POTENTIAL GDP IN ROMANIA

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Abstract: *Economic and financial crisis has hit Romania since the second half of 2008, causing a significant drop in production and household income. The consequences of this crisis include rising unemployment and falling household consumption expenditure. Thus, in June 2008, the unemployment rate was 3.7% and in March 2010 it reached 8.4% level. Final consumption expenditure of households fell by 9.2% in 2009 and by 3.3% in 2010. The slowly begun recovery in 2011 revealed that unemployment in the Romanian economy has a significant structural component. As a result, the potential GDP remains low. The paper presents a method for estimating the potential GDP to determine the gap between real GDP affected by cyclical factors and the productive potential of the economy, used in any circumstances.*

Key words: *potential GDP, natural rate of unemployment, full employment*

1. Introduction

Productive capacity of an economy is highlighted potential GDP. According to Michael Parkin (2005) this indicator corresponds to the equilibrium in the long run of the final output which was recorded over one year in the country, value that can be achieved if labour resources are fully occupied. Full use of human resources (full employment) occurs while the cyclical unemployment is zero and existing unemployment is determined only by structural and frictional unemployment. Unemployment rate caused by structural and frictional unemployment is known as *the natural rate of unemployment*.

In opinion of Olivier Blanchard (2006), potential GDP can be also defined as the level of output corresponding to the equilibrium state of the economy (steady-state), characterized by stable inflation, consistent with an unemployment rate that does not lead to an acceleration of inflation, called NAIRU, meaning Non Accelerating Inflation Rate of Unemployment. As Dobrescu et al. (2011) mentioned NAIRU hypothesis is based on a model of imperfect competition, both in the labour market and goods market. Some imperfections, such as trade unions (trade unions) and the presence of oligopolistic firms determine the imperfect character of competition. On labour market through the collective bargaining process, the demand is determined by the real wage negotiated while on the goods market, firms offer their goods at a given price, which allows them a higher profit than the normal.

Potential GDP and the difference between real GDP and potential GDP (output gap) have been research subjects a long time since Arthur Okun (1962), who first pointed out the importance of these variables in predicting the cyclical position of the economy. Nowadays, potential GDP is widely used in macroeconomic models, in economic policies analysis, of budget

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balance and of fiscal policies sustainability.

Potential PIB reflects the best offer of an economy and facilitates an estimate of the economic growth rate in order to not generate inflationary imbalance. A positive output gap is associated with an excess of demand, which can lead to the inflation pressure. In the short term, this inflationary gap determines an unemployment rate lower than the natural rate of unemployment, which corresponds to a real GDP above potential GDP. On long run, the economy returns to potential GDP due to changes occurring in the cost structure and expectations of the people and in businesses. Changes in potential GDP are given by changing technologies and the capital amount used in economics, as well the amending the amount of balance in the labour market.

Because potential GDP is not a directly observable variable, it is necessary to use theoretical models to filter the observed data and retain their essence, respectively the level of potential GDP. The parameter values of these models are determined using various statistical and econometric methods. One of the easiest ways to calculate the potential PIB is to consider that it is equal with the average of current GDP. This method is deviating from the widely accepted meaning of potential GDP, the fact that it is equal to the size of the output, when the labour market is in equilibrium, i.e. the level of employment is equal to the full employment level and the unemployment rate is equal to the natural rate of unemployment.

In this paper, to measure potential GDP, a method based on production function is used. This method involves, first, determining the natural rate of unemployment, which is used to determine the equilibrium amount of labour in the market. Regarding capital stock, it is noted that there are no official statistics on this indicator, which could provide the necessary data to estimate production function parameters. According with Altăr et al. (2010), for determining the capital stock in Romania, you can use the method Perpetual Inventory Method (PIM). This method includes: an estimate of the initial capital stock through a benchmark statistics of gross fixed capital formation and information about fixed capital depreciation.

