AN ECONOMETRIC STUDY OF A MONTHLY INDICATOR OF ECONOMIC ACTIVITY

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I. Introduction

The economic indicator selected for this study refers to orders in Spanish industry and we denote it by CP. This is a qualitative indicator, computed as the difference between the percentage of responses which indicate that the level of orders are above "normal" and the percentage of responses saying that orders are below the "normal" level. The responses are collected in a montly survey conducted by the Spanish Ministery of Industry. The graph of the CP series and its first differences are given in figure 1.

Economic indicators are important for following the month to month evolution of an economy, mainly with reference to its trend and cyclical behaviour. For that purpose the methods used are mainly univariate time series. The results of this paper for the CP series indicate: a) the feasibility of constructing dynamic seasonally unadjusted monthly econometric models for these indicators; b) that these models are useful for the month to month study of the economy because with them we can point out the input variables responsable for the different upturns and downturns of such indicators, and c) that we get a better forecast with the econometric model than with univariate models.

In our strategy for constructing an econometric model for the CP series we start by carrying out a univariate time series analysis of it. This univariate study which is relatively simple to perform, is interesting because with it we obtain the simplest explanation of CP, an explanation only

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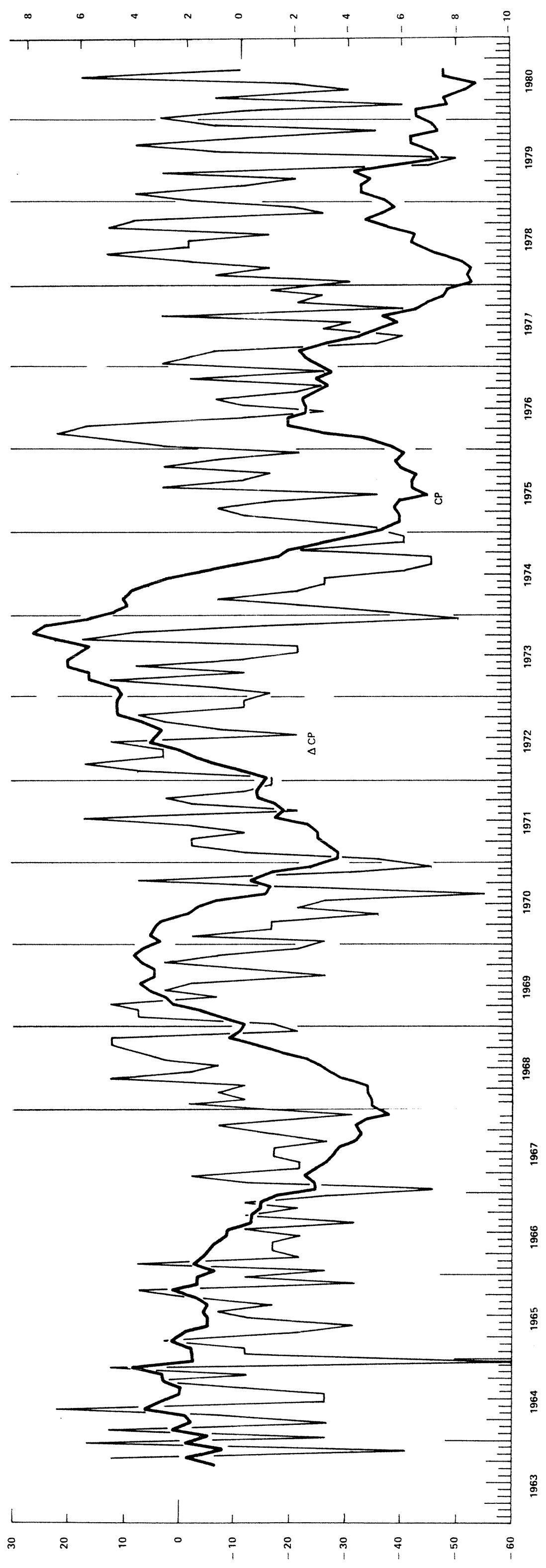
Figure 1.



CP follow the left hand scale.
ΔCP follow the right hand scale.

in terms of its own past, and therefore it will serve us as a bench mark that must be improved with models containing more information. With the univariate analysis we also learn the more relevant aspects of the series that we must take account of in the construction of an econometric model. These aspects are:

a) The series has not an underlying trend and only shows a fluctuating local level;

b) the seasonality of CP requires only stationary operators; and

c) its cyclical behaviour can be captured by moving average operators better than by autorregresive operators.

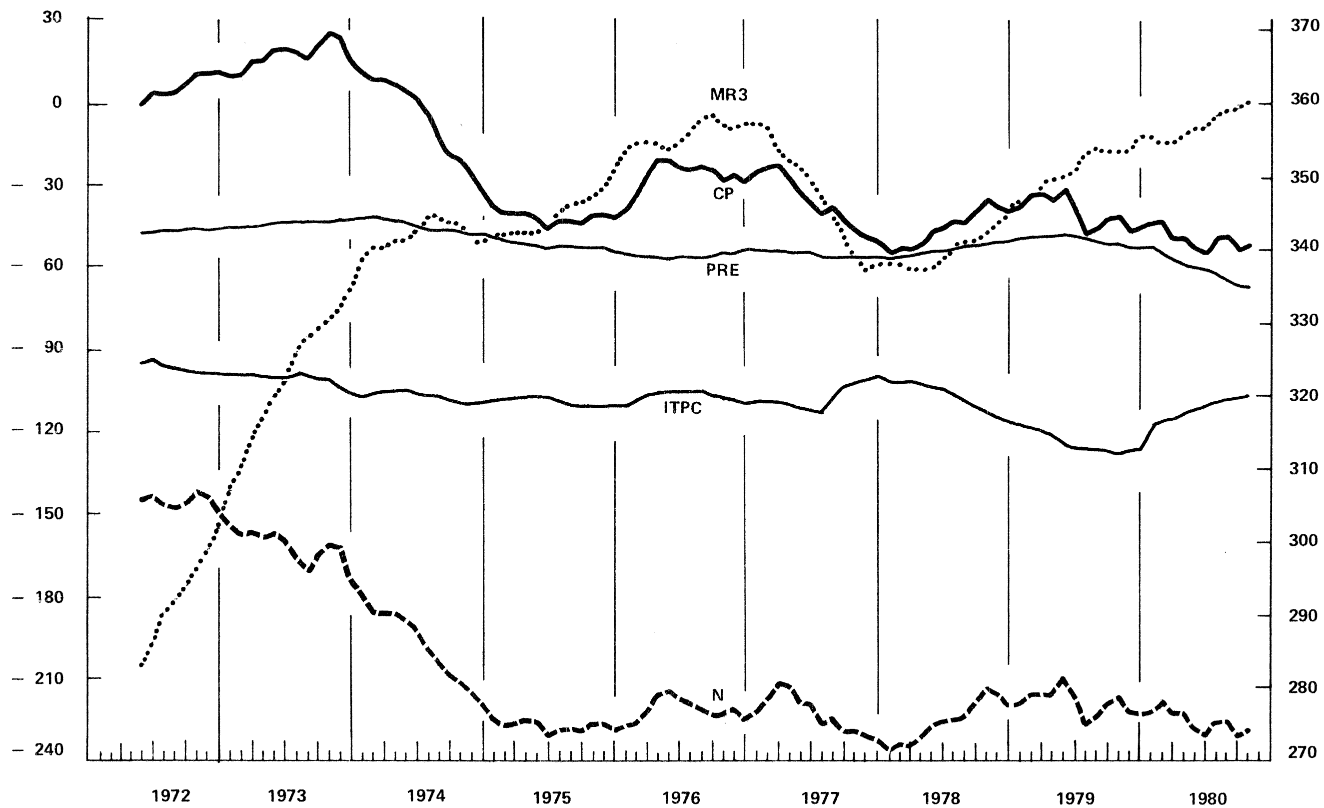
In the second part of the paper we explain orders in Spanish industry using an uniequational rational distributed lag model with the money supply (in real balances), MR3, the relative price for energy, PRE, and the real effective exchange rate of the peseta, ITPC, as inputs. We use this model to decompose the CP series in four parts each one capturing the contribution to CP of MR3, PRE, ITPC and a residual term, respectively. We denote these components of CP_t by $MR3_t^*$, PRE_t^*, $ITPC_t^*$ and N_t respectively.

