Икономически изследвания
ECONOMIC STUDIES
ГОДИНА XXVI, 2017, 5

Ivan Todorov[1]

BULGARIA'S CYCLICAL POSITION AND MARKET (DIS)EQUILIBRIA

Bulgaria's potential output and cyclical position for the period 2010-2015 are estimated by a methodology based on a two-factor Cobb-Douglas production function. An IS-LM model of the Bulgarian economy is developed to study the condition of the different types of markets (labor market, goods market and money market). During the entire period 2010-2015 Bulgaria's output remained below its potential, while unemployment was above its natural level. The goods market and the money market were not balanced but fluctuated around their equilibrium levels. The conclusions of the study are in agreement with the Keynesian views about the disequilibrium character of the economic system and about the necessity of an expansionistic macroeconomic policy to stabilize the economy at its potential level in case of a deflationary gap (as in Bulgaria during 2010-2015).
JEL: E32

Introduction

After a period of a relatively high economic growth of 6-7% per annum before the global crisis, Bulgaria's economy contracted by 5.01 % in 2009 and recorded faint growth over the next years. This faint growth was accompanied by deflation trends, which is a dangerous combination and calls for a prompt and adequate response by Bulgarian macroeconomic policymakers.

The present research has three objectives:

- First, to estimate Bulgaria's potential output and determine the cyclical position of Bulgaria's economy for the period 2010-2015;
- Second, to set the equilibrium conditions for the different types of markets (labor market, goods market and money market) and check whether these conditions are satisfied in the period 2010-2015;

[1] *Ivan Todorov is Chief Assistant Professor, PhD, South-West University "Neofit Rilski", Faculty of Economics, Department of Finance and Accounting, 66 Ivan Mihailov Street, 2700 Blagoevgrad, Bulgaria, email: ivank.todorov@swu.bg*

- Third, to formulate recommendations on adequate macroeconomic policies for smoothing the cyclical fluctuations of Bulgaria's economy.

The first objective is accomplished by employing an approach to estimating Bulgaria's potential output based on a two-factor Cobb-Douglas production function (section one). The second objective is achieved by developing and applying an IS-LM model for exploring the (dis)equilibria in the different types of markets in Bulgaria (section two). The third objective is fulfilled in the conclusions section by recommending macroeconomic policies aimed at minimizing the cyclical fluctuations of the Bulgarian economy.

Empirical estimations of Bulgaria's potential output and cyclical position were made by Ganev (2004 and 2015), Gladnishki (2005), the World Bank (2005), Tsalinski (2007), the European Commission (2014a, 2014b and 2015), Ganchev (2010), the International Monetary Fund (2010 and 2014), the Economic Research Institute at the Bulgarian Academy of Sciences (2012), the Ministry of Finance of the Republic of Bulgaria (2014a and 2014b) and others.

IS-LM models of the Bulgarian economy were developed by Kacharnazov (2008) and Keppel and Orthofer (2009).

1. Estimating Bulgaria's potential output and determining the cyclical position of the Bulgarian economy

1.1. Assumptions and methodology of calculations

As in Gladnishki (2005), in this research Bulgaria's potential output is estimated by a methodology based on a two-factor Cobb-Douglas production function:

$$\textbf{(1) YPOT = A * K}^{\alpha} \textbf{ * LPOT}^{\beta}$$

where **YPOT** is Bulgaria's potential output, **A** is total factor productivity, **K** is capital stock, **α** is the elasticity of output with respect to capital, **LPOT** is the potential (optimal) employment of labor resources and **β** is the elasticity of output with respect to labor.

1.1.1. Estimating the elasticity coefficients in the production function

The elasticity coefficients are estimated via an equilibrium approach, which is based on the income structure of Bulgaria's GDP and was used by Raleva (2013). According to this approach the whole mixed income is treated as a labor income. The labor income is calculated by adding to the compensation of employees **CE** one third of the sum of the net mixed income **NMI** and the net operating surplus **NOS**. The capital income equals two thirds of the sum of the net mixed income **NMI** and the net operating surplus **NOS**. The coefficients **α** and **β** are calculated as

(2) $\alpha = \frac{2}{3}(NOS + NMI)/(CE + NOS + NMI)$

(3) $\beta = [CE + 1/3\,(NOS + NMI)]\,/\,(CE + NOS + NMI)$

The sum of **α** and **β** is 1. The average values of **α** and **β** for the period 1997-2015 are respectively 0.35 and 0.65 and are used in estimating Bulgaria's potential output.

1.1.2. Estimating capital stock

Since the Bulgarian national statistics does not provide data on capital stock, one of the methodological problems, related to potential output estimation, is how to calculate the size of capital stock. Two approaches can be used to solve this problem – the perpetual inventory method (Ganev, 2005) and the constant capital-output ratio approach (Minassian, 2008; Raleva, 2013; Todorov, 2015). In this paper the constant capital-output ratio approach is employed.

The capital-output ratio **K/Y** is considered constant in economic theory. In empirical studies this ratio varies between 2 and 3. For Bulgaria the used values of the capital-output ratio are 2.5 (Minassian, 2008), 2.3 (Raleva, 2013) and 2.2 (Todorov, 2015). For the purpose of this study the used value of the capital-output ratio is 2.2. It is calculated as the average gross-capital-formation-to-change-in-real-GDP ratio for the period 1998-2008 (in accordance with the assumption of Harrod and Domar that the average and the marginal productivity of capital are equal). Hence, the actual real size of capital stock **K** can be determined by multiplying the real GDP **Y** by the capital/output ratio **K/Y,** whose value is 2.2:

(4) K = Y * K/Y = Y * 2.2

The estimated values of capital stock are shown in Table 1.

Table 1

Estimated values of capital stock

Year	Real GDP (Y) at prices of 2010, million levs	Capital/output ratio (K/Y)	Capital stock (K) at prices of 2010, million levs
2010	74 771	2.2	164 497
2011	76 203	2.2	167 647
2012	76 227	2.2	167 699
2013	76 884	2.2	169 144
2014	77 906	2.2	171 392
2015	80 724	2.2	177 592

Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

1.1.3. Measuring labor input and estimating potential employment

Two indicators can be used to measure labor input in the production function - the number of employed persons or the number of hours worked in an economy. In this paper the first indicator is employed.

The potential (optimal) employments of labor is calculated as

(5) LPOT = LF * (1 – NRU)

where **LPOT** is the potential (optimal) employments of labor resources, **LF** is the labor force and **NRU** is the natural rate of unemployment.

The natural rate of unemployment is a sum of the rates of structural and frictional unemployment:

(6) NRU = SUR + FUR

where **NRU** is the natural rate of unemployment, **SUR** is the structural unemployment rate and **FUR** is the frictional unemployment rate.

As an approximation for the structural unemployment rate **SUR** the long-term unemployment rate **LTUR** is used:

(7) SUR = LTUR

The long-term unemployment rate **LTUR** is the percentage share of the long-term unemployed **LTU** in the labor force **LF:**

(8) LTUR = (LTU / LF) * 100%

The frictional unemployment rate is calculated as a difference between the rates of outflows and inflows of employees under labor contract:

(9) FUR = OREULC – IREULC

where **FUR** is the frictional unemployment rate, **OREULC** is the outflow rate of employees under labor contract and **IREULC** is the inflow rate of employees under labor contract.

The outflow rate of employees under labor contract **OREULC** is the percentage share of the outflow of employees under labor contract **OEULC** in the labor force **LF:**

(10) OREULC = (OEULC / LF) * 100

The inflow rate of employees under labor contract **IREULC** is the percentage share of the inflow of employees under labor contract **IEULC** in the labor force **LF:**

(11) IREULC = (IEULC / LF) * 100

The natural rate of unemployment **NRU** can be expressed as

(12) NRU = LTUR + OREULC – IREULC = (LTE + OEULC – IEULC) / LF *100

The potential (optimal) employment of labor resources **LPOT** can be calculated as

(13) LPOT = LF * (1 – LTUR - OREULC + IREULC) = LF – LTE – OEULC + IEULC

The estimated values of the potential employment of labor resources and of the natural rate of unemployment can be seen in Table 2.

Table 2

Estimation of the potential employment of labor resources

Year	Labor force LF, thousands of people	Long-term unemployment LTUR, %	Outflow rate of employees under labor contract OREULC, %	Inflow rate of employees under labor contract IREULC, %	Natural rate of unemployment NRU, %	Potential employment of labor resources LPOT, thousands of people
2010	3 428	4.75	27.00	26.48	5.27	3 247
2011	3 341	6.30	27.71	28.70	5.32	3 164
2012	3 344	6.78	27.77	28.53	6.02	3 143
2013	3 371	7.43	27.59	28.90	6.12	3 165
2014	3 366	6.93	29.18	30.85	5.26	3 189
2015	3 337	5.60	31.09	32.67	4.02	3 203

Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

1.1.4. Estimating total factor productivity

For each year of the period 2010-2015 total factor productivity is calculated as

(14) $\mathbf{A_t = Y_t / (K_t^{0.35} * L_t^{0.65})}$

where $\mathbf{A_t}$ is total factor productivity in year **t**, $\mathbf{Y_t}$ is GDP in year **t** at prices of 2010 in millions of levs, $\mathbf{K_t}$ is capital stock in year **t** at prices of 2010 in millions of levs and $\mathbf{L_t}$ is the number of employed persons in thousands.

