Directional accuracy for inflation and unemployment rate predictions in Romania

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Abstract

The main objective of this study is to assess the usefulness and rationality of the inflation and unemployment rate forecasts made for Romanian by three experts in forecasting: F1, F2 and F3. All the unemployment rate forecasts over the horizon 2001-2013 provided by all experts do not provide valuable information for future decisional process. According to Pesaran-Timmermann test, the directional forecasts of F3 and the autumn expectations of F2 are useful and rational.

Keywords: forecasts, directional accuracy, inflation rate, unemployment rate

JEL Classification: C52, C53, E27, E37

1. Introduction

Macroeconomic forecasts are the support of decisional process in economic and financial policies. The ability to predict macroeconomic variables changes and modify directions will affect the business confidence, consumer subjectivity, and foreign direct investment (Chang et al., 2011). Therefore, it is necessary to assess the rationality of directional predictions, but also their usefulness.

The common approach to evaluate the predictions' usefulness consists in the measurement of the error's magnitude, using accuracy measures like mean square error (MSE) (Diebold and Mariano, 2002), or log of the mean squared error ratio (log MSER) (Armstrong and Collopy, 1992; Hyndman and Koehler, 2006). However, these measures do not have an economic interpretation and they neglect the presence of outliers. These are reasons for the development of directional forecasts that were presented initially by several others (Merton, 1981; Henriksson and Merton, 1981). Later, this technique was used for assessing the macroeconomic forecasts (Pesaran and Timmermann, 1994; Artis, 1996; Öller and Barot, 2000; Pons, 2001).

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In this study, the directional accuracy was assessed, using only the predictions' signs, and the final values. The errors' magnitude has been neglected. In order to make the predictions robust to the presence of outliers, the high and the low errors received the same importance. It was assessed the directional accuracy of Romanian inflation and unemployment rate, using three important institutes: European Commission, Institute for Economic Forecasting and National Commission for Prognosis. There are various studies regarding the assessment of directional accuracy for IMF and OECD predictions of the G7 countries (Pons, 2000; Öller and Barot, 2000; Pons, 2001; Ashiya, 2003; Ashiya, 2006). Other studies are interested in the rationality and usefulness predictions for the G7 countries, the forecast being provided by OECD (Ash et al., 1998). Kumar (2010) used a time-Varying parameter vector auto-regression model for predicting emerging market exchange rates, obtaining a good degree of accuracy.

The paper is structured as it follows. The second section describes the methodology while the third one presents the forecasts data set provided by the three forecasters and the directional accuracy is assessed. The last section gives a brief conclusion.

2. Methodological background

In order to check if the predictions are 'valuable' the comparison is made with the naïve forecast that supposes that the value in the actual period will remain the same in the next period. Schnader and Stekler (1990) and Stekler (1994) used the contingency table approach in order to check the probabilistically independence between the sign of the predicted, respectively actual change. The null hypothesis of this directional accuracy test assumes the independence between the actual and the predicted value. The forecasts are valuable if the independence hypothesis is rejected (Merton, 1981). The real and the forecast values of the variable changes are presented in a 2×2 contingency table. Different tests are use in this case: Fisher's exact test, chi-square test, and the test proposed by Pesaran and Timmermann (Pesaran and Timmermann, 1992).

Table 1: Contingency Table for macroeconomic forecasts

Actual (A) Forecasted (F)	negative change	positive change	Subtotal
negative change	n_{00}	n_{01}	n_{00}
positive change	n_{10}	n_{11}	n_{10}
Subtotal	n_{00}	$n_{\square 1}$	N

Source: author's construction
Note: there is a total number of N observations, subscript i for n_{ij} shows the forecasted outcome, subscript j for n_{ij} shows the actual result, $i\ (j) = 0$ implies negative change, and $i\ (j) = 1$ implies positive change.

