A Note on the Diachronic Behaviour of the OECD Forecasts for Greece.

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Abstract.

In this short paper a Gamma distributed lags model is used to study the diachronic responses between the actual data and the forecasts supplied by OECD the last 27 years for the case of the Greek Economy. According to our results we verified the potentials of the OECD to improve its forecasts as the size of the foreseeable period decreases. Irrespective of how good are the OECD's forecasts, there is certainly much room for further improvement.

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1. Introduction.

Every year and half-year the OECD provides projections of several economic variables, published in the OECD Economic Outlook. Because these forecasts are used extensively by governmental and nongovernmental organizations, it is useful to examine their accuracy. The assessment provided here differs in approach from earlier assessments, but its purpose is similar. Since 1967 the Organisation for Economic Co-operation and Development (OECD) has published semi-annual forecasts of economic activity in its seven largest Member countries Canada, France, Germany, Italy, Japan, the UK and the USA. These forecasts, the last years extended to include all country members of the Organisation, covering the major components of demand and output, inflation and the balance of payments. According to Llewellyn J and Arai H. ,(1984) the OECD aims to "produce an integrated set of internationally consistent country forecasts, taking into account the linkages between economies". Across the years the forecasting methods employed by the OECD have evolved from the systematic but relative informal "pooling or confronting" of Member country forecasts first dubious by Mc Mahon (1965), to a current large INTERLINK system of formal macroeconometric models which ensures consistency in forecasting world trade flows, capital flows and domestic economic developments. Llewellyn J and Arai H.,(1984) explain the structure of INTERLINK and how the system is used for forecasting; OECD forecasting techniques are summarised in the Technical Appendix to each issue in the OECD Economic Outlook; details of relevant research appear from time to time in the OECD Economics and Statistics Department's Working Papers and Occasional Studies, for example Richardson (1988), Artis, M.J (1988), Ballis B., (1989), Barrionuevo, (1993), and Koutsogeorgopoulou, V. (2000). The OECD publishes its forecasts twice a year in the June/July and December issues of OECD Economic Outlook making available one-two and three step ahead forecasts. The forecasts cover the current and the next calendar years.

Although a lot of attention has been paid to analyse the performance of these one-two and three step ahead OECD forecasts using standard forecasting performance

measures (to mention only a few of these studies : Ash J. C. K.,et all (1990,1991) Ballis B., (1989), Holden K. and Peel D.A., (1985) , (1990) ,Holden K., et all (1987), Llewellyn J. and Arai H., (1984). Richardson P., (1988),Smyth D.J.,(1983) , Smyth D.J. and Ash J.C.K., (1981) , Artis, M.J. (1988), Barrionuevo,(1993), DeMasi, P.(1996), Kreinin, M.(2000), Koutsogeorgopoulou V. (2000), Vuchelen, J. and Gutierrez, M.(2005)), little has been done to analyse the diachronic relationships between these forecasts and the actual data. Traditional error measures, such as mean square error, do not provide a reliable basis for comparison of forecasting methods (for empirical evidence on this, see Armstrong and Collopy 1992).

In this paper , using Greek data ,we analyse the diachronic relationship between the actual data and the one-, two- and three-step ahead OECD forecasts, henceforth denoted by F_{1t} , F_{2t} and F_{3t} respectively, for seven macroeconomic variables. The model we use to study the above diachronic relations is a Gamma Distributed Lags model (Schmidt Peter (1974)).

For the case of Greece to date, we have not seen studies of this kind on the forecasting ability of the OECD. In a lot of studies the analysis of the OECD forecastst performance for Greece is only a part of a panel of countries and usually refer to a few economic magnitudes using some standard (Theil (1966)) forecasting performance measures and tests Exception are the studies of Tserkezos Dik.(1996a, 1996b, 1996c, 1997 ,and 1998) were the diachronic behaviour of the OECD forecasts is compared with the actual data. Some of these studies have been conducted concerning the forecasting ability of the Greek Ministry of National Economy Forecasts (Tserkezos (1997), (1996b)) for basic macroeconomic variables of the Greek Economy and some of these studies concerning the forecasts of the OECD for Greece . Although these studies use a different sample period, appears to indicate that there is still much room for improvement.

This paper is organised as follows: In section 2 the available data and the suggested forecasting measures are discussed in some detail. The empirical results are

presented and discussed in section 3. Conclusions and some thoughts for further research are given in section 4.

