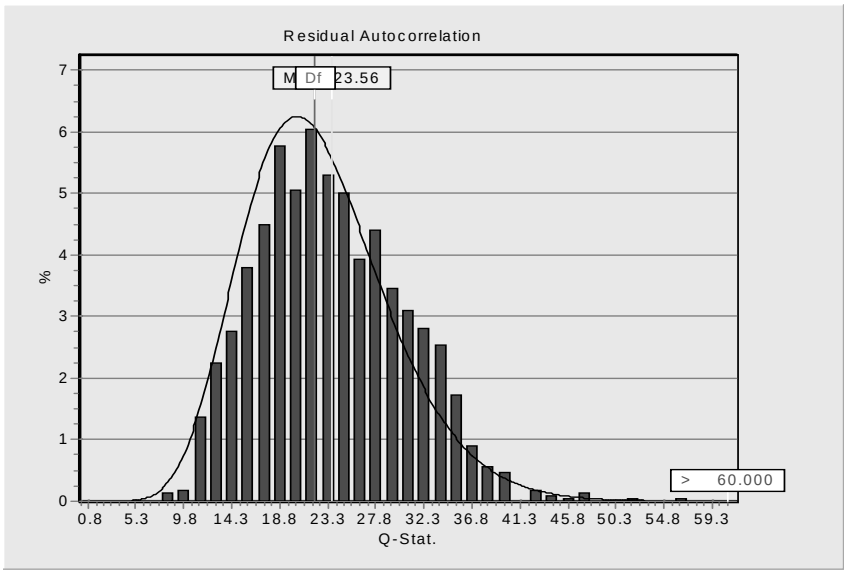
The group is relatively homogeneous. A large majority of series require multiplicative adjustment and are nonstationary. 10% have purely regular models, and 58% follow an Airline-type model.

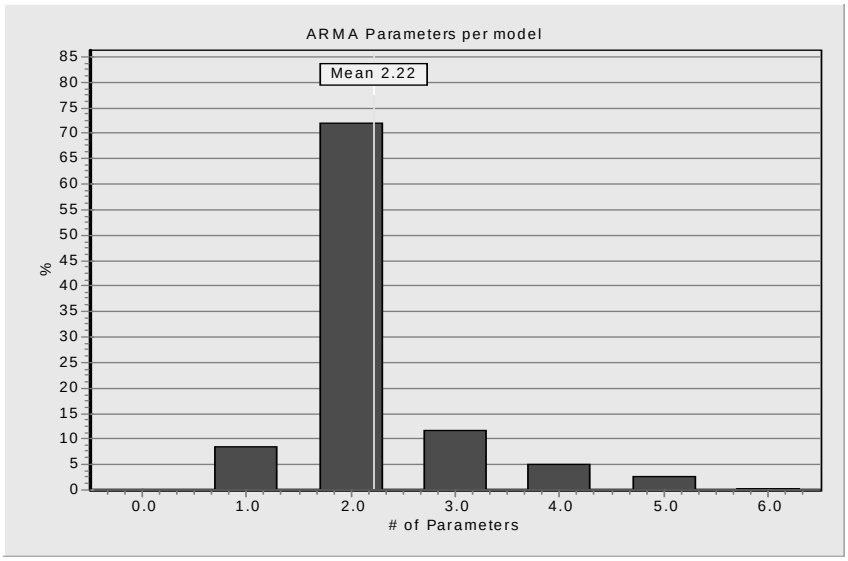
The average number of ARMA parameters per model is 2.2.

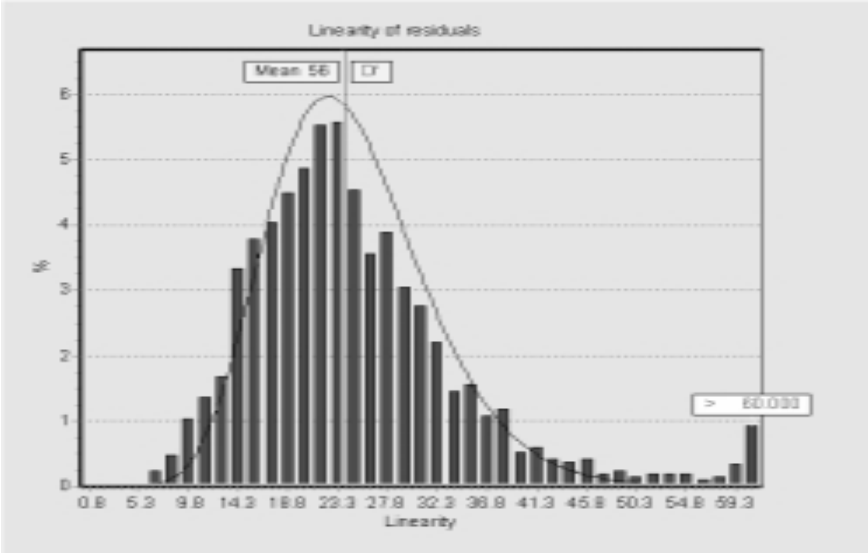
The average number of outliers is 2 per series, half of them AO. TD affects 77% of the series; EE affects 25%.