The most used test is based on the contingency tables (chi-square test). This test was used in many previous studies (Schnader and Stekler, 1990; Stekler, 1994; Leitch and Tanner, 1995; Artis, 1996; Ash et al., 1998; Joutz and Stekler, 1998). The statistic of this test is:

$$\hat{\chi}^2 = \sum_{i=0}^{1}\sum_{j=0}^{1} \frac{(n_{ij} - n_{i\bullet} n_{\bullet j}/N)^2}{n_{i\bullet} n_{\bullet j}/N} \quad (1)$$

Wickens (1989) concluded that this test can become too conservative because the independence assumption can be wrongly accepted. Therefore, it is recommended the use of Yates' continuity correction (Yates, 1934), based on the following statistic:

$$\chi^2_{\text{Yates}} = \frac{N(|n_{00}n_{11} - n_{01}n_{10}| - N/2)^2}{n_{00}n_{10}n_{00}n_{01}} \quad (2)$$

Another problem of the chi-square test is the continuous distribution hypothesis for the chi-square, but the computation uses discrete categories. The discrete frequencies approximation can generate an inaccurate approximation of the test statistic in case of very low expected frequencies. For an accurate test requires no more than 20% of the cells should have frequencies less than 5 and all cells should have frequencies greater than 1 (Everitt, 1992).

In order to solve the problem of low expected frequencies, the Fisher's exact test for contingency tables is employed. This test is based on a hyper-geometric repartition for directly computing the independence probability. This probability for a 2×2 contingency table is computed as:

$$p = \frac{\binom{n_{00}}{n_{00}}\binom{n_{10}}{n_{10}}}{\binom{N}{n_{00}}} = \frac{n_{00}!n_{10}!n_{00}!n_{01}!}{n_{00}!n_{01}!n_{10}!n_{11}!N!} \quad (3)$$

Pesaran and Timmermann (1992) proposed a non-parametric test on the correct forecast of the directional accuracy. It supposes the estimation of the probability of independence between results and predictions. This statistic of this test follows a chi-square distribution with one degree of freedom. The general standardized test statistic for assessing the predictive performance has the following form:

$$S_n^2 = \frac{(\hat{p} - \hat{p}^*)^2}{\text{Var}(\hat{p}) - \text{Var}(\hat{p}^*)} \sim \chi^2(1) \quad (4)$$

$\hat{p} = (n_{00} + n_{11})/N$: Sample's estimate of the probability of a correctly signed prediction $\text{Var}(\hat{p}) = [\hat{p}^*(1 - \hat{p}^*)]/N$

$\hat{p}_f = n_{10}/N$: probability of positive change in predicted outcomes

$\hat{p}_a = n_{01}/N$: probability of positive change in actual results

$\hat{p}^* = \hat{p}_f \hat{p}_a + (1-\hat{p}_f)(1-\hat{p}_a)$: estimator under the null hypothesis

$$\text{Var}(\hat{p}^*) = [(2\hat{p}_f - 1)^2 \hat{p}_a(1-\hat{p}_a) + (2\hat{p}_a - 1)^2 \hat{p}_f(1-\hat{p}_f) + 4\hat{p}_a\hat{p}_f(1-\hat{p}_a)(1-\hat{p}_f)/N]/N .$$

Pesaran and Timmermann (1994) provied also the generalization of their test when actual values and predictions are grouped in more than two classes. The test is useful when a joint assessment of two predictions is made, no requirement being necessary regarding the forecasts' independece (Sinclair et al., 2011).

3. The assessment of the directional accuracy for inflation and unemployment rate forecasts

The experts' predictions for inflation rate and unemployment rate in Romania will be used, the horizon covering the period from 2001 to 2013.

The evolution of forecasts for all the forecasters is presented in Figure 1.

According to the above graph, the errors associated to the unemployment rate predicts are higher than those for inflation predictions for all the experts.

First of all, the forecasts was assessed using the prediction error (Stekler, 1994; Joutz and Stekler, 2000; Clements et al., 2007). Some statistics are computed for the predictions of inflation and unemployment rate: mean absolute deviation (MAD), standard deviation (SD), the maximal and the minimum value.

From Table 2 it results that the F1 outperforms the the other experts that provide periodically forecasts for inflation rate. The lowest MAD for inflation rate forecasts was registered for the spring version, while the lowest SD for the automn one. For the unemployment rate predictions, F3 is recommended. The first scenario is the best in term of MAD, while the second is more suitable according to SD criterion. The unemployment rate forecasts based F2 are also more accurate that the inflation expectations of F1 forecasts. The indicators are computed in Table 2.