This decomposition is useful to see how the different inputs have affected CP during the seventies. In fact, from inspection of figure 2, where we have represented CP and its four components, we can make the following points:

a) during 1972-74 the money supply experienced a high increase that in the orders series was not reflected until late in 1973 because of the negative tendency of the residual term during those years;

Figure 2.

DECOMPOSITION OF THE ECONOMETRIC MODEL OF CP.



The MR3* follows the right hand scale. The other series follow the left hand scale.

b) during 1975-77 the evolution of CP followed mainly the pattern of MR3;

c) the recovery of CP in 1978, due to the contribution of MR3, PRE and the residual term, was curbed by the fall in the contribution of the peseta's real effective exchange rate;

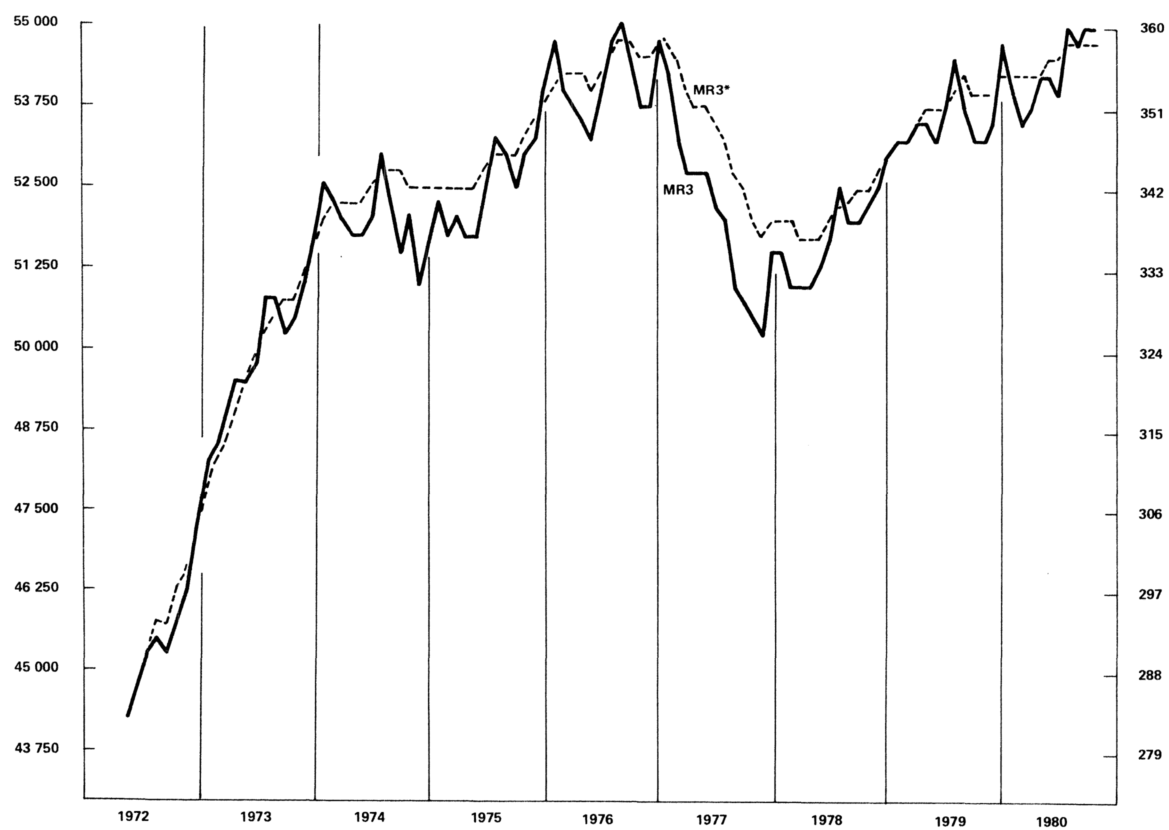
d) during 1979-80 orders followed a negative tendency in spite of the positive one in MR3. In 1979 the behaviour of CP was due to the contribution of ITPC but in 1980 it was the relative price of the energy which determined the decline in CP.

From the above mentioned decomposition of CP we can observe that the $MR3^*$ component shows a more stable behaviour than MR3, see figure 3, indicating, perhaps, that orders are sensitive to the medium and long run movements of the money supply but not to the short run deviation of MR3 from this path. If this is true it would indicate that the monetary authorities could deviate temporarily from their monetary objectives, in order to obtain smoother evolutions in the different markets, without influencing the level of economic activity. This is an important issue to be investigated in further studies. For instance we could try to decompose MR3 into permanent and transitory components and study their influence on CP.

For the variables PRE and ITPC we observe, see figures 4 and 5, that they suffered important interventions. These occured in PRE when the price of oil registered a big change and in ITPC when the exchange rate of the peseta moved abruptly. In both cases from the original variable we can extract the effect of the interventions, see Box and Tiao(1975), that we call $PRED_t$ and $ITPCD_t$. If now we define

FIGURE 3.

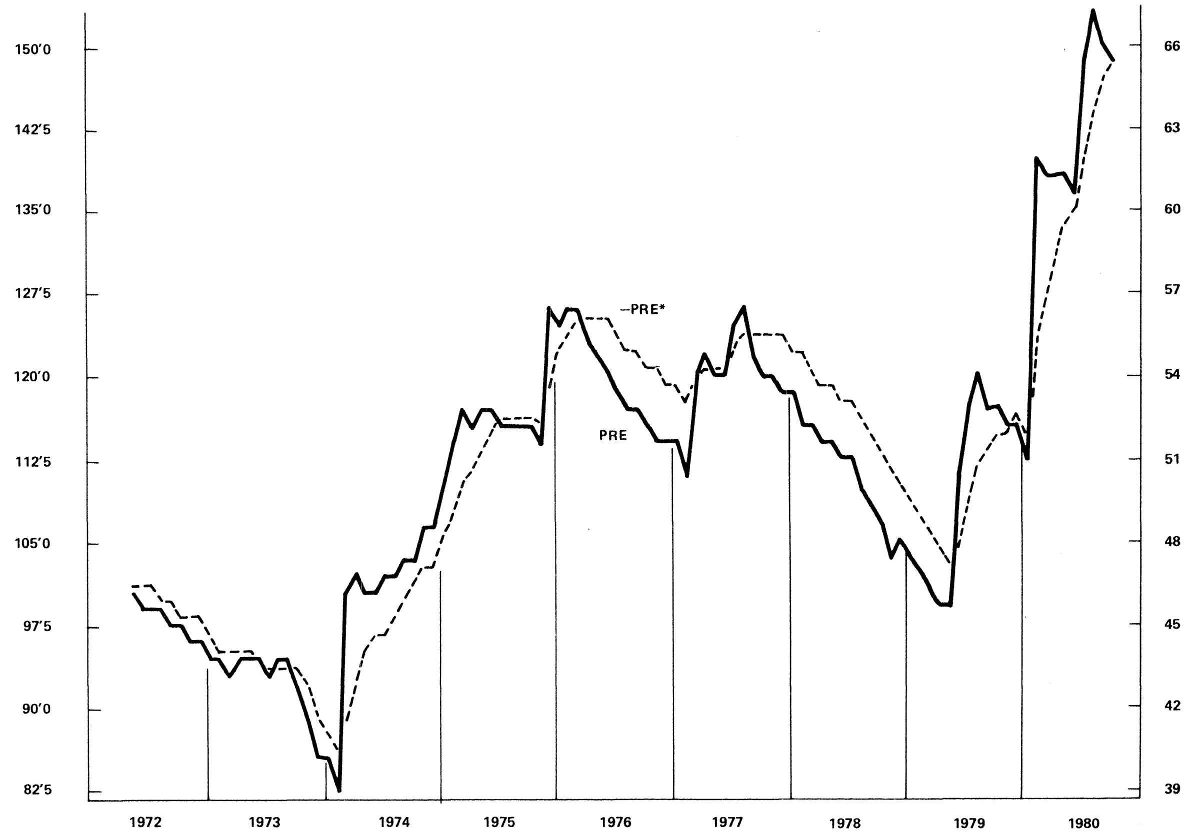
M R 3



The MR3 * series follows the right hand scale and MR3 the left hand scale.

FIGURE 4.

