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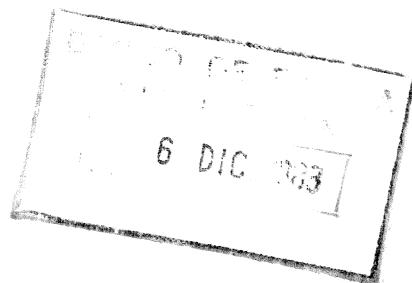
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DETERMINISTIC AND STOCHASTIC SEASONALITY:
AN UNIVARIATE STUDY
OF THE SPANISH INDUSTRIAL PRODUCTION INDEX

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Abstract

In this paper we consider that the seasonal component in economic time series has an slowly evolving nature, but it can also register situations in which specificic social habits, of seasonal character, change more suddenly. In such cases the standard stochastic (lineal and stationary or non stationary) structures are not able to explain, in a satisfactory manner, the behaviour of the series during a time period after the change, and the consideration of enlarged models incorporating simple deterministic schemes, could help to capture more rapidly the new situation.

We face a problem of this type studing the monthly Spanish Industrial Production Index, that it has been affected by a new tendency, appeared in 1980, to concentrate the summer holidays in August. For this series we arrive to a univariate Arima model with deterministic elements in the trend and seasonal components, and we use it for the seasonal adjustment of the series. This combination of deterministic and stochastic structures contributes to a better explanation of the series and, therefore, to better forecasts and seasonal adjustment.

DETERMINISTIC AND STOCHASTIC SEASONALITY: AN UNIVARIATE
STUDY OF THE SPANISH INDUSTRIAL PRODUCTION INDEX(*)

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I.- INTRODUCTION

Economic Time Series Analysts try to arrive, from their experience with real data, to recommendations that could be useful when working with a series that present a specific set of characteristics. With respect to the seasonal aspects, quite often the following recommendation is made: use deterministic seasonal structures when working with short series (five or six years long) and try stochastic schemes for longer ones. This is based on the idea that economic seasonality evolves slowly with time. In such cases, that evolution is scarcely detectable in short samples and deterministic seasonal models can work. On the other hand the data points are too few for a consistent estimation of stochastic seasonality. With longer samples models incorporating stochastic seasonality can be tried and, generally, produce better results.

(*) I am very grateful to J.A. Carro for his efficient collaboration as research assistant in this work. I am also grateful to A. Maravall for the interesting discussions maintained at different stages of the paper. This paper has been accepted for presentation at the 1983 European meeting of the Econometric Society.

This dichotomy between stochastic or deterministic seasonality seems to converge to the idea that the seasonal component in Economic Time Series has mixed nature. In that direction, in Pierce (1976) there is a good exposition of the problems and treatment of mixed seasonal models. Nevertheless, in a few applied studies mixed models are found. In the present paper, the combination of seasonal and deterministic structures has contributed to a better explanation of the series under study and, therefore, to better forecasts and seasonal adjustment.

In our opinion the mixed seasonality is specially interesting in explaining series in which the seasonal component is mainly of a slowly evolving nature, but it can register situations in which specific social habits, of seasonal character, change more suddenly. In such cases the standard stochastic structures (linear and stationary or with unit roots) are not able to explain, in a satisfactory manner, the behaviour of the series during a time period after the change, and the consideration of enlarged models with additional simple deterministic schemes, can help to capture, more rapidly, the new situation.

In this paper we deal with the monthly Spanish Industrial Production Index, 1965-82, see appendix 1. The trend of that series has been quite affected by the 1974 and 1979 energy crisis, as it has happened with similar data of other national economies. In our case we have an additional problem, because the methodology used in the construction of the index changed in January 1975.

In section 2 we present an univariate study of the IPI series for the whole period, that incorporates trend and

seasonal breaking points from 1975, but considers homogeneous, for the complete sample, all the other components. In that part of the study we arrive to model (1). Its main aspects are a downfall of nine percentual points in the rate of growth for the 1975-82 period compared with the previous years, and an important decrease, from 1975 onwards, of the activity during August followed by a more vigorous seasonal reaction during the fourth quarter.

Forecasting 1982 with model (1) the errors were small for the first half of the year but for the summer months the forecast values were clearly biased. We detected that the reason was a possible new seasonal change, affecting the summer months since 1980. In section III we consider that new situation and, restricting ourselves to the 1975-82 sample, we propose for it model (4). This model contains an important stochastic seasonal component and a deterministic one to capture the mentioned change in the eighties.

From the results of model (4) we can say that in the Spanish Industrial Production there is, since 1980, a bigger tendency to concentrate the summer holydays in August. That phenomenon has not been occurring slowly from year to year but, due perhaps to the fact that with the second energy crisis in 1979 the relative costs of production registered important changes, made its appearance quite suddenly in 1980.

In the remaining of the paper we compute the deterministic seasonal factors, section IV, the stochastic factors, section V, and present and discuss the wholly adjusted series, section VI.

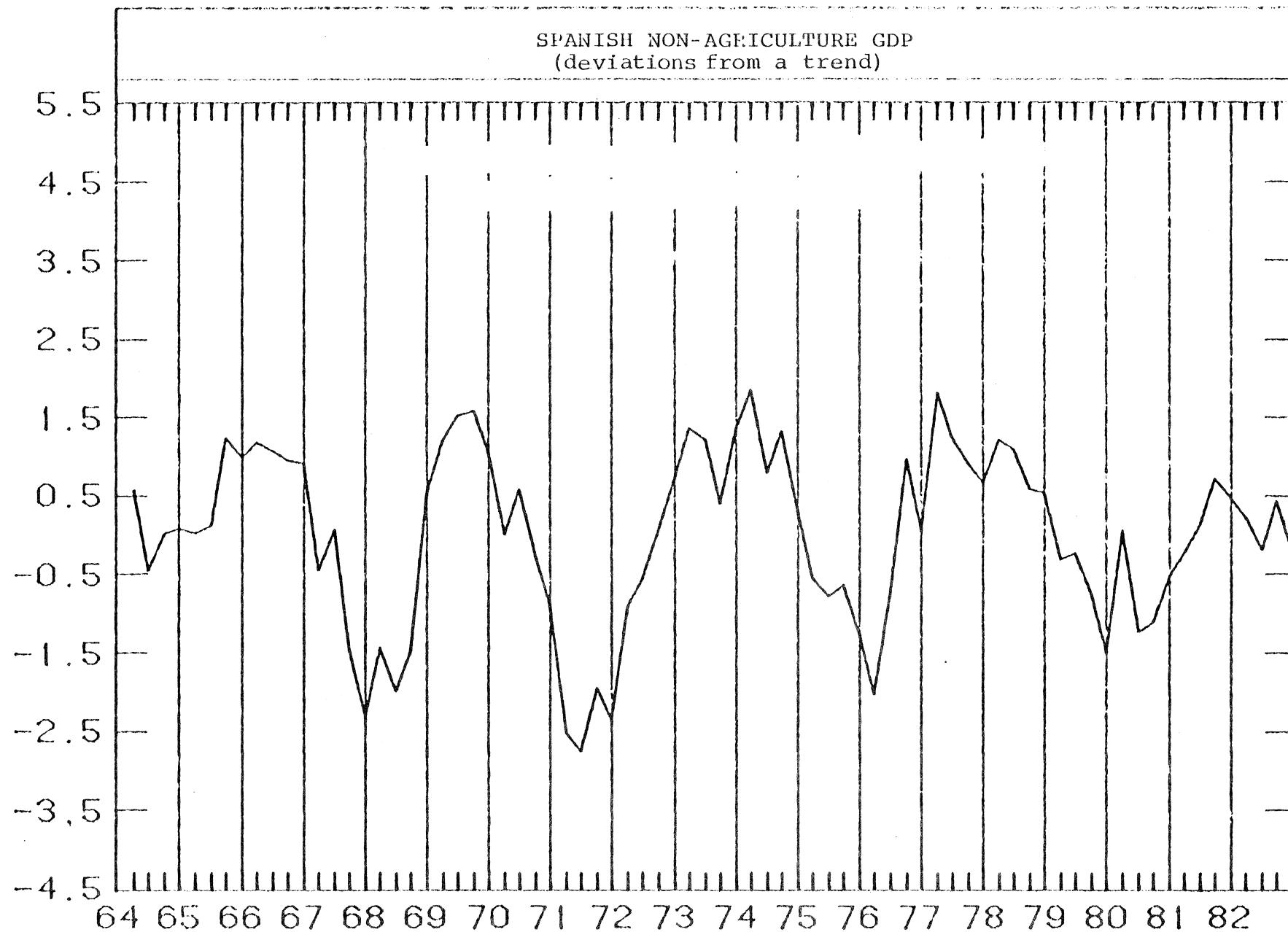
II.- AN UNIVARIATE STUDY OF THE SPANISH INDUSTRIAL PRODUCTION INDEX FOR THE PERIOD 1965(01)-1982(08)

For the Spanish Industrial Production index monthly series, that we denote by IPI, there exists data since 1965, but in the course of that sample period (in January 1975) a change was made in the methodology used to construct the index. If we are interested in the estimation of the cyclical structure of the series, the sample period 1975-1982 is too short for a reliable estimation of it. For that reason, we try in this section to carry out an univariate study of the series for the whole period, assuming that the 1975 methodological change has affected mainly the seasonal structure of the series, while its effects in the other components of the IPI have not been so important. We will also assume that the 1974 and 1979 energy crisis have affected the rate of growth of the Spanish industrial production, but not its cyclical behaviour. Some base for the later assumption, as a working approximation of the universe under study, is provided in figure 1, taken from Espasa (1982), that portrays the deviations from its trend^(*) of the Spanish quarterly GDP. This figure shows that the pattern of the cyclical structure after 1974 is not too different from the one observed before.

With all these assumptions, an univariate ARIMA model with seasonal dummies was constructed in 1981 with data up to December 1980. This model was used for prediction purposes till the second quarter of 1982. The model reestimated with an updated sample presents the following results:

(*) That trend has been estimated taking explicit account of the abrupt breaking points in its rate of growth due to the energy crisis.

Figure 1



$$\begin{aligned}\Delta \log IPI_t = & -0.058 \Delta S27410_t - 0.030 \Delta DSS_t + \\& (2.6) \quad (4.9) \\& + 0.019 SA1_t + 0.006 SA2_t + 0.059 SA3_t - \\& (5.3) \quad (1.6) \quad (12.0) \\& - 0.006 SA5_t - 0.052 SA7_t - 0.184 SA8_t + \\& (1.27) \quad (12.3) \quad (39.1) \\& + 0.216 SA9_t + 0.041 SA10_t + 0.007 SA11_t - \\& (45.7) \quad (7.9) \quad (1.6) \\& - 0.007 SA12_t + 0.068 SB3_t - 0.037 SB4_t + \\& (1.7) \quad (15.9) \quad (5.5) \\& + 0.021 SB5_t - 0.016 SB6_t - 0.043 SB7_t - \\& (2.9) \quad (4.1) \quad (8.8) \\& - 0.440 SB8_t + 0.487 SB9_t + 0.048 SB10_t - \\& (83.4) \quad (81.6) \quad (7.7) \\& - 0.011 SB11_t - 0.062 SB12_t + \\& (1.8) \quad (11.9) \\& + \frac{(1-0.58 L)(1-0.94 L^{12})}{(1-0.93 L^{12} + 0.63 L^{24})} a_t , \quad (1)\end{aligned}$$

sample period 1965(01)-1982(08),

$\sigma_a = 0.026$

number of residuals: 177,

Box-Pierce-Ljung statistic $\begin{cases} 14 \text{ lags} = 16.4 \\ 26 \text{ lags} = 29.9 \\ 38 \text{ lags} = 42.3 \end{cases}$,

values in the correlogram significantly different from zero:

$r_{12} = -0.16$ and $r_{48} = -0.16$,

residual outliers: see table one,

standard deviation of the prediction error twelve months ahead = 0.046.

In (1) L is the lag operator and $\Delta = (1-L)$. S27410 is a dummy with value one from October 1974 and zeros otherwise. DSS is a dummy with value one in the month containing the Easter Sunday and zeros otherwise. The variables SA_j are dummies with value one in the j month of the years 1965 to 1974 and zeros otherwise, and the dummies SB_j have the value one in the j month of the years after 1974 and zeros otherwise. In model (1) we have omitted the SA_j and SB_j variables that if are included appeared with t values less than one.

Table 1

Residual outliers from model (1)

<u>observation number</u>	<u>date</u>	<u>value ($\sigma = 0.026$)</u>
59	1969(11)	-2.00 σ
63	1970(03)	-2.04 σ
104	1973(08)	-2.58 σ
109	1974(01)	2.58 σ
120	1974(12)	-2.00 σ
164	1978(08)	2.19 σ
176	1979(08)	2.58 σ
212	1982(08)	2.81 σ

The main characteristic of this model are:

- a) It has stochastic and deterministic seasonality,
- b) it incorporates a change in the seasonal structure,

- c) It captures a permanent fall in the level of the series from October 1974, by the dummy S27410,
- d) It includes, as we shall see below, a fall in the rate of growth of the series, from January 1975,
- e) It contains a pseudo-cyclical effect of module 0.8 and period around six years, and
- f) It allows for a transitory fall of the index during the Easter period.

To explain the seasonality of the series we tried stochastic, deterministic and mixed structures, and the results obtained pointed out that the essential aspect of the IPI seasonal evolution was its sudden change in 1975. The best way that we found to incorporate that feature was by the use of the SAj and SBj dummies and this drove us to model (1).

We could evaluate the mentioned seasonal change through the estimated coefficients for the SAj's and SBj's variables. Denote by δA_j^* and δB_j^* , respectively, the coefficients of those variables and transform them in deviation from their respective means. In order to carry out this transformation we first calculate:

$$\overline{\delta A^*} = \frac{1}{12} \sum_{j=1}^{12} \delta A_j^* = 0.0084 \quad \text{and}$$
$$\overline{\delta B^*} = \frac{1}{12} \sum_{j=1}^{12} \delta B_j^* = 0.0013 .$$

and then define,

$$\delta A_j = \delta A_j^* - \overline{\delta A}^*, \quad j = 1, \dots, 12$$

and

$$\delta B_j = \delta B_j^* - \overline{\delta B}^*. \quad .$$

Those coefficients are given in table 2.

The value $\overline{\delta A}^*$ and $\overline{\delta B}^*$ are the average rate of growth of the IPI till 1974 and from 1975 outwards, respectively. These rates put in annual bases are 10.5% and 1.6%. This can be interpreted in the sense that with the energy crisis the rate of growth of the Spanish industrial production ^{fell} by nine percentual points. This estimation cannot be taken as a very precise one, because we have not taken into account that such fall was not a sudden event but something that last between one and two years in the first crisis and few months in the second one. The nine percentual points estimated here represent a bigger magnitude than the one estimated in Espasa (1982) for the non-agriculture Spanish GDP. In that case the estimation was of five points between 1974 and 1976 and two additional points during the last half of 1979.

Table 2

Months	Seasonal Coefficients from Model (1)			
	Series: $\Delta \log IPI$		Series: $\log IPI$	
	1965-74 δA_j	1975-82 δB_j	1965-74 βA_j	1975-82 βB_j
January	0.0110	-0.0013	0.0154	0.0108
February	-0.0027	-0.0013	0.0127	0.0095
March	0.0502	0.0668	0.0629	0.0763
April	-0.0084	-0.0382	0.0545	0.0381
May	-0.0146	0.0198	0.0399	0.0579
June	-0.0084	-0.0175	0.0315	0.0404
July	-0.0602	-0.0447	-0.0287	-0.0043
August	-0.1922	-0.4411	-0.2209	-0.4454
Septembre	0.2079	0.4854	-0.0130	0.0400
Octobre	0.0331	0.0472	0.0201	0.0872
November	-0.0010	-0.0122	0.0191	0.0750
December	-0.0149	-0.0631	0.0042	0.0119

The coefficients δA_j and δB_j refer to the $\Delta \log IPI$ series, and it is convenient to use them to calculate the seasonal coefficients corresponding to the $\log IPI$

series. Denote by βA_j and βB_j those coefficients. If we impose on them the restrictions:

$$\sum_{j=1}^{12} \beta A_j = 0 \text{ and } \sum_{j=1}^{12} \beta B_j = 0 ,$$

we have that, see Pierce (1978) pp. 247 and 248, the β 's and δ 's are related in the following way:

$$\beta A_j = \sum_{i=1}^j \delta A_i + \frac{1}{12} \sum_{i=1}^{12} \delta A_i \quad \text{and} \quad (2)$$

$$\beta B_j = \sum_{i=1}^j \delta B_i + \frac{1}{12} \sum_{i=1}^{12} \delta B_i . \quad (3)$$

The βA_j 's and βB_j 's are given in table 2. Comparing those coefficients we can evaluate the 1975 seasonal change. In table 2 we observe that the biggest change happened in August, where its actual seasonal fall is twice its previous value. Nonetheless the changes in other months are also important. For instance, the industrial activity in the fourth quarter of the year has now a more pronounced seasonal upswing than it had before.

III.- AN UNIVARIATE STUDY OF THE SPANISH INDUSTRIAL PRODUCTION INDEX FOR THE PERIOD 1975(01)-1982(12)

As we mentioned above, with a model like (1) we made forecasts several months ahead, till the second half of 1982. At that time we realized that the forecasts for the 1982 summer were unacceptable and decided to reconsider the model.

A close examination of the recent evolution of the IPI series, see figure 2, shows that the slacks in the Spanish industrial production during the last three Augusts, were more pronounced than what had been experienced before. So, see table 3, from an average rate of growth in August of -39.1% during 1975-79, we passed to a rate of -55.5% for the period 1980-82. This fact revealed that a main problem was a new seasonal change in the index, during the summer months. We could have taken account of it by extending model (1) with another set of seasonal dummies for the summer months of the last three years, but the number of variables in this extended model would have been bigger than what is allowed in the standard Time Series computer programs that we have. Therefore to take into consideration the new seasonal structure, we were forced to restrict ourselves to the sample from 1975 till now, because then we did not have the seasonal problem for the previous years.

In table 4 we have the mean, variance and Box-Pierce-Ljung statistic for different transformations of the IPI series. Figures 3 to 5 contain the graphs of $\Delta \log IPI$, $\Delta_{12} \log IPI$ and $\Delta\Delta_{12} \log IPI^{(*)}$. From all this information it seems that the $\Delta\Delta_{12} \log IPI$ series can be taken as stationary and its correlogram and partial correlogram are given in figure 6.