The values of total factor productivity are displayed in Table 3.

Table 3

Estimates of total factor productivity and Bulgaria's potential output

Year	Total factor productivity A_t	Potential GDP (YPOT), million levs at prices of 2010	Actual GDP (Y), million levs at prices of 2010
2010	6.04	77 457	74 771
2011	6.26	79 481	76 203
2012	6.30	79 713	76 227
2013	6.34	80 751	76 884
2014	6.33	81 388	77 906
2015	6.41	83 656	80 724

Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

In this research for the estimation of Bulgaria's potential outputs is used Equation (15), which is a concretization of Equation (1):

(15) $\mathbf{YPOT = A^* (Y * 2.2)^{0.35} * [(LF * (1 - LTUR - OREULC + IREULC)]^{0.65} = A * (Y * 2.2)^{0.35} * (LF - LTE - OEULC + IEULC)^{0.65}}$

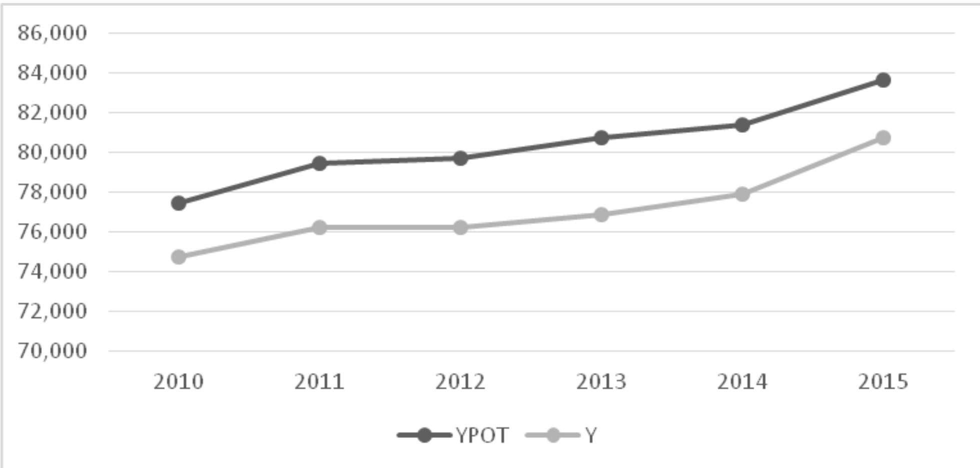
The values of the potential and the actual GDP of Bulgaria for the period 2010-2015 are shown in Table 3.

1.2. Results and inferences from the estimation of Bulgaria's potential GDP and cyclical position

Over the entire period 2010-2015 Bulgaria's output remained below its potential level (see Figure 1). The average value of the actual GDP for the period was 77 119 million levs, while the average value of the potential GDP was 80 408 million levs. The stabilities of the dynamics of potential output and actual output were alike (a coefficient of variation of 2.59% for potential GDP and 2.65% for actual GDP).

Figure 1

Potential and actual GDP at prices of 2010, million levs

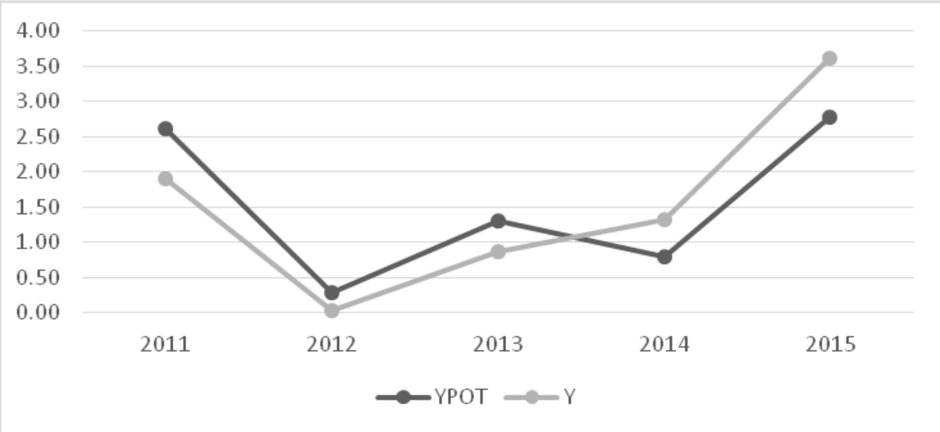


Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

The growth rates of actual and potential output compared to the previous year were comparable in size (average values of 1.55 and 1.56% respectively for the period 2011-2015). The direction of their movements was different only in 2013-2014 when the growth rate of actual output increased but the growth rate of potential output decreased (see Figure 2). The growth rates of potential GDP (with a coefficient of variation of 71%) were steadier than those of actual GDP (with a coefficient of variation of 86.73%).

Figure 2

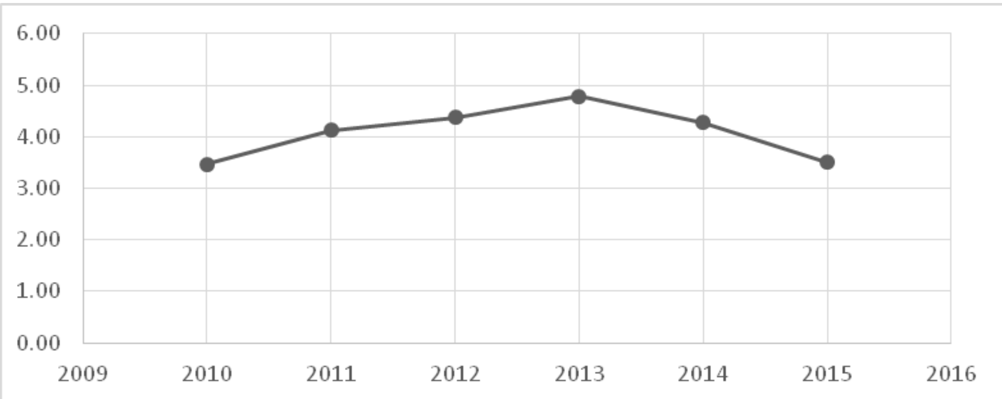
Rates of growth of potential and actual GDP compared to the previous year, percentage



Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

Figure 3

GDP gap (difference between potential and actual output), percentage share of potential GDP

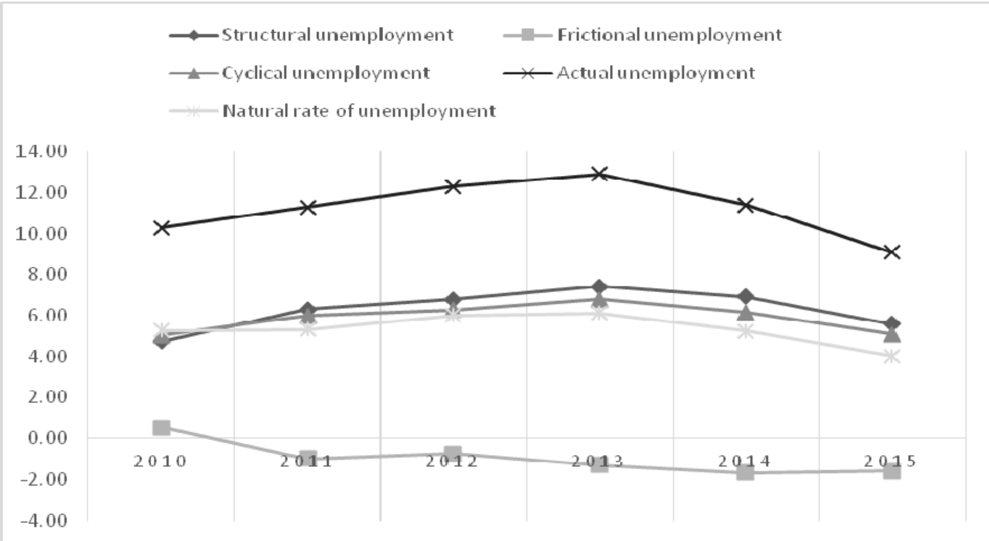


Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

The difference between potential and actual GDP, measured as a percentage of potential output (the so called GDP gap) increased during 2010-2013 and decreased in 2013-2015 (see Figure 3), but remained relatively high for the period 2010-2015 (an average value of 4.09%). The dynamics of the GDP gap was relatively stable (a coefficient of variation of 12.64% for the period 2010-2015).

