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Factor Income Taxation and Growth with Increasing Integration of World Capital Markets

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Abstract

In a closed economy, the infinite-horizon and the overlapping generations (OG) model prescribe diametrically opposite policies on factor taxation: the former argues that the growth-maximizing capital income tax rate should be set to zero, whereas the latter argues that it should be set as high as possible. This note investigates the issue by taking into account global capital market integration. We show that the long-run growth-maximizing capital income tax rate in a small open OG economy is decreasing as the economy's capital market is increasingly integrated with the rest of the world, and will be equal to zero as prescribed in the infinite-horizon model once the degree of integration becomes sufficiently high.

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1 Introduction

How labor and capital income should be taxed in the context of growth is an unresolved issue. On the one hand, in the infinite-horizon setup, Lucas (1990), Rebelo (1991), Jones et al. (1993) and Milesi-Ferretti et al. (1998) have shown that the growth maximizing capital income tax rate should be set to zero since any positive tax rate on capital income reduces the rate of return on capital, which in turn curbs the saving incentive and economic growth. This result suggests that, to raise a required amount of tax revenue, labor income should bear the main thrust. On the other hand, in the finite-horizon overlapping generations (OG) setup, Jones and Manuelli (1992) and Uhlig and Yanagawa (1996) argue that shifting the tax burden from labor to capital income may benefit economic growth and hence setting the latter tax rate as high as possible can be optimal.

To understand the intuition behind the result in the OG model, it is best to consider a two-period OG with the log utility function, $\ln c_t^1 + \beta \ln c_{t+1}^2$, where c_t^1 is generation t 's consumption in period 1, c_{t+1}^2 is their consumption in period 2, and β is a discount factor. This utility function can be equivalently expressed in Cobb-Douglas form $(c_t^1)(c_{t+1}^2)^\beta$. It is then well known that the wealth allocated to c_{t+1}^2 , which amounts to saving in this setup, will be determined by the preference β and will be completely independent of the capital income tax rate. Put formally, the interest elasticity of saving is zero in the case of the log utility function. Since the young earn only labor income and engage in saving while the old earn only capital income and save nothing in this OG model, to stimulate saving and growth, it is optimal to set the labor tax rate to zero while the capital income tax rate is set at the maximum.

Caballé (1998) introduces altruistic preferences into the OG model, showing that when the interest elasticity of saving is sufficiently small, there exists a threshold value of intergenerational altruism, below which the growth maximizing capital tax rate is one, whereas above that value it equals zero. However, this finding does not reconcile the infinite-horizon model with the OG model, in the sense that the OG model de facto becomes dynastic or infinite horizon when intergenerational altruism is high.

In this note we argue that the diametrically opposite growth policy prescriptions on factor taxation between the infinite-horizon and the OG model will be mitigated and even disappear

if one takes into consideration the increasing degree of integration in the world capital market. Specifically, we show that the growth-maximizing capital tax rate in the OG model is decreasing with the increasing degree of integration in the world capital market, and will be equal to zero as prescribed in the infinite-horizon setup when the world capital market is sufficiently integrated.¹

The mechanism behind our result is intuitive. With the opening up of the world capital market, domestic capital will flow out to seek higher rates of return abroad in response to a higher domestic capital tax rate. This capital outflow implies a disconnection between domestic saving and domestic investment, which in turn implies in an OG setting that a higher domestic capital tax rate does not necessarily result in higher domestic capital formation even though it does result in higher domestic saving. With the increasing integration of the world capital market, the force of capital outflow will become more and more dominating and will eventually lead to the prescription of a zero capital tax once the integration is sufficiently high.

For sure, this is not the first paper to address the non-optimality of taxing capital income to the maximum in an OG growth model. For instance, Ho & Wang (2007) show that the growth-maximizing capital income tax rate is between zero and one and is decreasing with the severity of information asymmetry between lenders and borrowers. Their result arises because the capital income tax policy worsens the adverse selection problem in the credit market which in turn gives rise to a negative effect on growth. While their main focus is to argue in favor of a less-than-one growth-maximizing capital income tax rate in the presence of asymmetric information, the present paper aims to show how the opposite long-run growth tax policy prescribed by OG and the infinite horizon models will become unified under global capital market integration.

