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A BUSINESS CYCLE CHARACTERIZATION OF THE SPANISH ECONOMY: 1970 - 1994

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ABSTRACT

Every procedure used to characterize business cycles by filtering macroeconomic series have some arbitrary elements and, therefore, they should, at least, satisfied the weak criterion of replicating the peaks and throughs of business cycles from a historical perspective. In order to characterize Spanish business cycles from 1970 to 1994 we propose a trend-cycle model characterization based on a particular class of unobserved component models, that fulfils the above mentioned criterion (wich other procedure, like Hodrick-Prescott filter, do not). We carry out sensitivity analysis with respect to the arbitrary element of our procedure, in order to check for the robustness of our results.

RESUMEN

Todos los procedimientos utilizados para caracterizar los ciclos económicos tienen elementos arbitrarios y, por tanto, deberían satisfacer, al menos, el débil criterio de replicar los auges y las recesiones desde una perspectiva histórica. Para caracterizar los ciclos de la economía española en el período 1970-1994, proponemos un modelo de componentes no observables, que cumple con el criterio mencionado (lo que no hacen algunos otros procedimientos, como el filtro de Hodrick-Prescott). Realizamos análisis de sensibilidad respecto al elemento arbitrario de nuestro procedimiento, para comprobar la robustez de nuestros resultados.

Keywords: Detrending, business cycles, filters, turning points
JEL Classification: E32; C22; C52

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1. INTRODUCTION

One common feature to all business cycle characterizations of the economy is the presence of unobserved components. The associated problem, however, lies on the fact that although the key concepts of trend, cycle and seasonality are apparently easy to understand they are rather difficult to define in an *objective* way. In spite of that, a large portion of the recent empirical literature on business cycle have adopted the filtering procedure proposed by Hodrick and Prescott (1980) to extract the trend component from the original time series data and seek the identification of the so called "stylized" facts in order to summarize certain regularities of the cyclical patterns and their implications for policy.

More recently, however, several authors have also indicated the possible distortions caused by the use of arbitrary filtering procedures and the lack of robustness of certain cycle regularities. It is not surprising, then, that much of the empirical debate on this matter is in a Tower of Babel stage where any outcome becomes dependent on the particular filtering method used. The question of precisely defining a cycle in a unique way is not an easy one, and certainly will lead to a large number of spurious results and sterile debates. Being the empirical description of the Spanish business cycles the main objective of this paper, our approach here follows a different road by openly recognizing a *subjective* view in our personal judgement at what constitutes a cycle. When trying to answer this question we are imposing certain subjective restrictions that we wish our cycle should comply with. These restrictions may have been derived either from theoretical (smoothness and orthogonality restrictions) or empirical (average cycle duration) sources. In any case, whatever *a priori* information we decide to impose, it is clear that our business cycle characterization should be able, at least, to replicate the peaks and throughs of the business cycle form a historical point of view. Without this basic requirement, it is very unlikely that our model could, later on, be used to anticipate cyclical movements of recessions and recoveries of the economy.

The paper is organised as follows. Section 2 presents a modified alternative rule (to the one used by the NBER) to identify a business cycle chronology of the Spanish economy from 1970.1 to 1994.4. Section 3 discusses some conflicting issues related to certain business cycle characterizations. In particular, the results of applying the Hodrick-Prescott filter to the Spanish case are discussed. Section 4 presents the statistical methodology and its implications to analyze the Spanish business cycle. Section 5 summarizes the stylized facts using our trend derivative as a business cycle indicator and discusses how sensitive the results are to changes on the smoothing prior parameter. Finally, section 6 presents some conclusions.

2. A BUSINESS CYCLE CHRONOLOGY OF THE SPANISH ECONOMY

We would like to start by identifying, using conventional wisdom criteria, recessions periods in the Spanish economy from 1970 to 1994. The NBER uses one of these type of criteria to define when the US economy starts a recession: *when the first of at least two succesive declines in the quaterly growth rate of GNP occurs.* Correspondingly, the economy is out of a recession, according to the NBER, *when the first of at least two succesive increases in the growth rate of GNP takes place.*

We are going to accept the NBER's definition for the starting of a recession, but we are going to add another restriction for the economy to be out of a recession. Namely, that not only the GNP (or GDP) has two consecutive positive rates of growth, but also that the GDP in the last year (or four quarter period) grows for at least two consecutive periods. The idea behind this definition is that until the one year flow of GDP does not experience positive growth, and it does so for at least two consecutive periods, the economy cannot be declared out of a recession.

This simple and intuitive criterium can be used to define a chronology of recessions undergone by the Spanish economy during the 1970-94 period. In Table 1 and in Figure 1 shaded areas represent recession periods according to the former NBER's definition. An straight application of this definition generates four recessions: From 1975.1 to 1975.3, 1978.4 to 1979.3, 1980.2 to 1981.2 and 1992.2 to 1993.4.

It is remarkable the high variability duration of both recessions and expansion periods, a feature common to other economys' experiences. There has been a expansion period of 43 quarters (from 1982.3 to 1992.1), another of more than 19 quarters (from before 1970.2 to 1974.4), another of only 12 quarters (from 1975.4 to 1978.3) and, finally one of just 2 quarters (1979.4 and 1980.1). The intensity of expansions also varies greatly from one experience to another. Even within the same expansion period there are different sub-periods in terms of intensity. Compare, for instance (Table 1), the rates of growth from 1981.4 to 1984.4 with the rates of growth in the last part of the same expansion period, from 1985.1 to 1990.4.

The recovery or expansion period from 1979.4 to 1980.1, lasted only two quarters and it would have been extremely mild in intensity were not there an abnormal behavior of fixed investment in construction in 1980.1. Gross investment in construction had negative growth in every quarter from 1976.4 to 1981.2, except in 1980.1 when it grew a surprising 5.9%. This accounts for a 0.8% growth in GDP, a significant proportion of GDP's growth rate in this quarter, which was 1.1%. Looking carefully at all indicators of construction activity during this period (housing construction, employment in construction sector, construction's businessmen opinion on production and orders, and cement consumption) they show, except the last one, a sharp decline in construction activity during all these quarters. Significantly enough, cement consumption declines every quarter from 1978.2 to 1981.2 except in 1980.1, when it jumped up. One wonders whether we could be in front of a measurement error induced by an outlier in cement consumption. If this is so, the expansion period we are discussing was only two quarters long and extremely mild, once the eventual measurement error was corrected. Therefore, we could ommit this expansion period and consider that the Spanish economy was in recession from 1978.4 to 1981.2.

