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USING THE ECONOMETRIC APPROACH TO IMPROVE THE ACCURACY OF GDP DEFLATOR FORECASTS

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Abstract :

In this article, the GDP deflator is predicted starting from econometric models of historical errors of forecasts based on Dobrescu macromodel. In Romania, a significant relationship between GDP deflator and GDP index predictions was not confirmed. However, there is an important dependence between the forecasts errors of the two variables. Econometric models were built for real errors, absolute ones and squared errors of Dobrescu predictions of 1997-2008. The forecasts errors of GDP deflator for 2009, 2010 and 2011 are lower in all cases than those based on Dobrescu macroeconometric model, the accuracy indicators being a proof of this. But, only the forecasts based on absolute errors are superior to naïve forecasts. This econometric approach for historical forecasts errors are a very good strategy of improving the experts predictions

Keywords: errors, accuracy, econometric models, forecasts, predictions, GDP deflator, Dobrescu macromodel

JEL Classification: E21, E27,C51, C53

1. INTRODUCTION

In this article, knowing the economic relationship between GDP index and GDP deflator, new strategies of predicting the GDP index are proposed for Romania. In this country, Dobrescu macromodel is used to forecast the GDP deflator and the GDP index. The relationship between the forecasts errors might help us in predicting one of the indicators. The computation of the predictions errors can be made in two ways: directly from an econometric model or indirectly, when, first of all, the variable is forecasted.

The results of this research can be use in order to improve the forecasting process of GDP deflator. The econometric models for historical errors of Dobrescu forecasts performed better than the Dobrescu macromodel itself and these are recommended in predicting macroeconomic indicators.

2. MEASURING AND IMPROVING THE FORECASTS ACCURACY

Bratu (2012) states some important strategies to be used in practice in order to improve the forecasts accuracy. One of these strategies is the building of combined forecasts in different variants:

predictions based on linear combinations whose coefficients are determined using the previous forecasts and predictions based on correlation matrix, the use of regression models for large data bases of predicted and effective values. On the other hand, we can apply the historical errors method, which supposes that the same value of an accuracy indicator calculated for a previous period. Combined forecasts are another technique used to improve the forecasts accuracy.

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 critic brought to macroeconomic 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, $\hat{X}_t(k)$ the predicted value after k periods from the origin time t, then the error at future time (t+k) is: $e_t(t+k)$. In literature, there are several traditional ways of measurement, which can be ranked according to the dependence or independence of measurement scale. A complete classification is made by Hyndman and Koehler (2005) in their reference study in the field, "Another Look at Measures of Forecast Accuracy ".

In practice, the most used measures of forecast error are, according to Fildes and Steckler (2000):

- Root Mean Squared Error (RMSE)

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

- Mean error (ME)

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

The sign of indicator value provides important information: if it has a positive value, then the current value of the variable was underestimated, which means expected average values too small. A negative value of the indicator shows expected values too high on average.

- Mean absolute error (MAE)

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

U Theil's statistic is calculated in two variants by the Australian Tresorery in order to evaluate the forecasts accuracy.

The following notations are used:

a- the registered results

p- the predicted results

t- reference time

e- the error (e=a-p)

n- number of time periods

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

If U_1 is closer to one, the forecast accuracy is higher.

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

If U_2 =1=> there are not differences in terms of accuracy between the two forecasts to compare

If U_2 <1=> the forecast to compare has a higher degree of accuracy than the naive one

If U_2 >1=> the forecast to compare has a lower degree of accuracy than the naive one

3. THE ACCURACY OF GDP INDEX PREDICTIONS BASED ON ECONOMETRIC MODELS

The strategies proposed to predict GDP index are original and dependent by the data series provided by the Romanian economy. These are used in order to improve the accuracy of forecasts using econometric models.

The predictions based on Dobrescu macromodel are used. This econometric model estimates, according to Dobrescu (2011) the short and medium-term economic effects for the policies of Romanian government.

The GDP deflator is a price index in Paasche system and it is calculated as a ratio between the nominal GDP dynamic and real GDP dynamic. The GDP index is calculated as the GDP in current period over the GDP in base period.

If we assume that the errors distribution is normal, the t-Student test can be applied. The results of this test in SPSS (**Annex 1**) show that there are significant differences between the two data series (the GDP index errors and the GDP deflator errors).

The Wilcoxon Signed Ranks test could be used when the series distribution is not normal or when the type of repartition is not known. In this case, the test showed again that the differences between the two data series are significant (**Annex 2**).

Some accuracy indicators were calculated in **Table 1** for 3-years-ahead forecasts based on Dobrescu macromodel for GDP index and GDP deflator.

