Journal of Social and Economic Statistics

Vol. 2, No.2, Winter 2013

COMBINED FORECASTS- STRATEGY TO IMPROVE THE PERFORMANCE OF UNEMPLOYMENT RATE PREDICTIONS IN USA AND ROMANIA

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Abstract

This study proved, using empirical data, that the combined forecasts were a suitable strategy for improving the accuracy, bias and efficiency of unemployment forecasts for Romania and the accuracy of USA unemployment predictions. The forecasting horizon of the alternative predictions of the unemployment rate in a country with experience in forecasting, USA, and Romania (with recently preoccupation in forecasting) is 2001-2011. In addition to the classical measures of accuracy, multi-criteria ranking was applied to assess the predictions' accuracy, considering at the same time several accuracy measures (U1 and U2 Theil's coefficients, root mean square error, mean error and mean square error). The institutions that best forecasted the unemployment rate in USA are, from the one with the lowest accuracy to the one with highest accuracy: Blue Chips, Congressional Budget Office, Organization for Economic Co-operation and Development and International Monetary Fund. In Romania the most accurate predictions are provided by three anonymous experts (E1, E2 and E3).

Keywords: forecasts, predictions, combined predictions, performance, accuracy, bias, efficiency

JEL Classification: C51, C53, E21

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1. Introduction

Assessment of predictions performance is a mirror of the forecasting process quality. Nowadays, for a macroeconomic indicator we have one or more forecasts provided by different institution. Therefore, the public face the situation of choosing the better forecast, but information about the criteria of choice should be known. In literature, the researchers consider three criteria of judging the performance of the forecasts: accuracy, un-biasedness and efficiency.

In this research we proposed a new way of evaluating the predictions' accuracy (multi-criteria ranking) by simultaneously considering several accuracy indicators. This method is utilized to establish the order of the institutions that provided the most accurate predictions.

There is an obvious preoccupation of the specialists in forecasting for improving the degree of performance associated to their expectations. The combined predictions are a useful tool, frequently applied to increase the forecasts' accuracy.

This paper is structured in some important sections that correspond to the logical procedure: the accuracy, bias and efficiency of the unemployment forecasts for USA and Romania are assessed. The combined forecasts are built in order to check if the performance has improved. We want to check if this strategy is suitable for both countries, for USA, that benefits of very good experts in forecasts, and for Romania, where the forecasting activity is low developed. This strategy proved to be a good way of getting more accurate forecasts for both countries, but for USA the BC bias was not reduced and the forecasts efficiency for all institutions did not grow.

The assessment and improvement of macroeconomic forecasts will also improve the decisional process and the government policy that will have more desirable effects.

The structure of the paper put in evidence the assessment of forecasts accuracy, followed by the biasness and the efficiency. Another section is dedicated to the combined forecasts seen as a possible strategy to improve the performance of the unemployment predictions made for Romania and USA.

A comparison between Romania and USA is important in order to see the quality of forecasts in a country with tradition in forecasting and a small country like Romania where the prediction activity is not well developed. We also want to see if some international tendencies like the systematic bias is checked for the two types of countries.

2. Literature

The forecasts performance is an important objective for many specialists in forecasting. Our objective is to evaluate the performance in order to apply a suitable strategy for growing the degree of predictions performance. In economic crisis the performance decreases, the necessity of assessing the performance growing. The forecasts performance is the topic of many studies, but only few of them are presented in this research.

Bratu (2013) proved that the filters and Holt Winters technique could be used as strategies to get more accurate predictions for inflation rate in USA, when the initial expectation are provided by SPF. The Holt-Winters method gave better results. According to Bratu (Simionescu) (2012), the combined forecasts are a suitable way of improving the unemployment forecasts in Romania.

Deschamps and Bianchi (2012) observed major discrepancies in terms of accuracy between different macroeconomic predictions made for China for GDP, inflation, investment rate and consumption rate. The information was used in an inefficient way, because the forecasts presented a considerable bias.

Allan (2012), who used quantitative and qualitative techniques to assess the forecasts accuracy, proved that combined forecasts are a good strategy to improve the OECD predictions for GDP in G7 countries.

Dovern and Weisser (2011) showed that G7 countries' forecasts are in general biased because of shocks, for accuracy and efficiency the results being different from a country to another.

Many international institutions that are specialized in making forecasts made comparisons between their predictions and the effective values, respectively the expectations of other forecasters.

Abreu (2011) considered the possibility of incorporating an economic crisis in the prediction and the author made comparisons between the forecasts made by different institutions like Economic Co-operation, European Commission, Consensus Economics and Development and International Monetary Fund.

Franses, Kranendonk and Lanser (2011) concluded that the predictions based on the official model of Netherlands are more accurate than the forecasters' expectations, but all the predictions present a consistent bias. Comparisons of forecasts' performance were also made by Reeve and Vigfusson (2011) that used as benchmark the naïve model and a random walk with drift.

For the unemployment rate in Japan, Kurita (2010) recommended the use of an ARFIMA model for marking predictions instead of a random walk, the first model generating more accurate forecasts.

