A COMPARATIVE ANALYSIS OF MACROECONOMIC FORECASTS ACCURACY IN SPAIN AND ROMANIA

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Abstract

In this study a comparative analysis of the forecasts accuracy for Spain (developed country) and Romania (developing country) was developed for the crisis period (2009–2013). The providers are national forecasters: Bank of Spain and FUNCAS (Spanish Savings Banks Foundation) for Spain and two anonymous experts for Romania (E1 and E2). Only for the unemployment rate the Spanish institutes provided more accurate forecasts, for the rest of the variables (inflation rate, private consumption and GDP growth) the Romanian institutes giving more accurate predictions. However, the results are contradictory for the accuracy assessment in each country, the U1 Theil's statistic and the accuracy tests (Diebold-Mariano test and Wilcoxon's signed rank test) indicating different hierarchies. All in all, for inflation rate, unemployment rate and GDP growth in Romania, E2 provided more accurate forecasts. In Spain, FUNCAS offered better forecasts for GDP growth and private consumption during 2009–2013.

Keywords: directional accuracy, forecasts, predictions, Diebold-Mariano test.

Jel Classification: E27; E37; C52; C53

INTRODUCTION

The main objective of this research is to make a comparative analysis of the accuracy of forecasts in two countries: Spain and Romania. The predictions are provided by anonymous experts in forecasting from Romania. The providers from Spain are the Central Bank and the FUNCAS (*Spanish Savings Banks Foundation*). The macroeconomic variables that were selected: GDP growth, inflation rate, private consumption, and unemployment rate. Romania and Spain were chosen because we want to assess the degree in a developing country and in a well developed country and

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to analyze better the effects of economic crisis on the forecasting process of these two types of countries.

In Romania and Spain there are very few studies that treated the problem of forecasts accuracy. The government, the National Bank and other institutions are directly interested by the use of the most accurate forecast.

There are many international organizations that provide their economic predictions for various countries. The comparisons between forecasts consider these institutions anticipations (OECD, IMF, World Bank, European Commission, SPF etc.) and those of other international organizations, the accuracy assessment being made. The forecast errors for these institutions are in general large and non-systematic. Three international institutions (European Commission- EC, IMF and OECD) made predictions using macroeconomic models, but these forecasts failed to anticipate the downturn from 2007. Other providers of forecasts are statistical institutes, ministries of finance, and private companies like banks or insurance companies.

Literature usually makes comparisons between OECD and IMF forecasts and Consensus Economics ones or private predictions. The accuracy is evaluated according to different criteria: forecasts errors and associated accuracy measures, comparisons with naïve predictions that is based on random walk, directional accuracy evaluation.

Glück and Schleicher (2005) compared the forecasts performance of IMF with that of OECD, evaluating the errors between G7 countries. Krkoska and Teksoz (2005) compared the changes in the EBRD (European Bank for Reconstruction and Development) predictions for transition countries with those made by other institutions (commercial and academic forecasters). They showed that the EBRD made on average higher changes in its earlier forecasts. Later, Krkoska and Teksoz (2007) showed for 25 transition countries that the EBRD predictions during 1994–2004 improve in accuracy with the progress in transition. These predictions accuracy for late GDP is better than of other institutions with around 0.4 percentage points. The Russian crisis seems to be the only structural break.

The European Commission's forecasts analyzed on the horizon from 1998 to 2005 are comparable in terms of accuracy with those of Consensus, IMF and OECD for variables like inflation rate, unemployment rate, GDP, total investment, general government balance and current account balance as Melander, Sismanidis, and Grenouilleau (2007) stated.

Abreu (2011) assessed the forecasts accuracy for predictions made by international organizations like IMF, European Commission and OECD and by private institutions (Consensus Economics and The Economist). The author made also the assessment of directional accuracy. Forecasters from Netherlands used the macroeconomic model of the Netherlands Bureau for Economic Policy Analysis (CPB) to make predictions that were compared to experts' anticipations. The results over the period 1997–2008 indicated that CPB model provided superior forecasts in terms of accuracy, the results being presented by Franses, Kranendonk and Lanser (2011).