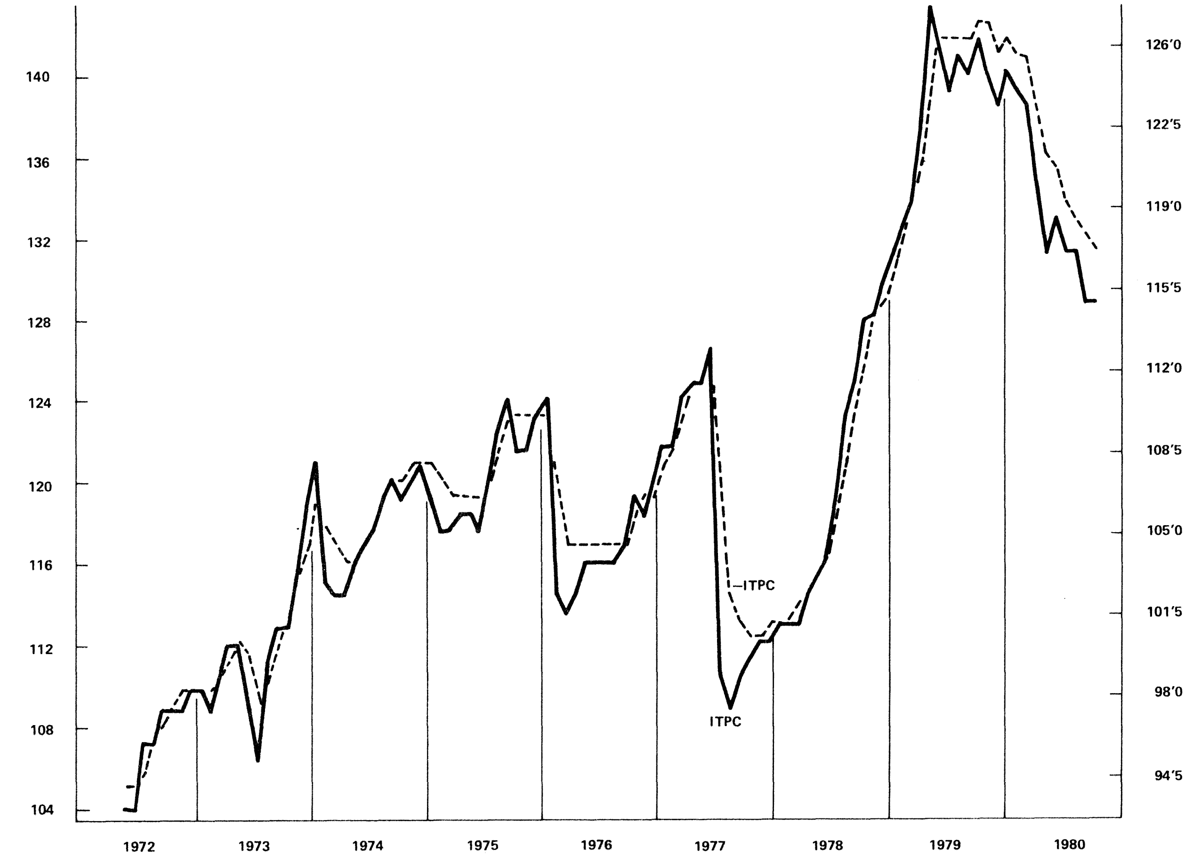
SERIES PRE AND (−1) PRE*



The series (−1) PRE* follows the right hand scale and PRE the left hand one.

FIGURE 5.

SERIES ITPC AND (−1) ITPC*



The series (−1) ITPC* follows the right hand scale and ITPC the left hand one.

$$PREN_t = PRE_t - PRED_t \qquad \text{and}$$

$$ITPCN_t = ITPC_t - ITPCD_t \quad ,$$

it seems to be another point of interest for future studies to test if in the model for CP we should use PRED, PREN, ITPCD and ITPCN as inputs instead of PRE and ITPC.

II. An univariate study of CP

From figure 1 and table 1 we see that the first differences of CP, that we denote by ΔCP, seems to be a stationary series. From its correlogram and partial correlogram, figure 6, we observe that a regular autorregresive operator at least of order three would be needed for the construction of an ARIMA model for CP. The seasonal component looks more complex and it seems advisable to consider AR o MA operators with lags 12, 24, 36 and 48, that we denote by AR(12,24,36,48) and MA(12,24,36,48). After experimenting with models with these sorts of operators we propose the following to explain the CP series(*):

$$\underset{(\pm 0.13)}{(1-0.67L}+\underset{(\pm 0.10)}{0.21L^2}-\underset{(\pm 0.08)}{0.26L^3})(1-L)CP_t=(1-\underset{(\pm 0.12)}{0.33L}+\underset{(\pm 0.08)}{0.20L^{11}}+\underset{(\pm 0.08)}{0.44L^{35}})a_t$$

σ = 2,8969

Box-Pierce (d.f.=55) = 47'4 .

The residuals of this model are in figure 7 and its correlogram in figure 8.

Using

$$(1-0.67L+0.21L^2-0.26L^3)=(1-0.81L)(1+0.14+0.33L^2)$$

the above ARIMA model can be approximated by

$$\Delta CP_t = 0.81\ \Delta CP_{t-1}+(1-0.47L-0.26L^2+0.19L^3+0.20L^{11}-0.06L^{13}+ +0.44L^{35}-0.06L^{36}-0.14L^{37})a_t$$

In figure 9 we illustrate how the univariate models are not useful to capture turning points. According to this a model with explanatory variables in it could be very helpful.

(*) In table 2 we have different ARIMA models for CP. The selected model is number 14.

Table 1

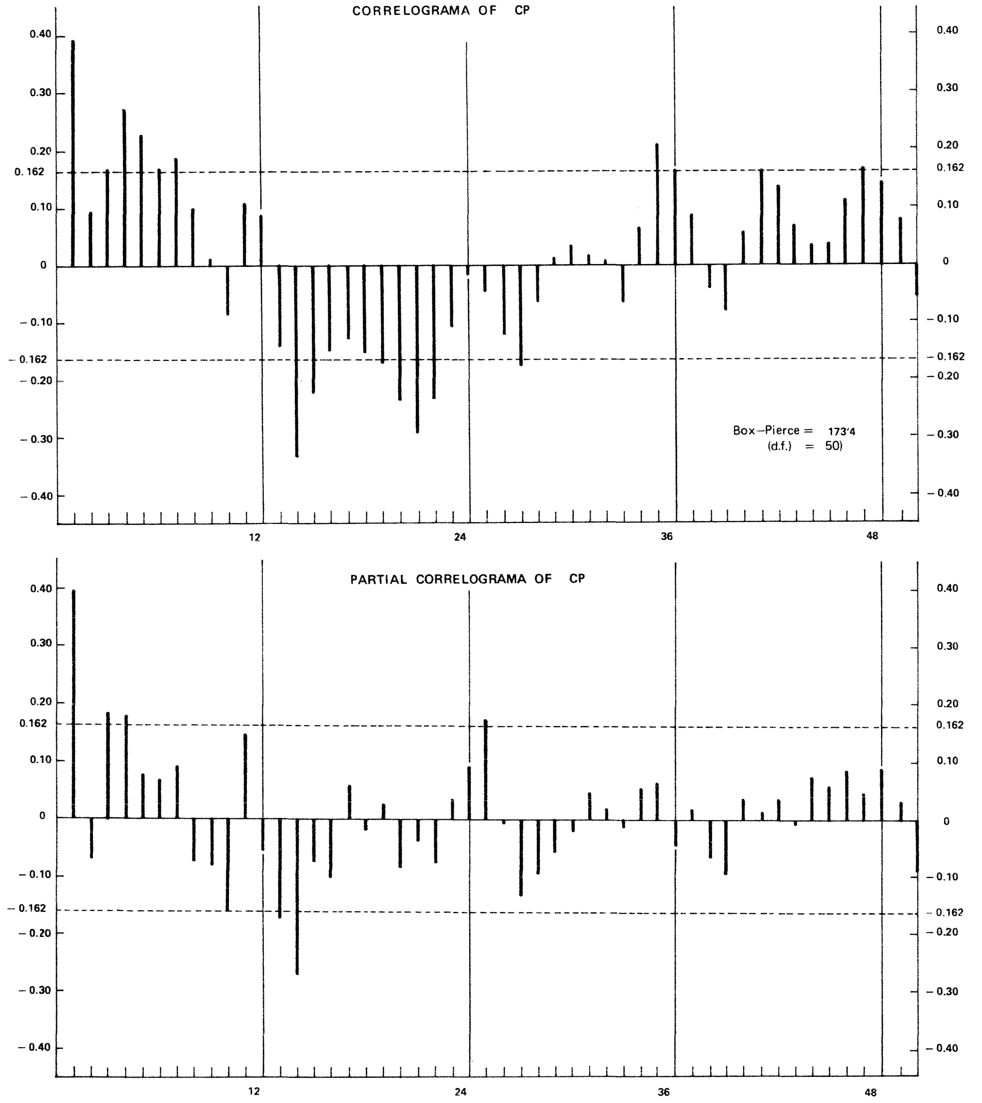
CP

Sample 1968-I to 1980-VIII

Differencing(*)	Mean(**)	Variance	Standar Deviation	Box Pierce(***)
(0,0)	-20,21053 (1,725)	452,48	21,27162	1.201,1
(0,1)	-1,900 (1,85)	479,49	21,89726	1.164,5
(1,0)	-0,08609 (0,286)	12,38	3,519	173,4
(1,1)	-0,179856 (0,404)	22,68	4,762	257,1

(*) The first figure states the number of regular differencing and the second the number of annual differencing.
(**) In brackets the standar deviation of the mean.
(***) The degrees of freedom are 50.