2. Data and Forecasts Measures.

The OECD publishes annual forecasts for the ensuing eighteen months (Three half-years). Thus we evaluate one, two and three step ahead forecasts, labeling F_{1t}, F_{2t} and F_{3t} respectively. In each case let F_{jt}, j=1,2,3 be the forecasted time series and A_t (t=1,2,...,T) be the time series of corresponding outcomes. To give a picture of the available data, in figure 1 we present the one-two- and three-step ahead OECD forecasts and the actual persantage changes of the Greek Gross Domestic Product (GDP) at 1995 constant Market Prices during the period 1980-2006.

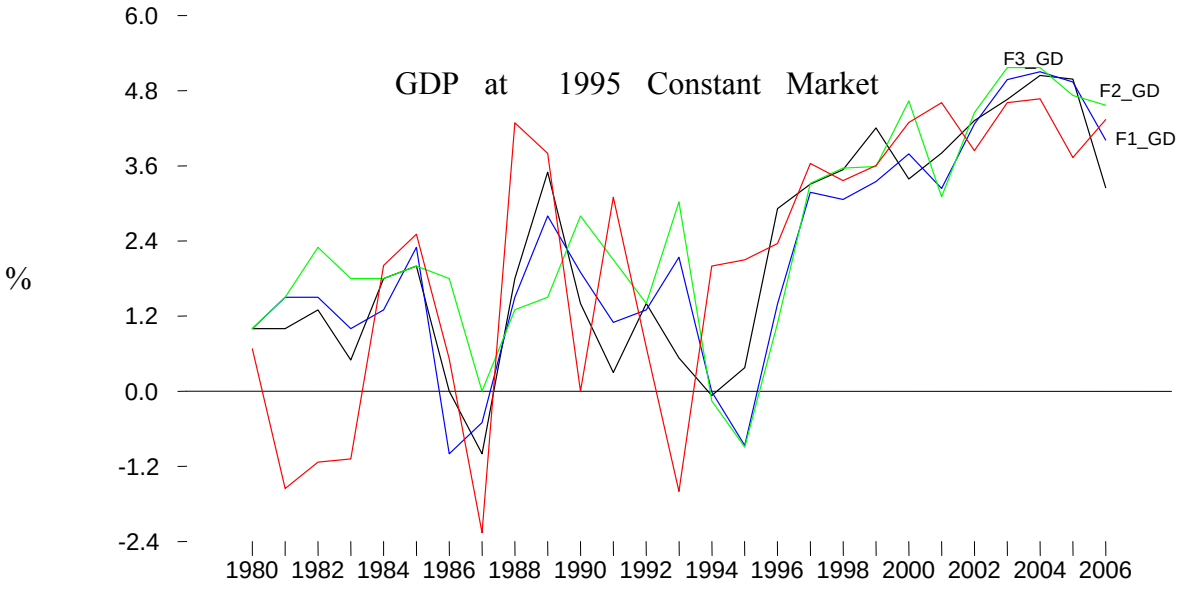

Figure 1. One-, two- and three-step ahead OECD forecasts and the actual persantage changes of the Greek GDP at 1995 constant Market Prices.

In order to formulate the diachronic relationship between the forecasts and the actual data (A_t) a Gamma Distributed Lags model is used (Schmith (1974)):

$$F_{jt} = \gamma_j + \sum_{i=0}^{\infty} \beta_{ji} A_{t-i} + \varepsilon_{jt} \quad , \text{t} = 1980,...,2006 \tag{1}$$

with

$$\beta_{ji} = \beta_j w_{ji} = (i+1)^{a_j/(1-a_j)} \lambda_j^{\,i} \quad j = 1,2,3,... \qquad i = 0,1,2... \tag{2}$$

$$0 \le \alpha_j < 1 \text{ and } 0 \le \lambda_j < 1 \tag{3}$$

and

A_t : Actual data

F_{jt} : One-, two- and three-step ahead OECD forecasts (F_{1t} , F_{2t} and F_{3t}) for each variable.

γ_j, β_j *and* λ_j : *Parameters under estimation.*

To give a picture of the possible reactions of the OECD forecast to the actual data , in figure 2, we present the alternative reactions weights based on a Gammma Distributed lags specification , for different value of the parameters a_j and λ_j in the intervals $0 < a_j \le 1$ and $0 < \lambda_j \le 1$.