For the exchange rate in USA and England, Shittu and Yaya (2009) made a comparison of the predictions and recommend also the ARFIMA model in forecasting providing better results than ARIMA model. Moreover, Lam, Fung and Yu (2008) proved that the combined predictions are a good strategy for increasing the degree of performance associated to exchange rate forecasts.

Edge, Kiley and Laforte (2009) used different econometric models to predict the macroeconomic indicators (a DSGE model and a time series model), comparing these forecasts with the anticipations of Federal Reserve staff. Gorr (2009) recommended the use of classical accuracy measures when a normal evolution of the economy is expected, while the ROC curve is more suitable for crisis times.

Heilemann and Stekler (2007) gave the following arguments for the lack of high accuracy for G7 macroeconomic predictions: unsuitable forecasting methods and unsuitable expectations regarding the degree of performance.

Meese and Rogoff (1983) proved by empirical studies that the random walk forecasts improved the accuracy of exchange rate predictions based on complex econometric model.

3. The forecasts performance of the unemployment rate forecasts. A comparative analysis

3.1. The forecasts accuracy evaluation

The data series refer to the unemployment rate forecasts with annual frequency provided for Romania by several experts in forecasting (E1, E2 and E3), the forecasting horizon being 2001-2011. For USA we utilized the predictions of the annual unemployment rate provided by four international institutions: Blue Chips, Organization for Economic Co-operation and Development, Congressional Budget Office and International Monetary Fund. The frequency of data is annual. As we can see in Appendix 6, the predictions provided by E3 and BC are the most homogenous for each country, the coefficient of variation getting the minimum value in each group. The research hypothesis is the test of forecasts performance and the check of some potential strategies to improve the forecasts accuracy.

The objective was to evaluate the three dimensions of the forecasts performance: efficiency, accuracy and bias. Then, we can determine the institution that provided the forecasts with the best performance. The classical measures of accuracy are computed and then the methods of the multi-criteria ranking are applied because the accuracy indicators might conduct us to different conclusions. There is an evident limitation of the classical accuracy measures given by the fact than an indicator might recommend a certain forecast as the best, while another one could indicate another prediction as the best.

Armstrong and Fildes (1995) recommended the use of more measures of accuracy. Therefore, in this study more accuracy measures are computed for the proposed forecasts on the mentioned horizon.

Comparisons between forecasts are made to show the order of institutions with respect to the predictions' accuracy criterion with the aid of multi-criteria ranking. This method is also applied to assess the performance in prediction, considering simultaneously three criteria (accuracy, un-biasedness and efficiency).

The multi-criteria ranking supposes two methods: method of relative distance compared to maximal performance and ranks method that are applied in order to get the ranking of institutions according to their forecasts' accuracy when several accuracy indicators are simultaneously considered on the same forecasting horizon (2001-2011).

$\hat{X}_t(k)$ is the forecasted value after k time periods compared to the origin time t. The error for a future period (t+k) is: $e_t(t+k)$ being computed as the effective value minus the forecasted value.

Multi-criteria ranking will take into consideration five of the accuracy measures:

*Root Mean Squared Error (RMSE)

$$RMSE = \sqrt{\frac{1}{n}\sum_{j=1}^{n} e_X^2 (T_0 + j, k)} \quad (1)$$

*Mean error

$$ME = \frac{1}{n}\sum_{j=1}^{n} e_X (T_0 + j, k) \quad (2)$$

A positive value of ME implies to low in average predictions, while a negative one supposes overestimated values.

***** Mean absolute error (MAE)

$$MAE = \frac{1}{n}\sum_{j=1}^{n} | \ e_X (T_0 + j, k) \ | \quad (3)$$

In practice the forecast is compared with the naïve one, which is based on random walk (the value registered in the previous period remains the same in the following period). Theil (1966) used his U coefficient (statistic) what was further developed in two variants.

a- actual value
p- prediction
t- time
e- error (actual value-predicted value)
n- periods' number

***** U1 Theil's statistic

$$U_1 = \frac{\sqrt{\sum_{t=1}^{n} (a_t - p_t)^2}}{\sqrt{\sum_{t=1}^{n} a_t^2} + \sqrt{\sum_{t=1}^{n} p_t^2}} \quad (4)$$

Closer to zero is the value of U1 Theil's coefficient, higher the degree of accuracy is.

***** U2 Theil's statistic

$$U_2 = \sqrt{\frac{\sum_{t=1}^{n-1} (\frac{p_{t+1} - a_{t+1}}{a_t})^2}{\sum_{t=1}^{n-1} (\frac{a_{t+1} - a_t}{a_t})^2}} \quad (5)$$

If U_2 =1=> similar forecasts in terms of accuracy

U_2 <1=> superior forecast compared to the naive prediction

U_2 >1=> inferior forecast compared to the naive prediction

Table 1: Measures of accuracy for Romania unemployment rate predictions of three experts in forecasting on the horizon 2001-2011

ACCURACY MEASURE	INSTITUTION		
	E1	E2	E3
ME	-0.55	-0.57	-0.73
MAE	1.25	1.65	1.1
RMSE	1.50	1.76	1.3
U1	0.11	0.13	0.1
U2	1.16	1.1	1

Source of data: author's computations

The accuracy measures showed in Table 1, except for mean error, recommend the predictions made by E3 as being the best according to accuracy criterion. Moreover, this is the single institution that provided forecasts that are superior to naïve predictions. All the forecasts of the three institutions are overestimated, the E2 offering the worst forecasts.

