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ARE THE REVISED FORECASTS FOR ROMANIA MORE ACCURATE THAN THE PRELIMINARY ONES DURING THE CRISIS?

Mihaela SIMIONESCU[1]

Abstract: *The research question of this study is: are the revisions of an anonymous Romanian forecaster more accurate than the initial predictions for the current year? Therefore, in order to provide a scientific response to this question, several macroeconomic variables were considered for the crisis period (2009-2013): real GDP growth, inflation rate, unemployment rate and exchange rate. The forecasts are provided for the current year in two versions: spring variant and autumn one. For 2009, the real GDP growth and unemployment rate revisions brought higher errors. Indeed, the crisis start was not precisely anticipated by the expert. For unemployment rate in each year belonging to the period 2009-2012 the revisions showed higher errors. According to predictions accuracy indicators, the forecaster was one which best predicted the exchange rate during 2009-2013. For this variable, all the accuracy measures have the lowest values. All the predictions for all the variables outperformed the naïve forecasts. According to the Harvey-Leybourne-Newbold test, there are not significant differences in accuracy between the initial and the revised forecasts of the real GDP rate and the inflation rate between 2009-2013.*

Key words: *forecasts, accuracy, error, revisions.*

1. Introduction

The main objective of this research is to check if the revisions of the expert forecasts improve the degree of accuracy. Therefore, the traditional forecasts accuracy measures and the modified Diebold-Mariano test for small sample were employed, taking into account that only the predictions during the economic crisis were analyzed (horizon: 2009-2013).

Recent studies have as objective the comparisons between forecasts accuracy [1]. Gorr and Schneider employed the receiver operating characteristic curve for predictions at microeconomic level. The accuracy measure was the partial surface under the ROC graph. The authors recommended the use of complex uni-variate methods for operations-level predictions with large or acceptable changes [5].

Other studies compared the inflation predictions of professional forecasters to those made by the academic environment. For assessing the forecasts accuracy, the author employed random walk, ARIMA

[1] Institute for Economic Forecasting of the Romanian Academy, Bucharest.

and Holt-Winters models, and singular spectral analysis [2].

Sinclair, Messina and Steckler analysed the revisions made for Greenbook predictions, but they did not obtain adjusted forecasts, sometimes the revisions being made in the incorrect sense as compared to the actual development of the economic phenomenon [7].

The article continues with a short presentation of the methodological background. After this, the assessment of initial and revised predictions of the expert is made. The last section provides the conclusions.

2. Methodological background

The prediction error at time *t* is the simplest indicator based on the comparison of the registered value with the forecast one and it is denoted by e_t. There are two ways of computing the forecast error if $\hat{y}_t$ is the prediction at time t: $e_t = y_t - \hat{y}_t$or $e_t = \hat{y}_t - y_t$. Seven out of eleven members from the International Institute of Forecasters recommended in a survey the use of the first variant ($e_t = y_t - \hat{y}_t$) [4]. This is the most utilized version in literature and it will also be used in this study.

There are many forecasts accuracy measures used to evaluate predictions. We will employ only several indicators, insisting on relative measures in order to make comparisons between forecasts. If h is the horizon length, then we can compute the following accuracy measures:

❖ Mean error- ME:

$$ME = \frac{1}{h}\sum_{t=n+1}^{n+h}(y_t - \hat{y}_t) \quad (1)$$

❖ Mean absolute error- MAE:

$$MAE = \frac{1}{h}\sum_{t=n+1}^{n+h}|y_t - \hat{y}_t| \quad (2)$$

❖ Root mean squared error- RMSE:

$$RMSE = \sqrt{\frac{1}{h}\sum_{t=n+1}^{n+h}(y_t - \hat{y}_t)^2} \quad (3)$$

❖ Theil's U1 statistic:

$$U_1 = \frac{\sqrt{\frac{1}{n}\Sigma(y_i - \hat{y}_i)^2}}{\sqrt{\frac{1}{n}\Sigma y_i^2} + \sqrt{\frac{1}{n}\Sigma \hat{y}_i^2}} \quad (4)$$

❖ Theil's U2 statistic

$$U_2 = \sqrt{\frac{\Sigma(\hat{y}_i - y_i)^2}{\Sigma(y_i - y_{i-1})^2}} \quad (5)$$

If U_2 =1=> no differences in accuracy

If U_2 <1=> better prediction than the naive one

If U_2 >1=> less accurate forecast than the naive prediction

For the -Mariano test, the null assumption of equal accuracy checks if the expected value of differential loss (d_t) is zero: $E(d_t) = 0$. The covariance stationary being given, the distribution of differential average follows a normal distribution. The DM statistic under null hypothesis is:

$$S_1 = \frac{\bar{d}}{\sqrt{\hat{V}(\bar{d})}} \rightarrow N(0,1) \quad (6)$$

$$\bar{d} = \frac{\sum_{t=1}^{n} d_t}{n} \quad (7)$$

$$\hat{V}(\bar{d}) = \frac{\hat{\gamma}_0 + 2\sum_{k=1}^{n-1}\hat{\gamma}_k}{n} \quad (8)$$

$$\hat{\gamma}_k = \frac{\sum_{t=k+1}^{n}(d_t - \bar{d})(d_{t-k} - \bar{d})}{n} \quad (9)$$