(*) $\Delta_{12} = (1-L^{12})$

FIGURE 2

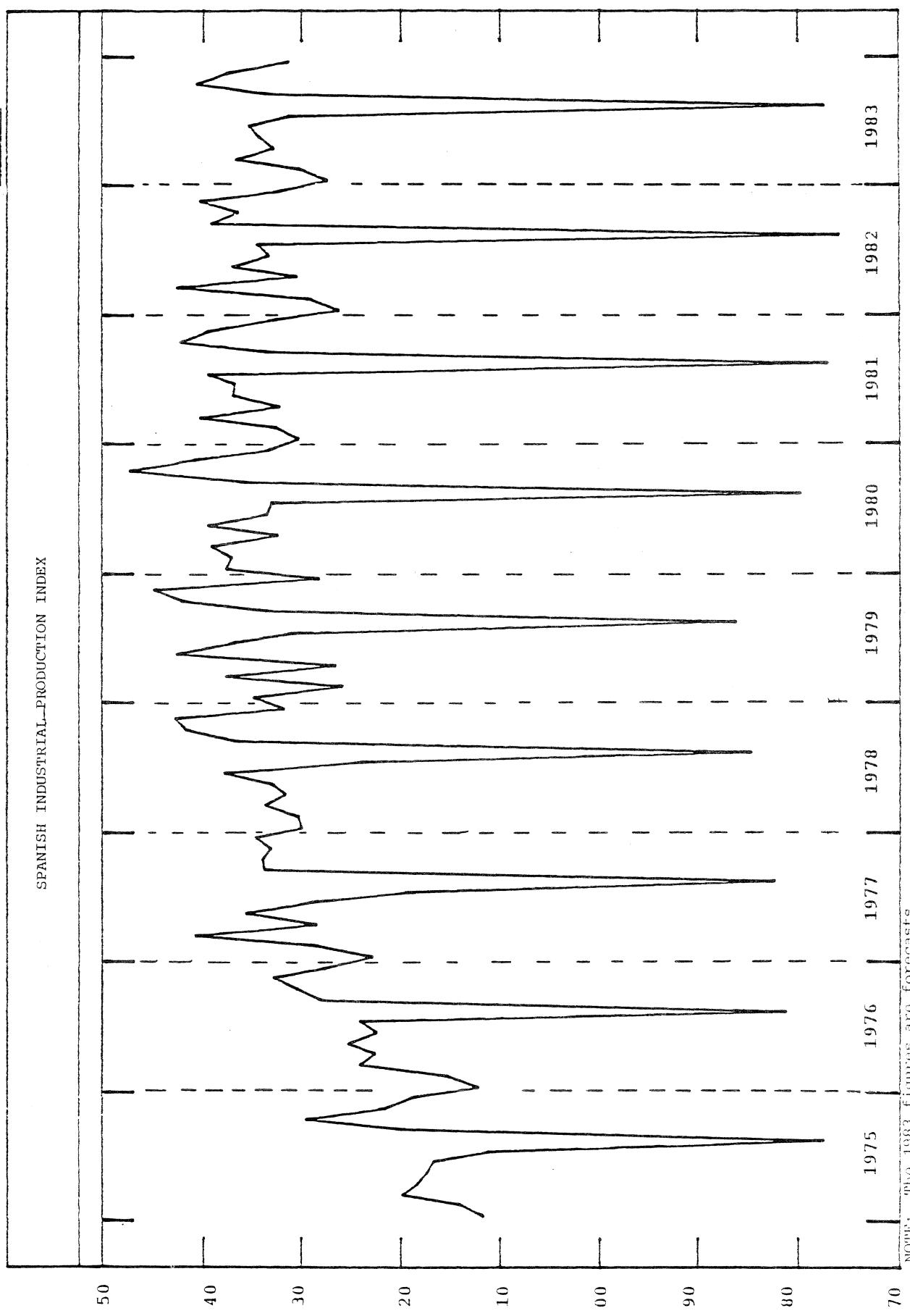


TABLE 3

Series: $\Delta \log \text{IPTI}$
(annual and monthly means-ranges)

DATE	VALUES OF THE SERIES											ANNUAL		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEANS-RANGES	
1975	.020	.049	-.012	* .003	* -.005	* .040	* -.013	* .361	* .439	* .075	* -.053	* -.023	* .004	* .799
1976	* .057	* .073	* .012	* .021	* -.023	* .013	* -.023	* .423	* .455	* .019	* .017	* -.039	* .006	* .970
1977	* .030	* .046	* .092	* .054	* .051	* .076	* -.051	* .371	* .494	* .001	* -.006	* .011	* .004	* .655
1978	* .035	* .035	* .015	* .010	* .035	* .105	* -.010	* .300	* .479	* .035	* .008	* -.079	* -.002	* .860
1979	* .022	* .063	* .089	* .019	* .041	* .044	* -.041	* .417	* .438	* .060	* .020	* -.121	* -.002	* .855
1980	* .071	* .004	* .049	* .051	* .043	* .004	* .004	* .510	* .530	* .082	* .046	* -.054	* .003	* .1040
1981	* .025	* .017	* .055	* .059	* .034	* .001	* .020	* .594	* .550	* .064	* -.021	* -.048	* -.000	* .145
1982	* .052	* .024	* .097	* .047	* -.027	* .007	* .573	* .607	* -.020	* .027	* -.036	* -.000	* .101	*
1983	* .039	* .021	* .049	* .029	* .011	* .007	* -.029	* .530	* .540	* .050	* -.023	* -.045	* -.001	* .076
MONTHLY MEANS-RANGES														
MEAN	* .019	* .010	* .060	* .040	* .016	* .030	* .016	* .462	* .503	* .041	* .010	* .051	* .002	*
RANGE	* .123	* .114	* .083	* .080	* .127	* .082	* .126	* .233	* .169	* .102	* .090	* .132	* .201	*
TOTAL														
MEAN-RANGE	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Note: the 1983 figures are forecasts

Spanish Industrial Production Index (*) Table 4

Differences Δ^d Δ^D $(d, D)^{12}$	Obs.-no.	Mean	Variance	Standard Deviation	Standard Deviation of the mean	Box-Pierce statistic 14 and 26 lags	Ljung with 26 lags
(0, 0)	96	4.8348	.022119	.14873	.015179	82.3	146.0
(1, 0)	95	.0017881	.041697	.2042	.02095	132.0	223.0
(0, 1)	84	.016938	.0017811	.042203	.0046047	81.5	98.2
(1, 1)	83	-0.00008	.0025036	.050036	.0054921	46.6	70.0

(*) The data are in logarithms.

FIGURE 3

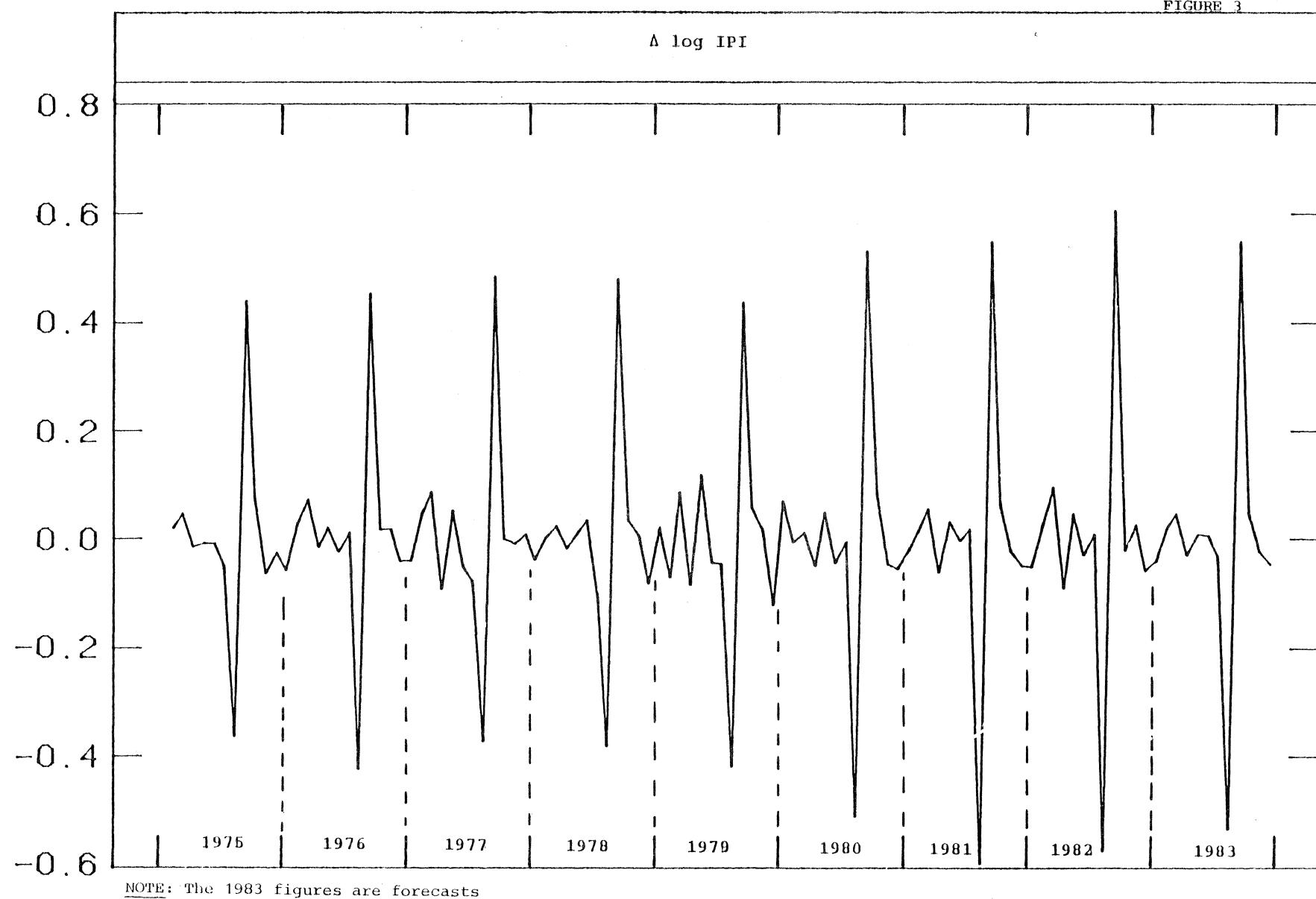


FIGURE 4

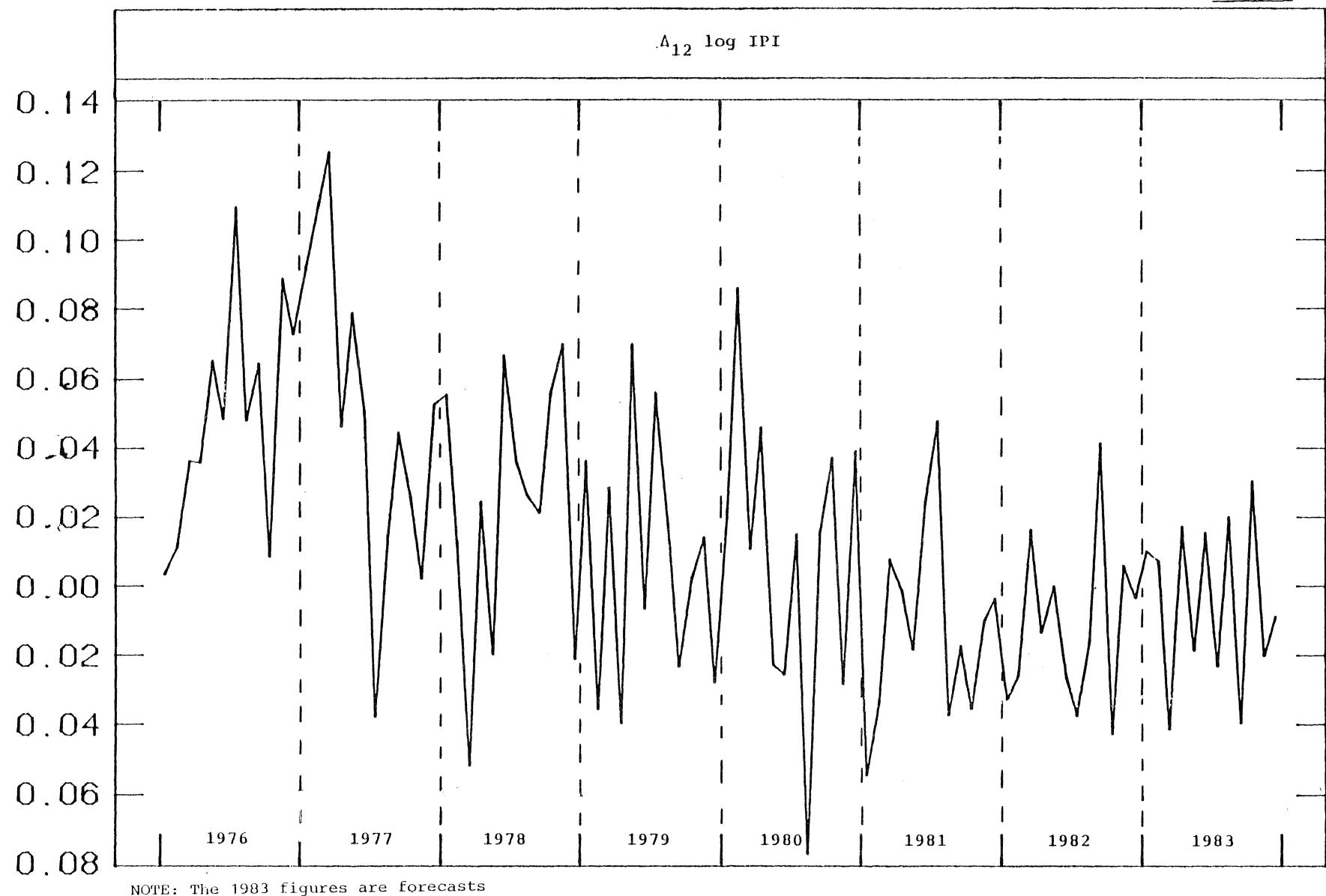
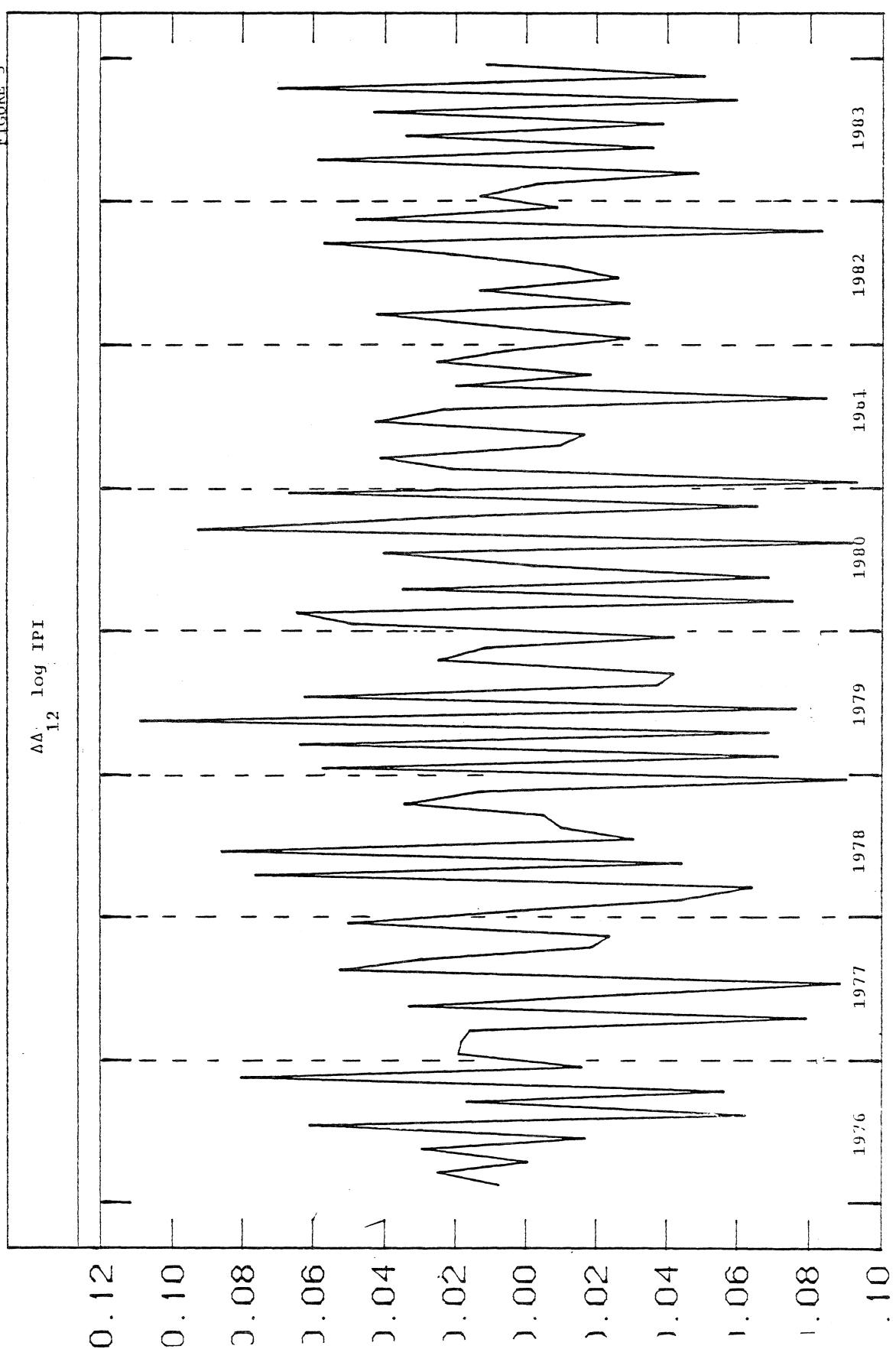


FIGURE 5



NOTE : The 1983 figures are forecasts

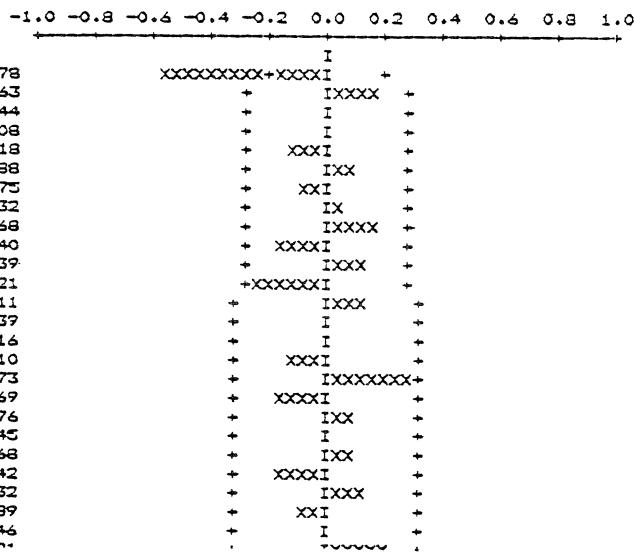
FIGURE 6

Correlogram and partial correlogram of the series

$\Delta \Delta_{12} \log IPI$

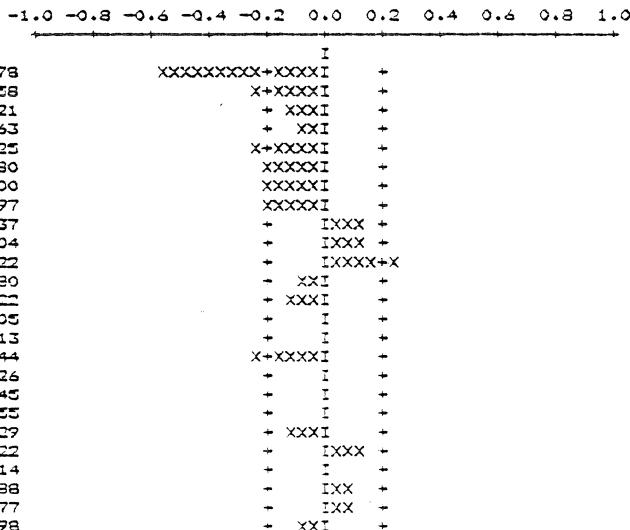
AUTOCORRELATIONS

1- 12	-.58	.16	-.04	.01	-.12	.09	-.08	.03	.17	-.14	.14	-.22
ST.E.	.11	.14	.14	.14	.15	.15	.15	.15	.15	.15	.15	.15
Q	28.8	31.1	31.2	31.2	32.5	33.2	33.7	33.8	36.5	38.4	40.3	45.2
13- 24	.11	-.04	-.02	-.11	.27	-.17	.08	-.05	.07	-.14	.13	-.09
ST.E.	.16	.16	.16	.16	.16	.17	.17	.17	.17	.17	.17	.17
Q	46.4	46.6	46.6	47.9	55.8	59.0	59.6	59.8	60.3	62.7	64.7	65.7
25- 30	-.05	.18	-.17	.11	-.05	.13						
ST.E.	.17	.17	.17	.17	.17	.17						
Q	65.9	70.0	73.6	75.2	75.6	77.9						



PARTIAL AUTOCORRELATIONS

1- 12	-.58	-.26	-.12	-.06	-.23	-.18	-.20	-.20	.14	.10	.22	-.08
ST.E.	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11
13- 24	-.12	-.01	-.01	-.24	-.03	-.04	-.06	-.13	.12	.01	.09	.08
ST.E.	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11
25- 30	-.10	.04	-.11	-.14	-.04	.17						
ST.E.	.11	.11	.11	.11	.11	.11						



The model at which we arrive for this sample is the following:

$$\begin{aligned}\Delta\Delta_{12} \log IPI &= -0.032 \Delta\Delta_{12} HSS_t + \\ &\quad (2.46) \\ &+ (0.042 - 0.166L + 0.102L^2) \Delta_{12} S8007_t + \\ &\quad (2.39) \quad (7.37) \quad (5.89) \\ &+ (1 - 0.82L)(1 + 0.38L^9)(1 - 0.86L^{12}) a_t, \quad (4) \\ &\quad (12.5) \quad (3.7) \quad (19.4)\end{aligned}$$

sample period: 1975(01)-1982(12),

$\sigma_a = 0.026$,

number of residuals: 83,

Box-Pierce-Ljung statistic $\begin{cases} 14 \text{ lags} = 4.0 \\ 24 \text{ lags} = 15.8, \end{cases}$

no values in the residual correlogram significantly different from zero,

standard deviation of the twelve months ahead forecasting errors: 0.034,

residual outliers:

<u>observation number</u>	<u>date</u>	<u>value ($\sigma = 0.026$)</u>
16	1976(04)	2.12σ
31	1977(07)	-2.12σ
50	1979(02)	-2.00σ
51	1979(03)	-2.00σ
61	1980(01)	2.35σ

In (4) HSS_t is a dummy variable included in the model to capture the decrease in production in Easter. The dummy has been constructed following Hillmer, Bell and Tiao (1981) and assuming a decreasing production period of twelve days^(*). The dummy variable $S8007$ is included to capture the seasonal change experienced from 1980. That variable has value one for the July month since 1980 and zeros otherwise.

