Okun's Law for Romania during 1992-2004

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Abstract: In this article the author examines, based on the *inflation rate* and *unemployment rate* registered in Romania during 1993-2004, how to show Okun's Law. Results consist of *two distinct models* explaining the dependency between the *GDP's growth rate of* and the *unemployment rate's growth* and *vice versa*. This shows that in the case of Romania we can not be talking about *reciprocal and unique two-way relationship* approach using the same model, the direct and mutual dependencies between *growth* of *unemployment rate* and the *growth rate of GDP's* as shown in the original formulation of Okun's Law.

Key words: Okun's Law, GDP's growth rate, unemployment rate's growth, econometric modeling, reciprocal and exclusive reciprocal *two-way relationship*.

1. Okun's Law – general review

Okun's Law (1962), current and however controversial, is a broad topic of discussion in economic literature.

While no one disputes the importance of this law, based on an inverse correlation between *unemployment rate's growth* and *GDP's growth rate*, there are debates on the econometric models that describe these relationships [2].

Initially, Okun (1962) proposed the use of a single model that describes the GDP's dependence of unemployment and unemployment's dependence of GDP. Later this approach was considered erroneous, demonstrating the need to use two distinct models to describe relations (1) and (2) [7].

$$grGDP\% = f(\Delta U\%) \quad (1)$$

$$\Delta U\% = f(grGSP\%) \quad (2)$$

where:

- $\Delta U\%$ - unemployment rate's growth expressed as a percentage;
- grPIB% - GDP's growth rate expressed as a percentage

Currently it is fully accepted that Okun's Law must be approached through two distinct models to describe relations (1) and (2). The parameters of models that describe Okun's law may vary in time and space depending on the structure of the economy that is projected for.

In its original form, Okun's Law specifies that the decrease by 1% of the *unemployment rate* implies an increase, in the average, of the *GDP's growth rate* by 3%. The most familiar of Okun's law associate a decrease by 1% in the rate of unemployment with an increase of GDP's growth rate by 2% [1].

One of the most commonly used estimations of the Okun's Law model is presented on relation (3) and on the equivalent relation[1] (3^*).

$$grGDP\% = 3.2\% - 2\,\Delta U\% \quad (3)$$

$$(3.2\% - grGDP\%)/2 = \Delta U\% \quad (3^*)$$

According to the relationship (3) it is observed that an increase by one percentage of GDP's growth rate over 3.2% implies a decrease in the unemployment rate by ½%. Okun calls the time-free model (3) coefficient "*potential growth rate of GDP*"[1].

From a long time it was considered that the value of *potential growth rate* is a long-term feature of an economy but later, by calculations, it was showed that the parameter value changes over time depending on the structure and dynamics of the national economy, and it

[1] *in the original form of Okun's Law.*

must be estimated regularly [1]. The *potential growth rate of GDP* represents "how much an economy can potentially produce when a *"total" employment*[2] of the *labor force* exists!" [5].

In relation (3*), the free term[3], +3.2%/2, represents the percentage of the *unemployment rate's growth* in a year if there is *no economic growth*. This term is called *the natural annual rate of unemployment*.

Inflation may affect Okun's law by changing the *potential growth rate* and the *natural rate of unemployment* [1].

Currently, the Okun's models class, that describe the link between the *unemployment rate* and the *GDP's growth rate,* was broadened considerably, in the specialty literature occurring variations that include trend type components, difference models, etc... [7].

2. Modeling the relationship between GDP and unemployment for Okun's law specific to Romania during 1992-2004

The modeling process of the reciprocal and exclusive *two-way dependencies* that are established between the *GDP's growth rate* and *unemployment rate's growth* described by Okun's law gets through *two stages*:

Stage 1: Model the *GDP's growth rate* depending on the *unemployment rate's growth*;

Stage 2: Model the *unemployment rate's growth* depending on the *GDP's growth rate*.

In the modeling process we have retained models that have significant *parameters* and *correlation coefficients* and whose modeling error satisfies the *normality* and *independence* assumptions.

We'll also present the *intermediate models* that describe Okun's law even if the parameters are not significant. For *intermediate models* interpretations will be made provided that they are likely descriptive, they are only representative for the studied sample and are not able to make extrapolations based on them.

In calculations were used the GDP values expressed in *comparable prices* to the level of 1990.

2.1. Modeling the GDP's growth rate depending on unemployment rate'growth

Following correlograms' analysis corresponding to GDP's growth rate (grGDP %) (Fig.1 and Fig.2) we can see that the variable is first order autoregressive. This entails placing a AR(1) component in the Okun's model for variable grGDP%.