Figure 6.


CORRELOGRAMA OF CP
0.40
0.30
0.20
0.162
0.10
0
– 0.10
– 0.162
– 0.20
– 0.30
– 0.40
12
24
36
48
Box–Pierce = 173'4
(d.f.) = 50)
PARTIAL CORRELOGRAMA OF CP

Univariate ARIMA models for CP

Table 2

Sample 1968-I to 1980-VII
(152 observations)

	σ	χ^2 d.f(55) sign.corr	corr. par.	Coefficients	Anomalous residuals
1)	2.8630	49,3 (10,12,14,33 34,38,50)	$(1,1^{+})0,84$	$\phi_1 = 0.887(0.145)$; $\phi_2 = -0.306(0.112)$; $\phi_3 = 0.248(0.086)$ $\phi_{12} = -0.163(0.059)$; $\theta_1 = 0.582(0.139)$; $\theta_{11} = -0.252(0.078)$ $\theta_{35} = -0.45(0.095)$; $\theta_{36} = 0.233(0.126)$; $\theta_{48} = -0.135(0.094)$	32(-2.0) 102(-2.3) 109(2.4) 116(3.4) 138(-2.6)
2)	2.8765	52,3 (14)	$(1,1^{+})0,87$	$\phi_1 = 0.849(0.157)$; $\phi_2 = -0.298(0.111)$; $\phi_3 = 0.275(0.085)$ $\phi_{12} = -0.133(0.06)$; $\theta_1 = 0.508(0.159)$; $\theta_{11} = -0.207(0.08)$ $\theta_{35} = -0.41(0.096)$; $\theta_{36} = 0.171(0.132)$;	44(-2.0) 102(-2.1) 109(2.4) 116(3.1) 117(-2.0) 138(-2.7)
3)	2.8770	46,9 (14)	$(1,1^{+})0,75$	$\phi_1 = 0.767(0.121)$; $\phi_2 = -0.261(0.108)$; $\phi_3 = 0.261(0.081)$ $\phi_{12} = -0.118(0.065)$; $\theta_1 = 0.452(0.105)$; $\theta_{11} = -0.212(0.079)$ $\theta_{35} = -0.445(0.087)$; $\theta_{48} = -0.184(0.099)$;	44(-2.1) 102(-2.2) 109(2.5) 116(3.4) 138(-2.2) 141(2.2)
4)	2.9061	48,2 (14)	$(1,1^{+})0,82$	$\phi_1 = 0.639(0.136)$; $\phi_2 = -0.203(0.105)$; $\phi_3 = 0.253(0.080)$ $\phi_{12} = -0.02(0.073)$; $\theta_1 = 0.303(0.125)$; $\theta_{11} = -0.229(0.079)$ $\theta_{35} = -0.412(0.091)$;	109(2.3) 116(3.2) 138(-2.6)
5)	2.8913	50.2 (14)	$(1,1^{+})0,77$	$\phi_1 = 0.629(0.125)$; $\phi_2 = -0.188(0.101)$; $\phi_3 = 0.249(0.08)$ $\theta_1 = 0.328(0.115)$; $\theta_{11} = -0.188(0.078)$; $\theta_{35} = -0.532(0.084)$ $\theta_{48} = -0.159(0.094)$;	109(2.3) 116(3.3) 138(-2.4)
6)	2.9039	46.5 (14)	$(1,1^{+})0,88$	$\phi_1 = 0.59(0.166)$; $\phi_2 = -0.191(0.102)$; $\phi_3 = 0.272(0.082)$ $\theta_1 = 0.264(0.163)$; $\theta_{11} = -0.249(0.079)$; $\theta_{35} = -0.39(0.085)$ $\theta_{36} = -0.079(0.122)$;	109(2.3) 116(3.3) 138(-2.4)
7)	2.9424	53,1 (14)		$\phi_1 = 0.352(0.08)$; $\phi_2 = -0.114(0.084)$; $\phi_3 = 0.254(0.08)$ $\theta_{11} = -0.216(0.077)$; $\theta_{35} = -0.478(0.089)$; $\theta_{36} = -0.235(0.091)$ $\theta_{48} = 0.012(0.108)$;	109(2.3) 116(3.2) 117(2.0) 138(-2.4) 141(2.0)
8)	2.9175	59.0 (14)		$\phi_1 = 0.368(0.081)$; $\phi_2 = -0.06(0.088)$; $\phi_3 = 0.195(0.081)$ $\theta_{11} = -0.303(0.077)$; $\theta_{12} = -0.211(0.073)$; $\theta_{35} = -0.466(0.087)$	116(3.1) 138(-2.4)
9)	2.8968	48.0 (14)	$(1,1^{+})0,86$	$\phi_1 = 0.659(0.156)$; $\phi_2 = -0.215(0.11)$; $\phi_3 = 0.261(0.08)$ $\theta_1 = 0.313(0.146)$; $\theta_{11} = -0.216(0.08)$; $\theta_{12} = -0.004(0.096)$ $\theta_{35} = -0.437(0.086)$;	109(2.3) 116(3.2) 138(-2.6)
10)	2.9228	46.6 (14)	$(1,1^{+})0,79$ $(12,12^{+})0,75$	$\phi_1 = 0.875(0.129)$; $\phi_2 = -0.315(0.115)$; $\phi_3 = 0.215(0.08)$ $\phi_{12} = -0.231(0.084)$; $\theta_1 = 0.569(0.1)$; $\theta_{11} = -0.156(0.081)$ $\theta_{12} = -0.104(0.126)$; $\theta_{35} = -0.296(0.083)$; $\theta_{48} = -0.369(0.106)$	44(-2.3) 109(2.1) 116(2.9) 117(-2.0) 138(-2.2)

Sample 1968-I to 1980-VII
(152 observations)

Univariate ARIMA models for CP

Table 2 (Cont.)