In model (4) we do not have any factor to capture the possible economic cycle fluctuations in the series, as it happens in (1) with the factor $(1 - 0.93 L^{12} + 0.63 L^{24})$. With the 1975(01)-1982(12) sample, the autorregresive operator $(1 - \phi_{12} L^{12} - \phi_{24} L^{24})$ does not appear with significant coefficients in any of the models that we have tried. For this sample period a possible model with a pseudo-cyclical factor can be obtained with the autorregresive operator $(1 - \phi_9 L^9 - \phi_{18} L^{18})$. In that framework we have estimated the following model:

$$\begin{aligned} \Delta\Delta_{12} \log IPI = & -0.029 \Delta\Delta_{12} HSS_t + \\ & (2.3) \\ & + (0.047 - 0.160 L + 0.108 L^2) \Delta_{12} S8007_t \\ & \frac{(1 - 0.66 L)(1 - 0.73 L^{12})}{(7.8) \quad (9.4)} a_t , \\ & \frac{(1 - 0.37 L^9 + 0.41 L^{18})}{(3.6) \quad (4.1)} \end{aligned} \quad (5)$$

(*) The dummy HSS have values different from zero in the observations corresponding to the months of March and April. These values for the year 1975-84 are: $(0.917, 0.083)$, $(0, 1.0)$, $(0, 1.0)$, $(1.0, 0)$, $(0, 1.0)$, $(0.333, 0.667)$, $(0, 1.0)$, $(0, 1.0)$, $(0.583, 0.417)$, $(1.0, 0)$.

sample period: 1975(01)-1982(12),

$\sigma_a = 0.029$

number of residuals: 65,

Box-Pierce-Ljung statistic $\begin{cases} 14 \text{ lags} = 10.9 \\ 18 \text{ lags} = 15.3, \end{cases}$

no values significantly different from zero in the residual correlogram,

standard deviation of the twelve months ahead forecasting error: 0.048,

residual outliers:

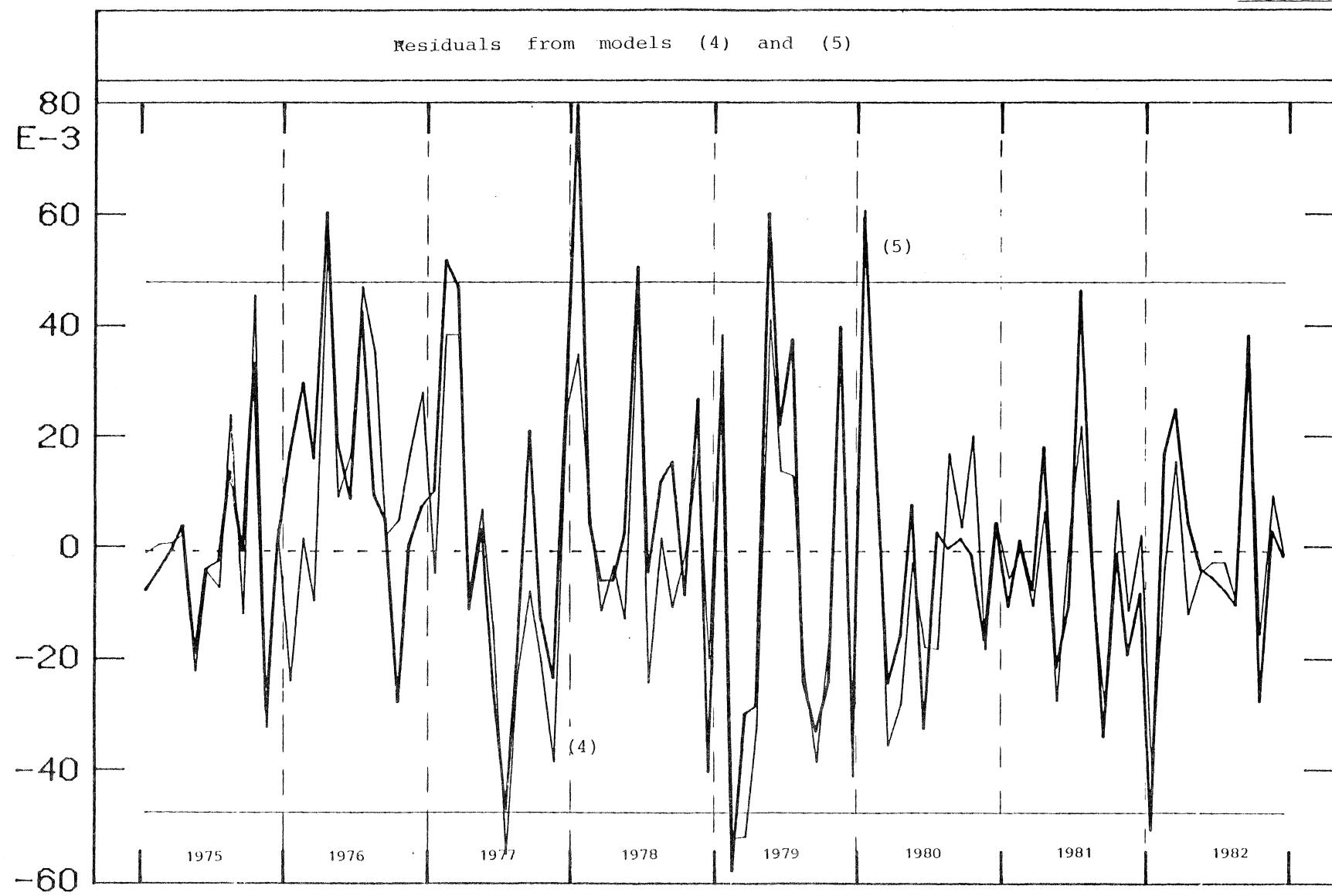
<u>observation number</u>	<u>date</u>	<u>value ($\sigma = 0.029$)</u>
16	1976(04)	2.07 σ
37	1978(01)	2.76 σ
50	1979(02)	-2.00 σ
53	1979(05)	2.07 σ
61	1980(01)	2.03 σ

In (5) the factor $(1 - 0.37 L^9 + 0.41 L^{18})$ has complex roots and their inverses have a module of 0.64 and a period around 45 months.

Comparing (4) with (5) we see that the standard deviation of the fit is better with model (4) than (5)^(*). We also observe that the results for (4) were quite invariant irrespectively of the estimation procedure used to approximate the exact maximum likelihood estimation, but in the results for (5) we find important differences. For all these reasons we select model (4) for the posterior study on the seasonal adjustment of the IPI series.

(*) The residuals for (4) and (5) are given in figure 7.

Figure 7



Note: The $\pm 1.96\sigma$ has been constructed with the one corresponding to model (4)

IV.- AN ESTIMATION OF THE DETERMINISTIC SEASONAL FACTORS FOR THE SPANISH INDUSTRIAL PRODUCTION INDEX.

In model (4) we have included variables as HSS and S8007 that contribute to explain certain deterministic aspects in the level and seasonal evolution of the IPI series. Our aim in this section is to separate the seasonal contributions, of those variables, from their contributions to the level of the IPI series.

Let us begin with the Easter effect on the log IPI series, that we will denote by E_t and has the following expresion:

$$E_t = \omega_1 HSS_t , \quad \omega_1 = -0.032. \quad (6)$$

The E_t series, that only has non-zero values in March and April, represents the total Easter effect on log IPI. Following Hillmer, Bell and Tiao (1981), we can decompose the HSS_t variable in the following way:

$$HSS_t = H1_t + H2_t + H3_t , \quad (7)$$

where:

$$H1_t = HSS_t - \frac{1}{2} MA_t , \quad (8)$$

$$H2_t = \frac{1}{2} MA_t - \frac{1}{12} , \quad (9)$$

$$H3_t = \frac{1}{12} \quad (10)$$

and MA_t is a dummy with value zero for all months except March and April where it takes the value one. Then we can rewrite (6) as:

$$E_t = \omega_1 H1_t + \omega_1 H2_t + \omega_1 H3_t , \quad (11)$$

and calling $E1$, $E2$ and $E3$ the three components of the right hand side of (11) we have:

$$E_t = E1_t + E2_t + E3_t . \quad (12)$$

If we observe that $H1_t$ only has non-zero values in March and April and they are such that they sum zero each year, we have that $E1_t$ is a kind of seasonal effect that is compensated between these two months. On the other hand $H2_t$ sums zero each twelve consecutive observations and therefore $E2_t$ is a pure seasonal effect. Finally $E3_t$ is a constant. In table 5 we list all those effects.

Using $E1$ and $E2$ we can calculate the following IPI Easter adjusted series:

$$\frac{IPI_t}{PH1_t} \times 100 = IPIH1_t \quad \text{and} \quad (13)$$

$$\frac{IPI_t}{PH12_t} \times 100 = IPIH12_t , \quad (14)$$

where the adjusting factors $PH1_t$ and $PH12_t$ are given by:

$$PH1_t = \exp\{E1_t\} \times 100 = \exp\{-0.032 H1_t\} \times 100 \quad \text{and} \quad (15)$$

$$\begin{aligned} PH12_t &= \exp\{E1_t + E2_t\} \times 100 = \\ &= \exp\{-0.032(H1_t + H12_t)\} \times 100 . \end{aligned} \quad (16)$$

TABLE 5

NOTE: The 1983 figures are forecasts.

TABLE 5 (cont.)

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$\text{MMA-2} = \text{MMA-1} + \text{MMA-3}$

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In (13) we adjust the IPI for the E1 effect and in (14) for the E1 and E2 effect. The adjusted series and their factors are given in table 5.

For the other deterministic component of model (4), we have that the total effect of the variable S8007 in $\Delta \log$ IPI is:

$$v_t = \left[\sum_{j=0}^{11} \delta_{j+1}^* L^j \right] s8001_t , \quad (17)$$

where $\delta_7^* = 0.042$, $\delta_8^* = -0.166$, $\delta_9^* = 0.102$, $\delta_\ell^* = 0$ ($\ell \neq 7, 8$ or 9) and $s8001$ is a dummy variable with value one for the January month since 1980 and zeros otherwise.

This effect can be decomposed in the following way:

$$v_t = \left[\sum_{j=0}^{11} (\delta_{j+1}^* - \bar{\delta}^*) L^j \right] s8001_t + \bar{\delta}^* \sum_{j=0}^{11} L^j s8001_t , \quad (18)$$

where,

$$\bar{\delta}^* = \frac{1}{12} \sum_{\ell=1}^{12} \delta_\ell^* = -0.00183 .$$

The first element in (18) captures a pure seasonal effect and the second one accounts for a change in the mean of the $\Delta \log$ IPI series since January 1980.

If we do,

$$\delta_\ell = \delta_\ell^* - \bar{\delta}^* , \quad \ell = 1, 2, \dots, 12 , \quad (19)$$

we have that the δ_ℓ 's are purely seasonal coefficients for $\Delta \log$ IPI series. Such coefficients are given in table 6.

Table 6

Seasonal Coefficients

<u>Months</u>	<u>Serie $\Delta \log IPI$</u>	<u>Serie $\log IPI$</u>
	δ_j	β_j
January	0'00183	.0040583
February	0'00183	.0058883
March	0'00183	.0077183
April	0'00183	.0095483
May	0'00183	.011378
June	0'00183	.013208
July	0'04383	.057038
August	-0'16417	-.10713
September	0'10383	-.0033017
October	0'00183	-.0014717
November	0'00183	.00035833
December	0'00183	.0021883

From the δ_ℓ coefficients we can calculate the corresponding coefficients for the log IPI series, that we denote by β_ℓ , and are given by the expresion:

$$\beta_\ell = \sum_{i=1}^{\ell} \delta_i + \frac{1}{12} \sum_{i=1}^{12} i \delta_i . \quad (20)$$

Observing the values of these coefficients (table 6) we see that the bigger seasonal changes have occurred for the period that starts with April and ends with August. For this last month we have now an aditional downturn of 10.7%, with respect to what was usual till 1979. The corresponding seasonal recovery takes place mainly from April to July. At a quarterly level we can sum up the new situation saying that we have a new downfall in the third quarter with the corresponding reverse seasonal movement in the second one.

From the β_ℓ coefficients we have that the seasonal factors to adjust the IPI series for this recent deterministic seasonal component are:

$$PV_t = \sum_{j=1}^{12} PV_{jt} = \sum_{j=1}^{12} \exp \{ \beta_j S80j \} \times 100 , \quad (21)$$

where $S80j$ is a dummy with value one in the month j from 1980 onwards and zeros otherwise. The PV_t factors and the adjusted, IPIV, series,

$$IPIV_t = \frac{IPI_t}{PV_t} \times 100 ,$$

are in table 7.

TABLE 7

* obs. n° *	IPI *	PV *	IPIV=	** obs. n° *	IPI *	PV *	IPIV=					
* and date *	*	*	=IPI/PV	** and date *	*	*	=IPI/PV					
* 1 7501 *	111.8	*	100	* 111.8	** 61	8001 *	137.7	*	100.41	*	137.14	*
* 2 7502 *	114.1	*	100	* 114.1	** 62	8002 *	137.2	*	100.59	*	136.39	*
* 3 7503 *	119.8	*	100	* 119.8	** 63	8003 *	139.1	*	100.77	*	138.03	*
* 4 7504 *	118.4	*	100	* 118.4	** 64	8004 *	132.5	*	100.96	*	131.24	*
* 5 7505 *	117.4	*	100	* 117.4	** 65	8005 *	139.4	*	101.14	*	137.82	*
* 6 7506 *	116.7	*	100	* 116.7	** 66	8006 *	133.5	*	101.33	*	131.75	*
* 7 7507 *	111.2	*	100	* 111.2	** 67	8007 *	133	*	105.87	*	125.63	*
* 8 7508 *	77.5	*	100	* 77.5	** 68	8008 *	79.9	*	89.841	*	88.935	*
* 9 7509 *	120.1	*	100	* 120.1	** 69	8009 *	135.8	*	99.67	*	136.25	*
* 10 7510 *	129.5	*	100	* 129.5	** 70	8010 *	147.4	*	99.853	*	147.62	*
* 11 7511 *	121.6	*	100	* 121.6	** 71	8011 *	140.8	*	100.04	*	140.75	*
* 12 7512 *	118.8	*	100	* 118.8	** 72	8012 *	133.4	*	100.22	*	133.11	*
* 13 7601 *	112.2	*	100	* 112.2	** 73	8101 *	130.4	*	100.41	*	129.87	*
* 14 7602 *	115.4	*	100	* 115.4	** 74	8102 *	132.7	*	100.59	*	131.92	*
* 15 7603 *	124.2	*	100	* 124.2	** 75	8103 *	140.2	*	100.77	*	139.12	*
* 16 7604 *	122.7	*	100	* 122.7	** 76	8104 *	132.3	*	100.96	*	131.04	*
* 17 7605 *	125.3	*	100	* 125.3	** 77	8105 *	136.9	*	101.14	*	135.35	*
* 18 7606 *	122.5	*	100	* 122.5	** 78	8106 *	136.8	*	101.33	*	135	*
* 19 7607 *	124.1	*	100	* 124.1	** 79	8107 *	139.5	*	105.87	*	131.77	*
* 20 7608 *	81.3	*	100	* 81.3	** 80	8108 *	77	*	89.841	*	85.707	*
* 21 7609 *	128.1	*	100	* 128.1	** 81	8109 *	133.5	*	99.67	*	133.94	*
* 22 7610 *	130.6	*	100	* 130.6	** 82	8110 *	142.3	*	99.853	*	142.51	*
* 23 7611 *	132.9	*	100	* 132.9	** 83	8111 *	139.4	*	100.04	*	139.35	*
* 24 7612 *	127.8	*	100	* 127.8	** 84	8112 *	132.9	*	100.22	*	132.61	*
* 25 7701 *	123	*	100	* 123	** 85	8201 *	126.2	*	100.41	*	125.69	*
* 26 7702 *	128.8	*	100	* 128.8	** 86	8202 *	129.3	*	100.59	*	128.54	*
* 27 7703 *	140.8	*	100	* 140.8	** 87	8203 *	142.5	*	100.77	*	141.4	*
* 28 7704 *	128.5	*	100	* 128.5	** 88	8204 *	130.6	*	100.96	*	129.36	*
* 29 7705 *	135.6	*	100	* 135.6	** 89	8205 *	136.9	*	101.14	*	135.35	*
* 30 7706 *	128.9	*	100	* 128.9	** 90	8206 *	133.3	*	101.33	*	131.55	*
* 31 7707 *	119.5	*	100	* 119.5	** 91	8207 *	134.5	*	105.87	*	127.04	*
* 32 7708 *	82.5	*	100	* 82.5	** 92	8208 *	75.8	*	89.841	*	84.372	*
* 33 7709 *	133.9	*	100	* 133.9	** 93	8209 *	139.1	*	99.67	*	139.56	*
* 34 7710 *	134	*	100	* 134	** 94	8210 *	136.4	*	99.853	*	136.6	*
* 35 7711 *	133.2	*	100	* 133.2	** 95	8211 *	140.2	*	100.04	*	140.15	*
* 36 7712 *	134.7	*	100	* 134.7	** 96	8212 *	132.5	*	100.22	*	132.21	*
* 37 7801 *	130	*	100	* 130	** 97	8301 *	127.48	*	100.41	*	126.96	*
* 38 7802 *	130.4	*	100	* 130.4	** 98	8302 *	130.24	*	100.59	*	129.48	*
* 39 7803 *	133.7	*	100	* 133.7	** 99	8303 *	136.72	*	100.77	*	135.67	*
* 40 7804 *	131.7	*	100	* 131.7	** 100	8304 *	132.87	*	100.96	*	131.61	*
* 41 7805 *	133	*	100	* 133	** 101	8305 *	134.38	*	101.14	*	132.86	*
* 42 7806 *	137.8	*	100	* 137.8	** 102	8306 *	135.35	*	101.33	*	133.57	*
* 43 7807 *	123.9	*	100	* 123.9	** 103	8307 *	131.42	*	105.87	*	124.13	*
* 44 7808 *	84.7	*	100	* 84.7	** 104	8308 *	77.32	*	89.841	*	86.063	*
* 45 7809 *	136.8	*	100	* 136.8	** 105	8309 *	133.72	*	99.67	*	134.16	*
* 46 7810 *	141.7	*	100	* 141.7	** 106	8310 *	140.63	*	99.853	*	140.84	*
* 47 7811 *	142.8	*	100	* 142.8	** 107	8311 *	137.45	*	100.04	*	137.4	*
* 48 7812 *	131.9	*	100	* 131.9	** 108	8312 *	131.35	*	100.22	*	131.06	*
* 49 7901 *	134.8	*	100	* 134.8	**	*	*	*	*	*	*	*
* 50 7902 *	125.9	*	100	* 125.9	**	*	*	*	*	*	*	*
* 51 7903 *	137.6	*	100	* 137.6	**	*	*	*	*	*	*	*
* 52 7904 *	126.6	*	100	* 126.6	**	*	*	*	*	*	*	*
* 53 7905 *	142.6	*	100	* 142.6	**	*	*	*	*	*	*	*
* 54 7906 *	136.9	*	100	* 136.9	**	*	*	*	*	*	*	*
* 55 7907 *	131	*	100	* 131	**	*	*	*	*	*	*	*
* 56 7908 *	86.3	*	100	* 86.3	**	*	*	*	*	*	*	*
* 57 7909 *	133.7	*	100	* 133.7	**	*	*	*	*	*	*	*
* 58 7910 *	142	*	100	* 142	**	*	*	*	*	*	*	*
* 59 7911 *	144.8	*	100	* 144.8	**	*	*	*	*	*	*	*
* 60 7912 *	128.3	*	100	* 128.3	**	*	*	*	*	*	*	*

note: the IPI values for 1983 are forecasts.

