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A NEW STRATEGY BASED ON ECONOMETRIC MODELS TO IMPROVE THE FORECASTS ACCURACY IN ROMANIA

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Abstract: *An empirical strategy of improving the forecasts accuracy is proposed in this article starting from econometric models with the random component determined using resampling techniques. New predictions were built using those provided by two institutions from Romania specialized in forecasting: the Institute for Economic Forecasting (IEF) and the National Commission of Prognosis (NCP). For the inflation and unemployment rate four different regression models were proposed to build other forecasts. Two of the regression models improved both institutions forecasts for the inflation and unemployment rate on the forecasting horizon 2010-2012, while the other two provided better predictions than the NCP ones. So, the models based on resampled errors is an original way of constructing new forecasts and at the same time a good strategy of improving the predictions accuracy for some macroeconomic forecasts in Romania.*

Key words: *accuracy, econometric models, forecasts, resampling techniques.*

1 Introduction

In this study we are interested in building new forecasts starting from the ones provided by two specialized institutions in Romania: the Institute for Economic Forecasting (IEF) and the National Commission of Prognosis (NCP). Actually, our purpose is to test if the new predictions based on econometric models using resample techniques to generate the random element are more accurate than the initial ones.

After a short review in the literature regarding the measures of forecasts accuracy and the strategies to improve it, we proposed some econometric models used in constructing new prognosis for inflation and unemployment rate on the horizon 2010-2012. The accuracy of these forecasts was assessed and the models that improved the accuracy were identified.

2 Forecasts accuracy

To assess the forecasts accuracy, as well as their ordering, statisticians have developed several measures of accuracy. For the comparison between the MSE indicators of forecasts, Granger and Newbold proposed a statistic. Another statistic is presented by (Diebold and Mariano, 1995) for the comparison of other quantitative measures of errors.

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Diebold and Mariano proposed a test in 1995 to compare the accuracy of two forecasts under the null hypothesis that assumes no differences in accuracy. The test they proposed was later improved by Ashley and Harvey, who developed a new statistic based on a bootstrap inference. Subsequently, Diebold and Christoffersen have developed a new way of measuring accuracy, while preserving the co-integration relation between variables.

Meese and Rogoff's paper, "Empirical exchange rate models of the seventies", remains the starting point for many research studies on the comparison of accuracy and bias. Recent studies target accuracy analysis using as a comparison criterion different models used in making predictions or the analysis of forecast values for the same macroeconomic indicators registered in several countries.

(Allan, 2012) obtained a good accuracy for the OECD forecasts combined with outturn values of GDP growth for G7 countries between 1984 and 2010. The same author mentioned two groups of accuracy techniques used in assessing the predictions: quantitative forecasts accuracy statistics and qualitative accuracy methods.

(Dovern and Weisser, 2011) used a broad set of individual forecasts to analyze four macroeconomic variables in G7 countries. After analyzing accuracy, bias and forecasts efficiency, large discrepancies resulted between countries and also in the same country for different variables.

Most international institutions provide their own macroeconomic forecasts. It is interesting that many researchers compare the predictions of those institutions (Melander for European Commission, Vogel for OECD, Timmermann for IMF) with registered values and those of other international organizations, but the comparison with official government predictions is omitted.

(Abreu, 2011) evaluated the performance of macroeconomic forecasts made by IMF, European Commission and OECD and two private institutions (Consensus Economics and The Economist). The author analyzed the directional accuracy and the ability to predict a possible economic crisis.

In the Netherlands, experts made predictions starting from the macroeconomic model used by the Netherlands Bureau for Economic Policy Analysis (CPB). For the period 1997-2008 the experts' model of the macroeconomic variables evolution was reconstructed and it was compared with the base model. The conclusions of (Franses, Kranendonk and Lanser, 2011) were that the CPB model forecasts are in general biased and with a higher degree of accuracy.

(Gorr, 2009) showed that the univariate method of prediction is suitable for normal conditions of forecasting, while using conventional measures for accuracy, but multivariate models are recommended for predicting exceptional conditions when the ROC curve is used to measure accuracy.