Table 1: Accuracy indicators of forecasts based on Dobrescu macromodel for GDP index and GDP deflator

Forecast horizon	ME		MAE		RMSE		U1	
	GDP index	GDP deflator	GDP index	GDP deflator	GDP index	GDP deflator	GDP index	GDP deflator
1997-1999	-0.149	0.004	0.149	0.200	0.149	0.218	0.125	0.363
2000-2002	-0.067	0.219	0.070	0.219	0.093	0.306	0.102	0.132
2003-2005	-0.037	-0.178	0.037	0.321	0.044	0.399	0.098	0.128
2006-2008	-0.181	-0.166	0.181	0.166	0.183	0.270	0.137	0.143
2009-2011	-0.109	0.592	0.119	0.592	0.143	0.592	0.129	0.142

Source: own computations using Excel

For GDP index all 3-years ahead predictions are overstimated in average. On the forecast horizon 2000-2002, 2003-2005 and 2009-2011 all the accuracy indicators for GDP index are lower than those of GDP deflator. The values of U1 indicator show that all the predictions of GDP deflator are more accurate than the forecasts made for the GDP index.

The errors data series for the GDP deflator forecasts based on Dobrescu approach for 1997-2008 is modeled as: $e\_DEFL_t = -0{,}0022 \cdot \frac{1}{e\_I\_GDP_{t-1}}$ (model A).

The data series of absolute errors will be denoted by e2 while the squared errors data series by e2. The econometric models used to make predictions for the GDP deflator errors are:

$e1\_DEFL_t = 1{,}547 \cdot e1\_I\_GDP_{t-1}$ (model B) and $e2\_DEFL_t = 6{,}33 \cdot 10^{-6} \cdot \frac{1}{e2_{I_{GDP_{t-1}}}}$ (model C).

The predicted errors starting from these econometric errors are displaied in **Table 2**.

Table 2: Predicted errors of GDP deflator based on econometric models of forecasted errors using Dobrescu macromodel

Year	Predicted errors using model A	Predicted errors using model B (absolute errors)	Predicted errors using model C (absolute errors)	Erros of forecasts based on Dobrescu macromodel
2009	0.0118	0.2893	0.0135	0.6276
2010	0.0106	0.3218	0.0121	0.5805
2011	0.0165	0.2058	0.0189	0.56712

Source: own computations using Excel and EViews

All the econometric models generated lower errors than those based on Dobrescu macromodel. The predictions based on model A are the most accurate. The absolute errors corresponding to models B

and C are higher. This use of econometric models based on the relationship betwwen GDP deflator and GDP index is a very good strategy of improving the predictions accuracy.

Starting from the predicted errors, the GDP deflator forecasts for 2009, 2010 and 2011 are gotten. These values are used in calculating some accuracy indicators for the deflator forecasts.

Table 3: Accuracy indicators for the GDP index predictions

Accuracy indicators (percentage points)	Model A forecasts	Model B forecasts	Model C forecasts	Dobrescu model predictions
Mean error (ME)	0.0130	0.2723	0.0148	0.5917
Mean absolute error (MAE)	0.0130	0.2723	0.0148	0.5917
Root mean squared error (RMSE)	0.0132	0.2766	0.0151	0.5923
U1	0.0144	0.0060	0.0132	0.3451
U2	1.4025	0.2262	2.7775	1.9454

Source: own computations using Excel

The highest accuracy is measured for the technique based on model B, according to the lowest value for U1. The predictions base on Dobrescu model are improved by appling these strategies based on econometric approach.

Only the forecasts based on errors of model B are better than the naive predictions, because of the value less than one for U2.

4. CONCLUSIONS

The predictions based on Dobrescu macromodel have a lower degree of accuracy than those based on proposed strategies. In this article, for Romania data set we proved that the predictions based on errors forecasts of Dobrescu macromodel are a very good way of improving the accurace of GDP deflator predictions. There is not a real relationship between forecasts made for GDP index and GDP deflator, but econometric models were built for historical errors of Dobrescu forecasts (simple errors, absolute errors, squared errors). According to U Theil's statistics values, the predictions of GDP deflator based on absolute historical errors of Dobrescu forecasts are the most accurate, being also superior to naive forecasts for 2009-2011.

This econometric approach is original and never mentioned in literature, but could be use for other countries and adapted to the data specificity.

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ANNEXES

ANNEX 1

T-STUDENT TEST FOR GDP DEFLATOR AND GDP INDEX

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 e_defl & e_I_GDP	15	-.011	.969

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 e_defl - e_I_GDP	.2025816	.3903920	.1007988	-.0136103	.4187735	2.010	14	.064

ANNEX 2

WILCOXON TEST FOR GDP DEFLATOR AND GDP INDEX

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
e_I_GDP - e_defl	Negative Ranks	11[a]	8.45	93.00
	Positive Ranks	4[b]	6.75	27.00
	Ties	0[c]		
	Total	15		

a. e_I_GDP < e_defl

b. e_I_GDP > e_defl

c. e_I_GDP = e_defl

Test Statistics[b]

	e_I_GDP - e_defl
Z	-1.874[a]
Asymp. Sig. (2-tailed)	.061

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test