The forecasts accuracy of the predictions provided by European Commission before and during the recent economic crisis was assessed by González Cabanillas and Terzi (2012). They compared these forecasts with those provided by Consensus Economics, IMF and OECD. The Commission's forecasts errors have increased because of the low accuracy from 2009 for variables as GDP, inflation rate, government budget balance, and investment.

The forecasts' accuracy for inflation and real GDP growth rate in case of the Germany predictions made by OECD and 3 professional forecasters from Germany was analyzed by Heilemann and Stekler (2013). In the last 10 years, the accuracy forecasts for Germany's inflation and GDP did not improved too much.

The strategic behavior of the private forecasters that placed their expectations away from OECD's and IMF's ones, was assessed by Frenkel, Rülke and Zimmermann (2013), this duration of this event being 3 months.

Greenbook inflation forecasts are more accurate than those of the private forecasts, Liu and Smith (2014) making comparisons between the predictions provided by Survey of Professional Forecasters, Greenbook and other private forecasters.

In Romania, excepting the studies of Simionescu (2013), there were not any preoccupations for assessing or comparing the macroeconomic forecasts accuracy. In Romania, the most accurate predictions for the unemployment rate on the forecasting horizon 2001-2012 were provided by the Institute for Economic Forecasting (IEF) that is followed by European Commission and National Commission for Prognosis (NCP).

1. FORECASTS ACCURACY ASSESSMENT

Let us consider the actual values of a variable $\{y_t\}, t = 1,2, \dots, T$ and two predictions for it $\{\hat{y}_{t1}\}, t = 1,2, \dots, T$ and $\{\hat{y}_{t2}\}, t = 1,2, \dots, T$. The prediction errors are computed as: $e_{it} = \hat{y}_{it} - y_t$, i=1,2. The loss function in this case is calculated as:

$$g(y_t, \hat{y}_{it}) = g(\hat{y}_{it} - y_t) = g(e_{it}) \tag{1}$$

In most cases this function is a square-error loss or an absolute error loss function.
Two predictions being given, the loss differential is:

$$d_t = g(e_{1t}) - g(e_{2t}) \tag{2}$$

The two predictions have the same degree of accuracy if the expected value of loss differential is 0.

For DM the null assumption of equal accuracy checks if the expected value of differential loss is zero: $E(d_t) = 0$. The covariance stationary been given, the distribution of differential average follows a normal distribution. The DM statistic, according to Diebold and Mariano (2012), under null hypothesis is:

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

$$\bar{d} = \frac{\sum_{t=1}^{n} d_t}{n} \tag{3}$$

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

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

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.

Wilcoxon's signed rank test is based on the sum of the ranks for the absolute values of positive prediction differentials:

$$WSR = \sum I(d_t > 0)rank(|d_t|)$$
$$I(d_t > 0) = 1 \; if \; (d_t > 0)$$

For T going to infinity, under the null assumption, the Wilcoxon's signed rank test has the following statistic:

$$\frac{SR - T(T+1)/4}{\sqrt{\frac{T(T+1)2T+1}{24}}} \to N(0,1) \tag{4}$$

The U1 Theil's statistic is used for making comparisons between predictions based on different methods or made for different countries. It considers the positive and the negative changes in a variable:

$$U_1 = \frac{\sqrt{\sum_{t=1}^{n}(a_t - p_t)^2}}{\sqrt{\sum_{t=1}^{n} a_t^2} + \sqrt{\sum_{t=1}^{n} p_t^2}} \tag{5}$$

a - actual values of a variable
p - predicted values of a variable
t - time index
e - forecast error (e=a-p)
n - length of forecasts horizon

There are other accuracy measures like mean absolute scaled errors, but this reduces to our U1 coefficient. The U2 statistic of Theil is used to make the comparison with the naïve forecasts.

2. THE EVALUATION OF FORECASTS ACCURACY IN ROMANIA AND SPAIN

A comparison between the forecasts made for two countries (Spain and Romania) and between the forecasters of each country is made. For Romania we used the predictions of two forecasters. For Spain the forecasts are made by the Central Bank and by FUNCAS (*Spanish Savings Banks Foundation*). The latter is a private organization with no profit that has as main purpose the benefit of the entire Spanish society. The FUNCAS forecasts contain average annual predictions for the current and the following year for 35 variables and aggregates. For Romania, the forecasts are provided by two experts in forecasting.

