AN APPLICATION OF TRAMO AND SEATS

REPORT FOR THE «SEASONAL ADJUSTMENT RESEARCH APPRAISAL» PROJECT

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SUMMARY

The Seasonal Adjustment Research Appraisal committee was created in Italy to evaluate procedures for seasonal adjustment of economic series. Because the TRAMO-SEATS programs were one of the main procedures considered, the committee sent a selection of 11 series of interest to be analysed. This paper contains the results of the application of TRAMO and SEATS to these series. It is seen that very simple procedures, based mostly on the automatic features, provide parsimonious models and considerably good results, in terms of seasonal adjustment, trend-cycle estimation, and short-term forecast.

The paper contains first a summary of the two programs. Then the application is discussed, starting with the description of the series and the selection of the input parameters.

1. DESCRIPTION OF THE PROGRAMS

1.1 PROGRAM TRAMO

TRAMO ("**T**ime Series **R**egression with Arima Noise, **M**issing Observations and **O**utliers") is a program that performs estimation, forecasting, and interpolation in regression models with missing observations and ARIMA errors, in the presence of possibly several types of outliers. The ARIMA model can be identified automatically. (No restriction is imposed on the location of the missing observations in the series).

Given the vector of observations:

$$z = (z_{t_1}, ..., z_{t_M}) \tag{1}$$

where $0 < t_1 <...< t_M$, the program fits the regression model

$$z_t = y_t' \beta + v_t, \tag{2}$$

where $\beta = (\beta_1, ..., \beta_n)'$ is a vector of regression coefficients, $y_t' = (y_{1t}, ..., y_{nt})$ denotes n regression variables, and v_t follows the general ARIMA process

$$\phi(B)\,\delta(B)\,v_t = \theta(B)\,a_t, \tag{3}$$

where B is the backshift operator; $\phi(B), \delta(B)$ and $\theta(B)$ are finite polynomials in B, and a_t is assumed a n.i.i.d $(0, \sigma_a^2)$ white-noise innovation.

The polynomial $\delta(B)$ contains the unit roots associated with differencing (regular and seasonal), $\phi(B)$ is the polynomial with the stationary autoregressive roots, and $\theta(B)$ denotes the (invertible) moving average polynomial. In TRAMO, they assume the following multiplicative form:

$$\begin{aligned}
\delta(B) &= (1 - B)^d (1 - B^s)^D \\
\phi(B) &= (1 + \phi_1 B + ... + \phi_p B^p)(1 + \Phi_1 B^s + ... + \Phi_P B^{s \times P}) \\
\theta(B) &= (1 + \theta_1 B + ... + \theta_q B^q)(1 + \Theta_1 B^s + ... + \Theta_Q B^{s \times Q}),
\end{aligned}$$

where s denotes the number of observations per year. The model may contain a constant μ, equal to the mean of the differenced series $\delta(B)\,z_t$. In practice, this parameter is estimated as one of the regression parameters in (2).

The program:

1) estimates by exact maximum likelihood (or unconditional/conditional least squares) the parameters in (2) and (3);
2) detects and corrects for several types of outliers:
3) computes optimal forecasts for the series, together with their MSE;

4) yields optimal interpolators of the missing observations and their associated MSE; and
5) contains an option for automatic model identification and automatic outlier treatment.

The basic methodology followed is described in Gómez and Maravall (1994), Gómez and Maravall (1992), Gómez (1997), and Gómez, Maravall and Peña (1999).

Estimation of the regression parameters (including intervention variables and outliers, and the missing observations among the initial values of the series), plus the ARIMA model parameters, can be made by concentrating the former out of the likelihood, or by joint estimation. Several algorithms are available for computing the likelihood or more precisely, the nonlinear sum of squares to be minimized. When the differenced series can be used, the algorithm of Morf, Sidhu and Kailath (1974), with a simplification similar to that of Mélard, (1984), is employed. This simplification extends to multiplicative seasonal moving average models, a case discussed, but not implemented, in Mélard. For the nondifferenced series, it is possible to use the ordinary Kalman filter (default option), or its square root version (see Anderson and Moore, 1979). The latter is adequate when numerical difficulties arise; however it is markedly slower.

By default, the exact maximum likelihood method is employed, and the unconditional and conditional least squares methods are available as options. Nonlinear maximization of the likelihood function and computation of the parameter estimates standard errors is made using Marquardt's method and first numerical derivatives.

Estimation of regression parameters is made by using first the Cholesky decomposition of the inverse error covariance matrix to transform the regression equation (the Kalman filter provides an efficient algorithm to compute the variables in this transformed regression). Then, the resulting least squares problem is solved by applying the QR algorithm, where the Householder orthogonal transformation is used. This procedure yields an efficient and numerically stable method to compute GLS estimators of the regression parameters, which avoids matrix inversion.

For forecasting, the ordinary Kalman filter or the square root filter options are available. These algorithms are applied to the original series; see Gómez and Maravall (1993) for a more detailed discussion on how to build initial conditions on a nonstationary situation.
When concentrating the regression parameters out of the likelihood, mean squared errors of the forecasts and interpolations are obtained following the approach of Kohn and Ansley (1985).

The program has a facility for detecting outliers and for removing their effect; the outliers can be entered by the user or they can be automatically detected by the program, using an original approach based on those of Tsay (1986) and Chen and Liu (1993). The outliers are detected one by one, as proposed by Tsay (1986), and multiple regressions are used, as in Chen and Liu (1993), to detect spurious outliers. The procedure used to incorporate or reject outliers is similar to the stepwise regression procedure for selecting the "best" regression equation.

This results in a more robust procedure than that of Chen and Liu (1993), which uses "backward elimination" and may therefore detect too many outliers in the first step of the procedure.

In brief, regression parameters are initialized by OLS and the ARIMA model parameters are first estimated with two regressions, as in Hannan and Risannen (1982). Next, the Kalman filter and the QR algorithm provide new regression parameter estimates and regression residuals. For each observation, t-tests are computed for four types of outliers, as in Chen and Liu (1993). If there are outliers whose absolute t-values are greater than a pre-selected critical level C, the one with the greatest absolute t-value is selected. Otherwise, the series is free from outlier effects and the algorithm stops.

If some outlier has been detected, the series is corrected by its effect and the ARMA model parameters are re-estimated. Then, a multiple regression is performed using the Kalman filter and the QR algorithm. If there are outliers whose absolute t-values are greater than the critical level C, the one with the greatest absolute t-value is selected and the algorithm goes on to the estimation of the ARMA model parameters to iterate. Otherwise, the algorithm stops. A notable feature of this algorithm is that all calculations are based on linear regression techniques, which reduces computational time. The four types of outliers considered are additive outlier, innovational outlier, level shift, and transitory change.

The program also contains a facility to pretest for the log-level specification and, if appropriate, for the possible presence of Trading Day and Easter effects; it further performs an automatic model identification of the ARIMA model. This is done in two steps. The first one yields the nonstationary polynomial $\delta(B)$ of model (3). This is done by iterating on a sequence of AR and ARMA(1,1) models (with mean), which have a multiplicative structure when the data is seasonal. The procedure is based on results of Tiao and Tsay (1983, Theor. 3.2 and 4.1), and Tsay (1984, Corol. 2.1). Regular and seasonal differences are obtained, up to a maximum order of $\nabla^2 \nabla_s$.

The second step identifies an ARMA model for the stationary series (corrected for outliers and regression-type effects) following the Hannan-Rissanen procedure, with an improvement which consists of using the Kalman filter instead of zeros to calculate the first residuals in the computation of the estimator of the variance of the innovations of model (3). For the general multiplicative model

$$\phi_p(B)\,\Phi_P(B^s)\,x_t = \theta_q(B)\,\Theta_Q(B^s)\,a_t,$$

the search is made over the range $0 \le (p,q) \le 3$, $0 \le (P,Q) \le 2$. This is done sequentially (for fixed regular polynomials, the seasonal ones are obtained, and viceversa), and the final orders of the polynomials are chosen according to the BIC criterion, with some possible constraints aimed at increasing parsimony and favouring "balanced" models (similar AR and MA orders).

Finally, the program combines the facilities for automatic detection and correction of outliers and automatic ARIMA model identification just described in an efficient way, so that it performs automatic model identification of a nonstationary series in the presence of outliers when some observations may be missing.

Although TRAMO can obviously be used by itself, for example, as a forecasting program, it can also be seen as a program that polishes a contaminated "ARIMA series": That is, for a given time series, it interpolates the missing observations, identifies outliers and removes their effect, estimates Trading Day and Easter Effect, etc..., and eventually produces a linear purely stochastic process (i.e., the ARIMA model). Thus, TRAMO, can be used as a pre-adjustment process to SEATS, which decomposes then the "linearized series" and its forecasts into its stochastic components.

1.2 PROGRAM SEATS

SEATS ("**S**ignal **E**xtraction in **A**RIMA **T**ime **S**eries") is a program that falls into the class of so-called ARIMA-model-based methods for decomposing a time series into its unobserved components (i.e., for extracting from a time series its different signals). The method was originally devised for seasonal adjustment of economic time series (i.e., removal of the seasonal signal), and the basic references are Cleveland and Tiao (1976), Box, Hillmer and Tiao (1978), Burman (1980), Hillmer and Tiao (1982), Bell and Hillmer (1984), and Maravall and Pierce (1987). An early related approach is contained in Piccolo and Vitale (1981). These approaches are closely related to each other and to the one followed in this program. In fact, parts of SEATS developed from a program built by Burman for seasonal adjustment at the Bank of England.

The program may also start by fitting an ARIMA model to the series. In agreement with TRAMO, the complete model can be written in detailed form as

$$\phi_p(B)\,\phi_P(B^s)\,\nabla^d\,\nabla_s^D\,x_t = \theta_q(B)\,\theta_Q(B^s)\,a_t + c, \tag{4}$$

and, in concise form, as

$$\Phi(B)\,x_t = \theta(B)\,a_t + c, \tag{5}$$

where $\Phi(B) = \phi(B)\,\delta(B)$ represents the complete autoregressive polynomial, including all unit roots. The autoregressive polynomial $\phi(B)$ is allowed to have unit roots, which are typically estimated with considerable precision. For example, unit roots in $\phi(B)$ would be present if the series were to contain a nonstationary cyclical component, or if the series had been underdifferenced. They can also appear as nonstationary seasonal harmonics.

The program decomposes a series that follows model (4) into several components. The decomposition can be multiplicative or additive. Since the former becomes the second by taking logs, we shall use in the discussion an additive model, such as

$$x_t = \sum_i x_{it}, \tag{6}$$

where x_{it} represents a component. The component that SEATS considers are:

x_{pt} = the TREND component,
x_{st} = the SEASONAL component,
x_{ct} = the TRANSITORY component,
x_{ut} = the IRREGULAR component.

Broadly, the trend component represents the long-term evolution of the series and displays a spectral peak at frequency 0; the seasonal component, in turn, captures the spectral peaks at seasonal frequencies. Besides capturing periodic fluctuation with period longer than a year, associated with a spectral peak for a frequency between 0 and $(2\pi / s)$, the transitory component also captures short-term variation associated with low-order MA components and AR roots with small moduli. Finally, the irregular component captures erratic, white-noise behaviour, and hence has a flat spectrum. The components are determined and fully derived from the structure of the (aggregate) ARIMA model for the observed series, which can be directly identified from the data. The program is mostly aimed at monthly or lower frequency data and the maximum number of observations is 600.

The decomposition assumes orthogonal components, and each one will have in turn an ARIMA expression. In order to identify the components, we require that (except for the irregular one) they be clean of noise. This is called the "canonical" property, and implies that no additive white noise can be extracted from a component that is not the irregular one. The variance of the latter is, in this way, maximized, and, on the contrary, the trend, seasonal and transitory components are as stable as possible (compatible with the stochastic nature of the model.) Although an arbitrary assumption, since any other admissible component can be expressed as the canonical one plus independent white-noise, it has some justification. (Moreover, the component estimates for any other admissible decomposition can be obtained from the canonical ones simply by removing a constant fraction of the irregular component estimate and adding it to the trend and/or seasonal ones.)

The model that SEATS assumes is that of a linear time series with gaussian innovations. In general, SEATS is designed to be used with the companion program, TRAMO. In this case, SEATS uses the ARIMA model to filter the linearized series, obtains in this way new residuals, and produces a detailed diagnosis of them. The program proceeds then to decompose the ARIMA model. This is done in the frequency domain. The spectrum (or pseudospectrum) is partitioned into additive spectra, associated with the different components. (These are determined, mostly, from the AR roots of the model.) The canonical condition on the trend, seasonal, and transitory components identifies a unique decomposition, from which the ARIMA models for the components are obtained (including the component innovation variances).

For a particular realization $[x_1, x_2, ..., x_T]$, the program yields the Minimum Mean Square Error (MMSE) estimators of the components, computed with a Wiener-Kolmogorov-type of filter applied to the finite series by extending the latter with forecasts and backcasts (see Burman, 1980). For $i = 1, ..., T$, the estimate $\hat{x}_{it|T}$, equal to the conditional expectation $E(x_{it} \mid x_1, ..., x_T)$, is obtained for all components.

When $T \to \infty$, the estimator $\hat{x}_{it|T}$ becomes the "final" or "historical" estimator, which we shall denote $\hat{x}_{it}$. (In practice, it is achieved for large enough $k = T - t$, and the program indicates how large k can be assumed to be.) For $t = T$, the concurrent estimator, $\hat{x}_{iT|T}$, is obtained, i.e., the estimator for the last observation of the series. The final and concurrent estimators are the ones of most applied interest. When $T - k < t < T$, $\hat{x}_{it|T}$ yields a preliminary estimator, and, for $t > T$, a forecast. Besides their estimates, the program produces several years of forecasts of the components, as well as standard errors (SE) of all estimators and forecasts. For the last two and the next two years, the SE of the revision the preliminary estimator and the forecast will undergo is also provided. The program further computes MMSE estimates of the innovations in each one of the components.

The joint distribution of the (stationary transformation of the) components and of their MMSE estimators are obtained; they are characterized by the variances and auto- and cross-correlations. The comparison between the theoretical moments for the MMSE estimators and the empirical ones obtained in the application yields additional elements for diagnosis (see Maravall, 1987). The program also presents the Wiener-Kolmogorov filter for each component and the filter which expresses the weights with which the different innovations a_j in the observed series contribute to the estimator $\hat{x}_{it|T}$. These weights directly provide the moving average expressions for the revisions. Next, an analysis of the estimation errors for the trend and for the seasonally adjusted series (and for the transitory component, if present) is performed. Let

$$d_{it} = x_{it} - \hat{x}_{it},$$

$$d_{it|T} = x_{it} - \hat{x}_{it|T},$$

$$r_{it|T} = \hat{x}_{it} - \hat{x}_{it|T},$$

denote the final estimation error, the preliminary estimation error, and the revision error in the preliminary estimator $\hat{x}_{it|T}$. The variances and autocorrelation functions for d_{it}, $d_{it|t}$, $r_{it|t}$ are displayed. (The autocorrelations are useful to compute SE of linearized rates of growth of the component estimator.) The program then shows how the variance of the revision error in the concurrent estimator $r_{it|t}$ decreases as more observations are added, and hence the time it takes in practice to converge to the final estimator. Similarly, the program computes the deterioration as the forecast moves away from the concurrent estimator and, in particular, what is the expected improvement in Root MSE associated with moving from a once-a-year to a concurrent seasonal adjustment practice. Finally, the SE of the estimators of the linearized rates of growth most closely watched by analysts are presented, for the concurrent estimator of the rate and its successive revisions, both for the trend and seasonally adjusted series. Further details can be found in Maravall (1988, 1995) and Maravall and Gómez (1992).

The default model in SEATS is the so-called Airline Model, analysed in Box and Jenkins (1970). The Airline Model is often found appropriate for actual series, and provides very well behaved estimation filters for the components. It is given by the equation

$$\nabla\nabla_{12} x_t = (1 + \theta_1 B)(1 + \theta_{12} B^{12}) a_t + c,$$

with $-1 < \theta_1 < 1$ and $-1 < \theta_{12} \leq 0$, and x_t may be the log of the series. The implied components have models of the type

$$\nabla^2 x_{pt} = \theta_p(B)\, a_{pt},$$

$$S\, x_{st} = \theta_s(B)\, a_{st},$$

where $S = 1 + B + \ldots + B^{11}$, and $\theta_p(B)$ and $\theta_s(B)$ are of order 2 and 11, respectively. Compared to other fixed filters, the default model allows for the observed series to estimate 3 parameters: θ_1, related to the stability of the trend component; θ_{12}, related to the stability of the seasonal component; and σ_a^2, a measure of the overall predictability of the series. Thus, to some extent, even in this simple fixed model application, the filters for the component estimators adapt to the specific structure of each series.

Programs TRAMO and SEATS provide a fully model-based method for forecasting and signal extraction in univariate time series. (The relation between them is somewhat similar to the one between the programs REGARIMA and X11 ARIMA that form the new method X12 ARIMA; see Findley et al, 1998.) The procedure is flexible, yet robust and reliable. Due to the model-based features, it becomes a powerful tool for detailed analysis of important series in short-term policy making and monitoring. Yet TRAMO-SEATS can efficiently be used for routine application to a large number of series. For this routine-application case, fully automatic procedures are available. The standard procedure pretests for the log-level specification and, if appropriate, for the possible presence of Trading Day and Easter effects; it further performs an automatic model identification and outlier detection and correction procedure (for several types of outliers), interpolates the missing values if any, and decomposes the series net of the previous (deterministic) effects into a seasonal, trend, transitory, and irregular stochastic components (If the identified ARIMA model does not accept an admissible decomposition, it is automatically replaced by a decomposable approximation). Finally, the components (and forecasts thereof) estimated by SEATS are modified to reincorporate the deterministic effects that were removed by TRAMO.

2. THE APPLICATION

2.1 THE SERIES AND SOME GENERAL COMMENTS ON THE EXERCISE

The SARA committee sent a set of eleven monthly italian series; they are listed in Table 1.

Table 1: Description of the series

Name	Meaning	Sample Period	No. of observation	Abbreviation
BDEGENGS	New orders and demand level on foreign markets. Balance.	1986/1 - 1996/12	132	BDE
BDIGENGS	New orders and demand level on domestic markets. Balance.	1986/1 - 1996/12	132	BDI
LGOLTOGI	Index of total employment in large firms.	1989/1 - 1996/11	95	LGO
PCOBENGP	Consumer price index. Goods.	1989/1 - 1996/12	96	PCO
PPIGENGP	Producer price index. Total Industry.	1981/1 - 1996/12	192	PPI
CITGENGQ	Imports. Quantity index.	1980/1 - 1996/10	202	CIT
CETGENGQ	Exports. Quantity index.	1980/1 - 1996/10	202	CET
IPIENGT	Industrial production index. Total.	1981/1 - 1996/12	192	IPI
IPIINVGT	Industrial production index. Investment goods.	1981/1 - 1996/12	192	IPIIN
IFAGENGE	Index of industrial turnover. Foreign market.	1985/1 - 1996/12	144	IFAE
IFAGENGN	Index of industrial turnover. Domestic market.	1985/1 - 1996/12	144	IFAN

The number of observations vary between a minimum of 95 months (about 8 years) and a maximum of 202 (nearly 17 years). The 11 series can be classified into 5 groups. BDE and BDI are demand indicators; PCO and PPI are price indices; CIT and CET are foreign trade series; IPI, IPIIN, IFAE , and IFAN are industry related indicators; finally, LGOL is an employment index.

I understood that the purpose of the exercise was to decompose the series for the complete period, and hence took the sample size as fixed. It is a fact that a few of the series display some in-sample unstability associated with the early years of the sample, and for these series the results could improve by cutting the first years. (This is true of the series CET and CIT and, to a lesser degree, PCO and PPI.). But even in this case, the results are quite similar and the differences relatively minor. Further, besides their names and the period they span, nothing else was known "a priori" on any of the series.

Given that the most relevant audience of the SARA committee are likely to be data producing agencies and institutions, a very important criterion seemed to be the SIMPLICITY OF THE PROCEDURE, reflected in a close to fully automatic functioning, where very few decisions have to be taken by the analyst on the individual series. We shall stick thus to mostly automatic procedures, where the only decisions allowed concern the specification of the trading day and easter effects, and the significance level for outlier detection. The results of this basically automatic procedure are, in all cases, acceptable. We shall see how, on occasion, they can be nevertheless improved.

A final comment: the present version of TRAMO contains a facility that provides the series of holidays for the different european countries. Since we have maintained the June 98 version of the program, the series of holidays have been added as a regression variable. One effect of including this variable is that, due to the correlation it displays with the easter variable, it decreases the significance of the easter effect.

2.2 THE PROCEDURE

To get a first general picture of the structure of the original series and, in particular, to assess whether trading day (TD), easter (EE) and holiday (HOL) effects should be included in the model, I run the 11 series with the input file

$$\text{RSA} = 4 \quad , \quad \text{IREG} = 1 \tag{I.1}$$

The regression variable was entered with IUSER = -1 and, given that it contains holidays, REGEFF = 2 (its effect are allocated to the seasonal component). For the rest of the paper, whenever the input file contains IREG = 1, the regression variable is entered in the same way.

Table 2 displays the results of the pre-test for TD and EE, as well as the t-value of the coefficient of the holiday variable when significant. It is seen that in no case easter effect appears to be significant, that trading day is moderately significant for the foreign trade series and that both trading day and holiday effects are significant for the industrial indicator series.

Table 2: Trading Day and Easter effect pretests; significance of holidays

SERIE	TRADING DAY	EASTER	HOLIDAY(*)
BDE	NO	NO	NO
BDI	NO	NO	NO
LGOL	NO	NO	NO
PCO	NO	NO	NO
PPI	NO	NO	NO
CIT	YES	NO	NO
CET	YES	NO	NO
IPI	YES	NO	-5.04
IPIIN	YES	NO	-5.15
IFAE	YES	NO	-2.16
IFAN	YES	NO	-2.56

(*) Since the holiday variable is entered as a regression, the t-values are reported ("NO" means | . | < 1.96).

With these preliminary results concerning the presence or absence of special effects, I proceed now to discuss the results for the individual series. The point of the exercise is not to seek the "best possible" model, but to assess the performance of the automatic features. Thus in all 11 cases the automatic-option RSA-parameters are used. All will share the following characteristics:

- **Automatic test for the log/level specification.**
- **Automatic model identification.**

The ARIMA part of the model belongs to the general class

$$\phi_P (B)\ \phi^s_{BP} (B^{12})\ (\nabla^D \nabla^{BD}_{12}\ x_t - \mu) = \theta_Q (B)\ \theta^s_{BQ} (B^{12})\ a_t,$$

where $\phi_P (B)$, $\phi^s_{BP} (B^{12})$, $\theta_Q (B)$, and $\theta^s_{BQ} (B^{12})$ are the regular AR polynomial (of order P), the seasonal AR polynomial (of order BP), the regular MA polynomial (of order Q), and the seasonal MA polynomial (of order BQ), respectively. D and BD are the orders of the regular and seasonal differences, μ is the mean of the differenced series, and a_t is a white-noise innovation. Automatic model identification determines:

* whether $\mu = 0$,
* the values of P, BP, D, BD, Q, BQ.

- **Automatic outlier detection**. This is done jointly with automatic model identification. Three types of outliers are considered:

  * Additive outlier (AO).
  * Transitory change (TC).
  * Level shift (LS).

  AO represents a spike, TC is a spike that disappears (exponentially) over several periods, and LS is a step function.

- The model finally identified, consisting of:

  ARIMA model + Outliers + Special effects (TD, EE, and HOL, if present)

  is estimated by exact maximum likelihood, concentrating out of the likelihood the variance of a_t, σ_a^2, the mean, μ, and the regression variables (outliers plus special effects).

- The series is decomposed into a trend-cycle component, p_t, a seasonal component, s_t, an irregular component, u_t and, on occasion, a transitory component, c_t. (When logs are used, the components are expressed as factors.) Two years of forecasts are provided for the series and its components.

2.3 THE SELECTION OF THE INPUT PARAMETERS; SOME BASIC RESULTS

Table 3 presents the input namelists considered for the 11 series; for 5 of them a reasonable alternative is provided. Table 4 displays the basic traits of the models identified. Table 5 exhibits the ARIMA model parameter estimates, Table 6 contains the outliers (data, type of outlier, and t-value), and Table 7 presents the residual root mean squared error (RMSE) and the Bayesian Information Criterion (BIC) for the 16 models.

Finally, Tables 8 and 9 display some basic diagnostics; Table 8 presents the results of tests for autocorrelation and normality of the residuals, and Table 9 shows the out-of-sample forecast F-test for each series when the last 12 and 18 observations are removed. These F-tests were carried out by fixing the models obtained for the shorter sample, estimated for the linearized series.

Starting with the demand indicators, for the series BDE the input namelist (I.1) indicated that the purely automatic procedure RSA = 3 seemed appropriate, and this is in fact the case, as evidenced by the first row of the Tables 4 to 9. For the series BDI, the same is true. RSA = 3 yields a satisfactory model. However, when used by SEATS, it does not accept an admissible decomposition. SEATS approximates the model by a decomposable one and the approximation amounts to a slight increase in the irregular component. The results would be clearly acceptable in any standardized automatic procedure (see the corresponding tables and figures summarizing the output of SEATS). If manual intervention is allowed, one may be interested in replacing the nondecomposable model in a more carefill manner, and proceed as follows. RSA = 3 yields the model

$$\nabla \nabla_{12} x_t = (1 - .248 B + .105 B^2 + .284 B^3)(1 - .980 B^{12}) a_t .$$

The regular MA(3) polynomial factorizes into the product of the root (1 + .5375 B) and an MA(2) with a complex conjugate solution. The nonadmissibility of the model,as often happens, is due to the fact that the order of the total MA polynomial is larger than that of the total AR one (what Burman calls "top heavy" models). Moving towards a more balanced model (which tend to decompose better,) it seems sensible to invert the MA(1), leaving a regular MA(2) specification. Estimation yields the model

$$(1 -.791 B) \nabla \nabla_{12} x_t = (1 - 1.050 B + .431 B^2)(1 - .987 B^{12}) a_t ,$$

which, as seen in the tables, gives very good results, slightly better than the pure automatic option. The AR(1) factor in this last model is assigned to the trend.

Moving to the employment in large firms series LGO, the absence of special effects again leads to the purely automatic procedure RSA = 3. Some problems with nonnormality are removed by lowering the threshold level for outlier detection to VA = 3.3. Unfortunately, the one-before-last observation is identified as an outlier, and this may produce unstability for the few next periods. Entering the parameter INT2 = -2, the one-before-last observation is flagged, but not corrected. No alternative model seems worth discussing.

The automatic procedure RSA = 3 works also well for the price series. For PCO the model identified by TRAMO performs very well but, as was the case with the series BDI, the model cannot be decomposed into an admissible decomposition. The approximation that SEATS provides is good, even better than for the BDI case. Still, as before, we may seek for an alternative model that can be decomposed. The model identified by TRAMO is a (0, 1, 2) (0, 1, 1)$_{12}$ model, with the solution of the MA(2) again a pair of complex conjugate roots (which do not factorize). Reasoning as before, a sensible alternative is to invert the regular MA(2) and estimate a (2, 1, 0) (0, 1, 1)$_{12}$ model. This yields the model

$$(1 - .276 B - .232 B^2) \nabla \nabla_{12} x_t = (1 - .737 B^{12}) a_t .$$

Since the MA (2) implies a minimum for ω close the middle of the $(0, \pi)$ frequency range, the AR(2) should imply a peak for $\omega = 0$ and a peak for $\omega = \pi$. This is indeed the case since the AR(2) factorises into (1 - .639B) (1 + .364 B). The alternative model does not improve the results, nor does it deteriorate them. It serves, however, to illustrate a feature of SEATS worth mentioning. The AR(2) root (1 - .639 B) is assigned to the trend, and the root (1 + .364 B), because its modulus is smaller than .5 (the default value of RMOD) is assigned to a "transitory component", c_t, which is found to follow the model

$$(1 + .364 B) c_t = (1 - B) a_{ct} , \quad V(a_c) = .0083 \; V_a .$$

As the figures show, this transitory component is small and highly erratic. Its role is to remove erraticity from the trend-cycle and seasonal component, so as to improve their smoothness. For most practical purposes this transitory component can be added to the irregular component u_t.

For the series PPI, the results of the automatic procedure RSA = 3 are clearly improved by lowering VA to VA = 3.1. It may be worth mentioning that, in my experience, if something can be added to the fully automatic RSA parameter, the first thing to consider is outliers. If the series does not already contain a relative large number of outliers for the default value of VA (3.5 in all our cases), then it is worth looking for the next outlier (and perhaps ignore it). Very "a grosso modo", I would consider a large number of outliers something in the order of more than 3 outliers per 100 observations (LGO would be in the limit).

The rest of the series (foreign trade and industrial indicators) are all subject to TD effect. For most cases, the original specification RSA = 4 has been preserved, so that ITRAD = 1 and weekdays are classified into only 2 groups: working and non-working days.

For the quantity index of imports, CIT, the regression HOL is not significant. The input namelist RSA = 4, VA = 3.4 yields good results although, as Table 8 indicates, normality of the residuals is rejected, and this is due to a relatively high kurtosis. In general, kurtosis in the residuals and the associated nonnormality are not a serious problem. The estimators from SEATS are still optimal (see Bell, 1984). Point estimators of the components remain unchanged; what should change are the standard errors of the estimators computed by SEATS, which should be slightly increased.

EE is not detected as significant. A small search over the values of IDUR (the parameter that controls the number of days affected by easter) shows that IDUR = 4 is usually preferable to higher values for the italian series. In fact, forcing the EE variable with this value of IDUR yields a value of t = -2.2. Now all tests are passed, nonnormality has disappeared, and the RMSE (a_t) and BIC are slightly better. Therefore, for CIT we select the two input namelists in rows 8 and 9 of Table 3.

