Spending and Growth: A Modified Debt to GDP Dynamic Model

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Abstract

The paper addresses a topical issue – how expansionary fiscal policy affects the debt to GDP ratio. It examines whether the projected future economic growth (stimulated by government spending) is sustained with the resulting national debt. It is discussedif government investment in infrastructure is an effective approach to boost the economy in times of economic downturn. The authors develop the debt to GDP ratio dynamics model and perform a series of simulations (based on US data) to forecast the evolution of the debt to GDP ratio over a 10-year horizon. It is shown that for the data characterizing the current state of the U.S. economy the government investment in infrastructure cannot decrease the debt to GDP ratio.

Keywords: debt dynamics, debt to GDP ratio dynamics, investment in infrastructure, stimulus

JEL Classification: C20, C60, O40

1. Introduction

The 2008 global financial crisis has resulted in large deficits and public debt burdens across many countries. According to IMF (2009) estimates, the level of public debt for advanced countries would reach over 100 percent of GDP by 2014, a level unseen since World War II. The United States has a huge national debt (about 16.1 trillion dollars in 2012) and it has surpassed 100% of gross domestic product. The European Union average debt was about 85% of GDP in 2012. That is why Germany and the majority of EU countries have undertaken austerity measures. Nevertheless, even as constraints on spending and borrowing have grown, many governments have been emphasizing the importance of infrastructure in assisting economic growth. A number of countries have explicitly recognized this as part of their stimulus packages. The $840 billion stimulus package enacted by the U.S. Congress contained $105 billion for infrastructure, which is significantly less than $2.5 trillion worth of stimulus launched by the Chinese government, most of which went to special purpose

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vehicles to build rail, bridges, airports, condo buildings, etc. Many economists consider the over-investment undertaken in China as an attempt to avert an economic slowdown.

The two camps of economists have different views concerning how to improve the economy in times of economic downturn. In contrast to those who consider government spending on infrastructure as an efficient strategy and support the approach based on additional government borrowing with a hope that this will help decrease the debt in the future, another group of economists, concerned with high government debt which, as they believe, can inevitably undermine economic growth, supports austerity measures.

The debt to GDP ratio is widely used to measure the impact of debt on the economy. It was introduced similar to the bank debt ratio – total debt as a percentage of income – determining the level at which businesses can afford to owe. There exists justifiable criticism of the debt to GDP ratio as the insufficiently informative and most overused economic index. The mentioned ratio as if ignores such important parameters as the interest rates associated with the debt and when the debt matures. Some economists state that the debt to GDP is a very poor measure of the health of a nation or its economy; the best measures are real GDP per capita, real GDP growth rates, unemployment rate, and inflation rate. Nevertheless, many economists and leading economic organizations use GDP and debt to GDP to evaluate the health of the country's economy, its ability to handle the increasing debt load and to predict the future economic environment. The European Union requires that member state's public debt not exceed 60 percent of GDP.

The literature on the relationship between government debt and economic growth is scarce. According to Reinhart and Rogoff (2009), debt to GDP ratios below a threshold of 90 percent of GDP ratios have no significant impact on growth; above the threshold of 90%, median growth rates fall by 1%, and average growth falls considerably more. Recently, Herndon et al. (2013) found an error in calculation of the threshold; they indicate that the average real GDP growth rate for countries carrying a debt to GDP ratio of over 90 % is actually 2.2 percent, and the relationship between public debt and GDP growth varied significantly by time period and country. Despite the mentioned error, the obtained results of Reinhart and Rogoff (2010) are qualitatively correct. However, the findings of both Herndon et al. (2013) and Reinhart and Rogoff (2010) are suggestive, rather than conclusive, since they operate with past data. It is dangerous to build future financial policy by using blindly such findings since pictures of the world economy are changing with time, and statistics of the past may not apply to a current or future economic situation in a country. More reliable mathematical models should be developed.

Paul Krugman questioned the validity of the above finding related to the linkage between government debt and economic growth (Krugman, 2012). He criticized the conclusion that stepping over the 90% "border" of the debt to GDP ratio is harmful for growth and believes that increasing government debt can increase growth, if the money is invested well, which he links to infrastructure spending (Krugman, 2012). Although the impact of government spending programs in the past that were intended to increase economic growth by using infrastructure-focused stimulus packages was very modest and did not restore economic activity, Krugman (2012) states that "fiscal expansion will be even better for America's future if a large part of the expansion takes the form of public investment – of building roads, repairing bridges and developing new technologies, all of which makes the nation richer in the long run". For him big government spending is a solution of problems of high unemployment and low GDP growth: "But the essential point is that what we really need to get out of this current depression is another burst of government spending".