2. The Function of Production

Production function of an economy, widely used in economic research is a Cobb-Douglas function with constant returns to scale (constant return to scale) and constant elasticity of substitution between factors of production (constant elasticity of substitution between the production factors):

$$Y = A \cdot L^{\alpha} \cdot K^{1-\alpha}$$

where α represents the elasticity of output with respect to labour (L), and $1-\alpha$ is the elasticity of output with respect to capital (K). Estimating potential GDP, using this type of production function is done by replacing the inputs in its expression, in according with each influence. Capital stock is determined by capital accumulation caused by gross capital formation and at the same time, influenced by the depreciation rate (rate of capital depreciation). The factor representing technical progress, A or the total factor productivity (TFP) is determined as the adjusted average of labour productivity growth rates in the analyzed period. The gap of real GDP to its potential level (output gap) is calculated directly from the observed data and those calculated. Estimating potential GDP by production function methodology (PF) involves determining the level of full employment

(the factor *L* when the labour market is in equilibrium). This calculation involves determining in advance the level of the natural rate of unemployment.

3. The Natural Rate of Unemployment

There is always a certain number of unemployed people. Some of them look for a job according to their skills, abilities and experience they have; others are in the process of training / retraining to meet the always changing needs of employers. During the economic crisis the number of the unemployed increases, due to lower labour demand, and during the expansion the jobs number increases and unemployment decreases. The level of full employment in the labour market occurs when cyclical unemployment is zero; the number of unemployed is determined solely by the frictional and structural unemployment.

When the labour market reaches full employment, unemployment rate corresponding to this level is called the natural rate of unemployment. The concept of the natural rate of unemployment was first used by Milton Friedman (1968) and Edmond Phelps (1968) as a way to differentiate between cyclical unemployment, which monetary policy can influence it and structural changes that cannot be influenced in this manner. The word "natural" became standard terminology, suggesting that this unemployment rate is a steady of an economy that cannot be affected, as Olivier Blanchard (2006) noted, by institutions or government policies.

There are not many controversies about the existence of the natural rate of unemployment. There are different ways of interpreting this concept. According to Michael Parkin (2005), the natural rate of unemployment is the result of the existence of structural and frictional unemployment.

Any fluctuations in the natural rate of unemployment are due to changes in these two forms of unemployment. Under the neoclassical assumption of perfect flexibility of prices of goods and factors of production, the natural rate of unemployment appears to be determined primarily by the characteristics of workers and the effectiveness of the labour market in facilitating the hiring process. These factors affect the rate at which jobs are created and disappear and the time required for unemployed to fill the available jobs.

According to Gregory Mankiw (2003), the natural rate of unemployment is the average unemployment rate around which, the current rate of unemployment fluctuates. In recession, the current rate of unemployment increases above the natural rate, while in the expansion, the current unemployment rate falls below the natural rate. This way of interpretation of the natural rate of unemployment eases its calculating size, considering that on long-term, labour market is in equilibrium, if the unemployment rate remains constant. We believe that the interpretation of the natural rate of unemployment as an average of current unemployment rates does not start from the factors that determine it, respectively the structural and frictional unemployment.

Lately, interpretation of natural rate of unemployment by Christopher Pissarides (2000) gained ground. His model comprises two curves: the Beveridge Curve (BC), which captures the aggregate supply of labour and Job Creation Curve (JCC), which includes the aggregate demand for labour. In this model, the labour market equilibrium is determined by the intersection of these two curves. Beveridge curve (BC) is essentially a frontier of the production possibilities for employment opportunities in the labour market. The rate at which job seekers are

committed to the vacancies depends primarily on the ratio of the rate of vacancies and unemployment rate. This shows the number of vacancies per worker unoccupied. The natural rate of unemployment is the unemployment rate corresponding to the point of intersection between the curve BC and the curve JCC. Equilibrium is a marginal one, depending on how many jobs are created in addition to the existent ones, respectively on the additional number of unemployed who are competing for existing jobs. The change of the equilibrium rate, i.e. the natural unemployment rate, occurs as a result of the displacement of the two curves.