Concerning the quantity export index CET, a similar reasoning applies, except for the fact that normality of the residuals is in this case comfortably accepted. First, I consider the input namelist that uses RSA = 3, imposes TD (the t-value is 1.8), and uses VA = 3. The alternative input namelist also imposes IEAST = 1 IDUR = 4. Although the associated t-value is small (- 1.6), including it improves the overall results a bit. The two input namelists are given in rows 10 and 11 of Table 3. The model obtained with the alternative specification is given by

$$(1 - .630\,B - .265\,B^2)\,(\nabla_{12} \log x_t - .049) = (1 - .668\,B)\,(1 - .425\,B^{12})\,a_t.$$

The AR (2) polynomial factorises into the product of the root (1 - .918), which will be assigned to the trend, and the root (1 + .288 B). Because the modulus of this second root is smaller than .5, as was the case for the PCO alternative model, it will be assigned to a "transitory component", given by

$$(1 + .288\ B)\ c_t = (1 + B)\ a_{ct}\ ,\ V(a_{ct}) = .0552\ V_a.$$

Although the component is now more important, the same comment made for the PCO case applies.

For the 4 industrial indicator series, TD effect is highly significant and HOL effect is also clearly significant. When EE is added, the results deteriorate. (The fact that EE is more significant than HOL for the foreign trade series, while the contrary is true for the industrial production series may have a very simple explanation. Different countries often share easter periods; holidays are more variable. For a particular country, the total number of holidays influences production more than the easter period.) For the IPI series, the first input namelist is given by (I.1) with VA = 3.2 added. The second namelist changes RSA = 4 to RSA = 6, and uses thus a 6 variable specification for the TD variable (i.e., it assumes different effects for the 5 working days of the week). As Table 4 to 9 show, the results of the models are about equivalent. As for the index for investment goods, IPIIN, the original input namelist (RSA = 4, IREG = 1) provides results that are acceptable. Similarly to the case of the series CIT, the residuals of IPIIN cannot be accepted as normally distributed and, given that 5 outliers are identified with the default value of VA, I would be reluctant to lower this value. Although the residuals have a symmetric distribution, kurtosis is high. As was mentioned before, this feature does not invalidate point estimates and, considering the excellent out-of-sample performance of the model (Table 9), the input parameters are left unchanged.

One striking feature of the industrial production index series is the fact that the outliers are concentrated in the month of August. The two series share outliers for August 84, 92 and 95; IPI contains an additional outlier for August 87, and IPIIN for August 88. Except for one case, all outlier are AO; half of them positive, half of them negative.

Although 4 or 5 outliers in 200 observation is not an excessive number, the fact that 4 of the 16 months of August present in the sample are detected as outliers points towards the presence of some heteroscedasticity in the seasonal component. This fact has been pointed out by Proietti (1998), who deals with the problem using a state space approach. An alternative approach that appears to work well within the TRAMO framework is the introduction of seasonal outliers (see Kaiser and Maravall, 1999). In any event, these are 2nd order improvements, with little effect on point estimators. The results of TRAMO-SEATS seem satisfactory, and this is strongly corroborated by the corresponding 6 F-tests for out-of-sample performance in Table 9.

If the industrial production indices are modelled in levels, not in logs, the trend-cycle becomes less smooth and the "august outlier" problem disappears. From the comparison of the full results, one could conclude that, for these two series, the levels are perhaps more appropriate to model than the logs. In fact, the next version of TRAMO will include a modified log/level pretest, which will be, by default, slightly less favourable to the choice of the logs, and which will allow the user to enter his/her own preference. At present, given that I wish to stick to the automatic application, I choose the input namelists of rows 12, 13, and 14 of Table 3, bearing in mind that the drops in the month of August are particularly volatile (I wonder if this feature could not be perhaps related to the business cycle ...)

Finally, for the two industrial turnover series, the number of outliers is relatively small. For the series IFAN, the original input namelist (RSA = 4, IREG = 1) is kept. For the series IFAE RSA is changed from 4 to 6 because the results were clearly better; further VA is set to 3.2. The two input lists are in rows 15 and 16 of Table 3. The Q-statistics for the ACF of the residuals of IFAE (see Table 8) is slightly high. By lowering VA and increasing the outliers to 5, it becomes perfectly clean. The high value of Q, however, is caused by the single autocorrelation $\rho_{13} = -.24$, and hence of not much concern. Removing this autocorrelation at the cost of adding 3 outliers does not seem worth it.

These comments justify the 16 input namelists of Table 3. Besides the automatic features mentioned earlier (RSA = 3, 4, or 6), the only additional options that have been considered are:

* IEAST = 1 , IDUR = 4 in 2 cases.
* VA = a value between 3 and 3.5 for all cases.
* INT2 = - 2 in one case.
* IREG = 1 in the last 5 models.

In summary, the presence or absence of special effects can be determined (at least partly) automatically by looking at the results of the pretests with RSA = 4, as we did. Besides some possible modification (such as, in our case, to force on some occasion the inclusion of EE), the only action required from the user is to chose a value of VA between 3 and the default value 3.5.

When the series are going to be routinely treated, it should be emphasized that the input files of Table 3 provide only starting points. Once the models are identified (and, presumably, have passed the diagnostics), their structure should remain fixed for some time (perhaps a year, unless something very special happens). After this period of (say) a year, the models should be reidentified with the 12 new observations. Fixing the model for a period means:

* Fix μ, (p d q), (BP BD BQ) and the log/level transformation.
* Fix the type and position of outliers (through IUSER = 2).
* Fix the presence or absence of trading day, easter effect, and holidays.
* And, every month, reestimate the coefficients.

As seen in Dossé and Planas (1998), proceeding in this way provides an optimal mixture of flexibility and stability. (For a more complete description of the procedure, see the appendix in Gómez and Maravall, 1998).

One final point: As mentioned earlier, the time span of the series was kept always equal to the one supplied by the SARA committee. This would be in line with routine application to data bases. When looking at an individual series, of course, one can always drop some first years if a change in regime is detected. Looking at the figures with the estimates of the components it is clear that this might well be the case for some of the series considered. In particular, both foreign trade series show a change in regime, whereby the first years contain a larger irregular component and smaller seasonal fluctuations. It may also apply to the two series of prices, where a change in the seasonal component is clearly appreciated.

Table 3: Input Namelists

Series	Parameters
BDE	RSA = 3
BDI BDI2	RSA = 3 P = 1, Q = 2, IMEAN = 0, IATIP = 1, LAM = 1
LGO	RSA = 3, VA = 3.3, INT2 = - 2
PCO PCO2	RSA = 3 P = 2, Q = 0, IMEAN = 0, LAM = 1, IATIP = 1
PPI	RSA = 3, VA = 3.1
CIT CIT2	RSA = 4, VA = 3.4 RSA = 3, ITRAD = 1, IEAST = 1, IDUR = 4
CET CET2	RSA = 3, ITRAD = 1, VA = 3 RSA = 3, ITRAD = 1, IEAST = 1, IDUR = 4, VA = 3.3
IPI IPI2	RSA = 4, VA = 3.2, IREG = 1 RSA = 6, VA = 3, IREG = 1
IPIIN	RSA = 4, IREG = 1
IFAE	RSA = 6, VA = 3.2, IREG = 1
IFAN	RSA = 4, IREG = 1

Table 4: Identified Models

Series(*)	Number of observ.	Transformati on	Model	Outliers			Special effects		
				AO	TC	LS	TD(**)	EE	HOL(**)
BDE	132	Level	(***)	-	-	2	-	-	-
BDI	132	Level	$(0,1,3)\ (0,1,1)_{12}$	-	-	-	-	-	-
[BDI2	"	"	$(1,1,2)\ (0,1,1)_{12}$	-	-	-	-	-	-]
LGO	95	Level	$(1,1,0)\ (0,1,1)_{12}$	-	1	3	-	-	-
PCO	96	Level	$(0,1,2)\ (0,1,1)_{12}$	-	-	-	-	-	-
[PCO2	"	"	$(2,1,0)(0,1,1)_{12}$	-	-	-	-	-	-]
PPI	192	Level	$(1,1,1)(0,1,1)_{12}$	1	2	1	-	-	-
CIT	202	Log	(***)	3	1	1	5.9	-	-
[CIT2	"	"	(***)	4	1	1	6.1	-2.2	-]
CET	202	Log	(***)	3	-	1	1.8	-	-
[CET2	"	"	$(2,0,1)\ (0,1,1)_{12}$ with mean	2	2	-	1.5	-1.6	-]
IPI	192	Log	(***)	3	-	1	17.7	-	-6.0
[IPI2	"	"	(***)	4	-	1	6 var	-	-6.9]
IPIIN	192	Log	(***)	5	-	-	14.7	-	-5.2
IFAE	144	Log	(***)	2	-	-	6 var	-	-2.5
IFAN	144	Log	(***)	2	-	1	16.9	-	-2.6

(*) The rows in brackets represent reasonable alternatives.

(**) t-values are given, except when the TD effect has the 6 variable specification.

(***) Model is Airline model. For all cases $\mu = 0$.

Table 5: ARIMA model parameter estimates

Series	ϕ_1	ϕ_2	θ_1	θ_2	θ_3	θ_{12}
BDE	-	-	-.321	-	-	-.931
BDI	-	-	-.248	.105	-.284	-.980
BDI2	-.791	-	-1.050	.431	-	-.987
LGO	-.674	-	-	-	-	-.896
PCO	-	-	.342	.421	-	-.811
PC02	-.276	-.232	-	-	-	-.737
PPI	-.848	-	-.302	-	-	-.494
CIT	-	-	-.674	-	-	-.502
CIT2	-	-	-.665	-	-	-.485
CET	-	-	-.807	-	-	-.539
CET2	-.630	-.265	-.668	-	-	-.425
IPI	-	-	-.583	-	-	-.598
IPI2	-	-	-.541	-	-	-.569
IPIIN	-	-	-.544	-	-	-.622
IFAE	-	-	-.373	-	-	-.564
IFAN	-	-	-.393	-	-	-.469

The polynomials are written as:

$$(1 + \phi_1 B + \phi_2 B^2)\ ,\ (1 + \theta_1 B + \theta_2 B^2 + \theta_3 B^3)\ ,\ (1 + \theta_{12} B^{12})\ .$$

Table 6: Outliers

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	TOTAL
BDE														9 LS 4.1			3 LS -3.9	2
BDI																		0
BDI2																		0
LGO													9 TC -7.8	12 LS -5.8	12 LS -7.4		1 LS 4.6	4
PCO																		0
PCO2																		0
PPI						12 TC 3.5			1 10 TC AO -5.7 -3.2		8 LS 3.9							4
CIT			1 TC 3.7	1 4 6 AO AO LS 6.7 5.1 3.8		12 AO 4.4												5
CIT2		3 AO -3.6	1 TC 3.5	1 4 5 AO AO LS 6.7 -4.9 3.9		12 AO 4.6												6
CET		4 LS 3.7	12 AO -3.1		6 AO -3.1	12 AO 3.4												4
CET2		3 9 AO TC -4.3 4.1			6 AO -3.6	12 TC 3.8												4
IPI					8 AO 4.9			8 AO -3.3					8 LS -3.4			8 AO 4.5		4
IPI2					8 AO 4.3		8 AO -3.4	8 AO -4.0					8 LS -3.5			8 AO 4.7		5
IPIIN					8 AO 4.5				8 AO 4.1				8 AO -6.6			8 12 AO AO 5.5 3.8		5
IFAE						8 AO 3.0							8 AO -6.6					2
IFAN								3 LS 4.1			8 AO 4.1	1 AO 3.9						3

First line: month of the year (1 for January, 12 for December)
Second line: type of outlier.
Third line: t-value.

Table 7: Residual Root Mean Squared Error and Bayesian Information Criterion

Series	RMSE (a_t)	BIC
BDE	4.8367	3.28
BDI	3.5336	2.65
BDI2	3.4560	2.61
LGO	0.1503	-3.54
PCO	0.1587	-3.56
PC02	0.1647	-3.49
PPI	0.2577	-2.55
CIT	0.0697	-5.15
CIT2	0.0673	-5.17
CET	0.0761	-5.00
CET2	0.0717	-5.02
IPI	0.0244	-7.24
IPI2	0.0236	-7.17
IPIIN	0.0413	-6.16
IFAE	0.0362	-6.32
IFAN	0.0263	-7.07

Table 8: Residual Diagnostics

Series	Q-test	N-test	Skewness (t-value)	Kurtosis (t-value)	Q_s-test
BDE	21.5	4.0	1.2	-1.5	3.3
BDI	16.1	0.8	-0.5	-1.0	4.1
BDI2	11.7	1.4	-0.9	-0.7	3.9
LGO	14.7	2.1	1.2	0.7	4.2
PCO	17.9	1.3	0.8	-0.8	5.0
PCO2	20.4	0.8	0.9	-0.1	3.7
PPI	24.4	4.0	0.6	1.8	0.2
CIT	23.3	8.3	-1.7	2.2	1.9
CIT2	32.4	3.2	-0.8	1.5	2.0
CET	31.4	0.3	0.0	-0.6	0.1
CET2	31.1	5.8	-2.3	0.5	3.6
IPI	25.7	4.9	2.1	0.1	5.5
IPI2	31.7	4.4	1.8	1.1	5.7
IPIIN	14.3	15.9	1.4	3.5	1.1
IFAE	33.6	4.5	2.0	0.6	0.9
IFAN	31.9	5.6	2.1	1.1	1.7
Approx. 95% Critical values	34	6	± 2	± 2	6

Q-Test: Ljung-Box test for residual autocorrelation (with 24 lags).
Q_s-test: Pierce test for residual seasonality (with 2 seasonal lags).

Table 9: Out-of-Sample Forecast F-Test

Series	Deleting 12 observ.	(Approx. 95% critical value)	Deleting 18 observ.	(Approx 95% critical value)
BDE	0.71	(1.85)	0.59	(1.73)
BDI	0.98	(1.85)	0.92	(1.73)
BDI2	1.04	(1.85)	0.97	(1.73)
LGO	1.89	(1.91)	1.52	(1.79)
PCO	1.48	(1.91)	1.26	(1.79)
PCO2	1.47	(1.91)	1.46	(1.79)
PPI	1.15	(1.80)	1.12	(1.67)
CIT	0.20	(1.78)	0.37	(1.65)
CIT2	0.20	(1.78)	0.39	(1.65)
CET	0.53	(1.78)	0.66	(1.65)
CET2	0.63	(1.78)	0.84	(1.65)
IPI	0.55	(1.80)	0.61	(1.67)
IPI2	0.52	(1.80)	0.60	(1.67)
IPIIN	0.29	(1.80)	0.53	(1.67)
IFAE	0.49	(1.83)	0.72	(1.71)
IFAN	0.62	(1.83)	0.74	(1.71)

2.4 SUMMARY OF MODEL IDENTIFICATION

From the previous tables, the following summary comments can be made:

1)Of the 11 series, 5 are modelled in levels, 6 in logs.
2)Of the 16 models considered, only one contains a mean.
3)Concerning the ARIMA model:
* All 16 cases contain the multiplicative IMA $(1,1)_{12}$ seasonal structure.
* Of the 16 models, 9 are of the Airline type (p = 0, d = 1, q = 1, bp = 0, bd = 1, bq = 1).
* The model (regular) orders can be summarized as follows:

	P			D		Q			
	0	1	2	0	1	0	1	2	3
Number of models	11	3	2	1	15	2	11	2	1

* The average number of parameters is 2.3 parameters per model.

4) The average number of OUTLIERS is 3 outliers per series. This is roughly equivalent to 1 outlier per 60 observations. Two of the 11 series contain no outlier, and the maximum number is 6 (for one of the largest series). As for the type of outliers, 60% are AO, 15% are TC, and 25% are LS.

   These results are quite in line with the large-scale results reported in Fischer and Planas (1998).

5) As for Trading Day effect, it affects moderately the foreign trade series (very moderately the exports one), and strongly the four industry indicators. Of the 9 models considered for theses series, 7 use the binary specification, and 2 use the 6-variable specification.

6) Easter effect is not significant for any of the series. The only ones for which it could be perhaps considered are the foreign trade series.

7) Holidays have a significant effect on all industry indicators, strongest for the case of the industrial production index.

8) As for diagnostics, the only noticeable problem is some evidence of nonnormality in the residuals for some of the series, which is mostly associated with kurtosis. This problem should have little effect on point estimators.

   On the positive side, what seems remarkable is that all 32 F-tests are passed comfortably (this is particularly true for the series modelled in logs.) A further proof of the models stability is that the F-statistics is more clustered around 1 when 18 (instead of 12) observations are deleted from the sample.

9) Moving on to SEATS, two of the 16 models do not accept an admissible decomposition and SEATS automatically approximates them with simpler models. The only two input files in Table 3 that do not contain the RSA parameter for automatic modelling correspond to additional alternatives to the nondecomposable models. Notice however that, when approximating a nondecomposable model, SEATS preserves the original forecasts, and the component forecasts are forced to satisfy the aggregation constraint.

2.5 SUMMARY OF THE MODEL DECOMPOSITION

The next tables select some results form the output from SEATS. They are followed by a selection of graphs. To reduce the paper's length, I only consider the 11 first proposed input namelist, and do not include the 5 alternative ones.

Five tables are provided for each series. The first one contains the ARIMA models for the components. The second table provides some additional tools for diagnosis based on the achieved decomposition. The third table provides the estimation errors of the trend and seasonally adjusted series, and some relevant implications. The fourth tables details the estimate of the seasonal component for the last two years, and its one-year-ahead forecast function. It permits to assess the significance of the estimated seasonality. Finally, the last table contains the standard errors of some relevant rate-of-growth measures used in short-term monitoring (for, both, the adjusted series and the trend).

The brief output selected from SEATS contains first the ARIMA models for the components. Let n_t, p_t, s_t, and u_t denote the SA series, the trend-cycle, the seasonal, and the irregular components, respectively.

(1) Models for the components

What are called "numerator" and "denominator" in the output are the MA and AR polynomials in the model for the component, respectively. The variance of the innovation is expressed as a fraction of the variance (V_a) of the residual a_t.

Thus, for the BDE series, for example, the model for the trend-cycle is given by

$$\nabla^2 p_t = (1 + .006B - .994B^2)\, a_{pt},$$

with Var (a_{pt}) = .108 V_a. The MA polynomial contains the root B = -1, which implies a spectral zero for the π frequency, and the root B = .99, which nearly cancels out one of the unit AR root. Thus the model for the trend is, very approximately, equal to

$$\nabla\, p_t = (1 + B)\, a_{pt} + \mu$$

where μ is a constant.

The variance of the components innovations measure the degree of stochasticity of the component. In the BDE example, Var(a_{st}) = .0014 is very small, so that the component is very stable, and hence quite close to deterministic. The BDE series serves as an example of why, in the TRAMO-SEATS approach, the distinction deterministic-stochastic is not needed; the model will automatically capture and approximate very well deterministic seasonality. The variance of the SA series innovations, $Var(a_{nt}) = .94\ V_a$ shows that seasonal adjustment hardly affects the stochastic nature of the series. Further, $Var(u_t) = .41\ V_a$ means that the series contains a relatively important irregular component.

(2) Diagnostics and inference

The second order moments of the stationary transformation of the four components and their estimators are compared. First, the ACF of $\nabla^2 n_t$, $\nabla^2 p_t$, Ss_t and u_t, theoretically derived from the components models, is compared to the ACF of $\nabla^2\hat{n}_t, \nabla^2\hat{p}_t, S\hat{s}_t$ *and* $\hat{u}_t$, derived also from the theoretical models implied for the MMSE estimators, and to the empirical ACF of the same transformation of the estimates actually obtained for the components. The comparison includes also the variances. Comparison of the component and the theoretical MMSE estimator shows the distortion induced by MMSE estimation. It should always be that the variance of the component is larger than that of the estimator. Comparison between the theoretical MMSE estimator and the empirical one provides elements for diagnosis. Both, theoretical and empirical estimator should be close, and large departures would indicate problems with the model specification (see, for example, Maravall, 1987).

A similar comparison is made for the crosscorrelation between the stationary transformation of the theoretical estimators and actual estimates. For example, for the BDE series it is seen that the estimators, and also the estimates, are practically uncorrelated.

Next, the variance of the components estimation error is presented, both for the estimation error of the final estimator and for the revision error in the concurrent estimator. The series BDE shows, for example, that the estimation error of the SA series is substantially smaller than that of the trend-cycle. Additional information on the revisions is provided: speed of convergence to the final estimator and duration of the revision period. For the BDE series example, it is seen that the first year revision in the trend-cycle is very large, and afterwards convergence proceeds slowly. Given that for this series the seasonal component is very stable and its estimation error is small, the gain from moving from a once-a-year adjustment to a concurrent one is minor: the root mean square error of the estimator is only reduced by 4%

Attention centres next on the estimator and forecast of the seasonal component. Considering the size of the estimation standard errors, for the BDE series it is seen that seasonality is highly significant and can be captured well even for preliminary estimators and forecasts.

Finally, the standard error of several growth measures is displayed (if the log transformation is used, the growth becomes the rate of growth). Growth is computed for the trend-cycle and the SA series. For the BDE series example, the monthly growth can be measured quite accurately and the 95% confidence intervals are in the order of ± 2.4 for the SA series, and ± 3.5 for the trend-cycle. Using the centered measure of annual growth (which uses 6 forecasts of the component), the trend outperforms both the SA series and the original series.

Concerning the figures, they are divided into 4 groups for each series. The first group comes from TRAMO and contains the original and linearized series, the residuals, and the series forecasts. The second group presents the components estimated by SEATS: seasonally adjusted series, trend-cycle, seasonal, and irregular components. The last two components are net of outliers and special effects). Proper assessment of the quality of a decomposition requires consideration of all components obtained: The irregular, in particular is obtained as a residual and hence will likely evidence problems in the estimation of the other components (if it were to display, for example, regular or seasonal features). The third group of figures presents the spectra of the components and the squared gain of the associated filter. The last group of figures shows the component forecasts. For two series (PPI and PCO) comparison of the levels of the original series, SA series, and trend is not informative. For these two cases, to assess the smoothing achieved by removing the seasonal component and the irregular the rates of growth are also compared.

SERIES TITLE: BDE

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 0.0059 -0.9941

TREND DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.10807

SEAS. NUMERATOR

1.0000 1.5102 1.6468 1.6125 1.4309 1.1814 0.8999

0.6118 0.3627 0.1248 -0.0277 -0.3380

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR.(*) 0.00138

IRREGULAR

VAR.(*) 0.40678

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.3152 0.3192

SEASONALLY ADJUSTEDDENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.93782

(*) INUNITSOF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS (STATIONARY TRANSFORMATION)

TREND ADJUSTED

LAG COMPONENT ESTIMATOR ESTIMATE COMPONENT ESTIMATOR ESTIMATE

1	0.000	0.376	0.272	-0.613	-0.613	-0.602
12	0.000	-0.034	-0.107	0.000	-0.034	-0.082
VAR.(*)	0.215	0.055	0.040	2.656	2.564	2.450

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.340	-0.404	0.930	0.755	0.676
12	0.000	-0.034	-0.076	0.000	0.946	0.731
VAR.(*)	0.407	0.259	0.236	0.019	0.000	0.000

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.503E-01	-0.164
SEASONAL-IRREGULAR	0.223E-01	0.464E-01
TREND-IRREGULAR	-0.121	-0.104E-01

ERROR ANALYSIS

FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
TREND	ADJUSTED	TREND	ADJUSTED

VAR.(*)	0.146	0.024	0.111	0.024

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.257	0.049

PERCENTAGE REDUCTION IN THE STANDARD ERROR OF
THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

	TREND	ADJUSTED
AFTER 1 YEAR	75.09	6.845
AFTER 2 YEAR	76.80	13.25
AFTER 3 YEAR	78.40	19.22
AFTER 4 YEAR	79.89	24.77
AFTER 5 YEAR	81.27	29.95

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 3.912

(*) IN UNITS OF VAR(A)

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	-1.615	0.9932
-23	-2.251	1.008
-22	0.5949	1.011
-21	4.750	1.012
-20	0.9250	1.012
-19	2.045	1.012
-18	-0.4259	1.012

-17	2.631	1.013
-16	-4.124	1.013
-15	-0.4226E-01	1.014
-14	-1.999	1.017
-13	-0.4959	1.020
-12	-1.595	1.025
-11	-2.250	1.042
-10	0.5740	1.045
-9	4.749	1.046
-8	0.9187	1.047
-7	2.053	1.047
-6	-0.4283	1.047
-5	2.640	1.047
-4	-4.126	1.048
-3	-0.4507E-01	1.049
-2	-2.018	1.052
-1	-0.4951	1.055
0	-1.579	1.061

STANDARD ERROR OF FINAL ESTIMATOR 0.7501

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-2.245	1.079
2	0.5730	1.082
3	4.751	1.083
4	0.9181	1.084
5	2.057	1.084
6	-0.4288	1.084
7	2.643	1.084
8	-4.127	1.085
9	-0.4605E-01	1.086

10	-2.023	1.089
11	-0.4957	1.093
12	-1.577	1.098

STANDARD ERROR OF ALTERNATIVE MEASURES OF GROWTH

(NONANNUALIZED GROWTH)

1. PERIOD TO PERIOD GROWTH OF THE SERIES

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	1.800	1.242
1 - PERIOD REVISION	1.549	1.242
FINAL ESTIMATOR	1.491	0.887

2. GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	3.832	4.789
1 - PERIOD REVISION	2.956	1.566
FINAL ESTIMATOR	2.513	1.117

(CENTERED) ESTIMATOR OF THE PRESENT ANNUAL GROWTH

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	8.913	9.301	9.307
FINAL ESTIMATOR	2.525	0.239	0.000

SERIES TITLE: BDI

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 0.0017 -0.9983

TREND DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.20777

SEAS. NUMERATOR

1.0000 1.7633 2.0651 2.1191 1.9635 1.6941 1.3652

1.0066 0.6865 0.3677 0.1714 -0.1653

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.00013

IRREGULAR

VAR.(*) 0.28574

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.0782 0.0798

SEASONALLY ADJUSTED DENOMINATOR.