$\hat{\gamma}_0$- estimated variance of d_t

$\hat{\gamma}_k$- estimated k-th auto-covariance of d_t

$\hat{V}$- asymptotic variance of the DM statistic

n- forecasts horizon length

S1- DM statistic

Instead of estimating the variance we can study the prediction error auto-covariances. This test does not suppose restrictions like forecast errors with normal distribution, independent and contemporaneously uncorrelated predictions errors [3].

For the small sample of predictions, the modified version of the DM test is employed by Harvey, Leybourne and Newbold [6]. The modified test statistic follows a t-distribution with n-1 degrees of freedom, where j-step-ahead predictions were used:

$$DM' = \frac{\bar{d}}{\sqrt{\gamma_0 + 2\gamma_1 + \cdots + 2\gamma_{n-1}}} \cdot \left(n + 1 - 2j + \frac{j(j-1)}{n}\right) \quad (10)$$

3. The evaluation of forecasts accuracy

In this study we evaluated the forecasts made by a forecaster in two versions: spring version and autumn version for the current year. The variables used in the research are: real GDP growth, inflation rate, unemployment rate and exchange rate. The forecasting horizon covers the economic crisis period: 2009-2013. We want to check if the revisions improved the forecasts accuracy.

Table 1

The annual forecast errors between 2009-2013 for expert predictions (spring and autumn versions)

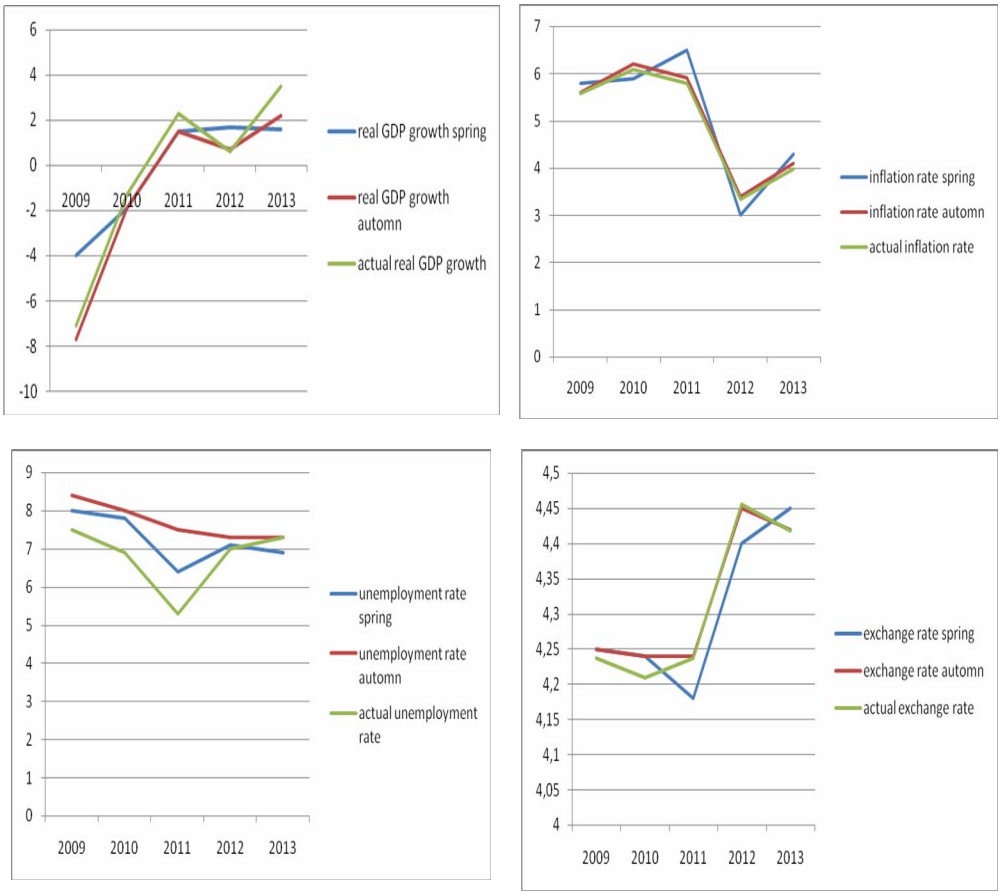
Year	**Real GDP growth**		**Inflation rate**	
	Spring version	Autumn version	Spring version	Autumn version
2009	-3.1	-3.7	-0.21	-0.01
2010	0.6	0	0.19	-0.11
2011	0.8	0	-0.7	-0.1
2012	-1.1	-1	0.33	-0.07
2013	1.9	0.6	-0.32	-0.12
Year	**Unemployment rate**		**Exchange rate**	
	Spring version	Autumn version	Spring version	Autumn version
2009	-0.5	-0.9	-0.5	-0.9
2010	-0.9	-1.1	-0.9	-1.1
2011	-1.1	-2.2	-1.1	-2.2
2012	-0.1	-0.3	-0.1	-0.3
2013	0.4	0	0.4	0

