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Progressive taxation and macroeconomic (in)stability with utility-generating government spending

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ABSTRACT

We examine the theoretical interrelations between progressive income taxation and macroeconomic (in)stability in an otherwise standard one-sector real business cycle model with utility-generating government purchases of goods and services. When private and public consumption expenditures are complements in the household utility and the tax schedule is progressive, we analytically show that the economy exhibits indeterminacy and sunspots if and only if the degree of government-spending preference externality is higher than a critical threshold. Unlike traditional Keynesian-type stabilization policies, raising the tax progressivity may destabilize this version of our model by generating endogenous cyclical fluctuations. Moreover, the economy always displays saddle-path stability and equilibrium uniqueness under utility substitutability between private and public consumptions and progressive taxation.

1. Introduction

The relationship between government purchases of goods and services versus agents' private consumption is an important aspect in understanding the demand-side effects of a fiscal policy rule within dynamic general equilibrium macroeconomic models.[2] In particular, whether private and public consumption expenditures enter the household's utility function as Edgeworth complements or substitutes may affect the model's local dynamics. Recent work in this area includes Cazzavillan (1996), Zhang (2000), Raurich (2003), Fernández et al. (2004), Chen (2006), Guo and Harrison (2008), Lloyd-Braga et al. (2008), Hori and Maebayashi (2013), among others. Building upon these existing studies, we consider a prototypical one-sector real business cycle (RBC) model with two prevalent features observed in developed economies: progressive income taxation[3] together with utility-generating public spending, and analytically explore the interrelations between tax progressivity and

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[2] Previous research that studies the supply-side effects of public expenditures in representative-agent models incorporate productive flow of government spending (*e.g.* Barro (1990), Barro and Sala-i-Martin (1992), Glomm and Ravikumar (1997), Turnovsky (1999), Palivos et al. (2003), Slobodyan (2006), Hu et al. (2008), Kamiguchi and Tamai (2011), and Chen and Guo (2013a,b)), or stock of public capital (*e.g.* Futagami et al. (1993), Glomm and Ravikumar (1994), Turnovsky (1997), Baier and Glomm (2001), Greiner (2006, 2007), and Agénor (2011)).

[3] By contrast, Cazzavillan (1996), Zhang (2000), Raurich (2003), Fernández et al. (2004), Chen (2006), Guo and Harrison (2008) all postulate a constant tax rate of income; and Hori and Maebayashi (2013) consider a flat consumption tax. On the other hand, Lloyd-Braga et al. (2008) incorporate progressive consumption taxation into a finance-constrained macroeconomy with heterogeneous agents.

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equilibrium (in)determinacy.[4] Our analysis is valuable not only for its theoretical relevance, but also for its broad implications for the design, evaluation and implementation of tax policies.

In this paper, we systematically study the (de)stabilization effects of Guo and Lansing's (1998) progressive tax formulation in an otherwise standard one-sector RBC model with balanced budget and utility-generating public expenditures. Per the empirical findings of Ni (1995), our model examines a constant-relative-risk-aversion (CRRA) Cobb-Douglas utility specification that postulates government spending as a positive preference externality. As it turns out, the (local) stability properties of the model's unique interior steady state depend crucially on (i) the utility complementarity or substitutability between private and public consumptions, (ii) the slope parameter of the tax schedule that governs its progressivity attribute, and (iii) the degree of government-purchases preference externality.

When government spending is complementary to private consumption in the household utility and the tax policy is progressive, we derive the *necessary and sufficient* condition under which our model exhibits an indeterminate steady state and endogenous cyclical fluctuations driven by animal spirits or sunspots. In particular, the degree of preference externality from public expenditures needs to be higher than a critical value that can be analytically expressed as a function of other structural parameters. Start the economy from its steady state, and consider a slight deviation caused by agents' optimistic anticipation about an expansion in future economic activities. Acting upon this belief, the representative household will reduce consumption and raise investment today. This in turn leads to another dynamic trajectory with higher future output, private consumption, and income tax rate because of progressive taxation. Through the government's balanced-budget constraint, the level of public spending also rises, which will then produce a further increase in future private consumption since private and public consumption expenditures are Edgeworth complements. We show that the after-tax return on investment is monotonically increasing along this alternative transitional path if and only if the government-spending preference externality exceeds the requisite threshold. As a result, agents' initial rosy expectations on the economy's future are validated as a self-fulfilling equilibrium. Moreover, in sharp contrast to previous studies with useless or wasteful government purchases of goods and services,[5] raising the tax progressivity *ceteris paribus* may transform our model's steady state from a saddle point into a sink provided the degree of public-consumption preference externality is sufficiently strong. It follows that unlike traditional Keynesian-type stabilization policies, a more progressive tax schedule may destabilize the economy by generating belief-driven business cycle fluctuations.

When government spending is substitutable with private consumption in the household utility and the tax policy is progressive, we find that the mechanism described in the proceeding formulation that makes for multiple equilibria, *i.e.* an increase of the equilibrium after-tax marginal product of capital in response to higher expenditures of today's investment, will not be realized in that higher public expenditures now lower the marginal utility of private consumption. It follows that our model economy always exhibits saddle-path stability and equilibrium uniqueness in this setting. Finally, the same stability/uniqueness result continues to hold when there is no government-purchases preference externality, regardless of the level of tax progressivity under consideration; or when the income tax rate is a fixed constant, no matter whether private and public consumptions are Edgeworth complements or substitutes.

The remainder of this paper is organized as follows. Section 2 describes the model and analyzes its equilibrium conditions. Section 3 examines the theoretical interrelations between tax progressivity, government-spending preference externality and our model's local stability properties. Section 4 concludes.

2. The economy

We incorporate utility-generating government purchases of goods and services into an otherwise standard one-sector real business cycle (RBC) model under the progressive income tax policy á *la* Guo and Lansing (1998). Households live forever, and derive utilities from private consumption, public expenditures and leisure. Based on the empirical findings of Ni (1995), our analysis considers a constant-relative-risk-aversion (CRRA) Cobb-Douglas utility specification that postulates government spending as a positive preference externality. On the production side, each competitive firm produces output using a constant returns-to-scale technology with capital and labor as inputs. We further assume that there are no fundamental uncertainties present in the economy.

2.1. Firms

There is a continuum of identical competitive firms, with the total number normalized to one. The representative firm produces output Y_t, using physical capital K_t and labor hours H_t as inputs, with a constant returns-to-scale Cobb-Douglas production function

$$Y_t = K_t^{\alpha} H_t^{1-\alpha}, \quad 0 < \alpha < 1. \tag{1}$$

Under the assumption that factor markets are perfectly competitive, the firm's profit maximization conditions are given by

[4] See Benhabib and Farmer (1999) for an excellent survey of the RBC-based indeterminacy literature.

[5] See, for example, Schmitt-Grohé and Uribe (1997), Guo and Lansing (1998), and Christiano and Harrison (1999), among others.