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Taxation, bubbles and endogenous growth[☆]

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HIGHLIGHTS

- We study the interplay between taxation, bubble formation and economic growth in an OLG model.
- A necessary and sufficient condition for the existence of bubbles is provided.
- We figure out the cases where bubbles may harm or promote economic growth.

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ABSTRACT

We study the interplay between taxation, bubble formation and economic growth. A rational bubble may be beneficial when growth is fueled by public investment (or R&D externalities) and the government levies taxes on bubble returns to finance this investment. Our main result challenges the conventional view about the negative effect of bubbles in endogenous growth (Grossman and Yanagawa, 1993).

1. Introduction

A pure bubble arises when the equilibrium price of an asset bringing no dividends is strictly positive.[1] In the mid of Eighties, Tirole (1985) found out that a pure bubble may emerge in OLG economies under capital overaccumulation. Proposition 2 of his influential paper pointed out that the asymptotically bubbly equilibrium is efficient while any asymptotically bubbleless equilibrium is not.[2] Grossman and Yanagawa (1993) extended (Tirole, 1985) with externalities from physical capital, a well-known engine of endogenous growth, while showing that the existence of a bubble may delay this growth and worsen the welfare of any generation.

Our paper reconsiders these results in an OLG model with fiscal policy. We study the impact of taxes on bubble dynamics and endogenous growth. Differently from Grossman and Yanagawa (1993), the growth fuel is the government spending in R&D (in the spirit of Barro, 1990). R&D investments are financed through the taxes not only on labor and capital income but also on returns on the bubble asset. The novelty of our paper rests on this additional fiscal instrument and its consequences. A comparison between these different taxes is also of interest.

First, we find that there is room for bubbles if and only if the aftertax interest rate in the bubbleless equilibrium is lower than the population growth rate. Therefore, bubbles appear if the tax

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[1] The reader is referred to Miao (2014) for an introduction to bubbles in infinite-horizon models and to Brunnermeier and Oehmke (2009) for a survey on bubbles in OLG models with asymmetric information or heterogeneous beliefs.

[2] An allocation is efficient if it is not possible to improve the welfare of all generations and strictly improve for at least one of them.

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rate on capital income is sufficiently high while they are ruled out if the tax rates on labor income or on the bubble return are sufficiently large. Moreover, with some specifications, we provide a full characterization of equilibrium dynamics, that is a global analysis of capital and bubble dynamics. The size of the bubble is explicitly computed.

Second, we figure out the cases where bubbles may harm or promote economic growth. If bubbles do not exist and, *de facto*, the government is prevented from using bubble taxes, while it is allowed to play only with low tax rates on capital and labor income, R&D activities turn out to be underfunded with detrimental effects on economic growth. Conversely, positive bubbles may ensure additional fiscal revenues and R&D expenditures sufficient to trigger a beneficial self-sustained growth. This result challenges the conventional view supported by Grossman and Yanagawa (1993) about a negative effect of bubbles in endogenous growth. However, under a higher tax rate on capital income, bubbles dampen the economic growth: thus, we recover the main conclusion by Grossman and Yanagawa (1993).

Our paper contributes to the literature on the positive effects of bubbles. Among others, Farhi and Tirole (2012) and Martin and Ventura (2012) consider OLG models and point out that, under financial market imperfections, bubbles may be beneficial through the reallocation of funds from less to more productive investments in the private sector. Hirano and Yanagawa (2015) study an infinite-horizon model and show that the effects of asset bubbles depend on financial market conditions: if the pledgeability level is relatively low (high), bubbles enhance (decrease) the economic growth rate. Hirano et al. (2015) develop (Hirano and Yanagawa, 2015) to take in account the connection between bailout policies and bubbles.

2. Framework

Consider a two-period OLG model of rational bubbles in the spirit of Tirole (1985) and Weil (1987).

A representative firm maximizes the profit under a complete capital depreciation: $F_t(K_t, L_t) - R_tK_t - w_tL_t$, where K_t and L_t denote the aggregate capital and the labor forces, while R_t and w_t represent the return on capital and the wage rate. For simplicity, the production function is Cobb–Douglas: $F_t(K_t, L_t) \equiv A_tK_t^{\alpha}L_t^{1-\alpha}$. Profit maximization yields

$$R_t = \alpha A_t k_t^{\alpha-1} \quad \text{and} \quad w_t = (1-\alpha) A_t k_t^{\alpha-1} \tag{1}$$

where $k_t \equiv K_t/L_t$ denotes the capital intensity.