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.98172

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS (STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	0.280	0.139	-0.537	-0.537	-0.609
12	0.000	-0.010	-0.040	0.000	-0.010	-0.129
VAR.(*)	0.415	0.181	0.113	2.129	2.108	1.943

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.460	-0.556	0.948	0.799	0.797
12	0.000	-0.010	-0.120	0.000	0.981	0.592
VAR.(*)	0.286	0.153	0.136	0.003	0.000	0.000

(*)IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION

OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.340E-01	-0.149
SEASONAL-IRREGULAR	0.135E-01	0.516E-01
TREND-IRREGULAR	-0.287E-01	0.842E-01

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.137	0.009	0.079	0.008

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.216	0.017

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

AFTER 1 YEAR	76.75	2.379
AFTER 2 YEAR	77.31	4.722
AFTER 3 YEAR	77.86	7.027
AFTER 4 YEAR	78.40	9.296
AFTER 5 YEAR	78.93	11.53

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 1.134

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	-0.1194	0.4688
-23	-2.212	0.4701
-22	0.3447	0.4708
-21	2.276	0.4711
-20	0.7677	0.4713
-19	1.452	0.4714
-18	0.1519	0.4714
-17	1.057	0.4714
-16	-7.294	0.4715
-15	0.8172	0.4717
-14	0.3069	0.4721
-13	2.456	0.4728
-12	-0.1188	0.4738
-11	-2.213	0.4752
-10	0.3438	0.4759
-9	2.275	0.4762
-8	0.7663	0.4764

-7	1.451	0.4765
-6	0.1493	0.4765
-5	1.057	0.4765
-4	-7.293	0.4766
-3	0.8178	0.4768
-2	0.3074	0.4773
-1	2.458	0.4780
0	-0.1181	0.4790

STANDARD ERROR OF FINAL ESTIMATOR 0.3528

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-2.213	0.4804
2	0.3439	0.4811
3	2.275	0.4815
4	0.7662	0.4817
5	1.451	0.4817
6	0.1487	0.4817
7	1.056	0.4817
8	-7.293	0.4818
9	0.8177	0.4821
10	0.3073	0.4825
11	2.458	0.4832
12	-0.2282	0.4842

STANDARD ERROR OF ALTERNATIVE MEASURES OF GROWTH

(NONANNUALIZEDGROWTH)

I. PERIOD TO PERIOD GROWTH OF THE SERIES

TREND SEASONALLY ADJ. SERIES

CONCURRENT ESTIMATOR	1.596	0.482
1 - PERIOD REVISION	1.316	0.482
FINAL ESTIMATOR	1.304	0.356

2. GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	3.408	3.726
1 - PERIOD REVISION	2.216	0.716
FINAL ESTIMATOR	1.944	0.529

(CENTERED) ESTIMATOR OF THE PRESENT ANNUALGROWTH

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	9.034	9.157	9.157
FINALESTI-MATOR	1.905	0.066	0.000

SERIES TITLE: LGO

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 -0.1595 -0.9924 0.1671

TREND DENOMINATOR

1.0000 -2.6740 2.3480 -0.6740

INNOV. VAR. (*) 0.32731

SEAS. NUMERATOR

1.0000 1.8516 2.7689 3.5235 3.9141 3.8954 3.5832

3.1214 2.5490 1.8132 0.9517 0.3501

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.00543

IRREGULAR

VAR.(*) 0.07926

SEASONALLY ADJUSTED NUMERATOR

1.0000 -0.9886 -0.0037 0.0014

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.6740 2.3480 -0.6740

INNOV. VAR. (*) 0.90329

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.245	0.398	0.308	-0.161	-0.158	-0.118
12	-0.004	-0.055	0.014	-0.002	-0.054	-0.078
VAR.(*)	0.593	0.441	0.390	1.069	1.009	0.868

IRREGULAR SEASONAL

LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.658	-0.588	0.968	0.857	0.856
12	0.000	-0.052	-0.138	0.000	0.895	0.716
VAR.(*)	0.079	0.028	0.022	0.480	0.005	0.001

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.321E-01	-0.100
SEASONAL-IRREGULAR	0.168E-01	0.562E-01
TREND-IRREGULAR	0.410E-01	0.461E-01

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.168	0.125	0.159	0.127

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

TREND ADJUSTED

VAR.(*) 0.327 0.252

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

	TREND	ADJUSTED
AFTER 1 YEAR	22.33	10.36
AFTER 2 YEAR	30.44	19.71
AFTER 3 YEAR	37.70	28.09
AFTER 4 YEAR	44.20	35.60
AFTER 5 YEAR	50.02	42.32

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 2.998

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	0.2736	0.6766E-01
-23	-0.4282	0.6768E-01
-22	-0.6493	0.6778E-01
-21	-0.5035	0.6806E-01
-20	-0.3474	0.6840E-01
-19	-0.1954	0.6868E-01
-18	-0.3995E-02	0.6884E-01
-17	0.2044	0.6889E-01
-16	0.2626	0.6889E-01
-15	0.5106	0.6895E-01
-14	0.5135	0.6920E-01
-13	0.3634	0.6979E-01
-12	0.2760	0.7088E-01
-11	-0.4284	0.7090E-01

-10	-0.6500	0.7102E-01
-9	-0.5033	0.7136E-01
-8	-0.3478	0.7177E-01
-7	-0.1959	0.7210E-01
-6	-0.3816E-02	0.7229E-01
-5	0.2033	0.7234E-01
-4	0.2633	0.7234E-01
-3	0.5109	0.7241E-01
-2	0.5136	0.7271E-01
-1	0.3607	0.7339E-01
0	0.2760	0.7467E-01

STANDARD ERROR OF FINAL ESTIMATOR 0.5260E-01

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-0.4279	0.7470E-01
2	-0.6494	0.7482E-01
3	-0.5028	0.7518E-01
4	-0.3474	0.7563E-01
5	-0.1958	0.7600E-01
6	-0.4149E-02	0.7621E-01
7	0.2032	0.7628E-01
8	0.2631	0.7628E-01
9	0.5112	0.7634E-01
10	0.5131	0.7663E-01
11	0.3606	0.7731E-01
12	0.2759	0.7858E-01

STANDARD ERROR OF ALTERNATIVE MEASURES OF GROWTH

(NONANNUALIZED GROWTH)

1. PERIOD TO PERIOD GROWTH OF THE SERIES

	TREND	SEASONALLY ADJ. SERIES
CONCURRENTESTIMATOR	0.064	0.048
1 - PERIOD REVISION	0.055	0.047
FINALESTIMATOR	0.047	0.034

2. GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.177	0.179
1 - PERIOD REVISION	0.117	0.106
FINAL ESTIMATOR	0.087	0.075

(CENTERED) ESTIMATOR OF THE PRESENT

ANNUALGROWTH

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	0.907	0.907	0.908
FINALESTI-MATOR	0.053	0.026	0.000

SERIES TITLE: PCO

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 0.0275 -0.9725

TRENDDENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.28091

SEAS. NUMERATOR

1.0000 2.0539 2.5452 2.6867 2.5514 2.2471 1.8578

1.4118 1.0086 0.5945 0.3256 -0.0172

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.03089

IRREGULAR

VAR. 0.10905

SEASONALLY ADJUSTED NUMERATOR

1.0000 -0.7468 -0.2194

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.74792

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

TREND ADJUSTED

LAG COMPONENT ESTIMATOR ESTIMATE COMPONENT ESTIMATOR ESTIMATE

1	0.000	0.168	0.266	-0.363	-0.366	-0.497
12	0.000	-0.142	-0.105	0.000	-0.142	-0.212
VAR.(*)	0.547	0.309	0.191	1.201	1.022	0.808

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.615	-0.747	0.955	0.842	0.863
12	0.000	-0.142	-0.238	0.000	0.711	0.790
VAR.(*)	0.109	0.036	0.033	1.155	0.049	0.069

(*)IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.905E-01	-0.135
SEASONAL-IRREGULAR	0.265E-01	0.440E-01
TREND-IRREGULAR	0.757E-01	0.570E-01

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.199	0.156	0.195	0.162

0.162

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.393	0.318

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

	TREND	ADJUSTED
AFTER 1 YEAR	40.73	28.28
AFTER 2 YEAR	57.61	48.71
AFTER 3 YEAR	69.68	63.31
AFTER 4 YEAR	78.31	73.76
AFTER 5 YEAR	84.49	81.23

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT
11.25

(*) IN UNITS OF VAR(A)

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	-0.1522	0.7742E-01
-23	-0.9675E-01	0.7806E-01
-22	0.4016E-01	0.7915E-01
-21	0.8224E-01	0.7983E-01

-20	0.1772	0.8018E-01
-19	0.2565	0.8032E-01
-18	0.3452	0.8033E-01
-17	0.2978E-01	0.8035E.01
-16	-0.2124	0.8048E 01
-15	-0.2483	0.8087E 01
-14	-0.1597	0.8166E 01
-13	-0.4477E-01	0.8297E-01
-12	-0.1666	0.8498E-01
-11	-0.1140	0.8612F.-01
-10	0.2179E-01	0.8805E-01
-9	0.7805E-01	0.8924E-01
-8	0.2009	0.8985E-01
-7	0.2922	0.9008E-01
-6	0.3755	0.9011E-01
-5	0.3510E-01	0.9014E-01
-4	-0.2135	0.9037E-01
-3	-0.2555	0.9105E-01
-2	-0.1769	0.9241E-01
-1	-0.6265E-01	0.9470E-01
0	-0.1852	0.9797E-01
STANDARD ERROR OF FINAL ESTIMATOR		0.6861E-01

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-0.1275	0.9949E-01
2	0.1225E-01	0.1023
3	0.7425E-01	0.1040
4	0.2039	0.1049
5	0.2985	0.1052

6	0.3827	0.1053
7	0.3919E-01	0.1053
8	-0.2090	0.1055
9	-0.2521	0.1062
10	-0.1751	0.1075
11	-0.6177E-01	0.1097
12	-0.1853	0.1129

STANDARD ERROR OF ALTERNATIVE MEASURES OF GROWTH

(NONANNUALIZED GROWTH)

1. PERIOD TO PERIOD GROWTH OF THE SERIES

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.082	0.075
1 - PERIOD REVISION	0.075	0.075
FINAL ESTIMATOR	0.065	0.056

2. GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.188	0.196
1 - PERIOD REVISION	0.144	0.136
FINAL ESTIMATOR	0.111	0.100

(CENTERED) ESTIMATOR OF THE PRESENT

ANNUAL GROWTH

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	0.544	0.547	0.551
FINAL ESTIMATOR	0.080	0.052	0.000

SERIES TITLE: PPI

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 -0.3439 -0.9658 0.3781

TREND DENOMINATOR

1.0000 -2.8479 2.6957 -0.8479

INNOV. VAR. (*) 0.18514

SEAS. NUMERATOR

1.0000 1.6415 2.2704 2.8038 3.1651 3.3078 3.2135

2.8793 2.3163 1.5734 0.7924 0.2942

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.11979

IRREGULAR

VAR. 0.04732

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.1609 0.1437 0.0583

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.8479 2.6957 -0.8479

INNOV. VAR.(*) 0.51237

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

TREND ADJUSTED

LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.187	0.400	0.495	-0.235	-0.144	-0.143
12	-0.010	-0.256	-0.341	-0.005	-0.254	-0.236
VAR.(*)	0.290	0.156	0.139	0.574	0.367	0.327

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.588	-0.654	0.968	0.870	0.874
12	0.000	-0.253	-0.157	0.000	0.533	0.168
VAR.(*)	0.047	0.011	0.010	7.767	0.458	0.274

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.683E-01	-0.155
SEASONAL-IRREGULAR	0.498E-01	0.600E-01
TREND-IRREGULAR	0.228E-01	0.103E-01

ERROR ANALYSIS

FINAL ESTIMATION ERROR   REVISION IN CONCURRENT ESTIMATOR

	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.352	0.345	0.467	0.427

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.819	0.773

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

AFTER 1 YEAR	52.86	47.83
AFTER 2 YEAR	76.72	74.23
AFTER 3 YEAR	88.50	87.27
AFTER 4 YEAR	94.32	93.71
AFTER 5 YEAR	97.20	96.90

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 10.26

(*) IN UNITS OF VAR(A)

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	-0.5014	0.1564
-23	-0.1967	0.1564
-22	0.4281E-01	0.1568
-21	0.3137	0.1575
-20	0.4380	0.1585
-19	0.5279	0.1595
-18	0.2946	0.1600

-17	0.3517E-01	0.1602
-16	-0.6631E-01	0.1602
-15	-0.1739	0.1605
-14	-0.2043	0.1621
-13	-0.2675	0.1666
-12	-0.4460	0.1739
-11	-0.1858	0.1739
-10	0.4008E-01	0.1751
-9	0.2541	0.1780
-8	0.4412	0.1815
-7	0.4010	0.1848
-6	0.1888	0.1869
-5	-0.1047	0.1876
-4	-0.1725	0.1876
-3	-0.1976	0.1885
-2	-0.1838	0.1927
-1	-0.2003	0.2023
0	-0.3986	0.2250

STANDARD ERROR OF FINAL ESTIMATOR 0.1504

Seasonal component: RECENT ESTIMATES

PERIOD	FORECAST	STANDARD ERROR
1	-0.1166	0.2250
2	0.9629E-01	0.2259
3	0.3067	0.2295
4	0.4587	0.2348
5	0.4054	0.2401
6	0.1578	0.2440
7	-0.1405	0.2457
8	-0.2006	0.2460
9	-0.2102	0.2463
10	-0.1750	0.2497

11	-0.1918	0.2598
12	-0.3901	0.2804

STANDARD ERROR OF ALTERNATIVE MEASURES OF GROWTH

(NONANNUALIZEDGROWTH)

1. PERIOD TO PERIOD GROWTH OF THE SERIES

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.129	0.130
1 - PERIODREVISION	0.114	0.125
FINAL ESTIMATOR	0.089	0.095

2. GROWTH OF A 3 - PERIOD(CENTERED) MOVING AVERAGE

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.349	0.353
1 - PERIODREVISION	0.280	0.277
FINAL ESTIMATOR	0.194	0.193

(CENTERED) ESTIMATOR OF THE PRESENT

ANNUALGROWTH

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	1.606	1.607	1.625
FINALESTI-MATOR	0.165	0.158	0.000

SERIES TITLE: CIT

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 0.0553 -0.9447

TREND DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.01498

SEAS. NUMERATOR

1.0000 0.7536 0.4873 0.2317 0.0075 -0.1734 -0.3057

-0.3893 -0.4282 -0.4292 -0.4008 -0.3536

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.08390

IRREGULAR

VAR.(*) 0.38208

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.6242 0.6421

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.57299

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.002	0.537	0.465	-0.658	-0.659	-0.646
12	0.000	-0.252	-0.232	0.000	-0.249	-0.281

VAR.(*)	0.028	0.001	0.001	2.321	1.685	1.719

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.162	-0.243	0.743	0.640	0.636
12	0.000	-0.251	-0.263	0.000	0.703	0.733
VAR.(*)	0.382	0.233	0.219	0.234	0.061	0.055

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.158	-0.114
SEASONAL-IRREGULAR	0.105	0.895E-01
TREND-IRREGULAR	-0.271	-0.184

ERROR ANALYSIS

FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
TREND	ADJUSTED	TREND	ADJUSTED

VAR.(*)	0.067	0.109	0.104	0.095

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.170	0.204

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

	TREND	ADJUSTED
AFTER 1 YEAR	90.11	48.72
AFTER 2 YEAR	95.00	74.27
AFTER 3 YEAR	97.49	87.09
AFTER 4 YEAR	98.74	93.52
AFTER 5 YEAR	99.37	96.75

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 33.49

(*) IN UNITS OF VAR(A)

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	0.7517E-01	0.2336E-01
-23	0.5600E-01	0.2449E-01
-22	0.1498E-03	0.2450E-01
-21	-0.2193E-01	0.2451E-01
-20	0.1568E-01	0.2451E-01

-19	0.1048	0.2451E-01
-18	0.7248E-02	0.2452E-01
-17	0.4114E-01	0.2454E-01
-16	0.5930E-01	0.2458E-01
-15	-0.2215E-03	0.2466E-01
-14	-0.4097	0.2477E-01
-13	0.7057E-01	0.2494E-01
-12	0.7852E-01	0.2517E-01
-11	0.5801E-01	0.2913E-01
-10	0.8073E-02	0.2917E-01
-9	-0.2682E-01	0.2919E-01
-8	0.1827E-01	0.2919E-01
-7	0.1106	0.2919E-01
-6	0.3632E-02	0.2922E-01
-5	0.2937E-01	0.2928E-01
-4	0.5623E-01	0.2941E-01
-3	-0.4630E-02	0.2963E-01
-2	-0.4116	0.2996E-01
-1	0.7097E-01	0.3042E-01
0	0.8136E-01	0.3104E-01

STANDARD ERROR OF FINAL ESTIMATOR 0.2272E-01

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	0.5970E-01	0.3939E-01
2	0.1074E-01	0.3945E-01
3	-0.2604E-01	0.3947E-01
4	0.2049E-01	0.3947E-01
5	0.1134	0.3948E-01
6	0.4223E-02	0.3950E-01
7	0.2768E-01	0.3958E-01
8	0.5560E-01	0.3972E-01

9	-0.5858E-02	0.3994E-01
10	-0.4126	0.4028E-01
11	0.7101E-01	0.4074E-01
12	0.8169E-01	0.4134E-01

STANDARD ERROR OF THE RATES OF GROWTH ESTIMATES
(IN POINTS OF NON ANNUALIZED PERCENT GROWTH)
(LINEAR APPROXIMATION)

1. PERIOD TO PERIOD RATE OF GROWTH OF THE SERIES(T11)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	1.167	4.121
1 - PERIOD REVISION	1.109	4.121
FINAL ESTIMATOR	0.999	3.194

2. RATE OF GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE (T31)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	2.653	5.918
1 - PERIOD REVISION	2.461	- 4.356
FINAL ESTIMATOR	1.990	3.346

(CENTERED) ESTIMATOR OF THE PRESENT
RATE OF ANNUALGROWTH, T(1 12)
(LINEAR APPROXIMATION)

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	6.559	8.333	8.793

FINAL ESTI-MATOR	2.458	1.903	0.000

SERIES TITLE: CET

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 0.0489 -0.9511

TREND DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.00578

SEAS. NUMERATOR

1.0000 0.6319 0.3278 0.0872 -0.0932 -0.2185 -0.2952

-0.3305 -0.3319 -0.3071 -0.2633 -0.2072

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.09167

IRREGULAR

VAR. 0.45890

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.7574 0.7671

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR.(*) 0.59109

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.001	0.600	0.622	-0.664	-0.664	-0.735
12	0.000	-0.245	-0.238	0.000	-0.231	-0.208
VAR.(*)	0.011	0.000	0.000	2.764	2.021	2.286

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.092	-0.216	0.667	0.577	0.514
12	0.000	-0.237	-0.217	0.000	0.690	0.672
VAR.(*)	0.459	0.304	0.288	0.191	0.048	0.038

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.183	-0.216
SEASONAL-IRREGULAR	0.137	0.165
TREND-IRREGULAR	-0.331	-0.304

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.047	0.117	0.074	0.088

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.121	0.206

PERCENTAGE REDUCTION IN THE STANDARD ERROR OF
THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

	TREND	ADJUSTED
AFTER 1 YEAR	93.29	45.96
AFTER 2 YEAR	96.06	70.89
AFTER 3 YEAR	97.70	84.32
AFTER 4 YEAR	98.75	91.56
AFTER 5 YEAR	99.32	95.45

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 35.55

(*) IN UNITS OF VAR(A)

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	0.8471E-01	0.2655E-01
-23	0.3210E-01	0.2798E-01
-22	0.3030E-01	0.2798E-01
-21	-0.1289	0.2798E-01
-20	-0.2077E-01	0.2798E-01
-19	0.8739E-01	0.2799E-01
-18	-0.4953E-02	0.2800E-01
-17	0.5813E-01	0.2803E-01
-16	0.8087E-01	0.2807E-01
-15	0.1433	0.2812E-01
-14	-0.3500	0.2820E-01
-13	0.1319E-03	0.2830E-01
-12	0.8756E-01	0.2843E-01
-11	0.3901E-01	0.3282E-01
-10	0.1634E-01	0.3282E-01
-9	-0.1419	0.3282E-01
-8	-0.1818E-01	0.3282E-01
-7	0.8571E-01	0.3284E-01
-6	-0.8133E-02	0.3288E-01
-5	0.6331E-01	0.3295E-01
-4	0.7431E-01	0.3306E-01
-3	0.1495	0.3321E-01
-2	-0.3426	0.3343E-01
-1	-0.1486E-01	0.3371E-01
0	0.9392E-01	0.3408E-01
STANDARD ERROR OF FINAL ESTIMATOR		0.2575E-01

Seasonal component: FORECAST

PERIOD SEASONAL

	FORECAST	STANDARD ERROR
1	0.4192E-01	0.4366E-01
2	0.1633E-01	0.4366E-01
3	-0.1423	0.4366E-01
4	-0.1665E-01	0.4367E-01
5	0.8616E-01	0.4370E-01
6	-0.8025E-02	0.4375E-01
7	0.6409E-01	0.4382E-01
8	0.7330E-01	0.4394E-01
9	0.1503	0.4410E-01
10	-0.3422	0.4430E-01
11	-0.1727E-01	0.4457E-01
12	0.9443E-01	0.4489E-01

STANDARD ERROR OF THE RATES OF GROWTH ESTIMATES
(IN POINTS OF NONANNUALIZED PERCENT GROWTH)
(LINEAR APPROXIMATION)

1. PERIOD TO PERIOD RATE OF GROWTH OF THE SERIES (T11)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.813	4.788
1 - PERIOD REVISION	0.791	4.787
FINAL ESTIMATOR	0.719	3.749

2. RATE OF GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE (T31)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	1.865	6.573
1 - PERIOD REVISION	1.790	4.875
FINAL ESTIMATOR	1.493	3.796

(CENTERED) ESTIMATOR OF THE PRESENT
RATE OF ANNUAL GROWTH, T(1 12)
(LINEAR APPROXIMATION)

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	4.615	7.776	8.315
FINAL ESTI-MATOR	2.204	2.217	0.000

SERIES TITLE: IPI

MODELS FOR THE COMPONENTS

TREND NUMERATOR
1.0000 0.0418 -0.9582
TREND DENOMINATOR
1.0000 -2.0000 1.0000
INNOV. VAR.(*) 0.02793

SEAS. NUMERATOR
1.0000 1.0503 0.8420 0.5745 0.2735 -0.0007 -0.2316
-0.4089 -0.5178 -0.5904 -0.6034 -0.7284
SEAS. DENOMINATOR
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
INNOV. VAR. (*) 0.03378

IRREGULAR
VAR.(*) 0.39972

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.5480 0.5652

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR.(*) 0.65991

(*) INUNITSOF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.001	0.490	0.429	-0.652	-0.653	-0.620
12	0.000	-0.202	-0.009	0.000	-0.201	-0.150
VAR.(*)	0.054	0.005	0.004	2.452	1.957	1.792

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.208	-0.217	0.805	0.683	0.594
12	0.000	-0.202	-0.111	0.000	0.779	0.699
VAR.(*)	0.400	0.253	0.233	0.167	0.034	0.020

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.110	-0.241
SEASONAL-IRREGULAR	0.593E-01	0.965E-01
TREND-IRREGULAR	-0.230	-0.188

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.090	0.093	0.121	0.092

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.211	0.185

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

AFTER 1 YEAR	84.47	38.95
AFTER 2 YEAR	90.72	63.51
AFTER 3 YEAR	94.45	78.19

AFTER 4 YEAR	96.69	86.97
AFTER 5 YEAR	98.02	92.21

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 24.91

(*) IN UNITS OF VAR(A)

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	-0.2619E-01	0.7891E-02
-23	0.8628E-03	0.8359E-02
-22	0.2815E-01	0.8370E-02
-21	0.1222	0.8376E-02
-20	0.2584E-01	0.8377E-02
-19	0.9662E-01	0.8377E-02
-18	0.8685E-01	0.8379E-02
-17	0.9478E-01	0.8386E-02
-16	-0.6939	0.8403E-02
-15	0.7799E-01	0.8435E-02
-14	0.1024	0.8486E-02
-13	0.8468E-01	0.8562E-02
-12	-0.2440E-01	0.8672E-02
-11	-0.5858E-03	0.9822E-02
-10	0.2903E-01	0.9850E-02
-9	0.1223	0.9863E-02
-8	0.2245E-01	0.9866E-02
-7	0.9531E-01	0.9866E-02
-6	0.8737E-01	0.9870E-02
-5	0.9526E-01	0.9887E-02

-4	-0.6897	0.9924E-02
-3	0.7796E-01	0.9992E-02
-2	0.1032	0.1010E-01
-1	0.8406E-01	0.1025E-01
0	-0.2655E-01	0.1044E-01

STANDARD ERROR OF FINAL ESTIMATOR 0.7422E-02

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-0.1585E-02	0.1230E-01
2	0.2930E-01	0.1234E-01
3	0.1222	0.1236E-01
4	0.2168E-01	0.1237E-01
5	0.9508E-01	0.1237E-01
6	0.8780E-01	0.1237E-01
7	0.9551E-01	0.1239E-01
8	-0.6882	0.1243E-01
9	0.7802E-01	0.1250E-01
10	0.1036	0.1261E-01
11	0.8411E-01	0.1277E-01
12	-0.2755E-01	0.1298E-01

STANDARD ERROR OF THE RATES OF GROWTH ESTIMATES

(IN POINTS OF NONANNUALIZED PERCENT GROWTH)

(LINEAR APPROXIMATION)

1. PERIOD TO PERIOD RATE OF GROWTH OF THE SERIES (T11)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.544	1.346
1 - PERIOD REVISION	0.507	1.346
FINAL ESTIMATOR	0.462	1.004

2. RATE OF GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE (T31)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	1.214	2.201
1 - PERIOD REVISION	1.094	1.475
FINAL ESTIMATOR	0.891	1.094

(CENTERED) ESTIMATOR OF THE PRESENT
RATE OF ANNUAL GROWTH, T(1 12)
(LINEAR APPROXIMATION)

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	2.887	3.375	3.472
FINAL ESTIMATOR	1.003	0.509	0.000

SERIES TITLE: IPIIN

MODELS FOR THE COMPONENTS

TREND NUMERATOR
1.0000 0.0387 -0.9613
TREND DENOMINATOR
1.0000 -2.0000 1.0000
INNOV. VAR. (*) 0.03449

SEAS. NUMERATOR

1.0000 1.1924 1.1076 0.9317 0.6860 0.4320 0.1906

-0.0224 -0.1840 -0.3213 -0.4018 -0.6076

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.03382

IRREGULAR

VAR. 0.39167

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.5112 0.5286

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.67820

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.001	0.472	0.430	-0.648	-0.649	-0.636
12	0.000	-0.190	0.012	0.000	-0.189	-0.239
VAR.(*)	0.066	0.007	0.006	2.416	1.958	1.848

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.228	-0.237	0.850	0.701	0.550
12	0.000	-0.189	-0.141	0.000	0.776	0.626

VAR.(*)	0.392	0.245	0.229	0.199	0.030	0.015

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.111	-0.211
SEASONAL-IRREGULAR	0.568E-01	0.141
TREND-IRREGULAR	-0.213	-0.187

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.099	0.091	0.127	0.090

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.226	0.181

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

TREND ADJUSTED

AFTER 1 YEAR	82.04	36.69
AFTER 2 YEAR	88.83	60.63
AFTER 3 YEAR	93.06	75.52
AFTER 4 YEAR	95.68	84.78
AFTER 5 YEAR	97.32	90.53

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 22.96

(*) IN UNITS OF VAR(A)

Seasonal Component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	0.7644E-01	0.1317E-01
-23	-0.5906E-01	0.1393E-01
-22	0.1443E-01	0.1396E-01
-21	0.1374	0.1397E-01
-20	0.6799E-01	0.1397E-01
-19	0.1433	0.1397E-01
-18	0.1351	0.1397E-01
-17	0.1359	0.1399E-01
-16	-0.9629	0.1401E-01
-15	0.7853E-01	0.1407E-01
-14	0.1044	0.1416E-01
-13	0.1254	0.1430E-01
-12	0.7944E-01	0.1449E-01
-11	-0.6025E-01	0.1623E-01
-10	0.1646E-01	0.1629E-01
-9	0.1410	0.1631E-01
-8	0.6922E-01	0.1632E-01
-7	0.1436	0.1632E-01
-6	0.1339	0.1633E-01

-5	0.1331	0.1635E-01
-4	-0.9642	0.1641E-01
-3	0.8016E-01	0.1652E-01
-2	0.1024	0.1670E-01
-1	0.1226	0.1696E-01
0	0.7926E-01	0.1730E-01

STANDARD ERROR OF FINAL ESTIMATOR 0.1226E-01

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-0.6096E-01	0.2000E-01
2	0.1702E-01	0.2010E-01
3	0.1422	0.2014E-01
4	0.7013E-01	0.2016E-01
5	0.1444	0.2016E-01
6	0.1340	0.2016E-01
7	0.1328	0.2019E-01
8	-0.9640	0.2025E-01
9	0.8111E-01	0.2036E-01
10	0.1023	0.2055E-01
11	0.1214	0.2081E-01
12	0.7944E-01	0.2118E-01

STANDARD ERROR OF THE RATES OF GROWTH ESTIMATES

(IN POINTS OF NONANNUALIZED PERCENT GROWTH)

(LINEAR APPROXIMATION)

1. PERIOD TO PERIOD RATE OF GROWTH OF THE SERIES (T11)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.997	2.187
1 - PERIOD REVISION	0.922	2.186
FINAL ESTIMATOR	0.843	1.626

2. RATE OF GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE (T31)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	2.214	3.728
1 - PERIOD REVISION	1.969	2.441
FINAL ESTIMATOR	1.604	1.806

(CENTERED) ESTIMATOR OF THE PRESENT
RATE OF ANNUALGROWTH, T(1 12)
(LINEAR APPROXIMATION)

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	5.236	5.957	6.099
FINAL ESTIMATOR	1.747	0.832	0.000

SERIES TITLE: IFAE

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 0.0465 -0.9535

TREND DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR.(*) 0.05987

SEAS. NUMERATOR

1.0000 1.4482 1.5438 1.4855 1.2953 1.0483 0.7768

0.5045 0.2723 0.0532 -0.0892 -0.3867

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR. (*) 0.05358

IRREGULAR

VAR.(*) 0.28861

SEASONALLY ADJUSTEDNUMERATOR

1.0000 -1.3383 0.3669

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR.(*) 0.63101

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.001	0.402	0.314	-0.625	-0.627	-0.560
12	0.000	-0.217	-0.295	0.000	-0.218	-0.191
VAR.(*)	0.114	0.020	0.017	1.846	1.440	1.238

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE

I	0.000	-0.313	-0.292	0.921	0.773	0.723
12	0.000	-0.218	-0.249	0.000	0.662	0.629
VAR.(*)	0.289	0.155	0.139	0.619	0.064	0.038

(*)IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.126	-0.133
SEASONAL-IRREGULAR	0.539E-01	0.847E-01
TREND-IRREGULAR	-0.143	-0.905E-01

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.121	0.107	0.157	0.112

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.278	0.219

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

AFTER 1 YEAR	74.67	42.06
AFTER 2 YEAR	85.71	67.30
AFTER 3 YEAR	91.93	81.54
AFTER 4 YEAR	95.45	89.58
AFTER 5 YEAR	97.43	94.12

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 22.61

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	0.5320E-01	0.1215E-01
-23	-0.7528E-01	0.1263E-01
-22	-0.1479E-03	0.1268E-01
-21	0.1149	0.1271E-01
-20	-0.8186E-02	0.1272E-01
-19	0.5259E-01	0.1272E-01
-18	0.9716E-01	0.1272E-01
-17	0.1661	0.1273E-01
-16	-0.5579	0.1276E-01
-15	0.5532E-01	0.1283E-01
-14	0.7609E-01	0.1294E-01
-13	0.3761E-01	0.1312E-01
-12	0.4741E-01	0.1339E-01
-11	-0.7768E-01	0.1472E-01

-10	-0.1572E-02	0.1486E-01
-9	0.1133	0.1494E-01
-8	-0.1319E-01	0.1497E-01
-7	0.4889E-01	0.1498E-01
-6	0.9991E-01	0.1498E-01
-5	0.1647	0.1500E-01
-4	-0.5517	0.1508E-01
-3	0.5631E-01	0.1524E-01
-2	0.8046E-01	0.1552E-01
-1	0.3707E-01	0.1593E-01
0	0.4397E-01	0.1647E-01

STANDARD ERROR OF FINAL ESTIMATOR 0.1152E-01

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-0.7828E-01	0.1873E-01
2	-0.1483E-02	0.1899E-01
3	0.1130	0.1913E-01
4	-0.1452E-01	0.1919E-01
5	0.4769E-01	0.1921E-01
6	0.1009	0.1921E-01
7	0.1644	0.1923E-01
8	-0.5504	0.1930E-01
9	0.5666E-01	0.1946E-01
10	0.8189E-01	0.1973E-01
11	0.3676E-01	0.2015E-01
12	0.4337E-01	0.2073E-01

STANDARD ERROR OF THE RATES OFGROWTH ESTIMATES

(IN POINTS OF NONANNUALIZED PERCENT GROWTH)

(LINEAR APPROXIMATION)

I. PERIOD TO PERIOD RATE OF GROWTH OF THE SERIES (T11)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	1.084	1.815
1 - PERIOD REVISION	0.983	1.814
FINAL ESTIMATOR	0.894	1.362

2. RATE OF GROWTH OF A 3 - PERIOD(CENTERED) MOVING AVERAGE (T31)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	2.397	3.243
1 - PERIOD REVISION	2.057	2.250
FINAL ESTIMATOR	1.645	1.677

(CENTERED) ESTIMATOR OF THE PRESENT

RATE OF ANNUAL GROWTH, T(1 12)

(LINEAR APPROXIMATION)

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT ESTIMATOR	5.926	6.285	6.445
FINALESTI-MATOR	1.599	0.919	0.000