	σ	χ^2 d.f(55) sign.corr	corr. par.	Coefficients	Anomalous residuals
11)	2.9262	46,9 (14)		$\phi_1 = 0.713(0.117)$; $\phi_2 = -0.23(0.104)$; $\phi_3 = 0.250(0.08)$ $\theta_1 = 0.399(0.088)$; $\theta_{11} = -0.172(0.073)$; $\theta_{12} = 0.066(0.086)$ $\theta_{35} = -0.509(0.08)$; $\theta_{48} = -0.175(0.086)$;	34(2.0) 109(2.2) 116(3.2) 138(-2.4)
12)	2.9106	56,4 (14)		$\phi_1 = 0.394(0.08)$; $\phi_2 = -0.07(0.088)$; $\phi_3 = 0.2(0.82)$ $\theta_{11} = -0.286(0.078)$; $\theta_{12} = -0.2(0.076)$; $\theta_{35} = -0.389(0.089)$ $\theta_{48} = 0.116(0.098)$;	43(2.0) 72(-2.2) 91(2.1) 116(2.8) 138(-2.6)
13)	2.9581	71,9 (14,27,47)	$(1,1^+)$0,89	$\phi_1 = 0.456(0.177)$; $\phi_2 = -0.115(0.117)$; $\phi_3 = 0.188(0.078)$ $\phi_{12} = -0.456(0.11)$; $\theta_1 = 0.111(0.155)$; $\theta_{11} = -0.196(0.08)$ $\theta_{12} = -0.54(0.148)$; $\theta_{35} = -0.115(0.104)$;	32(-2.0) 72(-2.5) 116(2.0) 117(-2.2) 138(-2.2)
14)	2.8969	47,4 (14)	$(1,1^+)$0,80	$\phi_1 = 0.675(0.133)$; $\phi_2 = -0.213(0.103)$; $\phi_3 = 0.263(0.08)$ $\theta_1 = 0.328(0.123)$; $\theta_{11} = -0.196(0.079)$; $\theta_{35} = -0.438(0.084)$	109(2.3) 116(3.2) 138(-2.6)
15)	2.9529	63,2 (14,21,27)	(1,2) -0,80 $(1,1^+)$ 0,91 $(2,1^+)$ -0,76 (12,12) 0,76	$\phi_1 = 0.478(0.204)$; $\phi_2 = -0.079(0.137)$; $\phi_3 = 0.128(0.078)$ $\phi_{12} = -0.429(0.115)$; $\theta_1 = 0.074(0.195)$; $\theta_{11} = -0.229(0.079)$ $\theta_{12} = -0.526(0.15)$; θ_{35} -0.023(0.107); $\theta_{36} = -0.008(0.107)$ $\theta_{48} = 0.063(0.112)$;	72(-2.5) 117(-2.1) 129(2.0) 138(-2.3)
16)	3.045	89,0 (10,14,21,27,47)		$\phi_1 = 0.413(0.083)$; $\phi_2 = -0.082(0.085)$; $\phi_3 = 0.15(0.075)$ $\phi_{12} = -0.56(0.094)$; $\theta_{11} = -0.126(0.077)$; $\theta_{12} = -0.681(0.11)$ $\theta_{35} = -0.036(0.09)$; $\theta_{36} = -0.0004(0.103)$; $\theta_{48} = 0.136(0.108)$	72(-2.4) 117(-2.1) 138(-2.4)
17)	2.8894	47,6 (14)	$(1,1^+)$ 0,91 $(1^+,36^+)$0,81	$\phi_1 = 0.694(0.196)$; $\phi_2 = -0.233(0.113)$; $\phi_3 = 0.269(0.084)$ $\phi_1 = 0.381(0.197)$; $\theta_{11} = -0.199(0.079)$; $\theta_{12} = 0.036(0.095)$ $\theta_{35} = -0.511(0.090)$; $\theta_{36} = -0.013(0.15)$; $\theta_{48} = -0.100(0.094)$	102(-2.6) 109(2.5) 116(3.4) 138(-2.4)

Variance of CP = 452.48

Variance of ΔCP = 12.38

Standard deviation of ΔCP = 3.52

Figure 7

RESIDUALES FROM THE ARIMA MODEL

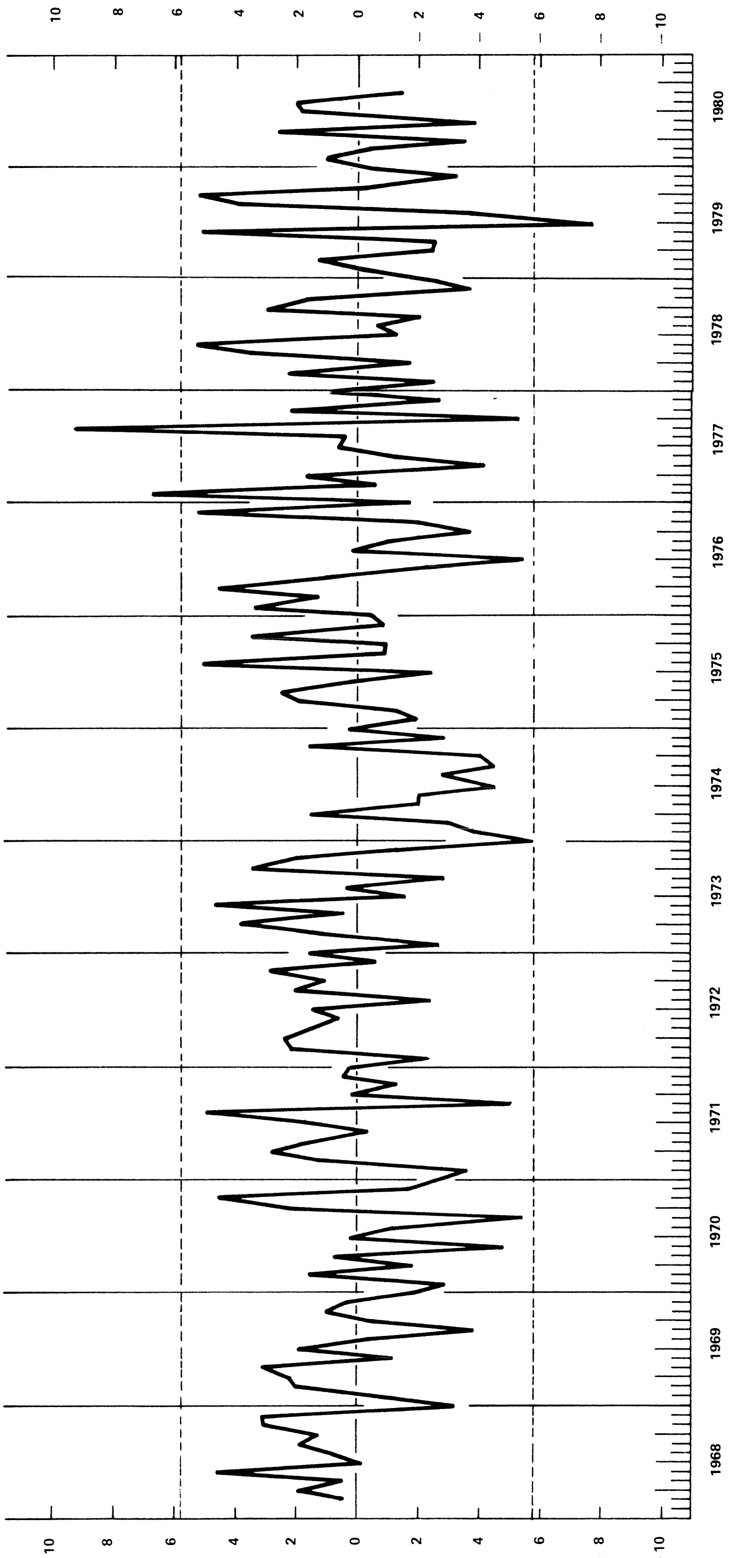


Figure 8.

CORRELOGRAM OF THE RESIDUALS FROM THE ARIMA MODEL

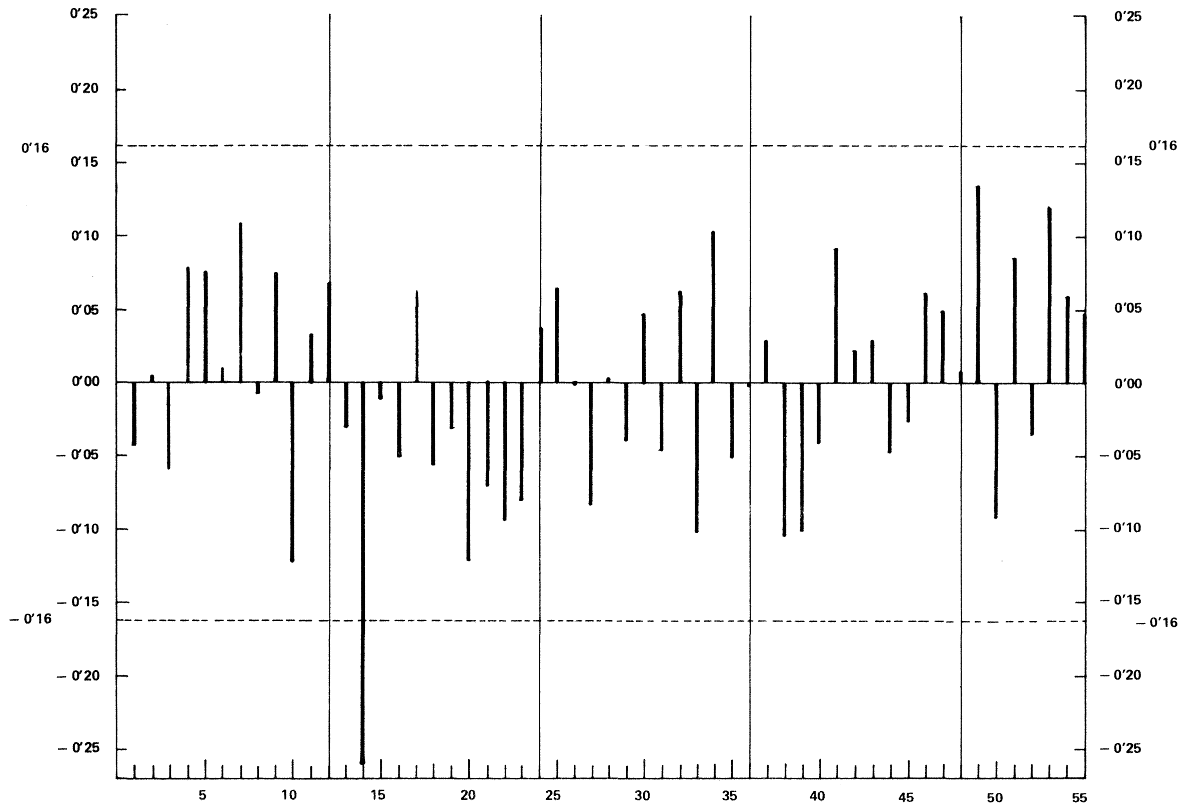


Figure 9.