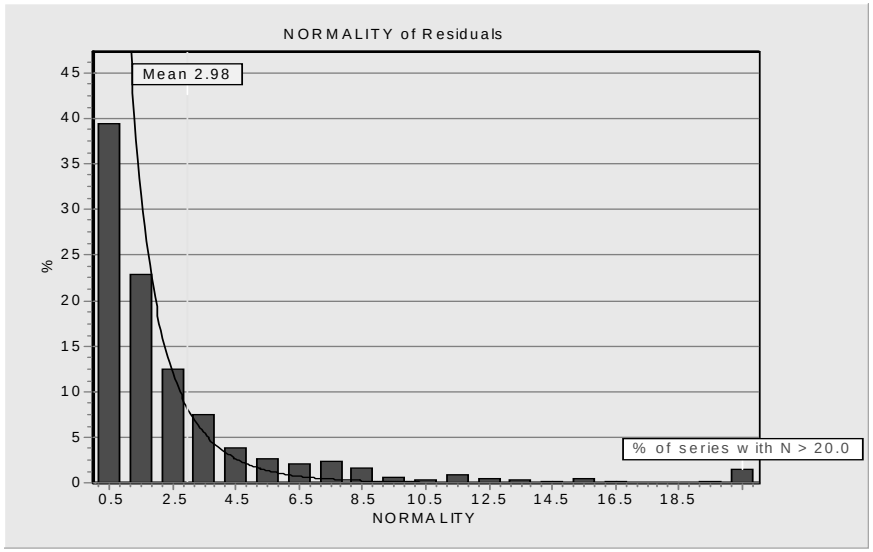
The diagnostics are overall good. Three of the tests (Q, QS, and Runs) have 1% empirical sizes smaller than the theoretical one, and all diagnostics at the 1% level are passed by at least 95% of the series.

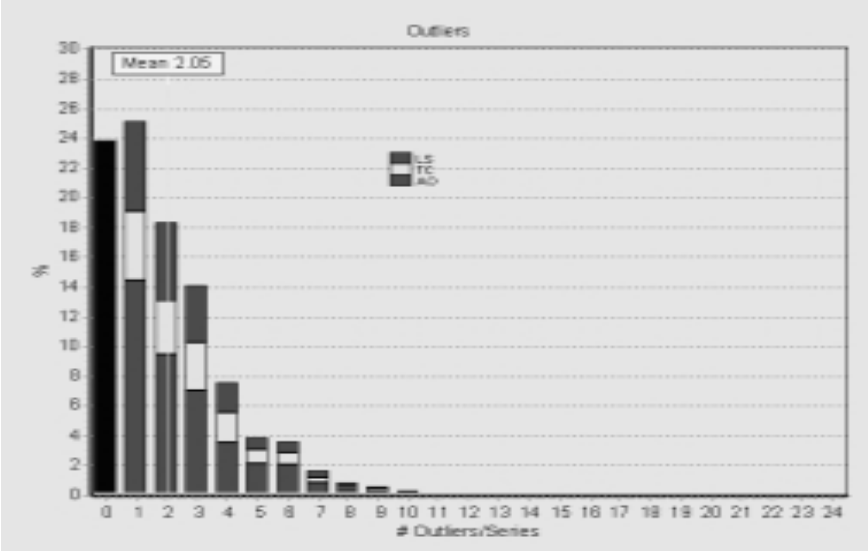
Graphs with the histograms corresponding to some of these results (including all diagnostics) are also produced. Some of the histograms are displayed in the next pages.

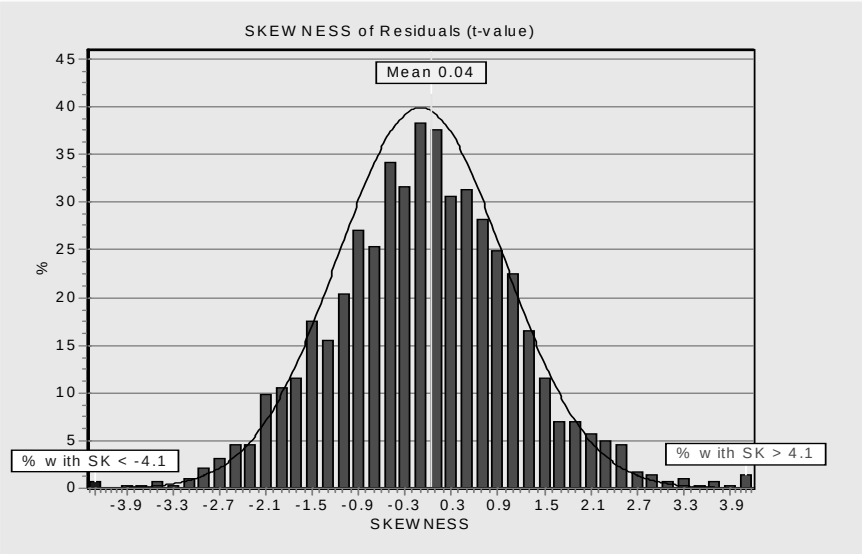

Residual Autocorrelation
M Df 23.56
%
0
1
2
3
4
5
6
7
0.8 5.3 9.8 14.3 18.8 23.3 27.8 32.3 36.8 41.3 45.8 50.3 54.8 59.3
Q-Stat.
> 60.000


