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Sustainability of public debt, public capital formation, and endogenous growth in an overlapping generations setting

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Abstract

Under the golden rule of public finance for public investment with a constant budget deficit/GDP ratio, we show that for the sustainability of government budget deficits there is a threshold of the initial public debt for a given stock of public capital, and that this threshold level of public debt is increasing in the stock of public capital. If the initial public debt is greater than the threshold, the government can no longer sustain budget deficits, while if it is smaller, the government can conduct a permanent deficit policy, which eventually leads to a positive public debt/GDP ratio.

JEL classification: E62; H54; H62; O40
Keywords: Endogenous growth; Public capital formation; Sustainability of public debts

1. Introduction

Since the outstanding work by Arrow and Kurz (1970), many authors have investigated the effects of public capital formation on the performance of the economy and the optimal fiscal policy in dynamic general equilibrium models.[1] In an endogenous growth setting, Futagami, Morita and Shibata (1993), among others, analyzed the growth-maximizing public investment size (the public investment/GDP ratio) assuming public capital formation rather than public flow expenditures of Barro (1990) type. In these theoretical contributions, however, they assumed that the government runs a balanced budget at any moment in time. Nonetheless, recently, an intensive debate has arisen regarding the long-term growth effects of public investment financed under various versions of the so-called golden rule of public finance (*e.g.* Greiner and Semmler, 2000; Ghosh and Mourmouras, 2004).[2] The golden rule of public finance is considered the fiscal rule according to which government expenditures for public consumption, transfer payments and interest payments must be smaller than the tax revenue. Under the rule, borrowing is allowed to finance only government investment.

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[1] Empirically, Aschauer (1989) and Iwamoto (1990) among others showed the substantially great growth-enhancing effects of public capital. However, Evans and Karras (1994) and Holtz-Eakin (1994) cast doubts on the empirical results.

[2] Among OECD countries, Japan has more than doubled its government debt/GDP ratio in the 1990s by raising the deficit finance ratio in the budget (0.9% in 1991, 6.6% in 1995 and 8.3% in 1999), and the growth rate declined drastically from the 1970s to the 1990s. The government debt/GDP ratio of Japan was 64.8% in 1991 and became 142.3% in 2001, the highest among OECD countries (OECD, 2004).

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Greiner and Semmler (2000) showed that the long-term growth effects of public capital depend on the exact budgetary regime adopted by the government, and that a less strict budgetary regime may not lead to a positive growth effect of a deficit-financed government investment. By comparing the welfare effects of allowing public borrowing under the standard dynamic government budget constraint and under the golden rule of public finance, Ghosh and Mourmouras (2004) showed that the golden rule of public finance can be an effective restriction on the composition of government expenditure and that a less strict budgetary stance may lead to a lowering of welfare.

Under budget deficit policies, public debt accumulates and in turn affects the government budget. While Greiner and Semmler (2000) and Ghosh and Mourmouras (2004) did not focus their attention on accumulation of public debt, the sustainability of public debt has been examined, for example, by Hamilton and Flavin (1986) and Bohn (1998). Among others, pointing out that the transversality condition tests depend on sensitivity on the choice of discount rates and the cointegration tests generally do not adjust real levels of fiscal variables, Bohn (1998) proposed a new test that requires that primary surplus increases at least linearly with the ratio of debt to GDP at high debt-GDP ratios. In contrast, Chalk (2000) examined the sustainability of government budget deficits in an overlapping generations model of Diamond (1965) type, and showed that the present value budget balance may not be crucial to the sustainability of permanent deficits.

While it is well known that permanent budget deficits can be sustainable when the dynamic resource allocation is dynamically inefficient in an overlapping generations setting (*e.g.* Diamond, 1965; Tirole, 1985), Chalk (2000) also showed that, even when the growth rate is lower than the interest rate and hence the cost of debt finance is high, the government can run the primary deficits, and that the permanent deficits are sustainable only when the initial public debt is not too large. Bräuninger (2005) showed in an overlapping generations model with the AK production structure that under a fiscal rule in which the government purchase/GDP ratio and the budget deficit/GDP ratio are constant, the tax rate therefore being endogenously adjusted, there is a stable steady-growth path as long as the initial debt-capital ratio is lower than a certain level, and that an increase in the deficit rate reduces the growth rate. However, both Chalk (2000) and Bräuninger (2005), as well as most of the literature on public debt sustainability, assumed that government expenditures are public consumption.[3]

Our purpose in this study is to analyze the sustainability of budget deficits, simultaneously taking into account the growth effects of a deficit-financed public investment, in an endogenous growth setting with the growth engine of public capital formation. For our purpose, we use the overlapping generations model pioneered by Diamond (1965), in which public debt can have real effects. We assume that the government not only controls the public investment/GDP ratio but also keeps the deficit finance ratio in public investment at less than one. Thus, the financing rule in this study is the mixture of the golden rule of public finance, as to the borrowing rule, and a deficit rule of keeping the budget deficits at a certain percentage of GDP, while the tax rate must be endogenously adjusted according to the government budget constraint.[4] The public debt/GDP ratio is endogenously determined by the fiscal rule along the growth path.

We illustrate that there can be two long-term equilibria, one locally stable and one saddle-point stable, and that there is a threshold for the initial public debt in order for budget deficits to be sustainable at each level of public capital stock. The threshold of the initial public debt is represented by a point on the stable branch to the saddle-point equilibrium, and is increasing in the stock of public capital, *i.e.* the so-called public assets. If the initial public debt is greater than the threshold at a level of public capital, the government can no longer sustain the fiscal deficit policy. If the initial debt is smaller than the threshold, the economy converges to the stable equilibrium and the government can run the permanent fiscal deficit and public investment policy, which eventually leads to a positive public debt/GDP ratio. We also show that decreases in the public investment/GDP ratio and/or the deficit finance ratio will raise the threshold for a given level of public capital stock, and that the decreased deficit finance ratio leads to higher balanced growth, while an increase in the public investment ratio can have a growth-enhancing effect.

The remainder of the paper is organized as follows. We devote the next section to developing an overlapping generations model of Diamond (1965) type, which incorporates public capital formation. Section 3 analyzes dynamics of the economy and the long-term equilibrium. The effects of policy changes are analyzed in Section 4, while the last section presents concluding remarks.

[3] Greiner (2007) examined the sustainability and the growth effects of public investment in a dynamic model, incorporating the fiscal rule proposed by Bohn (1998) into a representative, infinitely-lived agent model of Futagami et al. (1993) type.

[4] Ghosh and Mourmouras (2004) classified fiscal rules into four types; (i) balanced budget rules, (ii) deficit rules, (iii) borrowing rules, and (iv) debt/reserve rules.