Table 2: The measures of accuracy for USA unemployment rate predictions on the horizon 2001-2011

ACCURACY MEASURE	INSTITUTION			
	CBO	OECD	IMF	BC
ME	1.0455	0.4664	0.0262	1.4818
MAE	1.3545	0.4973	0.0520	1.5909
RMSE	2.1564	0.8430	0.1120	2.3524
U1	0.1806	0.0654	0.0085	0.2047
U2	0.6560	0.6560	0.0551	1.4500

Source of data: author's computations

CBO- Congressional Budget Office

OECD- Organization for Economic Co-operation and Development

IMF- International Monetary Fund

BC- Blue Chips

According to Table 2, the best predictions on the horizon 2001-2011 were made by IMF for unemployment. OECD and CBO gave less accurate forecasts. BC provided the worst expectations, less accurate even than naïve appreciations. The predictions provided by OECD and IMF are better than all the forecasts offered for Romania. A persistent overestimation is observed for all the predictions made for unemployment in Romania.

The application of the **ranks method** involves the following stages:

1. For each accuracy measure ranks are assigned (the rank 1 will be attributed to the smallest value of the accuracy indicators)

The analysed units are represented by the three institutions from Romania/four institutions in case of USA that provided the predictions. The notation for the institution' rank is: $(r_{i_{ind_j}})$, i- index for the institutions and ind_j −accuracy indicator j. Five measures of accuracy were selected: U1 and U2 Theil's coefficients, root mean square error, mean error and mean square error.

2. The score of the ranks is calculated by summing them up. $S_{i=\sum_{j=1}^{5}(r_{i_{ind_j}})}$ (6)

3. The final rank 1 will be attributed to the institutions with the smaller score.

Table 3: The ranks of institutions for the Romania unemployment forecasts (ranks method)

ACCURACY MEASURE	INSTITUTION		
	E1	E2	E3
ME	1	2	3
MAE	2	3	1
RMSE	2	3	1
U1	2	3	1
U2	3	2	1
Sum of ranks	10	13	7
Final ranks	2	3	1

Source of data: author's computations

The results of the ranks method displayed in Table 3 are the equivalent to the results showed by the majority of the accuracy measures. If all the proposed accuracy indicators are considered at the same time, the institutions provided accurate forecasts in the following order (from the best to the one with the less performance): E3, E1 and E2.

Table 4: Institutions' ranks for the USA unemployment forecasts (ranks method)

RANKS	INSTITUTION			
	IMF	OECD	CBO	BC
Final ranks	1	2	3	4

Source of data: author's computations

This method offered the same results as the previous one, as we can observe in Table 4. The best forecasts belong to IMF and then OECD, while BC forecasts' performance is lower.

Relative distance method compared to the best performance

We computed for each institution the accuracy measures compared to the best institution. The relative distance is calculated as the accuracy measure value of an institution over the lowest accuracy measure value from the entire sample of institutions. In this case a geometric mean of distances is computed, representing a mean relative distance for a certain institution.

The final ranks are established by analysing the means of relative distances. The best institution will have the rank one. The ration between the mean of relative distance and the minimum distance will give the location. The formulae are presented in Appendix 6.

Table 5: The institutions' ranks for the Romania unemployment forecasts (relative distance method with respect to the best institution that has the highest performance)

ACCURACY INDICATOR	E1	E2	E3
MEAN ERROR	1.00	1.03	1.33
MEAN ABSOLUTE ERROR	1.14	1.5	1.00
ROOT MEAN SQUARE ERROR	1.15	1.35	1.00
U1COEFFICIENT	1.16	1.35	1.00
U2 COEFFICIENT	1.16	1.10	1.00
Mean of relative distance	1.12	1.26	1.06
Ranks	2	3	1
Location (%)	105.5	118.4	100.00

Source of data: author's computations

This technique conducts us to the same results as the ranks method as Table 5 shows. For E3 the minimum value of the mean of relative distances was computed.

Table 6: The institutions' ranks for the USA unemployment forecasts (method of relative distance compared to the institution with the highest performance)

INDICATORS	IMF	OECD	CBO	BC
Mean of relative distances	1	10.3	22	30
Ranks	1	2	3	4
Position (%)	100%	10.3%	22%	30%

Source of data: author's computations

The same conclusions were obtained in this case compared to the other techniques. According to Table 6 the IMF is the best forecaster.

The DM test (Diebold-Mariano test) is applied for observing the differences in accuracy.

An indicator of difference is computed starting from squared values of the prediction errors.

$$d_{t,t} = \left(e_{t,t}^{2}\right) - \left(e_{t,t}^{*2}\right) \quad (7)$$

Starting from the difference indicator, a model is built:

$$d_{t,t} = a + \varepsilon_t \qquad (8)$$

We test if “a” is different from the value zero, with H0 that assigns a null value. Ho is rejected if the threshold (5%) in our case is greater than the computed p-value.

