

GROWTH, INCOME TAXES AND CONSUMPTION ASPIRATIONS

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ABSTRACT:

In a Barro-type economy with exogenous consumption aspirations, raising income taxes favors growth even in the presence of lump-sum taxes. Such policy is compatible with the behavior of private consumption, income taxes and growth rates observed in actual economies.

Keywords: Consumers' aspirations, income taxes, public investment, growth.

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1 Introduction

This paper is about the relationship between growth and income taxes. Barro (1990) represents an important breakthrough in characterizing the influence of income taxes on growth. Starting from low levels of tax rates, a raise in income taxes in Barro's setup increases the rate of growth, while growth becomes slower when income tax rates increase beyond a given threshold.¹ When a non-distortionary tax is also used to finance public investment, growth is shown to uniformly decrease with income taxes. However, the presence of technological externalities inducing over-accumulation of physical capital (Turnovsky, 1996), an endogenous labor-leisure choice (deHeck, 2006) or the requirement to finance an exogenous ratio of public expenditures to output (Marrero and Novales, 2005, 2007), would make the relationship between growth and income taxes to be positive again at low income tax rates. This paper contributes to the literature providing an additional reason explaining why there might exist a positive relationship between income taxes and growth even in the presence of non-distortionary taxation.

We consider a simple modification of the Barro-type framework by incorporating a Stone-Geary-type utility function (Geary, 1950-1951, and Stone, 1954).² The representative consumer derives utility from the part of consumption that exceeds from a benchmark level, which can be interpreted either as a minimum subsistence level of consumption (Alvarez-Pelaez and Diaz, 2005) or a level of consumption aspirations (Carrera and Raurich, 2010). In this simple framework, we show that the aspiration by consumers to maintain certain consumption standards could give rise to an inverted U-shaped relationship between income taxes and growth, even when allowing for the possibility of lump-sum taxes.

The basic framework is described in the next section, results are shown in Section 3, and Section 4 concludes.

2 The model and the balanced growth equilibrium path

Technology and policy rules are standard. As in Glomm and Ravikumar (1994), output, Y , is produced according to,

$$Y_t = AK_t^{1-\theta}G_t^\theta, \quad (1)$$

¹See also Futagami *et al.* (1993), Aschauer (2000) and Marrero (2008), among many others.

²There exists an extensive literature pointing out that the inclusion of subsistence consumption (i.e., basically Stone-Geary preferences) improves the explanatory power of growth models substantially. Steger (2000) argues this fact in a linear growth model. Additional empirical support has been found by Atkeson and Ogaki (1996) and Rebelo (1992), among others.

G and K are public and private capital, respectively; labor is constant and normalized to one; A is a technological scale factor. K and G accumulate according to:

$$K_{t+1} = I_t + (1 - \delta)K_t, \quad (2)$$

$$G_{t+1} = I_t^g + (1 - \delta)G_t, \quad (3)$$

where $\delta \in (0, 1)$ is the capital depreciation rate, which, by simplicity, is assumed to be the same for both types of capitals, and I and I^g are private and public investment, respectively. As it is standard in the related literature, I^g is a constant fraction, x , of Y ,

$$I_t^g = xY_t, \quad 0 \leq x \leq 1. \quad (4)$$

The government collects taxes on total income at a rate τ , as well as lump-sum taxes, T , to finance I^g . We denote by v the ratio of T to Y , although it should be clear that it is T , rather than v , that is chosen by the Government. Hence,

$$x = \tau + v. \quad (5)$$

Either τ or v could be negative, but they must be positive in the aggregate, since $x \geq 0$. A fiscal policy is characterized by (x, v, τ) .

The representative consumer allocates her resources between consumption, C , and investment, I ; labor is offered inelastically. Preferences are of the Stone-Geary form, being defined on the difference between C and a minimum consumption requirement - *aspiration* -, denoted by C^* ,

$$\sum_{t=0}^{\infty} \beta^t \frac{\tilde{C}_t^{1-\sigma} - 1}{1-\sigma}, \quad \sigma > 0, \quad \tilde{C}_t = C_t - C_t^*, \quad (6)$$

where β is the subjective discount rate, $\beta \in (0, 1)$, and σ is a concavity parameter. In an endogenous growth setting, C^* is more conveniently interpreted as consumers' *aspirations* (Carrera and Raurich, 2010), which is assumed to be an exogenous fraction of output, $C^* = z^*Y$.