2 Setup

Consider a small open economy in which there is an infinite sequence of two-period-lived overlapping generations with homogeneous, non-altruistic agents. All generations are identical in size and composition. The population size of each generation is normalized to one.

¹Correia (1996) shows that the celebrated result in Chamley (1986) - the long-run optimal capital income tax rate should be zero - can be extended to the circumstances of small open economies with frictionless, international capital mobility.

The utility function of the representative agent is given by:

$$U(c_t^1) + \beta U(c_{t+1}^2) \quad (1)$$

with $1 > \beta > 0$ and $U(c) = \log(c)$. c_t^1 and c_{t+1}^2 denote the young agent's consumption and the old agent's consumption, respectively. Using a logarithmic utility function implies that the inter-temporal elasticity of substitution is equal to one. Such an assumption will make our results most transparent.

Each young agent born in time period t supplies endowed labor inelastically to earn wage income w_t . Since an agent when old is not endowed with any labor and hence no wage income, he needs to save for old-age consumption. His saving is allocated between domestic investment and international investment, which are denoted by i_t and b_t , respectively. The domestic interest rate at time t is given by r_t and the rate of return in the world capital market, r_b , is exogenously given for the small open economy. In order to keep the focus on the case with capital outflow, we assume that $r_b > r_t$ holds throughout the rest of the discussion. A young agent needs to incur a cost $\mu \frac{b_t^2}{k_t}$ to identify and to materialize the investment opportunities in the world capital market, where $\mu \in (0, \infty)$ is a parameter. To be compatible with perpetual growth, this cost is set to be in proportion to the capital stock per capita, k_t . In the sequel, the inverse of the parameter μ will be interpreted as a measure of the degree of integration of the domestic economy with the international capital market. Full integration takes place when μ tends to zero.

Each old agent consumes his net returns from both domestic investment and international investment. Given that the government imposes proportional taxes on domestic labor and domestic capital income at flat rates τ_w and τ_r respectively, the young agent's consumption will be

$$c_t^1 = (1 - \tau_w)w_t - i_t - b_t - \mu \frac{b_t^2}{k_t},$$

and the old agent's consumption will be

$$c_{t+1}^2 = [1 + (1 - \tau_r)r_{t+1}]i_t + (1 + r_b)b_t$$

subject to $\tau_w \in [0, 1]$ and $\tau_r \in [0, 1]$.

There are many competitive firms in the economy. At the beginning of time period t , each firm produces a homogeneous consumption good according to the following production function:

$$y_t = f(k_t, l_t) = k_t^\theta (A_t l_t)^{1-\theta} \quad (2)$$

with $0 < \theta < 1$, where k_t and l_t are the capital stock per capita and labor, respectively, and A_t is a technology parameter which represents the technological spill-overs. Following the endogenous-growth literature, we postulate that $A_t = k_t$ so that the economy exhibits sustainable growth in the long run. Since only young agents are endowed with labor, which is normalized to a unity measure, the competitive rental rate of capital and the wage rate of labor are equal to, respectively:

$$r_t = \theta, \quad (3)$$

$$w_t = (1 - \theta)k_t. \quad (4)$$

It is also assumed that capital depreciates completely after one period of use. As usual, output can be used for consumption or investment.

The government finances the stream of public expenditures, which is assumed to be equal to a constant fraction, α , of output by collecting revenues from flat rate taxes on wage income and capital income in each time period. It is straightforward to show that the government budget constraint is given by:²

$$\alpha = (1 - \theta)\tau_w + \theta\tau_r.$$

The above equation clearly indicates that the capital and labor income tax rates are negatively related to each other, given θ and α . In the next section we are going to show that, depending on the degree of global capital market integration, the growth-maximizing capital income tax rate can be equal to one, between zero and one, or even become zero.