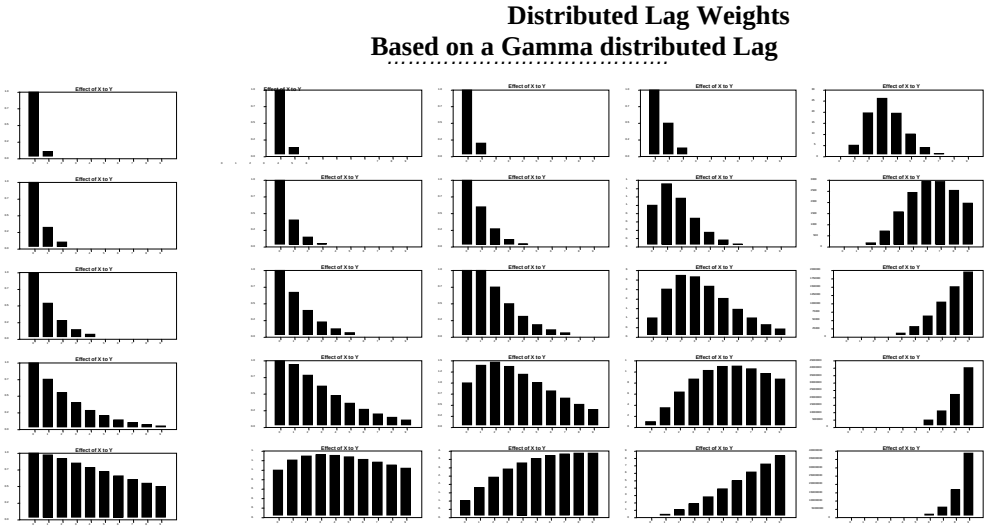

Figure 2. Possible reactions weights based of the Gamma Distributed Lags Model specified by (1)-(2) for different values of the parameters a and λ in the intervals $0 < a \leq 1$ and $0 < \lambda \leq 1$.

Estimation of the specification (1) –(2) give us the opportunity to estimate the average lag reactions of the OECD forecasts to the actual data as follows:

$$\text{Average Lag Reactions: } \hat{z}_j = \frac{\sum_{i=0}^{\infty} i\hat{\beta}_{ji}}{\sum_{i=0}^{\infty} \hat{\beta}_{ji}} \frac{\sum_{i=0}^{\infty} i\hat{\beta}_j \hat{w}_{ji}}{\sum_{i=0}^{\infty} \hat{\beta}_j \hat{w}_{ji}} = \frac{\sum_{i=0}^{\infty} i\hat{\beta}_j (i+1)^{\frac{\hat{\alpha}_j}{(1-\hat{\alpha}_j)}} \hat{\lambda}_j^{\,i}}{\sum_{i=0}^{\infty} \hat{\beta}_j (i+1)^{\frac{\hat{\alpha}_j}{(1-\hat{\alpha}_j)}} \hat{\lambda}_j^{\,i}} \qquad (5)$$

with

$$j = 1,2,3(\textit{Number of Forecasts})$$
$$\infty = \textit{Number of Distributed Lags}$$

Good forecasts adjustment to the actual data assumes a value of z_j close to zero. If z_j is getting greater than zero the adjustment process of the forecasts to the actual is getting slower.

The use of the above specification between the forecasts and the actual data can be criticized from different points of view. We must clarify that we use this specification not to identify possible causality effects between these variables. From theoretical reasons there are not causality effects, although someone could comply that there is a

sort of causality running from the actual data to the forecasts. We simply use the above specification to schedule the diachronic relations between the actual data and the OECD forecasts. All the data are used as percentages and are stationary time series, avoiding problems of pseudo correlations between the variables. Finally the use of a gamma distributed lags model instead of a free lag distribution between the variables does help us from the methodological point of view due to the fact that the available data are not enough to support techniques relaying absolutely to the available data in determining the shape of the distribution between the actual and the forecasted data. In order to estimate efficiently the parameters of the above specification we followed an iterative process suggested by Schmith P, (1974) to minimize the sum:

$$\min_{\hat{\gamma}_j,\hat{\beta}_{ji},\hat{\lambda}_j} \sum_{t=1}^{T}(F_{jt}-\hat{\gamma}_j-\sum_{i=0}^{\infty}\hat{\beta}_{ji}A_{t-i})^2 \qquad (6)$$