New variables are calculated (dif1, dif2 and dif3) to compare E1 and E2 expectations, E1 and E3 forecasts, and E2 and E3 predictions. The models’ parameters are not significant, the differences in terms of accuracy between predictions being insignificant. The estimated regressions models are displayed in Appendix 1. All in all, the accuracy indicators results and the DM test conduct us to the conclusion that E3 is the better institution, and E2 the worst.

The test of the correct forecast’s change was applied under the null hypothesis of the lack of relationship between the real values and change direction. All the p-values are more than 0.05, conducting us to the acceptance of independence hypothesis (see Appendix 5).

The differences’ indicators were computed (d1, d2, d3, d4, d5, d6) in order to compare the predictions provided for USA by the four institutions. The predictions provided by OECD and IMF, respectively BC and CBO are significantly different. The conclusions can be proved by the information from Appendix 1. Conclusions are confirmed by the accuracy indicators, IMF expectations being better than OECD ones.

3.2. The bias of predictions

Corder (2003) compared in terms of bias and efficiency the forecasts provided by Consensus. Early results showed that the projections of private sector are biased and uncorrelated with the rational expectations hypothesis. Batchelor (2007) proved that there is a significant bias in the predictions provided by private institutions for G7 members on the horizon 1990-2005. Regression models and tests of accuracy are used to check the presence of bias. Corder (2003) and Fair and Schiller (1989) proved the large differences between the extreme predictions and the application of tests with rational expectations.

Mincer-Zarnowitz test is used to check the presence of bias:

$$A_t = a + b \cdot P_t + e_t . \qquad (9)$$

A_t -actual values, P_t – predictions.

Another test variant checks the existence of a null mean: $A_t - P_t = m + e_t$. (10)

The presence of additional information may improve the predictions. If X_i are some variables that are correlated with the forecast, we can compute :

$$e_Y(t-k,k) = \gamma + \sum_i \sum_{j>k} \delta_{i,j} X_i(t-j) + e_t . \quad (11)$$

We can have a better forecast if we take into consideration the correlation with X_i only if γ *and* $\delta_{i,j}$ are different from the null value.

A t-test can be used to check the bias:

$$e_{t+1} = a + \varepsilon_{t+1} \qquad (12)$$

A statistically significant value for the parameter "a" shows the presence of the bias.

E2 expectations are the most biased and E3 ones have the smallest bias. The errors (e1, e2 and e3) and the associated tests can be observed in Appendix 2. The forecasts provided for USA are biased, the tendency of biasness being maintained like in the research of Batchelor (2007).

3.3. The efficiency of predictions

The efficiency of forecasts is tested using a F test for the following regression model:

$$y_{t+1} = a + b \cdot y_{t+1,t} + \varepsilon_{t+1} \qquad (13)$$

y_{t+1} –the value of the indicator registered for year (t+1)

$y_{t+1,t}$ –the forecast of the indicator made at moment t for the period (t+1)

The E3 provided the best predictions of unemployment rate in terms of efficiency, being followed by E2 and the E1.

The test proposed by Fair and Schiller (1989) compares in terms of efficiency the predictions provided by two forecasters.

$$X_t - X_{t-1} = b_0 + b_1(X_1^p - X_{t-1}) + b_2(X_2^p - X_{t-1}) \qquad (14)$$

X_t - value of variable X at "t" moment

X_{t-1} - value of variable X at "t-1" moment

X_1^p - prediction of institution 1

X_2^p - prediction of institution 2

b1> 0 and b2 = 0 implies that the institution 2 was more efficient

b2> 0 and b1 = 0 implies that the institution 2 was more efficient

b1> 0 and b2> 0 implies that each institution provides different information

E1 provided relative efficient forecasts with respect to those of E2, while E2 predictions are "more efficient" than those of E3. On the other hand, E1 and E3 brought different information in their forecasts. In Appendix 3 the results of efficiency tests can be viewed.

Another test of weak efficiency regresses the error on a constant term and a lagged forecast error, according to Melander, Sismanidis and Grenouilleau (2007):

$$e_{t+1} = a + b \cdot e_t + \varepsilon_{t+1} \qquad (15)$$

The null hypothesis acceptance implies a weak efficiency (bias and/or serial correlation) for a Prob. higher than 0.05. The results of this test of weak efficiency presented in Appendix 3 imply the acceptance of null hypothesis.

Ljung-Box test is applied to check the persistence of errors. The null hypothesis of the test states the absence of errors autocorrelation. If Prob. is less than 0.05, we conclude with a probability of 95% that there is errors autocorrelation.

The errors of E3 are auto-correlated only for a lag equalled to one, according to the results presented in Appendix 4, for which the Prob. are greater than 0.05. There is not any autocorrelation for E2 predictions, while for a lag up to 2 the E1 forecasts are correlated.