In Figure 2 shaded areas show this new definition of recession periods, and in Table 2 a business cycle chronology of the Spanish economy from 1970 to 1994 is presented.

3. CONFLICTING ISSUES ON BUSINESS CYCLE CHARACTERIZATIONS

Since the seminal work on the characteristics, length and prediction of the business cycle by Burns and Mitchell (1946), there has been a permanent debate in macroeconomics about the nature and measurement of economic cycles. Being basically unobserved, a common attitude shared by many practitioners in this field, has been to consider the trend as a "nuissance" component (that we should get rid of) in order to analyze the cyclical properties of the detrended data. Computation of the so called "stylized" facts of the business cycles are derived later from the filtered series. Behind the compilation of these simple facts are both an interest in learning about the set of complex comovements among aggregates in the economy, as well as finding certain regularities consistent with numerical implications derived from theoretical models.

However, any empirical analysis of the business cycle regularities involves the controversial issue of detrending. This question is particularly important given the surprisingly scant discussion in the literature on how assumptions about the nature of the trend component affects business cycle characteristics. Since the influential paper of Hodrick and Prescott (1980) their HP filtering procedure has been widely used to characterize business cycle facts for different sampling interval data sets and a large number of countries (see, among others, Backus and Kehoe, 1989; Danthine and Giradin, 1989; Dolado *et al.*, 1993; and King and Rebelo, 1993). More recently, however, some authors (see, e.g. Canova, 1991; García-Ferrer and Queralt, 1995; Harvey and Jaeger, 1993; and Singleton, 1988) have warned us about the possible distortions induced by the use of arbitrary prefiltering procedures as well as on the lack of robustness of certain cycle regularities[1]. Consequently, certain qualitative statements like that productivity is procyclical (Mankiw, 1989) or that the contemporaneous correlation between employment and output is small (Stock and Watson, 1988), or that money does not lead real GDP (Dolado *et al.*, 1993) may not be robust across procedures and crucially depend on the detrending methods employed.

To make things worse, the important work by Canova (1991) also illustrates how this "criticism" applies not only to the HP procedure but it is also shared by a large number of both univariate and multivariate detrending alternatives. Using post-World War II quarterly U.S. data, Canova (1991) showed how the relevant statistics, the qualitative response of aggregate variables to GNP shocks, the gain functions of various detrending filters and the seasonal and cyclical properties of U.S. business cycles vary both qualitatively and quantitatively cross detrending methods[2]. More shocking, however, is the finding that, practically, none of the nine methods used could *broadly replicate the features of the U.S. business cycles and reproduce the NBER turning points from a historical perspective*[3].

[1] In particular for the HP filter, current research carried out by King and Plosser (1989), Baxter (1991), and Cogley and Nason (1995) have shown how the mechanical application of this filtering procedure to certain type of economic time series may include spurious results.

[2] The range of relative volatilities is remarkably large. For example, the variablity of consumption with respect to GNP is between 34% and 153% while the variablity of investment ranges between 97% to 672% of the variability of GNP. A similar wide range of results is observed in the cross correlations of the cyclical components of the various series with GNP. See Canova (1991, Table 4).

[3] Actually, only three out of nine (HP, BN and FD1) are the only methods which capture all NBER turning points (plus some additional false alarms) although in some cases *the lag in recognizing a turning point can be as large as four quarters.*

Under these circumstances, there is little hope that both quantitative stylized facts and some qualitative features of the data may help in characterizing business cycle fluctuations. As Brandolini (1995) points out regarding real wages cyclical patterns, it is not unfair to describe the present debate as revolving around the impossibility of rejecting or confirming conflicting *a priori* beliefs on the basis of substantially mixed factual evidence. At this stage of disrupt, it seems logical to wonder if *there is a minimum set of requirements that any business cycle characterization should comply with* that does not depend on a particular prefiltering procedure?. Our answer to this contention is clear. Whatever *subjective* approach we decide to use it should have the following properties: i)the estimated cycle component should be able to replicate the peaks and throughs of the business cycle from a historical point of view; and if possible, ii)it should also be able to anticipate cyclical movements of recession and recovery of the economy.

Given the predominance of the HP filter as a widely used tool in compiling business cycle statistics, it is interesting to verify how it behaves in reproducing recessions and recoveries of the Spanish economy. We have conducted this exercise on quarterly seasonally adjusted Spanish real GDP data for the period 1970.1 to 1994.4[4]. Time plots for the quarterly growth rates appear in Figure 2 where the shaded areas indicate *recessions* according with the rules established in section 2. In Figure 3 we have plotted the corresponding HP cycle ($\lambda = 1600$) obtained for this particular data set. Several characteristics of these plots are worth mentioning. First, the contemporaneous cross correlation between both variables is very low ($r = 0.126$) indicating a very weak relationship between them across the sample period. Empirical results remain unchanged when we split the sample into two equally spaced subperiods. Second, the HP cyclical component is much more volatile than the quarterly GDP growth rate. The ratio of its standard error with respect to the GDP growth rate one is 1.87. This result goes against the accepted view of the cycle as an smooth approximation to the growth rate of the original variable. Third, the HP cycle identifies two spurious recession cycles that are not present in the data: 1970.2 - 1972.3 and 1984.1 - 1987.3. While the one corresponding to the first period might be ignored due to the problems associated with initial estimates of the algorithm, the second one indicates a considerable false alarm at times when the Spanish economy was growing around 0.8% per quarter. To characterize the 12 months period from 1986.4 to 1987.3 as part of a recession strikes anybody's memories. This period was one of the 12-month periods with higher growth in Spanish recent history (the highest since 1973): GDP and Private Consumption were in 1987.3 a 6.1% higher than in 1986.3, Gross Fixed Investment was 13.7% higher in the latter quarter than in the former and non-agricultural employment grew a 4.4% from 1986.3 to 1987.3. Fourth, in the remaining cases where recessions are correctly identified the HP cycle always lagged observed recessions (by two or three quarters) and remained in a recessionary path long after the economy has already recovered.

** Insert Figure 3*

These results for the Spanish case confirm the findings obtained by Canova (1991) and others about the dangers of using the HP filter as the solely detrending method in compiling business cycle statistics and characterizing comovements among the main economic aggregates. In the following section, we propose an alternative way of dealing with this problem based on a trend-cycle characterization that imposes certain restrictions obtained directly from the data.

[4] Dolado *et al.* (1993) applied the HP filter to the same data, but for the sample 1970.1-1991.4. Comments made here are applicable to their work.