(Ruth, 2008), using the empirical studies, obtained forecasts with a higher degree of accuracy for European macroeconomic variables by combining specific sub-groups predictions in comparison with forecasts based on a single model for the whole Union.

(Heilemann and Stekler, 2007) explain why macroeconomic forecast accuracy in the last 50 years in G7 has not improved. The first explanation refers to the criticism brought to macro-econometrics models and to forecasting models, and the second one is related to the unrealistic expectations of forecast accuracy. Problems related to the forecasts bias, data quality, the forecast process, predicted indicators, the relationship between forecast accuracy and forecast horizon are analyzed.

If we consider $\hat{X}_t(k)$ to be the predicted value after k periods from the origin time t, then the error at future time (t+k) is: $e_t(t+k)$. This is the difference between the registered value and the predicted one.

The indicators for evaluating the forecasts accuracy that will be taken into consideration when the accuracy is assessed are:

› Root Mean Squared Error (RMSE)

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

› Mean error (ME)

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

› Mean absolute error (MAE)

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

Theil proposed the calculation of U statistic that is used to make comparisons between forecasts from the accuracy point of view.

Theil's U statistic can be computed in two ways.

a- the registered results
p- the predicted results
t- reference time
e- the error (e=a-p)
n- number of time periods

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

A value close to zero for U_1 indicates a better accuracy.

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

If U_2 <1=> a value less than one for the U2 statistic, it results that the forecast to compare has a higher degree of accuracy than the naive one.

Bratu (2012) utilized some strategies to improve the forecasts accuracy (combined predictions, regressions models, historical errors method, application of filters and exponential smoothing techniques).

3 New forecasts built using resample techniques

In this study few models based on a random value were generated using the resample technique. This research uses the inflation and unemployment rates provided by the Institute for Economic Forecasting (IEF) and the National Commission of Prognosis (NCP) on the forecasting horizon 2010-2012.

Supposing that we know the past values of an indicator and the forecasts provided by certain institutions, the future values are determined using the following model:

New_prediction= provided_forecast + random_value (M1)

The problem is to determine the random element. The average of past predictions is used as a model for the forecasts. The difference between each prediction and this average is computed. The differences are resampled in groups equalled with the length of the forecasting horizon.

Unlike the parametric tests, the resampling methods start from theoretical repartitions. Actually, the inference is based on many replications of the same sample. The resampling simulates a very large number of possible results. An Add-in module in Excel was used to resample

the historical errors.

For a forecasting horizon of 3 years, starting from the predictions made by NCP and IEF, the following new predictions were obtained for the inflation rate and unemployment rate:

New forecasts based on M1 model Table 1

	Inflation rate (%)	
Years	based on IEF forecasts	based on NCP forecasts
2010	5.555	6.3
2011	5.258	5.9
2012	4.055	3.8
	Unemployment rate (%)	
	based on IEF forecasts	based on IEF forecasts
2010	6.935	6.935
2011	5.743	5.743
2012	5.235	5.235

The values of predictions decrease in time for both variables, a higher decrease being registered by the forecasts made for NCP in 2012 with respect to the forecasts provided for 2011.

The accuracy of forecasts made by IEF and NCP and of new predictions for the inflation rate Table 2

Accuracy indicator	IEF forecasts	NCP forecasts
ME	-0.2043	0.7967
MAE	0.669	0.87
RMSE	0.7262	1.1919
U1	0.0669	0.1194
U2	1.6005	1.0082
	New forecasts based on IEF expectations	New forecasts based on NCP expectations
ME	0.3073	-0.0700
MAE	-2.1437	0.13666
RMSE	0.4487	0.1462
U1	0.0434	0.0135
U2	2.5705	7.7097

Author's computations using Excel

The inflation predictions based on the model M1 that considers the past random value provided better accuracy than the corresponding ones of IEF and NCP. All the accuracy measures conduct us to the same conclusion, but all the forecasts are less accurate than the naïve ones.