ARMA Parameters per model
Mean 2.22
%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
0.0 1.0 2.0 3.0 4.0 5.0 6.0
# of Parameters


Linearity of residuals
Mean 56
Cr
> 60.000
%
Linearity


NORMALITY of Residuals
Mean 2.98
% of series with N > 20.0
%
NORMALITY


Outliers
Mean 2.05
LS
TC
AO
%
Outliers/Series


SKEWNESS of Residuals (t-value)
Mean 0.04
% with SK < -4.1
% with SK > 4.1
%
SKEWNESS

3.11 Output Files Options

3.11.1 COMPLETE LIST OF OUTPUT FILES

OUTPUT FILE	CONTENT	DIRECTORY WHERE IT IS DEPOSITED AS TXT FILE (within PROGRAM FILES\ TSW)	ICON IN TSW	REFERENCE TO SECTION IN MANUAL
(1) Main Output Files				2.7.1.
seriesname.out	Main TRAMO output file	OUTPUT\TRAMO	OUTPUT	
seriesname.out	Main SEATS output file	OUTPUT\SEATS	OUTPUT	
(2) Summaries of Main Output Files (Single series application)				2.7.3.
summaryt.txt	One-page summary of TRAMO.	OUTPUT\TRAMO	OUTPUT	
summarys.txt	One-page summary of SEATS.	OUTPUT\SEATS	OUTPUT	
(3) Tables with Series				2.7.2.
Table-t.out	Table with series produced by TRAMO	OUTPUT\TRAMO	OUT-TABLES	
Table-s.out	Table with series produced by SEATS	OUTPUT\SEATS	OUT-TABLES	

(4) Summary Matrices Multiple series applications. Each row = one series.				2.10.2.
tfit.m **tarmapar.m** **tdeterm.m** **tcalend.m** **toutlier.m** **tregvar.m** **tparams.m**	TRAMO estimation results and diagnostics Estimates of ARMA parameters Summary of Deterministic effects Estimates of TD, LY, and EE Outliers detected and corrected Estimates of regression effects Input parameters	All in OUTPUT\TRAMO	All in OUT-MATRIX	
sgeneral.m **sparami.m** **sparamii.m**	Summary results of the SEATS decomposition	All in OUTPUT\SEATS		
(5) Aggregate Summary Results Multiple series applications. One-page summary.				2.10.3.
sumodels.out	Aggregate summary results for the multiple series application	OUTPUT\TRAMO	OUT-MATRIX (TRAMO)	
(6) Graphs (in groups)				2.10.2.
ACF	Arrays with all graphs produced by the program (In Multiple series applications only a few are produced)	GRAPH\ACF	GRAPH	
SERIES		GRAPH\SERIES	GRAPH	
SPECTRA		GRAPH\SPECTRA	GRAPH	
FILTERS		GRAPH\FILTERS	GRAPH	
FORECAST		GRAPH\FORECAST	GRAPH	
REGOUTSE		GRAPH\REGOUTSE	GRAPH	
HIST	Histograms for Multiple-series applications	GRAPH\HIST	GRAPH	

3.11.2 PARAMETER OUT

The parameter OUT controls the output files that will be produced according to the following table.