Informational efficiency tests are applied are stronger than those for testing weak efficiency. Actually, these tests check if the past information was fully utilized. Therefore, we check the dependencies between the forecasts errors and the key variable predictions or respectively the past values of a certain variable. The equations models could have the following forms:

$$e_{t+1,t} = a + b \cdot var_{t+1,t} + \varepsilon_{t+1} \quad (16)$$

where "var" is the forecasted variable and

$$e_{t+1,t} = a + b \cdot var_{t-1} + \varepsilon_{t+1} \quad (17)$$

The null hypothesis for both tests is: b=0.

The parameter differs significantly from zero for E1 and E3 forecasts if the first test is applied. The parameter is zero for E2 forecasts. So, only E1 and E3 provided efficient predictions from informational point of view, according to the results presented in Appendix 4. The p-values greater than 0.05 show the presence of errors auto-correlation. The second efficiency test gave other results: the E2 and E3 forecasts are efficient, but not the E3 ones. These results are quite good, because Dovern and Weisser (2011) showed that the international forecasts are not efficient from the informational point of view.

Only the forecasts provided by CB are biased, the other institutions giving unbiased forecasts for USA unemployment rate. e1, e2, e3 and e4 are the notations for errors corresponding to the four institutions, the results being in Appendix 2. Only IMF and OECD forecasts are efficient.

4.Combined forecasts- a strategy to improve the unemployment rate forecasts performance

Some methods for increasing the degree of predictions' accuracy are provided by Bratu (2012): combined forecast, historical accuracy method, the construction of regressions models, the use of exponential smoothing methods and econometric filters). The limitation of these strategies is related to the fact that they are empirical, being dependent by the type of forecasts. A strategy could improve a forecast or not. The researcher has to check if his assumption is valid on a particular set of data. On the other hand, we consider that a particular valid strategy on a past horizon might give better results for future short run predictions.

In literature three approaches are the most commonly utilized:

- equal weights combination (EW);
- optimal approach (OPT);
- inverse mean square error approach (INV).

Bates and Granger (1969) used the case of two predictions for the variable Xt, being denoted by f (i,t). In the case of unbiased predictions, the error is :

$$e_{i,t} = X_{i,t} - f_{i,t} \quad (18)$$

The errors follow a normal distribution of 0 mean and σ_i^2 variance. The covariance is computed as $\sigma_{12} = \rho \cdot \sigma_1 \cdot \sigma_2$ (19)

The combined forecast is actually a weighted average:

$$c_t = m \cdot f_{1t} + (1-m) \cdot f_{2t} \quad (20)$$

The error is calculated as:

$$e_{c,t} = m \cdot e_{1t} + (1-m) \cdot e_{2t} \quad (21)$$

The variance of the combined prediction is:

$$\sigma_c^2 = m^2 \cdot \sigma_1^2 + (1-m)^2 \cdot \sigma_{2t}^2 + 2 \cdot m \cdot (1-m) \cdot \sigma_{12} \quad (22)$$

The values for m corresponding to the three approaches are computed by getting the minimum of the error dispersion:

$$m_{opt} = \frac{\sigma_2^2 - \sigma_{12}}{\sigma_1^2 + \sigma_2^2 - 2 \cdot \sigma_{12}} \quad (23)$$

$$m_{inv} = \frac{\sigma_2^2}{\sigma_1^2 + \sigma_2^2} \quad (24)$$

For the equally weighted case the same weights are considered for each model.

The U Theil's coefficients corresponding to the combined predictions are presented in Table 7:

Table 7: Combined predictions' accuracy for the Romania unemployment on the horizon from 2001 to 2011

Accuracy indicator	Predictions of:		
	E1 and E2	E1 and E3	E2 and E3

Optimal approach			
U1	**0.085**	**0.067**	0.126
U2	**0.987**	**0.713**	1.107
Inverse mean square error approach			
U1	**0.087**	**0.055**	**0.111**
U2	1.003	**0.589**	1.012
Equally weighted approach			
U1	**0.086**	**0.075**	**0.089**
U2	**0.921**	**0.794**	**0.914**

Source of data: author's computations

We have a superior accuracy for the following combinations: E3 and E1 forecasts (the most accurate prognoses) and E2 and E1 expectations under the optimal and inverse mean square error approach and E3 and E2 under equally weighted approach.

The most accurate forecasts are those resulted from combining E1 and E3 expectations. Only two combinations are not superior to random walk forecasts: E3 and E2 forecasts under optimal and inverse mean square error approach and E2 and E1 under optimal approach.

We test the biasedness of the combined forecasts. The combined predictions for E1 and E3 expectations are biased, all the other predictions being unbiased, according to the results presented in Appendix 2. So, the combined forecasts are a very good strategy of getting unbiased forecasts.

Each combined forecast based on INV scheme provided different information if we make comparisons of two forecasts from this group. The combined forecasts of E1 and E3 and those of E2 and E3 are relative efficient with respect to the combined predictions of E1 and E2. These efficient combined forecasts have a better performance than the original ones of the institutions in what concerns the efficiency, according to Appendix 3.