The remaining effect of the variable $S8007_t^*$, model (4), in the series $\Delta \log IPI$ is the change, δ^* , in its mean value since January 1980. Since the value of δ^* is -0.00183 we have that the rate of growth of the Spanish Industrial Production Index has decreased by 2.2 annual percentual points, and this can be interpreted as due to the second energy crisis. The 2.2 figure agrees with the corresponding estimated decrease, in Espasa (1982), for the non-agriculture Spanish GDP.

From the Easter, PH1 and PH12, and PV adjusting factors we can obtain the corresponding adjusting factor for both effects jointly. We call them P1, if in the Easter effect we only include E1, and P12, if for the Easter effect we include E1 and E2. The corresponding adjusted IPI series will be denoted by IPIHIV and IPIH12V, respectively. All those factors and adjustments are in table 8 and their corresponding formule are:

$$P1_t = \frac{PH1_t \times PV_t}{100} , \quad (22)$$

$$P12_t = \frac{PH12_t \times PV_t}{100} , \quad (23)$$

$$IPIH1V_t = \frac{IPI_t}{P1} \times 100 \quad \text{and} \quad (24)$$

$$IPIH12V_t = \frac{IPI_t}{P12} \times 100 . \quad (25)$$

In figure 8 we compare the rate of growth of the IPI and the IPIH12V series, and we can see the impact of the summer correction obtained in the adjusted series that reveals a more homoscedastic evolution.

TABLE 8

NUM. DE OBS.	PH1	PH12	BETA	PV=	* P1=	* P12=	IPI	IPIH1U=	IPIH12W=
Y FECHA	*	*	*	* =EXP(BETA)*	* =PH1*xPV	* =PH12*xPV	*	* =IPI/P1	* =IPI/P12
1	7501	*	100.00	*	100.27	*	.00000	*	100.00
2	7502	*	100.00	*	100.27	*	.00000	*	100.00
3	7503	*	98.41	*	97.37	*	.00000	*	100.00
4	7504	*	101.41	*	100.00	*	.00000	*	101.41
5	7505	*	100.00	*	100.27	*	.00000	*	100.00
6	7506	*	100.00	*	100.27	*	.00000	*	100.00
7	7507	*	100.00	*	100.27	*	.00000	*	100.00
8	7508	*	100.00	*	100.27	*	.00000	*	100.00
9	7509	*	100.00	*	100.27	*	.00000	*	100.00
10	7510	*	100.00	*	100.27	*	.00000	*	100.00
11	7511	*	100.00	*	100.27	*	.00000	*	100.00
12	7512	*	100.00	*	100.27	*	.00000	*	100.00
13	7601	*	100.00	*	100.27	*	.00000	*	100.00
14	7602	*	100.00	*	100.27	*	.00000	*	100.00
15	7603	*	101.41	*	100.27	*	.00000	*	100.00
16	7604	*	98.41	*	97.11	*	.00000	*	100.00
17	7605	*	100.00	*	100.27	*	.00000	*	100.00
18	7606	*	100.00	*	100.27	*	.00000	*	100.00
19	7607	*	100.00	*	100.27	*	.00000	*	100.00
20	7608	*	100.00	*	100.27	*	.00000	*	100.00
21	7609	*	100.00	*	100.27	*	.00000	*	100.00
22	7610	*	100.00	*	100.27	*	.00000	*	100.00
23	7611	*	100.00	*	100.27	*	.00000	*	100.00
24	7612	*	100.00	*	100.27	*	.00000	*	100.00
25	7701	*	100.00	*	100.27	*	.00000	*	100.00
26	7702	*	100.00	*	100.27	*	.00000	*	100.00
27	7703	*	101.41	*	100.27	*	.00000	*	100.00
28	7704	*	98.41	*	97.11	*	.00000	*	100.00
29	7705	*	100.00	*	100.27	*	.00000	*	100.00
30	7706	*	100.00	*	100.27	*	.00000	*	100.00
31	7707	*	100.00	*	100.27	*	.00000	*	100.00
32	7708	*	100.00	*	100.27	*	.00000	*	100.00
33	7709	*	100.00	*	100.27	*	.00000	*	100.00
34	7710	*	100.00	*	100.27	*	.00000	*	100.00
35	7711	*	100.00	*	100.27	*	.00000	*	100.00
36	7712	*	100.00	*	100.27	*	.00000	*	100.00
37	7801	*	100.00	*	100.27	*	.00000	*	100.00
38	7802	*	100.00	*	100.27	*	.00000	*	100.00
39	7803	*	98.41	*	97.11	*	.00000	*	100.00
40	7804	*	101.41	*	100.27	*	.00000	*	100.00
41	7805	*	100.00	*	100.27	*	.00000	*	100.00
42	7806	*	100.00	*	100.27	*	.00000	*	100.00
43	7807	*	100.00	*	100.27	*	.00000	*	100.00
44	7808	*	100.00	*	100.27	*	.00000	*	100.00
45	7809	*	100.00	*	100.27	*	.00000	*	100.00
46	7810	*	100.00	*	100.27	*	.00000	*	100.00
47	7811	*	100.00	*	100.27	*	.00000	*	100.00
48	7812	*	100.00	*	100.27	*	.00000	*	100.00
49	7901	*	100.00	*	100.27	*	.00000	*	100.00
50	7902	*	100.00	*	100.27	*	.00000	*	100.00
51	7903	*	101.41	*	100.27	*	.00000	*	101.41
52	7904	*	98.41	*	97.11	*	.00000	*	100.00
53	7905	*	100.00	*	100.27	*	.00000	*	100.00
54	7906	*	100.00	*	100.27	*	.00000	*	100.00
55	7907	*	100.00	*	100.27	*	.00000	*	100.00
56	7908	*	100.00	*	100.27	*	.00000	*	100.00
57	7909	*	100.00	*	100.27	*	.00000	*	100.00
58	7910	*	100.00	*	100.27	*	.00000	*	100.00
59	7911	*	100.00	*	100.27	*	.00000	*	100.00
60	7912	*	100.00	*	100.27	*	.00000	*	100.00

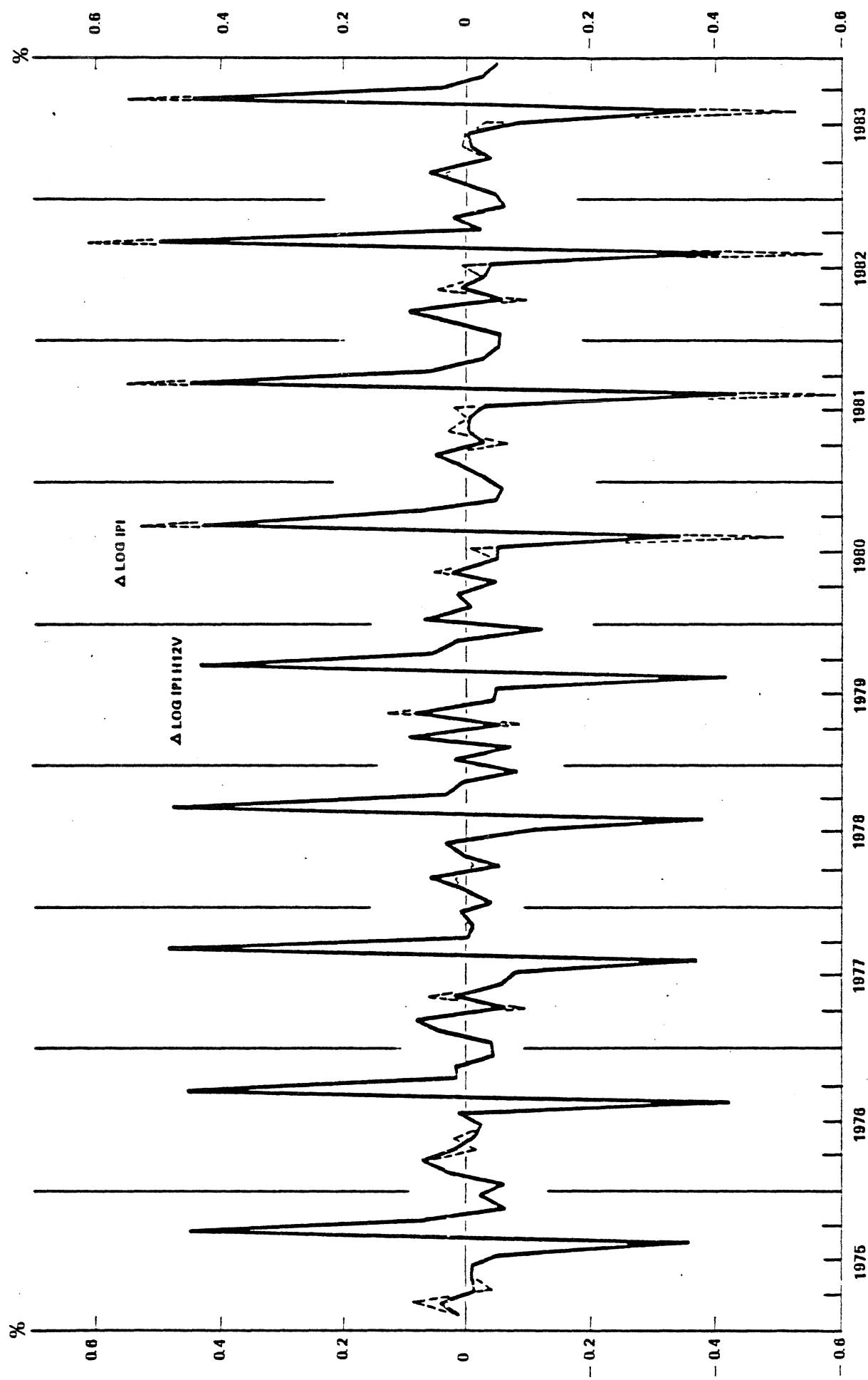
NOTE: The 1983 figures are forecasts

TABLE 8 (cont.)

NUM. DE O.R.S.	*	PH1	*	PH12	*	BETA	*	PV=	*	P1=	*	P12=	*	IPI	*	IPIH1V=	*	IPIH12V=	
Y FECHA	*	*	*	*	*	=EXP(BETA)X	*	=PH1*PV X	*	=PH12*PV X	*	=PH12*PV X	*	*	*	=IPI/P1 X	*	=IPI/P12	
61	S001	*	100.00	*	100.27	*	.00406	*	100.41	*	100.41	*	100.67	*	137.70	*	137.14	*	136.78
62	S002	*	100.00	*	100.27	*	.00589	*	100.59	*	100.59	*	100.86	*	137.20	*	136.39	*	136.03
63	S003	*	100.53	*	99.20	*	.00772	*	100.77	*	101.31	*	99.972	*	139.10	*	137.30	*	139.14
64	S004	*	99.47	*	98.15	*	.00955	*	100.96	*	100.42	*	99.092	*	132.50	*	131.94	*	133.71
65	S005	*	100.00	*	100.27	*	.01138	*	101.14	*	101.14	*	101.41	*	139.40	*	137.82	*	137.46
66	S006	*	100.00	*	100.27	*	.01321	*	101.33	*	101.33	*	101.6	*	133.50	*	131.75	*	131.40
67	S007	*	100.00	*	100.27	*	.01504	*	105.87	*	105.87	*	104.15	*	133.00	*	129.63	*	125.29
68	S008	*	100.00	*	100.27	*	-.10713	*	89.84	*	89.84	*	90.081	*	79.90	*	88.94	*	88.70
69	S009	*	100.00	*	100.27	*	-.00330	*	99.67	*	99.67	*	99.937	*	135.80	*	135.25	*	135.89
70	S010	*	100.00	*	100.27	*	-.00147	*	99.85	*	99.85	*	100.12	*	147.40	*	147.62	*	147.22
71	S011	*	100.00	*	100.27	*	.00036	*	100.04	*	100.04	*	100.3	*	140.80	*	140.75	*	140.57
72	S012	*	100.00	*	100.27	*	.00219	*	100.22	*	100.22	*	100.49	*	133.40	*	133.11	*	132.75
73	S101	*	100.00	*	100.27	*	.00406	*	100.41	*	100.41	*	100.67	*	136.40	*	129.87	*	129.53
74	S102	*	100.00	*	100.27	*	.00589	*	100.59	*	100.59	*	100.86	*	132.70	*	131.92	*	131.57
75	S103	*	101.61	*	100.27	*	.00772	*	100.77	*	102.40	*	101.04	*	140.20	*	136.91	*	138.75
76	S104	*	98.41	*	97.11	*	.00955	*	100.96	*	99.36	*	98.041	*	132.30	*	133.16	*	134.94
77	S105	*	100.00	*	100.27	*	.01138	*	101.14	*	101.14	*	101.41	*	134.90	*	133.35	*	134.99
78	S106	*	100.00	*	100.27	*	.01321	*	101.33	*	101.33	*	101.6	*	136.80	*	135.00	*	134.65
79	S107	*	100.00	*	100.27	*	.01504	*	105.87	*	105.87	*	106.15	*	139.50	*	131.77	*	131.41
80	S108	*	100.00	*	100.27	*	-.10713	*	89.84	*	89.84	*	90.081	*	77.00	*	85.71	*	85.48
81	S109	*	100.00	*	100.27	*	-.00330	*	99.67	*	99.67	*	99.937	*	133.50	*	133.94	*	133.58
82	S110	*	100.00	*	100.27	*	-.00147	*	99.85	*	99.85	*	100.12	*	142.30	*	142.51	*	142.13
83	S111	*	100.00	*	100.27	*	.00036	*	100.04	*	100.04	*	100.3	*	139.40	*	138.35	*	138.98
84	S112	*	100.00	*	100.27	*	.00219	*	100.22	*	100.22	*	100.49	*	132.90	*	132.61	*	132.26
85	S201	*	100.00	*	100.27	*	.00406	*	100.41	*	100.41	*	100.67	*	124.20	*	125.69	*	125.35
86	S202	*	100.00	*	100.27	*	.00589	*	100.59	*	100.59	*	100.86	*	129.30	*	128.54	*	128.20
87	S203	*	101.61	*	100.27	*	.00772	*	100.77	*	102.40	*	101.04	*	142.50	*	139.16	*	141.03
88	S204	*	98.41	*	97.11	*	.00955	*	100.96	*	99.36	*	98.041	*	130.60	*	131.45	*	133.21
89	S205	*	100.00	*	100.27	*	.01138	*	101.14	*	101.14	*	101.41	*	134.90	*	133.35	*	134.99
90	S206	*	100.00	*	100.27	*	.01321	*	101.33	*	101.33	*	101.6	*	133.30	*	131.55	*	131.20
91	S207	*	100.00	*	100.27	*	.01504	*	105.87	*	105.87	*	106.15	*	134.50	*	127.04	*	126.70
92	S208	*	100.00	*	100.27	*	-.10713	*	89.84	*	89.84	*	90.081	*	75.80	*	84.37	*	84.15
93	S209	*	100.00	*	100.27	*	-.00330	*	99.67	*	99.67	*	99.937	*	139.10	*	139.56	*	139.19
94	S210	*	100.00	*	100.27	*	-.00147	*	99.85	*	99.85	*	100.12	*	136.40	*	136.60	*	136.24
95	S211	*	100.00	*	100.27	*	.00036	*	100.04	*	100.04	*	100.3	*	140.20	*	140.15	*	139.78
96	S212	*	100.00	*	100.27	*	.00219	*	100.22	*	100.22	*	100.49	*	132.50	*	132.21	*	131.86
97	S301	*	100.00	*	100.27	*	.00406	*	100.41	*	100.41	*	100.67	*	127.48	*	126.96	*	126.63
98	S302	*	100.00	*	100.27	*	.00589	*	100.59	*	100.59	*	100.86	*	130.24	*	129.48	*	129.13
99	S303	*	99.73	*	98.41	*	.00772	*	100.77	*	100.51	*	99.175	*	136.72	*	136.03	*	137.86
100	S304	*	100.27	*	98.94	*	.00955	*	100.96	*	101.33	*	99.888	*	132.87	*	131.26	*	133.02
101	S305	*	100.00	*	100.27	*	.01138	*	101.14	*	101.14	*	101.41	*	134.38	*	132.86	*	132.51
102	S306	*	100.00	*	100.27	*	.01321	*	101.33	*	101.33	*	101.6	*	135.35	*	133.57	*	133.22
103	S307	*	100.00	*	100.27	*	.01504	*	105.87	*	105.87	*	106.15	*	131.42	*	124.13	*	123.80
104	S308	*	100.00	*	100.27	*	-.10713	*	89.84	*	89.84	*	90.081	*	77.52	*	86.06	*	85.83
105	S309	*	100.00	*	100.27	*	-.00330	*	99.67	*	99.67	*	99.937	*	133.72	*	134.16	*	133.80
106	S310	*	100.00	*	100.27	*	-.00147	*	99.85	*	99.85	*	100.12	*	140.63	*	140.84	*	140.46
107	S311	*	100.00	*	100.27	*	.00036	*	100.04	*	100.04	*	100.3	*	137.45	*	137.40	*	137.03
108	S312	*	100.00	*	100.27	*	.00219	*	100.22	*	100.22	*	100.49	*	131.35	*	131.06	*	130.71

NOTE: The 1983 figures are forecasts

FIGURE 8



NOTE: The 1983 figures are forecasts

V.- AN ESTIMATION OF THE STOCHASTIC SEASONAL FACTORS FOR THE SPANISH INDUSTRIAL PRODUCTION INDEX.

From the results of the previous sections we have:

$$\begin{aligned} \Delta\Delta_{12} \log IPIH12V_t &= -0.00183 \Delta_{12} S^*8001_t + \\ &+ (1-0.82 L)(1+0.38 L^9)(1-0.86 L^{12})a_t , \end{aligned} \quad (26)$$

where S^*8001_t is a dummy with unity values in all its observations since January 1980 and zeros otherwise.

From $IPIH12V_t$ we can generate:

$$\log IPI_t^* = \log IPIH12V_t + 0.00267 + 0.00183T8001_t , \quad (27)$$

where $T8001$ is a trend dummy with zeros till December 1979 and with values $1, 2, \dots$ since January 1980^(*). This series is generated by the model:

$$\Delta\Delta_{12} \log IPI_t^* = (1-0.82L)(1+0.32L^9)(1-0.86L^{12})a_t , \quad (28)$$

and operating in the right hand side of (28) we have that,

$$\begin{aligned} \Delta\Delta_{12} \log IPI_t^* &= (1-0.82 L+0.32 L^9-0.26 L^{10}- \\ &-0.86 L^{12}+0.71 L^{13}-0.28 L^{21}+0.22 L^{22})a_t . \end{aligned} \quad (29)$$

According with all this we have that IPI_t^* , which only has stochastic factors, is the purely stochastic component of IPI . The other components of this last series are, the seasonal deterministic elements used to generate

(*) The constant -0.00267 is equal to $-0.032/12 = E3_t$.

IPIH12V and the deterministic trend (with reverse sign) included in (27). Therefore, calculating the stochastic seasonal factors of IPI^{*} we automatically have the corresponding ones for IPI.

The correct way to calculate those factors would be by a method based on model (29). Hillmer, Bell and Tiao (1981), HBT from now on, developped a procedure on those lines but for the series of this study HBT can be approximated by the X-11 method. Therefore our approach will be the following:

- a) use (4) to forecast the twelve months of 1983 and enlarge the original sample with them,
- b) apply X-11 to IPI^{*}, to obtain the stochastic factors, PX, of IPI.

