6 MODELING THE ECONOMIC GROWTH IN ROMANIA. THE INFLUENCE OF FISCAL REGIMES

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Abstract

Taking into consideration the importance of the sustainability of public finance, in the present study we calibrate and simulate a three-sector Greiner, Semmler and Gong (2004) model for the Romanian economy. The simulations were performed considering three fiscal regimes, defined according to the way the government expenditures were financed. By calibrating the model to the Romanian economy, we determine for each fiscal regime the optimal tax rate, that is the tax that maximizes the long-run growth rate, and we forecast the evolution of the real GDP.

Keywords: endogenous economic growth, fiscal regime, three-sector economy, path simulation, public capital, balanced growth path

JEL Classification: C15, C61, E62, 41

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1. Introduction

Arrow and Kurz (1970) were the first to introduce productive public capital into an exogenous growth model, concluding that the stock of public capital is more important than the flow of government spending. The endogenous growth models developed lately emphasize the prominent role of the fiscal policy in ensuring the long-run economic growth. Studies like Barro (1990), Barro and Sala-i-Martin (1992), Turnovski (1995), Futagami, Morita and Shibata (1993) have identified the influence of the public capital on sustainable growth. Futagami, Morita and Shibata (1993) present an

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endogenous growth model where the stock of public capital has positive effects as concerns the marginal product of private capital, thus leading to endogenous growth. Greiner, Semmler (2000) and Greiner, Semmler, and Gong (2004) take up the approach presented by Futagami, Morita and Shibata (1993) and analyze how fiscal policy affects the balanced growth rate of an economy, allowing for a budget deficit of the government and taking into account government debt. The government decisions are supposed to be restricted by certain budgetary regimes which are generally formulated in terms of the instruments (expenditure and tax regimes) or in terms of a well-defined target like the budget deficit or the size of public debt. Domar (1957), Blinder and Solow (1973), Barro (1979), van Ewijk (1991) emphasize that the government need to establish budgetary regimes and rules determining the tax rate and the way the public expenditures are financed.

Taking into consideration the importance of the sustainability of public finances, in the present study we calibrate and simulate a three-sector Greiner, Semmler and Gong (2004) model for the Romanian economy. The model is simulated for three fiscal regimes. For each regime, we determine the optimal taxation rate, which maximizes the long-run growth rate, we forecast the evolution of real GDP and we determine the path of public debt share in the GDP.

The fiscal regimes are defined taking into account the way the government expenditures are financed. In the first fiscal regime, the total expenditures on public consumption, transfers and interest payments are financed entirely by the budgetary revenues. Consequently, the government issues new bonds only to cover the investment expenditures. The second fiscal regime assumes that government issues bonds to finance the investments and a fraction of the interest rate payments. In the third fiscal regime, the government issues bonds only to finance the interest rate payments.

The paper is organized as follows: in the second section, we present the main equations of the model. In the third section, we study the model dynamics, focusing on the balanced growth path. In the fourth section, the parameters of the model are calibrated to the Romanian economy. In the fifth section, we simulate the evolution of the real GDP and of the ratio of public to private capital. The final section concludes.

2. The model

In this section, we present a Greiner, Semmler, and Gong (2004) endogenous growth model in a closed economy with three sectors: household sector, productive sector, and government.

The productive sector is assumed to be represented by one firm which behaves competitively exhibiting a Cobb-Douglas per capita production function:

$$f(K,G) = A \cdot K^{\beta} (\overline{G} / L)^{\alpha},$$

where: A is a positive technology parameter, $\overline{G}$ is the aggregate stock of public capital that is subject to congestion, L is the labor supply, K is the private per capita capital, and α, β are the shares of public and private capital, respectively. It is assumed that the per capita stock of public capital $G = \overline{G}/L$ affects per capita output, implying that an increase in the labor input leads to a decrease in the contribution of public capital to total output.