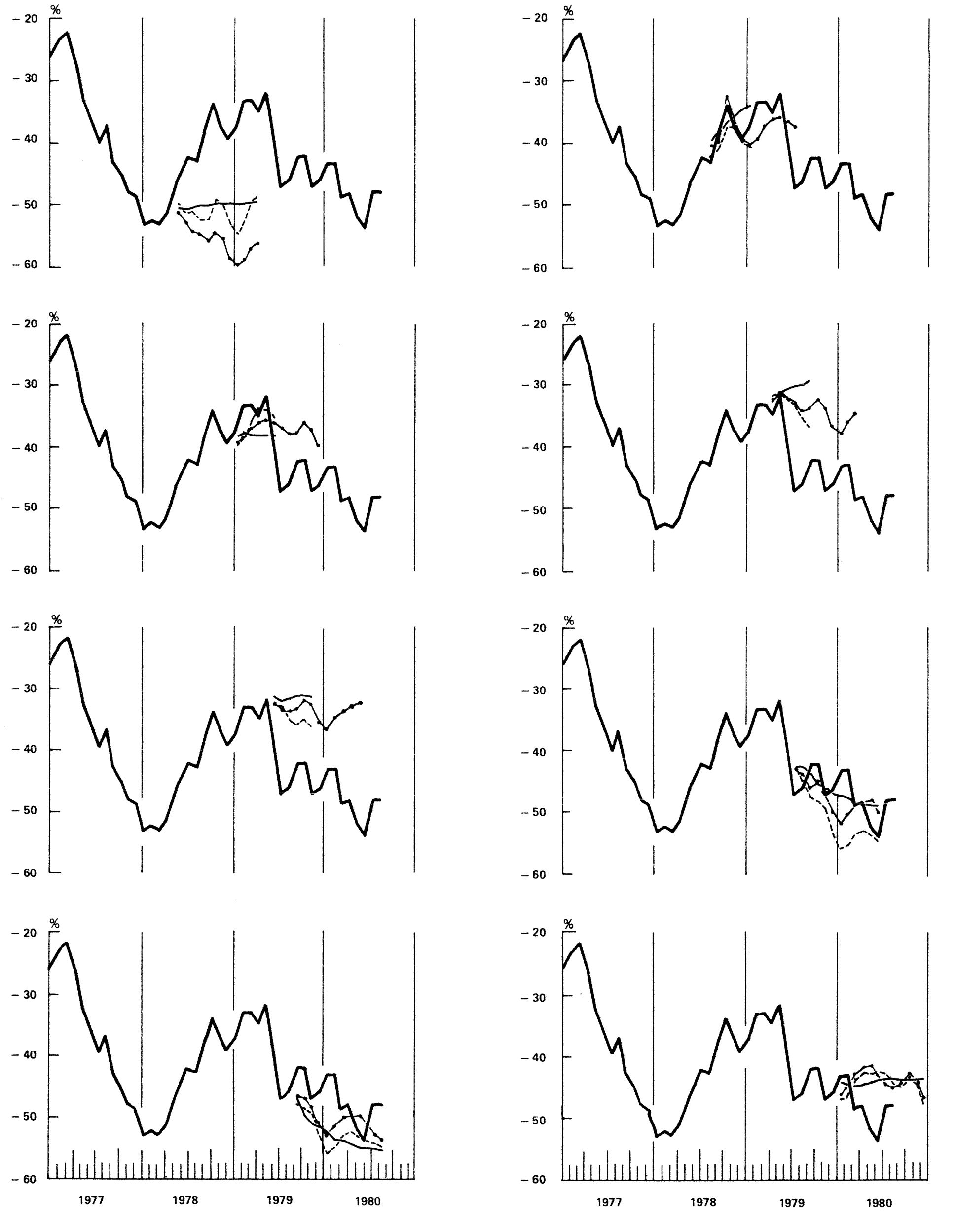
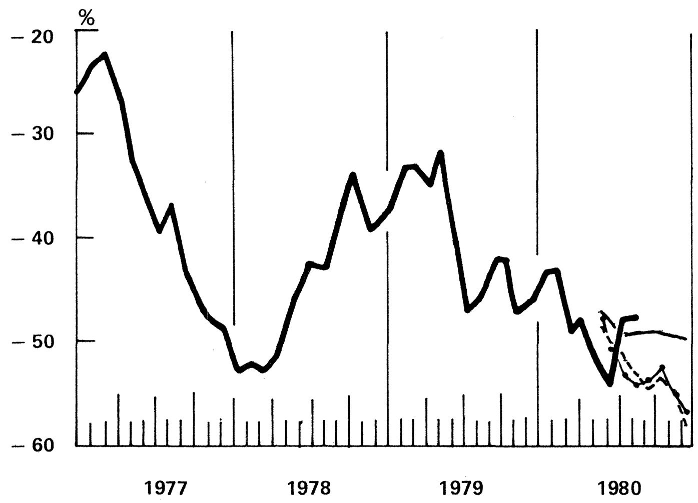
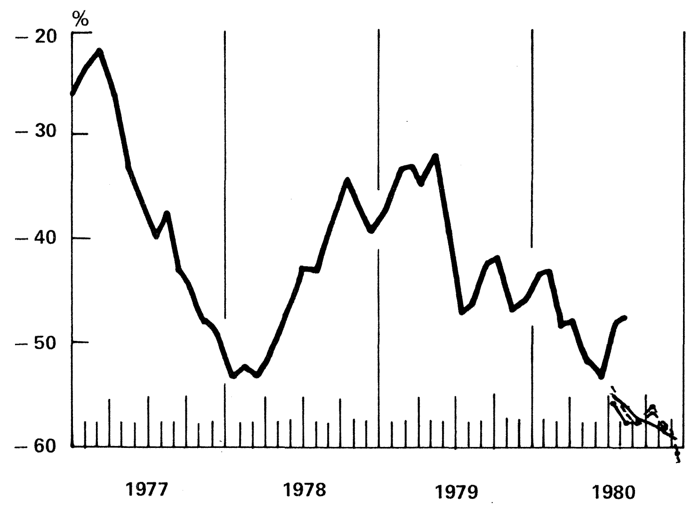


Figure 9. (Cont.)





Forecasting with the selected ARIMA model.

Forecasting with alternative ARIMA models

III. An econometric model for CP

In this section we try to estimate an econometric model for CP using MR3, PRE and ITPC as explanatory variables. The models considered have been of the type:

$$\Delta CP_t = \frac{\omega_1(L)}{\delta_1(L)} \Delta MR3_{t-b_1} + \frac{\omega_2(L)}{\delta_2(L)} \Delta PRE_{t-b_2} + \frac{\omega_3(L)}{\delta_3(L)} \Delta ITPC_{t-b_3} + $$

$$+ \frac{\theta(L)}{\phi(L)} a_t \quad ,$$

where $\omega_j(L)$, $\delta_j(L)$, $\theta(L)$ and $\delta(L)$ are polynomials in the lag operator, L, and $\Delta = (1-L)$. It was found convenient to use the Δ operator for all variables because if we omit it, a unit root appears in the $\delta(L)$ polynomial.