VI.- THE SEASONALLY ADJUSTED IPI SERIES

From the P12 and PX factors of the previous sections we obtain the final seasonal (mixed) factors, PF, as

$$PF_t = \frac{P12_t \times PX_t}{100}, \quad (30)$$

and dividing IPI by them we have the IPI adjusted series. In that series we could observe that its values for July and August 1980 were a bit lower and higher, respectively, than one would expect. This fact pointed out that the deterministic seasonal elements for 1980 were, in absolute values, overestimated. Then we tried a more sophisticated intervention analysis in model (4) that allowed for an additional seasonal deterministic effect for 1981. We estimated (4) with this new intervention and the results obtained were almost identical to the ones expressed in section IV, but for the intervention, that we obtained the following:

$$\frac{0.0362 - 0.1370 L + 0.0831 L^2}{1 - 0.2758 L^{12}} \Delta_{12} S3007_t \quad (31)$$

In (31) the coefficient in the denominator is not significantly different from zero, by usual standards, but its inclusion in the model is important because it implies that the deterministic seasonal effect, appeared in 1980, had an additional impact in 1981. This impact measured by the corresponding coefficients, defined similarly as we did in section 4, can be seen in table 9.

We denote by PW the corresponding factors to adjust IPI for this change in seasonality captured by the intervention referred in (31). Then:

$$P12W = \frac{PH12 \times PW}{100} , \quad (32)$$

are the factors to adjust IPI for the whole deterministic seasonality.

The factors for the stochastic seasonality can be obtained following the steps mentioned in section V, but now using model (31) to forecast 1983, and we denote them by PXW^* . The final factors, denoted by PFW, will be now:

$$PFW_t = \frac{P12W_t \times PXW_t}{100} .$$

All these factors and the ones corresponding to the direct application of the X-11 method, for the extended sample till 1983 of the IPI, and denoted by $PFX11$, are given in table 10. The adjusted series with the PFW_t factors is in figure 9 and in figure 10 we can compare it with the adjusted series using $PFX11$ factors. In appendix 2 we include different graphs to compare the different adjusting methods commented in this section.

(*) These factors are obtained using the trading day correction option available in the X-11 method.

FIGURE 9

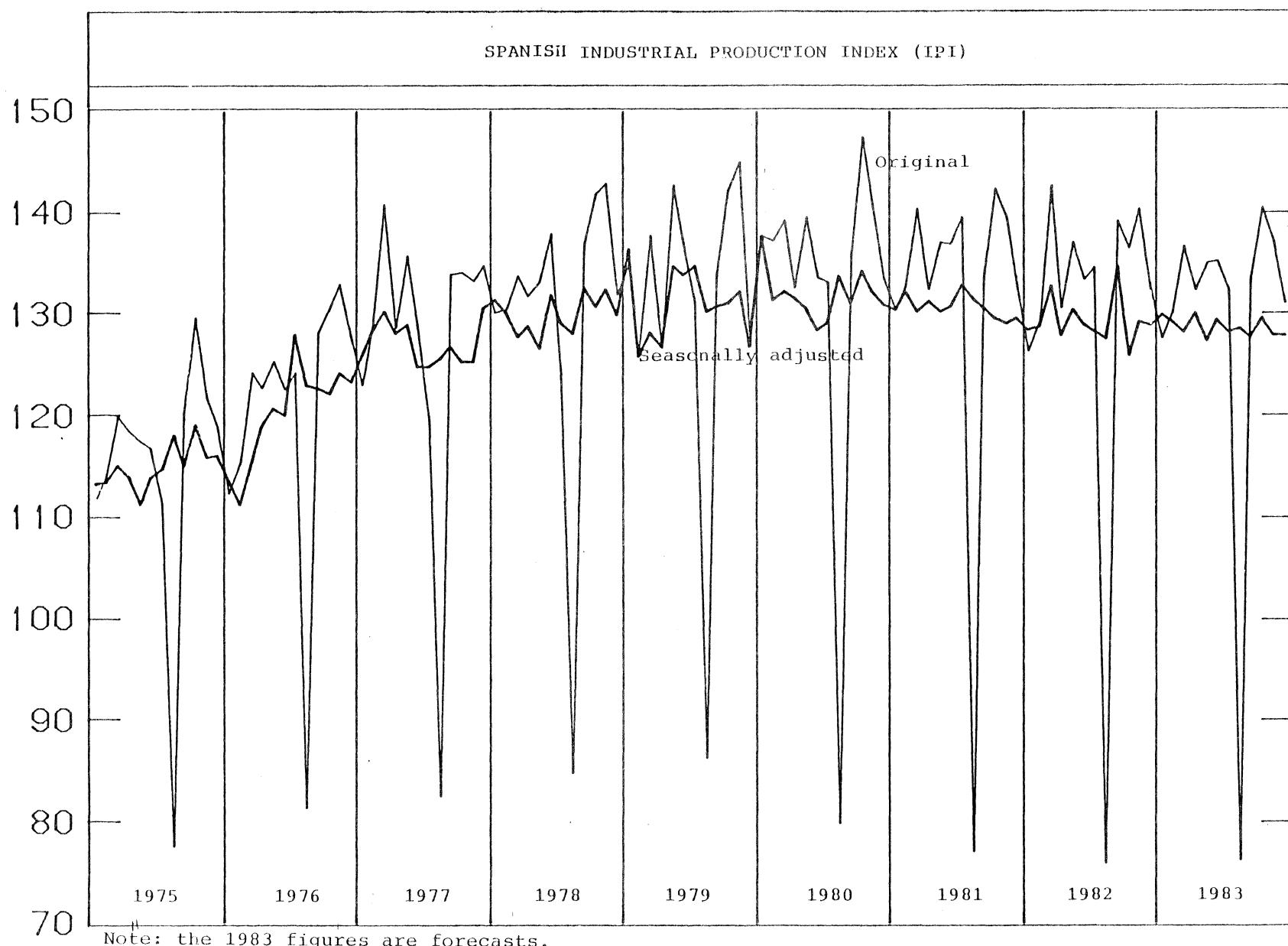


Figure 10

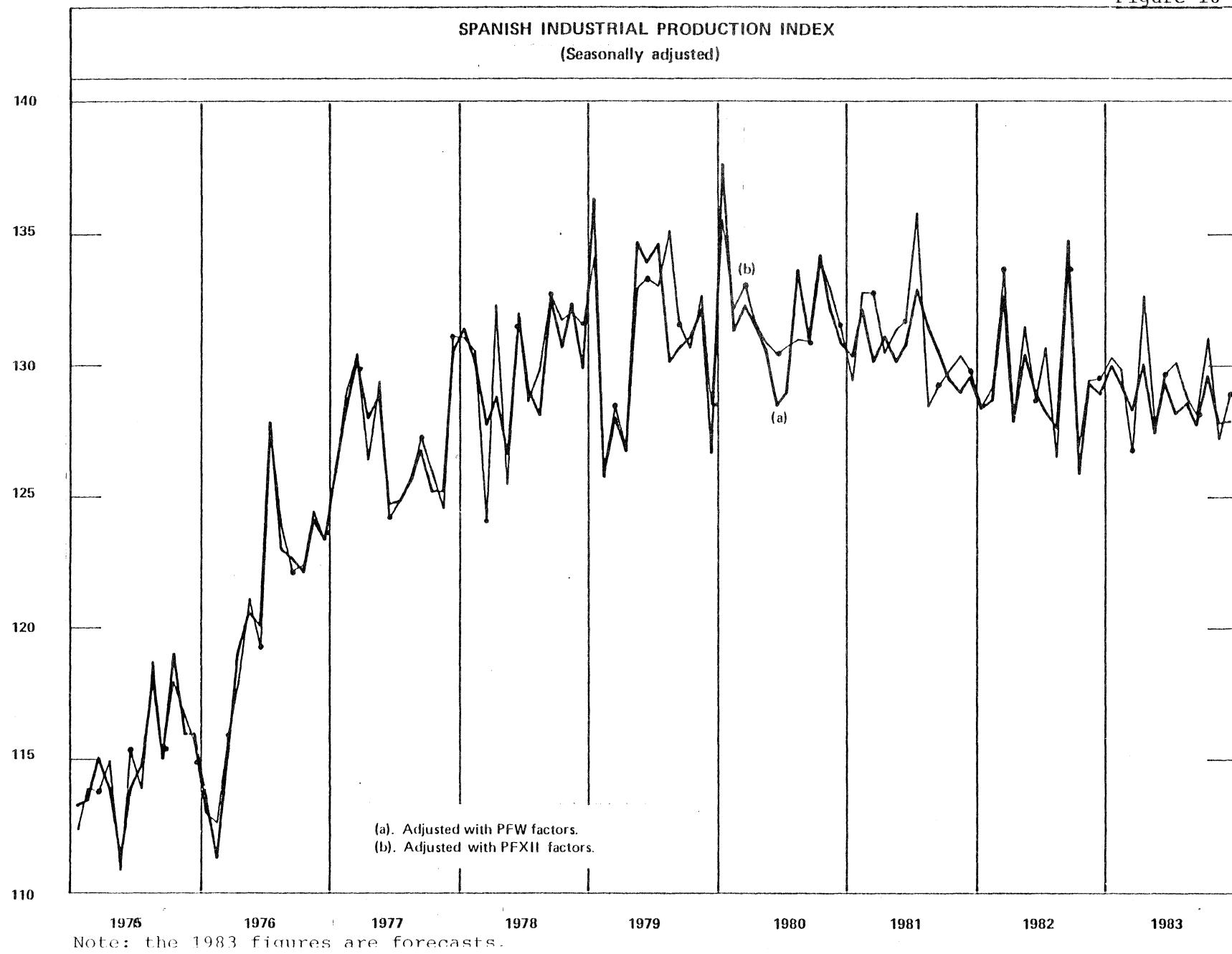


Table 9

Deterministic seasonal coefficients for log IPI

derived from (31)

<u>Months</u>	<u>1980</u>	<u>1981 onwards</u>
January	0.00317	0.00404
February	0.00465	0.00594
March	0.00612	0.00784
April	0.00760	0.00974
May	0.00907	0.01164
June	0.01055	0.01354
July	0.04823	0.06163
August	-0.08730	-0.11148
September	-0.00272	-0.00355
October	-0.00125	-0.00165
November	0.00023	0.00025
December	0.00170	0.00215

It is interesting to compare the alternative final PF, PFW and PFXII factors corresponding to the summer months from 1979 onwards. We see that for 1979 PFXII has decrease from its previous level even when in that year the downfall for August has not registered a significant additional increase. On the other hand PF and PFW do not register appreciable changes at this date. In 1980 PFXII keeps falling approximately at the same rate of 1979, but PF and PFW register an important decrease. For that year the downfall in August, observed in the original series, is the

Table 10

*	OBS. NUM.	*	PH12	*	PW	*	P12W	*	FXW	*	PFW	*	PF	*	PFX11	*
*	AND DATE	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
*	1	7501	*	100.27	*	100	*	100.27	*	98.48	*	98.741	*	98.80	*	99.54
*	2	7502	*	100.27	*	100	*	100.27	*	100.30	*	100.57	*	100.26	*	100.20
*	3	7503	*	97.37	*	100	*	97.37	*	106.92	*	104.11	*	104.09	*	105.30
*	4	7504	*	100.00	*	100	*	100.00	*	104.00	*	104	*	104.02	*	103.05
*	5	7505	*	100.27	*	100	*	100.27	*	105.25	*	105.53	*	105.61	*	105.97
*	6	7506	*	100.27	*	100	*	100.27	*	102.14	*	102.41	*	102.41	*	101.18
*	7	7507	*	100.27	*	100	*	100.27	*	96.63	*	96.884	*	96.97	*	97.68
*	8	7508	*	100.27	*	100	*	100.27	*	65.46	*	65.637	*	65.54	*	65.30
*	9	7509	*	100.27	*	100	*	100.27	*	104.10	*	104.37	*	104.41	*	104.25
*	10	7510	*	100.27	*	100	*	100.27	*	108.52	*	108.81	*	109.08	*	109.78
*	11	7511	*	100.27	*	100	*	100.27	*	104.59	*	104.87	*	104.74	*	104.23
*	12	7512	*	100.27	*	100	*	100.27	*	102.14	*	102.43	*	102.56	*	102.74
*	13	7601	*	100.27	*	100	*	100.27	*	98.49	*	98.755	*	98.80	*	99.35
*	14	7602	*	100.27	*	100	*	100.27	*	103.41	*	103.69	*	103.15	*	102.52
*	15	7603	*	100.27	*	100	*	100.27	*	107.41	*	107.7	*	107.82	*	107.10
*	16	7604	*	97.11	*	100	*	97.11	*	106.13	*	103.06	*	103.12	*	104.07
*	17	7605	*	100.27	*	100	*	100.27	*	103.62	*	103.87	*	103.97	*	103.49
*	18	7606	*	100.27	*	100	*	100.27	*	101.74	*	102.01	*	101.97	*	102.71
*	19	7607	*	100.27	*	100	*	100.27	*	96.81	*	97.073	*	97.19	*	97.28
*	20	7608	*	100.27	*	100	*	100.27	*	65.92	*	66.099	*	66.03	*	65.62
*	21	7609	*	100.27	*	100	*	100.27	*	104.15	*	104.43	*	104.50	*	104.87
*	22	7610	*	100.27	*	100	*	100.27	*	106.61	*	106.9	*	106.85	*	106.73
*	23	7611	*	100.27	*	100	*	100.27	*	106.81	*	107.09	*	107.21	*	106.82
*	24	7612	*	100.27	*	100	*	100.27	*	103.32	*	103.59	*	103.69	*	103.57
*	25	7701	*	100.27	*	100	*	100.27	*	97.29	*	97.547	*	97.60	*	97.61
*	26	7702	*	100.27	*	100	*	100.27	*	100.09	*	100.35	*	100.05	*	99.92
*	27	7703	*	100.27	*	100	*	100.27	*	107.87	*	108.15	*	108.13	*	107.94
*	28	7704	*	97.11	*	100	*	97.11	*	103.35	*	100.36	*	100.41	*	101.64
*	29	7705	*	100.27	*	100	*	100.27	*	104.92	*	105.2	*	105.17	*	104.80
*	30	7706	*	100.27	*	100	*	100.27	*	103.06	*	103.33	*	103.46	*	103.78
*	31	7707	*	100.27	*	100	*	100.27	*	95.47	*	95.724	*	95.59	*	95.70
*	32	7708	*	100.27	*	100	*	100.27	*	65.48	*	65.654	*	65.64	*	65.55
*	33	7709	*	100.27	*	100	*	100.27	*	105.35	*	105.63	*	105.65	*	105.23
*	34	7710	*	100.27	*	100	*	100.27	*	106.70	*	106.98	*	107.12	*	106.44
*	35	7711	*	100.27	*	100	*	100.27	*	106.07	*	106.34	*	106.34	*	106.92
*	36	7712	*	100.27	*	100	*	100.27	*	102.93	*	103.21	*	103.28	*	102.72
*	37	7801	*	100.27	*	100	*	100.27	*	98.67	*	98.934	*	98.88	*	99.20
*	38	7802	*	100.27	*	100	*	100.27	*	99.95	*	100.22	*	99.97	*	99.89
*	39	7803	*	97.11	*	100	*	97.11	*	107.77	*	104.66	*	104.75	*	107.77
*	40	7804	*	100.27	*	100	*	100.27	*	101.98	*	102.25	*	102.08	*	99.57
*	41	7805	*	100.27	*	100	*	100.27	*	104.72	*	105	*	105.29	*	106.01
*	42	7806	*	100.27	*	100	*	100.27	*	104.23	*	104.51	*	104.55	*	104.43
*	43	7807	*	100.27	*	100	*	100.27	*	95.74	*	95.998	*	96.06	*	96.34
*	44	7808	*	100.27	*	100	*	100.27	*	65.94	*	66.111	*	65.86	*	65.24
*	45	7809	*	100.27	*	100	*	100.27	*	102.93	*	103.21	*	103.27	*	103.08
*	46	7810	*	100.27	*	100	*	100.27	*	108.09	*	108.38	*	108.31	*	107.58
*	47	7811	*	100.27	*	100	*	100.27	*	107.63	*	107.92	*	108.07	*	108.17
*	48	7812	*	100.27	*	100	*	100.27	*	101.26	*	101.53	*	101.36	*	100.28
*	49	7901	*	100.27	*	100	*	100.27	*	98.59	*	98.852	*	99.08	*	100.51
*	50	7902	*	100.27	*	100	*	100.27	*	99.82	*	100.09	*	99.90	*	99.91
*	51	7903	*	100.27	*	100	*	100.27	*	107.21	*	107.49	*	107.62	*	107.12
*	52	7904	*	97.11	*	100	*	97.11	*	102.82	*	99.85	*	99.83	*	99.78
*	53	7905	*	100.27	*	100	*	100.27	*	105.60	*	105.88	*	106.03	*	107.24
*	54	7906	*	100.27	*	100	*	100.27	*	101.95	*	102.22	*	102.26	*	102.69
*	55	7907	*	100.27	*	100	*	100.27	*	97.07	*	97.329	*	97.26	*	98.46
*	56	7908	*	100.27	*	100	*	100.27	*	66.12	*	66.301	*	65.96	*	63.87
*	57	7909	*	100.27	*	100	*	100.27	*	102.05	*	102.32	*	102.24	*	101.62
*	58	7910	*	100.27	*	100	*	100.27	*	108.03	*	108.32	*	108.46	*	108.68
*	59	7911	*	100.27	*	100	*	100.27	*	109.28	*	109.57	*	109.64	*	109.14
*	60	7912	*	100.27	*	100	*	100.27	*	100.99	*	101.26	*	101.31	*	99.83

Table 10 (cont.)