Krugman believes that it is the debt to GDP ratio that matters and not the debt itself. In Krugman (2009) he wrote: "How, then, did America pay down its debt? Actually, it didn't... But the economy grew, so the ratio of debt to GDP fell, and everything worked out fiscally... Which brings me to a question a number of people have raised: maybe we can pay the interest, but what about repaying the principal? ...But why would we have to do that? Again, the lesson of the 1950s - or, if you like, the lesson of Belgium and Italy, which brought their debt-GDP ratios down from early 90s levels - is that you need to stabilize debt, not pay it off; economic growth will do the rest". Being a supporter of Keynesian economic doctrine, he believes that it is governments' role to create jobs – more teachers, construction workers for public works projects, etc.,– when the private sector cannot, and that such a strategy results in economic growth, so the ratio of debt to GDP should fall, and everything should work out fiscally.

Research results related to the debt to GDP ratio were based mostly on analysis of the existing statistical economic data. Different conclusions and following disputes reflect different interpretation by economists of the available statistical material. Using regression models and/or the existing historic data most of the above mentioned publications examined the impact of government spending to stimulate the economy on GDP or analyzed the influence of the debt to GDP ratio on economic growth. However, they did not establish the direct relationship between GDP, the related government spending and the debt to GDP ratio.

This paper considers a model describing the debt to GDP ratio dynamics and examines the linkage between the GDP growth rate, the related government spending (its effect is presented by related fiscal multipliers) and the debt to GDP ratio. Based on the developed model giving the lower estimate of the debt to GDP ratio, the impact of expansionary fiscal policy intended to reduce unemployment and increase economic growth by using infrastructure-focused stimulus packages is analyzed.

The paper is organized as follows. Section 2 discusses the developed debt to GDP ratio dynamics model, its specifics – the ability to obtain the lower estimate of the debt to GDP ratio. Section 3 describes the simulation results grounded upon the developed theoretical model. In Section 4, some conclusions are drawn.

2. Debt to GDP ratio dynamics

The debt dynamics can be described by the following equation

$$D_{t+1} - D_t = rD_t + G_{t+1} - T_{t+1} \tag{1}$$

where D is general government debt; r is the interest rate on debt; G and T are government purchases (expenditure excluding interest payments on the debt) and revenues, respectively; the lower index indicates discrete time - years.

Government revenues are presented in the form

$$T_t = \tau Y_t \tag{2}$$

where τ is a tax rate and the Cobb-Douglas function Y_t represents GDP (in many models the Cobb-Douglas function is used as the estimation and forecasting of GDP from the supply side)

$$Y_t = AK_t^{\alpha} L_t^{\beta} \tag{3}$$

where A is a measure of technology, α and β are the output elasticities of capital K and lab or L, respectively.

The Cobb-Douglas functional form of production functions and its modifications are widely used to represent the relationship of an output to inputs in macro- and microeconomic models (see, e.g., Glomm and Ravikumar, 1997; Yanushevsky, 1992).

Various economic models, starting from the Solow growth model (see, e.g., Romer, 2006), used the Cobb-Douglas function to examine long-run growth analytically and determine the economy's balanced-growth path. If initially capital was represented by one parameter, later in some models private and public capital were considered separately (see, e.g., Aschauer's, 1989; Cassou and Lansing, 1998; Glomm and Ravikumar, 1994; 1997; Lynde and Richmond, 1993; Munnell, 1990). Economists began to study the influence of government spending on consumption-savings decisions in models which allow the possibility of persistent growth; long-run growth models with productive government spending combine several goods and services, such as roads and highways, sewer systems, harbors, public sector R&D, together into one category called public capital. Government spending is maintained by taxes and government borrowing. To obtain visible analytical results the mentioned models contain unrealistic assumptions, such as that the government's budget is balanced and tax revenues are used only to finance public investment in infrastructure (see, Glomm and Ravikumar, 1997).

In contrast to the above mentioned long-run dynamic models operating with private and public capital, the model developed below belongs to the so-called short-run models. It analyzes the situation when a certain government policy focuses to move the economy on a more productive stage. Usually, such a situation is characterized by the unbalanced government budget, significant debt and unemployment. As indicated earlier, this situation is currently in the U.S. and some European countries. Since the opinion of economists, mostly only supported by chosen historic examples, diverges whether government spending focused on infrastructure can improve the economic situation, the developed debt to GDP ratio dynamics model focuses to resolve this problem rigorously.