From the optimal problem of the representative firm, we obtain that the wage rate (w) and the return to private capital (r_1) are determined as

$$w = (1-\beta)K^{\beta}G^{\alpha}\text{, and } r_1 = \beta K^{\beta-1}G^{\alpha}.$$

The evolution of the stock of private physical capital is given by

$$\dot{K} = K^{\beta}G^{\alpha} - (\delta_K + n)K - C - C_p - I_p,$$

where: δ_K is the depreciation rate of capital, C is private consumption, C_p is public consumption, and I_p stands for public investment.

The household's optimization problem is given as

$$\max_{C(t)} \int_0^{\infty} e^{-(\rho-n)t} L_0 \frac{C(t)^{1-\sigma} - 1}{1-\sigma} dt, \qquad \text{(P)}$$

subject to

$C(t) + \dot{K}(t) + (\delta_K + n)K(t) + \dot{B}(t) + nB(t) = (w(t) + r_1(t)K(t) + r_2(t)B(t))(1-\tau) + T_p(t)$ where: $C(t)$ is per capita consumption at time t, $T_p(t)$ is the lump-sum transfer payment to the household, taken as given, $r_2(t)$ is the return to government bonds, ρ is a constant subjective rate of time preference, σ is the inverse of the constant inter-temporal elasticity of substitution, L_0 is the initial labor supply and n is the constant growth rate of labor supply. The assets accumulated by the household are private physical capital $K(t)$ and government bonds $B(t)$. The term τ is the income tax rate.

The per capita budget constraint of the government is given by

$$\dot{B} = r_2 B + C_p + T_p + I_p - T - nB. \qquad (1)$$

The tax revenue (T) is given by

$$T = \tau(w + r_1 K + r_2 B). \qquad (2)$$

The sustainability of public debt requires that the government cannot play a Ponzi game. Thus, the following transversality condition must hold

$$\lim_{t\to\infty} B(t) e^{-\int_0^t (r_2(s)-n)ds} = 0. \qquad (3)$$

Budgetary regimes are formulated in the economic literature either in terms of instruments, or in terms of target variables. Van Ewijk and van de Klundert (1993) consider the following three regimes, which are named according to the authors who have first introduced them:

1. Blinder and Solow (1973) $C_p + T_p + I_p - T = const.$,

2. Domar (1957) $C_p + T_p + I_p - T + r_2 B = const.$,

3. Barro (1979) $C_p + T_p + I_p - T = g \cdot B$,

where: g is the rate of economic growth.

Observing that the three budgetary regimes considered by van Ewijk and van de Klundert (1993) are not suitable for endogenous growth models, Greiner, Semmler, and Gong (2004) define four alternative regimes, and assess the impact of fiscal policy.

The public consumption and transfer payments to the household are supposed to constitute a certain part of tax revenue:

$$C_p = \varphi_2 T \text{ and } T_p = \varphi_1 T,\ \varphi_1, \varphi_2 < 1.$$

The sum of the consumption expenditure and of the transfer payments is entirely covered by the tax revenue. On the other hand, the debt service can be financed either by the tax revenue, or by issuing new bonds. More specifically,

$$C_p + T_p + \varphi_4 r_2 B = \varphi_0 T,$$

where: $\varphi_0 < 1$ depends on the budgetary regime under consideration.

The per capita government expenditure for public (gross) investment is defined as

$$I_p = \varphi_3 (1 - \varphi_0) T,\ \varphi_3 \geq 0.$$

The per capita public capital stock evolves according to:

$$\dot{G} = \varphi_3 (1 - \varphi_0) T - (\delta_G + n) G,$$

where: δ_G is the depreciation rate of public capital.

The four budgetary regimes are determined by the source of the deficit.

The budgetary regime F1 is defined by $\varphi_1 + \varphi_2 < 1$, $\varphi_4 = 1$ and $\varphi_3 > 1$. Namely, the government decides to use borrowed funds from the capital market for infrastructure investment. In the budgetary regime F2, the government can also finance a small part of the debt service by issuing new bonds. Formally, the F2 regime is defined by $\varphi_1 + \varphi_2 < 1$, $\varphi_4 < 1$ and $\varphi_3 > 1$.