Figure 4

Dynamics of the basic types of unemployment, percentage



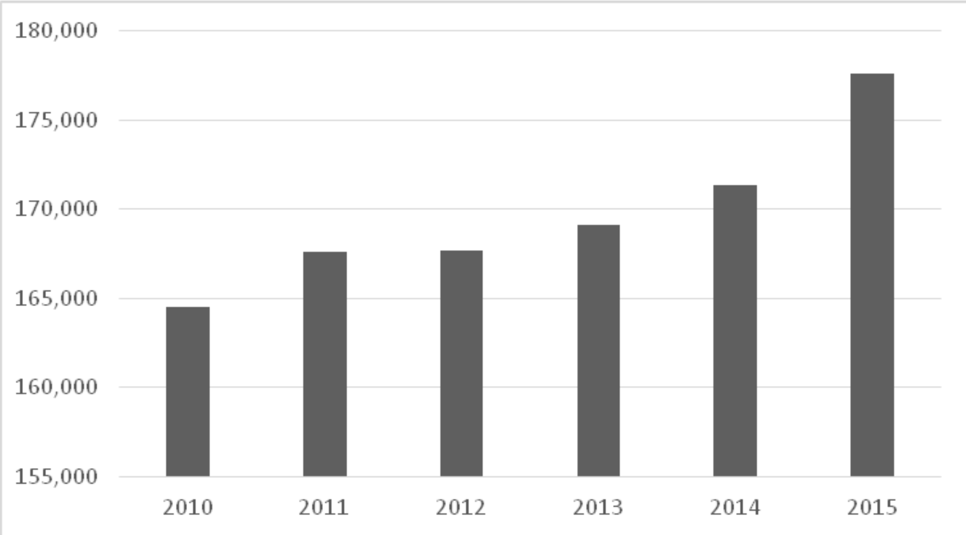
Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

The dynamics of the basic types of unemployment is interesting (see Figure 4). Over the entire period 2010-2015 the actual unemployment rate (an average value of 11.22%) was above the natural rate of unemployment (an average value of 5.33%), while structural and cyclical unemployment had an approximately equal contribution to actual unemployment (average values of 6.30% for structural and 5.88% for cyclical unemployment). The contribution of frictional unemployment to actual unemployment was small (an average of -0.96% for the analyzed period). The movements of the natural rate of unemployment, the actual unemployment rate, the structural unemployment rate and the cyclical unemployment rate were relatively steady (coefficients of variation of 14.10%, 12.20%, 15.52% and 11.82% respectively). However, the dynamics of frictional unemployment was unstable (a coefficient of variation of -83.83%). It may be inferred that a serious problem in the Bulgarian labor market is the existence of high structural unemployment. Increased investment in human capital formation is recommended in order to overcome the differences between the requirements of employers and the qualification of job seekers.

Capital stock rose in 2010-2015 (see Figure 5). The average capital stock for the period of investigation was 169 662 million levs, and its dynamics was stable (a coefficient of variation of 2.65%).

Figure 5

Dynamics of capital stock, million levs

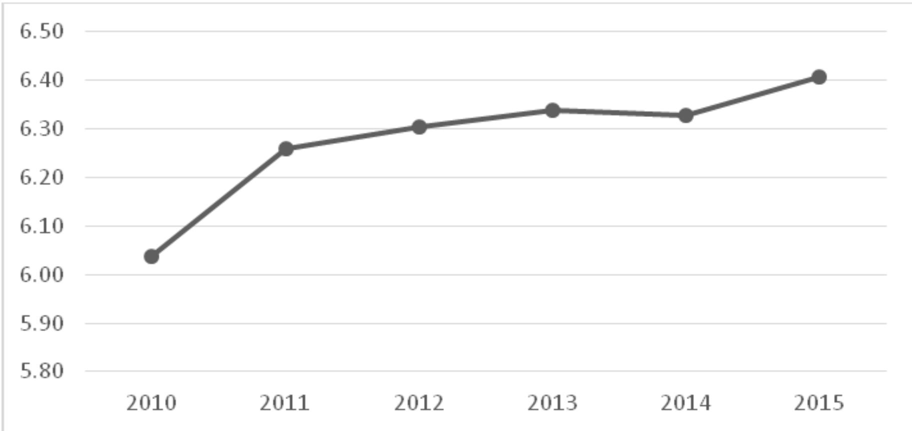


Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

A reason to be optimistic about the future development of the Bulgarian economy is the upward movement of total factor productivity (see Figure 6). Total factor productivity is the most important determinant of the long-term economic growth and the standard of living of a nation. Under the conditions of limited quantities of factors of production, the permanent improvement of production efficiency is the only way to continuously improve the welfare of a nation. The dynamics of the total factor productivity reflects the influence of all sources of real GDP growth which are not changes in employment and in physical capital accumulation, such as research and development and the formation of human capital. Total factor productivity increased from 6.04 in 2010 to 6.41 in 2015 and its average for the period 2010-2015 was 6.28 implying that economic efficiency has risen due to improvements in technology and/or organization of production. Total factor productivity is the main contributor to Bulgaria's economic growth under a currency board arrangement (Todorov and Durova, 2016).

Figure 6

Dynamics of total factor productivity



Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

2. The main types of markets and their dis(equilibria)

2.1. The labor market

The labor market is in equilibrium when the actual rate of unemployment **ARU** equals the natural rate of unemployment **NRU:**

(16) ARU = NRU

The actual rate of unemployment **ARU** is the share of unemployed persons **UP in the** labor force **LF:**

(17) ARU = UP / LF

The natural rate of unemployment **NRU** is a sum of the frictional unemployment rate **FUR** and the structural unemployment rate **SUR:**

(18) NRU = FUR + SUR

The frictional unemployment rate **FUR** is the share of the difference between the outflow of employees under labor contract **OEULC** and the inflow of employees under labor contract **IEULC** in the labor force **LF:**

(19) FUR = (OEULC – IEULC) / LF

The structural unemployment rate **SUR** is the ratio of long-term unemployed persons **LTUP** to the labor force **LF:**

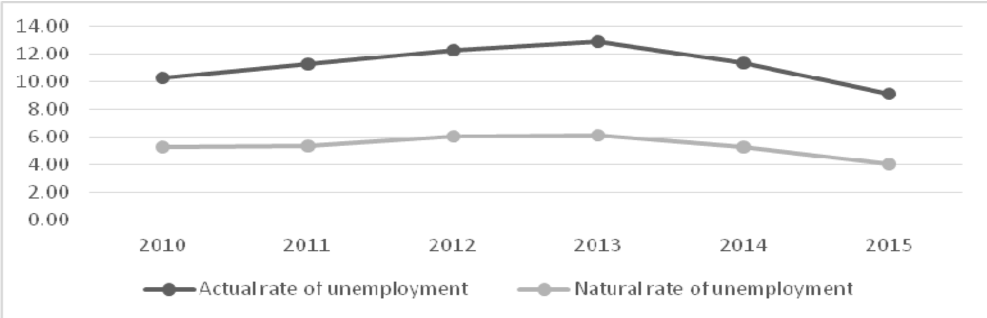
(20) SUR = LTUP / LF

If **FUR** and **SUR** are substituted in Equation (18) by the right-hand sides of Equations (19) and (20), then **NRU** can be calculated as

(21) NRU = (OEULC – IEULC + LTUP) / LF

Figure 7

Actual rate of unemployment and natural unemployment rate in the Bulgaria's labor market for the period 2010-2015



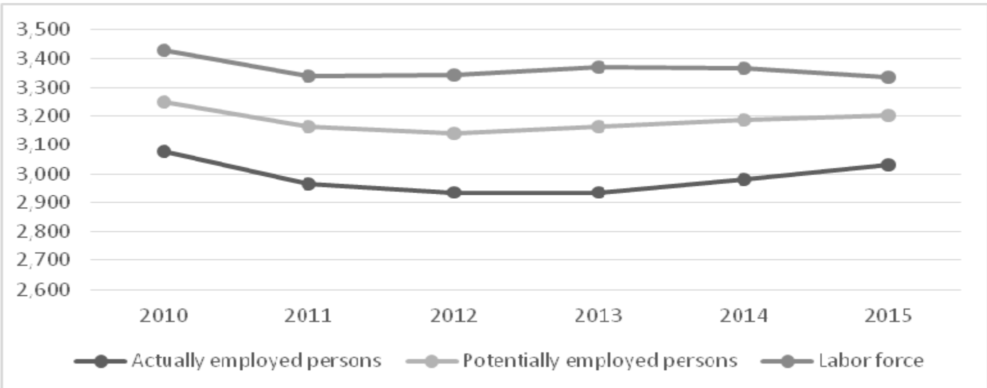
Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

The labor market equilibrium condition can also be expressed as an equality between the numbers of actually employed persons **AEP** and potentially employed persons **PEP:**

(22) AEP = PEP

Figure 8

Labor force, actually employed persons and potentially employed persons in Bulgaria's labor market for the period 2010-2015



Source: Own calculation on the basis of data from the website of the National Statistical Institute of Bulgaria www.nsi.bg.

The number of potentially employed persons **PEP** can be calculated as

(23) PEP = LF * (1 – NRU),

where **LF** is the labor force and **NRU** is the natural rate of unemployment.

Bulgaria's labor market was not in equilibrium during 2010-2015. Over the entire period 2010-2015 unemployment was above its natural rate, while employment was below its potential level (see Figures 7 and 8). Cyclical unemployment was present in 2010-2015, which presumed the implementation of expansive macroeconomic policies.