4. THE THEORETICAL MODEL AND ITS IMPLICATIONS TO ANALYZE THE SPANISH BUSINESS CYCLE

4.1 The Theoretical Model

As an alternative, we have considered an univariate unobserved components (UC) model of the type developed by Young (1994), where any observed time series Y_t can be written as:

$$Y_t = T_t + P_t + \epsilon_t \qquad (4.1)$$

where T_t is a low frequency or *trend* component, P_t is a perturbational component around the trend and ϵ_t is a zero mean, serially uncorrelated white noise component with variance σ^2_ϵ . It is assumed that the low frequency component can be represented by a local linear *integrated random walk* (IRW) model of the form:

$$\begin{aligned} T_t &= T_{t-1} + D_{t-1} + \eta_t \\ D_t &= D_{t-1} + \xi_t \end{aligned} \qquad (4.2)$$

where D_t denotes the local slope or *derivative* of the trend, and η_t and ξ_t are zero mean, serially and mutually uncorrelated white noise inputs with variances σ^2_η and σ^2_ξ, respectively.

In most cases of interest, η_t can be safely constrained to zero (Ng and Young, 1989), which we do in what follows. Then the variance of ξ_t is the only unknown in (4.2) and it can be defined by the *Noise Variance Ratio* (NVR), which is the relation between σ^2_ξ and the variance of the observational noise σ^2_ϵ : NVR $= \sigma^2_\xi/\sigma^2_\epsilon$.

It is also assumed that the sum of the stochastic perturbation P_t and the white noise component admits an ARMA representation of the form:

$$P_t+\epsilon_t=\frac{\gamma(L)}{\phi(L)}a_t \qquad (4.3)$$

where γ (L) and ϕ (L) are polynomials in the lag operator L. No stationary restictions are necessarily imposed on (4.3) and in empirical applications we, usually, concentrate on the use of purely autoregressive (AR) form of (4.3). In these cases, an AR or subset AR model is identified for the perturbations using the Akaike Information Criteria (AIC).

This filtering technique can be shown to be equivalent to applying the HP filter to a series to obtain an estimate of its unobserved trend T_t. One could then predict the perturbation around the trend by an ARMA model like (4.3). There is a one-to-one correspondence between the NVR value and the choice of the single parameter (usually denoted by λ) in the HP methodology [Jakeman and Young (1984)].

Once we have defined the model structures for all the components, it is then straightforward to assemble them into an aggregate state space form [Young (1994)]. As regards identification and subsequent parameter estimation, the choice of the NVR value plays a crucial role[5]. García-Ferrer *et al.* (1993) have shown how the classical Kolmogorov - Wienner - Whittle approach to filtering and signal extraction can be applied to obtain the optimally smoothed estimate of T_t at sampling instant t based on all N samples as,

$$T_{t/N}=\frac{NVR}{NVR+(1-L)^2(1-L^{-1})^2}Y_t \qquad (4.4)$$

This is a symmetric, two sided filter requiring only the specification of the NVR value. It is easy to verify that this is a lag-free, low pass filter with a sharp cutt off for smaller values of the NVR and excellent filtering properties which attenuates all higher frequency noise on the data. In terms of the associated spectral density function for various NVR values, Young (1994) have shown how the NVR controls the bandpass of the filter, which is reduced progressively as the NVR is reduced in size.

However, how to choose the NVR remains an open question since there are several ways in which the NVR can be selected. They all can be interpreted as defining the bandwidth of the filter in spectral terms. It has been empirically shown [Young, T.J. (1987)] that the "cutt-off" frequency F_{50} (i.e., the frequency at which the filter attenuates the signal by 50%) is related to the NVR by the empirical equation,

$$NVR = 1600\,[F_{50}]^4 \qquad (4.5)$$

More recently, however, Pedregal (1995) has shown how it is possible to improve the approximation used in (4.5) by deriving the exact relationship between the bandwidth of the IRW filter and the NVR as,

[5] So far, we are faced with two alternatives. The first one can be considered half the way between the objective optimisation approach and the subjective bayesian one: selecting an NVR value for the trend so that its estimate does not contain higher frecuency components associated with the perturbational behaviour (García-Ferrer et al., 1993). This alternative implies manual tuning of the NVR that can be dangerous as the previous results for λ shows. The second alternative, recently developed by Tych and Young (1993) is based on optimising the NVR values based upon the spectral properties of the random walk family of models used to describe the nonstationary parameters, so that the logarithm of the pseudospectrum matches the logarithm of either the AR spectrum or the periodogram of the data in a least squares sense (García-Ferrer et al., 1994). Given the nonseasonal characteristics of our quaterly series, this alternative may not be advisable in this case.

$$F_{\alpha} = \frac{\arccos\left[1 - \sqrt{\frac{NVR\,(1-\alpha)}{4\,\alpha}}\right]}{2\pi} \tag{4.6}$$

so that the NVR that will extract a given band of low frequencies can be computed from both expressions[6]. Tables 3a and 3b show the implied cycles per sample and the cycles (in quarters and years) for different NVR values. Suposse, for instance, that we are interested to include in the trend (of a quarterly series) cycles up to ten years. Then Table 3b will provide the corresponding NVR = 0.000627. If on the contrary, we want to know what are the cycles in the trend for certain NVR values, we should go to Table 3a to find out that, for instance, an NVR = 0.01 will leave on the trend cycles of five years and more.

* *Insert Tables 3a ,3b*

With this in mind, it is then straightforward to verify the existence of well defined cyclical structures allowing for the possibility of a *pseudo-cycle within the trend*. In a sense, different NVR values produce estimates similar to those of *cyclical trend models* which reveal long term oscillatory behaviour in the trend [7]. Although large differences in the chosen NVR may, apparently, track the long-term behaviour of any time series equally well, when we look at their associated trend derivative plots , the picture changes dramatically. In some cases, estimated trends actually contain some higher frequency components related to the shorter period annual cycle; components which are amplified by the derivative operation and show up very well on the derivative plot [8].Confirmation of this evidence for the Spanish quarterly GDP data is accomplished in the following section, where we show the properties of the trend derivative as a business cycle indicator.

4.2 The Trend Derivative as a Business Cycle Indicator

One of the advantages of the theoretical IRW trend model exposed in the previous section, is that it allows to incorporate in the trend those cycles wished by the analyst by a *subjective* choice of the NVR value. If the trend derivative can be seen as an smooth approximation to the growth rate of the variable, then the definition of the cycle can be closely linked to the changes in the trend and hence to the derivative [9]. Using the derivative as a device for anticipating peaks and troughs in the business cycle, also allows us an alternative definition of expansions and recessions within our

[6] Note, however, that using (4.6) has some advantages. It not only provides an exact relationship but also allow us to compute the bandwidth for any value of α, not necessarily the F_{50} one. Nevertheless, in the case of the quaterly data used in this paper, numerical differences between the exact and the approximate expressions are negligible.