In the F3 and F4 regimes, the debt service is financed entirely by issuing new bonds. That is $\varphi_1 + \varphi_2 < 1$, and $\varphi_4 = 0$. The difference between the two regimes is that in the F3 regime the new public debt is used only to finance the debt service $(\varphi_3 < 1)$, while in the F4 regime it can be used to finance also a fraction of the public investment $(\varphi_3 > 1)$.

The four budgetary regimes are summarized in Table 1.

Table 1

Budgetary Regimes

Regime	*Target*	*Deficit due to*
F1	$C_p + T_p + r_2 B < T$	Public investment
F2	$C_p + T_p + \varphi_4 r_2 B < T$	Public investment plus a fraction of debt service
F3	$C_p + T_p + I_p < T$	Debt service
F4	$C_p + T_p + I_p > T, C_p + T_p < T$	Debt service and a fraction of public investment

Greiner, Semmler, and Gong (2004) have found that in the F4 budgetary regime, for reasonable parameter values, sustained per capita growth is not feasible. Consequently, we will focus our analysis only on the first three regimes.

3. Balanced Growth Path (BGP) and the reduced model

In order to simplify the problem, following Mino (1996), we define total assets of the household as

$$S = K + B.$$

The household's budgetary constraint can be rewritten as

$$\dot{S} = -C - (\delta_K + n)K - nB + (w + r_1 K + r_2 B)(1-\tau) + T_p.$$

Denoting by γ_1 and γ_2 the dual variable and the Langrange multiplier of the system, respectively, the current value Hamiltonian function is:

$$H(\cdot) = L_0 u(C) + \gamma_1((w + r_1 K + r_2 B)(1-\tau) + T_p - C - nB - (\delta_K + n)K) + \gamma_2(S - K - B)$$

The first-order conditions for an interior solution of problem (P) are given by

$$L_0 C^{-\sigma} = \gamma_1; \tag{4a}$$

$$\gamma_2 = \gamma_1((1-\tau)r_1 - (n + \delta_K)); \tag{4b}$$

$$\gamma_2 = \gamma_1((1-\tau)r_2 - n); \tag{4c}$$

$$\dot{\gamma}_1 = (\rho - n)\gamma_1 - \gamma_2 \tag{4d}$$

plus the usual transversality condition:

$$\lim_{t\to\infty} e^{-(\rho-n)t}\gamma_1 S = 0. \tag{4e}$$

Combining (4b) and (4c) yields

$$\frac{\gamma_2}{\gamma_1} = (1-\tau)r_1 - (n+\delta_K) = ((1-\tau)r_2 - n) \ ,$$

taking into account the no-arbitrage condition between holding physical capital and government bonds:

$$r_2 = r_1 - \delta_K / (1-\tau) \, .$$

Solving the optimization problem of the household, taking into account the marginal productivity rules and the budgetary regimes, the dynamics of the model are described by the following system of differential equations:

$$\gamma_K \equiv \frac{\dot{K}}{K} = -\frac{C}{K} - (\delta_K + n) + K^{\beta-1}G^{\alpha}$$
$$- \tau(\varphi_2 + \varphi_3(1-\varphi_0)) \times \left(K^{\beta-1}G^{\alpha} + \frac{B}{K}\left(\beta K^{\beta-1}G^{\alpha} - \frac{\delta_K}{1-\tau} \right) \right) .$$

$$\gamma_B \equiv \frac{\dot{B}}{B} = (\varphi_0 - 1)(1-\varphi_3)\,\tau \left(\beta K^{\beta-1}G^{\alpha} - \frac{\delta_K}{1-\tau} + \frac{K^{\beta}G^{\alpha}}{B} \right) - n$$
$$+ (1-\varphi_4)\left(\beta K^{\beta-1}G^{\alpha} - \frac{\delta_K}{1-\tau} \right) .$$

$$\gamma_C \equiv \frac{\dot{C}}{C} = -\frac{\rho + \delta_K}{\sigma} + \frac{(1-\tau)\,\beta K^{\beta-1}G^{\alpha}}{\sigma} \, .$$

$$\gamma_G \equiv \frac{\dot{G}}{G} = \varphi_3(1-\varphi_0)\,\tau \left(G^{\alpha-1}K^{\beta} + \beta K^{\beta-1}G^{\alpha}\frac{B}{G} - \frac{B}{G}\frac{\delta_K}{1-\tau} \right) - \delta_G - n \, .$$

A balanced growth path (BGP) is defined as a set of functions of time $\{K(t), B(t), G(t), C(t)\}$ that solve the optimal control problem (P), such as that K, B, G, and C grow at a constant rate.