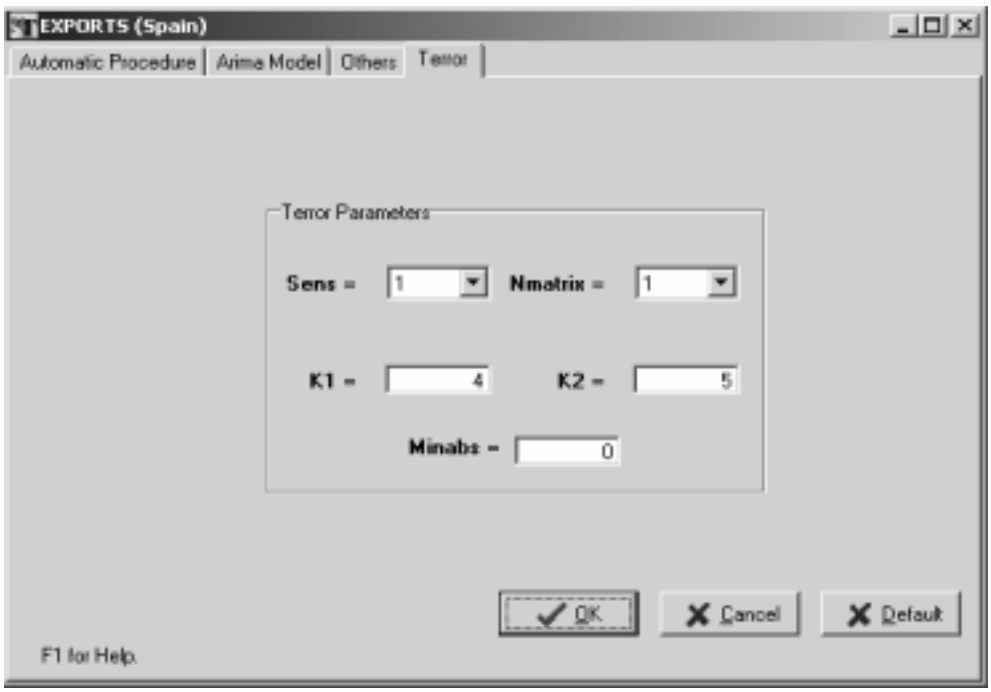
Groups of files	**SINGLE SERIES** (Iter = 0)			**MULTIPLE SERIES** (Iter > 0)		
	OUT = 0	**OUT = 2**	**OUT = 3**	**OUT = 0**	**OUT = 2**	**OUT = 3**
Main output file	YES	---	---	YES	---	---
One-page summary of output file	YES	YES	YES	---	---	---
Tables with output series	YES	YES	YES	YES	YES	YES
Summary matrices	---	---	---	YES	YES	YES
One-page summary of aggregate results	---	---	---	When MODELSUMM = 1, YES		
GRAPHS:						
SERIES	YES	Reduced set	---	Reduced set	Reduced set	---
FORECAST	YES	Reduced set	---	Reduced set	Reduced set	---
ACF	YES	---	---	---	---	---
FILTERS	YES	---	---	---	---	---
SPECTRA	YES	---	---	---	---	---
REGOUTSE	YES	---	---	---	---	---
HIST	---	---	---	When MODELSUMM = 1, YES		

3.12 Program Terror

The program is an application of TSW to the detection of errors in new data reported to large sets of time series. Errors in the new data are detected as abnormally large forecast errors in the 1-period-ahead forecasts computed ignoring the new observation. The program uses the automatic features of TRAMO.

TERROR is run by:

a) choosing “Terror” as the program option in the Main Window of TSW;
b) entering the set of series (usually, from an Excel file);
c) clicking in **+ MODEL** (or **++ MODEL**), and then selecting the “Terror” sheet:



Setting the appropriate parameter values (see next section) and clicking in **OK**, the program can be run. A new file is produced **(list.out** in **OUTPUT)**. It contains the list of series that have produced abnormally large forecast errors. A more complete description of TERROR is contained in the document **terror.pdf**, already referred to.

4 Input Parameters

4.1 Automatic Procedure

RSA = **0** Parameter not active.

= **1** As RSA=3, but the default Airline model is always used.

= **2** As RSA=4, but the default Airline model is always used.

= **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-cycle, seasonal, irregular and (perhaps) transitory component. If the model does not accept an admissible decomposition, it is replaced by a decomposable one.

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

= **5** As RSA=4, but the Trading Day specification uses 6 parameters (each day-of-week effect may be different).

Note on the Automatic procedure:
The automatic configurations associated with the RSA parameter can be modified: after setting the RSA parameter, enter the modified parameters (if the value desired is the default one, you still have to reenter the parameter).

4.2 Tramo Parameters

4.2.1 ARIMA MODEL

P	= **0**	(Default) **, 1, 2, 3.**	Order of regular autoregressive polynomial.
Q	= **1**	(Default) **, 0, 2, 3.**	Order of regular moving average polynomial.
D	= **1**	(Default) **, 0, 2.**	Order of regular differences.
BP	= **0**	(Default) **, 1.**	Order of seasonal autoregressive polynomial.
BQ	= **1**	(Default) **, 0.**	Order of seasonal moving average polynomial.

BD = **1** (Default) **, 0.** Order of seasonal differences.

INIT = **0** (Default) All ARIMA parameters will be estimated.
= **1** Some parameters are fixed. The location of fixed parameters is entered setting: JQR(i)=1; JQS(i)=1 ; JPR(i)=1 ; JPS(i)=1 , … The fixed values of the parameters are entered as TH(i)=fixedvalue, PHI(i)=fixedvalue,...
= **2** Values for all parameter input and no parameter estimation is done. Parameters entered in TH, BTH, PHI, BPHI**.**

PHI = Estimates of regular autoregressive parameters. Not input if INIT=0. If (INIT=2) or (INIT=1, JPR(I)=1), PHI(I)=k fixes the I-th regular AR parameter.

TH = Estimates of regular moving average parameters. Not input if INIT=0. If (INIT=2) or (INIT=1, JQR(I)=1), TH(I)=k fixes the I-th regular MA parameter.

BPHI = Estimates of seasonal autoregressive parameters. Not input if INIT=0. If (INIT=2) or (INIT=1, JPS(I)=1), BPHI(I)=k fixes the seasonal AR parameter.

BTH = Estimates of seasonal moving average parameters. Not input if INIT=0. If (INIT=2) or (INIT=1, JQS(I)=1), BTH(I)=k fixes the seasonal MA parameter.