2.2. The goods market

The goods market clearance condition demands that actual national saving **ANS** equal equilibrium national saving **ENS**:

(24) ANS = ENS

Actual national saving **ANS** are a sum of private saving **PS** and government saving **GS**:

(25) ANS = PS + GS

In an open economy equilibrium national saving **ENS** are a sum of gross capital formation **GCF** and the current account balance **CAB**:

(26) ENS = GCF + CAB

Government saving **GS** equals the government budget balance **GBB** and private saving **PS** can be approximated by the change in private deposits (the deposits of non-financial corporations, households and non-profit institutions serving households) **ΔPD**, therefore Equation (25) can be modified to

(27) ANS = GBB + ΔPD

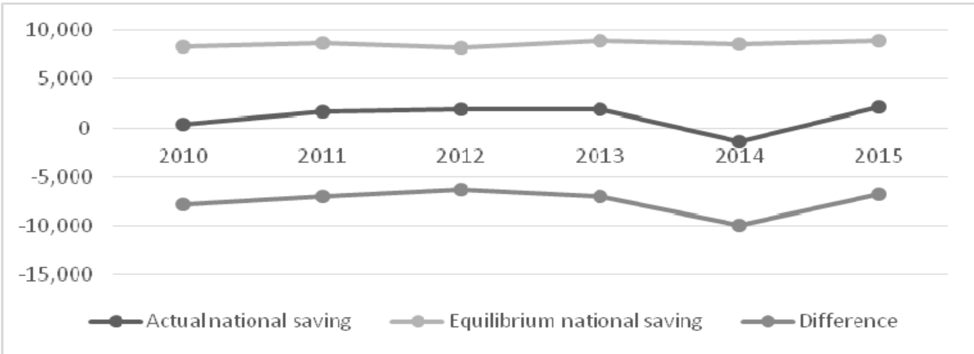
The goods market clearance condition can be expressed as

(28) GBB + ΔPD = GCF + CAB

Bulgaria's goods market was not in equilibrium over the years 2010-2015 (see Figure 9). Over the entire period actual national saving was below its equilibrium level, which agrees with the conclusion that employment and output were below their potential levels.

Figure 9

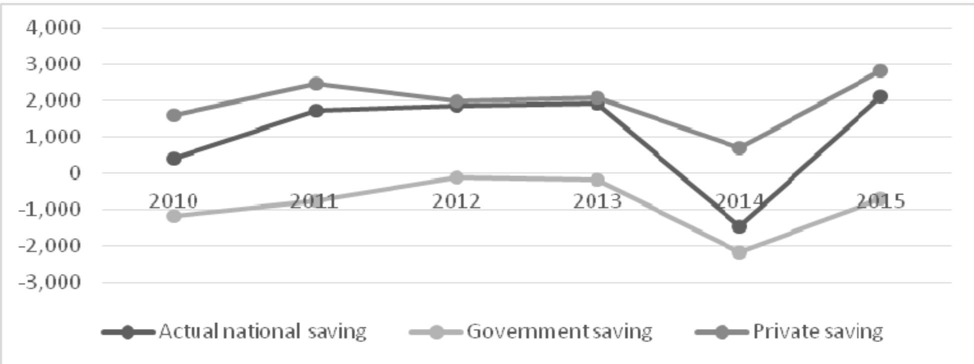
Actual and equilibrium national saving in Bulgaria over the period 2010-2015, million Euros at prices of 2010



Source: Own calculation on the basis of data from the websites of the Bulgarian National Bank www.bnb.bg and Eurostat.

Figure 10

Dynamics of actual national saving, private saving and government saving in Bulgaria for the period 2010-2015, million Euros at prices of 2010



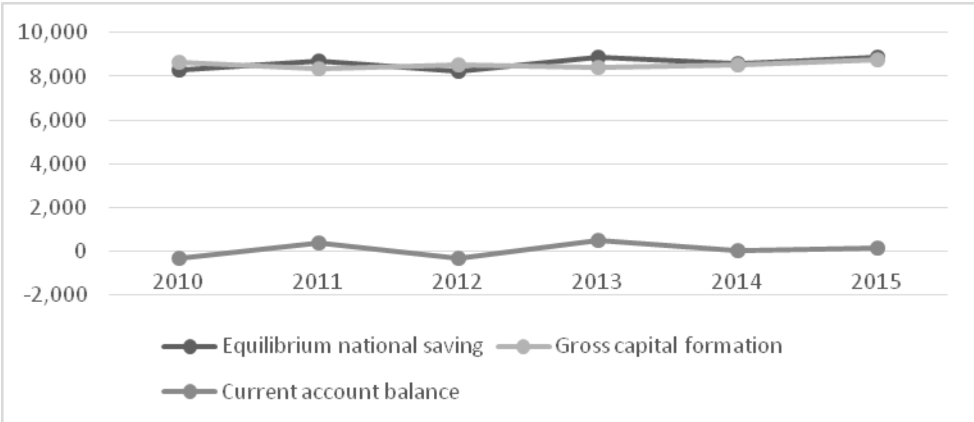
Source: Own calculation on the basis of data from the websites of the Bulgarian National Bank www.bnb.bg and Eurostat.

The dynamics of actual national saving depends on the government's fiscal policy and on private saving decisions. Over the entire period 2010-2015 government saving was negative (with an average of -852 million Euros at prices of 2010) but private saving was positive with an average of 1950 million Euros at prices of 2010 (see Figure 10). In 2010-2013 and in 2015 positive private saving compensated the government's budget deficits, but in 2014 Bulgaria's actual national saving was negative (–1.5 billion Euros at prices of 2010). The average actual national saving for the period 2010-2015 was positive (1098 million Euros at prices of 2010).

Equilibrium national saving depends on private investment activity and on foreign economic relations.

Figure 11

Dynamics of Bulgaria's equilibrium national saving, gross capital formation and current account balance for the period 2010-2015, million Euros at prices of 2010



Source: Own calculation on the basis of data from the websites of the Bulgarian National Bank www.bnb.bg and Eurostat.

Over the entire period 2010-2015 the dynamics of equilibrium national saving (average value of 8600 billion Euros) was determined by domestic investment activity (average gross capital formation of 8536 million Euros), while the impact of foreign sector was insignificant (average current account balance of 64million Euros) (see Figure 11).

Equilibrium national saving **ENS** can be expressed as a linear function of the real interest rate **r** and real GDP **Y**:

(29) $\mathbf{ENS_t = a_0 + a_1*r_t + a_2*Y_t + u_t}$

where $\mathbf{a_0}$ is an intercept term, $\mathbf{a_1}$ and $\mathbf{a_2}$ are regression coefficients and $\mathbf{u_t}$ is an error term.

Equation (29) can be estimated via the ordinary lest squares (OLS) method. For the OLS estimation of Equation (31) are used quarterly seasonally- and calendar-adjusted Eurostat data on Bulgaria's gross capital formation, current account balance and gross domestic product (in millions of Euros at prices of 2010 г.) and on the three-month money market interest rate for the period from the first quarter of 2007 to the third quarter of 2015. All data are deflated in order to be transformed from nominal into real.

The Augmented Dickey Fuller (ADF) Unit Root tests indicate that equilibrium national saving and the real interest rate are stationary at the 10% significance level but real GDP is not (see Tables 4, 5 and 6). The ADF test shows that the first differences of real GDP are stationary (see Table 7) at the 10% significance level. Equilibrium national saving and the real interest rate are integrated of order zero I(0), while real GDP is integrated of order 1 I(1). The three time series are not co-integrated because they are integrated of different order. Since the three time series are not co-integrated and an Error Correction Model (ECM) cannot be specified, the process of modeling continues with the first differences of the three variables:

(30) $\Delta ENS = a_0 + a_1 * \Delta r + a_2 * \Delta Y + u_t$

Table 4

ADF unit root test on equilibrium national saving

Null Hypothesis: ENS has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.403984	0.0185
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ENS)
Method: Least Squares
Date: 09/09/16 Time: 13:49
Sample (adjusted): 2008Q1 2015Q3
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ENS(-1)	-0.489921	0.143926	-3.403984	0.0022
D(ENS(-1))	-0.468874	0.138414	-3.387462	0.0023
D(ENS(-2))	-0.716840	0.089481	-8.011103	0.0000
D(ENS(-3))	-0.736396	0.101195	-7.276970	0.0000
C	1116.405	285.2579	3.913669	0.0006
R-squared	0.916091	Mean dependent var		88.03950
Adjusted R-squared	0.903182	S.D. dependent var		1005.236
S.E. of regression	312.7858	Akaike info criterion		14.47560
Sum squared resid	2543710.	Schwarz criterion		14.70689
Log likelihood	-219.3719	Hannan-Quinn criter.		14.55100
F-statistic	70.96463	Durbin-Watson stat		2.352058
Prob(F-statistic)	0.000000			

Source: Own calculations on the basis of Eurostat data.

Table 5

ADF unit root test on the real interest rate

Null Hypothesis: R has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.376330	0.0720
Test critical values:	1% level	-4.262735	
	5% level	-3.552973	
	10% level	-3.209642	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(R)
Method: Least Squares
Date: 09/09/16 Time: 14:01
Sample (adjusted): 2007Q3 2015Q3
Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
R(-1)	-0.254830	0.075476	-3.376330	0.0021
D(R(-1))	0.482781	0.135380	3.566104	0.0013
C	1.963633	0.608217	3.228509	0.0031
@TREND(2007Q1)	-0.062906	0.019175	-3.280658	0.0027

R-squared	0.475052	Mean dependent var	-0.142491
Adjusted R-squared	0.420747	S.D. dependent var	0.447348
S.E. of regression	0.340470	Akaike info criterion	0.796235
Sum squared resid	3.361683	Schwarz criterion	0.977630
Log likelihood	-9.137883	Hannan-Quinn criter.	0.857269
F-statistic	8.747857	Durbin-Watson stat	2.257674
Prob(F-statistic)	0.000275		

Source: Own calculations on the basis of Eurostat data.