Subject to :

$$\hat{\beta}_{ji}=\hat{\beta}_j(i+1)^{\frac{\hat{\alpha}_j}{(1-\hat{\alpha}_j)}}\hat{\lambda}_j^{\,i} \qquad (7)$$

The choice of the appropriate estimates of the parameters $\hat{\beta}_{ji}$ for different values of the parameters $a_{j,}$ *and* λ_j in the intervals $0<a_j\le 1$ and $0<\lambda_j\le 1$. has been made using the well known Akaike Information Criterion (Akaike, 1973)

$$Akaike=-2\log L/T+2K/T \qquad (8)$$

where L is the Loglikelihood function of (1) , T is the number of the available observations and K is the number of the regressors

More information about this minimization procedure is available by request, although some very interesting references can be found in Schmith P.,(1974)., Harvey, C,(1981),Maddala G.,(1977) and Pindyck S. and Rubinfeld D. (1981). The application of a Seemingly Unrelated Regression System (SURE) technique to take into account the possible information's contained in variance-covariance matrix of the

disturbance terms of the one-, two- and three-step ahead OECD forecasts (F_{1t} , F_{2t} and F_{3t}) for each variable, did not improve our results.

3. Empirical Results.

The data used in this paper have been collected from various issues of OECD Economic Outlook. They are annually and cover the period 1986 – 2006. We analyse the OECD forecasts for seven variables as they presented in the first collum of Tables 1 and 2. We present the estimation results for the coefficients α and λ, for the one, two and three step ahead OECD forecasts, for the seven macroeconomic variables.

TABLE 1.

Gamma Lag Model Parameter Estimates (λ parameter estimates)

Forecasted Variables	One Step Ahead Forecasts	Two Step Ahead Forecasts	Three Step Ahead Forecasts
1. Private Consumption	0.01 [1.74]	0.01 [1.75]	0.11 [1.66]
2.Gross Fixed Capital Formation	0.01 [2.56]	0.01 [1.46]	0.11 [2.57]
3.Total Domestic Demand	0.11 [1.4]	0.11 [0.9]	0.21 [2.5]
4. Exports of Goods and Services.	0.51 [2.98]	0.31 [3.4]	0.81 [1.64]
5. Imports of Goods and Services.	0.30 [1.21]	0.31 [1.85]	0.81 [1.74]
6. GDP at Market Prices.	0.11 [1.64]	0.31 [1.69]	0.61 [4.2]
7. GDP Implicit Price Deflator.	0.01 [0.12]	0.01 [0.09]	0.01 [0.24]

Source : Author's estimates(t-statistics in brackets)

TABLE 2.

Gamma Lag Model Parameter Estimates.(α parameter estimates)

Forecasted Variables	One Step Ahead Forecasts	Two Step Ahead Forecasts	Three Step Ahead Forecasts
1. Private Consumption	0.01	0.81	0.71
	[3.5]	[27.5]	[25.4]
2.Gross Fixed Capital Formation	0.81	0.80	0.51
	[15.6]	[14.6]	[3.7]
3.Total Domestic Demand	0.31	0.11	0.50
	[28.8]	[9.9]	[11.4]
4. Exports of Goods and Services.	0.51	0.71	0.01
	[0.5]	[1.01]	[0.02]
5. Imports of Goods and Services.	0.81	0.81	0.11
	[0.29]	[0.27]	[0.91]
6. GDP at Market Prices.	0.61	0.11	0.01
	[13.9]	[1.74]	[0.24]
7. GDP Implicit Price Deflator.	0.01	0.01	0.01
	[1.15]	[0.88]	[1.18]

Source : Author's estimates(t-statistics in brackets)

The results of our estimations are the ones we have expected. They confirm that on the average the predictions adjust better to the real data when the forecast period is decreased. Especially , with the basis of the adjustment coefficients α and λ, results that the quickest adjustment of forecasts to outcomes is presented in the one step ahead forecast. Following this step are the two and three step ahead forecasts respectively

The results for each of the economic time series differently are also very interesting. In order to study the estimates of Table 1 and 2 efficiently, in Table 3 we present the corresponding average lag coefficients.

TABLE 3.

Average Lag Distributions Using the Gamma Distributed Model Parameter Estimates.