Optimal conditions for firms are the usual marginal product conditions,

$$r_t = (1 - \theta) \frac{Y_t}{K_t}, \quad (7)$$

$$w_t = \theta Y_t, \quad (8)$$

where w_t is real wage and r_t is the real interest rate. Given K_0 and policy variables, the representative household chooses $\{C_t, K_{t+1}\}_{t=0}^{\infty}$ to maximize (6), subject to the budget constraint

$$C_t + K_{t+1} - (1 - \delta)K_t + T_t = (1 - \tau)(w_t L_t + r_t K_t) \quad (9)$$

and $K_{t+1} \geq 0$, $C_t \geq C_t^*$, for all t . Competitive equilibrium optimality leads to the standard intertemporal optimality condition,

$$\left(\tilde{C}_{t+1}/\tilde{C}_t\right)^\sigma = \beta [1 - \delta + (1 - \tau_{t+1})r_{t+1}]. \quad (10)$$

In this setting, a balanced growth path (BGP) is a trajectory along which aggregate variables grow at a positive constant rate. A standard argument shows that Y_t , $\tilde{C}_t$, K_t , G_t all grow at the same constant rate along the BGP, denoted by γ . Time subscripts are omitted hereinafter. The steady-state growth rate γ can be characterized by either combining (10), (7) and (5), which leads to

$$1 + \gamma = \left\{ \beta [1 - \delta + (1 - x + v)(1 - \theta)Ag^\theta] \right\}^{1/\sigma}, \quad (11)$$

where $g = G/K$, or by combining (4), (3) and (1), which gives us

$$1 + \gamma = A x g^{\theta-1} + 1 - \delta. \quad (12)$$

Proposition 1 *Given policy variables x , v and τ , there exists a unique BGP.*

Proof. *The expressions for $1 + \gamma$ in (11) and (12) must be equal along the BGP. Hence, given (x, v, τ) , positive roots of*

$$\Phi(g) = \beta^{1/\sigma} [1 - \delta + (1 - x + v)(1 - \theta)Ag^\theta]^{1/\sigma} - xAg^{-(1-\theta)} - 1 + \delta = 0 \quad (13)$$

are potential candidates to be steady-state values of g . Given $\sigma > 0$, $\theta \in (0, 1)$, $x < 1$, it is easy to show that $\Phi(g)$ is continuous and strictly increasing in g for $g > 0$, with $\lim_{g \rightarrow 0^+} \Phi(g) = -\infty$ and $\lim_{g \rightarrow +\infty} \Phi(g) = +\infty$. Hence, there exists a single and strictly positive level of g such that $\Phi(g) = 0$ ■

3 Growth, income taxes and aspirations

Since we want to focus on the relationship between growth and taxes, we solve the growth-maximizing policy for the competitive equilibrium. Proposition 2 describes the relationship between x and v along this policy: growth would be maximized by setting lump-sum taxes at the highest level allowed by the constraint $\tilde{C} \geq 0$ (or $C = C^*$).

Proposition 2 *The growth-maximizing ratio x^+ relates to the tax policy variable v through:*

$$x^+ = \theta(1 + v). \quad (14)$$

Proof. Using (12) and specifying (9) along the BGP, we get: $\lim_{x \rightarrow 0} \gamma = -\delta < 0$ and $\lim_{x \rightarrow 1^-} \gamma = -C/K - \delta < 0$, so that positive values of γ can be attained only for values of x inside the interval $(0, 1)$. Taking derivatives in (12) with respect to x , we obtain

$$\frac{\partial \gamma}{\partial x} = Ag^{\theta-2} \left(g - x(1 - \theta) \frac{\partial g}{\partial x} \right) = 0. \quad (15)$$