In order to analyze the BGP, we introduce three new variables

$$c \equiv \frac{C}{K} \, , \; b \equiv \frac{B}{K} \text{ and } x \equiv \frac{G}{K} \, . \tag{5}$$

The reduced dynamic system is given by the equations (6)-(8)

$$\gamma_c \equiv \frac{\dot{c}}{c} = -\frac{\rho+\delta_K}{\sigma} + \frac{(1-\tau)\beta G^{\alpha}}{\sigma K^{1-\beta}} + \frac{C}{K} + (\delta_K + n) - \frac{G^{\alpha}}{K^{1-\beta}} +$$
$$\tau(\varphi_2 + \varphi_3(1-\varphi_0)) \cdot \left(\beta\frac{G^{\alpha}}{K^{1-\beta}} + \frac{B}{K}\left(\beta\frac{G^{\alpha}}{K^{1-\beta}} - \frac{\delta_K}{1-\tau} \right) \right) \tag{6}$$

$$\gamma_b \equiv \frac{\dot{b}}{b} = (\varphi_0 - 1)(1-\varphi_3)\tau\left(\beta\frac{G^\alpha}{K^{1-\beta}} - \frac{\delta_K}{1-\tau} + \frac{K^\beta G^\alpha}{B}\right)$$
$$+(1-\varphi_4)\left(\beta\frac{G^\alpha}{K^{1-\beta}} - \frac{\delta_K}{1-\tau}\right) + \frac{C}{K} + \delta_K - \frac{G^\alpha}{K^{1-\beta}} \tag{7}$$
$$+\tau(\varphi_2 + \varphi_3(1-\varphi_0))\cdot\left(\beta\frac{G^\alpha}{K^{1-\beta}} + \frac{B}{K}\left(\beta\frac{G^\alpha}{K^{1-\beta}} - \frac{\delta_K}{1-\tau}\right)\right)$$

$$\gamma_x \equiv \frac{\dot{x}}{x} = \varphi_3(1-\varphi_0)\tau\left(\frac{K^\beta}{G^{1-\alpha}} + \beta\frac{G^\alpha}{K^{1-\beta}}\frac{B}{G} - \frac{B}{G}\frac{\delta_K}{1-\tau}\right) - \delta_G + \frac{C}{K} + \delta_K - \frac{G^\alpha}{K^{1-\beta}} +$$
$$+\tau(\varphi_2 + \varphi_3(1-\varphi_0))\cdot\left(\beta\frac{G^\alpha}{K^{1-\beta}} + \frac{B}{K}\left(\beta\frac{G^\alpha}{K^{1-\beta}} - \frac{\delta_K}{1-\tau}\right)\right) \tag{8}$$

We will restrict the analysis to the case $\alpha + \beta = 1$, in which the reduced system is autonomous in c, b and x. The local dynamics can be analyzed using the eigenvalues of the Jacobian matrix of the system. However, this matrix is very complicated, so that the analytical approach to solve the stability properties of the general model does not seem feasible.

The balanced growth rate depends on the steady state value of the auxiliary variable x^*:

$$\gamma_Y^* = \gamma_K^* = \gamma_B^* = \gamma_C^* = -\frac{\rho + \delta_K}{\sigma} + \frac{(1-\tau)\,\beta\left(x^*\right)^\alpha}{\sigma}.$$

As far as the fiscal policy is concerned, φ_1, φ_2, φ_3, and φ_4 are exogenous parameters defining the budgetary regimes, while φ_0 is an endogenous parameter, determined from the constraint $C_p + T_p + \varphi_4 r_2 B = \varphi_0 B$.

4. Model calibration

In this section, we present the methodology employed for the calibration of the parameters to the Romanian economy.