The intermediate estimated model is taking the form shown in relationship (4).

$$grGDP\%_t = 2.031\% + 0.691\% * grGDP\%_{t-1} - 1.712\% * \Delta U\%_t \quad (4)$$

Std. Err.	(2.627)	(0.287)	(0.519)
Sig.	(0.463)	(0.043)	(0.011)
R square	0.771		

[2] *The term* total *does not necessarily refer to the percentage of 100% but represents the difference between 100% and the natural rate of unemployment.*

[3] Also name the *intercept term*.

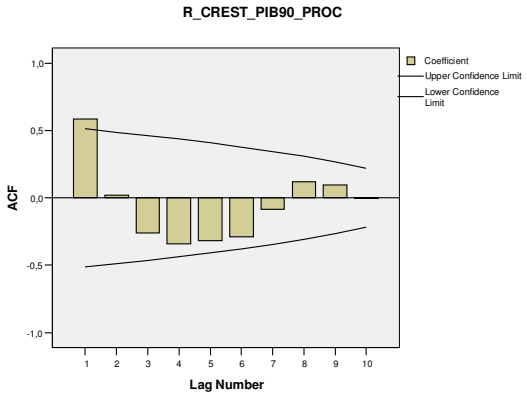

Fig. 1: grGDP% autocorrelation function plot

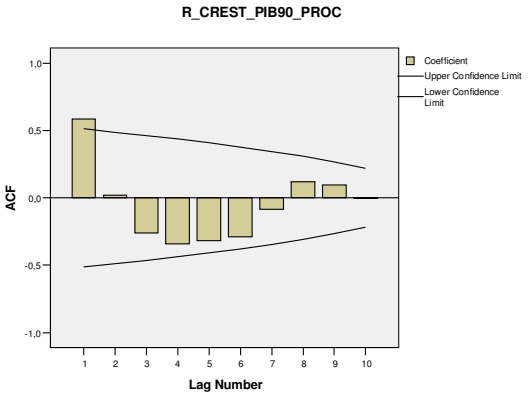

Fig. 2: *grGDP% partial autocorrelation function plot*

Based on the model estimated by the relationship (4) we can say that Romania has a *annual potential GDP's growth rate* of 2.031%. We also notes that at a decrease in the *unemployment rate*'s *growth* by 1%, as the influence grGDP% $_{t-1}$ remains constant, it corresponds an increase in grGDP%$_t$ by 1.712%$_t$ with which implies a increase of *GDP' growth rate* at time *t* versus time *t-1* by 101.7%. For the model estimated by the relationship (4) we observe that grGDP%$_{t-1}$ influences in a small measure grGDP%$_t$, compared to the influence of *unemployment rates' growth*.

The existence of an autoregressive component in the model indicates that the Romanian economy is characterized by a high inertial state. This may be due to a traditional structure of the Romanian economy focused on unproductive industries.

For the model estimated by the relationship (4), *annual potential GDP' growth rate* does not differ significantly from zero. Due to this fact we will have to estimate another model without the parameter *annual potential GDP' growth rate,* described by the relationship (5).

$$grGDP\%_t = 0.785\% * grGDP\%_{t-1} - 1.701\% \, \Delta U\%_t \quad (5)$$

Std. Err.	(0.231)	(0.469)
Sig.	(0.008)	(0.006)
R square 0.758		

Variables *unemployment rate's growth* and *GDP's growth rate* for the prior period successfully explain, at the rate 75.8%, through the linear model estimated in relationship (5), the GDP' *growth rate* variation. Estimated values for the new parameters are slightly different from the estimations obtained for the intermediate model (4). It notes that by removing the intercept term *it increases the influence of autoregressive component* in the model, from 0.691% to 0.785% and *slightly decreases the influence of unemployment rate's growth* on the GDP's growth rate, from 1.712% to 1.701%.

Analyzing the graph shown in *figure 3* it is observed that the model (5) produces *overestimations* of the actual values for 1996, 1997 and 1998, *underestimations* for the years 1999, 2001, 2002, 2003 and approximately *accurate estimations* for the years 1994, 1995, 1998, 2000 and 2004. Most errors occur for the years 1996, 1999, 2001 and 2003.