The debt to GDP ratio d_t dynamics can be presented as

$$d_{t+1} - d_t = \frac{D_{t+1}}{Y_{t+1}} - \frac{D_t}{Y_t} = \frac{D_t + rD_t + G_{t+1} - T_{t+1}}{Y_t(1+g)} - \frac{D_t}{Y_t} = \frac{r-g}{1+g} d_t + \frac{G_{t+1} - T_{t+1}}{Y_{t+1}} \tag{4}$$

where

$$Y_{t+1} - Y_t = A\left(K_t^{\alpha} + \alpha K_t^{\alpha-1} \dot{K}_t\right)(L_t^{\beta} + \beta L_t^{\beta-1} \dot{L}_t) - AK_t^{\alpha} L_t^{\beta}$$

$$= (\alpha \frac{\dot{K}_t}{K_t} + \beta \frac{\dot{L}_t}{L_t} + O(\varepsilon))\, Y_t = g\, Y_t \tag{5}$$

$$g \approx \alpha \frac{\dot{K}_t}{K_t} + \beta \frac{\dot{L}_t}{L_t} \tag{6}$$

g is a GDP growth rate (we neglect O(ε) = $\alpha\beta \dot{K}_t \dot{L}_t / (K_t L_t)$, which has higher order of smallness than other terms of (5)).

Practical application of (4) requires knowledge of G_{t+1} and Y_{t+1}. However, these parameters are interconnected. In reality, we deal with a system of equations since Y_{t+1} depends on $\dot{K}_t$ and $\dot{L}_t$ (see (5) and (6)) and (4) should be supplemented with equations describing dynamics of capital K and labor L. Analysis of such a system presents substantial difficulties, especially when it is necessary to predict future values of the debt to GDP ratio. Below we use (4) to build the model that allows us to obtain the analytical solution of the lower estimate of d_t.

Let for $t = t_0$, $g = g_0 < r$, and $G_t = l_0 T_t$, $l_0 > 1$ (l_0 characterizes the ratio between government expenditure excluding interest payments on the debt and its revenues, so that $l_0 > 1$ assumes the revenues to be less than the expenditures).

As indicated above, one of the approaches to stimulate GDP growth and employment is the use of additional government spending ΔG_t to resuscitate the economy by investing in infrastructure – repair and build roads, bridges, etc. It is assumed that with the increasing number of working people the consumption will rise and this will stimulate economic growth. This approach was tested in a case of economic recessions – significant decline in the economic activity and high unemployment – and is recommended by many economists as the necessary cure for the economic slump. The multiple effect of infrastructure spending will be presented by the multiplier $l_1 > 1$.

A classic question in macroeconomics about the size of the government spending multiplier was extensively discussed in economics literature (e.g., Auerbach and Gorodnichenko, 2010; Blanchard and Perotti, 2002; Christiano et al., 2011; Leeper et al., 2010; Ramey, 2011). Numerical estimates of the value of the fiscal multiplier vary significantly across model classes. Within each class of models, they vary a lot with the economic and policy environment. Using traditional macroeconomic models Christiano et al. (2011) under rather rigorous assumptions show that the multiplier varies enormously depending on how monetary policy reacts to the economy. They found the long-run effect to be positive and the multiplier can be as high as about 4. However, in most of the related publications the multiplier's peak value does not exceed 2.5. The results of some researchers differ significantly since the theoretical models used to examine the impact of government spending on GDP contain many interconnected parameters which cannot be determined precisely. Some results based on econometric models (e.g., Auerbach and Gorodnichenko, 2010; Blanchard and Perotti, 2002; Ramey, 2011) cannot be reproduced in the Neo-Keynesian models. Auerbach and Gorodnichenko (2010) found that in recessions the long-run multiplier's effect is as high as 2.5 but as low as –1 in expansions.

Although the mentioned publications analyze the multiplier's dynamics, usually in practice, in simulation models, the multiplier is presented as a constant parameter. Since additional government spending contributes to the national debt, it is of importance to determine whether the projected future economic growth (in accordance with a chosen multiplier) is sustained with the resulting national debt.

The model analyzed below corresponds to the case of declining economic activity, substantial debt and high unemployment. It is assumed that at $t = t_0,\ \dot{L}_{t_0} = 0$ and for $t > t_0$, when the government stimulus package focuses infrastructure, the GDP growth the rate $g_1 > g_0$ can be achieved by increasing employment, i.e., in (6) for $t > t_0,\ \dot{L}_t > 0$.