[7] Antecedents of embedding the trend and the cycle within a single components are, among others, Harvey (1985), Harvey and Jaeger (1993) and García-Ferrer and Queralt (1995).

[8] See, García-Ferrer (1992) and García Ferrer et al. (1994).

[9] One of the advantages of our IRW trend model over other UC alternatives in that changes in the trend (derivate) are smooth and do not contain higher frequencies components. For a comparison with other UC alternatives, see Queralt (1994).

theoretical framework. Following García-Ferrer *et al.*(1994) we define the *anticipation of a recession* at that particular point when the (estimated) derivative reaches its maximum numerical value; and the *anticipation of a (potential) recovery* at the derivative´s minimum. Needless to say that the practical usefulness of these definitions are, again, strongly linked to the chosen NVR. If in the case of quarterly data we select a very small NVR value (like the 0.000625 one of the HP filter) the corresponding derivative will be too smooth (with long swings) and shall, probably, miss intermediate cycles of shorter periods. If on the contrary, we select a large NVR, say 0.1, there are chances of identifying too many small cycles that actually did not occur.

Within the range of hypothetical NVR values it seems logical to use those which incorporate in the trend the cycles with similar lengths as the ones shown in the historical chronology of the business cycle. Unfortunatly, for the Spanish case,(where we lack an NBER business cycles reference dates) we have to rely only on the cycle dating rules depicted in section 2. Also, contrary to what happened in other countries where a longer data set is available we have only experienced two complete business cycles during the last 25 years. In this situation, it does not make much sense to compute average cycle durations or different expansion/contraction ratios that can help us in deciding a suitable NVR value. However, when similar GDP data was used for a large number of countries including Spain, García-Ferrer and Queralt (1995) found some empirical reasons to restrict the NVR search within a reasonable range of values. More precisely, they define a *long, medium and short term trends* which include cycles greater than nine, five and three years, respectively. For quarterly series, the corresponding NVR´s as well as the cycles in quarters and years are the following,

TREND	NVR	CYCLES	QUARTERS	YEARS
SHORT	0.1	0.0888	11.26	2.81
MEDIUM	0.01	0.0500	20.00	5.00
LONG	0.001	0.0281	35.59	8.90

In Figure 4, plots of the three trend derivatives of the Spanish GNP corresponding to the above NVR values are presented. As before, shaded areas indicate recessions according to the rules established earlier. Out of the three candidates, only the medium-term trend derivative (MTDGDP) adequately captures the historical chronology of the Spanish business cycles. Points A, C and E correctly anticipate recessions, while points B,D and F rightly anticipate recoveries. As expected, the long-term trend derivative (LTDGDP) is too smooth and misses the first two recessions and the last recovery. On the contrary, the short-term trend derivative (STDGDP) correctly identifies incoming recessions (points A^*, B^* and I^*) and recoveries (points B^*, F^* and J^*) but generates two intermediate cycles that did not occur (points D^*/E^* and G^*/H^*)[10].

**Insert Figure 4*

According to these results, the MTDGDP seems an adecuate candidate to represent the Spanish business cycle chronology over the last 25 years. It not only complies with the conditions established in section 3.2; but it also seems to be a good approximation to the quarterly growth rates

[10] Note, however, that had we choose the characterize the 78.4 - 81.2 recession as two separate recession periods (as in figure 1) only the STDGNP would have correctly identified the event.

of Spanish GDP [11]. In the following section, we shall use the medium-term trend derivatives of the different aggregates to analyze certain quantitative stylized facts that may help in characterizing the Spanish business cycle fluctuations.

5. STYLIZED FACTS USING TREND DERIVATIVES AS A BUSINESS CYCLE INDICATOR

We are using the medium-term trend derivative of GDP (MTDGP) as the trend-cycle indicator that describes the Spanish economy's business cycles from 1970 to 1994. In order to obtain the "stylized" facts that can be used as a benchmark to examine the validity of different theoretical models, we proceed to obtain the medium-term trend derivative (using NVR=0.01, the same as the one used with the GDP in the previous section) for a set of Spanish macroeconomic variables: private consumption, public consumption, equipment investment, construction investment, exports, imports, net exports, employment and GDP's price deflactor.

In Figure 5 the actual data for all these variables are depicted. In Figure 6 the trend derivative of each of these variables together with the GDP's trend derivative are also shown. In Table 4 the basic statistics for all estimated trend derivatives are presented. For the complete (1970.2 - 1994.4) sample, only public consumption is less volatile than the GDP. Employment has a volatilty similar to the one shown by the GDP. Private consumption is slightly more volatile than GDP, while the other variables show a significantly higher volatility than GDP. The fact that private consumption does not show a lower volatility than income seems to contradict the permanent income hypothesis. This feature of consumption behaviour might be explained by the presence of wealth effects in consumption decisions in a context with relatively high volatility of asset prices.

Insert Figures 5 and 6

If we split the sample into two periods, the first one from 1970.2 to 1981.4 and the second one from 1982.2 to 1994.4 things change slightly. Private consumption is more volatile than GDP in the second sub-period while it had a similar volatility than income in the first sub-period, a fact that might be explained by a higher volatility of asset prices in the second sub-period[12]. Employment, on the other hand, is less volatile than GDP in the first sub-period whereas has a significantly higher volatility through the second sub-period. This difference can be explained by lower dismissal costs in the second sub-period. Higher dismissal costs produces a lower increase of employment in "good" times and a lower job destruction in "bad" times (see Rogerson, 1990). The difference in dismissal costs in both sub-periods are due to two factors: a) in 1984 a significant change in labour legislation was introduced by which the use of temporary contracts (as opposite to indefinite contracts) was generalized; and b) from 1975 to 1978 actual dismissal costs were high not only because severance payments were high (being most of the labour contracts permanent), but also

[11] Contrary to what happened in the case of the HP cycle, the contemporaneous correlation between the MTDGDP and the quaterly GDP growth rates is quite high (r=0.861). Also, the MTDGDP cyclical components is less volatile than the GDP growth rate. The ratio of their respective standard errors is 0.83.