In this paper, to determine the natural rate of unemployment and, hence, the corresponding equilibrium level of employment in the labour market (full employment level) is using the model formulated by Pissarides (2000). The main element of this model is the combining function (matching function).
It expresses the number of places created at any point of time ($M = m \cdot L$) as a function of the total number of workers seeking employment ($U = u \cdot L$) and the number of vacancies held by companies ($V = v \cdot L$):

$$M = m(U,V) \rightarrow m \cdot L = m(u \cdot L, v \cdot L)$$

where m is the rate of combining, i.e. the number of jobs filled per unit of time; u is the unemployment rate, i.e. the number of unemployed as a fraction of the labour force; v is the vacancies rate, i.e. the number of vacancies as a fraction from the labour force; L is labour force.

The function of combining describes the efficiency of occupying process of jobs, emphasizing the importance of two measurements: the number of vacancies and the number of unemployed.

The rate at which vacancies are filled is:

$$q(\theta) \equiv \frac{m(uL, vL)}{vL} = m(\frac{u}{v}, 1)$$

where $\theta = v/u$ represents the number of vacancies, for an unemployed worker.

The function of combining is assumed to be upwards, concave in both arguments and homogeneous of first degree. Choosing a Cobb-Douglas function, the function of combining becomes:

$$m = u^{\alpha} v^{1-\alpha}$$

where $0 < \alpha < 1$ is the elasticity of the combining function with respect to unemployment.

Number of employees, n, evolves over time according to inflows (occupied jobs, unemployed who find a job) and to outflows (disappearance of existing jobs with the rate δ).

The relationship between the rate of vacancies and unemployment rate (θ) is a measure of the tight character of labour market. The probability of an unemployed person to find a job and to be employed depends on θ, which is a measure of labour market frictions. An increase of θ makes job search more difficult, as a decrease in the size facilitates job search.

A basic tool for analyzing the labour market is the Beveridge Curve (BC). It describes the inverse relationship between unemployment rate and vacancies rate. This relationship can be obtained following the way how the unemployment rate is changing over time:

$$\dot{u} = (1-u) \cdot \delta - u \cdot \theta^{1-\alpha}$$

where $(1-u) \cdot \delta$ represents the flow into unemployment, i.e. the number of destroyed jobs, with rate δ, and $u \cdot \theta^{1-\alpha}$ represents the flow from unemployment, i.e. number of created jobs, with rate θ. At steady-state, the unemployment is constant over time ($\dot{u} = 0$) to obtain the expression known as the Beveridge Curve:

$$u = \frac{\delta}{\delta + \theta^{1-\alpha}}$$

The official statistics do not record data about the lost jobs, so no statistics on δ. In this case, we used the graphical method, aiming to determine the coordinates of the points of intersection between the curve BC and the curve JCC. Correlation plot between the unemployment rate and jobs rate is shown in Figure 1.
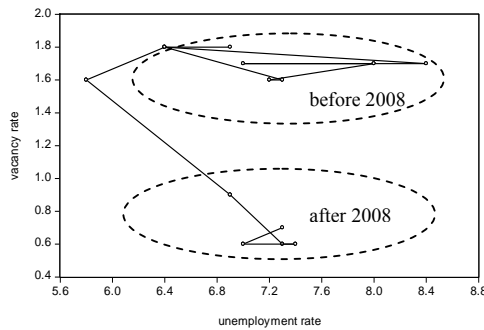

Fig. 1. *Correlation between "v" and "u"*

BC curve was obtained as a regression corresponding to the period before the crisis in 2008 and after the crisis. The results of the regression which estimates the vacancies rate depending on unemployment rates before and after the economic and financial crisis of 2008 are:

$$v = 2.1239 - 0.0571 \cdot u + e_t$$
$$(6.96) \quad (-1.35)$$
$$R^2 = 0.23$$
$$(\cdot) = t\ Stat$$

for the period 2000 – 2008, respective:

$$v = 5.4488 - 0.6366 \cdot u + e_t$$
$$(8.59) \quad (7.30)$$
$$R^2 = 0.93$$
$$(\cdot) = t\ Stat$$

for the period 2008 – 2013.