SERIES TITLE: IFAN

MODELS FOR THE COMPONENTS

TREND NUMERATOR

1.0000 0.0610 -0.9390

TREND DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR. (*) 0.04845

SEAS. NUMERATOR

1.0000 1.4235 1.5027 1.4345 1.2405 0.9941 0.7264

0.4603 0.2347 0.0229 -0.1152 -0.4067

SEAS. DENOMINATOR

1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000

1.0000 1.0000 1.0000 1.0000 1.0000

INNOV. VAR.(*) 0.07853

IRREGULAR

VAR.(*) 0.26183

SEASONALLY ADJUSTED NUMERATOR

1.0000 -1.3514 0.3873

SEASONALLY ADJUSTED DENOMINATOR

1.0000 -2.0000 1.0000

INNOV. VAR.(*) 0.55853

(*) IN UNITS OF VAR(A)

AUTOCORRELATION FUNCTION OF COMPONENTS

(STATIONARY TRANSFORMATION)

	TREND			ADJUSTED		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.002	0.413	0.323	-0.630	-0.633	-0.667

12	0.000	-0.265	-0.174	0.000	-0.266	-0.271
VAR.(*)	0.091	0.014	0.009	1.662	1.215	1.170

	IRREGULAR			SEASONAL		
LAG	COMPONENT	ESTIMATOR	ESTIMATE	COMPONENT	ESTIMATOR	ESTIMATE
1	0.000	-0.303	-0.425	0.917	0.776	0.692
12	0.000	-0.266	-0.252	0.000	0.593	0.554
VAR.(*)	0.262	0.134	0.118	0.852	0.116	0.059

(*) IN UNITS OF VAR(A)

For all components it should happen that :

- Var(Component) > Var(Estimator)
- Var(Estimator) close to Var(Estimate)

CROSSCORRELATION BETWEEN STATIONARY TRANSFORMATION OF ESTIMATORS

	ESTIMATOR	ESTIMATE
TREND-SEASONAL	-0.139	-0.198
SEASONAL-IRREGULAR	0.591E-01	0.629E-01
TREND-IRREGULAR	-0.152	-0.546E-01

ERROR ANALYSIS

	FINAL ESTIMATION ERROR		REVISION IN CONCURRENT ESTIMATOR	
	TREND	ADJUSTED	TREND	ADJUSTED
VAR.(*)	0.110	0.116	0.162	0.124

TOTAL ESTIMATION ERROR (CONCURRENT ESTIMATOR)

	TREND	ADJUSTED
VAR.(*)	0.272	0.239

PERCENTAGE REDUCTION IN THE STANDARD ERROR
OF THE REVISION AFTER ADDITIONAL YEARS
(COMPARISON WITH CONCURRENT ESTIMATORS)

	TREND	ADJUSTED
AFTER 1 YEAR	78.93	50.73
AFTER 2 YEAR	90.12	76.91
AFTER 3 YEAR	95.37	89.18
AFTER 4 YEAR	97.83	94.93
AFTER 5 YEAR	98.98	97.62

AVERAGE PERCENTAGE REDUCTION IN RMSE FROM CONCURRENT ADJUSTMENT 27.07

(*) IN UNITS OF VAR(A)

Seasonal component: RECENT ESTIMATES

PERIOD	ESTIMATE	STANDARD ERROR
-24	0.9812E-01	0.9092E-02
-23	-0.1099	0.9382E-02
-22	-0.1879E-01	0.9411E-02
-21	0.1004	0.9427E-02
-20	0.1642E-01	0.9433E-02
-19	0.6357E-01	0.9434E-02

-18	0.7543E-01	0.9435E-02
-17	0.7733E-01	0.9442E-02
-16	-0.5257	0.9463E-02
-15	0.9473E-01	0.9507E-02
-14	0.8729E-01	0.9587E-02
-13	0.5013E-01	0.9716E-02
-12	0.1050	0.9924E-02
-11	-0.1135	0.1109E-01
-10	-0.2110E-01	0.1120E-01
-9	0.9702E-01	0.1126E-01
-8	0.8539E-02	0.1128E-01
-7	0.6165E-01	0.1129E-01
-6	0.7688E-01	0.1129E-01
-5	0.7642E-01	0.1131E-01
-4	-0.5241	0.1139E-01
-3	0.9628E-01	0.1155E-01
-2	0.8607E-01	0.1182E-01
-1	0.4692E-01	0.1221E-01
0	0.1076	0.1272E-01

STANDARD ERROR OF FINAL ESTIMATOR 0.8843E-02

Seasonal component: FORECAST

PERIOD	FORECAST	STANDARD ERROR
1	-0.1147	0.1502E-01
2	-0.2024E-01	0.1526E-01
3	0.9741E-01	0.1539E-01
4	0.7800E-02	0.1544E-01
5	0.6180E-01	0.1545E-01
6	0.7815E-01	0.1545E-01
7	0.7681E-01	0.1547E-01

8	-0.5238	0.1555E-01
9	0.9697E-01	0.1570E-01
10	0.8619E-01	0.1597E-01
11	0.4558E-01	0.1636E-01
12	0.1081	0.1692E-01

STANDARD ERROR OF THE RATES OF GROWTH ESTIMATES

(IN POINTS OF NONANNUALIZED PERCENT GROWTH)

(LINEAR APPROXIMATION)

1. PERIOD TO PERIOD RATE OF GROWTH OF THE SERIES (T11)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	0.738	1.382
1 - PERIOD REVISION	0.676	1.381
FINAL ESTIMATOR	0.608	1.052

2. RATE OF GROWTH OF A 3 - PERIOD (CENTERED) MOVING AVERAGE (T31)

	TREND	SEASONALLY ADJ. SERIES
CONCURRENT ESTIMATOR	1.653	2.298
1 - PERIOD REVISION	1.444	1.697
FINAL ESTIMATOR	1.141	1.279

(CENTERED) ESTIMATOR OF THE PRESENT

RATE OF ANNUAL GROWTH, T(1 12)

(LINEAR APPROXIMATION)

STANDARD ERROR	TREND	SEAS. ADJ. SERIES	ORIGINAL SERIES
CONCURRENT	4.210	4.482	4.655

FINALESTI- MATOR	1.133	0.776	0.000

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APPENDIX: FIGURES

For each one of the 11 series a set of figures from TRAMO-SEATS have been selected. To save some space, only the first input option for each series is considered.

Figure 1 comes from TRAMO, and displays the original series, the series corrected for deterministic effects (outliers, trading day, easter effect, and holidays, when appropriate); this corrected series is called the linearized series, since it is considered the output of a linear stochastic process. The figure also displays the residuals from fitting the model, and the series forecast, together with the associated 95% confidence internal.

Figure 2, from SEATS, displays the estimator of the unobserved components. In the figures, x stands for the original series, and *safin* and *trfin* denote the final estimators of the seasonally adjusted series and of the trend, respectively. The seasonal and irregular components estimators are also presented.

Figure 3, from SEATS, show the pseudospectra of the original and seasonally adjusted series, and of the trend. It also displays the frequency domain representation of the squared gain of the filter that provides the seasonally adjusted series, the trend, and the seasonal component estimators.

Figure 4, from SEATS, exhibits the 24 period-ahead forecast function of the original series, trend and seasonal component, as well as the associated 95% confidence intervals. In the figures, *forx*, *fort*, and *fors* denote the forecasts of the original series, trend and seasonal factors. *CI* denotes the corresponding confidence interval.

In some cases an additional figure from SEATS is added, namely, Figure 5. It compares the monthly growth of the original series to that of the seasonally adjusted series, and the latter to that of the trend.

FIG1: BDE

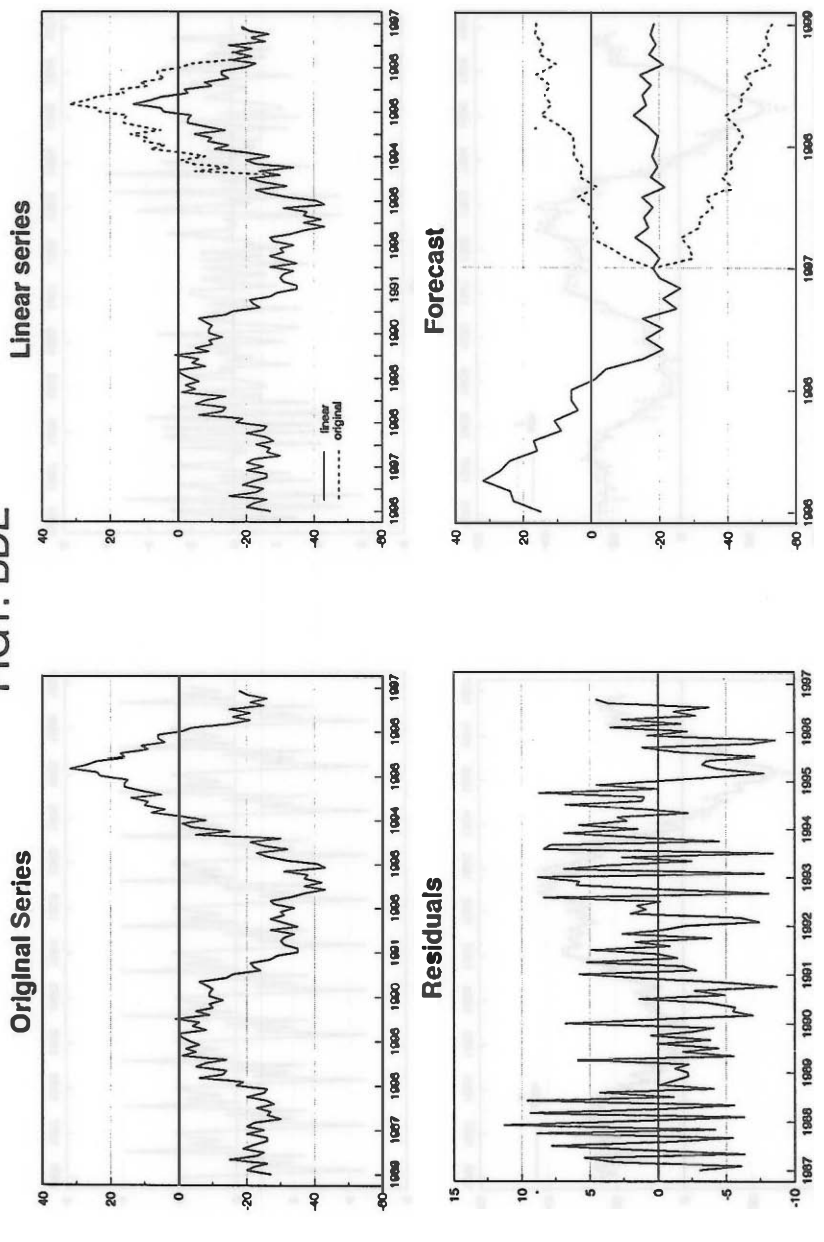

Original Series
Linear series
linear
original
Residuals
Forecast

FIG2: BDE

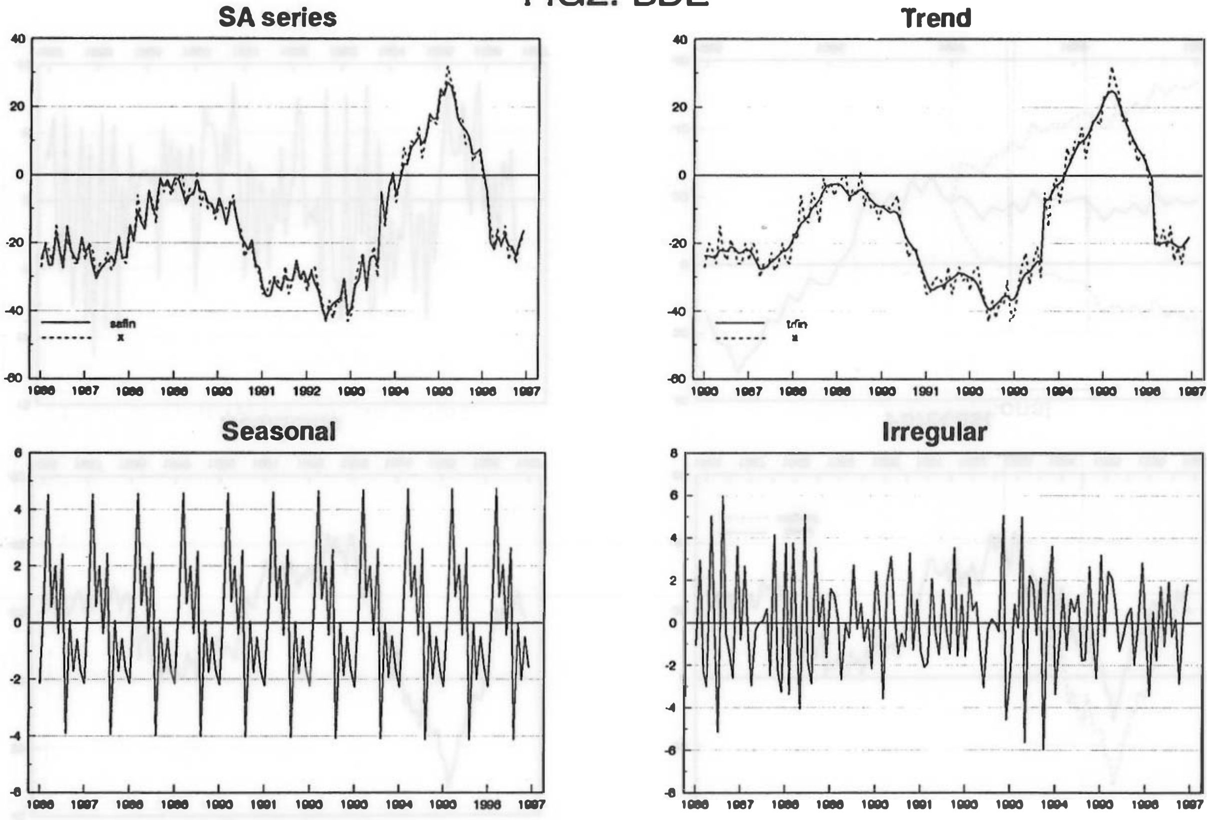


FIG3:BDE

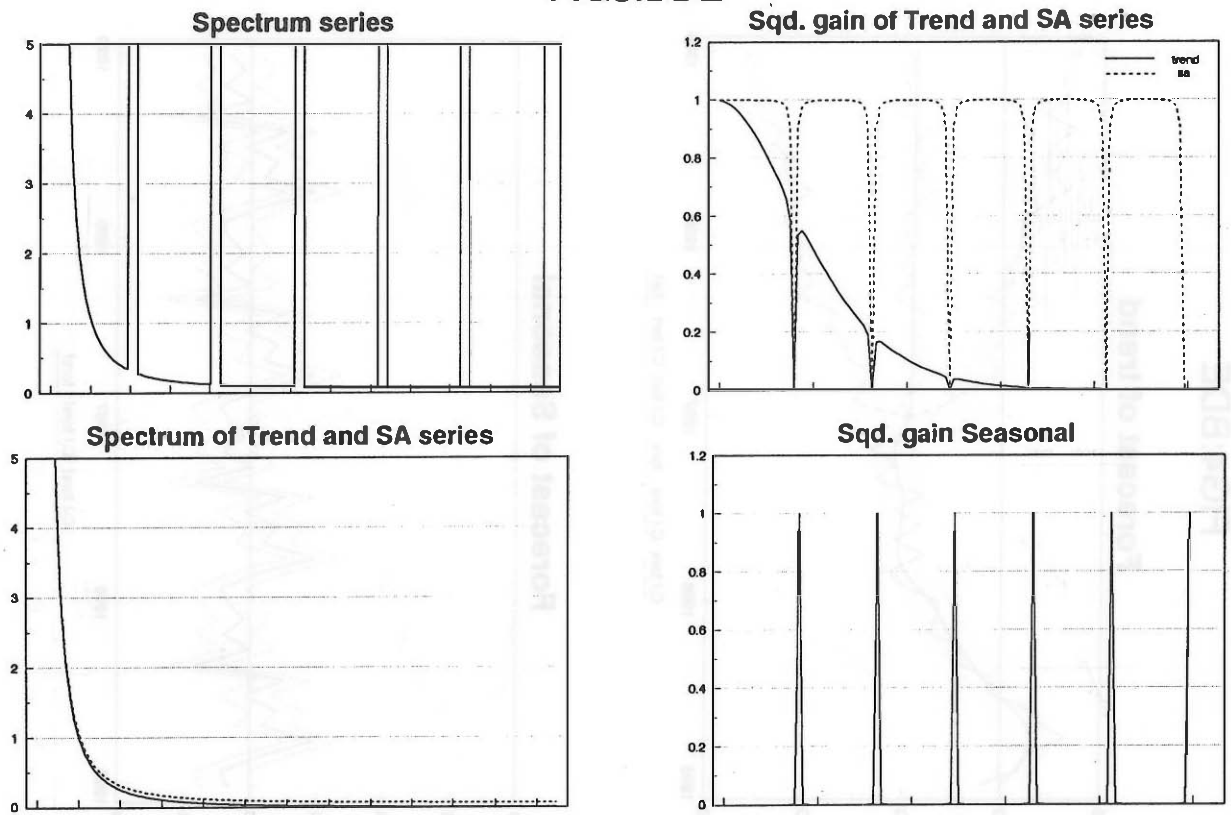
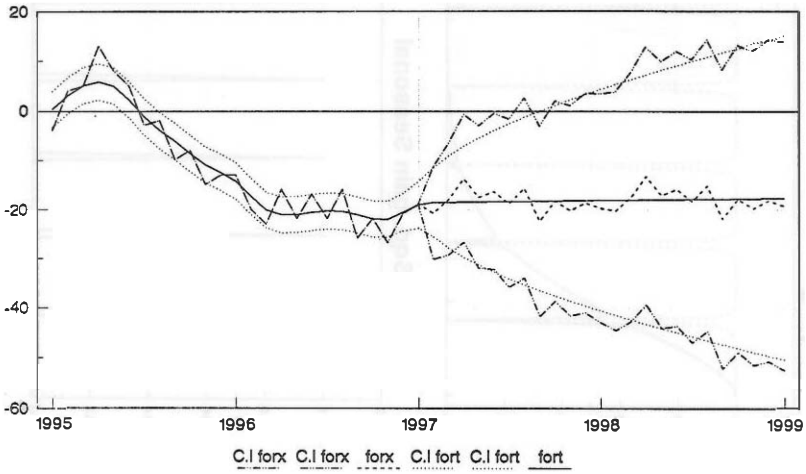

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and SA series
Sqd. gain Seasonal

FIG4:BDE

Forecast of trend



Forecast of Seasonal

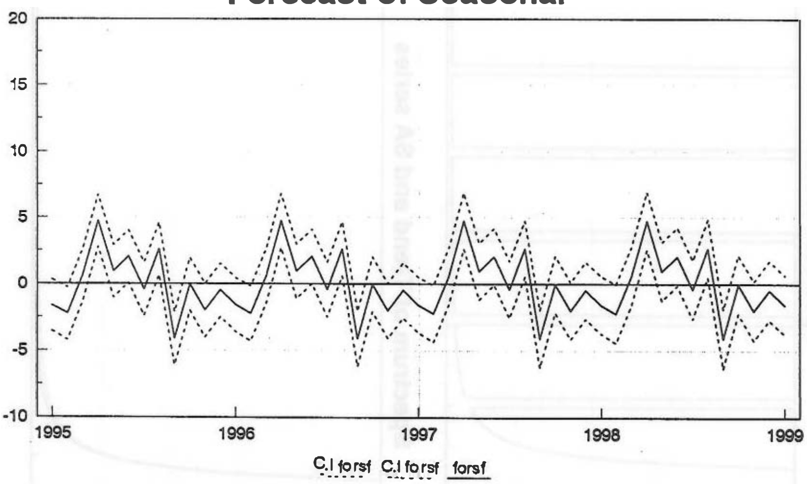


FIG1: BDI

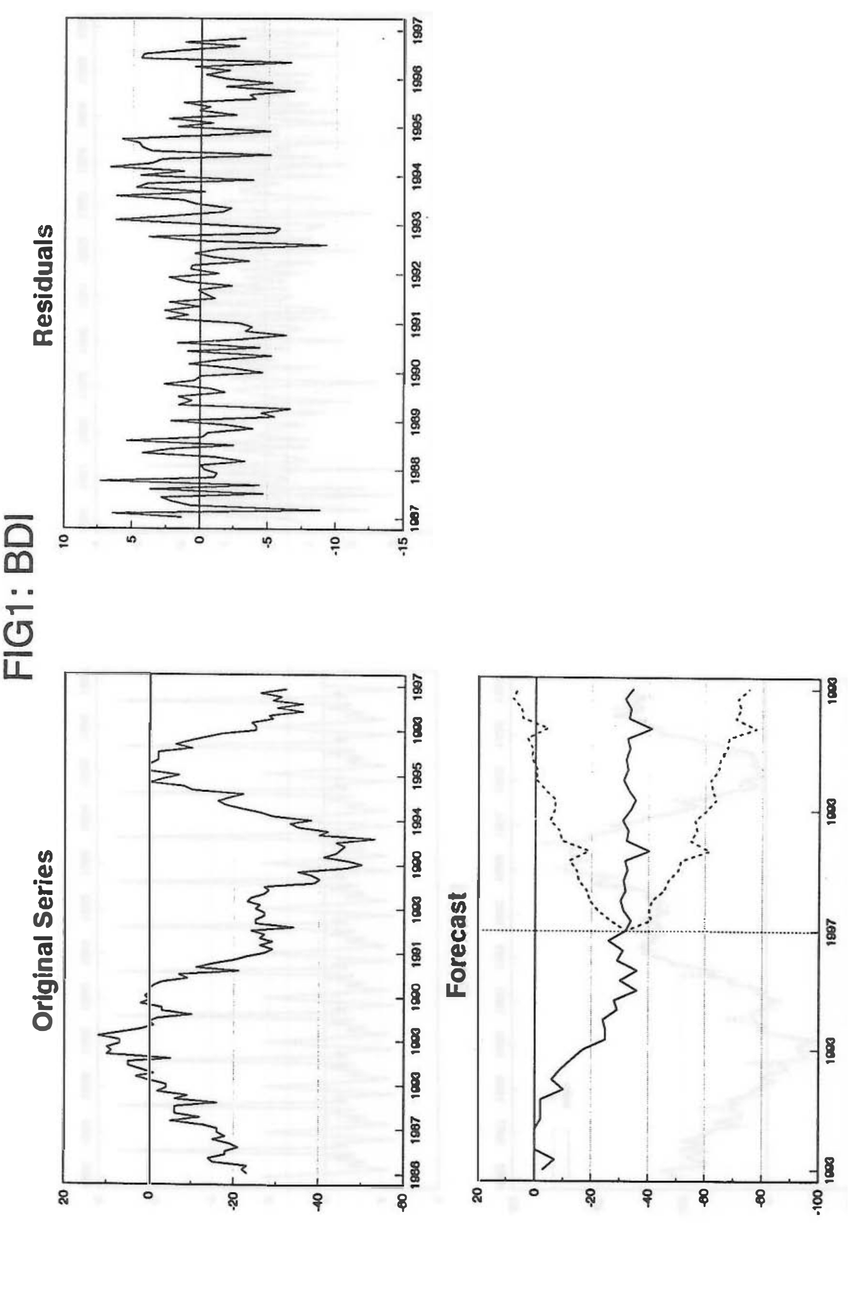


FIG2: BDI

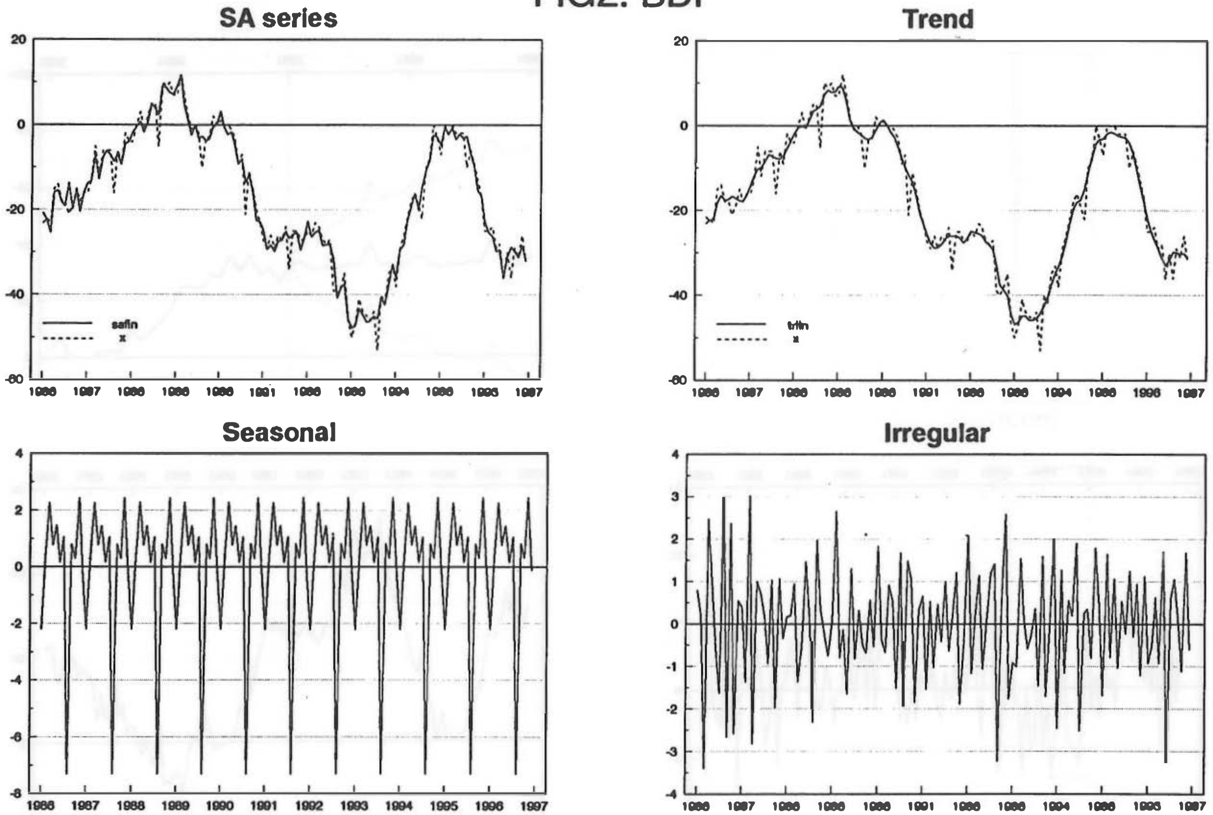

SA series
Trend
Seasonal
Irregular
safin
x
trfin
x
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997

FIG3:BDI

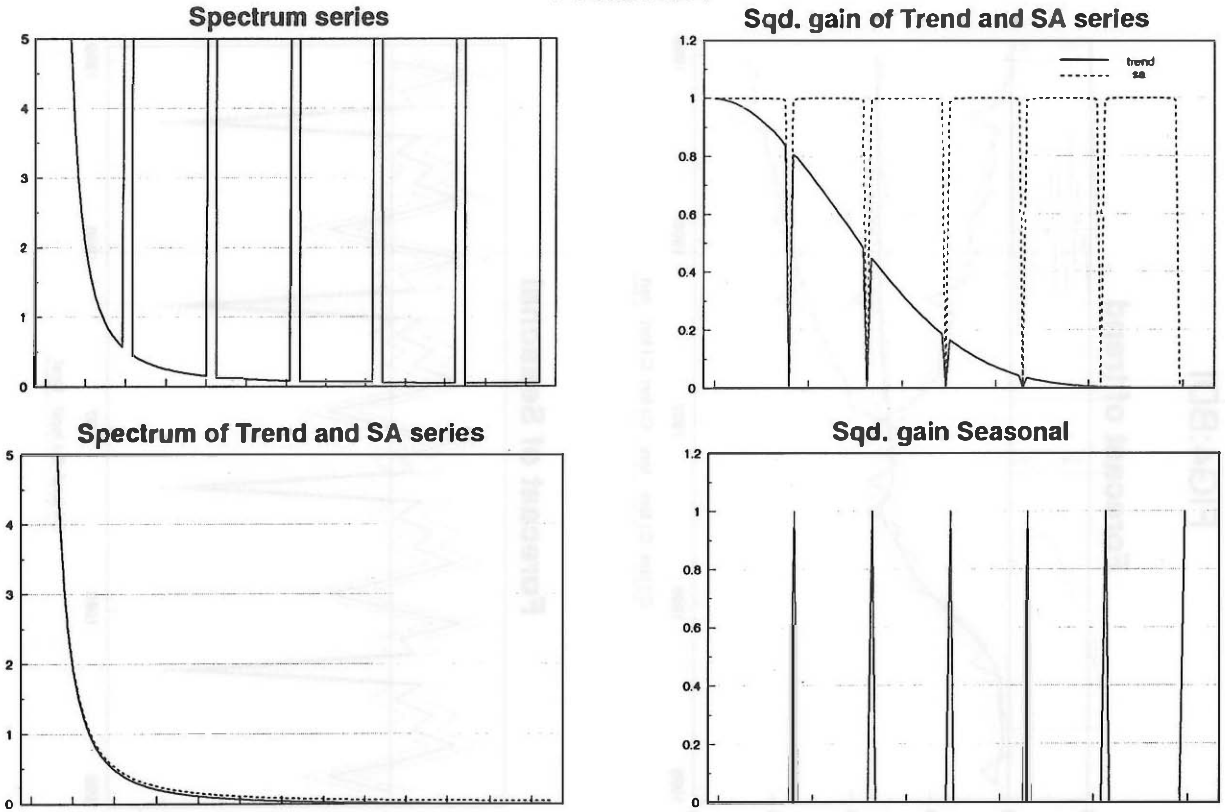
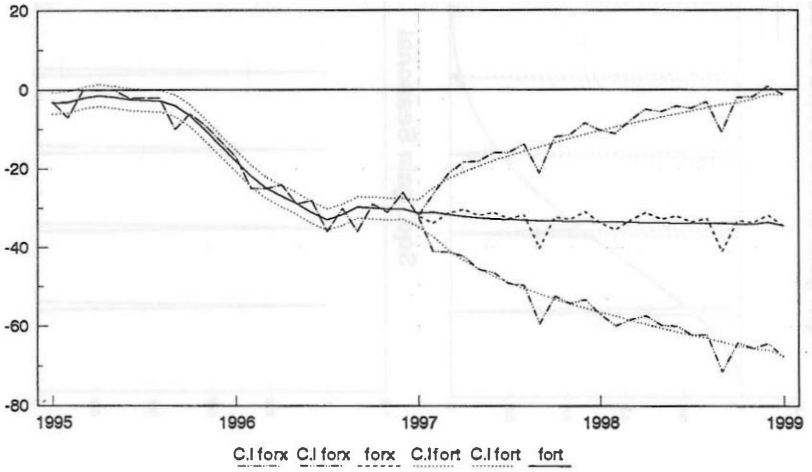