* OBS. NUM.	* PH12	* PW	* P12W	* PXW	* PFW	* PF	* PFX11
* AND DATE	*	*	*	*	*	*	*
* 61 8001 *	100.27 *	100.32 *	100.59 *	99.47 *	100.05 *	100.22 *	101.61 *
* 62 8002 *	100.27 *	100.47 *	100.73 *	103.67 *	104.43 *	104.43 *	103.80 *
* 63 8003 *	99.20 *	100.61 *	99.81 *	105.38 *	105.18 *	105.53 *	104.52 *
* 64 8004 *	98.15 *	100.76 *	98.90 *	101.81 *	100.69 *	100.83 *	100.62 *
* 65 8005 *	100.27 *	100.91 *	101.18 *	105.49 *	106.73 *	107.16 *	106.54 *
* 66 8006 *	100.27 *	101.06 *	101.33 *	102.54 *	103.7 *	104.17 *	102.35 *
* 67 8007 *	100.27 *	104.94 *	105.22 *	97.98 *	103.09 *	104.04 *	101.72 *
* 68 8008 *	100.27 *	91.64 *	91.88 *	65.08 *	59.796 *	58.15 *	61.01 *
* 69 8009 *	100.27 *	99.728 *	99.99 *	103.66 *	103.65 *	103.76 *	103.72 *
* 70 8010 *	100.27 *	99.876 *	100.14 *	109.69 *	109.85 *	109.79 *	109.98 *
* 71 8011 *	100.27 *	100.02 *	100.29 *	106.21 *	106.52 *	106.40 *	105.94 *
* 72 8012 *	100.27 *	100.17 *	100.44 *	101.51 *	101.96 *	102.17 *	101.56 *
* 73 8101 *	100.27 *	100.4 *	100.67 *	99.37 *	100.04 *	100.19 *	100.75 *
* 74 8102 *	100.27 *	100.6 *	100.86 *	99.58 *	100.44 *	100.39 *	99.96 *
* 75 8103 *	100.27 *	100.79 *	101.06 *	106.58 *	107.7 *	107.81 *	105.62 *
* 76 8104 *	97.11 *	100.98 *	98.06 *	102.89 *	100.89 *	101.01 *	101.40 *
* 77 8105 *	100.27 *	101.17 *	101.44 *	103.68 *	105.18 *	105.01 *	104.25 *
* 78 8106 *	100.27 *	101.36 *	101.63 *	102.92 *	104.6 *	104.66 *	103.86 *
* 79 8107 *	100.27 *	106.36 *	106.64 *	98.45 *	104.98 *	104.62 *	102.74 *
* 80 8108 *	100.27 *	89.451 *	89.69 *	65.31 *	58.578 *	58.48 *	59.95 *
* 81 8109 *	100.27 *	99.645 *	99.91 *	102.31 *	102.22 *	102.28 *	103.32 *
* 82 8110 *	100.27 *	99.835 *	100.10 *	109.77 *	109.88 *	109.76 *	109.63 *
* 83 8111 *	100.27 *	100.02 *	100.29 *	107.75 *	108.06 *	108.12 *	106.92 *
* 84 8112 *	100.27 *	100.21 *	100.48 *	102.09 *	102.58 *	102.58 *	102.41 *
* 85 8201 *	100.27 *	100.4 *	100.67 *	97.64 *	98.298 *	98.20 *	98.24 *
* 86 8202 *	100.27 *	100.6 *	100.86 *	99.60 *	100.46 *	100.49 *	100.11 *
* 87 8203 *	100.27 *	100.79 *	101.06 *	106.33 *	107.46 *	107.90 *	106.65 *
* 88 8204 *	97.11 *	100.98 *	98.06 *	104.12 *	102.1 *	102.17 *	101.93 *
* 89 8205 *	100.27 *	101.17 *	101.44 *	103.50 *	104.99 *	104.98 *	104.13 *
* 90 8206 *	100.27 *	101.36 *	101.63 *	101.70 *	103.36 *	103.26 *	103.57 *
* 91 8207 *	100.27 *	106.36 *	106.64 *	98.33 *	104.84 *	104.45 *	102.93 *
* 92 8208 *	100.27 *	89.451 *	89.69 *	66.22 *	59.392 *	59.28 *	59.91 *
* 93 8209 *	100.27 *	99.645 *	99.91 *	103.34 *	103.24 *	103.42 *	103.97 *
* 94 8210 *	100.27 *	99.835 *	100.10 *	108.23 *	108.34 *	107.90 *	107.43 *
* 95 8211 *	100.27 *	100.02 *	100.29 *	108.12 *	108.43 *	108.59 *	108.30 *
* 96 8212 *	100.27 *	100.21 *	100.48 *	102.28 *	102.77 *	102.82 *	102.32 *
* 97 8301 *	100.27 *	100.4 *	100.67 *	97.51 *	98.164 *	98.27 *	97.85 *
* 98 8302 *	100.27 *	100.6 *	100.86 *	99.69 *	100.55 *	100.64 *	100.31 *
* 99 8303 *	98.41 *	100.79 *	99.19 *	107.37 *	106.5 *	106.82 *	107.89 *
* 100 8304 *	98.94 *	100.98 *	99.91 *	101.89 *	101.79 *	101.88 *	100.17 *
* 101 8305 *	100.27 *	101.17 *	101.44 *	104.45 *	105.96 *	105.75 *	105.18 *
* 102 8306 *	100.27 *	101.36 *	101.63 *	102.85 *	104.53 *	104.58 *	104.37 *
* 103 8307 *	100.27 *	106.36 *	106.64 *	96.81 *	103.24 *	102.61 *	100.98 *
* 104 8308 *	100.27 *	89.451 *	89.69 *	66.07 *	59.255 *	59.34 *	60.05 *
* 105 8309 *	100.27 *	99.645 *	99.91 *	104.52 *	104.42 *	104.48 *	104.38 *
* 106 8310 *	100.27 *	99.835 *	100.10 *	108.19 *	108.3 *	108.06 *	107.31 *
* 107 8311 *	100.27 *	100.02 *	100.29 *	106.90 *	107.22 *	107.23 *	108.04 *
* 108 8312 *	100.27 *	100.21 *	100.48 *	101.99 *	102.48 *	102.49 *	101.85 *

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39'7% of the current annual mean, compared with the 33'8% registered as average in previous years^(*). In 1981 the downfall in August was of 41'3% and this is captured in the PFW factor by an additional decrease in that month. The PFXll keeps decreasing but at a similar rate than before. On the other hand PF shows a slight increase that seems incorrect.

As a conclusion we can say that intervention analysis in ARIMA models can be very useful to estimate sudden seasonal changes in the series. From the intervention results we can compute the corresponding seasonal deterministic factors and with them adjust the series for that component. This modified series can then fully seasonally adjusted using standard methods. With the series under study in this paper we have that the direct application of X-11 capture too slowly the summer seasonal changes observed in the eighties and as a consequence the adjusted values for 1979 and 1981 seem biased. The use of the mixed procedure developed in the paper can be proposed as preferable but it must be applied using an intervention analysis that takes two years to complete the recent seasonal change.

(*) The downfalls in August respect with the corresponding annual averages are: 1975(32.5), 76(32.6), 77(35.01), 78(34.8), 79(34.1), 80(39.7), 81(41.3) and 82(41.6).

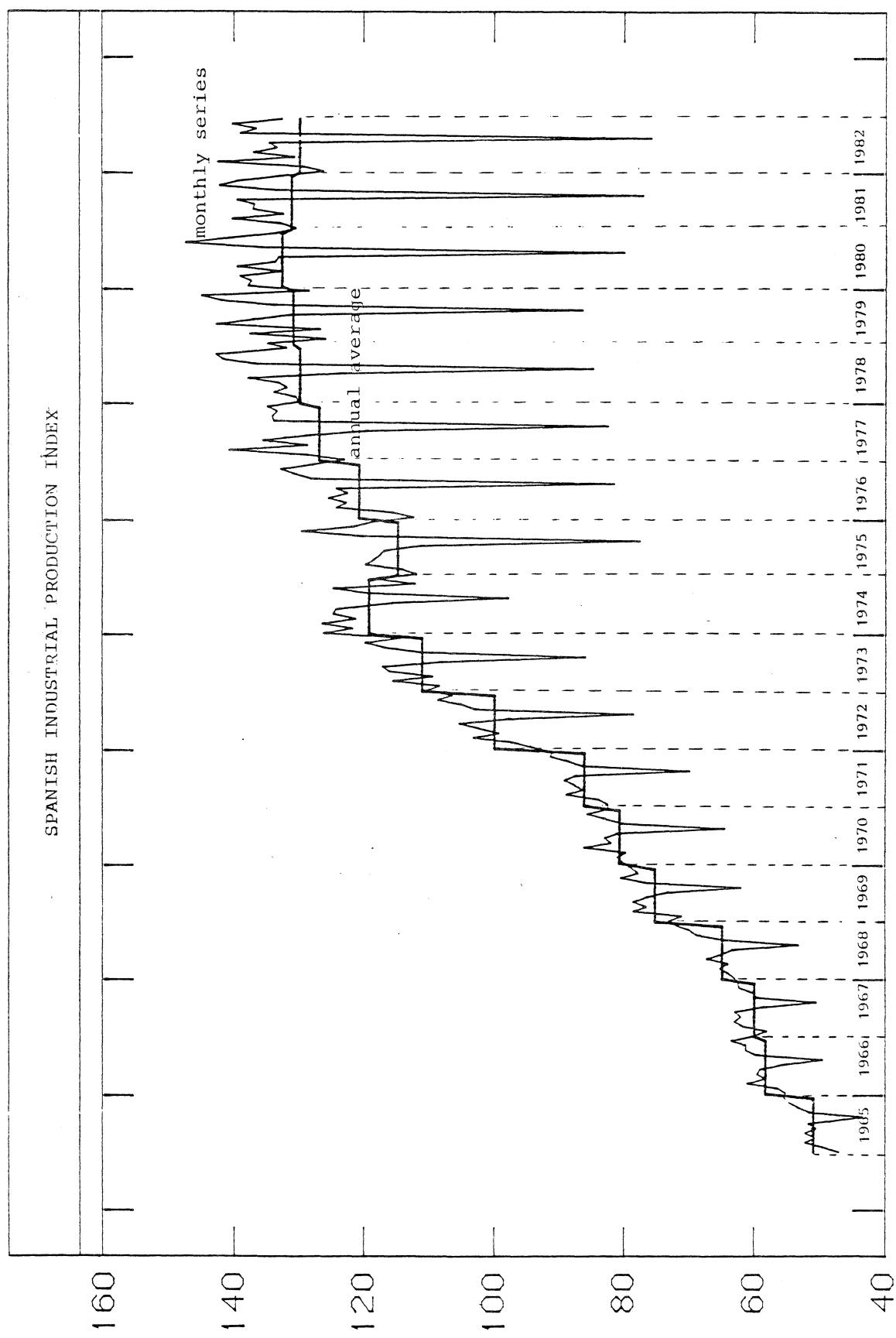
REFERENCES

- Cleveland, W. y G.C. Tiao, 1976, "Decomposition of Seasonal Time Series: a model for the Census X-11 program", Journal of the American Statistical Association 71, pp. 581-87.
- Espasa, A., 1982, "Trends in macroeconomic variables: an study of the Spanish GDP", unpublisn work.
- Hillmer, S.C., W.R. Bell and G.C. Tiao, 1981, "Modeling considerations in the seasonal adjustment of Economic Time Series" paper presented at the ASA-CENSUS-NBER Conference on Applied Time Series Analysis of Economic Data, Washington.
- Pierce, D.A., 1978, "Seasonal Adjustment when both deterministic and stochastic seasonality are present", in the volume A. Zellner (editor), Seasonal Analysis of Economic Time Series, Bureau of the Census.

APPENDIX 1

SPANISH INDUSTRIAL PRODUCTION INDEX

* DATE	* JAN	* FEB	* MAR	* APR	* MAY	* JUN	* JUL	* AUG	* SEP	* OCT	* NOV	* DEC	* ANNUAL
													* MEANS-RANGES
VALUES OF THE SERIES													
* 1965 *	46.8 *	49.3 *	51.9 *	50.5 *	52.1 *	50.3 *	51.5 *	43.2 *	51.4 *	52.9 *	54.6 *	55.2 *	* 50.8 12.0 *
* 1966 *	55.0 *	56.1 *	61.0 *	58.2 *	59.5 *	58.9 *	55.4 *	49.2 *	59.6 *	61.2 *	61.2 *	63.5 *	* 58.2 14.3 *
* 1967 *	60.0 *	57.9 *	61.6 *	62.8 *	61.9 *	62.9 *	58.0 *	50.3 *	59.4 *	60.2 *	62.2 *	62.3 *	* 60.0 12.6 *
* 1968 *	62.8 *	63.9 *	65.0 *	63.8 *	67.1 *	64.9 *	63.2 *	53.1 *	64.6 *	68.9 *	69.8 *	71.9 *	* 64.9 18.8 *
* 1969 *	72.9 *	71.1 *	78.5 *	76.5 *	78.4 *	76.6 *	73.2 *	61.9 *	76.6 *	80.5 *	77.6 *	78.6 *	* 75.2 18.6 *
* 1970 *	80.2 *	80.9 *	79.8 *	86.0 *	81.9 *	83.0 *	80.9 *	64.4 *	80.1 *	83.0 *	85.6 *	82.3 *	* 80.7 21.6 *
* 1971 *	82.4 *	83.8 *	88.9 *	86.3 *	87.5 *	89.0 *	87.3 *	69.7 *	86.4 *	88.5 *	91.4 *	91.0 *	* 86.0 21.7 *
* 1972 *	94.3 *	97.0 *	103.1 *	99.1 *	102.3 *	105.4 *	97.7 *	78.5 *	102.8 *	104.8 *	108.7 *	106.4 *	* 100.0 30.2 *
* 1973 *	110.3 *	108.4 *	115.4 *	109.4 *	115.9 *	117.1 *	108.1 *	85.9 *	111.3 *	116.7 *	119.6 *	114.2 *	* 111.0 33.7 *
* 1974 *	126.1 *	121.8 *	126.3 *	121.2 *	124.7 *	124.2 *	115.4 *	97.7 *	119.1 *	124.7 *	112.1 *	118.4 *	* 119.3 28.6 *
* 1975 *	111.8 *	114.1 *	119.8 *	118.4 *	117.4 *	116.7 *	111.2 *	77.5 *	120.1 *	129.5 *	121.6 *	110.8 *	* 114.7 52.0 *
* 1976 *	112.2 *	115.4 *	124.2 *	122.7 *	125.3 *	122.5 *	124.1 *	81.3 *	128.1 *	130.6 *	132.9 *	127.3 *	* 120.6 51.6 *
* 1977 *	123.0 *	128.8 *	140.8 *	128.5 *	135.6 *	128.9 *	119.5 *	82.5 *	133.9 *	134.0 *	133.2 *	134.7 *	* 126.9 58.3 *
* 1978 *	130.0 *	130.4 *	133.7 *	131.7 *	133.0 *	137.0 *	123.9 *	84.7 *	136.8 *	141.7 *	142.8 *	131.9 *	* 129.9 58.1 *
* 1979 *	134.8 *	125.9 *	137.6 *	126.6 *	142.6 *	136.9 *	131.0 *	86.3 *	133.7 *	142.0 *	144.8 *	128.3 *	* 130.9 58.5 *
* 1980 *	137.7 *	137.2 *	139.1 *	132.5 *	139.4 *	133.5 *	133.0 *	79.9 *	135.8 *	147.4 *	140.8 *	133.4 *	* 132.5 67.5 *
* 1981 *	130.4 *	132.7 *	140.2 *	132.3 *	136.9 *	136.8 *	139.5 *	77.0 *	133.5 *	142.3 *	139.4 *	132.9 *	* 131.2 65.3 *
* 1982 *	126.2 *	129.3 *	142.5 *	130.6 *	136.9 *	133.3 *	134.5 *	75.8 *	139.1 *	136.4 *	140.2 *	132.5 *	* 129.8 66.7 *
MONTHLY MEANS-RANGES													
* * * JAN	* * * FEB.	* * * MAR	* * * APR	* * * MAY	* * * JUN	* * * JUL	* * * AUG	* * * SEP	* * * OCT	* * * NOV	* * * DEC	* * * TOTAL	
* * * MEAN *	99.8 *	100.2 *	106.1 *	102.1 *	105.5 *	104.4 *	100.5 *	72.2 *	104.0 *	108.1 *	107.7 *	104.7 *	* * * MEAN-RANGE
* * * RANGE *	90.9 *	87.9 *	90.6 *	82.0 *	90.5 *	87.5 *	88.0 *	54.5 *	87.7 *	94.5 *	90.2 *	79.5 *	* * * 101.3
													* * * 104.2



APPENDIX 2

In this appendix we compare, graphically, different seasonal adjustment methods applied to the IPI series. These methods are: the mixed procedure proposed in this paper leading to the PFW seasonal factors, the X-11 method leading to the PFX11 factors and the X-11 method with PH1 prior adjustment factors for the Easter effect. We denote by PFX11H the global seasonal factors derived by the last procedure. All this factors are listed in table A2.1 and the corresponding adjusted IPI series are given in table A2.2.

In figure A2.1 we compare the seasonal adjusted series with PFW and PFX11H factors. In figures A2.2 and A2.3 we compare the three-term moving average of the adjusted series and in figures A2.4 to A2.7 we present T_1^1 and T_3^3 annual rates of growth^(*) of the different adjusted series.

(*)

$$T_{1t}^1 = \left[\begin{pmatrix} x_t \\ x_{t-1} \end{pmatrix}^{12} - 1 \right] \cdot 100; T_{3t}^3 = \left[\left(\frac{x_t + x_{t+1} + x_{t+2}}{x_{t-3} + x_{t-2} + x_{t-1}} \right)^4 - 1 \right] \cdot 100$$

TABLE A2.1

SPANISH INDUSTRIAL PRODUCTION INDEX (SEASONAL FACTORS)											
* OBS. NO.	* PF	* PFW	* PFX11	* PFX11H	**	* OBS. NO.	* PF	* PFW	* PFX11	* PFX11H	**
* AND DATE	*	*	*	*	**	* AND DATE	*	*	*	*	**
* 1 7501 *	98.798 *	98.741 *	99.541 *	99.419 **		61 8001 *	100.22 *	100.05 *	101.61 *	100.09 *	
* 2 7502 *	100.26 *	100.57 *	100.2 *	100.05 **		62 8002 *	104.43 *	104.43 *	103.8 *	103.86 *	
* 3 7503 *	104.09 *	104.11 *	105.3 *	103.7 **		63 8003 *	105.53 *	105.18 *	104.52 *	104.63 *	
* 4 7504 *	104.02 *	104 *	103.05 *	104.13 **		64 8004 *	100.83 *	100.69 *	100.62 *	100.12 *	
* 5 7505 *	105.61 *	105.53 *	105.97 *	106.15 **		65 8005 *	107.16 *	106.73 *	106.54 *	106.82 *	
* 6 7506 *	102.41 *	102.41 *	101.18 *	101.95 **		66 8006 *	104.17 *	103.9 *	102.33 *	103.09 *	
* 7 7507 *	96.965 *	96.884 *	97.675 *	97.552 **		67 8007 *	104.04 *	103.09 *	101.72 *	101.33 *	
* 8 7508 *	65.535 *	65.637 *	65.297 *	65.389 **		68 8008 *	58.15 *	59.796 *	61.015 *	61.169 *	
* 9 7509 *	104.41 *	104.37 *	104.25 *	103.95 **		69 8009 *	103.76 *	103.65 *	103.72 *	103.62 *	
* 10 7510 *	109.08 *	108.81 *	109.78 *	109.87 **		70 8010 *	109.79 *	109.85 *	109.98 *	110.25 *	
* 11 7511 *	104.74 *	104.87 *	104.23 *	104.48 **		71 8011 *	106.4 *	106.52 *	105.94 *	105.78 *	
* 12 7512 *	102.56 *	102.43 *	102.74 *	102.49 **		72 8012 *	102.17 *	101.96 *	101.56 *	101.72 *	
* 13 7601 *	98.797 *	98.755 *	99.355 *	99.027 **		73 8101 *	100.19 *	100.04 *	100.75 *	99.963 *	
* 14 7602 *	103.15 *	103.69 *	102.52 *	102.61 **		74 8102 *	100.39 *	100.44 *	99.955 *	99.865 *	
* 15 7603 *	107.82 *	107.7 *	107.1 *	107.86 **		75 8103 *	107.81 *	107.7 *	105.62 *	106.68 *	
* 16 7604 *	103.12 *	103.06 *	104.07 *	103.34 **		76 8104 *	101.01 *	100.89 *	101.4 *	100.83 *	
* 17 7605 *	103.97 *	103.89 *	103.49 *	103.95 **		77 8105 *	105.01 *	105.18 *	104.25 *	104.28 *	
* 18 7606 *	101.97 *	102.01 *	102.71 *	102.02 **		78 8106 *	104.66 *	104.6 *	103.86 *	103.73 *	
* 19 7607 *	97.192 *	97.073 *	97.279 *	97.713 **		79 8107 *	104.62 *	104.98 *	102.74 *	103.11 *	
* 20 7608 *	66.1028 *	66.099 *	65.621 *	65.612 **		80 8108 *	58.478 *	58.578 *	59.751 *	60.304 *	
* 21 7609 *	104.5 *	104.43 *	104.87 *	105.03 **		81 8109 *	102.28 *	102.22 *	103.32 *	102.56 *	
* 22 7610 *	106.85 *	106.9 *	106.73 *	106.62 **		82 8110 *	109.76 *	109.88 *	109.63 *	109.7 *	
* 23 7611 *	107.12 *	107.09 *	106.82 *	106.85 **		83 8111 *	108.12 *	108.06 *	106.92 *	107.56 *	
* 24 7612 *	103.69 *	103.59 *	103.57 *	104.14 **		84 8112 *	102.58 *	102.58 *	102.41 *	102.25 *	
* 25 7701 *	97.602 *	97.547 *	97.612 *	97.337 **		85 8201 *	98.204 *	98.298 *	98.237 *	97.514 *	
* 26 7702 *	100.05 *	100.35 *	99.917 *	99.889 **		86 8202 *	100.49 *	100.46 *	100.11 *	99.99 *	
* 27 7703 *	108.13 *	108.15 *	107.94 *	108.37 **		87 8203 *	107.9 *	107.46 *	106.65 *	107.63 *	
* 28 7704 *	100.41 *	100.36 *	101.64 *	100.48 **		88 8204 *	102.17 *	102.1 *	101.93 *	101.58 *	
* 29 7705 *	105.17 *	105.2 *	104.8 *	104.82 **		89 8205 *	104.98 *	104.99 *	104.13 *	104.4 *	
* 30 7706 *	103.46 *	103.33 *	103.78 *	104.08 **		90 8206 *	103.26 *	103.36 *	103.57 *	102.88 *	
* 31 7707 *	95.588 *	95.724 *	95.699 *	95.949 **		91 8207 *	104.45 *	104.86 *	102.93 *	103.15 *	
* 32 7708 *	65.643 *	65.654 *	65.552 *	65.413 **		92 8208 *	59.276 *	59.392 *	59.911 *	60.03 *	
* 33 7709 *	105.65 *	105.63 *	105.23 *	105.67 **		93 8209 *	103.42 *	103.24 *	103.97 *	104.19 *	
* 34 7710 *	107.12 *	106.98 *	106.44 *	106.8 **		94 8210 *	107.9 *	108.34 *	107.43 *	107.33 *	
* 35 7711 *	106.34 *	106.36 *	106.92 *	106.32 **		95 8211 *	108.59 *	108.43 *	108.3 *	108.12 *	
* 36 7712 *	103.28 *	103.21 *	102.72 *	103.29 **		96 8212 *	102.82 *	102.77 *	102.32 *	102.76 *	
* 37 7801 *	98.877 *	98.934 *	99.203 *	98.278 **		97 8301 *	98.268 *	98.164 *	97.846 *	97.597 *	
* 38 7802 *	99.965 *	100.22 *	99.892 *	99.872 **		98 8302 *	100.64 *	100.55 *	100.31 *	100.15 *	
* 39 7803 *	104.75 *	104.66 *	107.77 *	105.33 **		99 8303 *	106.82 *	106.5 *	107.89 *	106.77 *	
* 40 7804 *	102.08 *	102.25 *	99.567 *	101.81 **		100 8304 *	101.88 *	101.79 *	100.17 *	101.13 *	
* 41 7805 *	105.29 *	105 *	106.01 *	105.8 *		101 8305 *	105.75 *	105.96 *	105.18 *	104.94 *	
* 42 7806 *	104.45 *	104.51 *	104.43 *	104.92 **		102 8306 *	104.58 *	104.53 *	104.37 *	104.76 *	
* 43 7807 *	96.056 *	95.998 *	96.343 *	96.886 **		103 8307 *	102.61 *	103.24 *	100.98 *	101.07 *	
* 44 7808 *	65.361 *	66.111 *	65.241 *	65.039 **		104 8308 *	59.336 *	59.255 *	60.05 *	60.07 *	
* 45 7809 *	103.27 *	103.21 *	103.08 *	103.1 **		105 8309 *	104.48 *	104.42 *	104.38 *	104.32 *	
* 46 7810 *	108.31 *	108.38 *	107.58 *	107.52 **		106 8310 *	108.06 *	108.3 *	107.31 *	107.52 *	
* 47 7811 *	108.07 *	107.92 *	108.17 *	108.51 **		107 8311 *	107.23 *	107.22 *	108.04 *	107.28 *	
* 48 7812 *	101.36 *	101.53 *	100.28 *	100.83 **		108 8312 *	102.49 *	102.48 *	101.85 *	102 *	
* 49 7901 *	99.079 *	98.852 *	100.51 *	99.191 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 50 7902 *	99.899 *	100.09 *	99.911 *	99.858 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 51 7903 *	107.62 *	107.49 *	107.12 *	107.95 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 52 7904 *	99.828 *	99.85 *	99.779 *	99.588 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 53 7905 *	106.03 *	105.88 *	107.24 *	106.84 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 54 7906 *	102.26 *	102.22 *	102.69 *	102.68 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 55 7907 *	97.1257 *	97.329 *	98.462 *	98.55 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 56 7908 *	65.964 *	66.301 *	63.873 *	64.221 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 57 7909 *	102.24 *	102.32 *	101.62 *	101.72 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 58 7910 *	108.46 *	108.32 *	109.58 *	109.35 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 59 7911 *	109.64 *	109.57 *	109.14 *	109.58 **		* * * * *	* * * * *	* * * * *	* * * * *		
* 60 7912 *	101.31 *	101.26 *	99.63 *	100.71 **		* * * * *	* * * * *	* * * * *	* * * * *		