[12] The only relevant asset for whom data is available for the whole sample are stocks. Stocks' prices are indeed more volatile in the second period than in the first one. The standard deviation of the first difference of the natural logarithm of Madrid's Stock Market Index (monthly data) was .07 between 1982 and 1994, while in the 1970-81 period was .05.

because of the conjunction of some political and economic factors. Namely, the political transition from dictatorship to democracy generated high social uncertainties that discouraged employment adjustment and, on the other hand, this lack of adjustment was made easier by the presence of negative real interest rate from 1975 to 1978 (see Sebastián and Servén, 1986).

Insert Table 4

In Table 5 cross correlations between the trend derivative of GDP and the trend derivatives of the macroeconomic variables chosen are shown. Again, computations have been made for the whole sample and for the two sub-periods defined above. Private consumption, public consumption, both types of investment, imports and employment show a high positive correlation with GDP in the three sample periods. One would then say that these variables show a strong pro-cyclical behaviour. Exports seem to be uncorrelated with GDP along the cycle when the whole sample is considered. Its cross correlation coefficients (at all leads and lags) are not different from zero. Things change completly between the two sub-samples. Exports show a positive correlation in the first sub-period and strong negative correlation in the second sub-period. One of the factors behind this difference is that in the second period real exchange rate was markedly pro-cyclical, experiencing a strong apreciation through the long expansion period, especially from 1983.4 to 1992.1, and undergoing a strong depreciation in the last recession, from 1992.2 to 1993.4. Real exchange rate behaviour in the first sub-period was much less pro-cyclical. A strong negative relationship between real exchange rate and exports is well established using Spanish data.

Insert Table 5

Price level, represented by GDP's deflactor is uncorrelated with GDP when the whole sample is considered, but, again, we obtain a different picture when we split the sample period. It is still uncorrelated in the second sub-period, but show negative correlation in the first sub-period. This seems consistent with the idea that fluctuactions in the first sub-period were mainly caused by supply factors (oil shocks, wage shocks, etc.) while in the second sub-period both demand and suply factors were present.

As shown by Canova (1991), the characterization of a variable as pro-cyclical or counter-cyclical or as having a higher or lower volatility is not independent of the detrending procedure used, being arbitrary the choice of a specific procedure. In our case, the arbitrarieness exists in the choice of the trend-cycle, by the use of a specific value of the NVR. The discussion above on the cyclical properties of selected macroeconomic variables was based on trend cycles estimated with a NVR equal to 0.01. The reasons to choose such value were stated in the previous section. But in order to be sure that we are making a consistent characterization of the cyclical properties of the variables, we should check whether different trend-cycles characterizations, obtained using different values of the NVR, generate similar cyclical properties of the variables. For this purpose, we have carried on a *sensitivity analysis* using trend-cycles derived for different NVR values, say 0.1 and 0.001, and compare the results obtained with those corresponding with the medium term one. (NVR= 0.01). As regards *relative volatilities*, the results are considerable robust across different NVR values. In some cases, like private and public consumption numerical differences are only found in the third decimal point. Only in net exports, imports and construction investment some numerical differences are found. As regards *cyclical behaviour* the cross-correlation function results between the GDP trend-cycle and the ones corresponding to the other selected macroeconomic variables are extremely robust across NVR values. Not only, the same qualitative message hold for the three NVR values, but also the quantitative results are remarkably similar[13].

6. CONCLUSIONS

In this paper we have analysed an alternative characterization of the Spanish business cycles using available quaterly data from 1970 to 1994. In order to accomplish this goal, we have established a restricted alternative criteria to the one used by the NBER to decide a business cycle chronology of the Spanish economy during the last 25 years. The dates of recessions and expansions show a remarkable high variability duration of both type of movements, a feature common to other economy's experiences for the same time period. Once the reference dates were constructed, our statistical model is later applied to verify if it could broadly replicate the features of the Spanish business cycles and reproduce the turning points from a historical perspective.

A few conclusions can be derived from this exercise. First, blind use of certain prefiltering procedures as the solely detrending method in compiling business cycle statistics and characterizing comovements among economic aggregates could be dangerous and misleading. In particular, the results of applying the HP filter to the Spanish case are revealing: two recessions periods are identified that are not present in the data. The second one indicates a considerable false alarm at times when the Spanish economy was growing around 0.8% per quarter. Second, out of the three subjective priors considered, the medium-term cyclical trend model (NVR = 0.01) was an adequate candidate to represent the Spanish business cycle chronology for this particular time period. It not only complied with the conditions established in section 3.2; but also seems to be a good approximation to the quaterly growth rates of Spanish GDP. The other alternatives, either miss recessions and recoveries or generates cycles that did no occur.

Third, using trend derivatives (for the medium-term model, NVR=0.01) of selected macroeconomic variables, a characterization of Spanish business cycles along the period of reference is made. In particular, volatility of macroeconomic variables relative to GDP and pro-cyclicity or counter-cyclicity of these variable are computed; both for the whole sample and for different sub-samples. An explanation of the most striking results is put forward. Fourth, given the relevance of Canovas' (1991) warning about the existence of arbitrariness in any procedure to characterize business cycles, sensitivity analysis using alternative values of the NVR is carried out, concluding that relative volatility and cross-correlation functions are hardly affected by the particular NVR used.

[13] Numerical results for the sensitivity analysis are available from the authors upon request.

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TABLE 1

	GDP 1970 - 1994								
	QUATERLY RATE OF CHANGE				RATE OF CHANGE OF ONE YEAR FLOW				
	1	2	3	4	1	2	3	4	
70	-	0.008	0.009	0.009	-	-	-	-	70
71	0.010	0.014	0.015	0.018	0.009	0.010	0.012	0.014	71
72	0.022	0.022	0.020	0.020	0.017	0.019	0.021	0.021	72
73	0.019	0.017	0.015	0.017	0.020	0.019	0.018	0.017	73
74	0.017	0.011	0.008	0.002	0.017	0.015	0.013	0.009	74
75	-0.003	-0.003	0.002	0.008	0.004	0.001	-0.001	0.001	75
76	0.011	0.011	0.010	0.009	0.005	0.008	0.010	0.010	76
77	0.008	0.004	0.003	0.006	0.009	0.008	0.006	0.005	77
78	0.005	0.003	0.002	-0.000	0.004	0.004	0.004	0.002	78
79	-0.004	0.000	0.003	0.005	0.000	-0.001	-0.000	0.001	79
80	0.011	-0.002	-0.003	-0.002	0.005	0.004	0.003	0.001	80
81	-0.001	0.002	0.002	0.002	-0.002	-0.001	0.000	0.001	81
82	0.005	0.005	0.005	0.005	0.003	0.004	0.004	0.005	82
83	0.007	0.007	0.004	0.004	0.005	0.006	0.006	0.005	83
84	0.003	0.003	0.004	0.005	0.004	0.003	0.003	0.004	84
85	0.008	0.007	0.008	0.007	0.005	0.006	0.007	0.007	85
86	0.005	0.009	0.011	0.012	0.007	0.007	0.008	0.009	86
87	0.015	0.016	0.015	0.013	0.012	0.014	0.015	0.015	87
88	0.012	0.013	0.010	0.010	0.014	0.013	0.012	0.011	88
89	0.012	0.013	0.012	0.010	0.011	0.011	0.012	0.012	89
90	0.009	0.008	0.007	0.007	0.011	0.010	0.009	0.008	90
91	0.004	0.004	0.006	0.005	0.006	0.006	0.005	0.005	91
92	0.003	-0.000	-0.003	-0.006	0.005	0.003	0.001	-0.002	92
93	-0.004	-0.003	0.000	0.004	0.003	-0.004	-0.003	-0.001	93
94	0.007	0.007	0.006	0.008	0.002	0.005	0.006	0.007	94