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and SA series
Sqd. gain Seasonal

FIG4:BDI

Forecast of trend



Forecast of Seasonal

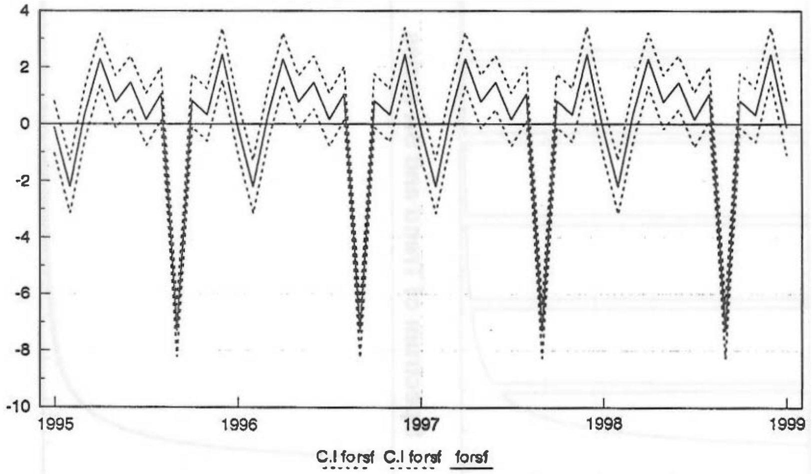
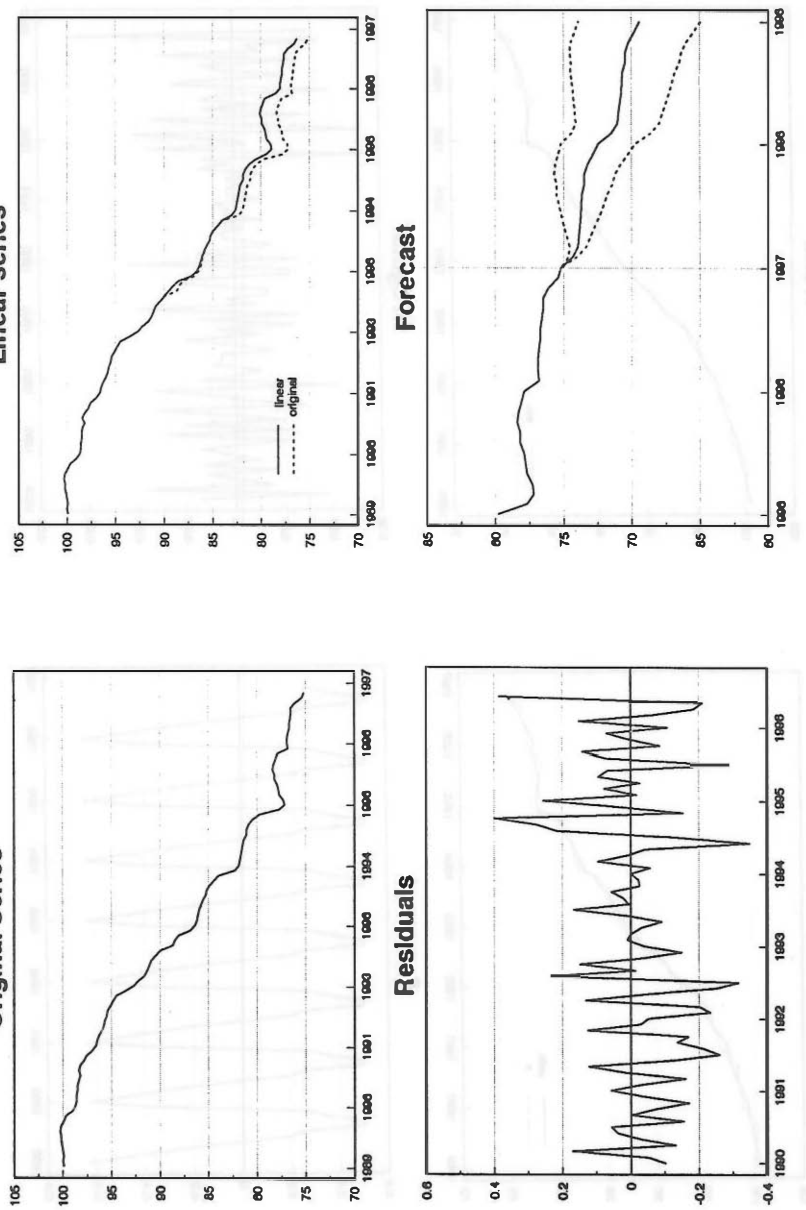


FIG1: LGO



Original Series
Linear series
linear
original
Residuals
Forecast

FIG2: LGO

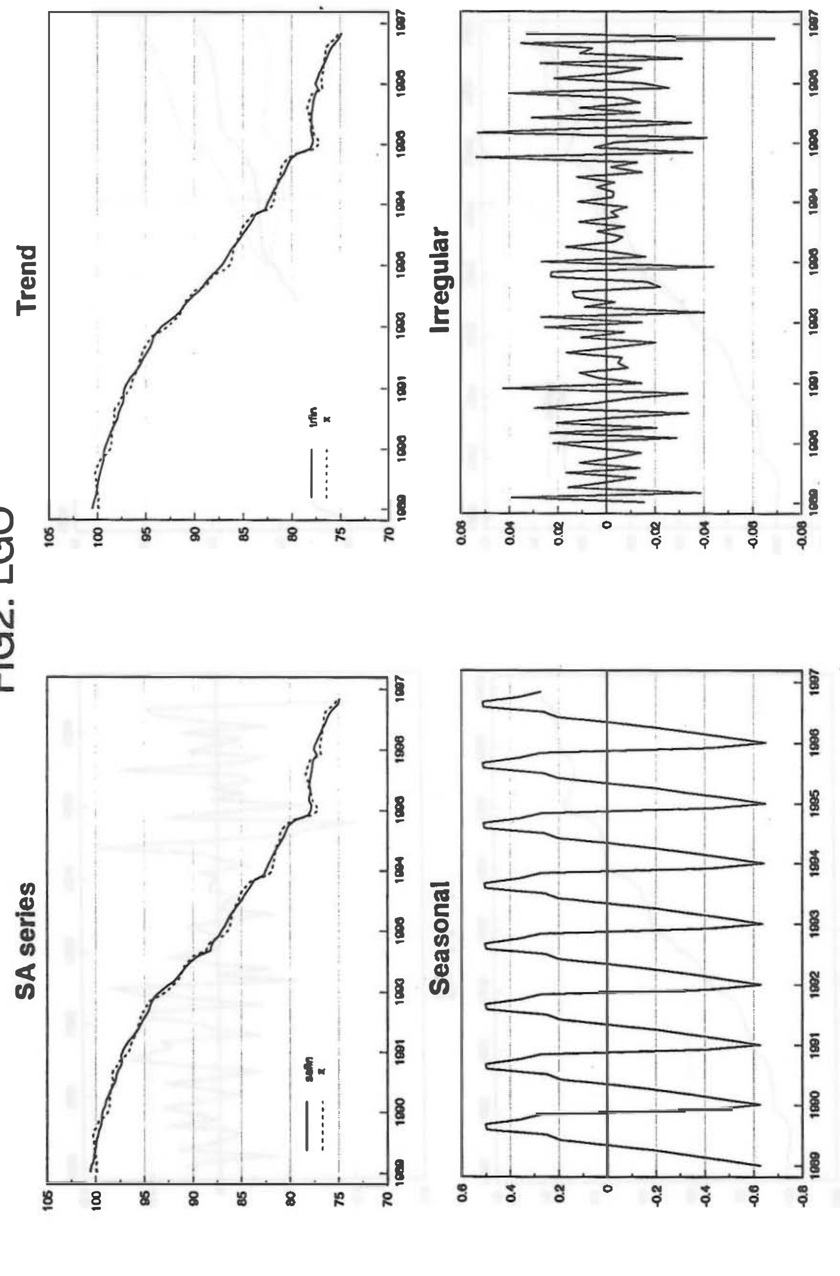


FIG3:LGO

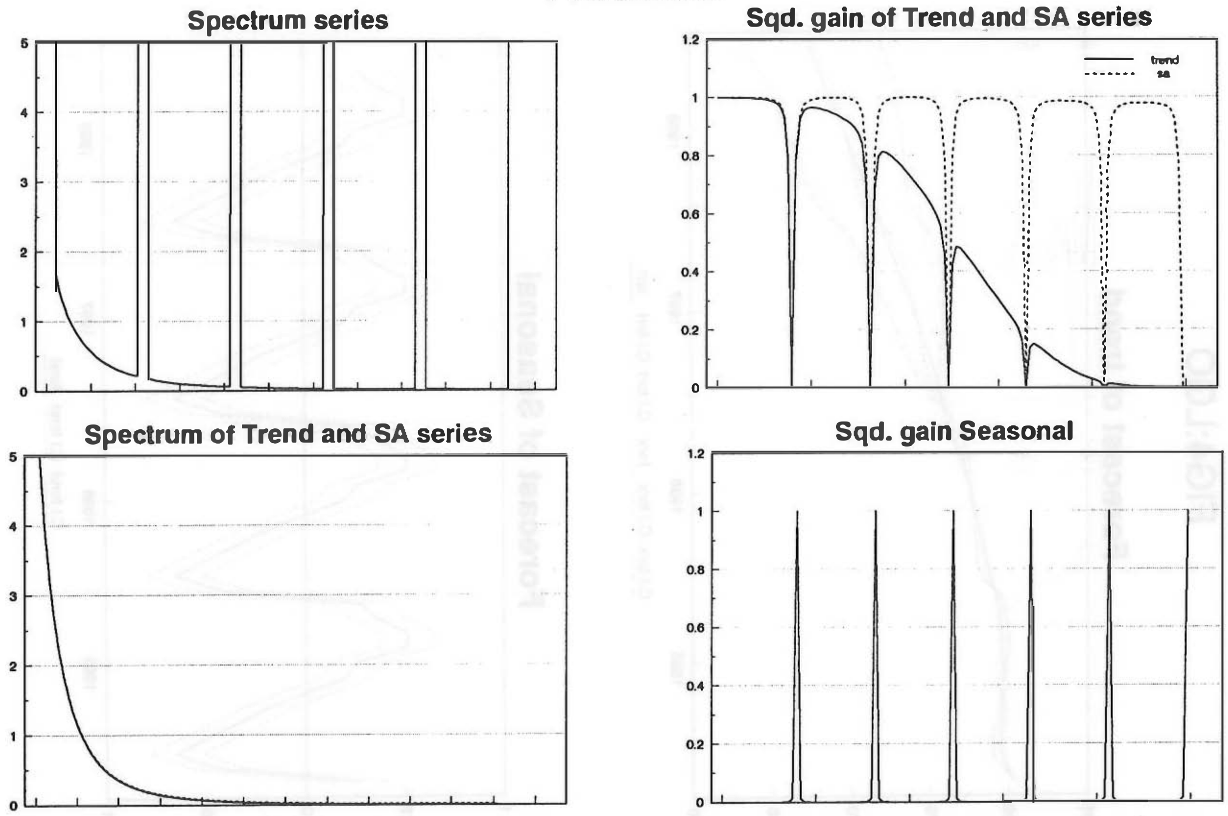
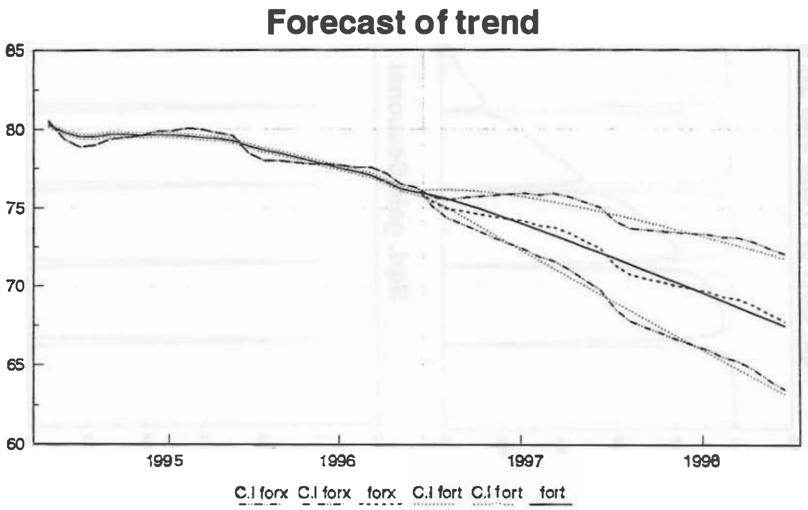
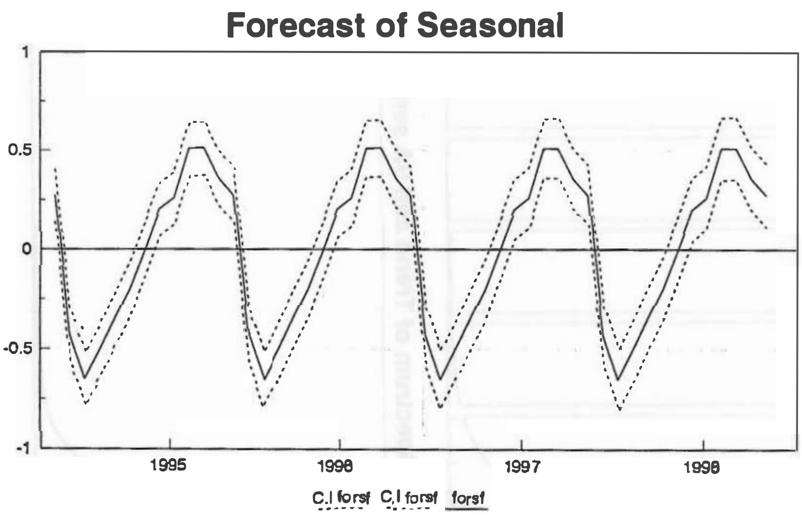

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and SA series
Sqd. gain Seasonal

FIG4:LGO



Forecast of trend
85
80
75
70
65
60
1995
1996
1997
1998
C.I forx C.I forx forx C.I fort C.I fort fort



Forecast of Seasonal
1
0.5
0
-0.5
-1
1995
1996
1997
1998
C.I forsf C.I forsf forsf

FIG1: PCO

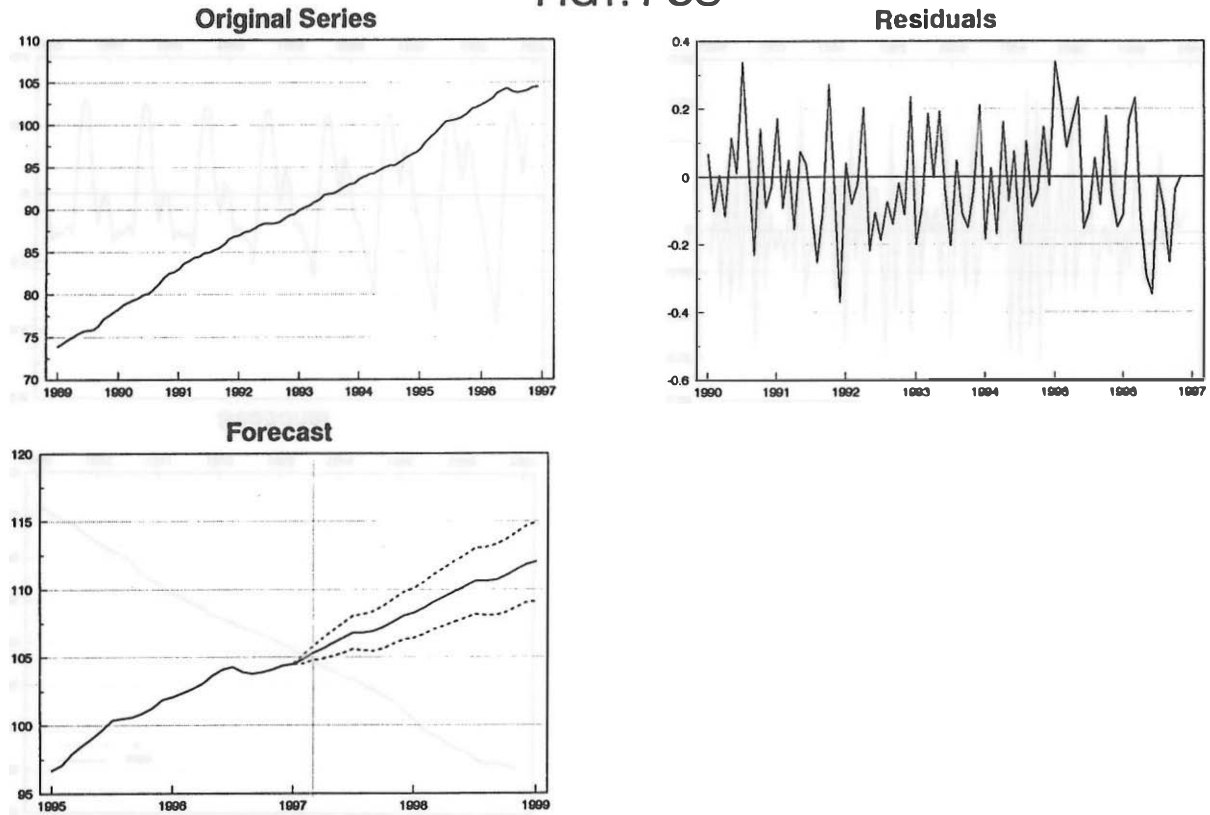


FIG2: PCO

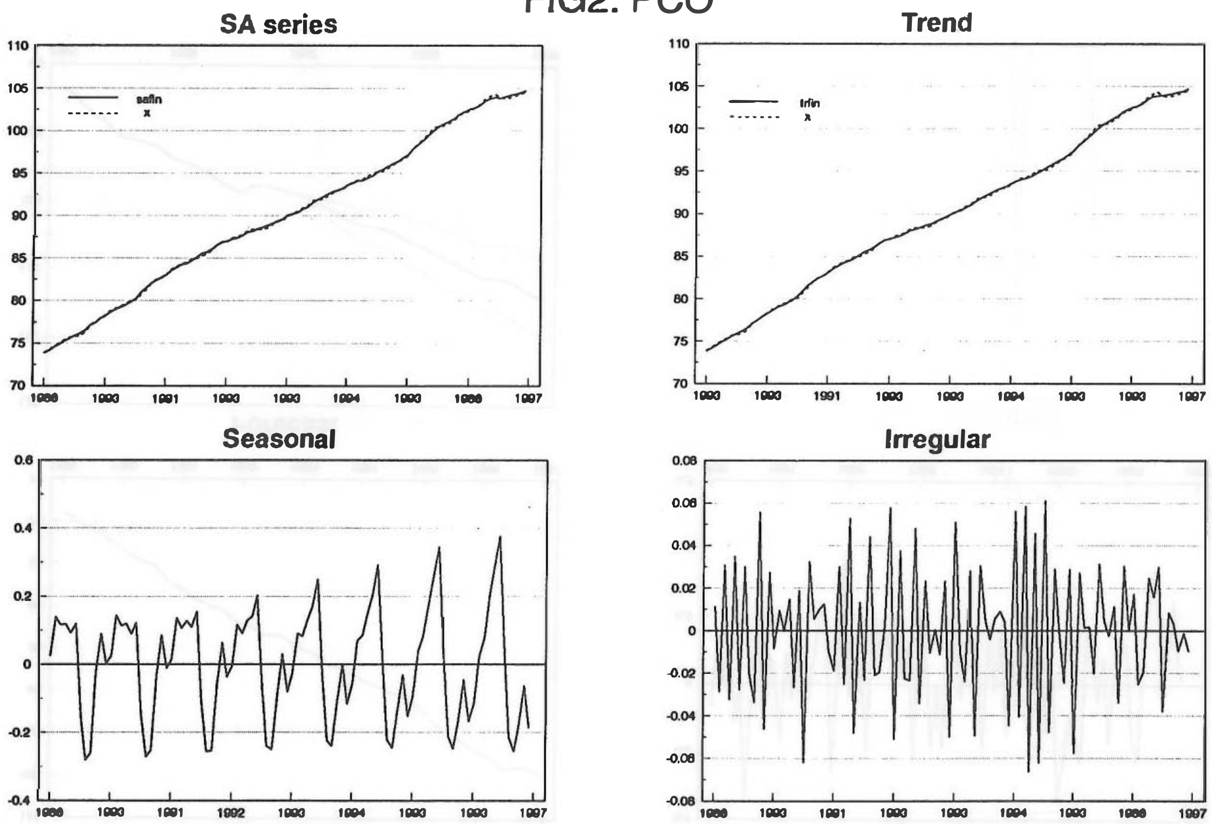


FIG3:PCO

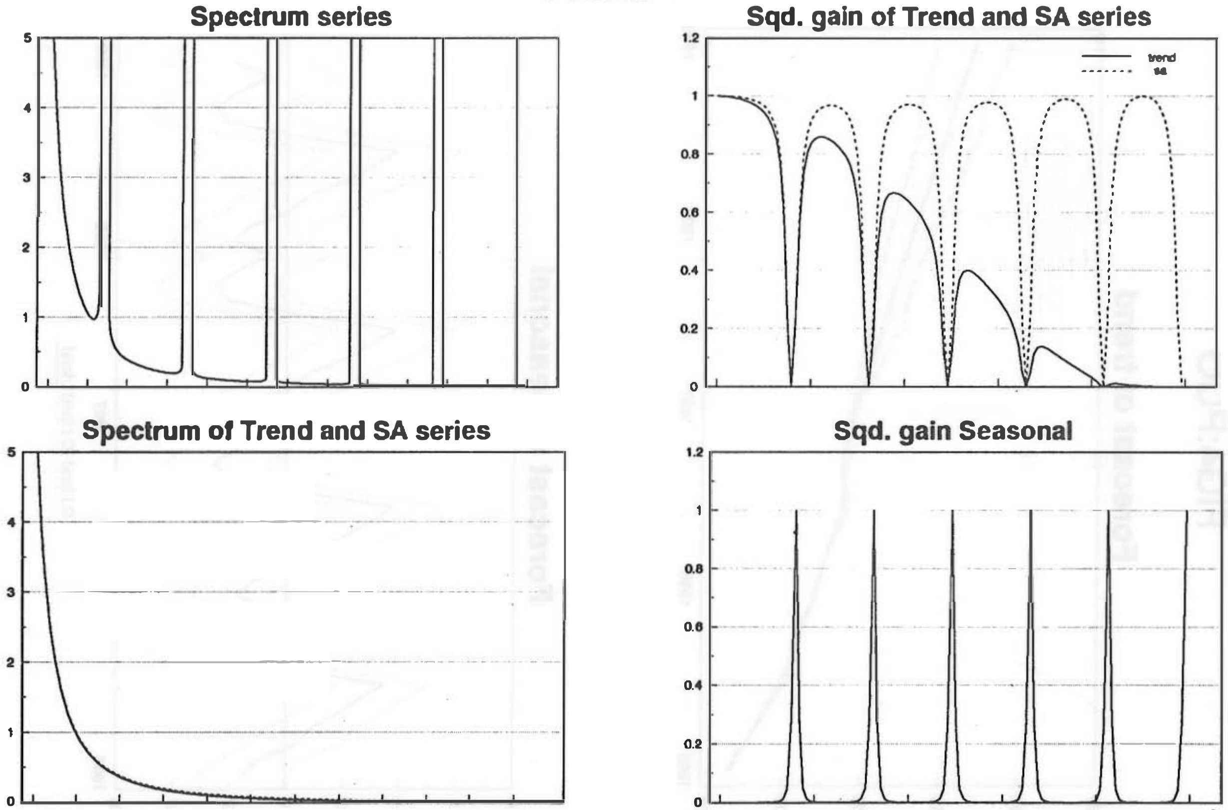
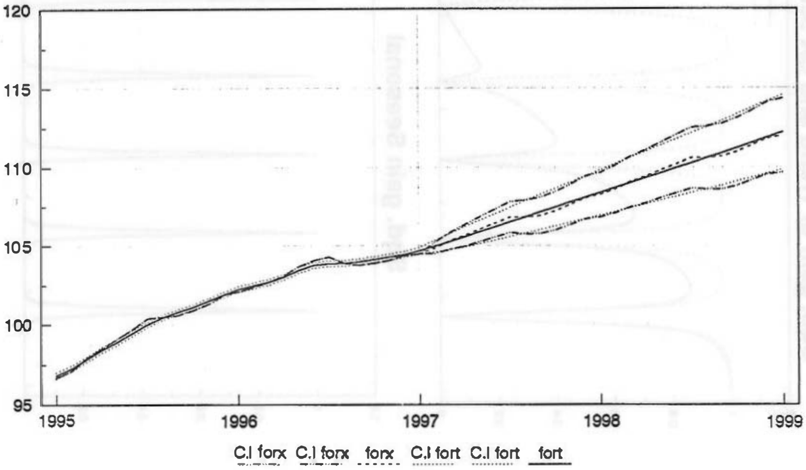

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and SA series
Sqd. gain Seasonal
5
4
3
2
1
0
1.2
1
0.8
0.6
0.4
0.2
0

FIG4:PCO

Forecast of trend



Forecast of Seasonal

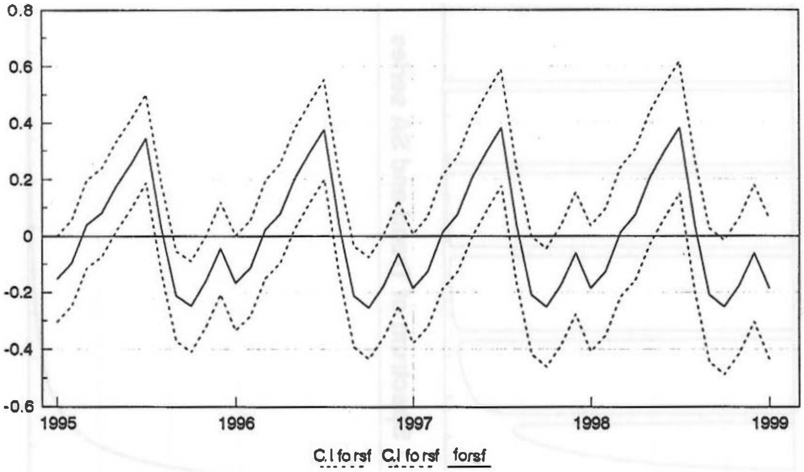
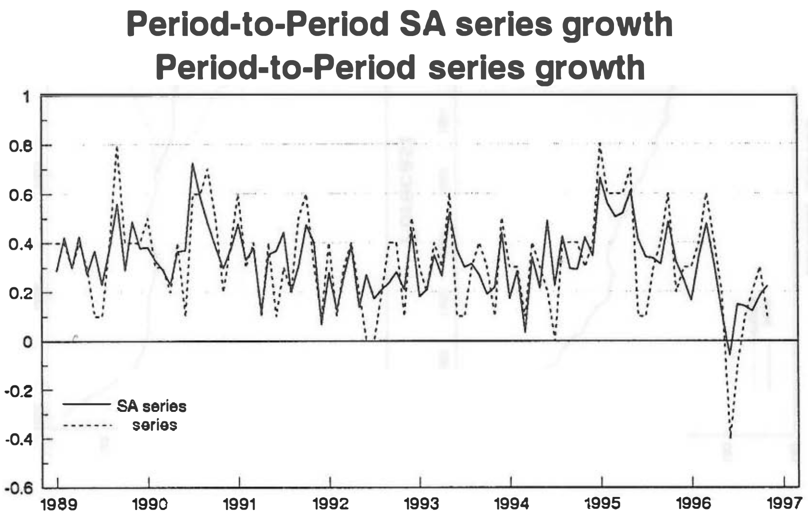
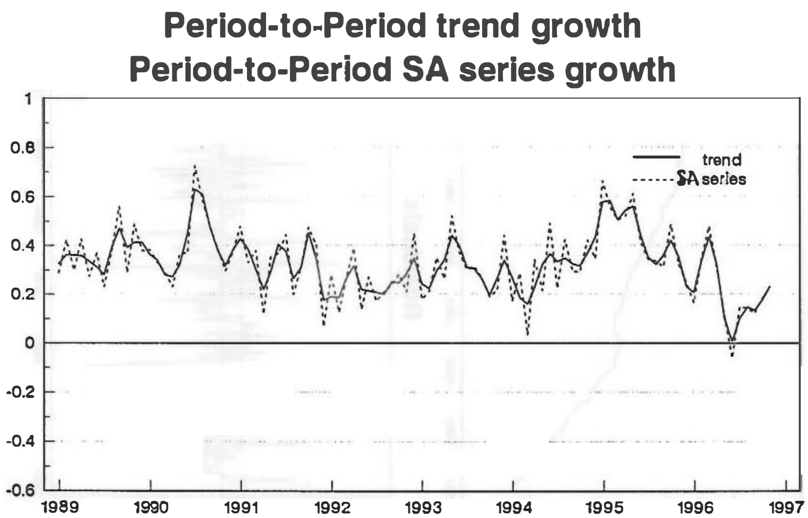


FIG 5:PCO



Period-to-Period SA series growth
Period-to-Period series growth
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
SA series
series
1989
1990
1991
1992
1993
1994
1995
1996
1997



Period-to-Period trend growth
Period-to-Period SA series growth
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
trend
SA series
1989
1990
1991
1992
1993
1994
1995
1996
1997