TABLE A2.2

SPANISH INDUSTRIAL PRODUCTION INDEX SEASONALLY ADJUSTED										
* FACTORS USED IN DE ADJUSTEMENT										
OBS. NO.	PF	PFW	PFX11	PFX11H						
AND DATE	*	*	*	*	*					
1	7501	*	113.16	*	113.23	*	112.32	*	112.45	*
2	7502	*	113.81	*	113.46	*	113.88	*	114.05	*
3	7503	*	115.09	*	115.07	*	113.77	*	115.53	*
4	7504	*	113.83	*	113.84	*	114.9	*	113.7	*
5	7505	*	111.17	*	111.25	*	110.79	*	110.6	*
6	7506	*	113.95	*	113.96	*	115.34	*	114.46	*
7	7507	*	114.68	*	114.78	*	113.85	*	113.99	*
8	7508	*	118.26	*	118.07	*	118.69	*	118.52	*
9	7509	*	115.03	*	115.07	*	115.21	*	115.54	*
10	7510	*	118.72	*	119.02	*	117.96	*	117.87	*
11	7511	*	116.1	*	115.95	*	116.66	*	116.39	*
12	7512	*	115.83	*	115.98	*	115.63	*	115.92	*
13	7601	*	113.57	*	113.61	*	112.93	*	113.37	*
14	7602	*	111.88	*	111.3	*	112.56	*	112.47	*
15	7603	*	115.19	*	115.32	*	115.96	*	115.15	*
16	7604	*	118.99	*	119.06	*	117.9	*	118.74	*
17	7605	*	120.52	*	120.61	*	121.08	*	120.54	*
18	7606	*	120.13	*	120.08	*	119.27	*	120.08	*
19	7607	*	127.69	*	127.84	*	127.57	*	127.01	*
20	7608	*	123.13	*	123	*	123.89	*	123.91	*
21	7609	*	122.58	*	122.66	*	122.15	*	121.97	*
22	7610	*	122.23	*	122.17	*	122.37	*	122.49	*
23	7611	*	123.96	*	124.1	*	124.42	*	124.38	*
24	7612	*	123.26	*	123.37	*	123.4	*	122.72	*
25	7701	*	126.02	*	126.09	*	126.01	*	126.36	*
26	7702	*	128.74	*	128.35	*	128.91	*	128.94	*
27	7703	*	130.21	*	130.19	*	130.44	*	129.93	*
28	7704	*	127.98	*	128.04	*	126.43	*	127.89	*
29	7705	*	128.93	*	128.89	*	129.39	*	129.36	*
30	7706	*	124.59	*	124.75	*	124.2	*	123.85	*
31	7707	*	125.02	*	124.84	*	124.87	*	124.54	*
32	7708	*	125.68	*	125.66	*	125.85	*	126.12	*
33	7709	*	126.74	*	126.77	*	127.25	*	126.71	*
34	7710	*	125.09	*	125.25	*	125.89	*	125.47	*
35	7711	*	125.26	*	125.24	*	124.58	*	125.29	*
36	7712	*	130.42	*	130.51	*	131.13	*	130.4	*
37	7801	*	131.48	*	131.4	*	131.04	*	132.28	*
38	7802	*	130.45	*	130.11	*	130.54	*	130.57	*
39	7803	*	127.64	*	127.75	*	124.06	*	126.88	*
40	7804	*	129.02	*	128.8	*	132.27	*	129.35	*
41	7805	*	126.31	*	126.67	*	125.46	*	125.71	*
42	7806	*	131.8	*	131.85	*	131.95	*	131.34	*
43	7807	*	128.99	*	129.07	*	128.6	*	127.88	*
44	7808	*	128.6	*	129.12	*	129.83	*	130.23	*
45	7809	*	132.47	*	132.55	*	132.72	*	132.69	*
46	7810	*	130.83	*	130.75	*	131.71	*	131.79	*
47	7811	*	132.13	*	132.32	*	132.01	*	131.6	*
48	7812	*	130.13	*	129.91	*	131.53	*	130.81	*
49	7901	*	136.05	*	136.37	*	134.12	*	135.9	*
50	7902	*	126.03	*	125.79	*	126.01	*	126.08	*
51	7903	*	127.86	*	128.01	*	128.45	*	127.47	*
52	7904	*	126.82	*	126.79	*	126.88	*	127.12	*
53	7905	*	134.49	*	134.68	*	132.98	*	133.48	*
54	7906	*	133.87	*	133.92	*	133.31	*	133.33	*
55	7907	*	134.7	*	134.59	*	133.05	*	132.93	*
56	7908	*	130.23	*	130.16	*	135.11	*	130.38	*
57	7909	*	130.77	*	130.67	*	131.57	*	131.44	*
58	7910	*	130.93	*	131.09	*	130.66	*	131.08	*
59	7911	*	132.07	*	132.15	*	132.67	*	132.14	*
60	7912	*	126.54	*	126.7	*	129.52	*	127.4	*

SPANISH INDUSTRIAL PRODUCTION INDEX SEASONALLY ADJUSTED										
* FACTORS USED IN DE ADJUSTEMENT										
OBS. NO.	PF	PFW	PFX11	PFX11H						
61	8001	*	137.39	*	137.63	*	135.52	*	137.58	*
62	8002	*	131.37	*	131.38	*	132.18	*	132.1	*
63	8003	*	131.82	*	132.25	*	133.09	*	132.95	*
64	8004	*	131.41	*	131.59	*	131.68	*	132.34	*
65	8005	*	130.09	*	130.61	*	130.85	*	130.51	*
66	8006	*	128.15	*	128.49	*	130.44	*	129.5	*
67	8007	*	127.83	*	129.01	*	130.76	*	131.26	*
68	8008	*	137.4	*	133.62	*	130.95	*	130.62	*
69	8009	*	130.88	*	131.01	*	130.93	*	131.06	*
70	8010	*	134.25	*	134.19	*	134.02	*	133.69	*
71	8011	*	132.33	*	132.18	*	132.91	*	133.11	*
72	8012	*	130.57	*	130.84	*	131.35	*	131.14	*
73	8101	*	130.15	*	130.34	*	129.43	*	130.45	*
74	8102	*	132.18	*	132.12	*	132.76	*	132.68	*
75	8103	*	130.04	*	130.17	*	132.74	*	131.42	*
76	8104	*	130.98	*	131.13	*	130.47	*	131.21	*
77	8105	*	130.37	*	130.16	*	131.32	*	131.29	*
78	8106	*	130.71	*	130.78	*	131.72	*	131.88	*
79	8107	*	133.34	*	132.88	*	135.78	*	135.29	*
80	8108	*	131.67	*	131.45	*	128.44	*	127.69	*
81	8109	*	130.53	*	130.6	*	129.21	*	130.17	*
82	8110	*	129.45	*	129.5	*	129.8	*	129.72	*
83	8111	*	128.93	*	129	*	130.38	*	129.6	*
84	8112	*	129.56	*	129.55	*	129.78	*	129.98	*
85	8201	*	128.51	*	128.39	*	129.46	*	129.42	*
86	8202	*	128.67	*	128.71	*	129.16	*	129.31	*
87	8203	*	132.07	*	132.61	*	133.61	*	132.4	*
88	8204	*	127.82	*	127.91	*	128.12	*	128.56	*
89	8205	*	130.41	*	130.39	*	131.48	*	131.13	*
90	8206	*	129.09	*	129.97	*	129.7	*	129.57	*
91	8207	*	128.77	*	128.27	*	130.67	*	130.39	*
92	8208	*	127.88	*	127.63	*	126.52	*	126.27	*
93	8209	*	134.5	*	134.73	*	133.79	*	133.51	*
94	8210	*	126.41	*	125.9	*	126.96	*	127.09	*
95	8211	*	129.11	*	129.3	*	129.45	*	129.67	*
96	8212	*	128.86	*	129.93	*	129.49	*	128.94	*
97	8301	*	129.73	*	129.97	*	130.29	*	130.62	*
98	8302	*	129.42	*	129.29	*	129.84	*	130.05	*
99	8303	*	127.99	*	128.31	*	126.72	*	128.05	*
100	8304	*	130.42	*	130.08	*	132.65	*	131.39	*
101	8305	*	127.07	*	127.44	*	127.76	*	128.06	*
102	8306	*	129.43	*	129.35	*	129.68	*	129.2	*
103	8307	*	128.08	*	128.21	*	130.14	*	130.03	*
104	8308	*	130.31	*	128.55	*	129.76	*	128.72	*
105	8309	*	127.99	*	127.75	*	129.11	*	127.57	*
106	8310	*	130.14	*	129.6	*	131.05	*	130.79	*
107	8311	*	128.19	*	127.84	*	127.22	*	128.12	*
108	8312	*	128.15	*	127.88	*	128.96	*	128.78	*

FIGURE A2.1

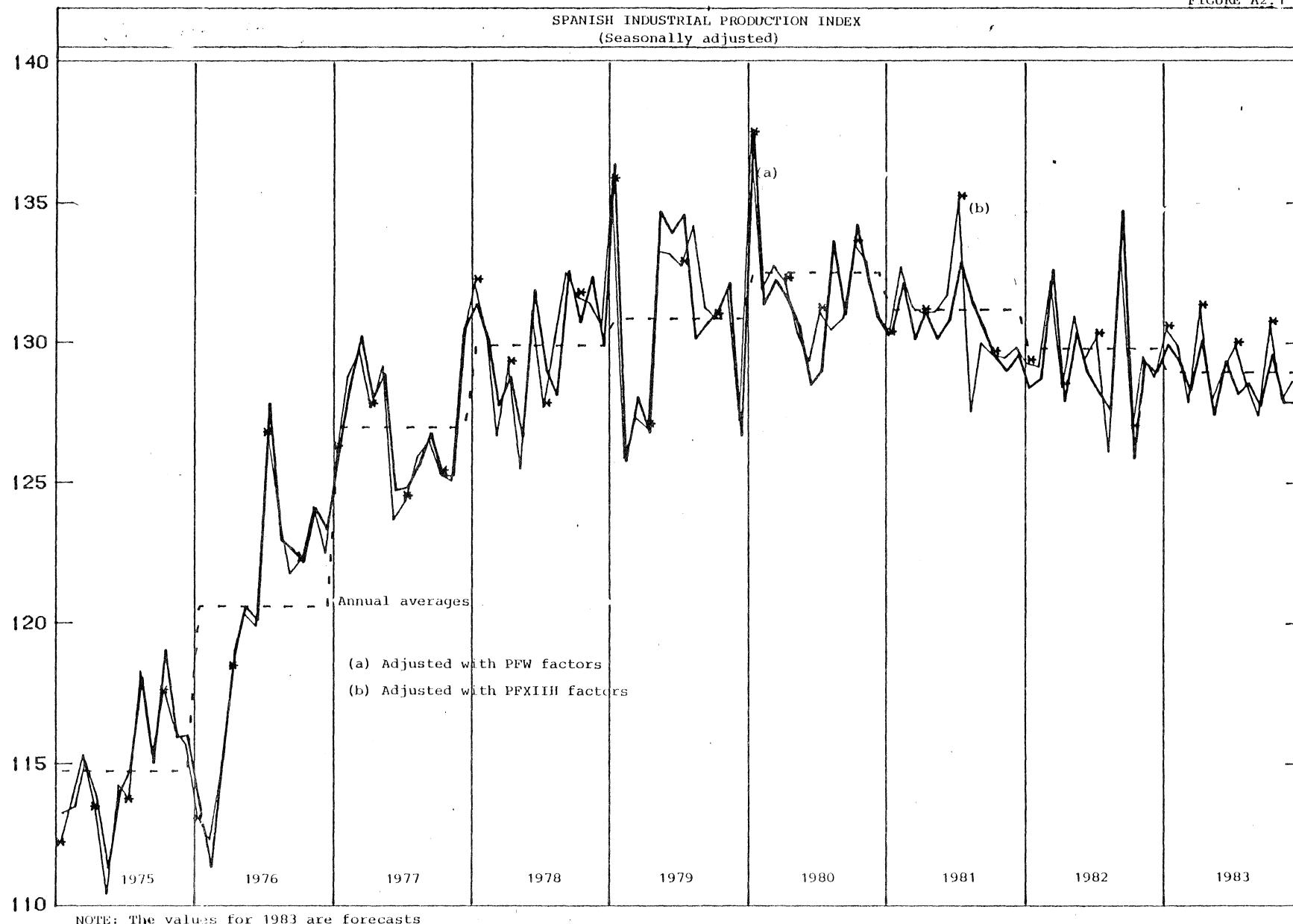
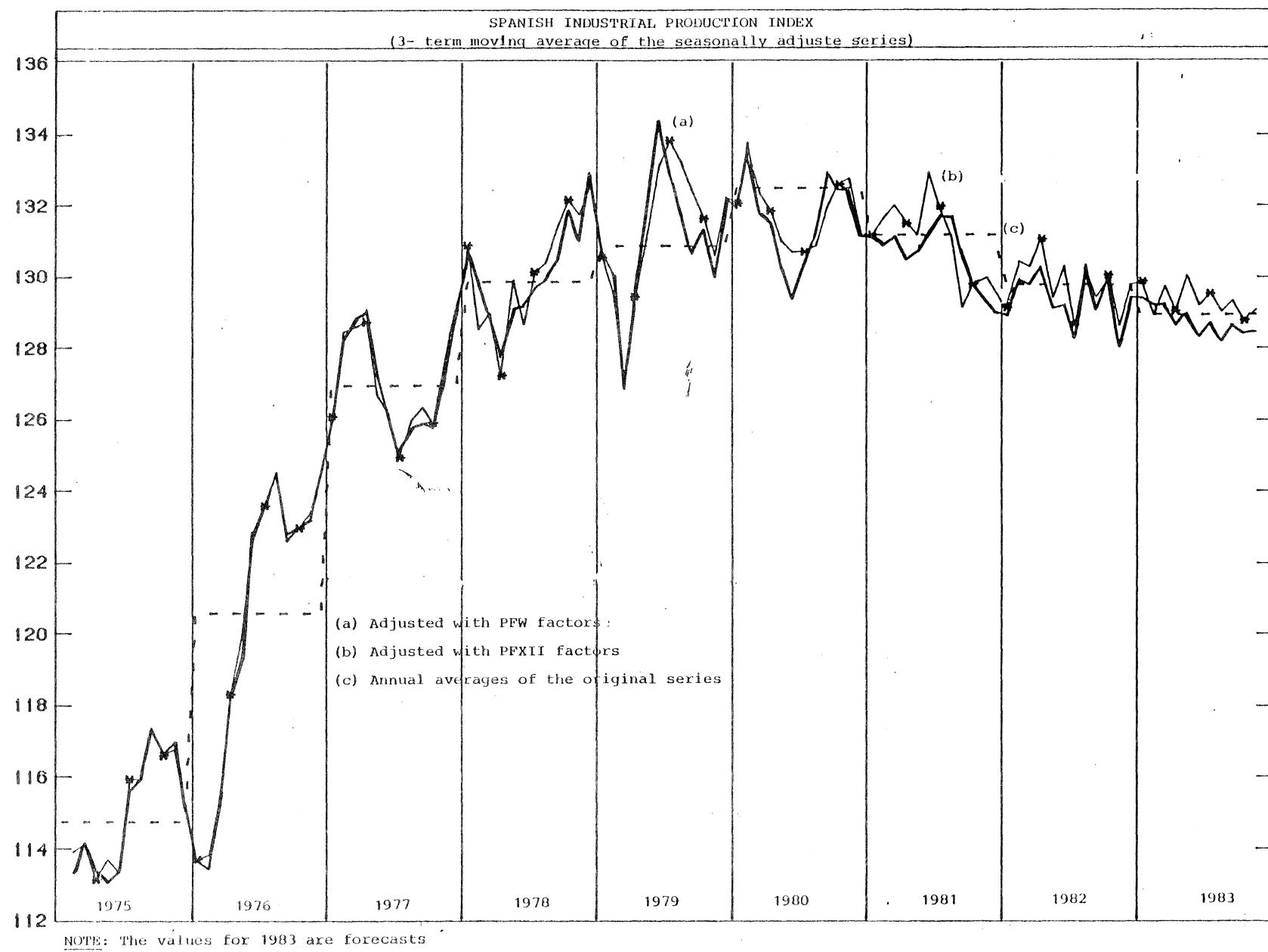