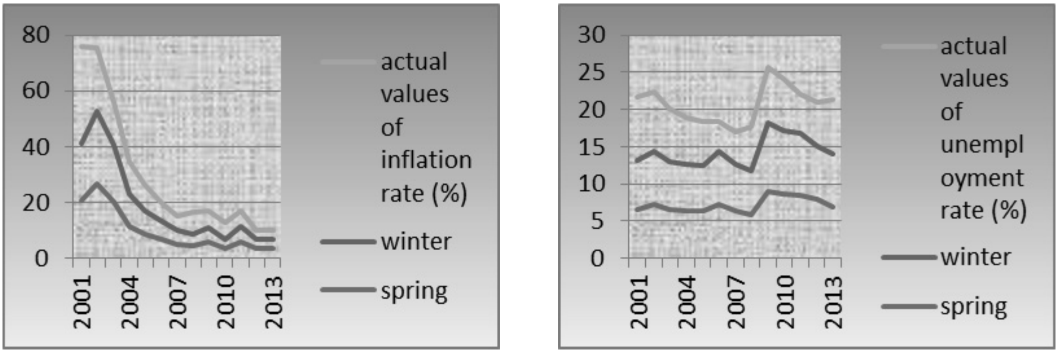
Table 2: Measures of forecasts errors

Forecasts' provider	Type of forecast	Inflation rate				Unemployment rate			
		MAD	SD	Max	Min	MAD	Std.	Max	Min
F1	Spring version	2,342	4,484	13,8	-4,9	1,400	1,637	2	-3,3
	Winter version	2,381	2,309	14	-5,1	1,292	1,544	2,1	-3
F2	Spring version	2,505	3,695	4,350	-10,300	1,377	1,482	1,200	-3,300
	Autumn version	2,450	4,043	4,250	-11,200	1,478	1,136	0,112	-3,800
F3	First scenario	4,495	8,343	0,600	-29,500	1,148	1,222	0,700	-2,300
	Second scenario	4,701	8,824	0,697	-31,461	1,162	1,175	0,500	-2,060