Forecasted Variables	One Step Ahead Forecasts	Two Step Ahead Forecasts	Three Step Ahead Forecasts
1. Private Consumption	2,009676	2,261382	2,221606
2.Gross Fixed Capital Formation	1,709548	2,082172	2,483516
3.Total Domestic Demand	2,469747	2,357487	2,283264
4. Exports of Goods and Services.	5,028081	5,24835	5,810236
5. Imports of Goods and Services.	3,450376	3,452793	3,253651
6. GDP at Market Prices.	1,047536	2,21606	2,063845
7. GDP Implicit Price Deflator.	0,733274	0,914165	1,321426

Source : Author's estimates.

The results of our estimates of the average lag distributions (3) on Table 3 are revealing and give another dimension on the dynamic characteristics of the OECD's forecasting ability.

According to the results of Table 3 the variable with the most drastic improvement of the OECD forecasts to outcomes and the lower average lag

coefficient is the GDP Implicit Price Deflator. Other economic time series, such as the Gross Fixed Capital Formation and Exports of Goods and Services have also improved quite rapidly the F_{1t} , F_{2t} and F_{3t} forecasts to the outcomes although their average lag coefficients are not that low compared with analogous average lag coefficients of other variables of Table 3. GDP at Market Prices and Private Consumption have only a partial forecasting improvement from F_{3t} directly to F_{1t} forecasts. Quite disappointed is the improvement of the F_{1t} , F_{2t} and F_{3t} forecasts to outcomes in the case of the variable of Imports of Goods and Services and the Total Domestic Demand.

Comparing the results of the Table 3 and Table 4 (Appendix) we may conclude that there are not contradictions. Our results are substitutive to the results on Table 2, where we analyze the OECD forecasting performance using 'standard' forecasting performance criteria. For example the variable with the worst forecasting accuracy according to the estimates of Table 3, is the variable Imports of Goods and Services. According to our results this variable has a quite high average lag coefficient and improves the forecasts F_{1t} , F_{2t} and F_{3t} to the outcomes , a result which is on the line with the results of Table 3 and especially with the Bias Proportion, the Variance Proportion and the Covariance Proportion of the Mean Square Error (MSE) in the three last columns of Table 4.

Lastly, a further confirmation of the quantitative performance of the OECD forecasts is provided by estimating the geometric mean of the average lag coefficients of the seven economic series.

$$\text{Geometric Mean of the Avarage Lags : } GM_{j=1,2,3} = \prod_{i=1}^{k=7} (\hat{\lambda}_{ij})^{1/k} \qquad (9)$$

Using the estimates of the average lag coefficients on the Table 3 , the Geometric Mean (GM_j) of the OECD's forecasts are 1.93853, 2.31963 and 2.47606 for the one-, two- and three-step ahead OECD forecasts (F_{1t} , F_{2t} and F_{3t}) respectively. The geometric mean average lags are quite high.

This confirms the slow forecasting adjustment of the OECD forecasts and at the same time the inability of the forecasting methods, OECD uses, to rapidly incorporate a large part of the most recent information about the actual values of the economic data. Indepentently of how high or low are the average lag coefficients $\hat{\lambda}_{(k=1,2..,7)(j=1,2,3)}$, our results confirms that for the case of the Greek Economy the OECD forecasts, on the average adjust better to the real data when the forecast period is decreased. Especially, with the basis of the Geometric Mean of the Average Lags coefficients results that the quickest adjustment of forecasts to outcomes is presented in the one step ahead forecast. Following this step, are the two and three step ahead forecasts respectively.

4. Conclusions.

Efforts by the OECD to provide forecasts of crucial variables are clearly warranted. The analysis of the diachronic behaviour of the OECD one- two and three step forecasts F_{1t} , F_{2t} and F_{3t} in relation to the attained sizes is interesting and revealing. Using data of the period 1980 – 2006 for the seven important macro economic variables of the Greek economy we verified the potentials of the OECD to improve the quality of its forecasts as the size decreases of the foreseeable period, and at the same time we located those economic time series which the forecasts of OECD are not greater effective. We refer to the case of the Imports of Goods and Services and the Total Expenditure of the Economy, in which, according to our results, the average lag distributions coefficients of the adaptations F_{1t} , F_{2t} and F_{3t} do not decrease as the forecast period is decreased.

Independently of the ability of the OECD forecasts, for the case of the Greek Economy, to adjust better to the real data when the forecast period is decreased , the average lag coefficients $\hat{\lambda}_{(k=1,2..,7)(j=1,2,3)}$ are still very high confirming that there is certainly room for further quantitative improvement. The geometric average lags are also quite high. This confirms the slow forecasting adjustment of the OECD forecasts to the actual outcomes and at the same time the inability of the forecasting methods it

uses to rapidly incorporate a large part of the most recent information about the actual values of the economic data.