There are three categories of parameters which need to be calibrated:

1. fundamental parameters describing households preferences: σ and ρ;
2. parameters describing the structure and the potential of the productive sector: α, β, A, δ_K, δ_G, and n; we consider the case $\alpha + \beta = 1$;
3. parameters modeling the fiscal regime: τ, φ_1, φ_2, φ_3, and φ_4.

The parameter modeling the time preferences of the households was selected according to similar studies, such as Greiner (2007), Greiner, Semmler and Gong (2004), as well as Greiner and Semmler (2000): $\rho = 0.01$.

Motivated by the recent demographic developments, we set the population rate of growth equal to zero. The depreciation rates of capital are set to $\delta_K = 7\%$ per annum for private capital, and to $\delta_G = 5\%$ per annum for public capital. The technology parameter A is set to 0.2.

Taking into account the average share of consumption and transfer expenditures in total budgetary revenues for the period 2000-2005 in Romania, we set $\varphi_1 = 0.3$ and $\varphi_2 = 0.35$. The model was calibrated for the budgetary regime F1, characterized by the fact that consumption, transfer and debt service expenditures are completely financed by the tax revenues. We consider that around 66% of the public investment expenditures are financed by tax revenues, 34% being covered by the issuance of new bonds, that is $\varphi_3 = 1.5$ and $\varphi_4 = 1$.

The output elasticity in respect to public capital, α, the parameter σ of the utility function, and the tax rate τ were calibrated to minimize a squared error function penalizing the deviations of the simulated GDP from the actual GDP. The minimization was performed for the period 2000:Q1-2005:Q4. The actual GDP values were seasonally adjusted. The data for real GDP are from the National Institute of Statistics. The calibration of the policy parameter τ is necessary because, although the model supposes a flat tax rate, over the period 2000-2005 the Romanian fiscal code was characterized by progressive taxation.

The minimum of the squared error function is obtained for $\alpha = 0.3$, $\sigma = 1.95$ and $\tau = 0.2$.

In order to solve the model, it is necessary to determine the value of x_0, the initial public to private capital ratio. The value of x_0 is obtained as the economically meaningful solution of the equation

$$\frac{Y}{K+G} = \frac{x_0^{\alpha}}{1+x_0},$$

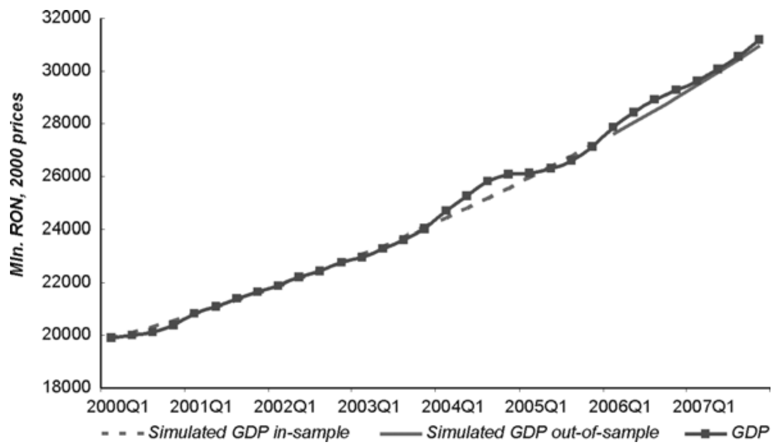
where, for the calibration period, the GDP to total capital ratio is around 0.5. Using the calibrated value for α, we obtain $x_0 = 0.059$.

The in-sample (2000:Q1-2005:Q4) and out-of-sample (2006:Q1-2007:Q4) simulated and actual GDP values are presented in Figure 1.

It is important to underline that the values obtained for the model parameters in the calibration process are in line with similar studies, both for Romania (Albu, 2006; Dobrescu, 2006; Caraiani, 2008; Altăr *et al.*, 2008) and for other economies (Greiner, and Semmler, 2000; Greiner, Semmler, and Gong, 2004). Figure 1 indicates that the calibrated model provides a good approximation for the evolution of the Romanian economy for the period 2000:Q1-2007:Q4.