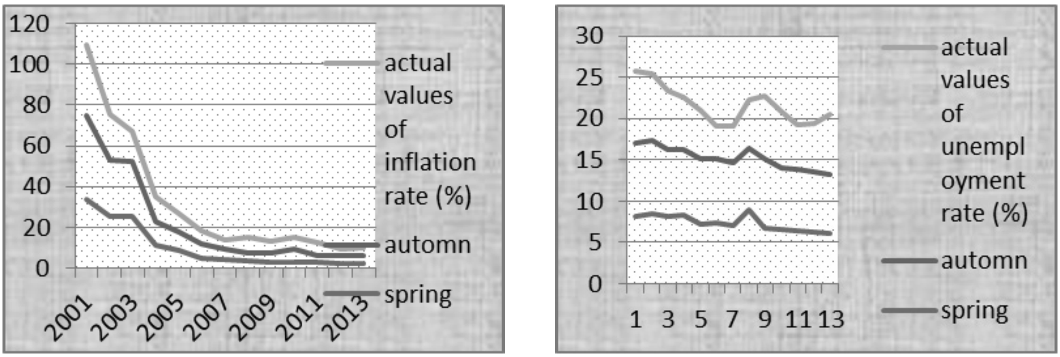
Source: author's computations

Figure 1: Romanian inflation and unemployment rate forecasts

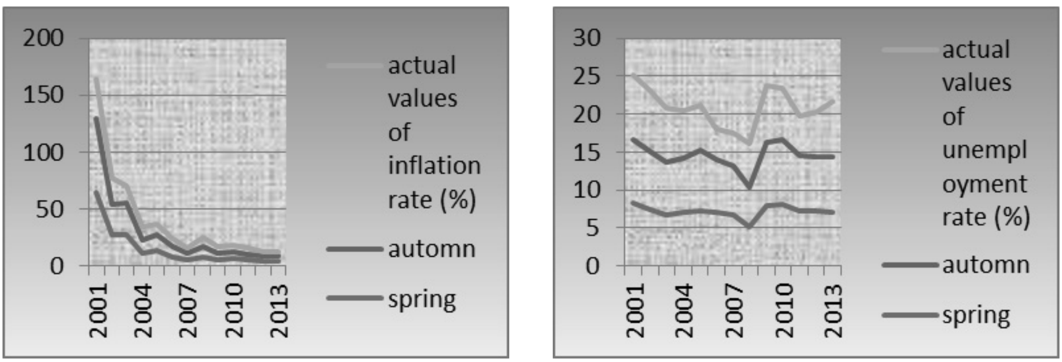
F1



F2



F3



Source: author's graph

The directional accuracy approach is based on the acceleration (deceleration) of growth forecast. The directional predictions usually consider no change in government policies, nominal exchange rates, and dollar-denominated oil prices.

The data are organized in a contingency table.

n_{00} - negative change in registered values and negative change in predictions

n_{01} - negative change in registered values and positive change in predictions

n_{10} - positive change in registered values and negative change in predictions

n_{11} - positive change in registered values and positive change in predictions

It was computed the number of correct (n_{00} and n_{11}) and incorrect (n_{01} and n_{10}) direction forecasts that were predicted by the three institutions. According to contingency tables made for all the experts, the cells frequencies are very low, this method being unsuitable for this particular case. In Table 3, the contingency tables are presented for the three types of forecasts providers.

Table 3: Contingency tables

Forecasts' provider	Type of forecast	Inflation rate				Unemployment rate			
		n_{00}	n_{01}	n_{10}	n_{11}	n_{00}	n_{01}	n_{10}	n_{11}
F1	Spring version	6	1	3	1	4	4	1	2
	Winter version	6	1	3	1	5	4	1	2
F2	Spring version	8	3	1	1	4	4	3	2
	Autumn version	8	1	1	3	5	4	1	2
F3	First scenario	7	2	0	3	4	4	3	2
	Second scenario	7	2	1	3	4	4	3	2

Source: author's computations

If the sum of inputs in the two cells of the leading diagonal (n_{00} + n_{11}) is high, three statistics could be computed, the null assumption of the tests stating that the prediction change is independent from probabilistic point of view of the actual change (Pons, 2000). The results of the application of directional accuracy tests are displayed in Table 4.

Table 4: Tests for directional accuracy

Institutes	Forecast periods	Inflation rate			Unemployment rate		
		$\hat{\chi}^2_{\text{Yates}}$	p	S^2_n	$\hat{\chi}^2_{\text{Yates}}$	p	S^2_n
F1	Spring version	0,316	0,003	1,139	0,113	0,003	0,381
	Winter version	0,316	0,003	1,139	0,003	0,031	0,034
F2	Spring version	0,037	0,462	0,445	0,048	0,408	0,243
	Autumn version	2,731	0,050	8,409	0,003	0,031	0,034
F3	First scenario	2,892	0,003	4,801	0,048	0,408	0,243
	Second scenario	1,411	0,112	5,569	0,048	0,408	0,243

Source: author's computations

The three statistics were computed to study the directional accuracy of unemployment and inflation prediction. The results show that for all the unemployment forecasts and for most of the inflation rate forecasts the null hypothesis was not rejected, which means that the forecasts are not valuable in the directional predictions.

According to Pesaran-Timmermann test, the inflation forecasts of F3 and the autumn predictions of F2 are valuable at 5% level of significance. To sort the accuracy of Romanian inflation and unemployment rate for direction forecast the following hierarchy was obtained: F3, F2 and F1. The statistics support the propositions that inflation forecasts are better than unemployment rate predictions in Romania.

4. Conclusions

This paper assessed the directional accuracy of the inflation and unemployment rate predictions made by F1, F2 and F3, using three nonparametric directional accuracy assessment methods. The results showed that most of the forecasts are not valuable, only for inflation rate the predictions of F3 were valuable according to Pesaran-Timmermann test. The advantage of this approach

The disadvantage is that there are differences in the directional accuracy between forecasters because of the transition economy and the different information about Romanian economy collected by the forecasts' providers.

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