For simplicity, we consider the initial moment $t_0 = 0$, so that $t = 0,1,2,\dots$.

Assuming that the taxes remain unchanged, the additional government spending ΔG_{t+1} at $t \ge t_0$ to increase Y_t and make it growing with the rate $g_1 > g_0$, i.e.,

$$Y_{t+1} = (1 + \mathrm{g}_1)Y_t \ , \tag{7}$$

should be

$$\Delta G_{t+1} = l_1^{-1}[(\mathrm{g}_1 + 1)^{t+1} - (\mathrm{g}_0 + 1)^{t+1}]Y_0 \tag{8}$$

(the above equation follows directly from the definition of the fiscal multiplier).

The assumption that the rate change is implemented immediately, i.e., the government spending takes effect without delay, which usually contradicts reality (inevitable delays may produce even opposite effect) will allow us to consider the obtained debt to GDP ratio estimate as optimistic. In addition, we assume that the basic government spending $G_t = l_0 T_t = l_0 \tau Y_t$ is not only frozen at $t = t_0$ (as a percent of GDP; see (2)) but for $t > t_0$ it will decrease by $\Delta G_{1,t+1}$ due to the increase in employment

$$\Delta G_{1,t+1} = l_2 (e^{\frac{\mathrm{g}_1 - \mathrm{g}_0}{\beta}(t+1)} - 1) G_0 \tag{9}$$

where l_2 characterizes the percent of welfare related spending at $t = t_0$; the exponential term reflects the step g-rate change in (6), and to simplify the model we ignore the influence of the capital component in (6) and operate with the increased rate of employment $(\mathrm{g}_1 - \mathrm{g}_0)\,\beta^{-1}$ (this simplification, as well as mentioned earlier, gives an optimistic estimate of the debt to GDP ratio; in (6) L and K are continuous variables).

Based on (7)-(9), the model describing the debt to ratio dynamics under the government strategy to decrease unemployment ($\dot{L} > 0$) and boost the economy (increase the growth rate from g_0 to g_1) by investing in infrastructure has the form

$$d_{t+1} = \left(1 + \frac{r - g_1}{1 + g_1}\right) d_t +$$

$$+ \frac{G_0 - l_2(e^{\frac{g_1 - g_0}{\beta}(t+1)} - 1)G_0 + l_1^{-1}[(g_1 + 1)^{t+1} - (g_0 + 1)^{t+1}]Y_0}{(1 + g_1)^{t+1} Y_0} - \tau$$

$$t = 0,1,2,\ldots \tag{10}$$

or since (see (7) and (9)) $G_0 = l_0 T_0 = l_0 \tau Y_0 = l_3 Y_0$, where $l_3 = l_0 \tau$, the above equation can be transformed to

$$d_{t+1} = \left(1 + \frac{r - g_1}{1 + g_1}\right) d_t + \frac{l_3 - l_2 l_3 (e^{\frac{g_1 - g_0}{\beta}(t+1)} - 1) + l_1^{-1}[(g_1 + 1)^{t+1} - (g_0 + 1)^{t+1}]}{(1 + g_1)^{t+1}} - \tau$$

$$t = 0,1,2,\ldots \tag{11}$$

Since the employment growth rate in the considered model is $(g_1 - g_0)\beta^{-1}$ (see (9)), it is valid only for a finite time interval. Taking into account the population growth, the current and admissible levels of unemployment, as well as reasonable values of g_1 and g_0 it is easy to conclude that the results obtained from the analysis of (11) are valid for the time interval of approximately 10-15 years.

The equation (11) is a recursion formula that specifies a recursive procedure for determining d_{t+1} based on d_t , $t = 0,1,2,\ldots$

Although the solution of (11) is given for a constant tax rate τ , in reality τ depends on time. But in the case of the unchanged government tax policy and absence of sharp economic turns the τ–changes are small. For example, the U.S tax revenues have averaged about 18.3 percent of GDP over 1970-2008. In 2009, it dropped to 15.1 percent and grew slowly to 15.8 percent in 2012. Since we operate with the lower estimate of the debt to GDP ratio, in the below examples τ is chosen to satisfy this requirement.

3. Simulation Results

The below examples are given for several fiscal multipliers examined in the literature (e.g., Auerbach and Gorodnichenko, 2010; Blanchard and Perotti, 2002; Christiano et al., 2011; Leeper et al., 2010; Ramey, 2011).