By the implicit function theorem, since $\Phi(\cdot)$ is a $\mathbb{C}^2$ -mapping, we get:

$$\frac{\partial g}{\partial x} = - \frac{\partial \Phi(g) / \partial x}{\partial \Phi(g) / \partial g} = \frac{(1 - \theta)\beta g + \sigma (1 - \delta + A x g^{\theta-1})^{\sigma-1}}{x g^{-1} \sigma (1 - \theta) (1 - \delta + A x g^{\theta-1})^{\sigma-1} + (1 - \theta)\beta \theta (1 - x + v)}. \quad (16)$$

Combining (15) and (16), we easily obtain that $x^+ = \theta(1 + v)$ ■

Once v has been set at the highest level allowed by imposing the level of consumption aspirations as a binding constraint ($C = C^*$), public investment, and hence growth, can still be increased by using additional resources coming from income taxation. Exploring the possibility of a growth stimulus from this tax effort might lead to a growth-maximizing policy made up by a positive income tax rate. Indeed, Proposition 3 provides an implicit analytical expression for the growth maximizing policy variables: g^+, x^+, v^+, τ^+ . In this general case, an explicit expression for the growth-maximizing policy cannot be obtained, since the level of g solving (13) depends in a highly non-linear way on structural and policy parameters. The only environment for which explicit expressions for g^+, x^+, v^+ and τ^+ can be determined is the benchmark case when $\sigma = 1$ and $\delta = 1$, which is shown in Corollary 4.

Proposition 3 *The growth maximizing policy (g^+, x^+, v^+, τ^+) verifies (13) together with:*

$$x^+ = \frac{g^+(1 - z^*)}{1 + g^+}, \quad (17)$$

$$v^+ = \frac{g^+(1 - z^*)}{\theta(1 + g^+)} - 1, \quad (18)$$

$$\tau^+ = 1 - \frac{g^+(1 - z^*)(1 - \theta)}{(1 + g^+)\theta}. \quad (19)$$

Proof. For a balanced growth equilibrium, the resource constraint (9) can be rewritten as

$$\frac{C}{Y} = (1 - \tau - v) - (\gamma + \delta) \frac{1}{Ag^\theta}. \quad (20)$$

Plugging (12) and (5) into (20), this condition reduces to

$$\frac{C}{Y} = 1 - x - \frac{x}{g}. \quad (21)$$

Under the growth maximizing policy: i) the consumption to output ratio C/Y is equal to z^* , ii) (17) and (14) must be equal, leading to (18). Finally, from (5), we obtain (19) ■

Corollary 4 Under a log-utility function and complete capital depreciation, the growth maximizing policy implies levels for g , x , v , τ and γ equal to:

$$g^+ = \frac{\theta}{\beta(1-\theta)^2}, \quad (22)$$

$$x^+ = \frac{\theta(1-z^*)}{\beta(1-\theta)^2 + \theta}, \quad (23)$$

$$v^+ = \frac{1-z^*}{\beta(1-\theta)^2 + \theta} - 1, \quad (24)$$

$$\tau^+ = 1 - \frac{(1-z^*)(1-\theta)}{\beta(1-\theta)^2 + \theta}, \quad (25)$$

$$1 + \gamma^+ = A \frac{\theta(1-z^*)}{\beta(1-\theta)^2 + \theta} \left(\frac{\beta(1-\theta)^2}{\theta} \right)^{1-\theta}. \quad (26)$$

Proof. We start by setting $\sigma = 1$ and $\delta = 1$ in (13) and solving $\Phi(g) = 0$ for g as a function of x and v , i.e., $\hat{g}(x, v)$. Then, plugging (17) and (18) into this expression for $\hat{g}(x, v)$ we obtain g^+ in (22). Finally, expressions for x^+ , v^+ , τ^+ and γ^+ come directly from combining (22) with (17), (18), (19) and (12), respectively ■

Corollary 1 shows g^+ to be independent of the level of consumption aspirations z^* , while x^+ and v^+ are inversely related to z^* , and τ^+ is positively related to it. Thus, as z^* increases, x^+ decreases and the tax burden moves from lump-sum to income taxes (i.e., v^+ turns negative while τ^+ becomes positive). From (25), τ^+ is positive for a sufficiently high level of aspirations,

$$\tau^+ > 0 \Leftrightarrow z^* > \tilde{z}^* = 1 - \beta(1-\theta) - \frac{\theta}{1-\theta}. \quad (27)$$

What is interesting from this expression is that the maximum of γ can well arise for a positive level of τ . Under these circumstance, the relationship between growth and income taxes is positive for $0 < \tau < \tau^+$, and an inverted U-shaped relationship between γ and τ arises even in the presence of lump-sum taxes, which is the main result of this note.