TABLE 2

SPANISH ECONOMY BUSINESS CYCLES 1970 - 1994		
PERIOD	PHASE	DURATION Quarters
- 1974.4	EXPANSION	
1975.1 - 1975.3	RECESSION	3
1975.4 - 1978.3	EXPANSION	12
1978.4 - 1981.2	RECESSION	11
1981.3 - 1992.1	EXPANSION	43
1992.2 - 1993.4	RECESSION	7
1994.1 -	EXPANSION	

Table 3a. NVR values and cycles per sample.

NVR	CYCLES	QUARTERS	YEARS
1	0,1580	6,33	1,58
0,1	0,0888	11,26	2,81
0,05	0,0747	13,39	3,35
0,01	0,0500	20,02	5,00
0,005	0,0420	23,80	5,95
0,001	0,0281	35,59	8,90
0,0005	0,0236	42,33	10,58
0,0001	0,0158	63,29	15,82
0,00005	0,0133	75,27	18,82
0,00001	0,0089	112,56	28,14
0,000001	0,0050	200,16	50,04

Table 3b. Cycles (in years and quarters) and NVR Values.

YEARS	QUARTERS	CYCLE	NVR
1	4	0,2500	6,2695
2	8	0,1250	0,3918
3	12	0,0833	0,0774
4	16	0,0625	0,02449
5	20	0,0500	0,01003
6	24	0,0417	0,004838
7	28	0,0357	0,002611
8	32	0,0313	0,001531
9	36	0,0278	0,000956
10	40	0,0250	0,0006270
15	60	0,0167	0,0001238
20	80	0,0125	0,00003918

TABLE 4

TREND DERIVATES OF SELECTED MACROECONOMIC VARIABLES Basic Statistics									
	1970.2 - 1994.4			1970.2 - 1981.4			1982.1 - 1994.4		
	MEAN	STD	RELATIVE VOLATILITY	MEAN	STD	RELATIVE VOLATILITY	MEAN	STD	RELATIVE VOLATILITY
GDP	0.7	0.52	1.00	0.8	0.61	1.00	0.6	0.42	1.00
PRIVATE CONSUMPTION	0.7	0.61	1.17	0.8	0.67	1.10	0.6	0.53	1.28
PUBLIC CONSUMPTION	1.2	0.40	0.77	1.3	0.27	0.44	1.1	0.14	0.34
EQUIPMENT INVESTMENT	0.6	1.87	3.60	0.7	1.41	2.31	0.5	2.22	5.33
CONSTRUCTION INVESTMENT	0.5	1.36	2.62	1.5	1.02	1.67	0.8	1.55	3.74
EXPORTS	1.7	0.86	1.65	1.8	0.97	1.59	1.7	0.75	1.81
IMPORTS	1.6	1.38	2.65	1.4	1.28	2.10	1.9	1.43	3.43
NET EXPORTS	0.08	1.77	3.40	0.4	1.39	2.28	-0.2	2.02	4.86
GDP's PRICE DEFLACTOR	2.6	1.11	2.13	3.4	0.91	1.49	1.8	0.57	1.37
EMPLOYMENT	-0.02	0.55	1.06	-0.2	0.40	0.66	0.1	0.63	1.52

TABLE 5

CROSS CORRELATIONS OF GDP's TREND DERIVATE WITH SELECTED MACROECONOMIC VARIABLE's TREND DERIVATES									
	1970.2 - 1994.4			1970.2 - 1981.4			1982.1 - 1994.4		
	1	0	-1	1	0	-1	1	0	-1
PRIVATE CONSUMPTION	0.95	0.96	0.93	0.95	0.96	0.93	0.93	0.94	0.89
PUBLIC CONSUMTION	0.71	0.66	0.59	0.61	0.52	0.43	0.90	0.87	0.80
EQUIPMENT INVESTMENT	0.78	0.81	0.82	0.85	0.86	0.85	0.85	0.91	0.94
CONSTRUCTION INVESTMENT	0.79	0.81	0.80	0.92	0.94	0.93	0.96	0.98	0.96
EXPORTS	-0.10	-0.02	0.04	0.32	0.43	0.49	-0.82	-0.81	-0.75
IMPORTS	0.80	0.80	0.80	0.87	0.88	0.85	0.86	0.89	0.88
NET EXPORTS	-0.67	-0.64	-0.60	-0.58	-0.51	-0.44	-0.91	-0.93	-0.90
GDP's PRICE DEFLACTOR	-0.08	-0.12	-0.16	-0.48	-0.57	-0.63	0.06	0.06	0.07
EMPLOYMENT	0.83	0.83	0.82	0.98	0.99	0.96	0.98	0.99	0.96