Table 1 presents the debt to GDP ratio estimate for the 10 years period based on the solution of (11) for the following parameters: $d_0 = 1$; r = 0.0289; $\tau = 0.14$; $\beta = 0.75$; $l_0 = 1.7$; $l_2 = 0.1$ (they are very close to the data characterizing the current state the U.S. economy). The table is built for g_0=0.02, g_1=0.03, and g_0=0.02, g_1=0.04,respectively. The chosen multiplier $l_1 = 1.59$ is recommended by Mark Zandi, chief economist of Moody's Analytics. As seen from Table 1, for the considered multiplier the debt to GDP ratio increasesal most twice in 10 years for g_1=0.03 and g_1=0.04.

Table 1: Simulation results for the considered debt to GDP ratio dynamics model for l_1 = 1.59

year	1	2	3	4	5	6	7	8	9	10
debt/GDP g_1=0.03	1.109	1.190	1.284	1.377	1.47	1.561	1.653	1.744	1.835	1.926
debt/GDP g_1=0.04	1.089	1.181	1.273	1.368	1.464	1.563	1.663	1.765	1.870	1.977

Since this and similarmultiplier's values are not supported by rigorous mathematics and their validity is argued by many economists, in Table 2 we presented the debt to GDP ratio estimate for $l_1 = 3.8$, the value given in Christiano et al. (2011). As seen from Table 1 and Table 2, the lower values of d_t correspond to the multiplier with the higher value.

Table 2: Simulation results for the considered debt to GDP ratio dynamics model for l_1 = 3.8

year	1	2	3	4	5	6	7	8	9	10
debt/GDP g_1=0.03	1.092	1.18	1.263	1.342	1.417	1.488	1.155	1.619	1.68	1.737
debt/GDP g_1=0.04	1.082	1.16	1.232	1.3	1.363	1.422	1.478	1.529	1.578	1.623

Of course, the GDP growth rate g_1 depends not only on the level of government investment in infrastructure. It depends on many factors including tax policies and the state of the world economy. Some economists - advocates of stimulus packages - prefer to ignore these factors and attribute economic growth only to stimulus measures. Taking into account that since the second quarter of 2000 the U.S. GDP rate has never reached the 5 percent level, we consider also the rosy scenario and evaluate the debt to GDP ratio for g_1=0.05 and l_1=3.8. The results presented in Table 3 show that even for this case in 10 years the debt to GDP ratio would increase by more than 50 percent. The reason of inefficiency of the described stimulus policy is a very high (100% of GDP) initial debt and a high level of the federal government spending (24% of GDP).

Table 3: Simulation results for the considered debt to GDP ratio dynamics model for $l_1 = 3.8$

year	1	2	3	4	5	6	7	8	9	10
debt/GDP g_1=0.05	1.073	1.14	1.202	1.259	1.312	1.36	1.405	1.446	1.484	1.52

The above considered model assumes that the government financial policy (excluding investment in infrastructure) remains unchanged, and as it follows from data of Table 1 and Table 2 the debt to GDP ratio increases with time. To analyze the efficiency of the policy combining investment in infrastructure with decreasing other government spending we assume that government spending not related to infrastructure decreases with a rate h, i.e., instead of the term G_0 in (10) we have G_t that is the solution of the equation

$$G_{t+1} = (1-h)^{t+1} G_t \,,\ t = 0,1,2,\ldots \tag{12}$$

so that the modified equations (10) and (11) should have instead of the terms G_0 and l_3 the terms $(1-h)^{t+1} G_0$ and $(1-h)^{t+1} l_3$, respectively.

Table 4 and Table 5 contain the simulation results for this case; h = 0.02 is chosen to get about a 20% decrease in the government spending in 10 years. As expected, the debt to GDP ratio estimate is less than in Table 1 and Table 2. However, the debt to GDP ratio is still above its initial value.

Finally, we consider the situation that at $t > t_0$ the government fiscal policy results in a conditionally balanced budget (revenues equal expenditure, excluding payments on infrastructure spending).

This corresponds to $\left(1+g_1\right)^{-(t+1)} l_3 - \tau = 0$ and r = 0 in (11). The simulation results in Table 6 show that the balanced budget is a proper approach to decrease the debt to GDP ratio, andgovernment spending on infrastructure may lead to a declining debt to GDP ratio when a balanced budget approach is followed at the same time. The data in Table 6 allows us to assume(since the considered model deals with a lower estimate, rather than the real value, of the debt to GDP ratio) that extensive infrastructure spending to increase significantly the GDP rate (in 10 years for g_1=0.04 the lower estimate of d_t equals 0.883) can be less effective, with respect to the debt to GDP ratio, than in the case of a moderate GDP growth (for g_1=0.03 this estimate equals 0.855).