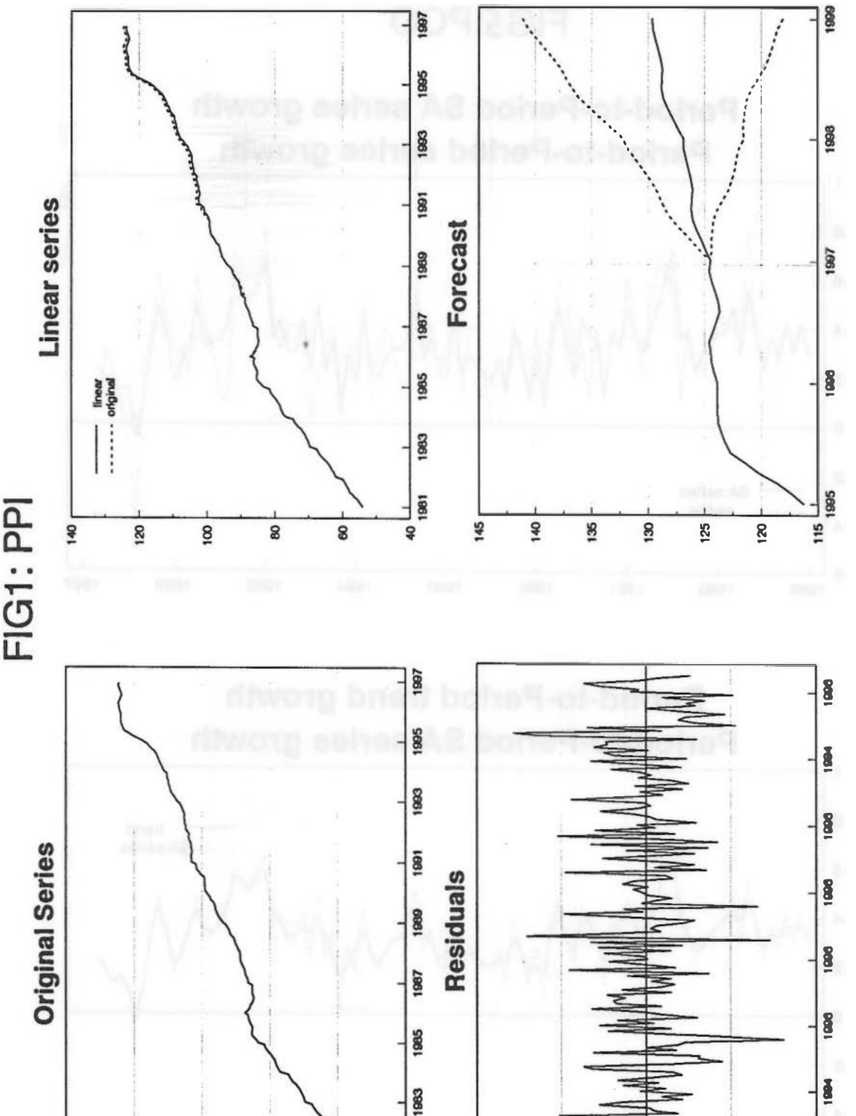

Original Series
Linear series
linear
original
Residuals
Forecast
FIG1: PPI

FIG2:PPI

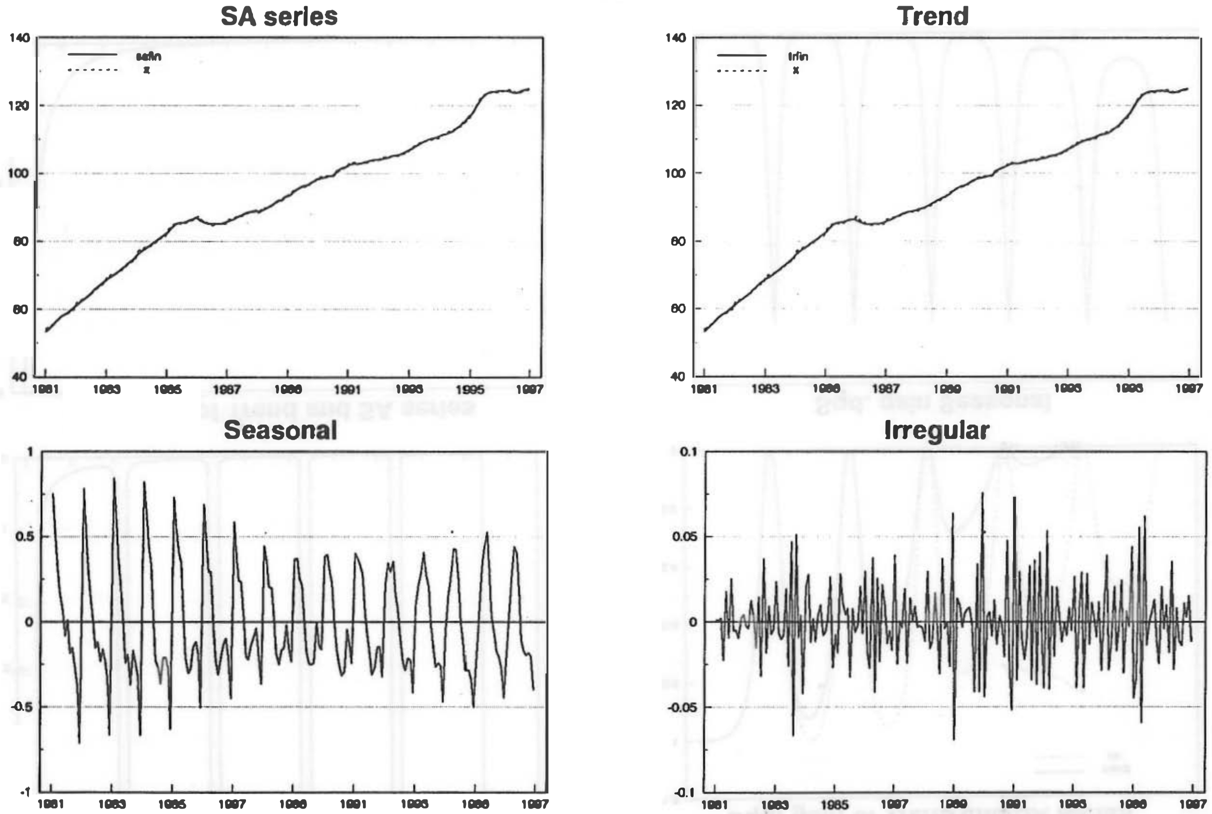

SA series
Trend
Seasonal
Irregular
x
x
140
120
100
80
60
40
1981
1983
1985
1987
1989
1991
1993
1995
1997
1
0.5
0
-0.5
-1
0.1
0.05
-0.05
-0.1

FIG3:PPI

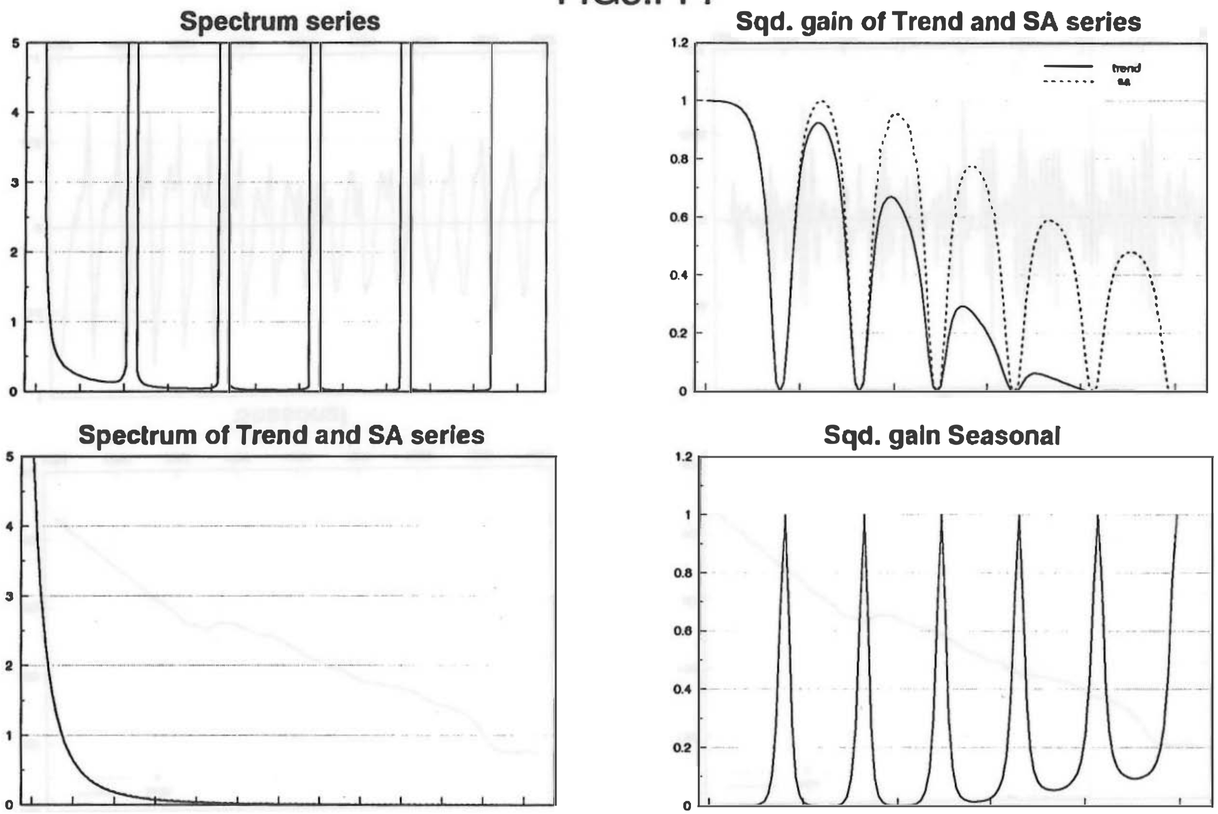
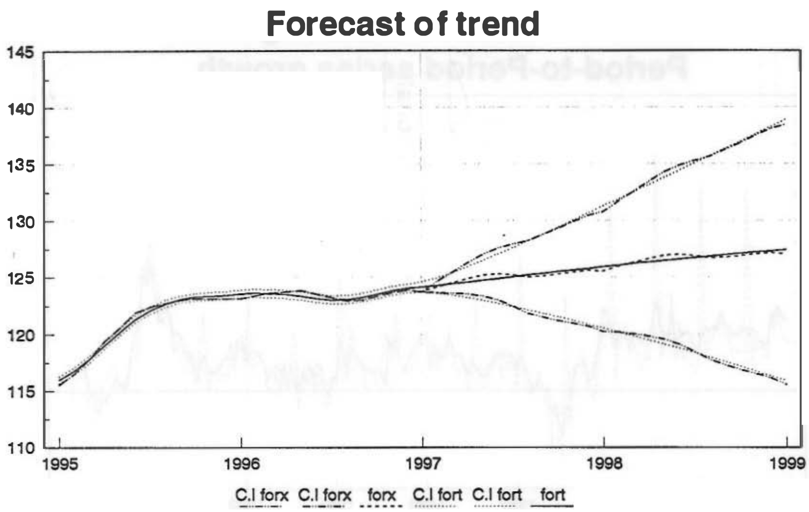

Spectrum series
Sqd. gain of Trend and SA series
trend
SA
Spectrum of Trend and SA series
Sqd. gain Seasonal
5
4
3
2
1
0
1.2
1
0.8
0.6
0.4
0.2
0

FIG4:PPI


Forecast of trend
145
140
135
130
125
120
115
110
1995
1996
1997
1998
1999
C.I forx C.I forx forx C.I fort C.I fort fort

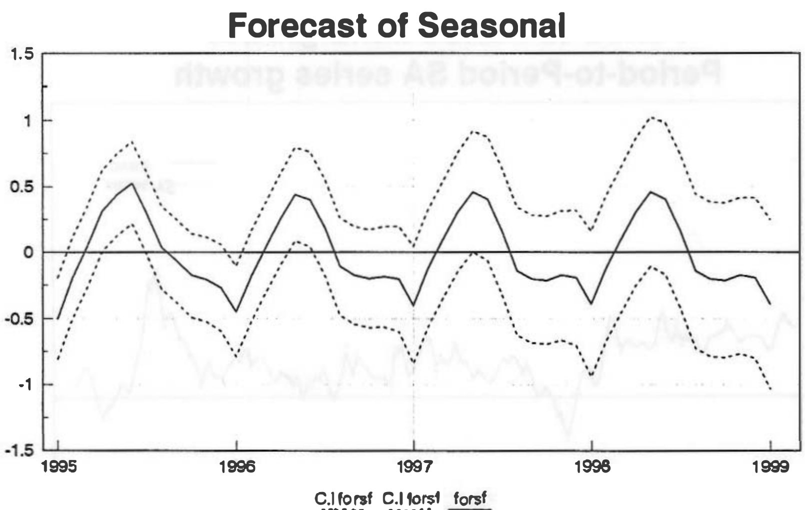
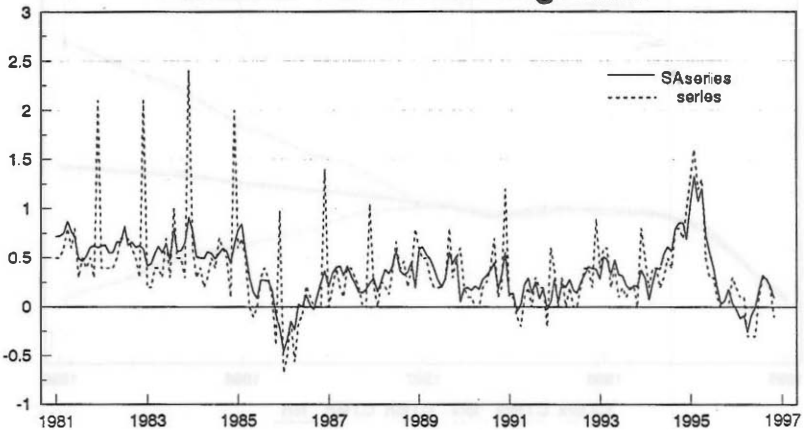

Forecast of Seasonal
1.5
1
0.5
0
-0.5
-1
-1.5
1995
1996
1997
1998
1999
C.I forsf C.I forsf forsf

FIG5:PPI

Period-to-Period SA series growth
Period-to-Period series growth



Period-to-Period trend growth
Period-to-Period SA series growth

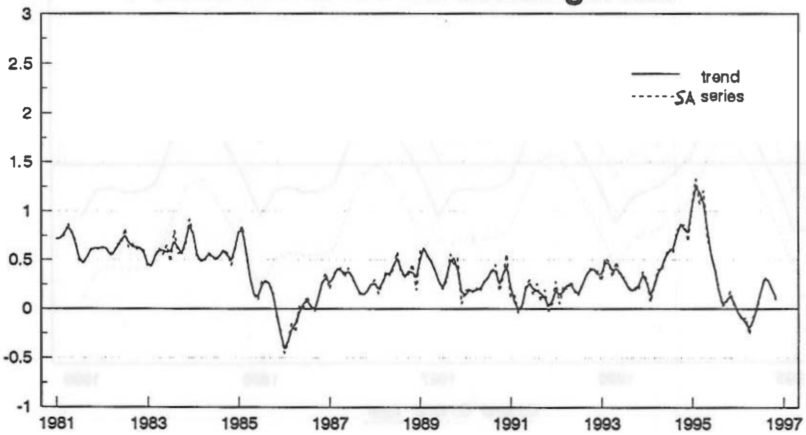


FIG1: CIT

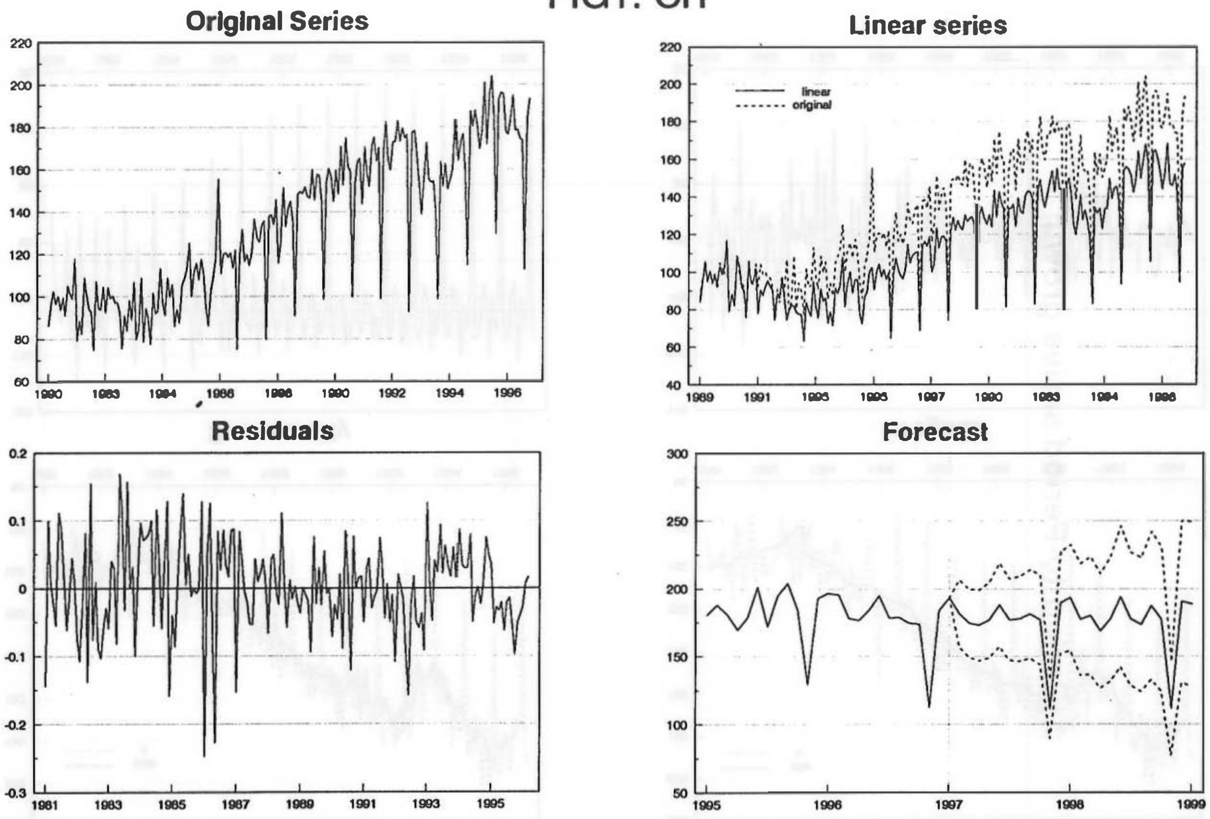

Original Series
220
200
180
160
140
120
100
80
60
Linear series
linear
original
220
200
180
160
140
120
100
80
60
40
Residuals
0.2
0.1
0
-0.1
-0.2
-0.3
1981
1983
1985
1987
1989
1991
1993
1995
Forecast
300
250
200
150
100
50
1995
1996
1997
1998
1999

FIG2: CIT

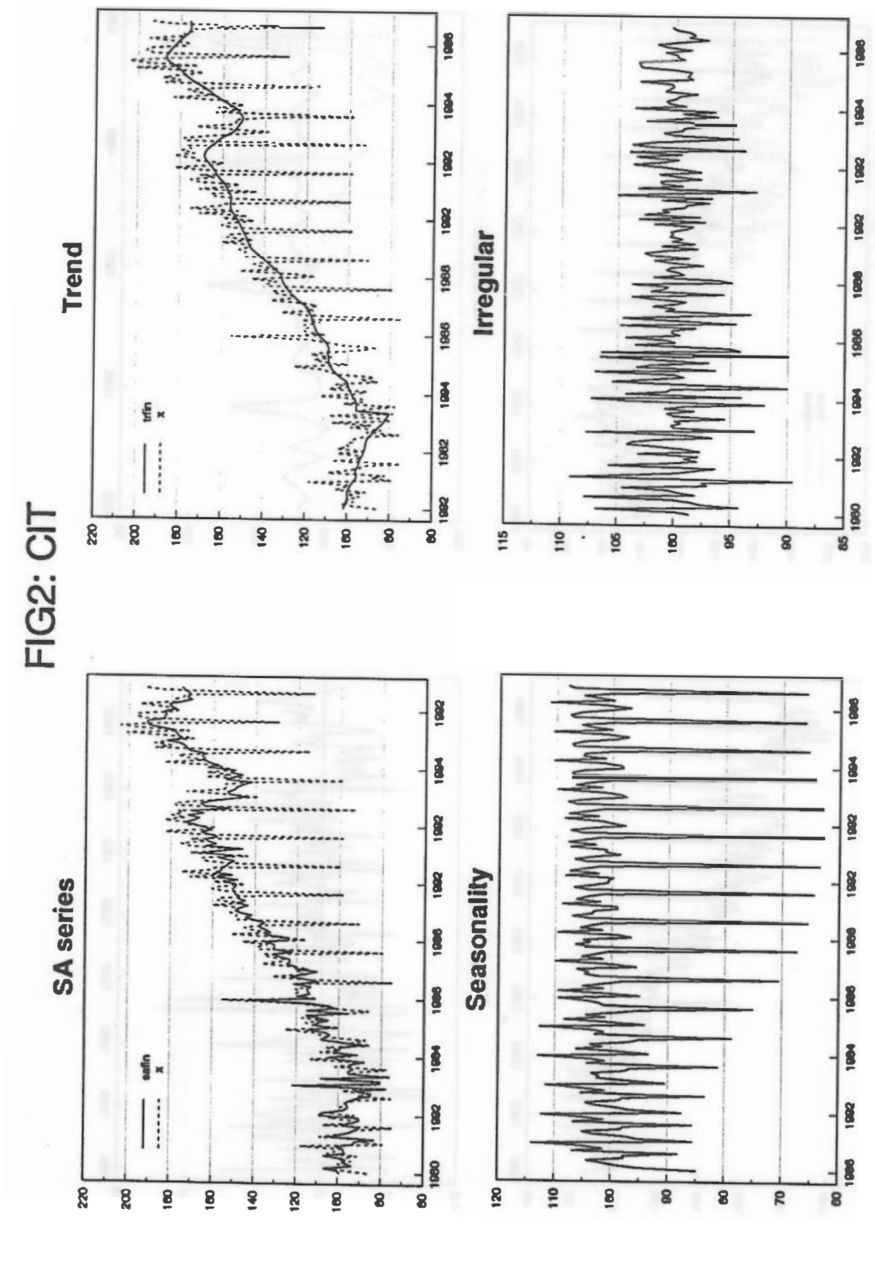


FIG3:CIT

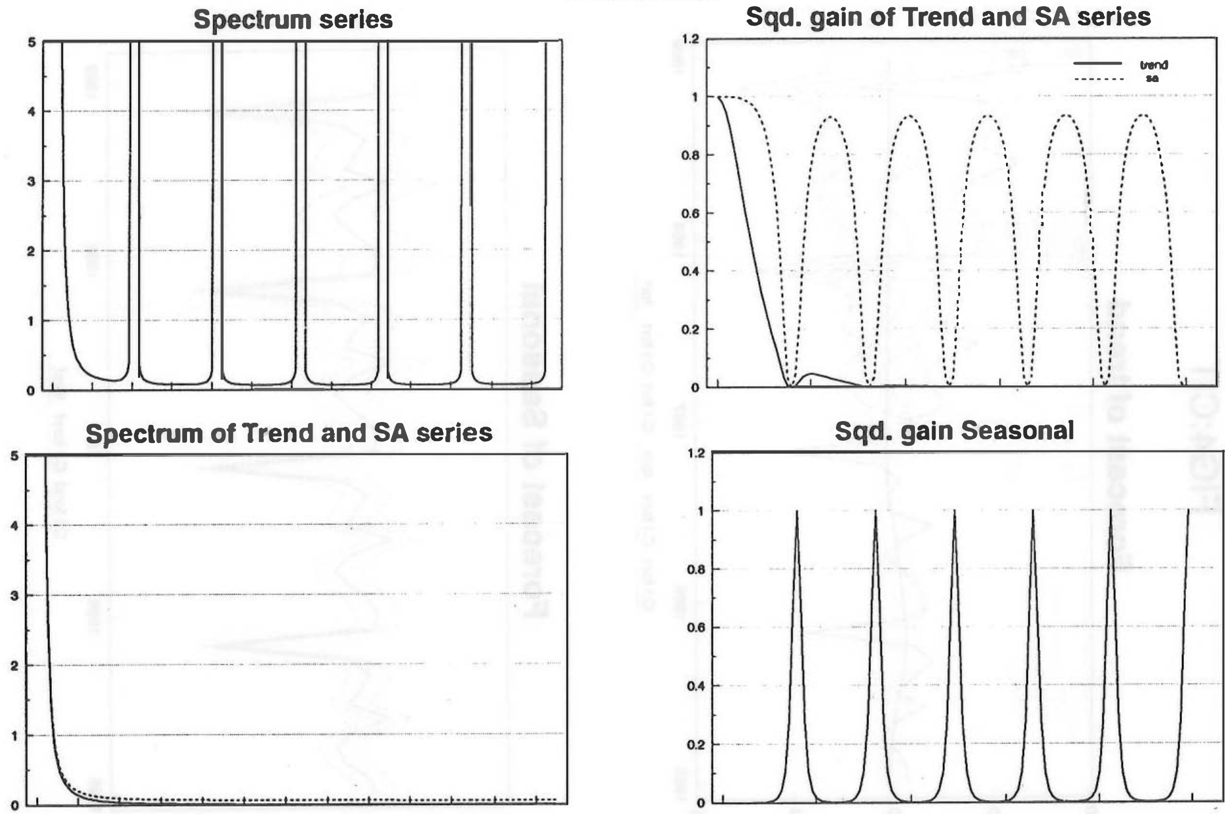
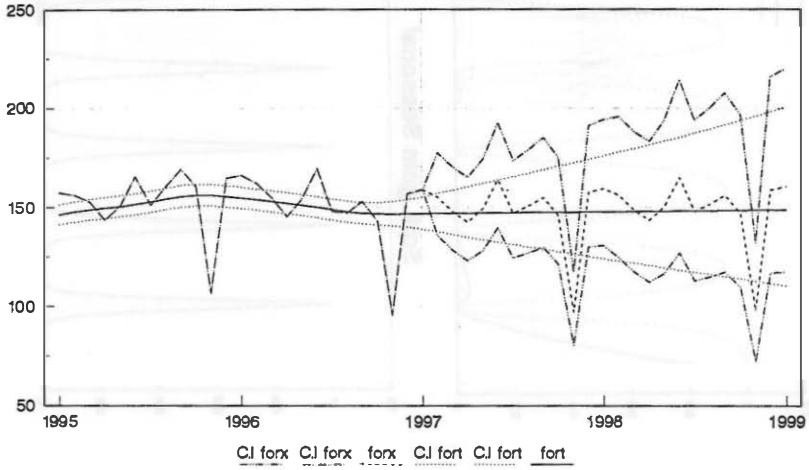

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and SA series
Sqd. gain Seasonal