Figure 1

Simulated and actual GDP



5. Simulation results

In this section, we use the calibrated model to obtain the growth rate on the balanced growth path, as well as the transitional dynamics for the Romanian economy. The analysis is focused on the evolution of real GDP, of public debt, and on the sustainability of public finance in Romania.

For every budgetary regime, the simulation process was conducted according to the following steps:

1. determining the $\dot{b}=0$, $\dot{c}=0$, and $\dot{x}=0$ loci;
2. computing the steady state values for b, c and x, as well as of the growth rate on the balanced growth path;
3. obtaining the stable arm of the saddle path by numerically solving the system of differential equations obtained by applying the time elimination method to equations (6)-(8); the stable arm consists of the functions $\tilde{b}(x)$ and $\tilde{c}(x)$, characterized by $\tilde{b}(x^*)=b^*$, and $\tilde{c}(x^*)=c^*$.
4. obtaining consistent initial values for the variables b, c, and x; since the system exhibits saddle path dynamics, there is a unique combination of initial values (b_0, c_0, x_0) ensuring convergence to the balanced growth path: $b_0=\tilde{b}(x_0)$, $c_0=\tilde{c}(x_0)$, where x_0 was calibrated in the previous section.
5. solving numerically the system (6)-(8) with initial conditions from the previous step and obtaining b, c, and x as functions of time;
6. forecasting the evolution of the real GDP, and of the public to private capital ratio.

The long-run growth rate in the case of budgetary regime F1, for different values of the tax rate, is presented in Table 2.

Table 2

Long-run growth rate in the F1 budgetary regime

Tax rate (%)	Growth rate (%)
14	5.91
16	6.03
18	**6.12**
20	6.02
22	5.83
24	5.72

As one may observe in Table 2, the optimal tax rate (i.e. the tax rate that maximizes the long-run growth rate) is 18%. The real GDP path in the case of F1 budgetary regime with tax rate 18% is presented in Table 3.

Table 3

Forecasted Romanian real GDP in the case of budgetary regime F1

Year	GDP (mill. RON, prices 2000)	Growth rate (%)
2008	128761.9	5.94
2009	136425.1	5.95
2010	144567.2	5.97
2011	153220.1	5.99
2012	162417.4	6.00
2013	172194.6	6.02
2014	182589.1	6.04
2015	193640.6	6.05
2016	205391.4	6.07
2017	217885.9	6.08
2018	231171.6	6.10
2019	245298.6	6.11
2020	260320.3	6.12

The evolution of the public to private capital ratio is displayed in Figure 2. The long-run value of this ratio is 13.52%.

The budgetary regime F2 allows the analysis of the GDP evolution if a fraction of the debt service is financed by issuing new bonds. Table 4 presents the long-run growth rate in the F2 budgetary regime, depending on the tax rate and on the fraction of the debt service financed by tax revenues, φ_4.

Figure 2

Simulated public to private capital ratio

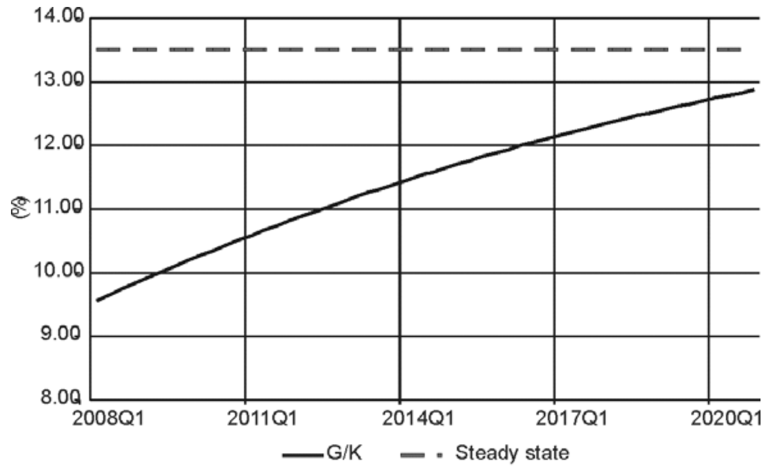


Table 4

Long-run growth rate in the F2 budgetary regime

φ_4	***Tax rate* (%)**		
	16%	18%	20%
0.99	6.02	**6.11**	6.00
0.98	6.00	**6.09**	5.98
0.97	5.96	**6.06**	5.94
0.96	5.90	**6.02**	5.89
0.95	5.83	**5.97**	5.85