Table 6

ADF unit root test on real GDP

Null Hypothesis: Y has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.605115	0.9700
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(Y)
Method: Least Squares
Date: 09/09/16 Time: 14:20
Sample (adjusted): 2009Q2 2015Q3
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y(-1)	-0.206967	0.342030	-0.605115	0.5541
D(Y(-1))	-0.727656	0.287004	-2.535354	0.0229
D(Y(-2))	-0.657918	0.242516	-2.712883	0.0160
D(Y(-3))	-0.584071	0.203578	-2.869031	0.0117
D(Y(-4))	0.244829	0.171892	1.424320	0.1748
D(Y(-5))	-0.219559	0.186340	-1.178273	0.2570
D(Y(-6))	-0.336505	0.169369	-1.986812	0.0655
D(Y(-7))	-0.458441	0.151866	-3.018710	0.0086
D(Y(-8))	-0.337535	0.144272	-2.339575	0.0336
C	1663.007	3173.665	0.524002	0.6079
@TREND(2007Q1)	18.19309	6.823411	2.666275	0.0176

R-squared	0.997351	Mean dependent var	120.9020
Adjusted R-squared	0.995585	S.D. dependent var	1541.483
S.E. of regression	102.4251	Akaike info criterion	12.39225
Sum squared resid	157363.4	Schwarz criterion	12.92452
Log likelihood	-150.0992	Hannan-Quinn criter.	12.54552
F-statistic	564.7457	Durbin-Watson stat	1.906247
Prob(F-statistic)	0.000000		

Source: Own calculations on the basis of Eurostat data.

Table 7

ADF unit root test on the first differences of real GDP

Null Hypothesis: D(Y) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.299310	0.0012
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(Y,2)
Method: Least Squares
Date: 09/09/16 Time: 14:38
Sample (adjusted): 2009Q2 2015Q3
Included observations: 26 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-4.643720	0.876288	-5.299310	0.0001
D(Y(-1),2)	2.786251	0.720789	3.865557	0.0014
D(Y(-2),2)	2.035973	0.571243	3.564111	0.0026
D(Y(-3),2)	1.387080	0.444338	3.121676	0.0066
D(Y(-4),2)	1.590198	0.344113	4.621148	0.0003
D(Y(-5),2)	1.281036	0.286760	4.467272	0.0004
D(Y(-6),2)	0.870674	0.219101	3.973841	0.0011
D(Y(-7),2)	0.360677	0.136328	2.645654	0.0176
C	-256.6631	87.64684	-2.928378	0.0098
@TREND(2007Q1)	14.97021	4.179863	3.581506	0.0025

R-squared	0.998957	Mean dependent var	152.1089
Adjusted R-squared	0.998370	S.D. dependent var	2486.059
S.E. of regression	100.3758	Akaike info criterion	12.33944
Sum squared resid	161204.8	Schwarz criterion	12.82333
Log likelihood	-150.4127	Hannan-Quinn criter.	12.47878
F-statistic	1702.194	Durbin-Watson stat	1.974016
Prob(F-statistic)	0.000000		

Source: Own calculations on the basis of Eurostat data.

The results from the OLS-estimation of Equation (30) are displayed in Table 8.

Table 8

OLS-estimates of the parameters of Equation (30)

Dependent Variable: D(ENS,1)
Method: Least Squares
Date: 09/09/16 Time: 14:49
Sample (adjusted): 2007Q2 2015Q3
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-17.88175	136.4773	-0.131024	0.8966
D(R,1)	-524.2865	299.4413	-1.750882	0.0899
D(Y,1)	0.431693	0.087952	4.908288	0.0000

R-squared	0.443528	Mean dependent var	90.05183
Adjusted R-squared	0.407626	S.D. dependent var	987.9449
S.E. of regression	760.3800	Akaike info criterion	16.18961
Sum squared resid	17923511	Schwarz criterion	16.32429
Log likelihood	-272.2234	Hannan-Quinn criter.	16.23554
F-statistic	12.35403	Durbin-Watson stat	2.733361
Prob(F-statistic)	0.000113		

Source: Own calculations on the basis of Eurostat data.

At the 5% level the intercept and the real interest rate are not significant but real GDP is. At the 10% level the real interest rate also becomes significant. The estimated value of $\mathbf{a_1}$ (-524.2865) means that a 1% change in the three-month money interest rate will lead to a national saving change of 524.2865 million Euros in the opposite direction, provided that GDP is held constant. The estimated value of $\mathbf{a_2}$ (0.431693**)** indicates that a one-million-Euro change in GDP will lead to a 0.43-million-Euro change in national saving in the same direction, if the three-month money interest rate remains unchanged.

The coefficient of determination ($R^2 = 0.443528$) shows that 44.35% of changes in national saving during the period of investigation can be explained by changes in GDP and the interest rate. The probability of the F-statistic (0.000113) indicates that at the 5% level of significance the alternative hypothesis for the adequacy of the regression model is accepted. The acceptance of the alternative hypothesis does not mean that the model specification is the best possible but only that the regression model adequately reflects the relationship between dependent variable and independent variables.

The residual heteroskedasticity test (ARCH) confirms the null hypothesis for the absence of heteroskedasticity at the 5% level of significance (see Table 9). The residual normality test (Jarque-Bera) confirms the null hypothesis for the presence of normal distribution of residuals at the 5% level of significance (see Figure 12). The value of 2.733361of the Durbin-Watson statistic presumes the existence of serial correlation (autocorrelation) of residuals. At the 5% level of significance the serial correlation LM test confirms the alternative hypothesis that residuals are serially correlated (see Table 10). The serial correlation of residuals is not unusual for time-series data. In the presence of serial correlation OLS estimates and based on them forecasts are inefficient but still unbiased and consistent. Since the regression model will not be used for forecasting, the serial correlation has not been removed from the model.

Table 9

Heteroskedasticity test (ARCH) on the residuals of Equation (29)

Heteroskedasticity Test: ARCH

F-statistic	1.941651	Prob. F(1,31)	0.1734
Obs*R-squared	1.945090	Prob. Chi-Square(1)	0.1631

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/09/16 Time: 15:12
Sample (adjusted): 2007Q3 2015Q3
Included observations: 33 after adjustments

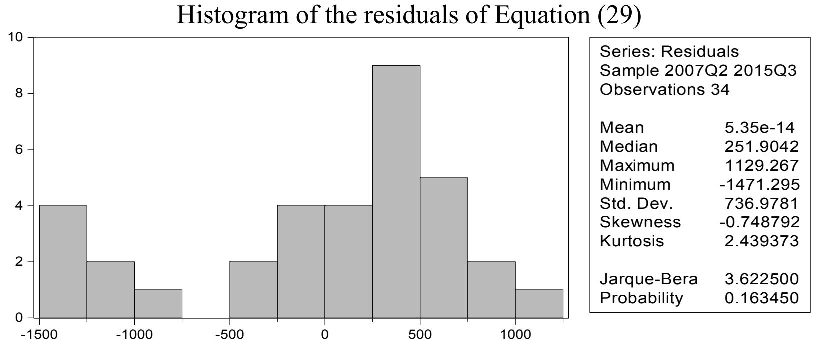
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	665373.8	143140.4	4.648399	0.0001
RESID^2(-1)	-0.241707	0.173461	-1.393431	0.1734

R-squared	0.058942	Mean dependent var	539658.4
Adjusted R-squared	0.028585	S.D. dependent var	647708.5
S.E. of regression	638383.9	Akaike info criterion	29.62996
Sum squared resid	1.26E+13	Schwarz criterion	29.72066
Log likelihood	-486.8943	Hannan-Quinn criter.	29.66048
F-statistic	1.941651	Durbin-Watson stat	2.214889
Prob(F-statistic)	0.173400		

Source: Own calculations on the basis of Eurostat data.

Figure 12

Histogram of the residuals of Equation (29)



Source: Own calculations on the basis of Eurostat data.

Table 10

Serial correlation LM test on the residuals of Equation (29)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	10.92799	Prob. F(2,29)	0.0003
Obs*R-squared	14.61191	Prob. Chi-Square(2)	0.0007

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 09/09/16 Time: 15:28
Sample: 2007Q2 2015Q3
Included observations: 34
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-28.01203	107.0088	-0.261773	0.7953
D(R,1)	296.9699	250.1303	1.187261	0.2448
D(Y,1)	0.380497	0.113159	3.362487	0.0022
RESID(-1)	-1.099789	0.235833	-4.663431	0.0001
RESID(-2)	-0.008930	0.171851	-0.051965	0.9589

R-squared	0.429762	Mean dependent var	5.35E-14
Adjusted R-squared	0.351109	S.D. dependent var	736.9781
S.E. of regression	593.6638	Akaike info criterion	15.74556
Sum squared resid	10220664	Schwarz criterion	15.97002
Log likelihood	-262.6745	Hannan-Quinn criter.	15.82211
F-statistic	5.463993	Durbin-Watson stat	2.029708
Prob(F-statistic)	0.002099		

Source: Own calculations on the basis of Eurostat data.

Ramsey's Regression Specification Error Test (RESET) alludes to the presence of unsolved specification problems in Equation 29 such as non-linearity or omitted variables (see Table 11). The Granger Causality Test confirms the alternative hypothesis for the presence of a causal relationship at the 5% level of significance in the following directions (see Table 12):

- From the real interest rate to national saving;
- From real GDP to national saving;
- From national saving to real GDP.