3 The Optimal Capital Income Tax Rate

From the assumption regarding the utility function and the agent's budget constraints, one can obtain the following first-order conditions which describe the perfect foresight competitive equilibrium for exogenous sequences of w_t , r_t , k_t , r_b , τ_w and τ_r .

$$\frac{c_{t+1}^2}{c_t^1} = \beta[1 + (1 - \tau_r)\theta], \quad (5)$$

$$\frac{c_{t+1}^2}{c_t^1} = \frac{\beta(1 + r_b)k_t}{2\mu b_t + k_t}. \quad (6)$$

²See the Appendix for the derivation.

We have applied (3) to deriving (5) and (6). Combining them gives:

$$z_t \equiv \frac{b_t}{k_t} = \frac{b}{k} = \frac{1}{2\mu} \left[\frac{1+r_b}{1+(1-\tau_r)\theta} - 1 \right].$$

Note that z_t is always positive based on the assumption that $r_b > r_t = \theta$ and $\tau_r \in [0, 1]$. It is worth pointing out that z_t is increasing with the capital income tax rate τ_r . This result is intuitive - a higher domestic capital income tax will all else equal enhance people's incentives to engage in "capital flight."

It can be readily verified that the economy always grows along the balanced growth path at the rate g , given by³:

$$g \equiv \frac{y_{t+1}}{y_t} = \frac{k_{t+1}}{k_t} = \frac{b_{t+1}}{b_t} = \frac{\beta(1-\theta)}{1+\beta} \left(1 - \frac{\alpha - \theta\tau_r}{1-\theta} \right) - \frac{1}{2\mu(1+\beta)} \left[\frac{1+r_b}{1+(1-\tau_r)\theta} - 1 \right] \left[\frac{(1+r_b)(1+\frac{\beta}{2})}{1+(1-\tau_r)\theta} + \frac{\beta}{2} \right]. \quad (7)$$

Now we are ready to see why taxing capital income generates two opposite forces on the economic growth of a small open economy. The first term on the right-hand side of (7) represents the conventional growth-enhancing effect of taxing capital income in the OG literature. In the small open economy case, one additional adverse growth effect of capital income taxation is captured by the second term. This effect arises primarily because increasing the capital income tax rate changes the trade off between domestic investment and international lending against the former, inducing young agents to lend more (i.e., more capital outflow) in the world capital market.

To formalize the above discussion, we take the partial derivative of (7) with respect to τ_r , giving:

$$\frac{\partial g}{\partial \tau_r} = \beta - \frac{(2+\beta)(1+r_b)^2}{2\mu[1+(1-\tau_r)\theta]^3} + \frac{(1+r_b)}{2\mu[1+(1-\tau_r)\theta]^2} = 0.$$

Some algebraic manipulations transform the above growth-maximizing first-order condition into:

$$\mu[1+(1-\tau_r^*)\theta]^3 = \frac{(1+r_b)}{2\beta} \{ (2+\beta)(1+r_b) - [1+(1-\tau_r^*)\theta] \},$$

where $\tau_r^* = \tau_r^*(\mu, \theta, r_b)$ is the growth maximizing capital income tax rate.⁴ We call the left-hand

³The derivation of this equation can be found in the Appendix.

⁴Since this is a third-order equation, it should have three roots. We then rewrite it as:

$$[1+(1-\tau_r^*)\theta]^3 + \frac{(1+r_b)[1+(1-\tau_r^*)\theta]}{2\mu\beta} - \frac{(1+r_b)^2(2+\beta)}{2\mu\beta} = 0.$$

Let $p = \frac{(1+r_b)}{2\mu\beta}$ and $q = -\frac{(1+r_b)^2(2+\beta)}{2\mu\beta}$. Since $4p^3 + 27q^2 > 0$ holds, this equation has one real root and two complex roots. We focus on the case with the real root.

side of the above equation locus LL and the right-hand side locus RR. Note that the locus LL is decreasing with τ_r whereas the locus RR is increasing with it. The intersection of these two loci determines the growth maximizing τ_r^* as shown in Figure 1, which is between zero and one if the following condition on the model parameters is met:

$$\frac{(1+r_b)}{2\beta(1+\theta)^3}[(2+\beta)(1+r_b)-(1+\theta)] \equiv \underline{\mu} < \mu < \bar{\mu} \equiv \frac{(1+r_b)}{2\beta}[(2+\beta)(1+r_b)-1].$$