Experimenting with $\omega_j(L)$ polynomials up to order 4, $\delta_j(L)$ polynomials up to order 2, and using for $\theta(L)$ and $\delta(L)$ the specifications obtained in the previous section we arrived at the following model:

$$\Delta CP_t = \frac{\omega_{01}}{1-\delta_{11}L} \Delta MR3_{t-2} + \frac{\omega_{02}}{1-\delta_{12}L} \Delta PRE_t + \frac{\omega_{03}}{1-\delta_{13}L} \Delta ITPC_{t-1} + $$

$$+ \frac{(1-\theta_1 L-\theta_{11}L^{11}-\theta_{35}L^{35})}{(1-\phi_1 L-\phi_2 L^2-\phi_3 L^3)} a_t \quad .$$

In table 3 we present estimations of that model for different sample periods. It can be observed that the model is quite stable, nevertheless it is worthwhile to make the following two points. First, the gain with respect to ΔMR3 has increased from 0.0059 to 0.0067. Second the gain with respect to ΔPRE increases in absolute value from the sample

Table 3

$$\Delta CP = \frac{\omega_{01}}{1-\delta_{11}L}\Delta MR_{t-2} + \frac{\omega_{02}}{1-\delta_{12}L}\Delta PRE_{t} + \frac{\omega_{03}}{1-\delta_{13}L}\Delta ITPC_{t-1} + \frac{(1-\theta_1 L-\theta_{11}L^{11}-\theta_{35}L^{35})}{(1-\phi_1 L-\phi_2 L^2-\phi_3 L^3)} a_t$$

	SAMPLE					
	1968(1)-1980(10)	1971(1)-1980(2)	1971(1)-1980(10)			
ω_{01}	.0017 (.0005)	.0019 (.0006)	.0018 (.0005)			
δ_{11}	.71 (.13)	.71 (.10)	.73 (.085)			
ω_{02}	-.075 (.061)	-.15 (.067)	-.10 (.060)			
δ_{12}	.82 (.33)	.76 (.25)	.78 (.26)			
ω_{03}	-.35 (.093)	-.49 (.091)	-.42 (.078)			
δ_{13}	.62 (.18)	.50 (.17)	.54 (.18)			
ϕ_1	.67 (.15)	.78 (.13)	.65 (.11)			
ϕ_2	-.28 (.099)	-.33 (.12)	-.34 (.11)			
ϕ_3	.34 (.081)	.30 (.10)	.36 (.094)			
θ_1	.38 (.14)	.57 (.10)	.49 (.080)			
θ_{11}	-.21 (.08)	-.39 (.09)	-.46 (.084)			
θ_{35}	-.23 (.08)	-.19 (.09)	-.26 (.096)			
Var (CP)	459,97	477,77	497,35			
Var (a_t)	7,84	7,22	7,55			
σ	2,80	2,69	2,75			
Box-Pierce (g.l.)	21,1(36)	24,4(36)	20,2(36)			
Valores significativos del correlograma		14(-0.204)				
Correlación entre parámetros superior a 0,75 en valor absoluto	(ϕ_1,θ_1)=.84		$(\omega_{01},\delta_{11})$=-.80			
Residuos superiores a 2σ en valor absoluto	Ag. 1969 = -2,0σ My. 1970 = -2,1σ Ag. 1970 = -2,3σ Jl. 1975 = 2,0σ En. 1977 = 2,5σ Sp. 1977 = -2,4σ Jl. 1978 = -2,2σ My. 1979 = -2,0σ	Ag. 1971 = -2,2σ Dc. 1973 = -2,2σ Jl. 1975 = 2,2σ Sp. 1976 = -2,2σ En. 1977 = 2,0σ	Ag. 1973 = -2,0σ Dc. 1973 = -2,0σ Jl. 1975 = 2,2σ En. 1977 = 2,1σ Jn. 1979 = -2,0σ Jl. 1980 = 2,1σ			
$g_1 = \omega_{01}/(1-\delta_{11})$	0,0059	0,0066	0,0067			
$g_2 = \omega_{02}/(1-\delta_{12})$	-0,42	-0,63	-0,45			
$g_3 = \omega_{03}/(1-\delta_{13})$	-0,92	-0,98	-0,91			

period 1968(I)-1980(X) to the 1971(I)-1980(II), but decreases to the first value when we extend the last sample period until the end of 1980. This could be due to the fact mentioned in the introduction that the interventions suffered by the series have an effect on CP that is different from the effect of the rest of PRE. And, possibly, even more, the several interventions that appear in PRE could have diverse effects on CP.

Comparing the econometric model with the univariate model of the section I we see that the standard deviation of the innovations falls from 2.9 in the ARIMA model to 2.8 in the present one, and the gain of the filter of the innovations also decreases from 4.75 to 3.93.

If in the econometric model estimated for the sample period 1971(I)-1980(X) we do the following transformations:

$$MR3_t^* = \frac{0.0018}{1-0.73L} \; MR3_{t-2} \quad ,$$

$$PRE_t^* = \frac{-0.10}{1-0.78L} \; PRE_t$$

$$ITPC_t^* = \frac{-0.42}{1-0.54L} \; ITPC_{t-1} \quad \text{and}$$

$$N_t = CP_t - MR3_t^* - PRE_t^* - ITPC_t^* \quad ,$$

we have decomposed CP_t as the sum of four components which include the influence of MR3, PRE, ITPC and the innovations, in CP. The listing and graphs of these elements are in table 4 and in figure 2, respectively.

In table 5 we expand the transfer function for ΔMR3, ΔPRE and ΔITPC and we can see that ΔMR3 affects ΔCP

Table 4

Nº ob.	Date	CP	MR3*	PRE*	ITPC*	N
1	7205	.00	282.76	-46.38	-93.56	-142.82
2	7206	5.00	286.22	-46.18	-93.47	-141.57
3	7207	3.00	289.71	-46.00	-94.73	-145.98
4	7208	4.00	292.54	-45.78	-95.69	-147.07
5	7209	7.00	294.07	-45.52	-96.66	-144.89
6	7210	11.00	296.15	-45.28	-97.35	-142.52
7	7211	11.00	298.62	-45.02	-97.71	-144.88
8	7212	11.00	302.34	-44.77	-98.01	-148.56
9	7301	10.00	306.92	-44.41	-98.24	-154.26
10	7302	11.00	310.67	-44.07	-98.23	-157.37
11	7303	16.00	314.09	-43.71	-98.78	-155.60
12	7304	16.00	317.35	-43.57	-99.68	-158.10
13	7305	20.00	319.69	-43.54	-100.03	-156.13
14	7306	20.00	322.08	-43.47	-99.06	-159.55
15	7307	18.00	325.62	-43.27	-97.47	-166.88
16	7308	16.00	328.08	-43.30	-98.53	-170.25
17	7309	22.00	329.06	-43.32	-99.87	-163.88
18	7310	26.00	330.06	-42.99	-100.45	-160.62
19	7311	24.00	331.88	-42.37	-101.89	-163.62
20	7312	16.00	334.44	-41.57	-104.13	-172.74
21	7401	11.00	337.67	-41.04	-106.31	-179.31
22	7402	9.00	339.76	-40.36	-105.17	-185.23
23	7403	10.00	340.51	-41.64	-104.00	-184.87
24	7404	8.00	340.69	-42.80	-103.61	-186.49
25	7405	5.00	340.86	-43.57	-103.87	-188.42
26	7406	2.00	341.62	-44.13	-104.57	-190.92
27	7407	-4.00	343.65	-44.64	-105.12	-197.89
28	7408	-11.00	343.94	-45.02	-106.23	-203.69
29	7409	-18.00	342.96	-45.53	-107.06	-208.38
30	7410	-20.00	342.75	-45.93	-107.12	-209.65
31	7411	-26.00	341.14	-46.60	-107.65	-212.89
32	7412	-32.00	341.15	-47.04	-108.09	-218.01
33	7501	-37.00	342.12	-47.81	-107.57	-223.74
34	7502	-40.00	341.73	-48.83	-106.77	-226.14
35	7503	-40.00	342.01	-49.87	-106.19	-225.96
36	7504	-39.00	341.96	-50.62	-106.30	-224.04
37	7505	-40.00	341.64	-51.29	-106.43	-223.92
38	7506	-45.00	342.71	-51.77	-106.25	-229.69
39	7507	-42.00	344.81	-52.11	-107.07	-227.64
40	7508	-42.00	346.21	-52.31	-108.59	-227.30
41	7509	-43.00	346.26	-52.40	-109.86	-227.00
42	7510	-40.00	347.25	-52.45	-109.74	-225.07
43	7511	-39.00	348.46	-52.42	-109.59	-225.46
44	7512	-41.00	350.65	-53.57	-110.17	-227.91
45	7601	-38.00	353.30	-54.37	-110.54	-226.39
46	7602	-33.00	354.25	-55.15	-106.93	-225.17
47	7603	-26.00	354.39	-55.69	-104.65	-220.35
48	7604	-20.00	354.13	-55.80	-103.96	-214.37
49	7605	-20.00	353.44	-55.73	-103.96	-213.75
50	7606	-23.00	353.97	-55.50	-104.01	-217.47
51	7607	-23.00	356.12	-55.17	-104.30	-219.65

Table 4 (Cont.)