FIG4:CIT

Forecast of trend



Forecast of Seasonal

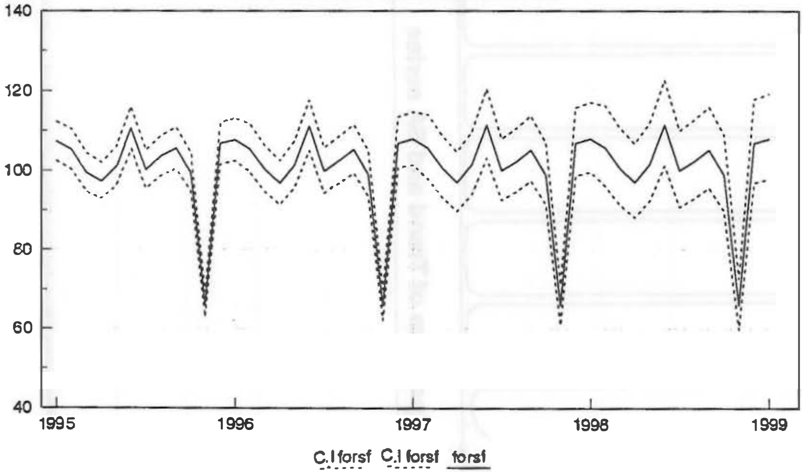


FIG1: CET

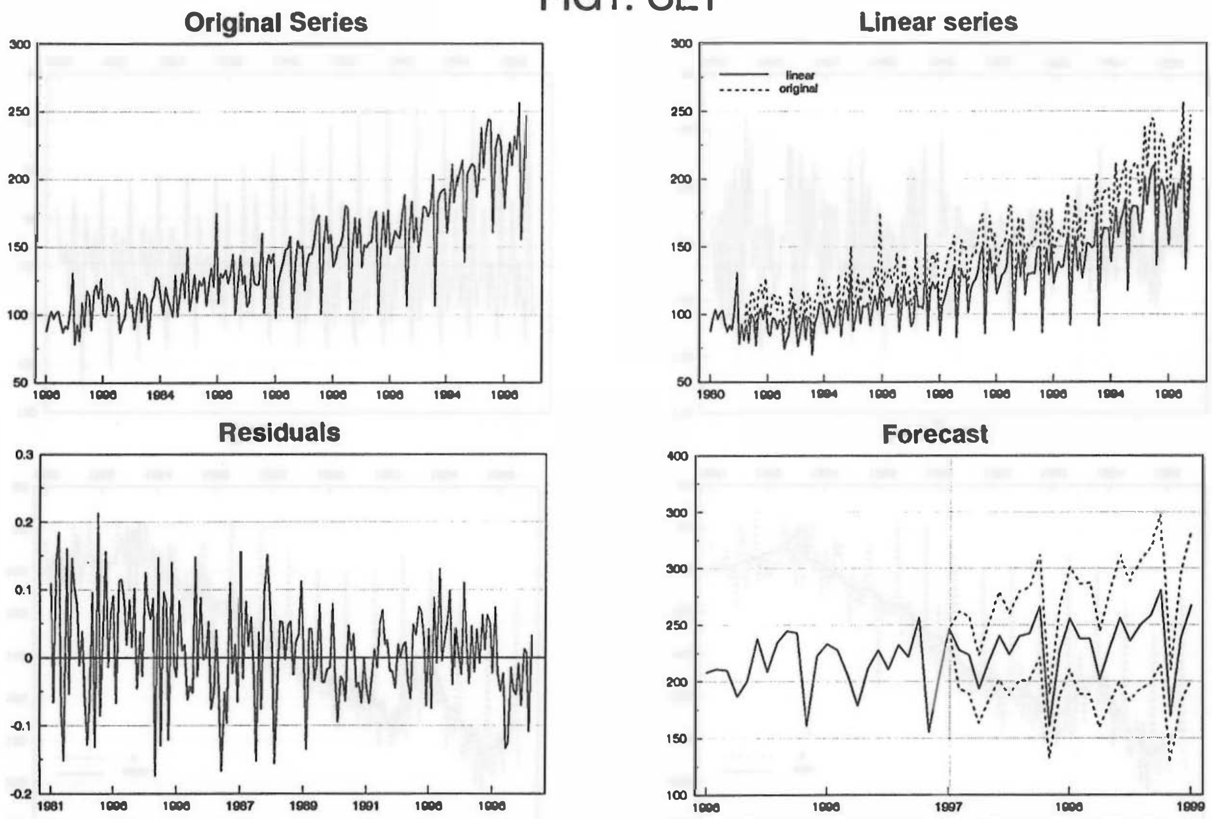

Original Series
Linear series
linear
original
Residuals
Forecast

FIG2: CET

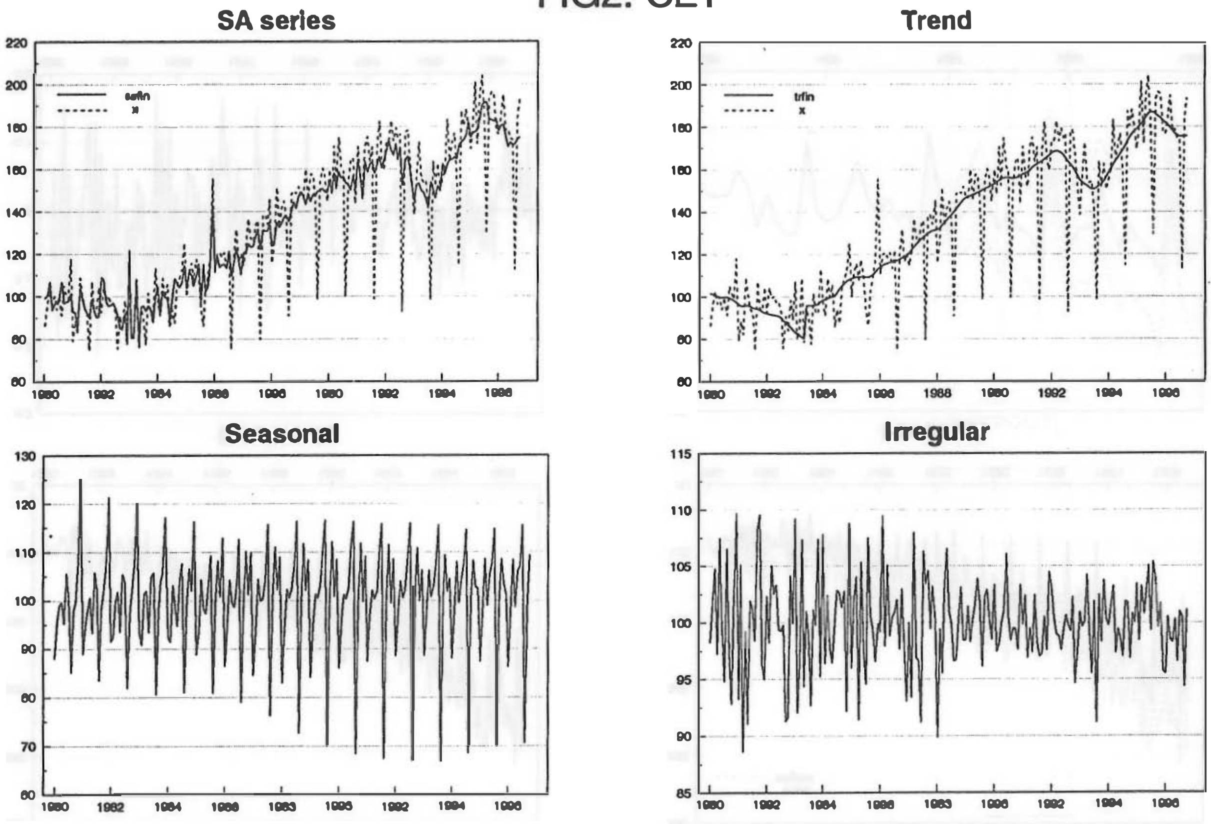


FIG3:CET

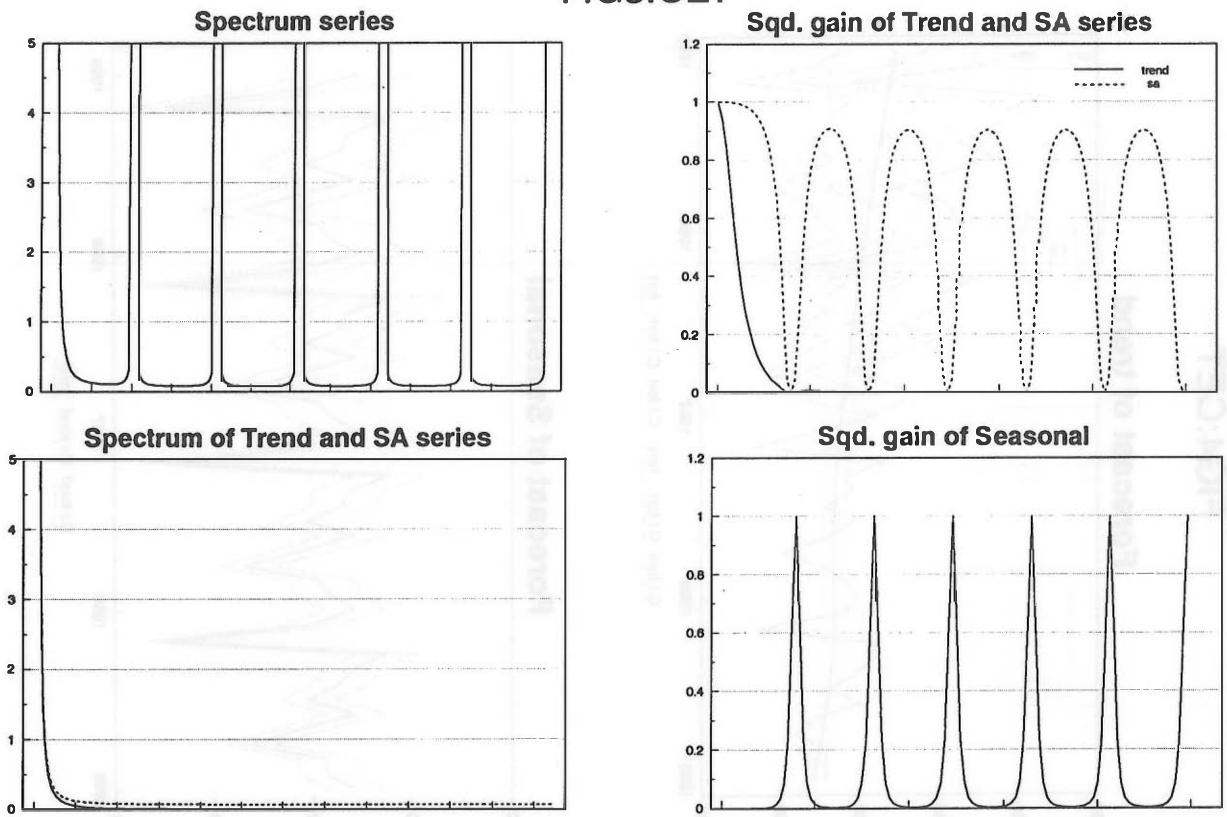
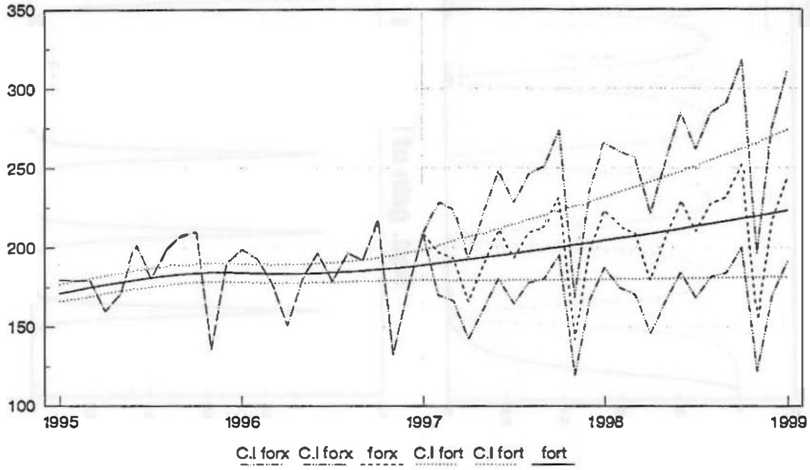

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and SA series
Sqd. gain of Seasonal

FIG4:CET

Forecast of trend



Forecast of Seasonal

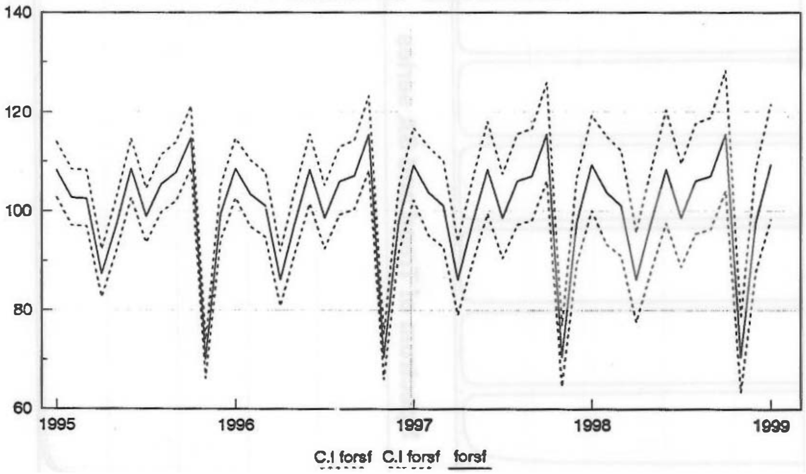


FIG1: IPI

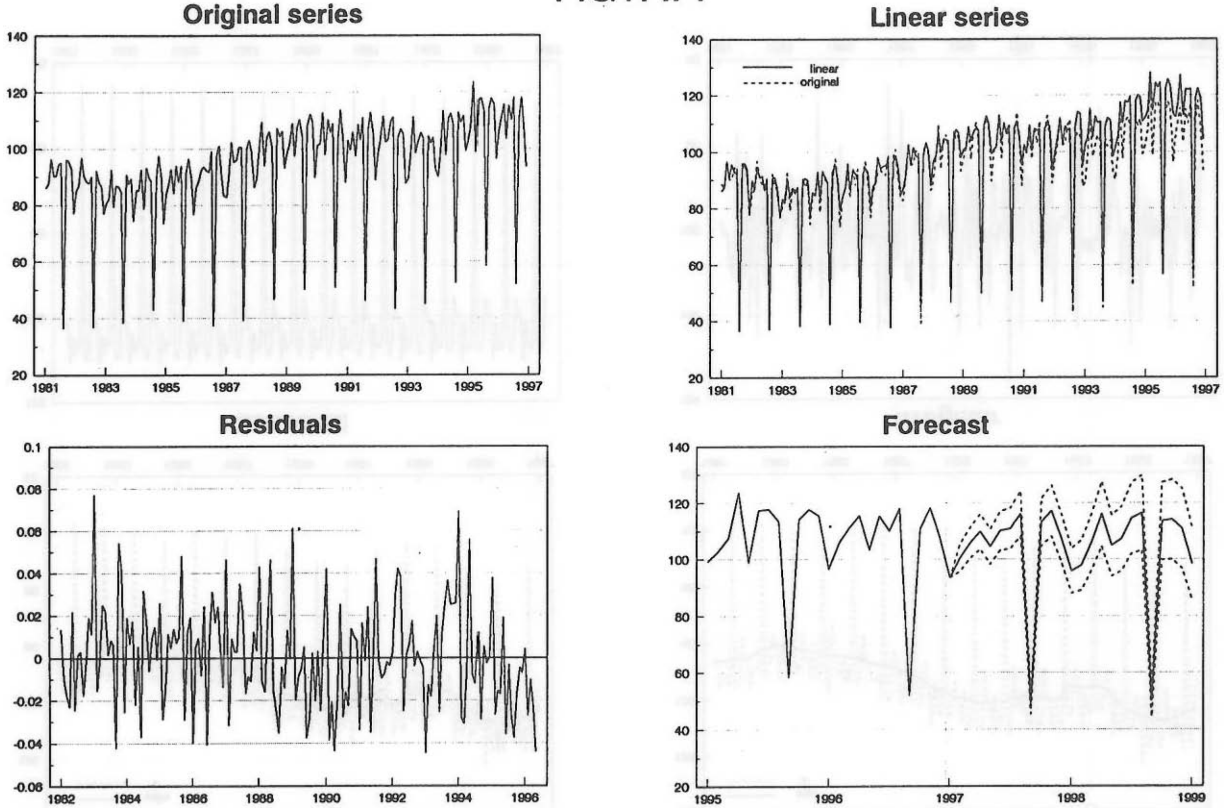

Original series
140
120
100
80
60
40
20
1981
1983
1985
1987
1989
1991
1993
1995
1997
Linear series
linear
original
Residuals
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
1982
1984
1986
1988
1990
1992
1994
1996
Forecast
1995
1996
1997
1998
1999

FIG2:IPI

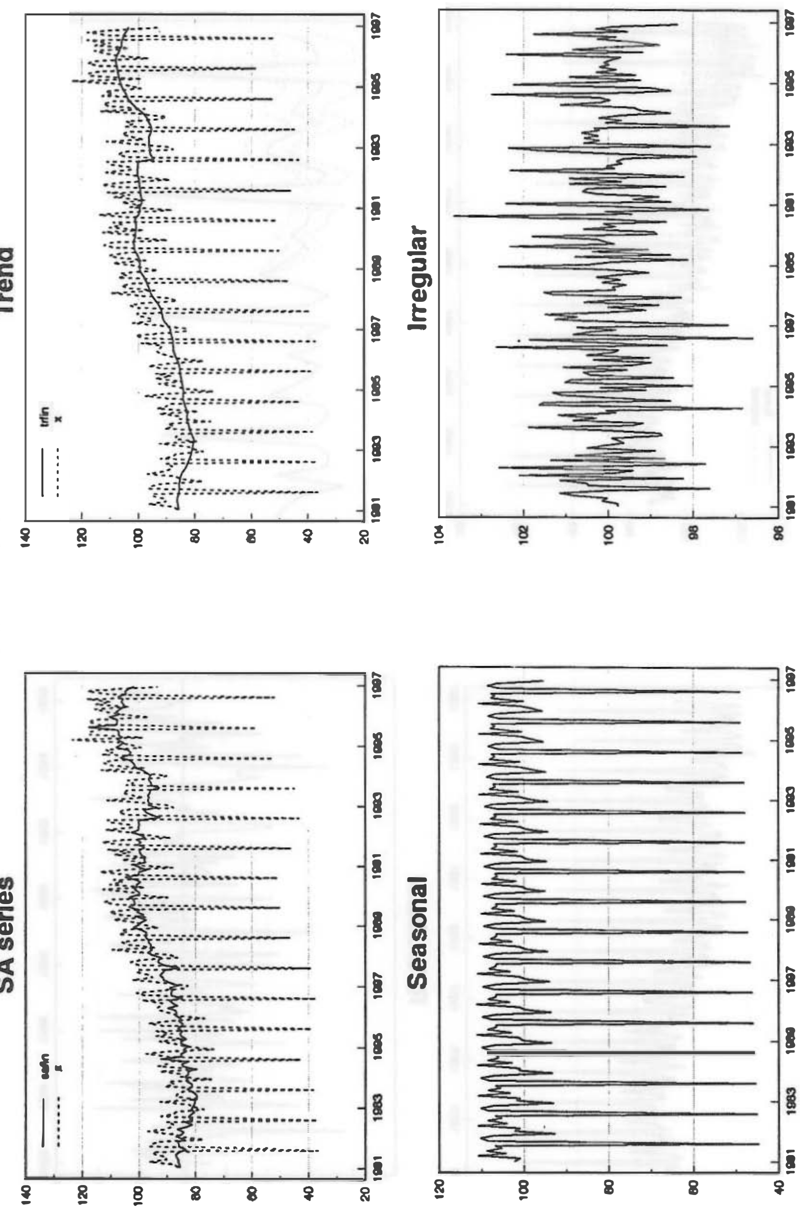

SA series
Trend
Seasonal
Irregular
safin
x
trfin
x
140
120
100
80
60
40
20
104
102
100
98
96
1981
1983
1985
1987
1989
1991
1993
1995
1997

FIG3:IPI

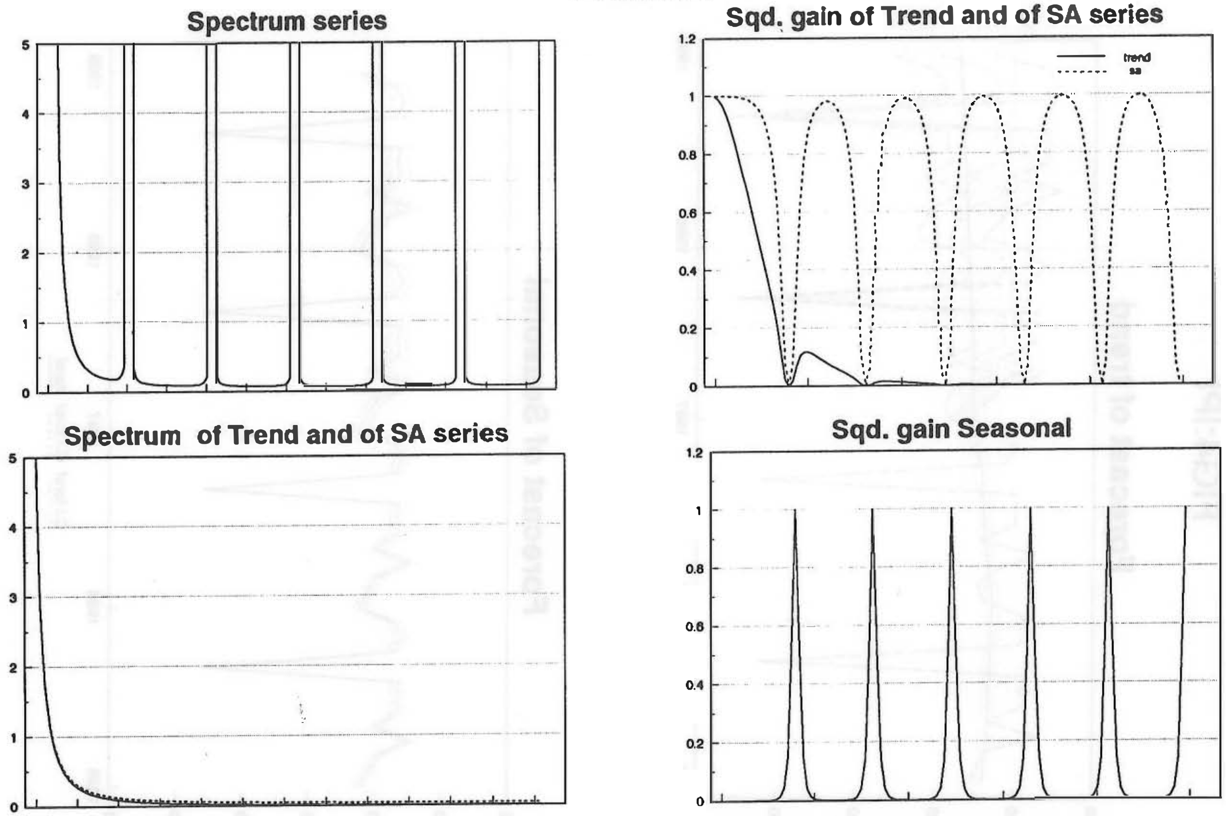
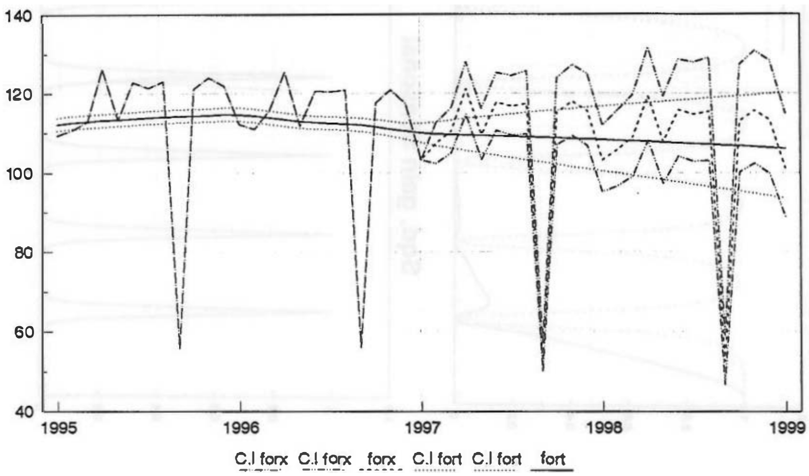

Spectrum series
5
4
3
2
1
0
Sqd. gain of Trend and of SA series
1.2
1
0.8
0.6
0.4
0.2
0
trend
sa
Spectrum of Trend and of SA series
5
4
3
2
1
0
Sqd. gain Seasonal
1.2
1
0.8
0.6
0.4
0.2
0

FIG4:IPI

Forecast of trend



Forecast of Seasonal

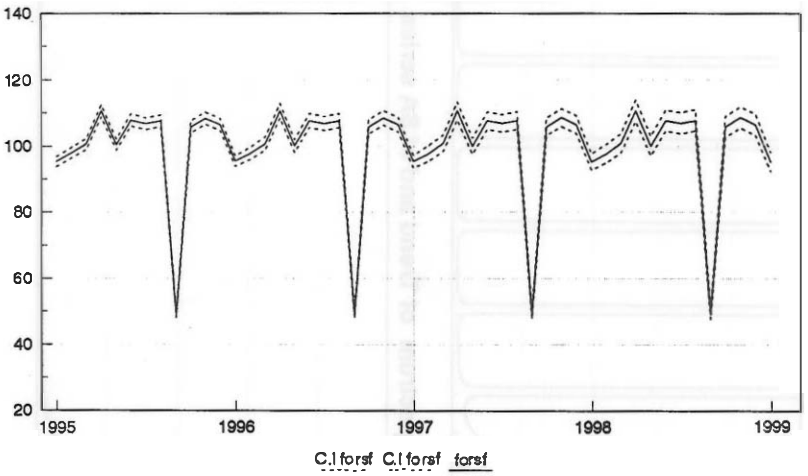


FIG1: IPIIN

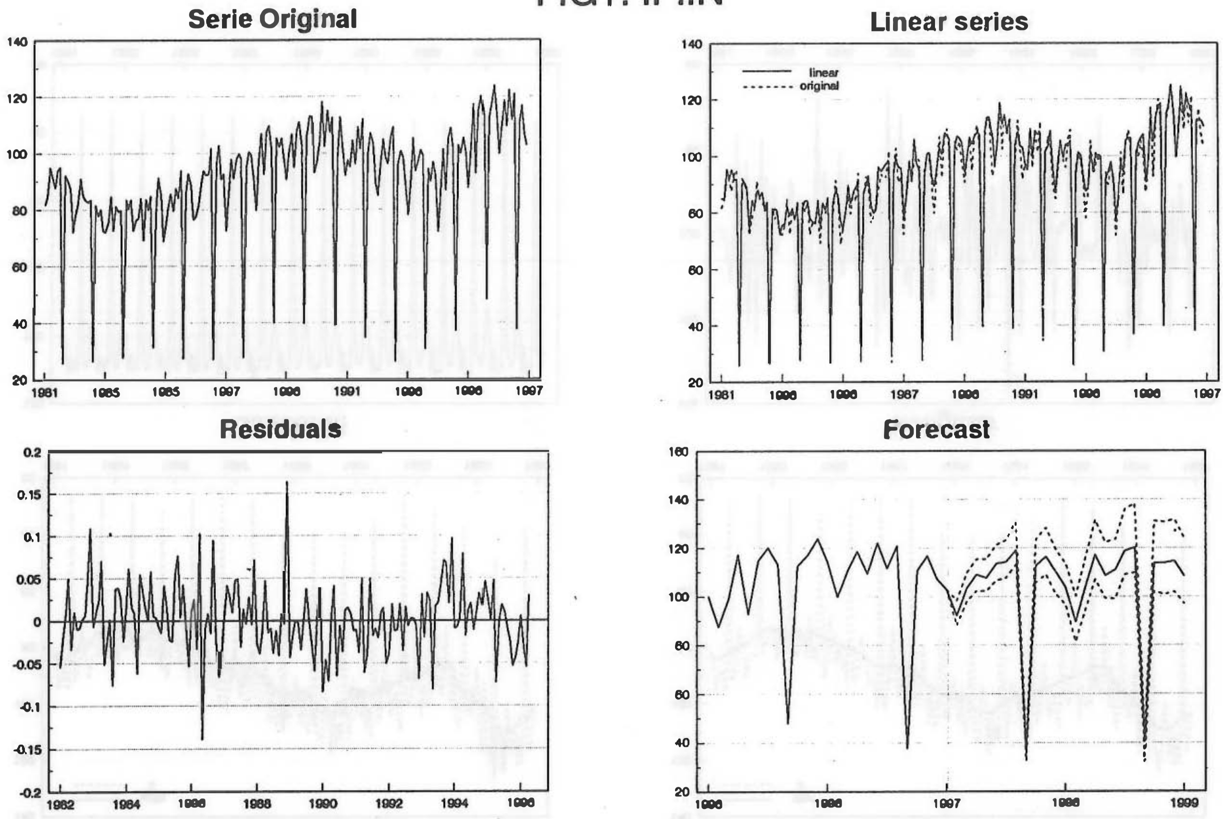

Serie Original
Linear series
linear
original
Residuals
Forecast

FIG2:IPIIN

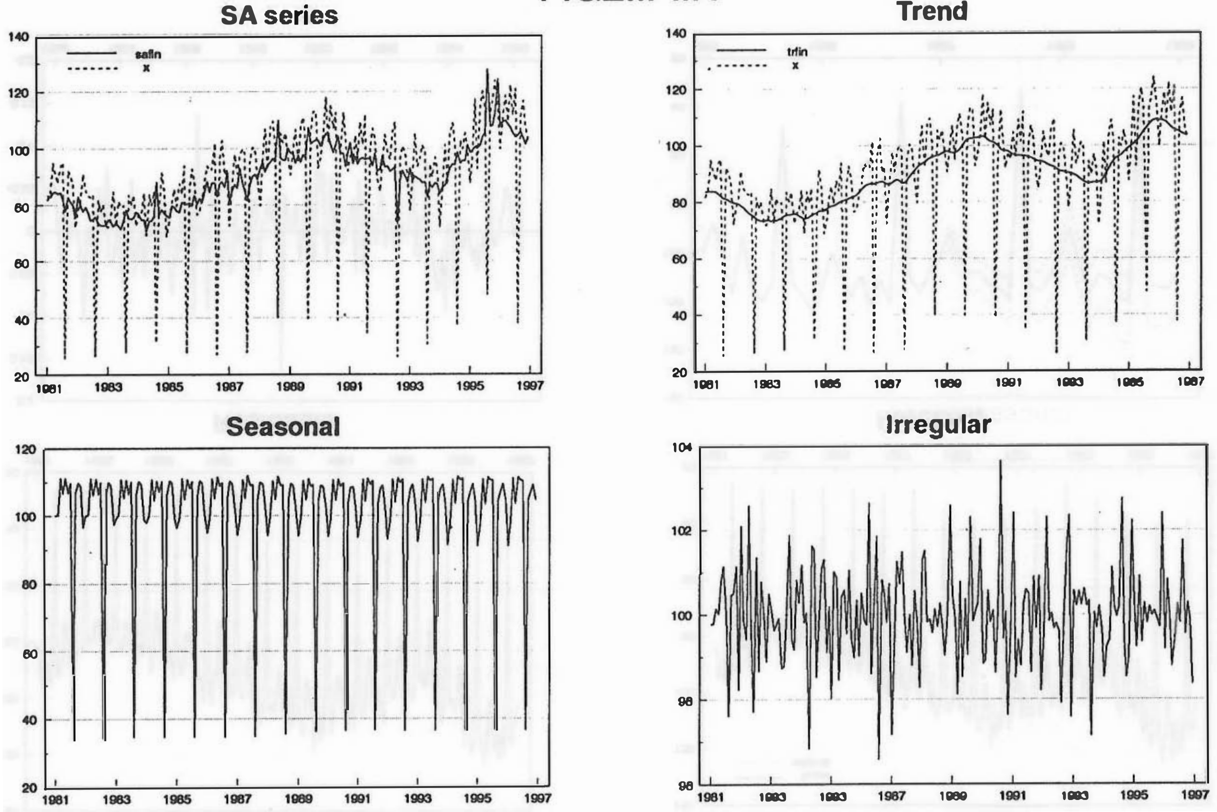


FIG3:IPIIN

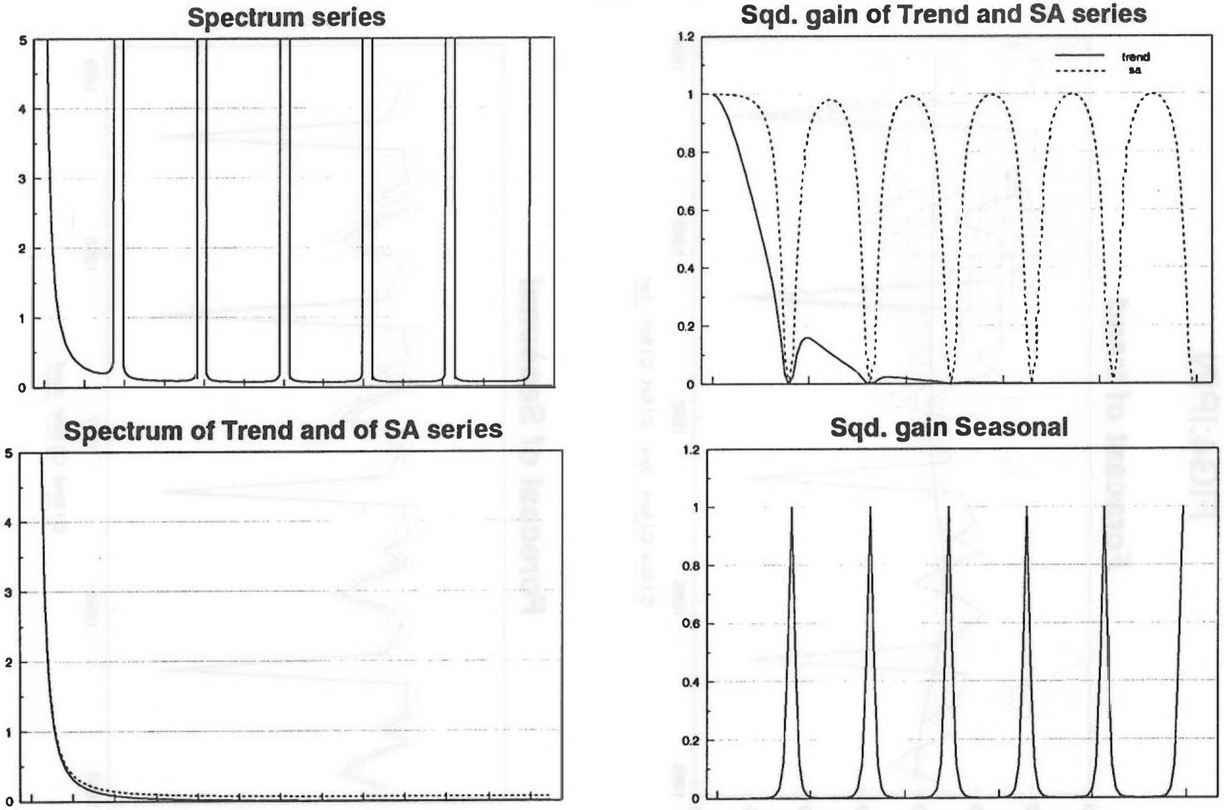
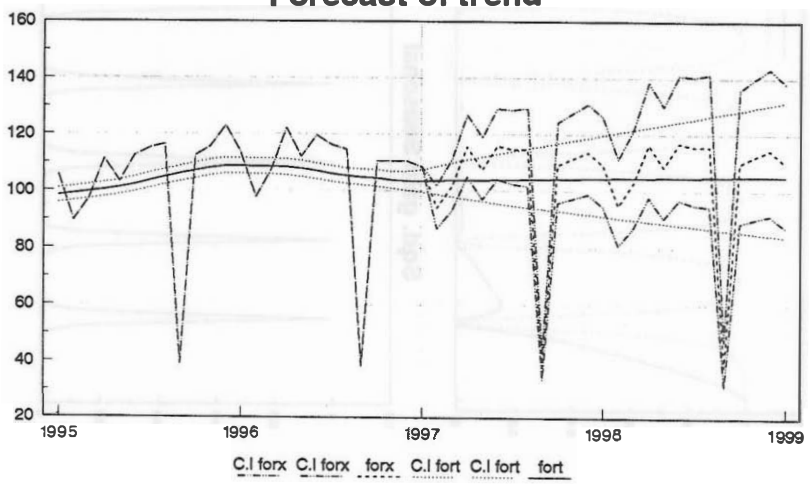