Table 8: Combined predictions' accuracy for USA unemployment on the horizon from 2001 to 2011

Accuracy measure	**IMF+OECD forecasts**	**IMF+CBO forecasts**	**IMF+BC forecasts**	**OECD+CBO forecasts**	**OECD+BC forecasts**	**CBO+BC forecasts**
Optimal approach						
U1	0.0523	0.1734	0.2073	0.1712	0.2058	0.2066
U2	0.0551	0.6560	0.6560	1.4405	0.0551	0.6560
Inverse mean square error approach						
U1	**0.0269**	0.1738	0.2042	0.1758	0.2044	0.2030
U2	0.0534	0.6566	0.6567	1.4667	0.0556	0.6546
Equally weighted approach						
U1	0.0459	0.1772	0.2044	0.1782	0.2045	0.2038
U2	0.0534	0.6546	0.6545	1.4478	0.0544	0.6577

Source of data: author's computations

Almost all combined forecasts (exception being given by CBO and OECD predictions) are better than the naïve ones (U2 values are less than 1) as Table 8 shows. INV scheme was the most efficient for combining IMF and OECD forecasts, but these predictions are biased.

These combined predictions based on BC forecasts are biased, according to Appendix 2. So, the combined predictions introduce bias to the original forecasts. The efficiency of the combined forecasts did not grow, the Appendix 3 showing that the models used to test the efficiency are not valid.

The de-trended predictions based on econometric filters or Holt-Winters method could be suitable methods for increasing the forecasts accuracy for particular sets of data as Bratu (2013) proved.

Hodrick-Prescott filter and Holt-Winters exponential technique were applied to the original predictions and the accuracy of new forecasts was evaluated. *Holt-Winters Simple exponential smoothing method* is based on the assumption of a seasonally adjusted series with linear trend. The Hodrick–Prescott (HP) filter is applied to compute the trend of a time series. Hodrick-Prescott filter and Holt-Winters exponential technique were not a suitable strategy to increase the degree of accuracy of unemployment rate predictions in Romania.

Table 9: Filtered and smoothed forecasts' accuracy of USA unemployment on the horizon from 2001 to 2011

Measure of forecasts' accuracy	Filtered IMF forecasts	Smoothed IMF forecasts	Filtered OECD forecasts	Smoothed OECD forecasts	Filtered CBO forecasts	Smoothed CBO forecasts	Filtered BC forecasts	Smoothed BC forecasts
U1	0.0886	0.0952	0.1001	0.1101	0.1837	0.1784	0.2045	0.2031

Source of data: author's computations

CB predictions are improved by applying Holt-Winters adjustment and HP filter one as it results from Table 9, but the predictions are still biased, like the ones of the other institutions. The results are quite good, because the international tendency is that of biased forecasts, according to Dovern and Weisser (2011).

The policy implications of the forecasts evaluation are very important, because the government should propose a certain type of economic policies, knowing the accuracy, the bias and the efficiency of the predictions. The degree of accuracy will impose the flexibility of the decisions based on a certain strategy. The unbiased forecasts are a good result and the trust degree of the policy maker will increase. The informational efficiency is an important for the government that essential information is provided for taking the best decisions. In our case, the performance of the Romania and USA forecasts is quite good, the state could take good results using these predictions.

5.Conclusions

The realization of forecasts is an important element in decisional process at different levels from macroeconomic one to microeconomic one. However, the offer of a simple forecast is not enough, being necessary to provide also some measures of performance of the predictions. The advantages of the forecasts assessment are numerous: the choice for a better forecasting method, the improvement of planning activity to microeconomic level, better governmental decisions.

In literature there are many studies in which the accuracy of the predictions made by different international institutions is assessed. Most of the international organizations predict the USA macroeconomic variables, an experience in this field could be seen. On the other hand, in Romania, the experts were interested in forecasting the macroeconomic indicators rather late in the context of the pass to market economy. We are interested in a comparative analysis between the two countries in order to see how better is the forecasting activity in Romania compared to a very developed country like USA with tradition in this domain. Moreover, E1 gave quite late its forecasts regarding the Romanian economy and we want to see if the E1 approach is superior to E2 and E3 forecasting activity.

These forecasts made by experts in prediction are referential, because they are provided by researcher with lot of experience in this domain. They might not just take the predictions resulted from the application of a quantitative method. They make a subjective adjustment in accordance to their rational expectation. This could be an important way of getting more accurate predictions.

The unemployment rate forecasts performance in Romania is evaluated for the expectations of the following institutions on the horizon 2001-2011: E3, E1 and E2. This is also the order of institutions according to the forecasts accuracy (from the highest to the lowest). This conclusion was drawn by using two methods: the computation of some classical accuracy measures, including U1 used in comparisons, and the use of multi-criteria ranking methods. All the predictions are biased, following the international tendency. The lowest bias is registered by E3 expectations, while the largest biased was observed for E2. E1 provided the forecasts with the highest efficiency, E3 offering the less efficient ones.