It is easy to show that $\underline{\mu}$ is indeed the degree of integration of the world capital market when the event $\tau_r^* = 0$ occurs while $\bar{\mu}$ applies when the event $\tau_r^* = 1$ takes place. Put simply, this condition specifies a range of values of μ in which $0 < \tau_r^* < 1$ exists.⁵

(Insert Figure 1 about here)

Note that increasing μ will shift the locus LL rightward in Figure 1, giving rise to a bigger growth maximizing capital income tax rate. When the value of μ satisfies $\mu \in [\bar{\mu}, \infty)$, indicating a low degree of integration with the world capital market, the second and the third terms in the growth maximizing first-order condition will be insignificant. Then it will be growth maximizing to set τ_r^* as high as possible in this case, in accordance with the finding as in Jones & Manuelli (1992) and Uhlig & Yanagawa (1996). On the other hand, when $\mu \in (0, \underline{\mu}]$ holds, the growth retarding effect of capital income taxation will dominate, making it optimal to untax any capital income. Consequently, if a small open economy is sufficiently integrated with the world capital market, the long-run growth maximizing capital income tax rate in the OG model should be zero, as in the infinite horizon setup (see for example Roubini & Milesi-Ferretti (1994)).

To sum up, we obtain:

Proposition 1. The long-run growth maximizing capital income tax rate in a small open OG economy is decreasing as the economy's capital market increasingly integrates with the rest of the

⁵The second-order condition displayed below holds:

$$\frac{\partial^2 g}{\partial \tau_r^2} = -\frac{\theta(1+r_b)}{\mu[1+(1-\tau_r)\theta]^3} \left\{ \frac{3(2+\beta)(1+r_b)}{2[1+(1-\tau_r)\theta]} - 1 \right\} < 0$$

since $\min \left\{ \frac{1+r_b}{1+(1-\tau_r)\theta} \right\} = 0.5$ and hence $\left\{ \frac{3(2+\beta)(1+r_b)}{2[1+(1-\tau_r)\theta]} - 1 \right\} > 0$ according to the parametric configurations $0 < \theta < 1$, $0 < \beta < 1$, $\tau_w \in [0, 1]$ and $\tau_r \in [0, 1]$. Therefore, τ_r^* is a maximum.

world, and will be equal to zero as prescribed in the infinite-horizon model once the degree of integration becomes sufficiently high.

The major finding that increasing capital market integration tends to shift the tax burden from capital income to labor income is supported by empirical studies. For example, Bretschger and Hettich (2002), using a panel data of 14 OECD countries for the period 1967-1996, find empirical evidence for the argument that capital market integration reduces corporate tax rates, which are used as the measure for capital taxation. Winner (2005) shows that, in a sample of 23 OECD countries, the degree of capital mobility exhibits a significant, negative relationship with a country's capital income tax rate whereas its relationship with the labor income tax rate is positive for the period from 1965 to 2000.

4 Conclusion

This paper examines the growth effects of factor income taxation in a small open economy with frictional capital mobility across countries. To obtain maximum clarity, we choose to work with a standard two-period OG model with investment-driven perpetual growth. As is typical in this kind of model, a representative young agent uses his wage income to support consumption and domestic investment. Liberalizing international capital mobility enables him to be a lender in the world capital market since the rate of return on investment in the world capital market is higher than that in the local one. In these circumstances, the main tenet is that capital income taxation will intensify capital outflow, thereby giving rise to a negative effect on economic growth. Therefore, in contrast with the conventional wisdom derived from the OG literature, our theoretical findings suggest that setting capital income tax rates as high as possible is growth promoting in a small open economy only if the degree of integration with the world capital market is low. As the degree of integration increases, the growth maximizing capital income tax rate should fall below one and will equal zero when the degree of integration is sufficiently large. The growth-maximizing policy prescriptions on factor taxation between the infinite-horizon and the OG model are eventually reconciled.