The Granger Causality Test confirms the null hypothesis for the absence of a causal relationship at the 5% level of significance in the following directions (see Table 12):

- From national saving to the real interest rate;
- From real GDP to the real interest rate;
- From the real interest rate to real GDP.

Table 11

Regression Specification Error Test on Equation (29)

Ramsey RESET Test
Equation: EQ01
Specification: D(ENS,1) C D(R,1) D(Y,1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	3.245758	30	0.0029
F-statistic	10.53495	(1, 30)	0.0029
Likelihood ratio	10.23288	1	0.0014

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	4658283.	1	4658283.
Restricted SSR	17923511	31	578177.8
Unrestricted SSR	13265228	30	442174.3
Unrestricted SSR	13265228	30	442174.3

LR test summary:

	Value	df
Restricted LogL	-272.2234	31
Unrestricted LogL	-267.1069	30

Unrestricted Test Equation:
Dependent Variable: D(ENS,1)
Method: Least Squares
Date: 09/09/16 Time: 15:42
Sample: 2007Q2 2015Q3
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	-509.9514	192.9467	-2.642965	0.0129
D(R,1)	-483.2556	262.1701	-1.843290	0.0752
D(Y,1)	0.549217	0.085012	6.460497	0.0000
FITTED^2	0.001134	0.000349	3.245758	0.0029

R-squared	0.588154	Mean dependent var	90.05183
Adjusted R-squared	0.546969	S.D. dependent var	987.9449
S.E. of regression	664.9619	Akaike info criterion	15.94747
Sum squared resid	13265228	Schwarz criterion	16.12704
Log likelihood	-267.1069	Hannan-Quinn criter.	16.00871
F-statistic	14.28089	Durbin-Watson stat	2.799710
Prob(F-statistic)	0.000006		

Source: Own calculations on the basis of Eurostat data.

Table 12

Granger Causality Test on Equation (29)

Pairwise Granger Causality Tests
Date: 09/09/16 Time: 15:56
Sample: 2007Q1 2015Q3
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
R does not Granger Cause ENS	33	10.8230	0.0003
ENS does not Granger Cause R		2.84882	0.0748
Y does not Granger Cause ENS	33	25.8671	4.E-07
ENS does not Granger Cause Y		22.3883	2.E-06
Y does not Granger Cause R	33	1.30172	0.2880
R does not Granger Cause Y		0.68546	0.5121

Source: Own calculations on the basis of Eurostat data.

If the regression coefficients $\mathbf{a_0}$, $\mathbf{a_1}$ and $\mathbf{a_2}$ are substituted in Equation (30) by their OLS-estimates, Equation (30) becomes

(31) $\mathbf{\Delta ENS = -17.88 - 524.29{*}\Delta r + 0.43{*}\Delta Y + u_t}$

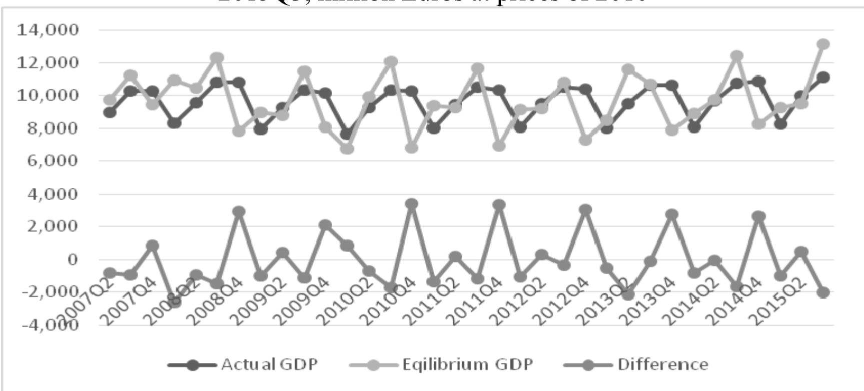
The equilibrium value of real GDP for the goods market in moment t $\mathbf{GMEY_t}$ can be calculated by transforming Equation (31) to

(32) $\mathbf{GMEY_t = (17.88 + \Delta ENS + 0.43 * Y_{t-1} + 524.29 * \Delta r) / 0.43}$

Equation (32) is the **IS** curve equation.

Figure 13

Actual and equilibrium values of real GDP for the goods market over the period 2007Q2 - 2015Q3, million Euros at prices of 2010



Source: Own calculations on the basis of Eurostat data.

In Figure 13 are displayed the values of actual real GDP, the equilibrium values of real GDP for the goods market (calculated by Equation 32) and their differences for the period 2007Q2- 2015Q3. It can be concluded that the goods market was near its equilibrium level in both periods 2010-2015 and 2007-2015.

2.3. The money market

The money market equilibrium condition demands that the real demand for money **MD/P** be equal to the real money supply **MS/P**:

(33) $\mathbf{MD/P = MS/P}$

where **MD** is the nominal demand for money, **MS** is the nominal money supply, and **P** is a price index (the GDP deflator).

The real demand for money **MD/P** can be presented as a linear function of the real interest rate **r** and real GDP **Y**:

(34) $\mathbf{MD/P = b_0 + b_1 * r + b_2 * Y + u}$

where $\mathbf{b_0}$, $\mathbf{b_1}$ and $\mathbf{b_2}$ are regression coefficients and **u** is an error term.

The money market equilibrium condition can be expressed as

(35) $\mathbf{MD/P = MS/P = b_0 + b_1 * r + b_2 * Y + u}$

Equation (34) can be estimated by the OLS method to obtain the values of the regression coefficients $\mathbf{b_0}$, $\mathbf{b_1}$ and $\mathbf{b_2}$. Under the OLS procedure are used nominal quarterly data on the monetary aggregate M3, GDP and the three-month money market interest rate, which are divided by the GDP deflator for the respective quarter.

It is already known from Section 2.2 that the real interest rate is integrated of order zero I(0), while real GDP is integrated of order 1 I(1). The monetary aggregate M3 is also integrated of order I(1) (see Tables 12 and 13).

Table 13

ADF unit root test on the monetary aggregate M3

Null Hypothesis: M3 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.763647	0.2159
Test critical values:	1% level	-4.107947	
	5% level	-3.481595	
	10% level	-3.168695	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M3)
Method: Least Squares
Date: 09/09/16 Time: 19:41
Sample (adjusted): 1999Q4 2015Q3
Included observations: 64 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M3(-1)	-0.222253	0.080420	-2.763647	0.0075
C	1556.289	442.9392	3.513550	0.0008
@TREND(1999Q3)	99.43456	36.25035	2.742996	0.0080

R-squared	0.111278	Mean dependent var	428.8706
Adjusted R-squared	0.082139	S.D. dependent var	705.9149
S.E. of regression	676.3021	Akaike info criterion	15.91690
Sum squared resid	27900456	Schwarz criterion	16.01810
Log likelihood	-506.3407	Hannan-Quinn criter.	15.95676
F-statistic	3.818938	Durbin-Watson stat	1.943395
Prob(F-statistic)	0.027376		

Source: Own calculations on the basis of Eurostat data.

The three time series are not co-integrated because they are integrated of different order. Since the three time series are not co-integrated and an Error Correction Model (ECM) cannot be specified, the process of modeling continues with the first differences of the three variables:

(36) $\mathbf{\Delta(M3/P) = b_0 + b_1{*}\Delta r + b_2{*}\Delta Y + u}$

The results from the OLS-estimation of Equation (36) are displayed in Table 14.

Table 14

ADF unit root test on the first differences of the monetary aggregate M3

Null Hypothesis: D(M3) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.380004	0.0000
Test critical values:	1% level	-4.110440	
	5% level	-3.482763	
	10% level	-3.169372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M3,2)
Method: Least Squares
Date: 09/09/16 Time: 19:50
Sample (adjusted): 2000Q1 2015Q3
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M3(-1))	-1.102006	0.131504	-8.380004	0.0000
C	488.9936	197.5865	2.474833	0.0162
@TREND(1999Q3)	-0.451651	4.988297	-0.090542	0.9282

R-squared	0.539572	Mean dependent var	22.14552
Adjusted R-squared	0.524225	S.D. dependent var	1042.675
S.E. of regression	719.2002	Akaike info criterion	16.04060
Sum squared resid	31034938	Schwarz criterion	16.14266
Log likelihood	-502.2790	Hannan-Quinn criter.	16.08074
F-statistic	35.15682	Durbin-Watson stat	1.984274
Prob(F-statistic)	0.000000		

Source: Own calculations on the basis of Eurostat data.

Table 15

OLS-estimates of the parameters of Equation (36)

Dependent Variable: D(M3,1)
Method: Least Squares
Date: 09/09/16 Time: 20:03
Sample (adjusted): 1999Q4 2015Q3
Included observations: 64 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	426.8034	87.19232	4.894966	0.0000
D(R,1)	58.52849	111.8706	0.523180	0.6027
D(Y,1)	0.148536	0.065668	2.261913	0.0273

R-squared	0.092959	Mean dependent var	428.8706
Adjusted R-squared	0.063220	S.D. dependent var	705.9149
S.E. of regression	683.2366	Akaike info criterion	15.93730
Sum squared resid	28475549	Schwarz criterion	16.03850
Log likelihood	-506.9936	Hannan-Quinn criter.	15.97717
F-statistic	3.125832	Durbin-Watson stat	2.232449
Prob(F-statistic)	0.051006		

Source: Own calculations on the basis of Eurostat data.