Table 4: Simulation results for the considered debt to GDP ratio dynamics model for l_1 = 1.59

year	1	2	3	4	5	6	7	8	9	10
debt/GDP g_1=0.03	1.091	1.177	1.258	1.335	1.407	1.476	1.542	1.606	1.666	1.725
debt/GDP g_1=0.04	1.085	1.167	1.248	1.327	1.405	1.482	1.56	1.637	1.716	1.795

Table 5: Simulation results for the considered debt to GDP ratio dynamics model for l_1 = 3.8

year	1	2	3	4	5	6	7	8	9	10
debt/GDP g_1=0.03	1.111	1.203	1.277	1.333	1.373	1.396	1.405	1.399	1.379	1.347
debt/GDP g_1=0.04	1.078	1.147	1.206	1.259	1.304	1.342	1.374	1.401	1.423	1.441

Table 6: Simulation results for the considered debt to GDP ratio dynamics model for l_1 = 3.8 and the conditionally balanced budget assumption

year	1	2	3	4	5	6	7	8	9	10
debt/GDP g_1=0.03	0.973	0.949	0.928	0.91	0.895	0.882	0.872	0.864	0.858	0.855
debt/GDP g_1=0.04	0.966	0.937	0.915	0.897	0.884	0.875	0.872	0.872	0.876	0.883

The Cobb-Douglas function (3) is considered for a constant A, i.e., it is assumed that a period of economic downturn is not accompanied with technological innovation that can ignite economic and job growth. For example, at the end of 20th century the Internet and information technology became accelerators of the economy in many countries. In the late 1990s, the U.S. government moved into fiscal surplus and the debt to GDP ratio fell from 66% in 1995 to 56% in 2000. However, it is too risky to spend lavishly on infrastructure with a hope of Internet-type miracles in the future.

The above analysis shows that government investment in infrastructure alone cannot decrease the debt to GDP ratio and boost the economy. It shows that Krugman, as well as some other economists, are wrong in their belief that the ratio of debt to GDP will fall and "everything worked out fiscally". But Krugman is right by saying "increasing government debt can increase growth, if the money is invested well". Public-private partnerships, individual and corporate contributions to infrastructure financing are innovative ways to seek new funding mechanism in order to prevent deficits from rising. To boost the economy, investment should focus on areas which would bring a substantial profit and growth of capital, i.e., $\dot{K} > 0$ in (6). Government stimulus programs related to these areas can increase growth and decrease the debt to GDP ratio. However, usually, the private sector (less bureaucratic and more dynamic than the public one) is more sophisticated and faster than the government in finding and investing in such areas.

As mentioned earlier, the existing publications focus mostly on investigating how efficient investment in infrastructure is and how dangerous high debt to GDP ratios are for economic growth, more precisely, how they influence the GDP growth rate (see also Beyzatlar and Kustepeli, 2011; Ichoku et al., 2012). The above simulation results show that economic growth reached by government investment in infrastructure can increase its debt to such a degree that the debt to GDP ratio becomes dangerously high. The crises in Greece and Ireland show the consequences of high debt to GDP ratios for countries with previously fast growing economies.

4. Conclusion

The developed debt to GDP ratio dynamics model belongs to the so-called short-run models. It analyzes whether government spending focused on infrastructure can improve the economic situation and whether this government fiscal policy is an effective tool in boosting the economy in times of economic downturn. The paper is a useful addition to the debate: is it best to let debt increase in the hope of stimulating economic growth to get out of the slump or is it better to cut spending to get public debt under control? The simulation results based on the developed debt to GDP ratio dynamics model for the data characterizing the current state of the U.S. economy show that government investment in infrastructure alone cannot decrease the debt to GDP ratio. Programs like public-private partnerships, individual and corporate contributions to finance infrastructure projects are potential mechanisms through which public spending on infrastructure can be more efficient. Government spending on infrastructure may lead to a declining debt to GDP ratio when a balanced budget approach is followed at the same time.Only investment in the areas which would bring a substantial profit and growth of capital can increase growth and decrease the debt to GDP ratio. Reforms to encourage private investment are the proper financial policies to restore economic health.

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