The accuracy of forecasts made by IEF and NCP and of new predictions for the unemployment rate Table 3

Accuracy indicator	IEF forecasts	NCP forecasts
ME	-0.9693	-0.2333
MAE	1.3026	1.5666
RMSE	1.4307	1.7407
U1	0.1023	0.1308
U2	1.2268	0.8714
	New forecasts based on IEF expectations	New forecasts based on NCP expectations
ME	0.4957	-0.2167
MAE	0.8143	1.45
RMSE	1.1631	1.5840
U1	0.0928	0.1194
U2	1.1543	0.9545

Author's computations using Excel

The new unemployment forecasts are more accurate than the initial estimations of IEF and NCP. The future random element was considered to be the past random values computed using the resampling technique. However, only the NCP forecasts and those based on its random values are more accurate than the forecasts based on the random walk.

Another regression model is based on the previous realization of the variable and the random element:

Prediction = previous_realization + random_value (M2)

New forecasts based on M2 model Table 4

Years	Inflation rate (%)	Unemployment rate (%)
2010	5.314	7.3778
2011	5.814	6.7778
2012	5.524	5.1778

Author's computations using Excel

The forecasts based on M2 model decrease in time on the forecasting horizon 2010-2012.

The accuracy of forecasts based on M2 model Table 5

Accuracy indicator	Inflation rate forecasts	Unemployment rate forecasts
ME	0.9160	0.0222
MAE	1.2586	1.32593
RMSE	1.3649	1.4721
U1	0.1130	0.1130
U2	1.1206	0.9824

Author's computations using Excel

According to U1 indicator, the inflation rate and unemployment rate forecasts based on M2 model are more accurate than those provided by NCP. The new unemployment forecasts are even better than the naïve forecasts.

Other proposed models express the prediction of an institution based on the prediction of the other.

Prediction (IEF) = Prediction (NCP) + random_value (M3)

New forecasts based on M3 model Table 6

Years	Inflation rate (%)	Unemployment rate (%)
2010	6.9774	8.5880
2011	5.6804	7.3960
2012	5.4774	6.8880

Author's computations using Excel

This model also generates forecasts that decrease in time, but the unemployment ones are overestimated in average.

The accuracy of forecasts based on M3 model Table 7

Accuracy indicator	Inflation rate forecasts	Unemployment rate forecasts
ME	0.4216	-1.1573
MAE	0.726814	1.36533
RMSE	1.0195	1.5642
U1	0.0809	0.1103
U2	1.3170	1.1353

Author's computations using Excel

The inflation and unemployment rate forecasts accuracy is improved for NCP predictions using the model M3, but these are still less accurate than the naïve forecasts.

The model denoted by M4 has the following form:

Prediction (IEF) = Prediction (NCP) + random_value (M4)

New forecasts based on M4 model Table 8

Years	Inflation rate (%)	Unemployment rate (%)
2010	5.7319	8.3247
2011	4.4349	7.1327
2012	4.2319	6.6247

Author's computations using Excel

This last model provided lower values for the inflation rate than the other models. The decrease in the values of predictions is slower.

The accuracy of forecasts based on the M4 model Table 9

Accuracy indicator	Inflation rate forecasts	Unemployment rate forecasts
ME	1.6671	-0.8940
MAE	1.667111	1.277555
RMSE	1.9081	1.3807
U1	0.1679	0.0992
U2	0.7305	1.2623

Author's computations using Excel

The model M4 succeeded in improving the accuracy of the unemployment rate provided by NCP and IEF, according to U1 indicator. However, only the inflation forecasts are better as compared to naive expectations.

4 Conclusions

The application of regression models that are based on resampling techniques to calculate the random element could be considered a good strategy of improving the forecasts accuracy in some cases.

For the foresting horizon 2010-2012, the first and the last proposed models improved the accuracy of inflation and unemployment predictions of the two institutions (NCP and IEF). The other two models are predictions for unemployment (M2 and M3) and for inflation (M3).

This strategy to improve the accuracy of the official forecasts is an empirical one and it depends on the particular characteristics of the initial forecasts. But the recent historical tendency in getting better forecasts is usually kept for a short forecasting horizon.

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