N°ob.	Date	CP	MR3*	PRE*	ITPC*	N
52	7608	-22.00	357.97	-54.86	-104.27	-220.84
53	7609	-24.00	358.18	-54.57	-104.62	-222.99
54	7610	-27.00	357.01	-54.16	-105.70	-224.15
55	7611	-25.00	356.34	-53.78	-106.24	-221.32
56	7612	-28.00	357.39	-53.44	-106.66	-225.28
57	7701	-25.00	357.32	-53.18	-107.92	-221.22
58	7702	-23.00	355.78	-52.70	-108.72	-217.37
59	7703	-22.00	353.52	-53.15	-110.18	-212.20
60	7704	-27.00	351.87	-53.72	-111.23	-213.91
61	7705	-33.00	350.82	-53.95	-111.60	-218.26
62	7706	-36.00	348.97	-54.15	-112.62	-213.21
63	7707	-40.00	347.36	-54.81	-106.48	-226.06
64	7708	-37.00	344.43	-55.42	-102.41	-223.60
65	7709	-43.00	341.62	-55.47	-100.92	-228.23
66	7710	-45.00	339.06	-55.36	-100.34	-228.36
67	7711	-48.00	337.07	-55.24	-100.44	-229.39
68	7712	-49.00	337.74	-55.04	-100.50	-231.20
69	7801	-53.00	338.37	-54.80	-100.88	-235.69
70	7802	-52.00	337.79	-54.43	-101.02	-234.34
71	7803	-53.00	337.45	-54.09	-101.35	-235.01
72	7804	-51.00	337.00	-53.65	-102.01	-232.35
73	7805	-46.00	337.24	-53.27	-102.80	-227.17
74	7806	-44.00	338.20	-52.91	-103.91	-225.38
75	7807	-42.00	340.24	-52.60	-105.56	-224.08
76	7808	-43.00	340.83	-52.10	-108.08	-223.65
77	7809	-38.00	341.37	-51.53	-110.19	-217.65
78	7810	-34.00	342.01	-50.91	-112.40	-212.71
79	7811	-37.00	343.01	-50.16	-113.76	-216.08
80	7812	-39.00	344.96	-49.72	-114.99	-219.25
81	7901	-37.00	346.67	-49.16	-116.47	-213.24
82	7902	-33.00	347.86	-48.52	-117.94	-214.40
83	7903	-33.00	349.07	-47.94	-119.08	-215.05
84	7904	-35.00	350.19	-47.38	-121.32	-216.49
85	7905	-32.00	350.51	-46.87	-124.34	-210.80
86	7906	-39.00	351.52	-47.63	-126.20	-216.58
87	7907	-47.00	353.46	-48.94	-125.91	-225.61
88	7908	-46.00	353.90	-50.19	-126.14	-223.58
89	7909	-42.00	353.12	-50.97	-126.11	-219.04
90	7910	-42.00	352.58	-51.46	-126.57	-216.56
91	7911	-47.00	352.75	-51.76	-126.41	-221.58
92	7912	-46.00	354.83	-51.93	-125.56	-223.34
93	8001	-43.00	355.00	-51.87	-125.69	-220.44
94	8002	-43.00	354.23	-54.56	-125.53	-217.14
95	8003	-49.00	354.46	-56.52	-125.19	-221.76
96	8004	-48.00	355.48	-58.03	-123.10	-222.35
97	8005	-52.00	355.88	-59.15	-120.36	-227.88
98	8006	-54.00	355.96	-59.91	-120.09	-229.96
99	8007	-48.00	357.08	-61.75	-119.10	-224.80
100	8008	-48.00	358.77	-63.57	-118.41	-224.79
101	8009	-53.00	359.14	-64.80	-117.36	-229.98
102	8010	-52.00	359.66	-65.57	-116.63	-229.46

Table 5

RATIONAL DISTRIBUTED LAG MODEL FOR ΔCP

		$\Delta MR3_{t-2}$	ΔPRE_t	$\Delta ITPC_{t-1}$
Transfer function		$\frac{0,0018}{1-0,7303L}$	$-\frac{0,1011}{1-0,7823L}$	$-\frac{0,4199}{1-0,5364L}$
Gain		0,0067	-0,4644	-0,9057
Impulse response weights	v_0	0,0018	-0,1011	-0,4199
	v_1	0,001315	-0,079091	-0,225234
	v_2	0,000960	-0,061873	-0,120816
	v_3	0,000701	-0,048403	-0,064805
	v_4	0,000512	-0,037866	-0,034762
	v_5	0,000374	-0,029622	-0,018646
	v_6	0,000273	-0,023174	-0,010002
	v_7	0,000199	-0,018129	-0,005365
	v_8	0,000146	-0,014182	
	v_9	0,000106	-0,011095	
	v_{10}	0,000078	-0,008679	
	v_{11}	0,000057	-0,006790	
	v_{12}	0,000041	-0,005312	
	v_{13}	0,000030	-0,004155	
	v_{14}		-0,003251	
	v_{15}		-0,002543	
	v_{16}		-0,001989	
Gain $\hat{g} = v(1)$		0,006592	-0,457254	-0,899530
Sample mean		MR3=50351,8	PRE=110,56	ITPC=118,07
CP sample mean = -23,86 . Sample mean of ΔCP = -0.193				

with a lag of two periods and the effect lasts for one year; ΔPRE has an instantaneous effect and lasts for more than one year and ΔITPC influences ΔCP with a lag of one period and its effect lasts for seven months. These lag structures can be biased because of the facts mentioned in the introduction and we expect to rerun this study following the suggestions made at the beginning of the paper.

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ABSTRACT FORM

Author(s): A. Espasa	Title: An Econometric Study of a Monthly Indicator of Economic Activity
Institute: Banco de España, Madrid	

The economic indicator selected for this study refers to orders in Spanish industry and we denote it by CP. Economic indicators are important for following the month to month evolution of an economy, mainly with reference to its trend and cyclical behaviour. For that purpose the methods used are mainly univariate time series. The results of this paper for the CP series indicate:a)the feasibility of constructing dynamic seasonally unadjusted monthly econometric models for these indicators; b) that these models are useful for the month to month study of the economy because with them we can point out the input variables responsible for the different upturns and downturns of such indicators, and c) that we get a better forecast with the econometric model than with univariate models.

In the first part of the paper we specify and estimate an ARIMA model for CP. We will use this estimation as a bench mark that must be improved with models containing more information. The main objective in this part is to capture the more relevant aspects of the series that we must take account of in the construction of an econometric model. These aspects appear to be:

a) the series has no underlying trend and only shows a fluctuating local level;

b) the seasonality of CP requires only stationary operators; and

c) its cyclical behaviour can be captured by moving average operators better than by autoregressive operators.

In the second part of the paper we explain CP using an uniequational rational distributed lag model with the money supply in real balances, MR3, the relative price of energy, PRE, and the real effective exchange rate of the peseta, ITPC, as inputs. From the final proposed model we can calculate the contributions of each input in CP and we denote them by an asterisk. Comparing MR3 with MR3* we see that the latter shows a more stable behaviour than MR3 and it could be interpreted in the sense that orders are sensitive to the medium and long-run movements of the money supply but not to the short-run deviation of MR3 from this path.

From the estimated distributed lags we see that ΔMR3 affects ΔCP with a lag of two periods and the effect lasts for one year(*); ΔPRE has an instantaneous effect and lasts for more than one year and ΔITPC influences ΔCP with a lag of one period and its effect lasts for seven months.

(*) $\Delta = (1 - L)$ where L is the lag operator.

ABSTRACT FORM

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As suggestions for further studies we point out the convenience of reestimating a model of this type decomposing the input variables. In that respect we propose decomposing MR3 into permanent and transitory components and each one of the variables PRE and ITPC into two components, one capturing the effects of the interventions suffered by these series and the other, as a residual component, that will collect the normal evolution of the corresponding series.

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