Finally comparing these results with analogous results based mainly on 'standard' forecasting criteria , we may conclude that on the average there are not contradictions. The methodology of testing the diachronic behaviour of the OECD macroeconomic forecasts for Greece, could become even more effective if we use more complicated dynamic linear and nonlinear models, if we take into account possible improvements in the quality of these forecasts and of course to compare the results of Table 1 with the analogous results for OECD forecasts for other countries. Lastly, one of our immediate objectives is to compare the forecasts of the OECD concerning the Greek economy with the analogous forecasts of various organizations as the International Monetary Found (IMF) and the Greek Ministry of National Economy.

APPENDIX A.

Table 4. 'Standard' Forecasting Measures Comparing the actual data and the OECD forecasts.

Variable	**MFE**	**MAE**	**RMSE**	U_{66}	$\mathbf{U^B}$	$\mathbf{U^V}$	$\mathbf{U^c}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Private Consumption.							
One Step Ahead Forecasts	0,45815	1,48250	2,09421	0,35033	0,04786	0,00194	0,95020
Two Step Ahead Forecasts	0,68306	1,55030	2,06346	0,34885	0,10958	0,00076	0,88966
Three Step Ahead Forecasts	0,59351	1,59656	2,08215	0,34534	0,08125	0,00385	0,91490
2. Gross Fixed Capital Formation.							
One Step Ahead Forecasts	0,32212	5,41774	6,94239	0,60293	0,00215	0,50392	0,49393
Two Step Ahead Forecasts	-0,04811	5,58484	7,11284	0,62864	0,00005	0,61351	0,38644
Three Step Ahead Forecasts	-0,55440	5,8292	7,33804	0,63621	0,00571	0,65143	0,34286

		6					
3. Total Domestic Demand.							
One Step Ahead Forecasts	0,35897	1,39768	1,77322	0,28163	0,04098	0,04859	0,91042
Two Step Ahead Forecasts	0,30574	1,50112	1,90770	0,29936	0,02569	0,03109	0,94322
Three Step Ahead Forecasts	0,08097	1,69458	2,12942	0,33802	0,00145	0,11740	0,88115
4. Exports of Goods and Services.							
One Step Ahead Forecasts	2,97797	4,79990	6,36545	0,54935	0,21887	0,16206	0,61907
Two Step Ahead Forecasts	3,07475	4,89577	6,22826	0,53981	0,24372	0,16435	0,59193
Three Step Ahead Forecasts	2,81646	4,85731	5,89020	0,51939	0,22864	0,29988	0,47149

5. Imports of Goods and Services.							
One Step Ahead Forecasts	1,86638	5,37898	7,21472	0,56542	0,06692	0,55935	0,37373
Two Step Ahead Forecasts	1,72205	5,65343	7,20932	0,55444	0,05706	0,50397	0,43898
Three Step Ahead Forecasts	1,86947	5,61633	7,24645	0,56563	0,06656	0,52626	0,40718
6. GDP at Market Prices.							
One Step Ahead Forecasts	-0,07683	1,05829	1,34913	0,23086	0,00324	0,11228	0,88448
Two Step Ahead Forecasts	-0,04903	1,28982	1,64461	0,28264	0,00089	0,07722	0,92189
Three Step Ahead Forecasts	-0,34803	1,43833	1,90149	0,31599	0,03350	0,07997	0,88653
7. GDP Implicit Price Deflator.							
One Step Ahead Forecasts	-0,13333	1,14667	1,48952	0,04147	0,00801	0,01742	0,97456
Two Step Ahead Forecasts	0,86667	2,21333	2,88652	0,08231	0,09015	0,07698	0,83287
Three Step Ahead Forecasts	1,11333	3,00667	3,84716	0,10992	0,08375	0,14844	0,76781

Source: Our Estimates (MFE: Mean Forecast Error , MAE: Mean Absolute Error ,RMSE: Root Mean Square Error , U_{66}: Theil 1966 Inequality Measure, U^B: Bias Proportion of MSE;U^V: Variance Proportion of MSE; U^C: Covariance Proportion of MSE).

Notes

2. All the calculations have been performed using the computer package RATS 6.01 , VAR Econometrics, Inc/Doan Associates. Detailed estimates for the other parameters of the model (5) are available by the author upon request

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