At the 5% level the intercept and the regression coefficient before real GDP are statistically significant. The estimated value of the intercept $\mathbf{b_0}$ (426.8034) indicates that in the hypothetical situation of a zero real GDP and a zero real interest rate Bulgaria would have a real equilibrium demand for money of 426.80 million Euros at prices of 2010. Such a situation could be explained by the need for a monetary exchange of goods and services even at zero values of real GDP and the real interest rate. The estimated value of $\mathbf{b_2}$ (0.148536**)** suggests that a one-million shift in GDP will change the equilibrium demand for money by 0.15 million Euros in the same direction provided that the three-month money market interest rate remains unchanged.

The coefficient of determination (R^2 = 0.092959) shows that 9.3% of the variations in the equilibrium demand for money during the period of investigation can be explained by changes in GDP and the interest rate. The probability of the F-statistic (0.051006) indicates that at the 10% level of significance the alternative hypothesis for the adequacy of the regression model is accepted. The acceptance of the alternative hypothesis does not mean that the model specification is the best possible but only that the regression model adequately reflects the relationship between dependent variable and independent variables.

The residual heteroskedasticity test (Breusch-Pagan-Godfrey) confirms the null hypothesis for the absence of heteroskedasticity at the 5% level of significance (see Table 15).

Table 16

Residual heteroskedasticity test (Breusch-Pagan-Godfrey) on Equation 36

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.512521	Prob. F(2,61)	0.6015
Obs*R-squared	1.057680	Prob. Chi-Square(2)	0.5893
Scaled explained SS	0.717245	Prob. Chi-Square(2)	0.6986

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 09/11/16 Time: 10:53
Sample: 1999Q4 2015Q3
Included observations: 64

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	459054.6	70473.73	6.513839	0.0000
D(R,1)	82639.45	90420.08	0.913950	0.3643
D(Y,1)	-33.54676	53.07682	-0.632042	0.5297

R-squared	0.016526	Mean dependent var	444930.4
Adjusted R-squared	-0.015719	S.D. dependent var	547940.6
S.E. of regression	552230.2	Akaike info criterion	29.32706
Sum squared resid	1.86E+13	Schwarz criterion	29.42826
Log likelihood	-935.4659	Hannan-Quinn criter.	29.36693
F-statistic	0.512521	Durbin-Watson stat	1.761145
Prob(F-statistic)	0.601540		

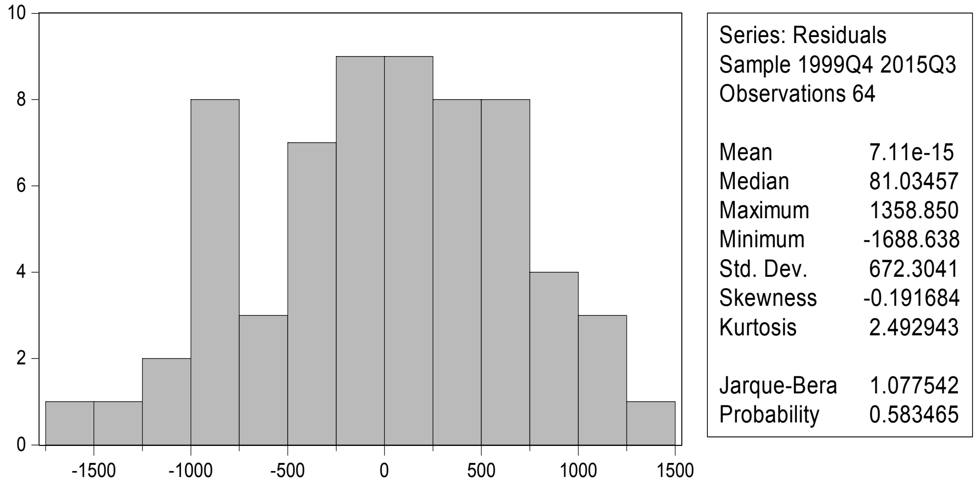
Source: Own calculations on the basis of Eurostat data.

The residual normality test (Jarque-Bera) confirms the null hypothesis for the presence of normal distribution of residuals at the 5% level of significance (see Figure 14).

The value of 2.232449 of the Durbin-Watson statistic presumes the lack of serial correlation (autocorrelation) of residuals. At the 5% level of significance the serial correlation LM test confirms the null hypothesis that residuals are not serially correlated (see Table 16).

Figure 14

Histogram of the residuals of Equation (36)



Source: Own calculations on the basis of Eurostat data

Table 17

Residual Serial Correlation LM Test (Breusch-Pagan-Godfrey) on Equation 36

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.722980	Prob. F(2,59)	0.4896
Obs*R-squared	1.530977	Prob. Chi-Square(2)	0.4651

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 09/11/16 Time: 11:08
Sample: 1999Q4 2015Q3
Included observations: 64
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.441351	87.63479	0.016447	0.9869
D(R,1)	17.73776	113.9170	0.155708	0.8768
D(Y,1)	-0.017990	0.067646	-0.265948	0.7912
RESID(-1)	-0.155307	0.135023	-1.150220	0.2547
RESID(-2)	-0.066343	0.136732	-0.485205	0.6293

R-squared	0.023922	Mean dependent var	7.11E-15

Adjusted R-squared	-0.042253	S.D. dependent var	672.3041
S.E. of regression	686.3607	Akaike info criterion	15.97559
Sum squared resid	27794370	Schwarz criterion	16.14425
Log likelihood	-506.2188	Hannan-Quinn criter.	16.04203
F-statistic	0.361490	Durbin-Watson stat	1.976567
Prob(F-statistic)	0.835023		

Source: Own calculations on the basis of Eurostat data.

Ramsey's Regression Specification Error Test (RESET) confirms the null hypothesis for the absence of errors in the specification of the regression model (see Table 18).

Table 18

Residual Ramsey's Regression Specification Error Test (RESET) on Equation 36

Ramsey RESET Test
Equation: EQ01
Specification: D(M3,1) C D(R,1) D(Y,1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.273036	60	0.7858
F-statistic	0.074548	(1, 60)	0.7858
Likelihood ratio	0.079469	1	0.7780

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	35336.21	1	35336.21
Restricted SSR	28475549	61	466812.3
Unrestricted SSR	28440212	60	474003.5
Unrestricted SSR	28440212	60	474003.5

LR test summary:

	Value	df
Restricted LogL	-506.9936	61
Unrestricted LogL	-506.9539	60

Unrestricted Test Equation:
Dependent Variable: D(M3,1)
Method: Least Squares
Date: 09/11/16 Time: 11:20
Sample: 1999Q4 2015Q3
Included observations: 64

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	281.8971	537.9469	0.524024	0.6022
D(R,1)	31.59316	149.7996	0.210903	0.8337
D(Y,1)	0.084374	0.244133	0.345608	0.7308

FITTED^2	0.000634	0.002323	0.273036	0.7858

R-squared	0.094085	Mean dependent var	428.8706
Adjusted R-squared	0.048789	S.D. dependent var	705.9149
S.E. of regression	688.4791	Akaike info criterion	15.96731
Sum squared resid	28440212	Schwarz criterion	16.10224
Log likelihood	-506.9539	Hannan-Quinn criter.	16.02046
F-statistic	2.077122	Durbin-Watson stat	2.214152
Prob(F-statistic)	0.112723		

Source: Own calculations on the basis of Eurostat data.

The Granger Causality Test (see Table 19) confirms the alternative hypothesis for the presence of a causal relationship at the 5% level of significance in the following directions:

- From real GDP to the equilibrium demand for money;
- From the equilibrium demand for money to real GDP;
- From the real interest rate to real GDP.

The Granger Causality Test (see Table 19) confirms the null hypothesis for the absence of a causal relationship at the 5% level of significance in the following directions:

- From the real interest rate to the equilibrium demand for money;
- From the equilibrium demand for money to the real interest rate;
- From real GDP to the real interest rate.

Table 19

Granger Causality Test on Equation (36)

Pairwise Granger Causality Tests
Date: 09/11/16 Time: 11:24
Sample: 1999Q3 2015Q3
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
R does not Granger Cause M3	63	2.50958	0.0901
M3 does not Granger Cause R		0.59526	0.5548
Y does not Granger Cause M3	63	3.31237	0.0434
M3 does not Granger Cause Y		30.5957	8.E-10
Y does not Granger Cause R	63	0.45843	0.6345
R does not Granger Cause Y		5.95006	0.0045

Source: Own calculations on the basis of Eurostat data.