JPR(I) = **1** When INIT=1 parameter number I in the regular autoregressive polynomial fixed to the value set in PHI(I) (it is not estimated).
= **0** (Default) Parameter not fixed.

JQR(I) = **1** When INIT=1 parameter number I in the regular moving average polynomial fixed to the value set in TH(I) (it is not estimated).
= **0** (Default) Parameter not fixed.

JPS(I) = **1** When INIT=1 parameter number I in the seasonal autoregressive polynomial fixed to the value set in BPHI(I) (it is not estimated).
= **0** (Default) Parameter not fixed.

JQS(I) = **1** When INIT=1 parameter number I in the seasonal moving average polynomial fixed to the value set in BTH(I) (it is not estimated).
= **0** (Default) Parameter not fixed.

IMEAN = **0** No mean correction.
= **1** (Default) Mean correction.

LAM = **0** Takes logs of data.
= **1** (Default) No transformation of data.
= **-1** The program tests for the log-level specification.

FCT = **1** (Default) Real value. Controls the bias in the log/level pretest.
> 1 Favors levels;
< 1 Favors logs.

TYPE = **0** (Default) Exact Maximum Likelihood (for SEATS and TRAMO).

= **1** Least Squares (conditional for SEATS, unconditional for TRAMO).

4.2.2 CALENDAR EFFECTS

IEAST = **0** (Default) No Easter effect.

= **1** Easter effect adjustment.

= **-1** The program pretests for Easter effect.

ITRAD = **0** (Default) No Trading Day effect is estimated.

= **1** # of (M, T, W, Th, F) -# (Sat, Sun) x 5/ 2. One parameter specification.

= **2** As the previous case, but with leap-year effect correction.

= **6** # M - # Sun, # T - # Sun, ..., # Sat - # Sun. Six parameters specification.

= **7** As the previous case, but with leap-year correction. (Seven parameters specification.)

= **-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.

IDUR = **6** (Default) Duration of period affected by Easter (# of days).

= **k** a positive integer.

4.2.3 OUTLIERS

IATIP = **0** (Default) No correction for outliers.

= **1** Automatic detection and correction for outliers.

AIO = **1** All outliers are treated as additive outliers or transitory changes (in this way the level of the series is preserved).

= **2** (Default) Additive outliers, transitory changes and level shifts are considered.

= **3** Only level shifts and additive outliers are considered.

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 (number of observations in series)

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.

IMVX = **0** (Default) The fast method of Hannan-Rissanen is used for parameter estimation in the intermediate steps of the automatic detection and correction of outliers.

= **1** Maximum likelihood estimation is used.

VA = **k** A positive real number. Sets the critical value for outlier detection.
The default value depends on NZ:

if (NZ $\leq$ 50) then VA = 3.0
if (50< NZ < 450) then VA = 3.0+0.0025*(NZ-50)
else VA = 4.0

INT1, INT2 See parameter: AIO.

4.2.4 AUTOMATIC MODEL IDENTIFICATION

INIC = **0** (Default) No automatic model identification is performed for stationary model.
= **3** The program searches for regular polynomials up to order 3, and for seasonal polynomials up to order 1 (stationary model);

IDIF = **2** (Default) No automatic model identification for non-stationary roots.
= **3** The program searches first for regular differences up to order 2 and for seasonal differences up to order 1.

UB1 If one of the roots in the "AR(2)xARs(1) plus mean" estimation (in the first step of the automatic identification of the differencing polynomial) is larger than **UB1**, in modulus, it is set to unity. (Default: .97 .)

UB2 If one of the roots in the "ARMA(1,1)xARMAs(1,1) plus mean" estimation (in the second step of the automatic model identification) is larger than **UB2**, in modulus, it is set equal to unity. (Default: .88 .)

PCR Level of significance for the Ljung-Box Q-test used in automatic model identification. (Default: 95%.)

PC Percentage by which VA is reduced in the second round when **IATIP** = 1. (Default: 12%.)

TSIG = **1** (Default) Minimum t for significant mean.
= **k** a real number 0 < k < 2.

4.2.5 INTERPOLATION AND FORECASTING

INTERP = **0** No interpolation of missing observations.
= **1** Interpolation of missing observations with the fixed-point smoother.
= **2** (Default) Interpolation of missing observations is made through regression ("Additive Outlier Approach").

Note: When automatic model identification is simultaneously performed, missing values are interpolated using the additive outlier approach.

NBACK = **0** (Default) No out-of-sample forecast test.

= **k<0** K a negative integer, then |k| 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 k 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.

NPRED = **k** a positive integer, # of multistep forecasts to compute for original series and components in TRAMO and SEATS. Default value = max (8, 2MQ).

When TRAMO and SEATS are both applied, the minimum number of forecasts computed is the default value. Thus the Forecast Horizon (**FH**) is equal to

- when only TRAMO is used FH = NPRED.
- when TRAMO and SEATS are executed,

  FH = max [NPRED, max (8, 2MQ)].