The horizon covers the actual economic crisis (2009–2013), when from empirical studies we know that the degree of accuracy decreases. The accuracy of macroeconomic forecasts for Spain and Romania is evaluated for several variables: inflation rate, unemployment rate, GDP growth and private consumption. 1 is Bank of Spain and 2 is FUNCAS.
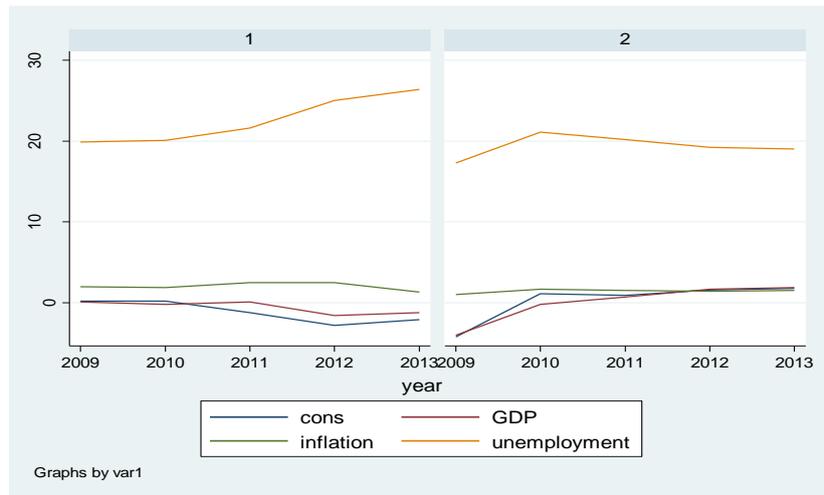

Figure 1. The predictions of macroeconomic variables in Spain

As we can observe from this graph the Bank of Spain predicts a tendency of increase for unemployment rate in the last years, while FUNCAS considers that the unemployment might decrease even if it is a crisis period.
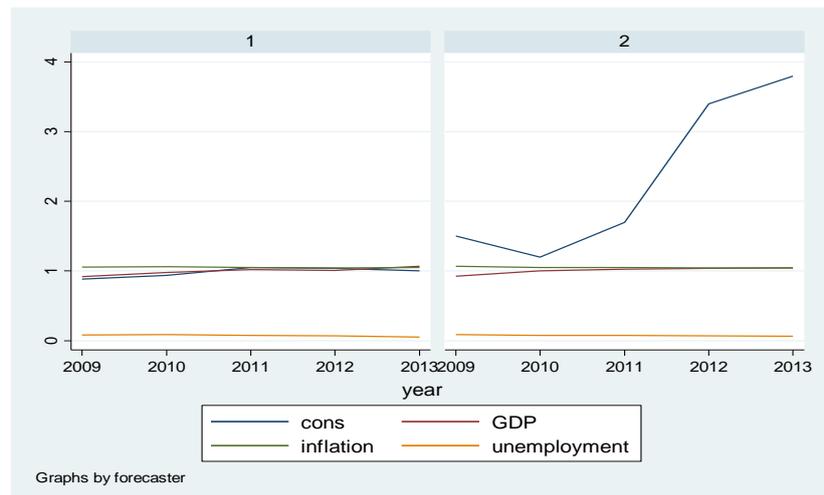
Figure 2. The predictions of macroeconomic variables in Romania made by E1 and E2

For private consumption starting with 2011 the E2 anticipated an increase, while E1 predicted low changes in population's consumption. Very low modifications are also observed for unemployment rate predicted by both forecasters, the differences between predictions being insignificant.

For making comparisons the U Theil's coefficient is computed in order to see which country predicted better its indicators and which expert in each country provided more accurate forecasts.