FIGURE A2.2



SPANISH INDUSTRIAL PRODUCTION INDEX
(3 term moving average of the seasonally adjusted series)

FIGURE A2.3

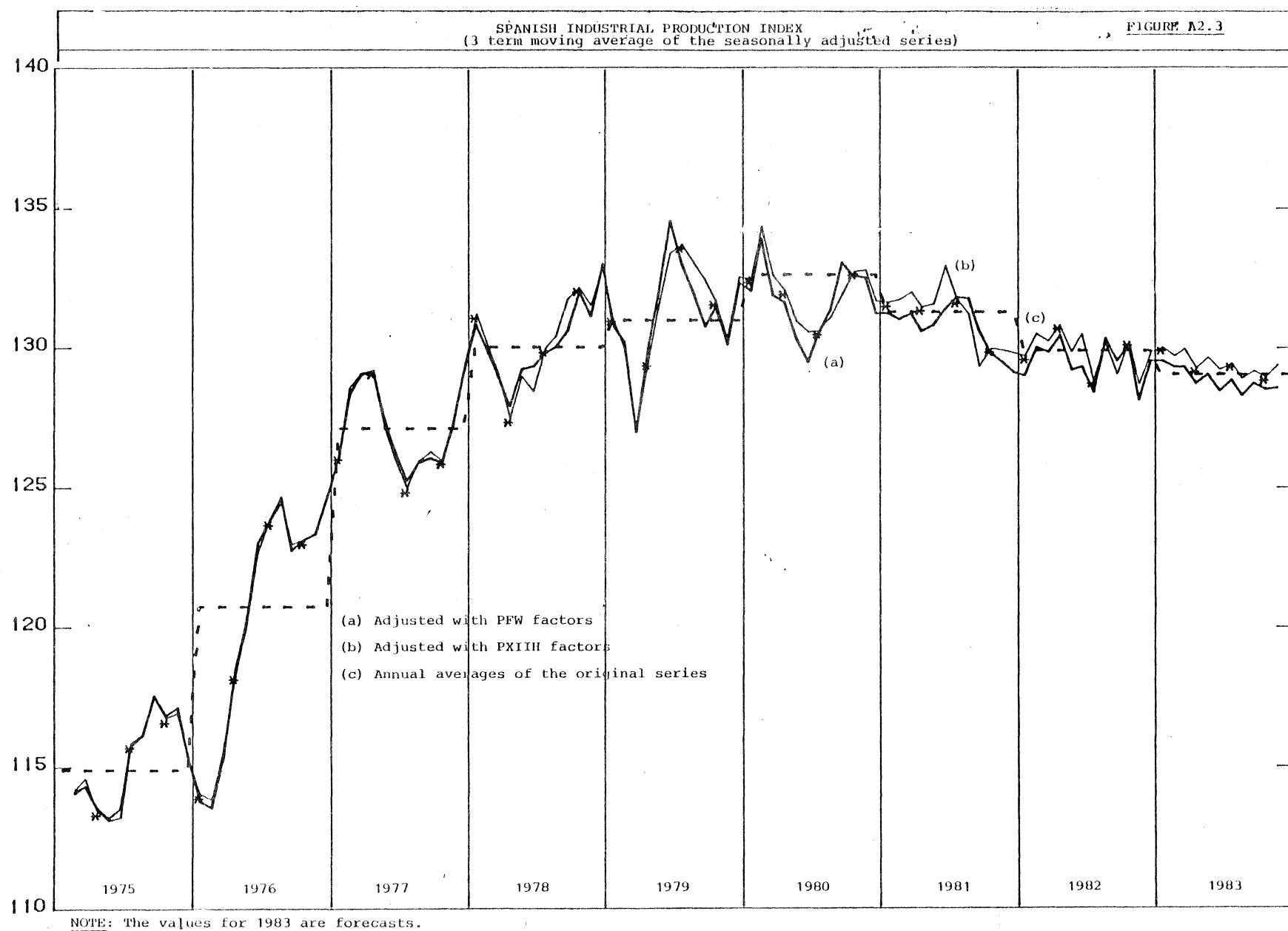
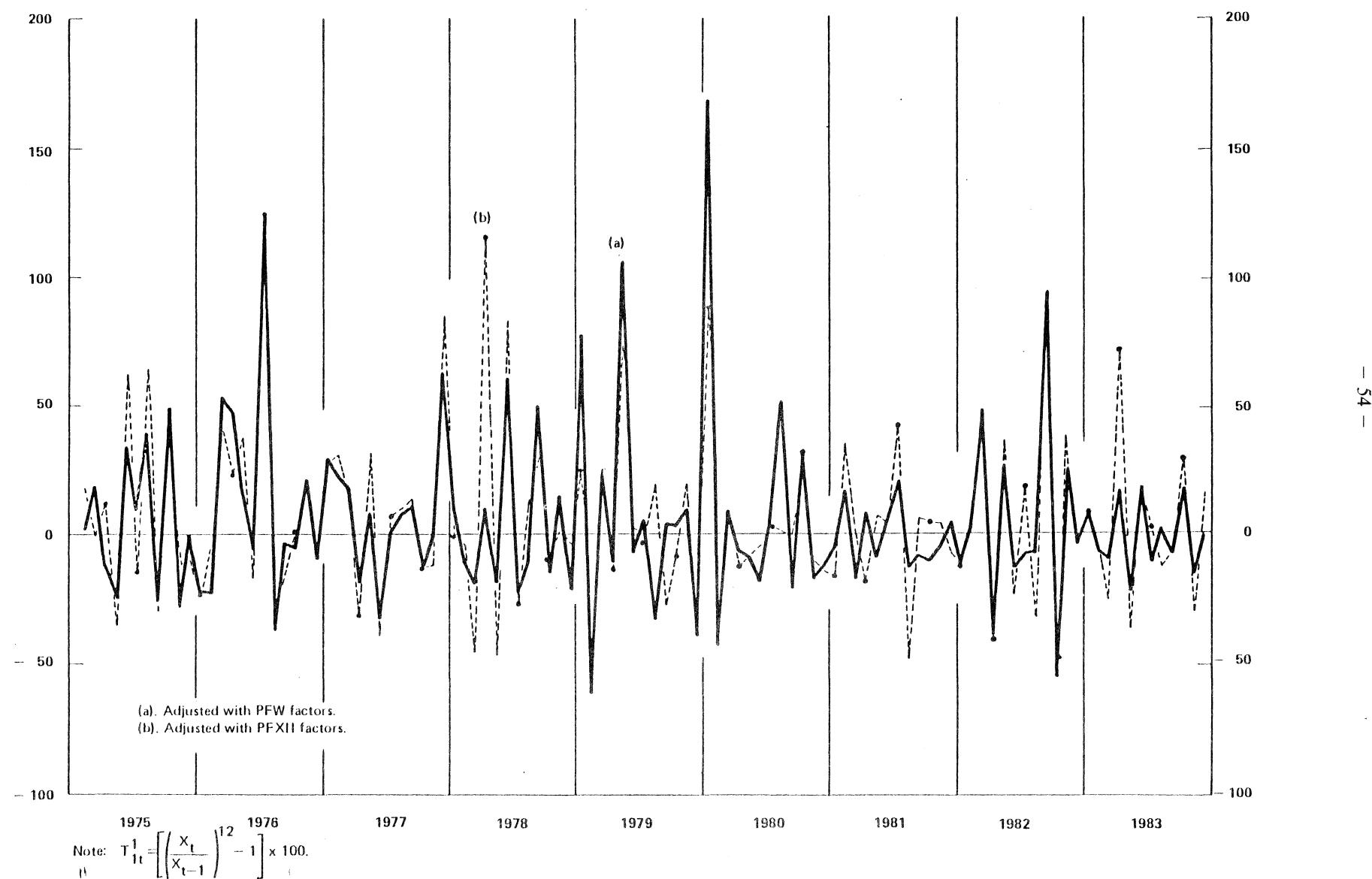


FIGURE A 2.4

SPANISH INDUSTRIAL PRODUCTION INDEX
(T_1^1 rates of the seasonally adjusted series)



SPANISH INDUSTRIAL PRODUCTION INDEX
(T_1^1 rates of the seasonally adjusted series)

FIGURE A 2.5

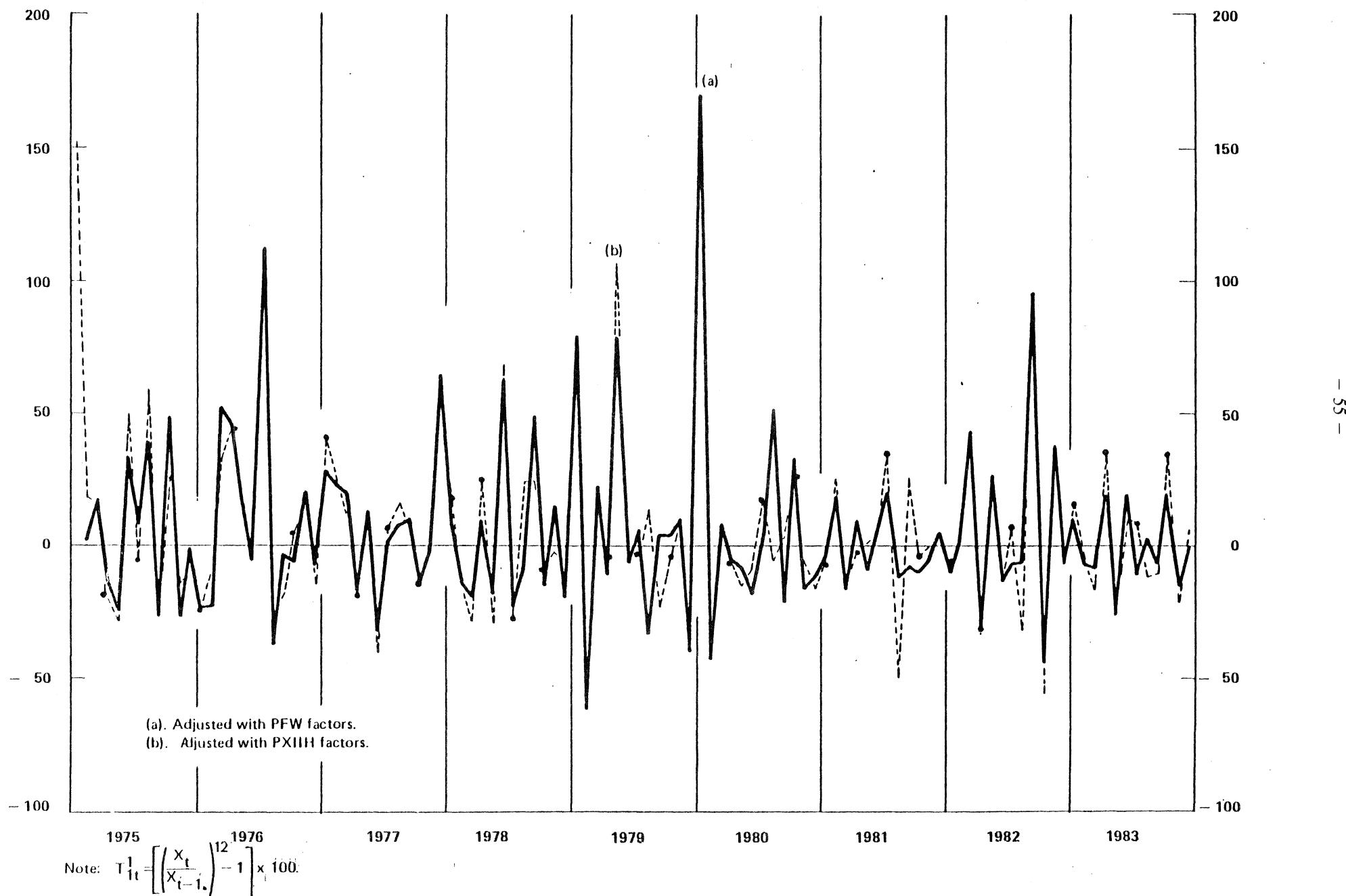
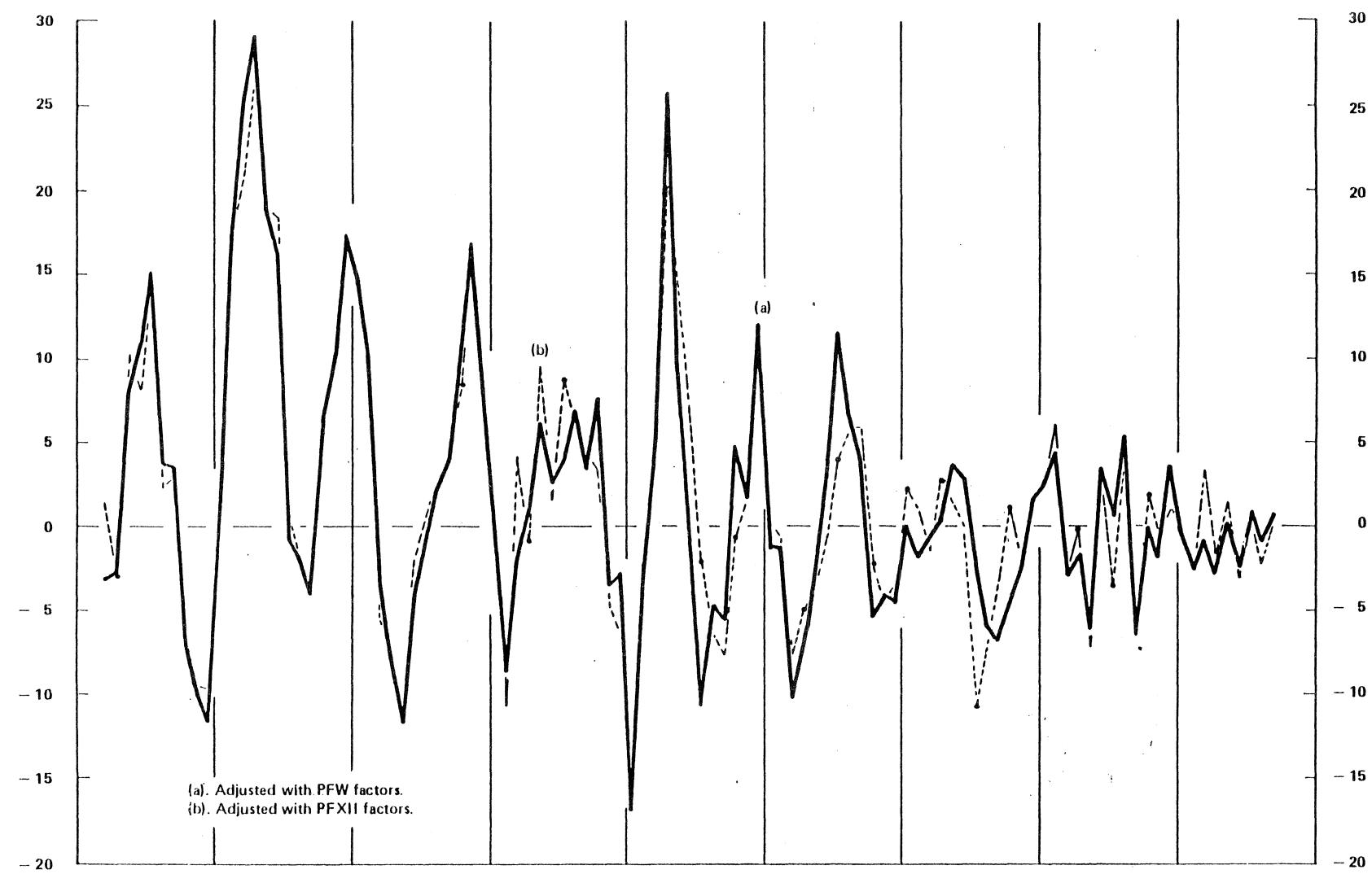


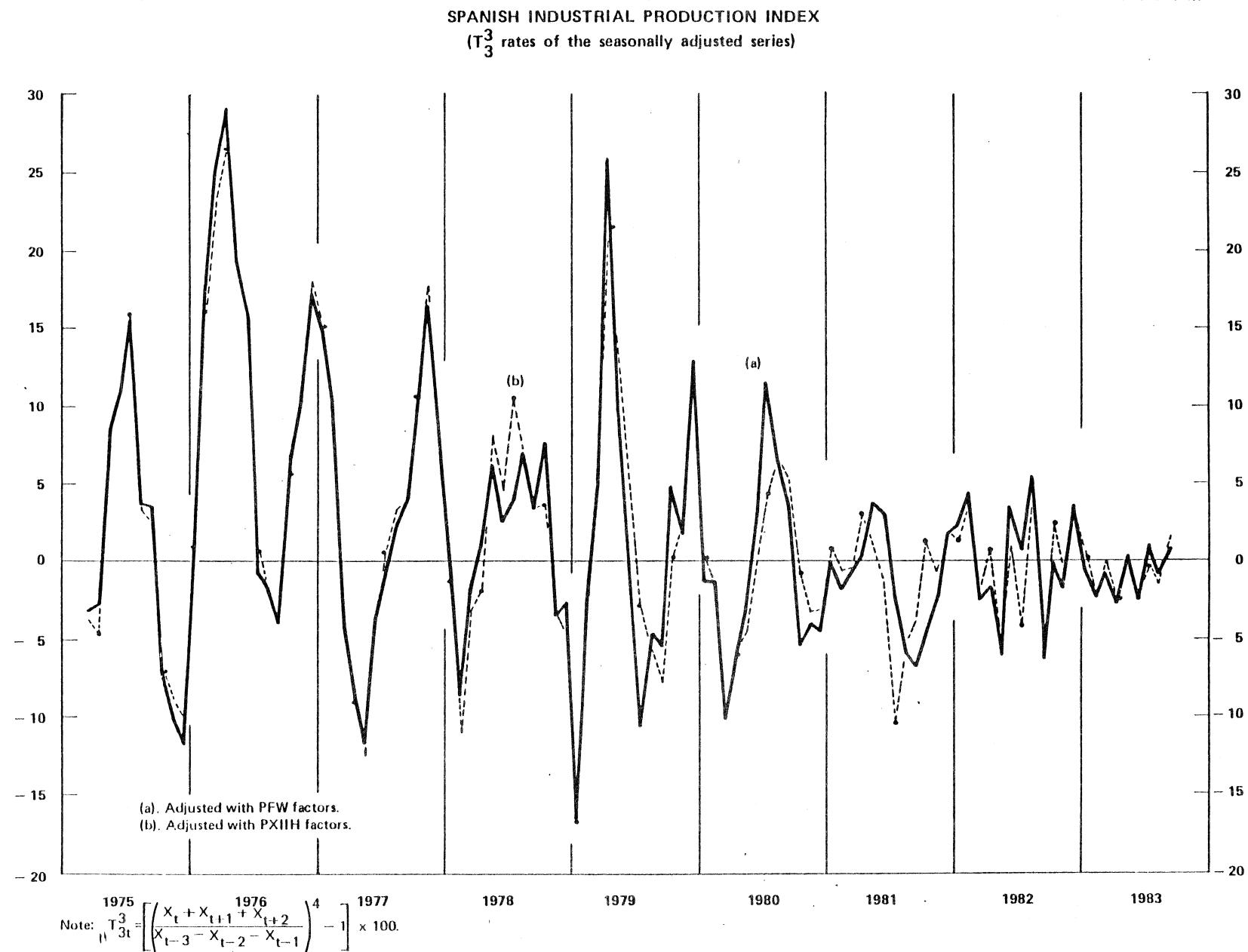
FIGURE A 2.6

SPANISH INDUSTRIAL PRODUCTION INDEX
(T_3^3 rates of the seasonally adjusted series)



Note: $T_3^3 t = \left[\frac{(X_t + X_{t+1} + X_{t+2}) - (X_{t-3} + X_{t-2} + X_{t-1})}{4} \right] - 1 \times 100.$

FIGURE A.2.7



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