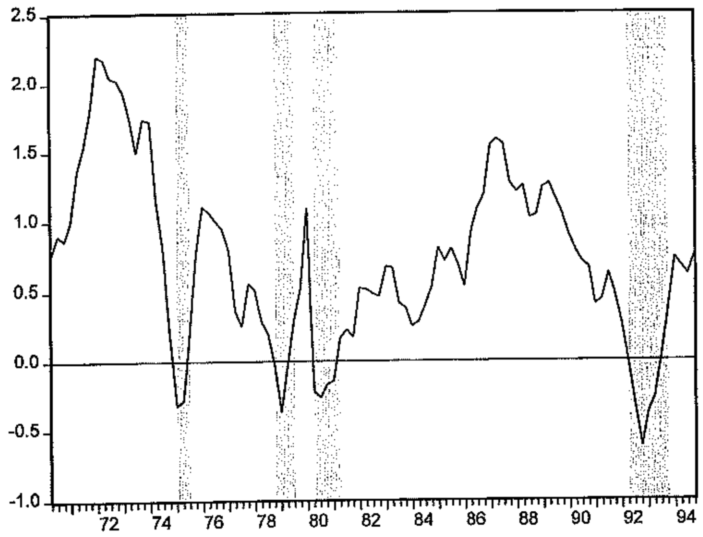

Figure 1: Quarterly Growth Rates of Spanish GDP 1970.2 - 1994.4

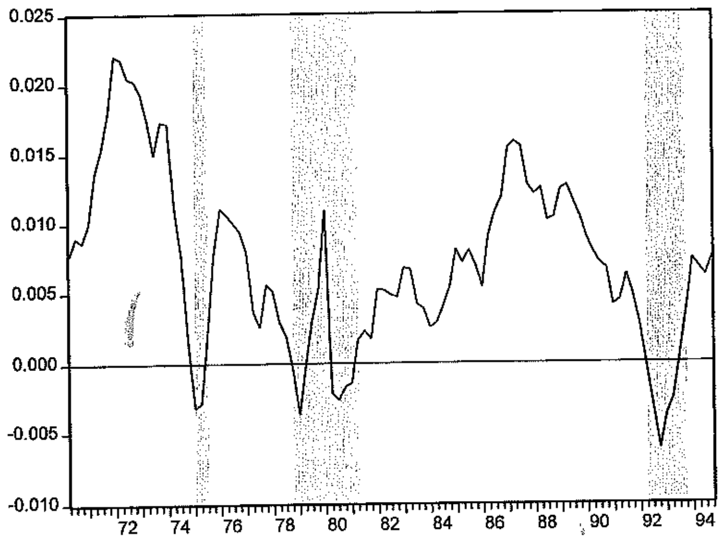

Figure 2: Quarterly Growth Rates of Spanish GDP 1970.2 - 1994.4

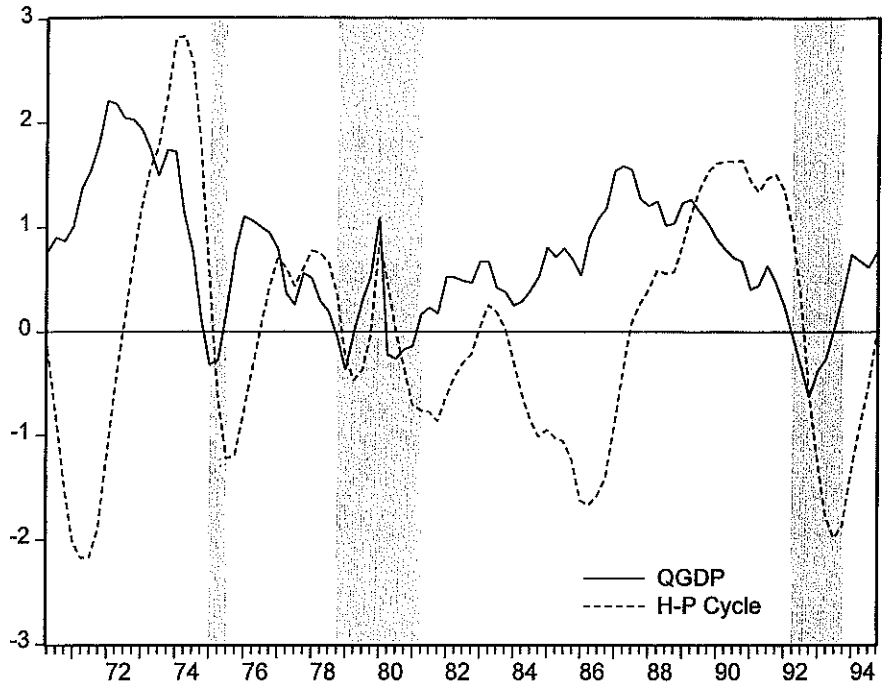

Figure 3: Quaterly Growth Rates of Spanish GDP and H-P Cycle 1970.2 - 1994.4

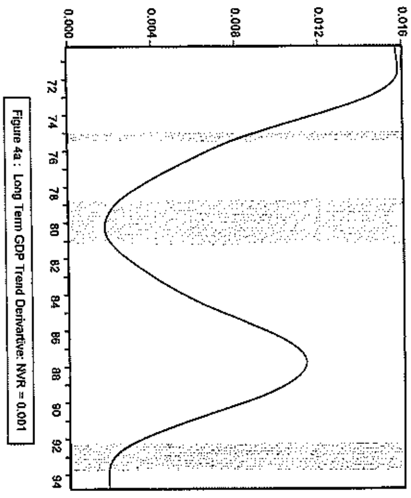

Figure 4a: Long Term GDP Trend Derivative: NVR = 0.001

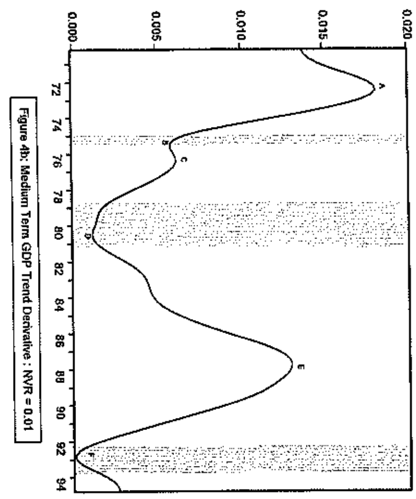

Figure 4b: Medium Term GDP Trend Derivative : NVR = 0.01

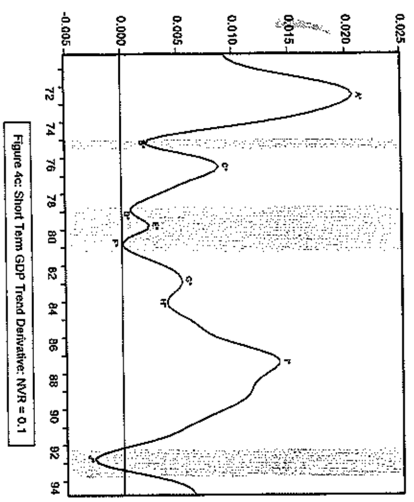

Figure 4c: Short Term GDP Trend Derivative: NVR = 0.1