Appendix (Not intended for publication)

The Derivation of the Government Budget Constraint

Since the government imposes proportional, flat tax rates τ_w and τ_r on domestic wage income and domestic capital income, respectively, and the public expenditures are a constant fraction of total output, its budget constraint is given by:

$$\alpha y_t = \tau_w w_t + \tau_r r_t i_{t-1}.$$

Substituting the market equilibrium condition $k_{t+1} = i_t$ with (3) and (4) into the above equation yields:

$$\alpha y_t = (1 - \theta)\tau_w k_t + \theta\tau_r k_t.$$

Since $A_t = k_t$ and $l_t = 1$, it follows that $y_t = k_t$ holds in equilibrium. Therefore, the government budget constraint can be written as:

$$\alpha = (1 - \theta)\tau_w + \theta\tau_r.$$

The Derivation of the Domestic Investment Equation and the Growth Equation

Substituting $c_t^1 = (1 - \tau_w)w_t - i_t - b_t - \mu \frac{b_t^2}{k_t}$ and $c_{t+1}^2 = [1 + (1 - \tau_r)\theta]i_t + (1 + r_b)b_t$ into (5) gives:

$$\frac{[1 + (1 - \tau_r)\theta]i_t + (1 + r_b)b_t}{(1 - \tau_w)w_t - i_t - b_t - \mu \frac{b_t^2}{k_t}} = \beta[1 + (1 - \tau_r)\theta].$$

Rewriting it as:

$$\begin{aligned} [1 + (1 - \tau_r)\theta]i_t + (1 + r_b)b_t &= \beta[1 + (1 - \tau_r)\theta][(1 - \tau_w)w_t - i_t - b_t - \mu \frac{b_t^2}{k_t}], \\ [1 + (1 - \tau_r)\theta](1 + \beta)i_t &= \beta[1 + (1 - \tau_r)\theta](1 - \tau_w)w_t - b_t\{(1 + r_b) + \beta[1 + (1 - \tau_r)\theta] \\ &+ \beta[1 + (1 - \tau_r)\theta]\mu \frac{b_t}{k_t}\}. \end{aligned}$$

By associating it with $\frac{b_t}{k_t} = \frac{1}{2\mu} \left[\frac{1+r_b}{1+(1-\tau_r)\theta} - 1 \right]$, the above equation becomes

$$\begin{aligned} [1 + (1 - \tau_r)\theta](1 + \beta)i_t &= \beta[1 + (1 - \tau_r)\theta](1 - \tau_w)w_t - \frac{k_t}{2\mu} \left[\frac{1 + r_b}{1 + (1 - \tau_r)\theta} - 1 \right] \left\{ (1 + r_b) \left(1 + \frac{\beta}{2} \right) \right. \\ &+ \left. \frac{\beta}{2} [1 + (1 - \tau_r)\theta] \right\}, \\ i_t &= \frac{\beta}{1 + \beta} (1 - \tau_w)w_t - \frac{k_t}{2\mu(1 + \beta)} \left[\frac{1 + r_b}{1 + (1 - \tau_r)\theta} - 1 \right] \left[\frac{(1 + r_b)(1 + \frac{\beta}{2})}{1 + (1 - \tau_r)\theta} + \frac{\beta}{2} \right]. \end{aligned}$$

Combining the market equilibrium condition $k_{t+1} = i_t$ and (4) with the above equation and using the government budget constraint yields

$$g \equiv \frac{k_{t+1}}{k_t} = \frac{\beta(1-\theta)}{1+\beta} \left(1 - \frac{\alpha - \theta\tau_r}{1-\theta}\right) - \frac{1}{2\mu(1+\beta)} \left[\frac{1+r_b}{1+(1-\tau_r)\theta} - 1 \right] \left[\frac{(1+r_b)(1+\frac{\beta}{2})}{1+(1-\tau_r)\theta} + \frac{\beta}{2} \right].$$

Using equation (2) with $A_t = k_t$ and $l_t = 1$ in association with the result that $\frac{b_t}{k_t} = \frac{b}{k}$, one can show that $\frac{y_{t+1}}{y_t} = \frac{b_{t+1}}{b_t} = \frac{k_{t+1}}{k_t} \equiv g$ holds.

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