The simulations performed under the F2 budgetary regime show that there is an inverse relation between the fraction of debt service financed by issuing new bonds and the long-run growth rate. Increasing the fraction of debt service financed by public debt with one percentage point leads to an average decrease in the long-run growth rate with 0.03 percentage points. The long-run growth rate under the F3 budgetary regime, for different values of the tax rate, is presented in Table 5.

Table 5

Long-run growth rate in the F3 budgetary regime

***Tax rate* (%)**	***Growth rate* (%)**
14	6.11
16	6.34
18	**6.58**
20	6.23
22	6.08
24	5.87

The results obtained indicate that the optimal tax rate is the same for all of the three budgetary regimes. Since the budgetary regime F3 is less restrictive, the long-run growth rate obtained in this case is larger than those obtained for the regimes F1 and F2.

Table 6

Forecasted Romanian real GDP

	F1		***F2*** ($\phi_4 = 0{,}98$)		***F3***	
Year	***GDP***	***Growth rate***	***GDP***	***Growth rate***	***GDP***	***Growth rate***
2008	128761.9	5.94	128438.8	5.91	134122.2	6.38
2009	136425.1	5.95	136045.4	5.92	142699.9	6.40
2010	144567.2	5.97	144125.3	5.94	151848.5	6.41
2011	153220.1	5.99	152709.6	5.96	161610	6.43
2012	162417.4	6.00	161831.2	5.97	172028.5	6.45
2013	172194.6	6.02	171525.1	5.99	183150.8	6.47
2014	182589.1	6.04	181827.9	6.01	195026.2	6.48
2015	193640.6	6.05	192778.7	6.02	207707.3	6.50
2016	205391.4	6.07	204418.7	6.04	221249.8	6.52
2017	217885.9	6.08	216791.7	6.05	235712.9	6.54
2018	231171.6	6.10	229944	6.07	251159.9	6.55
2019	245298.6	6.11	243924.8	6.08	267658.2	6.57
2020	260320.3	6.12	258786.5	6.09	285279.3	6.58

The simulations performed for the period 2008-2020 using the calibrated model show that, in the long run, the real GDP annual growth rate is about 6%, which is consistent with the results of similar studies using other methods (Caraiani, 2008; Păuna, Ghizdeanu, Scutaru *et al*., 2008; Altăr *et al.*, 2008). The annual growth rate is important in determining the number of years required to achieve the convergence with the EU-15 countries. According to Iancu (2007b), for average annual growth rates of 6% for the Romanian economy and 1.8% for the EU-15 economies, Romania will achieve convergence in around 25 years.

6. Concluding remarks

This study employs Greiner, Semmler, and Gong (2004) endogenous growth model in a closed economy with three sectors, in order to emphasize the role of public finances in economic growth in the case of the Romanian economy, by analyzing the impact of three budgetary regimes on the balanced growth path.

The model is calibrated by minimizing the distance between the simulated and the actual path of the real GDP. The calibrated model provides a good approximation for the evolution of the Romanian economy both in-sample (2000:Q1-2005:Q4) and out-of-sample (2006:Q1 2007:Q4).

The simulations performed for the period 2008-2020 using the calibrated model show that in the long run the real GDP annual growth rate ranges between 6% and 6.58%, depending on the budgetary regime adopted by the government, which is consistent with the results of similar studies using other methods (Caraiani, 2008; Pauna, Ghizdeanu, Scutaru *et al.*, 2008; Altăr *et al.*, 2008). The results also indicate that in the long run the ratio of the public to private capital is around 14%.

Given the importance of the sustainable development process, further research should also be concerned with the impact on the Romanian economy of other growth determinants, such as R&D incentives, and non-renewable resources.

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