Moreover, since $\partial \tilde{z}^*/\partial \beta = -(1-\theta) < 0$ and $\partial \tilde{z}^*/\partial \theta = \beta - 1/(1-\theta)^2 < 0$, then a positive relationship between income taxes and growth is more likely to appear in economies with low levels of τ , high levels of z^* , β and θ (or lower α , since $\alpha + \theta = 1$).

According to (27), when $z^* < \tilde{z}^*$ lump-sum taxes will finance public investment and a proportional income subsidy (i.e., $\tau^+ < 0$). For $z^* > \tilde{z}^*$, τ^+ is always positive. If z^* is between $\tilde{z}^*$ and $(1-\theta)[1-(1-\theta)\beta]$, then v^+ and τ^+ are both positive, and x^+ falls between $\frac{\theta}{1+\theta}$ and θ . In this case, lump-sum taxes are levied to finance public investment to the point where the private consumption to output ratio comes down to z^* . Growth is maximized by complementing the lump-sum tax with an income tax, the aggregate proceeds being used to finance the investment in public infrastructures. When $z^* = (1-\theta)[1-(1-\theta)\beta]$, then $\tau^+ = \theta$, a typical result in a number of existing studies, and public infrastructures are then entirely financed with income taxes: $x^+ = \tau^+$ and $v^+ = 0$. Finally, $v^+ < 0$ when $z^* > (1-\theta)[1-(1-\theta)\beta]$. Inside this range of values for z^* , income taxes will be used to finance a public investment ratio below θ , as well as the positive transfer from the government to the consumer that is required to achieve the desired level of consumption aspirations.

A numerical illustration under $\sigma \neq 1$ and $\delta \in (0,1)$ [conditions (13), (17), (18) and (19)], setting $A = 0.40$, $\theta = .20$ and $z^* = .45$, reveals that $\tau^+ = 40.0\%$ when $\sigma = .5$, and $\tau^+ = 31.3\%$ when $\sigma = 1.5$. In the first case, public investment, subsidies/transfers to the private sector and growth rates would be $x^+ = 15.0\%$, $v^+ = -25.0\%$ and $\gamma^+ = 3.15\%$, while for $\sigma = 1.5$, we would have: $x^+ = 17.2\%$, $v^+ = -14.2\%$ and $\gamma^+ = 2.92\%$. Such policies are compatible with a behavior of private consumption, income tax rates, subsidies to the private sector and growth rates as is observed in actual developed economies. A sensitivity analysis would show that for a high enough level of consumers' aspirations, the growth maximizing policy entails the combination of positive income taxes and a lump-sum subsidy that we have seen under full depreciation and logarithmic utility.

4 Final Remarks

The main point of the paper is that the rate of growth can sometimes be increased by raising the tax rate on productive factor incomes, even when lump-sum taxes are available as a policy instrument. That could be the case if the economy happens to be in a gridlock, possibly because financing public investment through lump-sum taxes might have taken private consumption too close to the level of consumption aspirations. In such a situation, using an income tax to finance additional public investment would crowd-out private investment, and the final effect on growth will generally be unclear. In a simple endogenous growth economy with exogenous consumption aspirations, we have shown that such a strategy may often enhance growth. In fact, we have seen that

the growth stimulus can be important enough so that growth is maximized by setting a significant income tax, and using the proceeds to finance public investment as well as a lump-sum subsidy to consumers. This result is obtained under a standard calibration implying a behavior for private consumption and investment, income tax rates, subsidies to the private sector and growth rates as it is observed in actual economies. The growth maximizing income tax rate and the level of subsidies to the private sector, both increase with the level of aspirations. In contrast, the public investment ratio and the maximized rate of growth decrease as the level of consumption aspirations increases. Our model can be used as a benchmark for future extensions regarding this important issue. In particular, generalizing preferences to include an endogenous habit level of consumption as in Corrado and Holly (2011) would be a natural and interesting setup to characterize the relationship between distortionary taxes and growth.

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