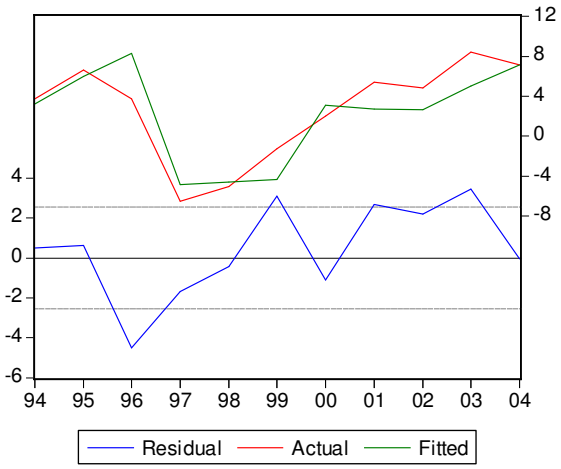

Fig. 3: *The actual(real) values compared with the fitted values, estimated by the model described by the relationship (5), and the residuals*

2.2. Modeling the unemployment rate's growth depending on the GDP's growth rate

In the case of expressing the dependence between *unemployment rates' growth* and *GDP's growth rate,* the model no longer contains the AR component because the variable *unemployment rates' growth* is not autocorrelated. The model that estimates the link between unemployment rate's growth and GDP's growth rate is shown in relationship (6)

$$\Delta U\%_t = 0.521\% - 0.268\% * grGDP\%_t \quad (6)$$

Std. Err.	(0.401)	(0.077)
Sig.	(0.223)	(0.007)
R square	0.54	

The intercept term from model (6) represents the *annual average natural unemployment rate's growth* for Romania during 1992-2004, and is equal to 0.521%. We also note that a decrease in the *GDP's growth rate* by 1% entail an increase in the *unemployment rates' growth* by 0.268%. For the model estimated by the relationship (6), based on *unemployment rates' growth* and the *GDP's growth rate* between 1992 and 2004 recorded for Romania it is observed that the *annual natural unemployment rate's growth* does not differ significantly from zero. Therefore, for this period it correspond a null *annual average natural unemployment rates' growth*. The existence of such a situation can have three major causes:

1. policy taken by the Romanian Government in the period 1992-2000, which had encouraged early retirement instead of unemployment;
2. large exodus of labor force in the EU countries, a phenomenon characteristic for states with a transition economy;
3. legislation that does not allow official tracking of unemployment phenomenon over a long period of time, which excludes the possibility of cumulating this phenomenon on too long periods of time.

Therefore the model described by the relationship (6) can be considered an *intermediate model* and it is necessary to reestimate the link between the two variables through the model described by the relationship (7).

$$\Delta U\%_t = -0.215\% * grGDP\%_t \quad (7)$$

Std. Err. (0.069)
Sig. (0.01)
R square 0.46

The *GDP's growth rate* describes, through the linear model estimated by relationship (7), in proportion of only 46% the *unemployment rates' growth* variation.

Residual resulting from the adjustment of the *actual values* through the theoretical model estimated by the relationship (7), *fitted values*, is plotted in *figure 4*. From its analysis it is observed that:

- for the years 1993-1994, 1997-1999 and 2002-2004 the model overestimates the *actual values* of *unemployment rate's growth*;
- for the years 1996 and 2000-2001 the model underestimates the *actual values* of *unemployment rates' growth*;
- for the year 1995 the model correctly estimates the actual value of *unemployment rate's growth*.

Large deviations of *fitted values* from the *actual values* are found for the years 1993 and 1996.

Fig. 4: *The actual(real) values compared with the fitted values, estimated by the model described by the relationship (7), and the residuals*

3. *Conclusions*

The results of modeling the *two-way relationship* that are established between *GDP's growth rate* and *unemployment rate's growth* are two distinct models which do not suggest a *reciprocal and unique two-way relationship* between the two variables.

If you try to express the dependence of *unemployment rate's growth* of *GDP's growth rate* starting from the model estimated by the relationship (4) or by the relationship (5) you'll obtain a different model from the estimated model by the relationship (6) or by the relationship (7). This shows that the approach to modeling *reciprocal and unique two-way relationship* between GDP's *growth rate* and *unemployment rates' growth* presented in the original form of Okun's Law (1962) does not work for the Romanian economy for the period 1992-2004.

The *annual natural unemployment rate's growth* and *annual potential GDP' growth rate* for Romania during 1992-2004 can not be estimated because the economic evolution of Romania in this period shows *large fluctuations* correlated to *strong variations of the inflation rate*, which entail *strong variations of unemployment rate* and implicitly of *GDP's growth rate*.

Based on the estimated coefficient of determination (R square) we can say that the estimation of the dependency between the GDP's growth rate and the unemployment rate's growth, the relationship (5), is better than the estimation of the dependency between the unemployment rate's growth and the GDP's growth rate, the relationship (7).

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