4.2.6 OTHER PARAMETERS

UNITS = **0** (Default) The units of the original series are preserved.

= **1** If the series units are too small (max $z_t \leq 10^{-3}$) or too large (min $z_t \geq 10^4$) the series is rescaled.

MODELSUMM = **0** (Default when NUMSER < 100) Parameter inactive.

= **1** (Default when NUMSER ≥ 100) A file with the aggregate summary results for the treated set of series is produced, as well as a set of graphs with histograms.

OUT = **0** (Default when NUMSER < 100) Full set of output files and graphs.

= **2** (Default when NUMSER ≥ 100) Summary results and graphs.

= **3** Summary results.

4.2.7 REGRESSION VARIABLES

IREG = **0** (Default) No regression variable.

= **k** A positive integer.

k = # of regression variables entered by the user (regvariables with IUSER = 1) + NSER for the variables entered as a matrix (with NSER columns) in an external file (for each regvariable with IUSER = -1) + # of "a priori" specified outliers (NSER in a single regvariable with IUSER = 2) + # intervention variables built by the program (regvariables with IUSER = 0, ISEQ > 0).

ILONG Length of regression variable.

= NZ + FH, where FH = Forecast Horizon.

IUSER = **1** The user will enter a series X(I), I=1..ILONG for this regression variable.

= **-1** The program will read **NSER** series from a file. There must be **NSER** columns of length ILONG in this file, containing the **NSER** series.

= **0** (Default) No regression variable when ISEQ=0. When ISEQ>0 the program will generate an intervention variable.

= **2** The user specifies the presence of NSER outliers. This is done by specifying a sequence of NSER pairs of number-string: (t1, j1) … (tNSER, jNSER), where t denotes the position of the outlier and j denotes the type of outlier according to the following code:

j = AO Additive Outlier
= LS Level Shift
= TC Temporary Change.

***Warning**: All "a priori" fixed outliers have to be included in a single regvariable with IUSER = 2 (i.e., no more regvariables with IUSER = 2 will be accepted).*

= **-2** The program will read the (moving) holidays series X(I), I=1..ILONG from a file. The holidays are incorporated to the Trading Day variable. *(Only applies to the 1 variable TD specification).*

REGEFF = **0** (Default) 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 assigned to the seasonally adjusted series, but as an additional separate component.

= **5** Regression effect assigned to transitory component.

= **6** Regression effect assigned to seasonal component as part of the calendar effect.

ISEQ = (k a positive integer) only when IUSER=0. The program will generate one intervention variable of length ILONG consisting of k-sequences of ones separated by zeroes. The user will provide k-pairs of numbers; the j-th pair indicates the time index where the j-th sequence of ones is to begin and its length, respectively.

= **0** (Default) The program will generate no intervention variable.

DELTA = **d** ($0 < d \leq 1$); the filter 1/(1-dB) will be applied to the k sequences of ones generated by the program.

= **0** (Default).

DELTAS= $\mathbf{d_S}$ ($0 < d_S \leq 1$); the filter $1/(1-d_S B_S)$, s=MQ, will be applied to the k sequences of ones generated by the program.

= **0** (Default).

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.

= **0** (Default).

NSER = **k** (k a positive integer) Number of series entered by the user in an external file (if IUSER=-1), or number of outliers entered by user (in regvariable with IUSER = 2).

= **1** If IUSER = 1, - 2, or 0 (with ISEQ > 0).

= **0** (Default).

4.3 Seats Parameters

XL = **.99** (Default) When the modulus of an estimated root falls in the range (XL,1), SEATS sets it 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 < k < 1.

EPSPHI = **3** (Default).

= **k** A real number. When the regular AR polynomial $\phi(B)$ contains a complex root, this root 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 transitory component.

RMOD = **.5** (Default).

= **k** (0 < real number < 1) Cutting point for the modulus of an AR real root. If modulus <k it goes to the transitory component; if $\geq$k, to the trend-cycle (positive roots) or to the seasonal component (negative roots).

NOADMISS = **0** (Default) When model does not accept an admissible decomposition, no approximation is made.

= **1** When model does not accept an admissible decomposition, it is automatically replaced with a decomposable one.

IQM = **k** 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, 6 it is equal to 4MQ; for MQ=1 it is equal to 8.

4.4 Terror Parameters

SENS = **0** High sensitivity

= **1** Medium sensitivity (Default)

= **2** Low sensitivity

The parameter SENS sets two parameters, k_1 and k_2 $(0 < k_1 \leq k_2)$. Let t = out-of-sample forecast error/standard deviation of in-sample residuals. Then, for a particular series,

If	$\|t\| > k_2$,	the new observation in the series is classified as "likely" to contain an error.
If	$k_1 < \|t\| \leq k_2$,	the new observation is classified as containing a "possible" error.
If	$\|t\| \leq k_1$,	the new observation is accepted as without error.