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and of SA series
Sqd. gain Seasonal
5
4
3
2
1
0
1.2
1
0.8
0.6
0.4
0.2
0

FIG4:IPIN

Forecast of trend



Forecast of Seasonal

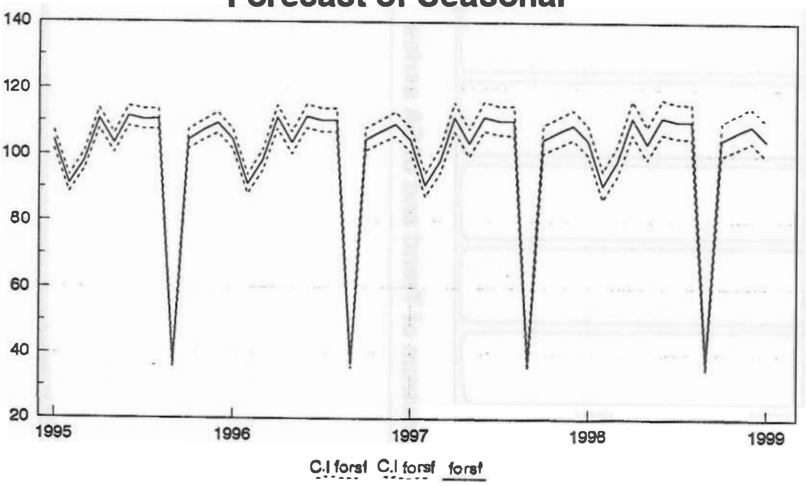


FIG1:IFAE

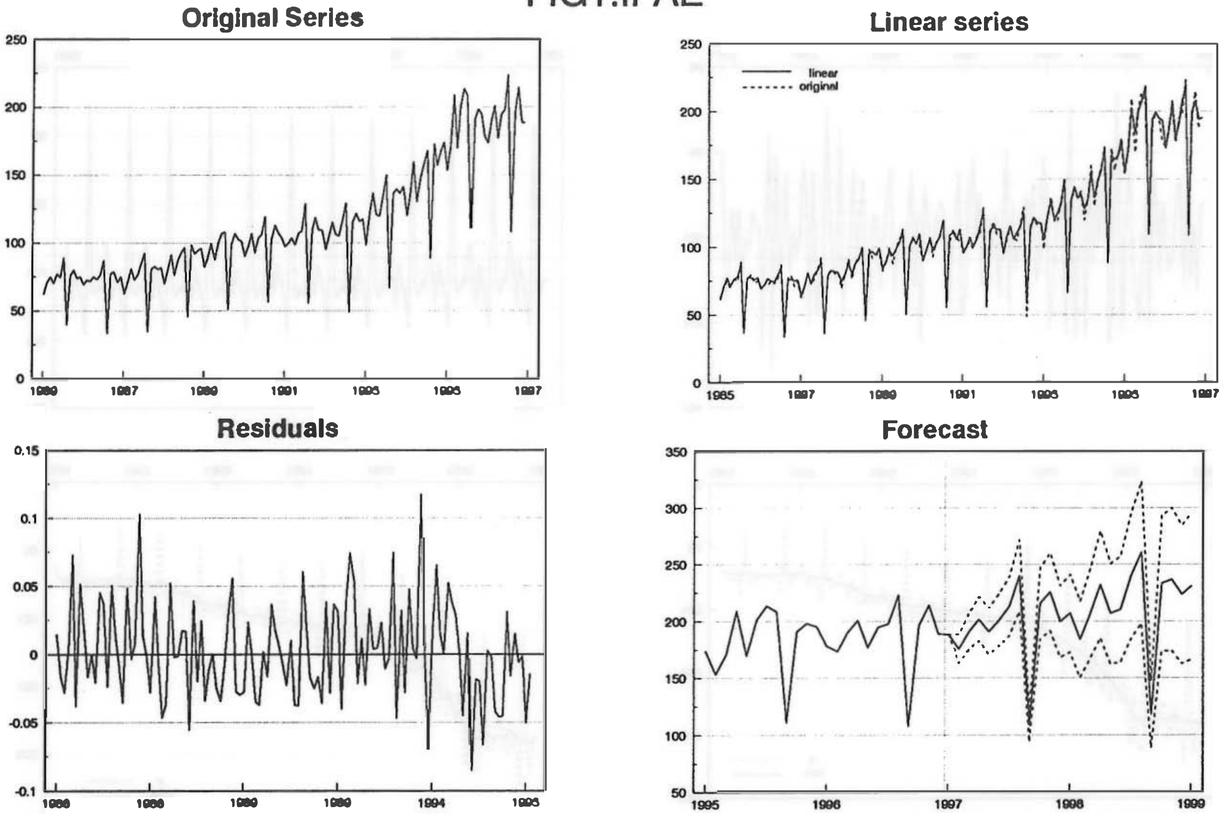

Original Series
Linear series
linear
original
Residuals
Forecast
1995
1996
1997
1998
1999

FIG2:IFAE

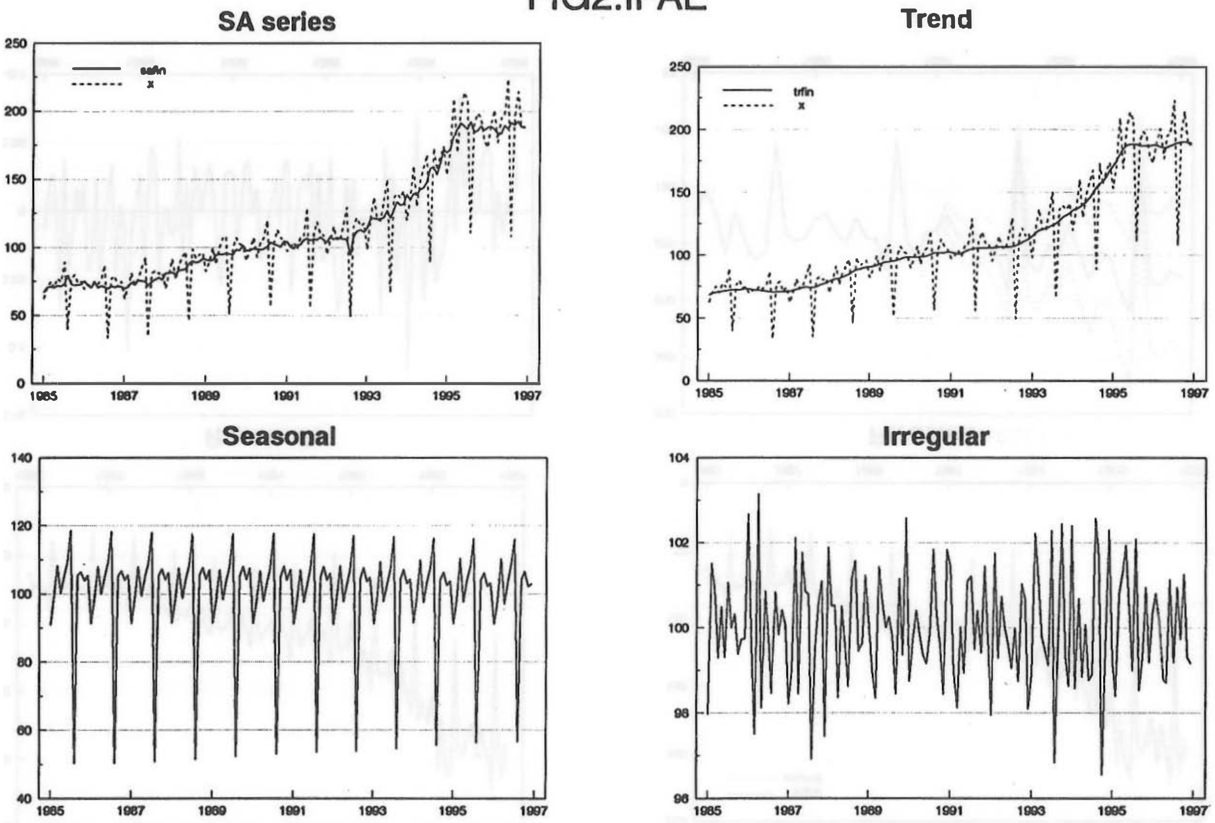

SA series
safin
x
250
200
150
100
50
0
1985
1987
1989
1991
1993
1995
1997
Trend
trfin
x
250
200
150
100
50
0
1985
1987
1989
1991
1993
1995
1997
Seasonal
140
120
100
80
60
40
1985
1987
1989
1991
1993
1995
1997
Irregular
104
102
100
98
96
1985
1987
1989
1991
1993
1995
1997

FIG3:IFAE

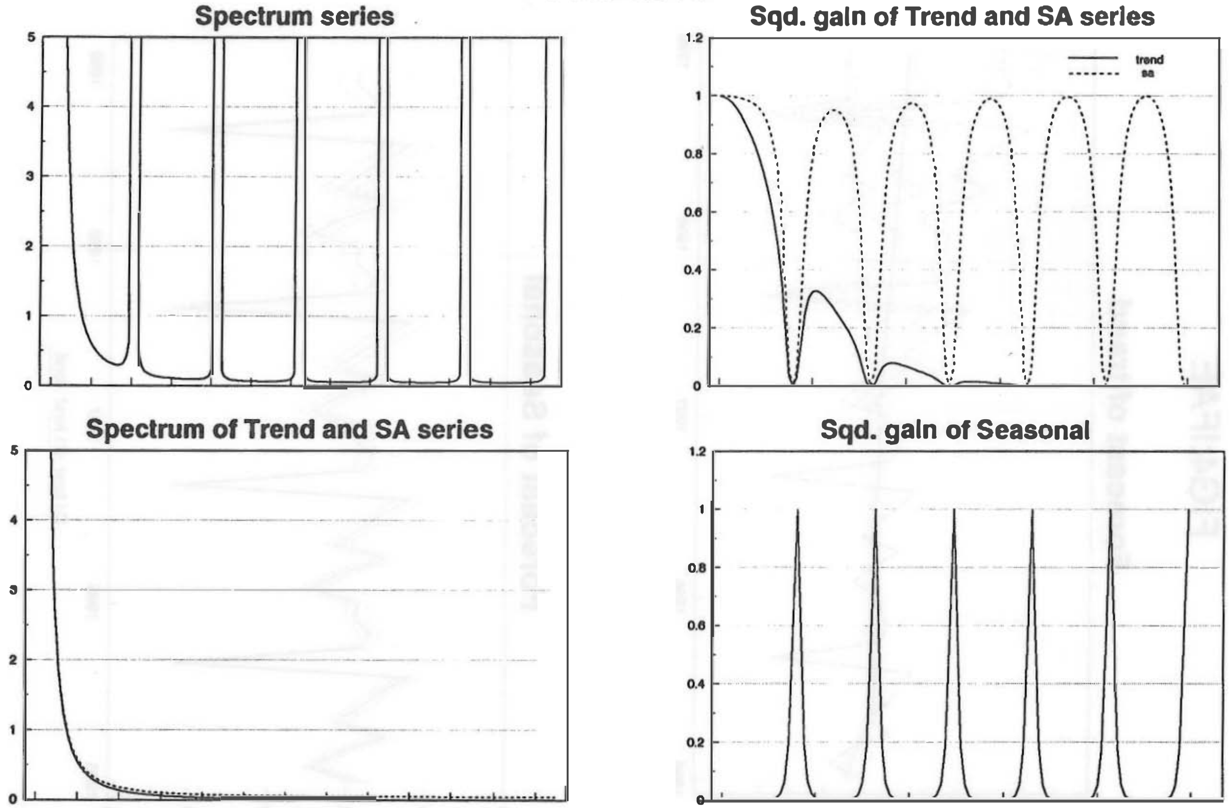
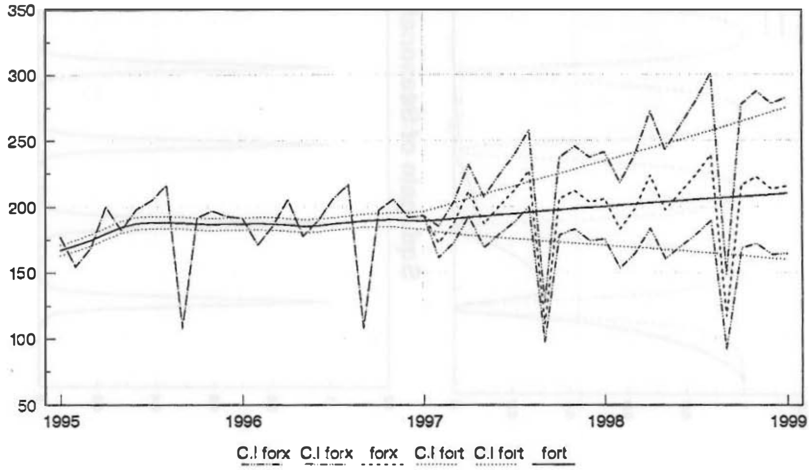

Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of Trend and SA series
Sqd. gain of Seasonal

FIG4:IFAE

Forecast of trend



Forecast of Seasonal

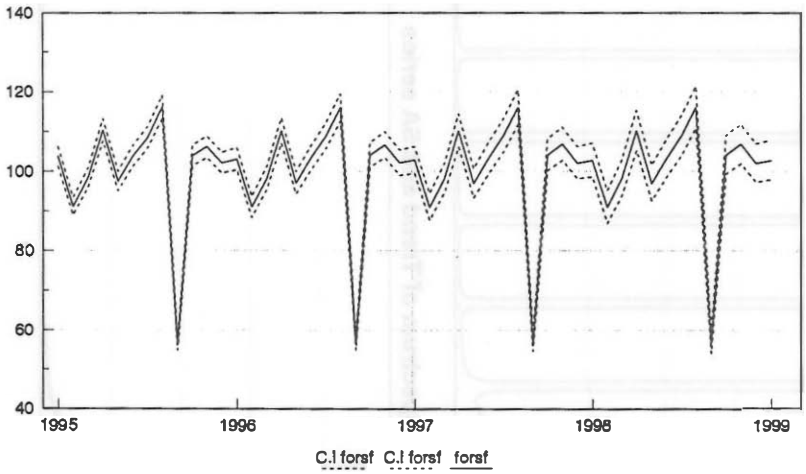
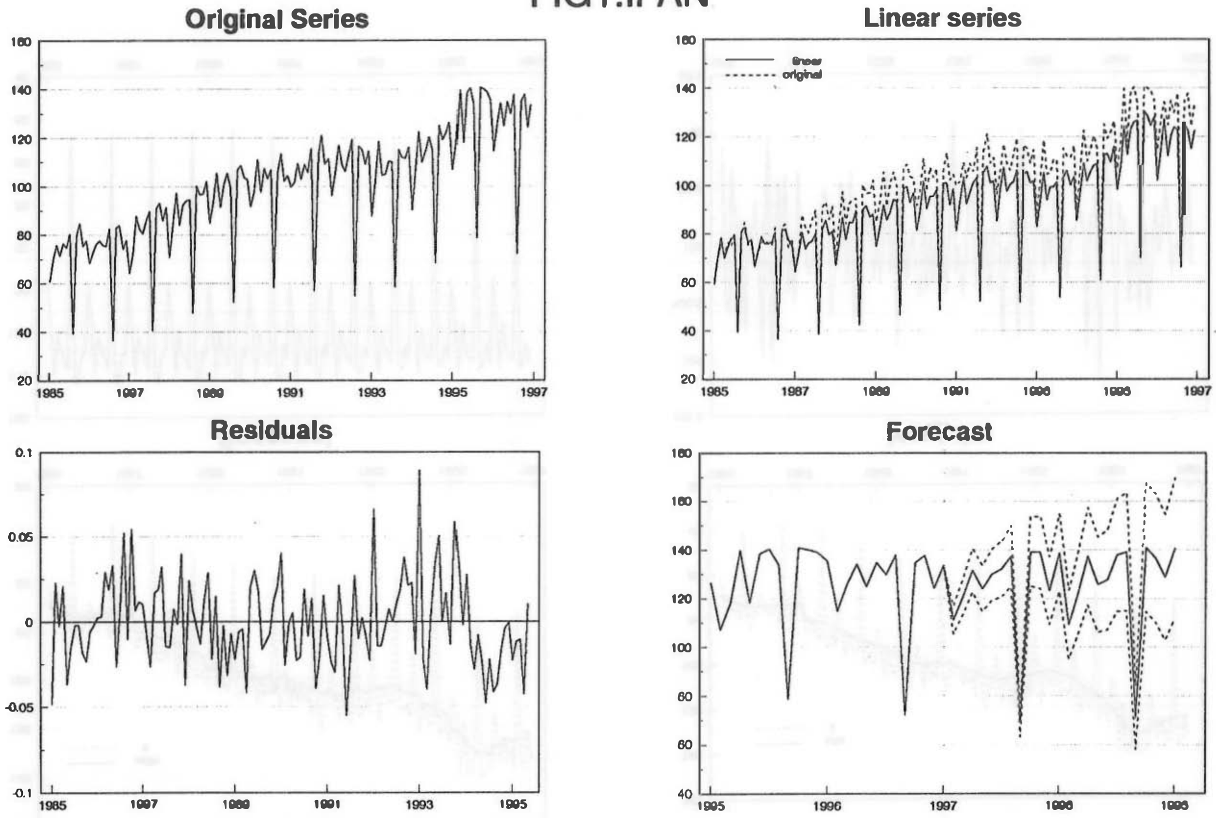


FIG1:IFAN



Original Series
Linear series
linear
original
Residuals
Forecast

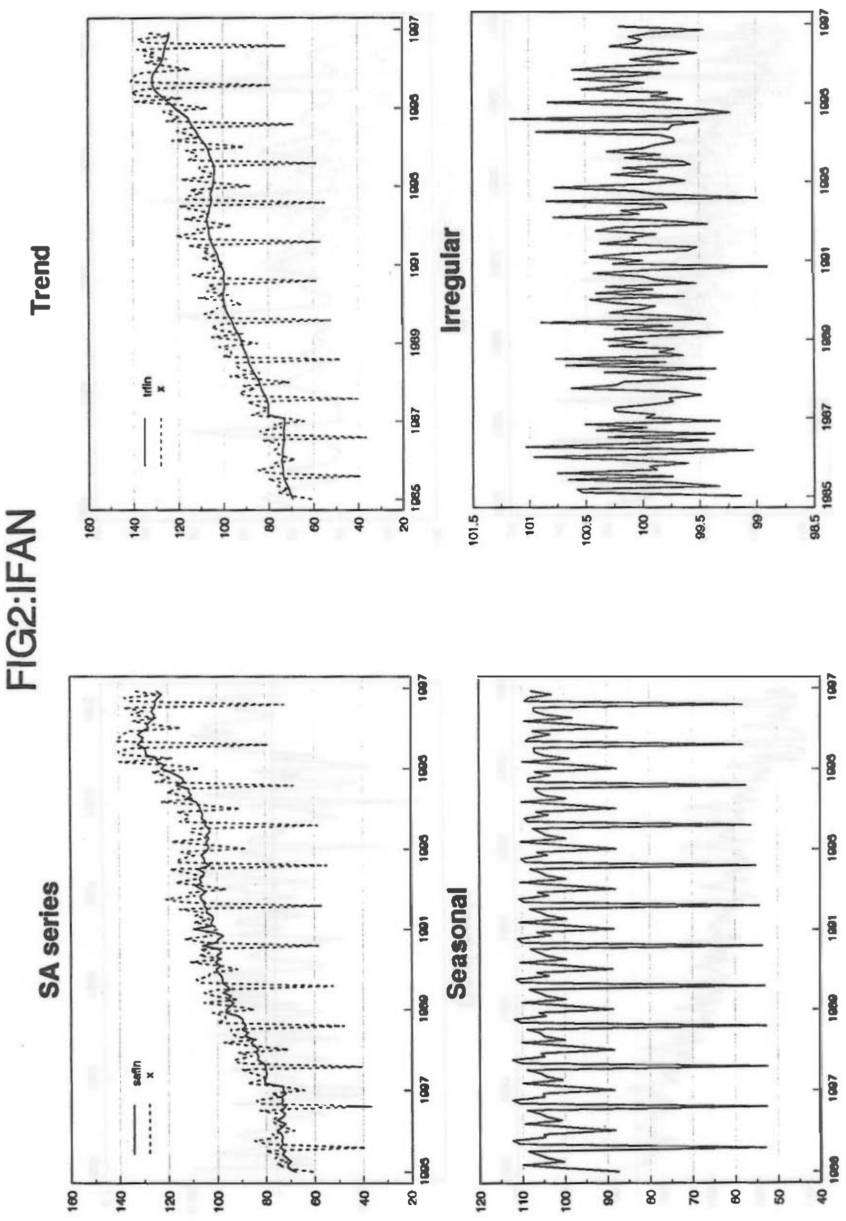
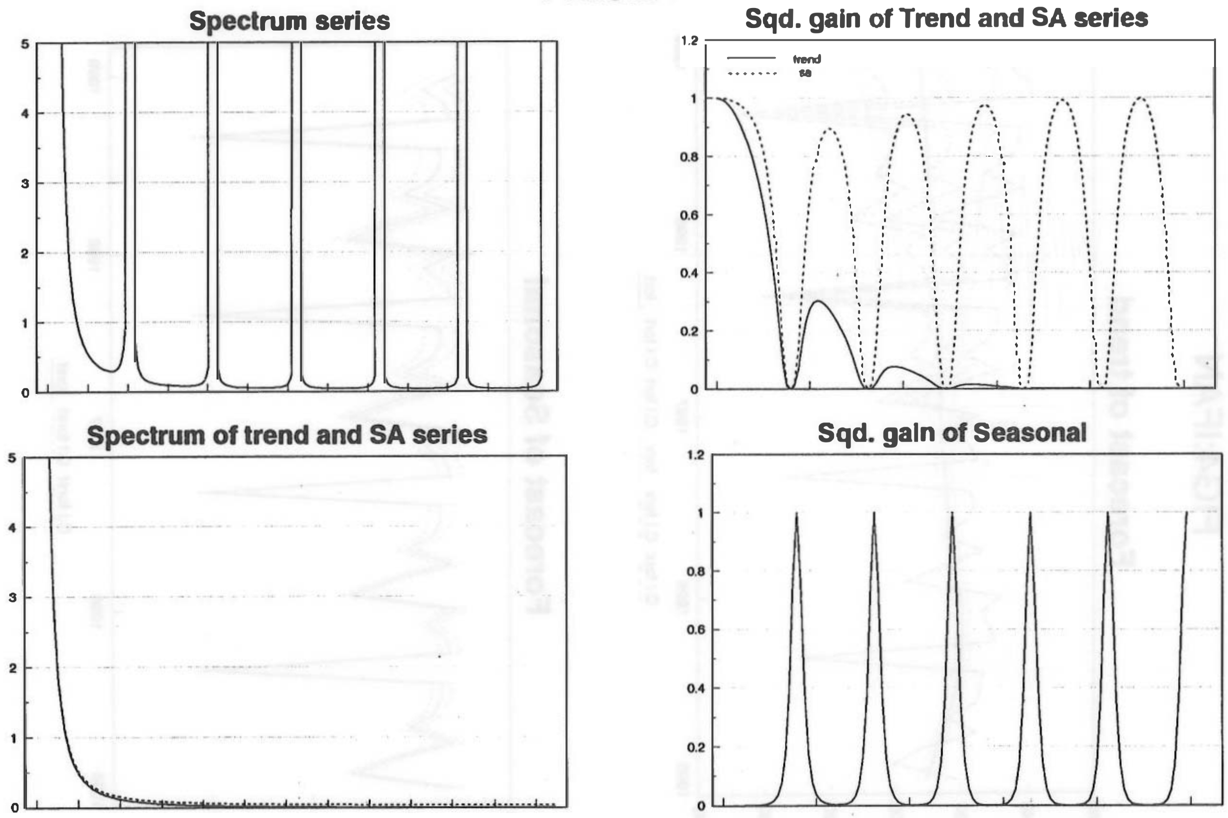


FIG2:IFAN
SA series
safin
x
Trend
trfin
x
Seasonal
Irregular

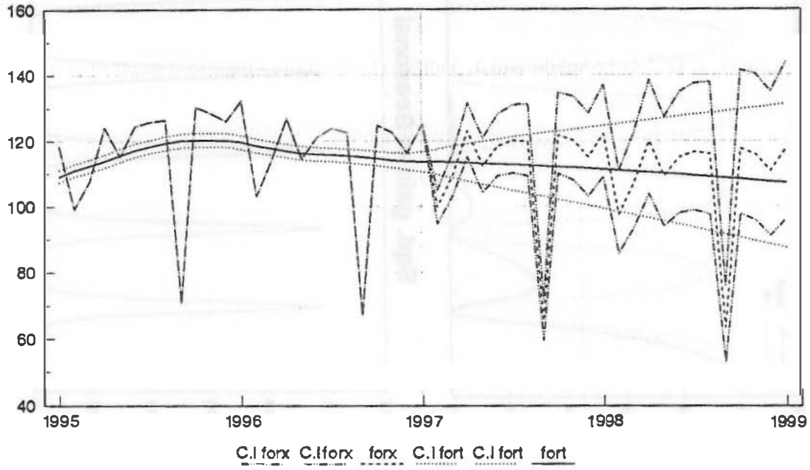
FIG3:IFA N



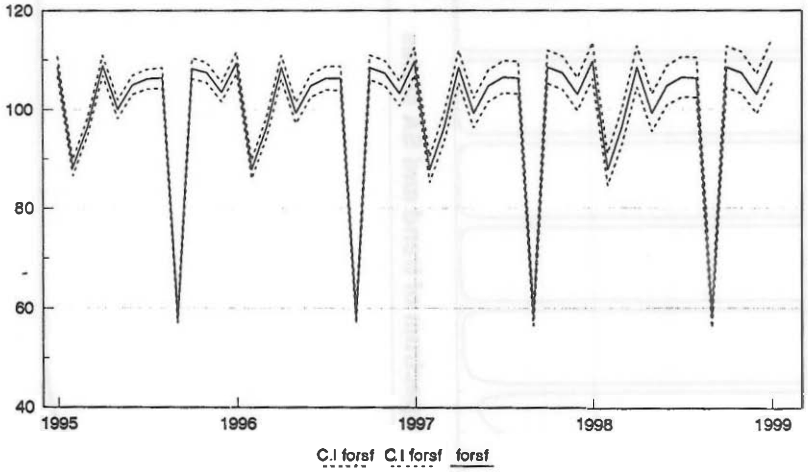
Spectrum series
Sqd. gain of Trend and SA series
trend
sa
Spectrum of trend and SA series
Sqd. gain of Seasonal

FIG4:IFAN

Forecast of trend



Forecast of Seasonal



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9825 **Javier Andrés, Ignacio Hernando and J. David López-Salido:** The long-run effect of permanent disinflations.

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