Table 1
Vacancies and unemployment rates

Year	v (%)	u (%)	θ
2000	1,8	6,9	0,26
2001	1,8	6,4	0,28
2002	1,7	8,4	0,20
2003	1,7	7,0	0,24
2004	1,7	8,0	0,21
2005	1,6	7,2	0,22
2006	1,6	7,3	0,22
2007	1,8	6,4	0,28
2008	1,6	5,8	0,28
2009	0,9	6,9	0,13
2010	0,6	7,3	0,08
2011	0,6	7,4	0,08
2012	0,6	7,0	0,09
2013	0,7	7,3	0,10

Source: Eurostat and authors' calculations

The data used to determine the natural rate of unemployment are those of Table 1. The coefficient θ is equal to the ratio of the vacancies rate, v, and the unemployment rate, u.

4. The Full Employment

Based on the natural rate of unemployment, determined above, $\bar{u}$, given the statistical records of the number of active population, *pa*, the level of full employment, *t*, was determined. The results obtained are shown in Table 2.

Full employment			Table 2
Year	Ū (%)	Pa (th. pers.)	T (th. pers.)
2000	6,70	11283	10527
2001	6,30	11151	10448
2002	8,26	10079	9246
2003	7,15	9915	9206
2004	7,95	9957	9165
2005	7,66	9851	9096
2006	7,66	10041	9272
2007	6,30	9994	9364
2008	5,74	9944	9373
2009	6,86	9924	9243
2010	7,34	9965	9234
2011	7,34	9868	9144
2012	7,24	9964	9243
2013	7,14	9977	9265

Source: INSSE and authors' calculations

5. The Capital Stock

The method of calculating the capital stock, K, is that used by Altăr et al. (2010). The capital stock in one year is determined to be equal to the capital stock of the previous year diminished with the depreciation rate, plus gross fixed capital formation in that year. The depreciation rate is considered to be constant and equal to 5%, which is consistent with that used by Denis G. et al. (2006). The initial value of the capital stock is as determined by Altăr et al. (2010). The obtained data are presented in Table 3.

Table 3

Vacancies and unemployment rates

Year	K (mil. RON 2000 prices)	Capital output ratio K/Y
2000	188388,90	2,33
2001	196461,80	2,30
2002	205740,60	2,29
2003	215733,05	2,29
2004	227318,08	2,22
2005	241299,85	2,26
2006	258782,26	2,24
2007	282786,06	2,31
2008	310500,57	2,37
2009	324832,95	2,65
2010	338483,34	2,80
2011	353871,99	2,86
2012	368934,17	2,96
2013	380909,24	2,95

Source: INSSE and authors' calculations

There are slight differences in the capital stock values to those determined Altăr et al. (2010), supported by frequent adjustments of statistical data. The capital intensity, reflected by the capital output rate has changed in a relatively low rhythm, increasing during the analyzed 14 years from 2.33 to 2.95. This reflects the slow pace of economic restructuring; the Romanian economy remains an economy with low capital accumulation. The same is evidenced by statistical data on gross fixed capital formation, which was maintained for the entire period under review, at a low level.

6. Potential GDP

Potential GDP depends on the level of full employment and capital stock. Also, potential GDP is influenced by the Total Factor Productivity (TFP). Estimating the TFP considers the trend as a whole of economic efficiency. In the literature, the determination of estimated TFP is in line with HP and Kalman filters applied to the Solow residual (IMF methodology).

In this paper, TFP is estimated to be the average of the annual growth rates of labour productivity, equal to 3.72. Labour productivity was calculated as the ratio of real GDP and Labour Force.

According with Gălătescu (2007), the elasticity of output with respect to labour is 0.65. Data for potential GDP of Romania, obtained by replacing the capital stock and labour force in the production function, are presented in Table 4. Potential GDP grew slower in the analyzed period. The average of the potential GDP growths in the period 2000 - 2013 was 1.29%. The average of potential GDP growths before the crisis in 2008 was 1.296%, almost identical to that recorded after 2008, which was 1.288%.