The values of k_1 and k_2 for the different levels of sensitivity are as follows:

SENS = 0	$k_1 = 3$	$k_2 = 4$
SENS = 1	$k_1 = 4$	$k_2 = 5$
SENS = 2	$k_1 = 5$	$k_2 = 6$

These values can be changed: by setting SENS $\geq$ 3, one can then enter the new values of k_1 and/or k_2.

NMATRIX = **0** The matrices in **Out-Matrix** are not computed.

= **1** (Default) The matrices that summarize the results for all series (see 3.10 a), are computed.

MINABS = **0** (Default) Parameter is inactive (all series will be considered).

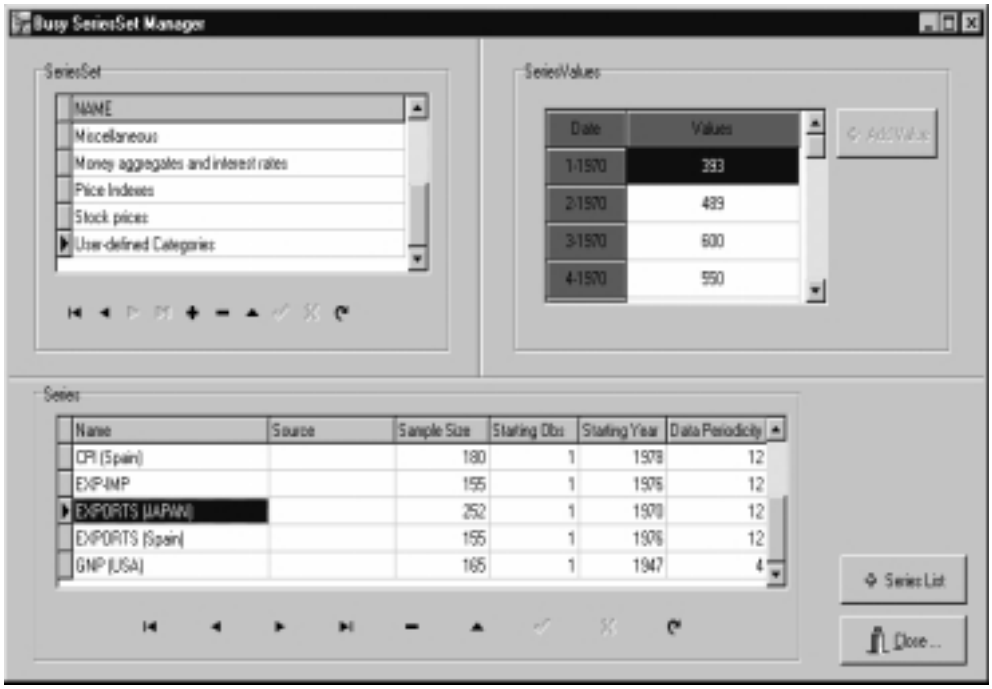
= **k** (real #>0). If, for a particular series, the absolute value of the forecast error (in original units) is < k, the series is not considered in the test for possible or likely errors.

5 Appendix

DATA BASE FACILITY: DBXPLORE

The database facility is intended to help in routine treatment of groups of series. The series are stored together with the model specification (orders of ARIMA model, date and type of outliers, type of TD/EE variables, set of regression variables). Then, a new observation can be added and the coefficients of the model saved updated.

Clicking in the button **DbXplore**, the user can access a DataBase screen. Three windows appear in it. The first one, **SeriesSet**, is related to the directories or records in which the DataBase is organized. When the user selects one of them, the second window, **Series**, will show the series in that directory. In the window **SeriesSet** several little buttons are available. The first button takes the user to the first directory of the DataBase. The second one takes the user to the previous directory, the third one, takes the user to the next directory, the fourth one takes the user to the last directory or record, the fifth one is used to insert a new directory, the sixth one is used to erase a directory, the seventh one permits the user to edit (change the name of the directory), the eighth one saves the change in a directory that has been edited, the ninth one cancels edition of the directory, and the last one refreshes the series of the directories.



The second window, **Series**, shows the name of the series, its sample size, starting observation, starting year and data periodicity. The small buttons in this window are similar to those in the window **SeriesSet**.