(37) $\Delta(M3/P) = b_0 + b_1*\Delta r + b_2*\Delta Y + u$

If the regression coefficients $\mathbf{b_0}$, $\mathbf{b_1}$ and $\mathbf{b_2}$ are substituted in Equation (36) by their OLS-estimates, Equation (36) becomes

(38) $\Delta(M3/P) = 429.80 + 58.53*\Delta r + 0.15*\Delta Y + u_t$

The equilibrium value of real GDP for the goods market in moment t $\mathbf{MMEY_t}$ can be calculated by transforming Equation (38) to

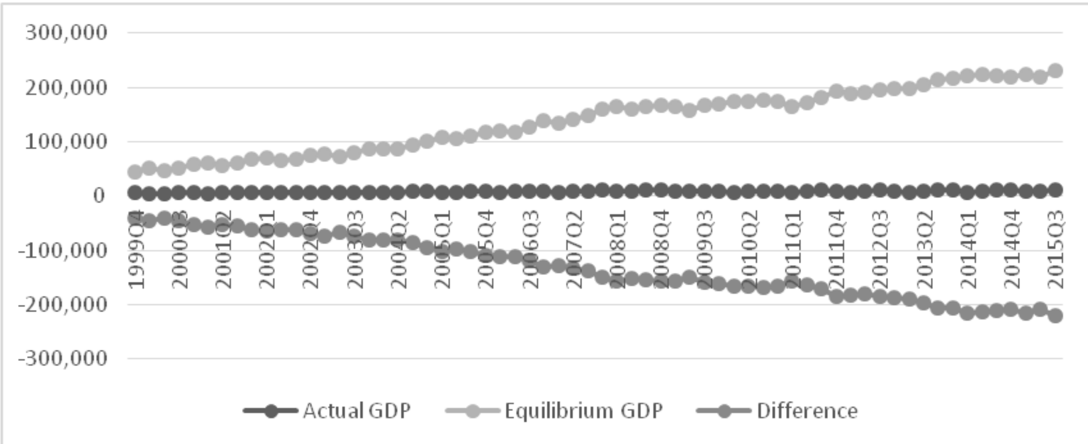
(39) $MMEY_t = (\Delta(M3/P) - 429.80 - 58.53*\Delta r + 0.15*Y_{t-1}) / 0.15$

Equation (39) is the **LM** curve equation.

In Figure 15 are shown the values of actual real GDP, the equilibrium values of real GDP for the money market (calculated by Equation 39) and their differences for the period 1999Q4 - 2015Q3. It can be inferred that the money market was much below its equilibrium level in both periods 2010-2015 and 1999-2015. The huge imbalances in Bulgaria's money market can be attributed to the bad condition of the Bulgarian economy (weak growth accompanied by deflationary trends) and to the lack of autonomous monetary policy in Bulgaria under a currency board arrangement.

Figure 15

Actual and equilibrium values of real GDP for the money market over the period 1999Q4 - 2015Q3, million Euros at prices of 2010



Source: Own calculations on the basis of Eurostat data

Conclusions

The research results confirm the Keynesian thesis of the disequilibrium character of the economic system. The lack of co-integration among macroeconomic variables indicates the absence of a stable long-term market equilibrium, which makes state intervention in the economy necessary. In case of a permanent and persistent deflationary GDP gap and deflationary trends policymakers should seek a combination of short-term demand-side stimuli and long-run supply-side measures.

The short-term demand-side stimuli ought to be fiscal because fiscal policy is the only macroeconomic instrument available under a currency board arrangement. Bulgaria's governments customarily implement more restrictive policies than European standards require and in this sense opportunities exist to stimulate aggregate demand through fiscal policy. Fiscal solutions ought to be sought in the following directions:

1) Improving the EU funds absorption rate. Considering the low absorption rate of EU funds in Bulgaria (about 30%) there are a lot of reserves in this area;
2) Introducing moderate progressive taxes on corporate profits and personal income. As shown by Tanchev (2016), progressive income taxation has a positive impact on Bulgaria's economic growth, while proportional income taxation has a negative influence on the real GDP of Bulgaria;
3) Lowering the rates of the Value Added Tax and the excise taxes on electricity and other energy sources used for manufacturing purpose. Such a measure aims at reducing production cost and prices and at encouraging consumption and production;
4) Balancing the government budget not by cutting expenditure but by optimizing it and by increasing revenue;
5) Transforming the tax system from a consumption-based one to a hybrid one, which is considered more stimulating to the economic growth (Stoilova, 2017);
6) Increasing the share of budget expenditure in GDP to the Euro area average. Maintaining fiscal parameters close to the Euro area average ought to facilitate the fulfillment of the Maastricht criteria for public finance.

The structures of Bulgaria's state budget have a lot of defects and create multiple problems, which require adequate management solutions. Whether Bulgaria's macroeconomic management possesses the necessary will and competence to find and implement these solutions is difficult to forecast.

The long-run supply-side measures are related to:

1) Improving the quality of legislation and institutions;
2) Building good public infrastructure;
3) Encouraging and investing in the formation of human capital;
4) Stimulating and investing in research and development (R&D) activities.

Bulgaria's institutional environment is characterized by high levels of bureaucracy and corruption and by sluggish and ineffective work of state administration. The lack of good legislation and quality institutions, the absence of quality infrastructure and the shortage of well-qualified and highly-productive labor force are the main obstacles to investment (local and foreign). Other factors, which impede investment, are the political instability and the absence of succession and continuity in macroeconomic policies of different Bulgarian governments.

Considering the slow and painful process of institutional transformation in Bulgaria, as well as the low share of investment in public infrastructure, human capital and research and development in Bulgaria's GDP compared to EU levels, the supply-side prospects of Bulgaria's economic growth cannot be good.

Bulgaria's ineffective money market, which remains much below its equilibrium levels in a period of economic stagnation, indicates the necessity of increasing the money supply in order to stimulate economic growth. A possible way to encourage growth is to improve the efficiency of financial markets in Bulgaria (Tsenkov, 2015).

References

Economic Research Institute at the Bulgarian Academy of Sciences, 2012. Annual Report 2012 "Economic Development and Policy in Bulgaria: Evaluations and Expectations. Special Focus: Competitiveness of Bulgarian Economy".

European Commission, 2014a. Macroeconomic Imbalances: Bulgaria 2014. Occasional Papers 173, March 2014.

European Commission, 2014b. The Production Function Methodology for Calculating Potential Growth Rates & Output Gaps. Economic Papers 535 November 2014.

European Commission, 2015. Bulgaria: Report prepared in accordance with Article 126(3) of the Treaty. Brussels, 16.11.2015 COM (2015) 802 final.

Ganchev, G., 2010. The fulfillment of the Maastricht criteria in Bulgaria. In: Bulgaria's accession to the Euro area: economic and social dimensions, pp. 9-31. The Economics and International Relations Institute and the Friedrich Ebert Foundation.

Ganev, K., 2004. Statistical estimates of the deviations from the macroeconomic potential. An application to the economy of Bulgaria. Agency for Economic Analysis and Forecasting Working Paper 12004en.

Ganev, K., 2005. Measuring Total Factor Productivity: Growth Accounting for Bulgaria. Bulgarian National Bank Discussion Paper No. 48/2005.

Ganev, K., 2015. A Small Model for Output Gap and Potential Growth Estimation: An Application to Bulgaria. St Kliment Ohridski University of Sofia, Faculty of Economics and Business Administration / Center for Economic Theories and Policies Bulgarian Economic Papers Series bep-2015-04.

Gladnishki, A., 2005. Measuring potential output: using the instruments of production functions. Agency for Economic Analysis and Forecasting (AEAF), Ministry of Finance, Republic of Bulgaria.

International Monetary Fund, 2010. Bulgaria: Selected Issues. IMF Country Report No. 10/159, June 2010.

International Monetary Fund, 2014. Bulgaria's EU Funds Absorption: Maximizing the Potential. IMF Working Paper WP/14/21.

Kacharnazov, N., 2008. The Model IS-LM as a Research Method for Economic Fluctuations of Bulgarian Economy. Dialog 2/2008.

Keppel, C. and A. Orthofer, 2009. A macroeconomic forecasting model for Bulgaria.

Minassian, G., 2008. Is the Bulgarian Economy Overheating? Economic Thought Journal, Volume 2008, Issue 3, pp. 3-29.

Ministry of Finance of the Republic of Bulgaria, 2014a. Bulgaria's economy 2013: an annual survey. ISSN 2367-5012.

Ministry of Finance of the Republic of Bulgaria, 2014b. Medium term budget forecast for the 2015-2017 period.

Raleva, S., 2013. Inflation and Economic Growth. Sofia: Publishing Complex of the University of National and World Economy.

Stoilova, D., 2017. Tax Structure and Economic Growth: Evidence from the European Union. Contaduria y Administracion, Volume 62, Issue 4.

Tanchev, S. 2016. The Role of the Proportional Income Tax on Economic Growth of Bulgaria. Economic Studies journal, Volume 2016, Issue 4, pp. 66-77.

Todorov, I. 2015. Two Approaches for Evaluating the Aggregated Production Function of Bulgaria. Economic Studies journal, Volume 2015, Issue 4, pp. 67-81.

Todorov, I. and K. Durova, 2016. Economic Growth of Bulgaria and Its Determinants. Economic Studies journal, Volume 2016, Issue 4, pp. 3-35.

Tsalinski, T., 2007. Two Approaches to Estimating the Potential Output of Bulgaria. Bulgarian National Bank Discussion Paper No. 57/2007.

Tsenkov, V., 2015. Economic Studies journal, Volume 2015, Issue 3, pp. 71-107.

World Bank. 2005. Bulgaria: The Road to Successful EU Integration. The Policy Agenda. Country Economic Memorandum. Report No. 34233-BG.