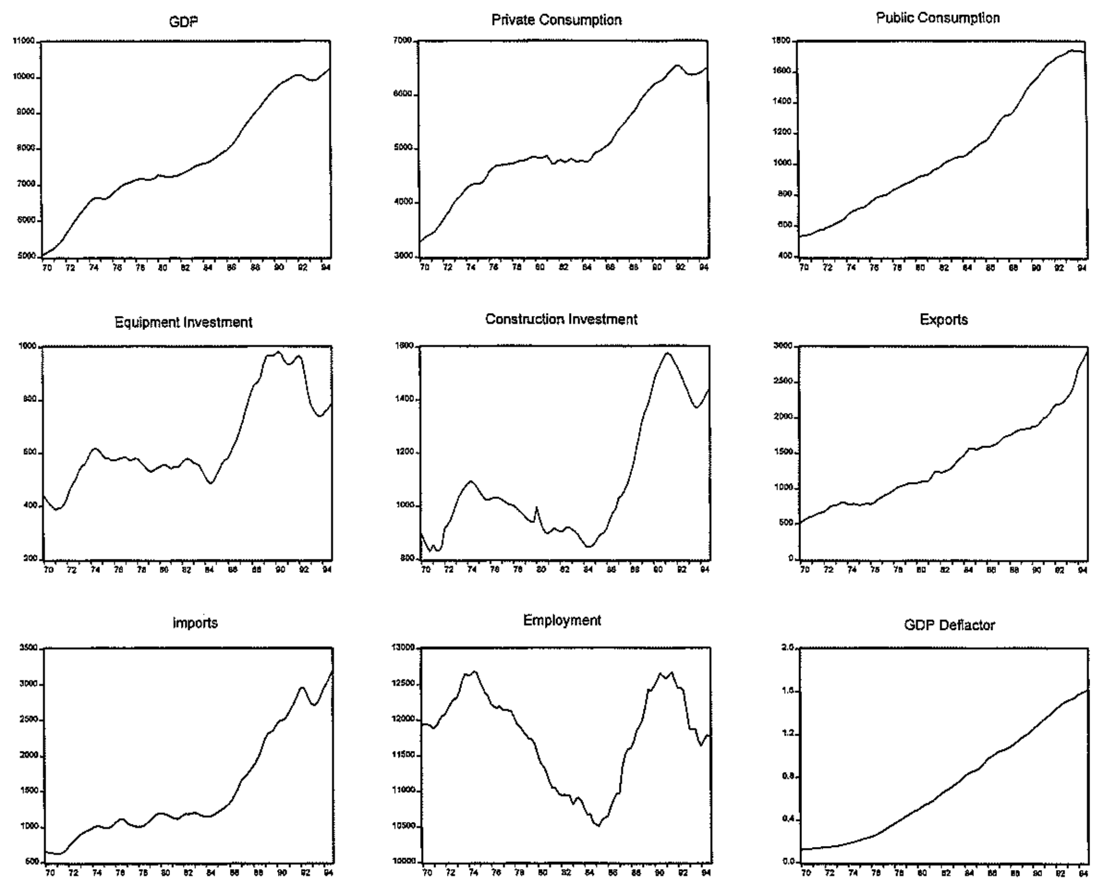

Figure 5: Selected Macroeconomic Variables of the Spanish Economy 1970.1 - 1994.4

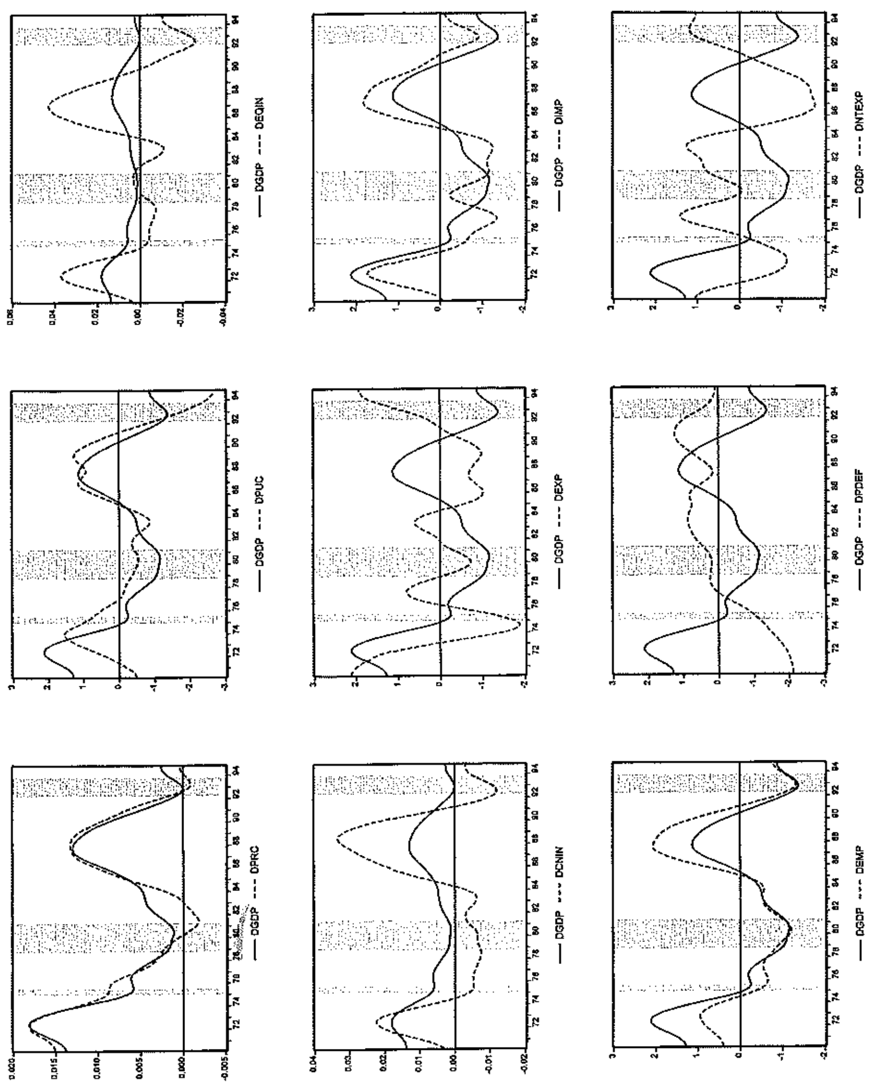

Figure 6: Trend Derivates Plots of the Selected Macroeconomic Variables of the Spanish Economy 1970.2 - 1994.4

DOCUMENTOS DE TRABAJO DEL *ICAE*

9301 *"Análisis del comportamiento de las cotizaciones reales en la Bolsa de Madrid bajo la hipótesis de eficiencia"*. Rafael Flores. Diciembre 1992. (Publicado en Estadística Española, Vol 36, nº 136, 1994)

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