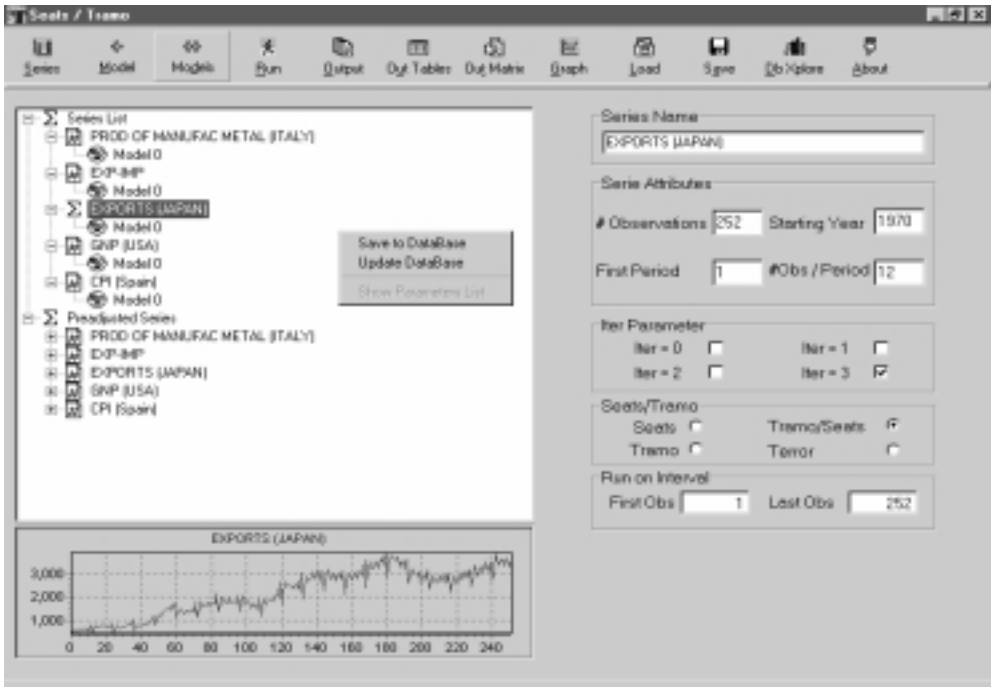
On the two tables you can navigate (scroll up, down), add records (Categories or Series), or remove and update them. It is also possible to add new series values. Some hidden tables are also defined (models, regs) which contain the model and regression

namelist associated to the series. It is possible to move/clone a series to a different SeriesSet (right-button mouse click on Series Grid).

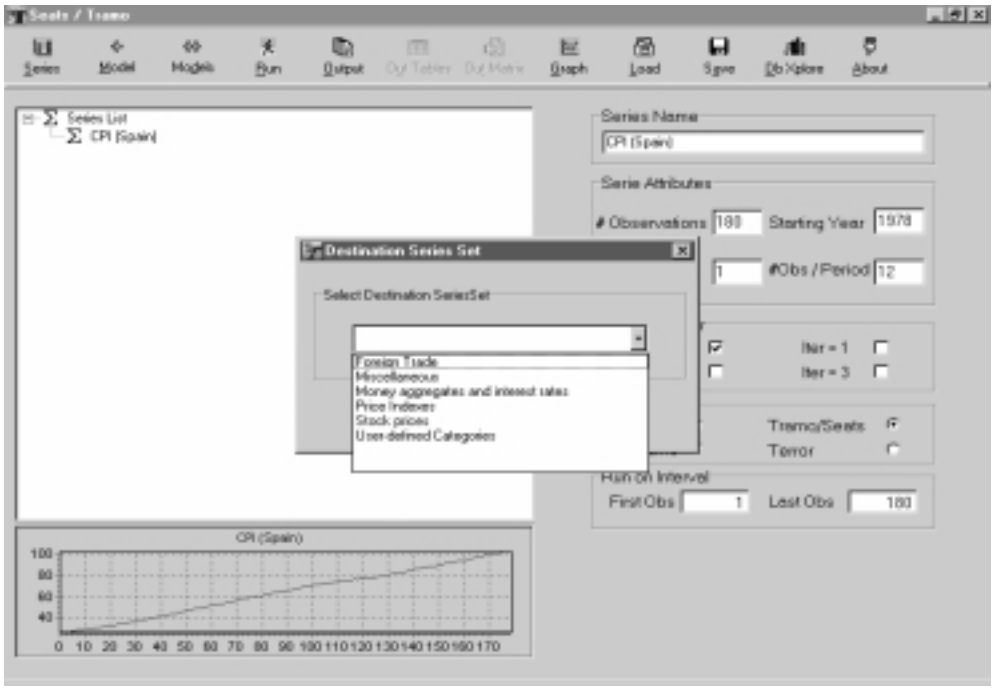
The third window of DbXplore is called **SeriesValue**. For the selected series, it shows the values of the series and the associated date.

When the user wants to run in TSW a series in the DataBase by pressing the button **+ Series List** and selecting the series, clicking on the left button of the mouse, an option called **Add to SeriesList** will appear in the screen. This option will take the series to the navigation tree of TSW. To select more than one series, use the Control key.

Alternatively, in order to add series in the Series List to the DataBase select the series (or the entire SeriesList) and right-mouse-click. A small window shows up with two options: **Save to DataBase** and **Update DateBase**. In the first case, the user can save a new series in the DataBase, and in the second case a series in the DataBase will be updated.



After selecting the option **Save to DataBase** a new small window appears indicating the DataBase directory in which the user wants to save the series. The DataBase gives the user several predefined directories; the user can of course create additional ones.



TSW offers to the user the possibility of editing a series in the DataBase. On the bottom of the screen there are several buttons. To edit a series press the (fourth from the right) **Edit Record** button, then the values of the series can be modified in the **SeriesValue** screen by clicking on the left button of the mouse. A new value can be added by clicking in the **+AddValue** button. The changes can be saved by clicking the **Post Record** button, which is to the right of **Edit Record**.

6 Index of INPUT Parameters