We also assessed the USA unemployment forecasts accuracy, efficiency and biasness for the forecasts on the horizon 2001-2011 by OECD, IMF, BC and CBO. All the applied methods (accuracy measures, multi-criteria ranking) conduct us to the conclusion that IMF has the most accurate forecasts, while BC the less accurate ones. The combined predictions under all the three approaches improved the accuracy of initial predictions. These predictions are unbiased, with an exception given by combined predictions of E1 and E3. These forecasts have a higher degree of efficiency. The combined predictions are a good approach for predictions improvement for both countries, the developed one (USA) and Romania, even if USA benefits of the activity of recognized experts in forecasting.

The combined forecasts increased the accuracy of the combined predictions made for OECD and IMF. All these predictions are biased, even if the initial expectations of CBO, IMF and OECD are unbiased. Only the BC predictions were improved by filtering technique.

The forecasts performance is the fundament of decisional process at any level. The combined forecasts are a recommended method for increasing the degree of accuracy in the unemployment rate predictions. The limitation of combined forecasts method is given by the potentiality of this strategy of accuracy improvement. The researcher has to check on real data if in his case the combined predictions are superior. On the other hand, we made the assumption that an empirical strategy of forecast improvement will probably gave better result for future predictions on short run.

The results of Bratu (2012) are in accordance with our findings, the combined expectations being a suitable way of getting more accurate forecasts. Clements and Harvey (2011) specified that in particular situations the combined forecasts are a good method of improving the predictions accuracy.

APPENDICES

APPENDIX 1.

Application of Diebold-Mariano test for Romania forecasts

Variable name	Value of coefficient	Standard error	Computed t	p-value
D1	-0.874545	1.187738	-0.736312	0.4785
D2	0.530909	0.624816	0.849704	0.4154
D3	1.405455	0.886219	1.585900	0.1438

Application of Diebold-Mariano test for USA forecasts

Variable name	Value of coefficient	Standard error	Computed t	p-value
D1	-0.883636	0.344872	-2.562214	0.0283
D2	-4.637454	2.345183	-1.977438	0.0762
D3	-5.521090	2.666494	-2.070543	0.0652
D4	-3.939427	2.520943	-1.562680	0.1492
D5	-0.883636	0.344872	-2.562214	0.0283
D6	-0.873636	0.37872	-2.332214	0.0123

APPENDIX 2

The results of bias tests for Romania forecasts

Variable name	Value of coefficient	Standard error	Computed t	p-value
e1	-0.545455	0.440116	-1.239341	0.2435
e2	-0.563636	0.528337	-1.066811	0.3111
e3	-0.727273	0.342741	-2.121934	0.0598

The results of bias tests for USA forecasts

Variable name	Value of coefficient	Standard error	Computed t	p-value
e1	0.026182	0.034439	0.760235	0.4647
e2	0.466364	0.222054	2.100231	0.0621
e3	1.045455	0.596408	1.752918	0.1102
e4	1.481818	0.577741	2.564847	0.0281
e5	1.045455	0.596408	1.752918	0.1102
e6	0.026182	0.034439	0.760235	0.4647
c1	6.678958	0.539466	12.38068	0.0000
c2	6.146983	0.607579	10.11717	0.0000
c3	6.017582	0.641704	9.377502	0.0000
c4	4.856279	0.026520	183.1166	0.0000
c5	4.867313	0.027033	180.0511	0.0000

c6	4.844737	0.026504	182.7940	0.0000

APPENDIX 3.

The results of efficient tests

Dependent Variable: UR

Variable name	Value of coefficient	Standard error	Computed t	p-value
C	1.243713	3.121967	0.398375	0.6996
E1	0.749926	0.431692	1.737179	0.1164
C	3.306537	1.662447	1.988958	0.0779
E2	0.460432	0.223734	2.057946	0.0697
C	-3.315701	2.908748	-1.139907	0.2838
E3	1.352822	0.393666	3.436471	0.0074

Dependent Variable: DIFFERENCE

Variable name	Value of coefficient	Standard error	Computed t	p-value
C	-0.522476	0.311075	-1.679582	0.1369
A1	0.494477	0.163304	3.027959	0.0192
A2	0.187598	0.156957	1.195222	0.2709
C	-0.544827	0.337852	-1.612618	0.1509
A1	0.332518	0.396650	0.838315	0.4295
A3	0.285263	0.440949	0.646930	0.5383
C	-0.550912	0.352550	-1.562651	0.1621
A2	0.061708	0.202908	0.304115	0.7699
A3	0.579810	0.234691	2.470519	0.0428

Weak efficiency tests

Dependent Variable: E1

	Value of coefficient	Standard error	Computed t	p-value
C	-0.552846	0.355320	-1.555913	0.1583
E1(-1)	0.494307	0.231391	2.136240	0.0652