Table 4

Potential GDP in Romania

Year	Potential GDP (mil. RON 2000 prices)	Potential growth (%)
2000	107475,71	-
2001	108533,01	0,98
2002	101876,72	-6,13
2003	103290,39	1,39
2004	104894,07	1,55
2005	106583,68	1,61
2006	110594,30	3,76
2007	114816,20	3,82
2008	118709,61	3,39
2009	119509,49	0,67
2010	121167,02	1,39
2011	122286,26	0,92
2012	124954,95	2,18
2013	126555,20	1,28

This shows that, in essence, the crisis of 2008 did not have any impact on production potential, did not significantly influence the structure of the productive system. The cyclical nature of this fluctuation was predominant. The crisis of 2008 did not cause a significant change in economic behaviour, especially in the labour force to determine the increasing of productive potential of the country.
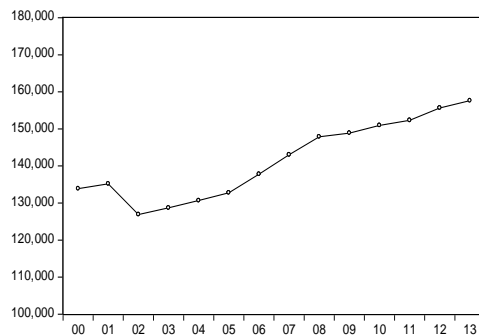

Fig. 2. *Evolution of potential GDP in Romania*

Graphical representation of potential output is shown in Figure 2. The decrease in 2002 can be explained by analyzing the evolution of overall economic activity in the period before 2000.

7. Output gap

Real GDP gap to potential GDP is known as the output gap. Figure 3 presents the output gap in analyzed period.
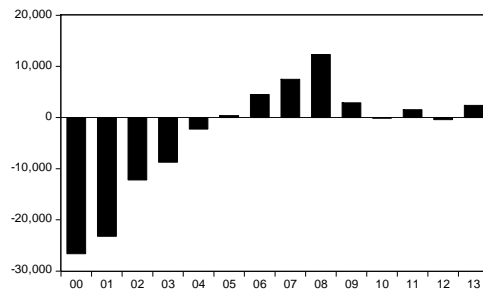

Fig.3. *Output-gap*

Until 2004, real GDP was below potential GDP. Employment level was below the full employment, and the unemployment rate was higher than the natural rate of unemployment. During 2005 - 2009, the real GDP was above the potential GDP. Surprising is that, in 2009, the year in which the economic crisis began to be felt, unemployment rate was lower than the natural rate of unemployment and real GDP was above potential GDP. But, as stated by Abel et al (2011), unemployment rate is a cyclical and delayed variable and unemployment continued to decline even after overall downward trend of economic activity began. In the years 2011 - 2013, the economy recorded small fluctuations around potential GDP. The fact that in 2012 real GDP was below potential GDP is a delayed effect of the crisis which began in 2008.

8. Conclusions

Potential GDP is a measure of the productive potential of the economy. This indicator is important for those who elaborate economic development programs, but also for those who are planning long-term economic activity. Since the cyclical fluctuations are transitory, structural and institutional characteristics essentially define the economy's capacity to produce goods.

The methodology chosen for the determination of potential GDP is the production function. The results are consistent with those obtained by other authors mentioned above, even if the methods of calculation are different. One problem encountered in determining potential GDP using the production function is the lack of statistical data.

The lack of relevant data makes it difficult to estimate the production function parameters. However, the results

correspond to the expectations. Potential GDP changes slowly over time, caused by structural changes, but also in the labour market. Cyclical fluctuations do not change potential GDP. In Romania, the crisis of 2008 did not result in significant changes in the economic structure; growth rates of potential GDP before and after the crisis did not differ significantly.

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