Table 1. The values of U1 Theil's statistic for predictions provided for Spain and Romania

Variable	Romania		Spain	
	E1	E2	Bank	FUNCAS
Inflation	0.009	0.007	0.268	0.271
GDP rate	0.084	0.081	0.818	0.188
Private consumption	0.026	0.489	0.751	0.698
Unemployment	0.099	0.095	0.086	0.024

Only for the unemployment rate the forecasts for Spain are more accurate than those for Romania, as U1 Theil's statistic shows. For the rest of the indicators, the projections for Romania are better. According to U1 coefficient, E2 predicted better in Romania compared to E1 the following variables, even if the differences are not large: inflation rate, GDP growth and unemployment rate. In Spain FUNCAS predicted with a higher accuracy all the variables excepting the inflation rate.

Moreover, the Diebold-Mariano and Wilcoxon's signed rank tests are applied for checking the differences in accuracy between the forecasts in each country. The results of Diebold-Mariano tests in STATA are presented in Table 1 and Table 2 for both countries.

Table 2. The results of forecasts accuracy tests during the economic crisis in Romania (horizon: 2009–2013)

Variable	Test	Statistic value	Decision-more accurate predictions provided by:
Inflation rate	DM test	S(1) =0.0118 p-value =0.9906	E2
Inflation rate	Wilcon's test	z =1.929 Prob> |z| =0.0537	No differences
Private consumption	DM test	S(1) =-1.641 p-value =0.1009	E1
Private consumption	Wilcon's test	z =-2.495 Prob> |z| =0.0126	E1
GDP growth	DM test	S(1) =0.3721 p-value =0.7098	E2
GDP growth	Wilcon's test	z =-0.378 Prob> |z| =0.7055	No differences
Unemployment rate	DM test	S(1) =1.051 p-value =0.2933	E2
Unemployment rate	Wilcon's test	z =0.605 Prob> |z| =0.5449	No differences

For private consumption predictions both accuracy tests indicated that E1 provided more accurate forecasts than E2. Wilcoxon's signed rank test shows that there are not

differences between unemployment rate, inflation rate and GDP growth predictions in Romania. For these variables, according to DM test, *E2* provided more accurate forecasts.

Table 3. The results of forecasts accuracy tests during the economic crisis in Spain (horizon: 2009–2013)

Variable	Test	Statistic value	Decision-more accurate predictions provided by:
Inflation rate	DM test	S(1) =1.40e+08 p-value =0.000	Bank of Spain
Inflation rate	Wilcon's test	z = 1.786 Prob> |z| =0.0740	No differences
Private consumption	DM test	S(1) =1021298 p-value =0.000	FUNCAS
Private consumption	Wilcon's test	z =-1.051 Prob> |z| =0.2933	No differences
GDP growth	DM test	S(1) =2.036 p-value =0.0417	FUNCAS
GDP growth	Wilcon's test	z =-1.571 Prob> |z| =0.1161	No differences
Unemployment rate	DM test	S(1) =1.369 p-value =0.1711	No differences
Unemployment rate	Wilcon's test	z =1.776 Prob> |z| =0.0758	No differences

According to Wilcoxon's test there are not significant differences between the forecasts of the two Spanish institutions. GDP growth and private consumption DM test indicated that FUNCAS's predictions are more accurate. For the unemployment rate predictions DM test did not detected differences in forecasts.

The results given by U coefficient and accuracy tests are contradictory. Therefore, there is necessary to make a judgment in order to determine the best provider. It is clearly that in Romania the forecasters predicted better all the indicators excepting the unemployment rate. In Spain FUNCAS forecasted better than the Bank of Spain all the variables excepting the inflation rate on the horizon 2009-2013. Excepting private consumption, E2 predicted better than E1 the other macroeconomic variables.

CONCLUSIONS

In this study we assessed the macroeconomic forecasts accuracy in two types of countries: a well developed one (Spain) and a developing country in economic transition (Romania). Surprisingly, the Romanian forecasters provided better predictions for private consumption, GDP growth and inflation rate. Only for unemployment rate the Spanish experts from FUNCAS and Bank of Spain provided more accurate forecasts during the economic crisis (2009–2013).

A future research on this topic could include the assessment of directional accuracy based on Pesaran-Timmermann test. Moreover, other dimensions of forecasts performance like bias and efficiency could be analyzed. Some strategies of improving the forecasts accuracy could be used. It is interesting to check if the combined predictions of the national forecasters could improve the degree of accuracy.

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