Dependent Variable: E2

C	-0.141481	0.657457	-0.215195	0.8350
E2(-1)	0.414903	0.383698	1.081328	0.3111

Dependent Variable: E3

C	-0.399439	0.412785	-0.967669	0.3615
E3(-1)	0.518748	0.302262	1.716219	0.1245

Information efficiency tests

Dependent Variable: E1

	Value of coefficient	Standard error	Computed t	p-value
C	1.243713	3.121967	0.398375	0.6996
E1	-0.250074	0.431692	-0.579289	0.5766
Dependent Variable: E2				
C	3.306537	1.662447	1.988958	0.0779
E2	-0.539568	0.223734	-2.411650	0.0391
Dependent Variable: E3				
C	-3.315701	2.908748	-1.139907	0.2838
E3	0.352822	0.393666	0.896247	0.3935
Dependent Variable: E1				
C	-3.654271	2.766698	-1.320806	0.2231
E1(-1)	0.406591	0.390078	1.042332	0.3277
Dependent Variable: E2				
C	0.252195	2.394369	0.105328	0.9187
E2(-1)	-0.100842	0.314602	-0.320537	0.7568
Dependent Variable: E3				
C	-7.027908	2.151712	-3.266194	0.0114
E3(-1)	0.843253	0.290478	2.902987	0.0198

APPENDIX 4.

The results of Ljung-Box test

Autocorrelation function	Partial Correlation function		Autocorrelation coefficient	Partial Correlation coefficient	Value of Q-Stat	p-value
. |****. |	. |****. |	1	0.484	0.484	3.3444	0.067
. |*** . |	. |* . |	2	0.374	0.183	5.5713	0.062
. | . |	. **| . |	3	0.042	-0.263	5.6024	0.133

Autocorrelation function	Partial Correlation function		Autocorrelation coefficient	Partial Correlation coefficient	Value of Q-Stat	p-value
. |** . |	. |** . |	1	0.295	0.295	1.2424	0.265
. **| . |	. ***| . |	2	-0.299	-0.423	2.6659	0.264
. *| . |	. |** . |	3	-0.071	0.238	2.7572	0.431

Autocorrelation function	Partial Correlation function		Autocorrelation coefficient	Partial Correlation coefficient	Value of Q-Stat	p-value
. |****. |	. |****. |	1	0.480	0.480	3.2990	0.069
. |* . |	. *| . |	2	0.134	-0.125	3.5863	0.166
. **| . |	. ***| . |	3	-0.239	-0.332	4.6052	0.203

APPENDIX 5.

Application of tests for checking the existence of directional accuracy

Test Statistics

	ur	E1
Chi-Square value	.818[a]	1.273[b]
Degrees of freedom	9	8
p-value	1.000	.996

Test Statistics

	ur	E2
Chi-Square value	.818[a]	.000[b]
Degrees of freedom	9	10
p-value	1.000	1.000

Test Statistics

	ur	E3
Chi-Square value	.818[a]	1.273[b]
Degrees of freedom	9	8
p-value	1.000	.996

APPENDIX 6.

The main statistics for the unemployment rate prediction (case of Romania and USA)

YEARS/INDICATORS for Romania	E1	E2	E3	REAL VALUE (%)
2000				10.5
2001	6.6	9.9	8.3	8.6
2002	7.3	9.2	7.6	8.1
2003	6.5	8.9	6.9	7.2
2004	6.3	8.6	7.2	6.3
2005	6.3	8.4	7.9	5.9
2006	7.3	4	7.1	5.6
2007	6.4	4.4	6.5	4.3
2008	5.8	5.8	5.3	3.9
2009	9	7.5	8.3	6.3
2010	8.7	6.9	8.4	9
2011	8.5	5.3	7.2	7.5
Average	7.154545	7.172727	7.336364	6.609091
Standard deviation	1.055172	1.940052	0.879331	1.579099

Coefficient of variation (%)	14.74828	27.04762	11.98593	23.89283

YEARS/INDICATORS for USA	Real value (%)	FMI	OECD	CBO	BC
2000	4				
2001	4.7	4.742	4.7	4.8	4.6
2002	5.8	5.783	5.3	6.1	4.9
2003	6	5.992	3.9	5.9	4.9
2004	5.5	5.542	4	5.2	4.9
2005	5.1	5.083	4.2	5.2	4.9
2006	4.6	4.608	4.3	5.2	4.9
2007	4.6	4.617	4.6	5.2	4.9
2008	5.8	5.8	5.8	5.2	4.9
2009	9.3	9.275	9.3	5.2	4.9
2010	9.6	9.633	9.6	5.2	4.9
2011	8.9	8.537	8.9	5.2	4.9
Average	6.354545	6.328364	5.872727	5.309091	4.872727
Standard deviation	1.849503	1.802659	2.149034	0.347601	0.086244
Coefficient of variation (%)	29.1052	28.48538	36.59346	6.547279	1.769932

APPENDIX 7.

Formulae for average relative distance compared to maximal performance

Formula for the relative distance

$$d_{i_{ind_j}} = \frac{ind_i^j}{\{\min abs(ind_i^j\}_{i=1,..,4}}, \text{ j=1,2,..,5}$$

Formula for the average relative distance

$$\overline{d_i} = \sqrt[5]{\prod_{j=1}^{5} d_{i_{ind_j}}}$$

Formula for the location of each institution

$$loc_i^{\%} = \frac{\overline{d_i}}{\min(d_i)_{i=\overline{1,4}}} \cdot 100$$

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