At period t, N_t individuals are born. Each consumer–worker lives two periods. When young, she supplies one unit of labor, earns a labor income taxed at a constant rate τ, consumes c_t and saves through capital s_t and a long-lived asset a_t. When old, she consumes d_{t+1}, that is the gross returns on capital and financial asset (which brings no dividend). These returns are taxed at the constant rates τ_k and τ_b. The price of consumption good is normalized to one while q_t denotes the price of asset in consumption units at time t. Preferences are rationalized by a separable intertemporal utility function $\ln c_t + \beta \ln d_{t+1}$, where β represents the discount rate. The agent faces two budget constraints (one per period):

$$c_t + s_t + q_t a_t \leq (1-\tau) w_t$$
$$d_{t+1} \leq (1-\tau_k) R_{t+1} s_t + (1-\tau_b) q_{t+1} a_t$$

to maximizes her utility with respect to s_t, a_t, c_t and d_{t+1}.

Solving the program, we find the sharing between consumption and savings

$$c_t = \frac{1}{1+\beta}(1-\tau) w_t \tag{2}$$

$$s_t + q_t a_t = \frac{\beta}{1+\beta}(1-\tau) w_t \tag{3}$$

jointly with the (equilibrium) no-arbitrage condition

$$(1-\tau_k) R_{t+1} q_t = (1-\tau_b) q_{t+1} \tag{4}$$

and the budget constraints, now binding.

The government levies taxes on labor income and gross returns on capital and the asset to finance public investment good:

$$G_t = \tau w_t + \tau_k \frac{R_t s_{t-1}}{n} + \tau_b \frac{q_t a_{t-1}}{n} \tag{5}$$

where G_t is the public investment good as a pure productive externality and $n \equiv N_{t+1}/N_t$ denotes the population growth rate, supposed to be constant.

We focus on a simple model of public investment (R&D, for instance) in the spirit of Barro (1990): $A_t = \theta G_t^{1-\alpha}$ for any t. Thus, G_t affects the TFP, the product and the revenues from labor, capital and financial speculation. These revenues are supposed to affect in turn, within the same period, the tax receipt and the public spending G_t at the end. This functional specification promotes endogenous growth dynamics.

Definition 1. 1. An equilibrium is a positive sequence

$$(q_t, R_t, w_t, c_t, d_{t+1}, a_t, s_t, K_{t+1}, L_t, G_t)_{t\geq 0}$$

satisfying (1), (2), (3), (4), (5), the market clearing conditions:

$$\text{asset}: N_{t+1}a_{t+1} = N_t a_t$$
$$\text{physical capital}: K_{t+1} = N_t s_t$$
$$\text{labor}: L_t = N_t$$
$$\text{consumption good}: s_t + c_t + d_t/n + G_t = f_t(k_t),$$

and budget constraints are binding for any $t \geq 0$.

2. If $q_0 > 0$, the equilibrium is said to be bubbly, otherwise it is said to be bubbleless.[3]

Equilibria in the asset and capital markets write $na_{t+1} = a_t$ and $s_t = nk_{t+1}$. The asset volume shrinks exponentially: $a_t = a_0 n^{-t}$. Let $b_t \equiv q_t a_t$ denote the value of financial asset. Therefore, the equilibrium system writes:

$$nk_{t+1} + b_t = \sigma A_t k_t^{\alpha} \tag{6}$$

$$b_{t+1} = \frac{1-\tau_k}{1-\tau_b}\frac{\alpha A_{t+1} k_{t+1}^{\alpha-1}}{n} b_t \tag{7}$$

$$A_t = \theta G_t^{1-\alpha}, \quad G_t = \tau w_t + \tau_k R_t k_t + \tau_b b_t \tag{8}$$

where σ is the propensity to save in the bubbleless equilibrium (i.e., when $b_t = 0$):

$$\sigma \equiv \frac{s_t}{f_t(k_t)} = (1-\tau)(1-\alpha)\frac{\beta}{1+\beta}.$$

We see that a positive sequence $(q_t, R_t, w_t, c_t, d_{t+1}, a_t, s_t, K_{t+1}, L_t, G_t)_{t\geq 0}$ is driven by (1), (6), (7) and (8). In short, $(k_{t+1}, b_t)_{t\geq 0}$ will denote an equilibrium sequence.

3. Equilibrium analysis

Our model bridges two theories: rational bubbles (à la Tirole, 1985) and endogenous growth (à la Barro, 1990). The main proposition rests on the balanced growth rates with and without bubbles.

[3] We notice that $q_0 > 0$ iff $q_t > 0$ for any t.