Source: own calculations

For 2009, the real GDP growth and unemployment rate revisions brought higher errors. All the predictions for 2009 for all variables were overestimated, the expert providing higher predictions than the actual values. Indeed, the crisis start was not precisely anticipated by EXPERT. The autumn version of GDP rate forecasts for 2010 and 2011 and the autumn variant of unemployment rate for 2013 overlapped the registered values. For the unemployment rate in each year from the

period 2009-2012 the revisions determined higher errors.

The difference between initial predictions, the revised ones and the actual values can be observed from the following graphs.



Source: own graph

Fig. 1. *The EXPERT predictions and the actual values for real GDP growth, inflation rate, unemployment rate and exchange rate during 2009-2013*

The performance of forecasts on the entire horizon was analysed by computing several accuracy indicators and by applying the modified version of the Diebold-Mariano test for small samples.

Table 2

Accuracy indicators for EXPERT forecasts on the horizon 2009-2013

Accuracy measure	**Real GDP growth**		**Inflation rate**	
	Spring version	Autumn version	Spring version	Autumn version
ME	-0.1800	-0.8200	-0.1420	-0.0820
MAE	1.5000	1.0600	0.3500	0.0820
RMSE	1.7567	1.7349	0.3953	0.0911
U1	0.1292	0.1035	0.0171	0.0040
U2	0.2412	0.2382	0.2556	0.0589
Accuracy measure	**Unemployment rate**		**Exchange rate**	
	Spring version	Autumn version	Spring version	Autumn version
ME	-0.4400	-0.9000	-0.4400	-0.9000
MAE	0.6000	0.9000	0.6000	0.9000
RMSE	0.6986	1.1790	0.6986	1.1790
U1	0.0221	0.0362	0.0221	0.0362
U2	0.5269	0.8892	0.5269	0.8892

Source: the author's own calculations

According to predictions accuracy indicators, EXPERT was the one which best predicted the exchange rate between 2009-2013. For this variable, all the accuracy measures have the lowest values. The revised predictions of the exchange rate outperformed the initial forecasts provided by the spring version. All the predictions, except for the spring variant of exchange rate predictions, are overestimated on the entire horizon, EXPERT providing too high in average forecasts. The less accurate predictions were provided for real the GDP growth, the revised version bringing a small accuracy improvement. For the unemployment rate the revised predictions are less accurate than the initial one. Indeed, the economic crisis brought higher unemployment rate in Romania than the experts' expectations. All the predictions for all the variables outperformed naïve forecasts.

The Harvey, Leybourne and Newbold test (HLN test) is applied to compare the initial forecasts with the revised ones for each variable on the horizon 2009-2013. The critical value (t with 4 degrees of freedom at 5% level of significance) is 2.132.

Table 3

The modified Diebold-Mariano test for comparing the EXPERT forecasts

Variable	**DM* statistic**	**Conclusion**
Real GDP growth	1.31e+08	There are not significant differences in accuracy between initial and revised forecasts.
Inflation rate	1.52e+08	There are not significant differences in accuracy between initial and revised forecasts.
Unemployment rate	-2.131	The initial forecasts are more accurate than revised ones.
Exchange rate	1.981	The revised predictions are more accurate than the initial ones.

Source: own calculations

According to the HLN test, there are not significant differences in accuracy between initial and revised forecasts of the real GDP rate and the inflation rate. The initial forecasts of the unemployment rate are more accurate than revised ones, while the revised predictions of the exchange rate are more accurate than the initial ones on the horizon 2009-2013.

4. Conclusions

The main purpose of this study is to check if the revisions of the EXPERT forecasts improve the degree of accuracy. Therefore, traditional forecasts accuracy measures and the modified Diebold-Mariano test for small sample were employed, taking into account that only the predictions during the economic crisis were analysed (horizon: 2009-2013).

For 2009, the real GDP growth and unemployment rate revisions brought higher errors. Indeed, the crisis start was not precisely anticipated by EXPERT. For the unemployment rate in each year from the period 2009-2012 the revisions brought higher errors. According to predictions accuracy indicators, EXPERT best predicted the exchange rate during 2009-2013. For this variable, all the accuracy measures have the lowest values. All the predictions for all the variables outperformed naïve forecasts. According to the Harvey-Leybourne-Newbold test, there are not significant differences in accuracy between initial and revised forecasts of the real GDP rate and the inflation rate between 2009-2013.

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