Tax on Capital Income:
The Role of Information Frictions

by

Wai-Hong Ho

and

Yong Wang

The issue

- When government has to resort to tax on factor income, what should be the optimal tax on capital income, vs. that on labor income, in a macro growth context?
- In the standard Ramsey-type growth models, the optimal tax on capital income is zero. See Judd (1985) and Chamley (1986), and subsequently extensions.
- However, in life-cycle (overlapping generations) models, the growth maximizing tax policy is to set the tax rate on capital income as high as possible (under certain plausible conditions). See Uhlig and Yanagawa (1996) and Caballe (1998).
- The reality is neither!

The issue

- In the Ramsey growth model, various extensions have been made to generate non-zero optimal tax on capital:
  - by incorporating distortions such as externalities of capital taxation (Barro 1990, Chen 2007) and imperfectly competitive product market (Guo and Lansing 1999).
  - by incorporating human capital accumulation in a two-sector growth model, where human capital is the engine of long-run growth (Chen and Lu 2013).

The issue

- In the overlapping generations model, there are two opposing effects of capital taxation on growth via savings.
  - As is standard, higher capital income taxation leads to less savings as it lowers returns (net interest rate) on savings.
  - Higher capital income taxation alleviates the need for labor income taxation, resulting in more savings when young.
  - Provided that the interest elasticity of savings is sufficiently low, therefore, raising capital income taxation will result in higher savings and hence growth.

The issue

- In the multi-periods life cycle models, studies have established that positive capital income tax can be optimal:
  - with multiple but finite periods of a life cycle and elastic labor-leisure choice in each period, the optimal tax policy necessarily involves age-dependent tax rates on labor income (Erosa and Gervais 2002);
  - when age-dependent labor income tax is not feasible, a positive tax rate on capital is optimal to mimic the required age-dependent tax structure (Conesa et al. 2009).

Our Approach

- In this paper, we reexamine the issue of optimal factor taxation in a standard OLG model.
- A distinguishing feature of our model is that physical capital is produced by risky projects that are partially financed through a credit market with asymmetric information between lenders and borrowers (in the form of the standard CSV problem).
- The asymmetric information in the credit market brings optimal contracting into the discussion.
- We show that the information friction introduces a rationale to lower the optimal tax rate on capital, which will no longer be as high as possible.

Main Results

- In the truth-telling equilibrium, the monitoring probability increases with the tax rate on capital income.
- The equilibrium monitoring probability also rises with the reliance on external financing in the credit market.
- To the extent that monitoring is costly and hence causes credit market distortions, external financing exacerbates the information frictions.
- The growth- and welfare-maximizing tax rates on capital income are lower with (i) more severe asymmetric information friction, and (ii) greater reliance on external financing.
- Welfare maximizing capital income tax rate is smaller than the growth maximizing counterpart.

The Model: Credit Market Equil.

- Individuals live for 2 periods: young and old
- A θ fraction of young agents is lenders and a 1-θ fraction is borrowers.
- Agents are risk neutral, work when young and consume when old (thus have a zero interest elasticity of savings, which would imply a corner solution for the optimal tax on capital in the absence of any frictions)

The Model: Credit Market Equil.

- Young lenders work and provide their wages as the source of loans, which have alternative use via a safe storage technology (yields ε units of consumption per unit of input)

- Young borrowers also work and seek loans to run risky projects which produce capital goods in next period

- The returns of borrowers' projects can take on one of two possible values: 0 (with prob. π) and κ (with prob. $1- \pi$)

The Model: Credit Market Equil.

- The project realization is privately observed by its operator (the borrower)
- Lenders can verify the project outcome via auditing, which has a cost of δ amount of capital (per unit of loan)
- Lenders offer contract $C_t = \{\Phi_t, R_t, q_t\}$, where Φ_t is the auditing probability, R_t is the loan rate, and q_t is the loan size (external financing)

The Model: Credit Market Equil.

- Government levies a tax rate τ_ρ on capital income and a tax rate τ_w on labor income.

- Two technical assumptions:

$$(1 - \pi)\kappa - \pi\delta > 0$$

$$\gamma^2 A[(1 - \pi)\,\kappa - \pi\delta](1 - \tau_\rho) > \varepsilon$$

The Model: Credit Market Equil.

- Due to competition, lenders maximize borrowers' expected payoff subject to constraints:

Max $(1 - \pi)(1 - \tau_\rho)(\kappa\rho_{t+1}Q_t - R_t q_t)$

s.t. $(\kappa\rho_{t+1}Q_t - R_t q_t) \geq (1 - \Phi_t)\kappa\rho_{t+1}Q_t$ (ICC)

$(1 - \tau_\rho)[(1 - \pi)R_t - \pi\Phi_t\delta\rho_{t+1}]q_t = \varepsilon q_t$ (ZPC)

$\kappa\rho_{t+1} \geq R_t$ (PC)

$q_t \leq \theta(1 - \tau_w)w_t/(1 - \theta)$ (Resource constraint)

$Q_t = (1 - \tau_w)w_t + q_t$ (internal and external financing)

The Model: Credit Market Equil.

- In the truth-telling equilibrium, the incentive compatibility constraint is binding.
- Since the participation constraint hold in strict inequality in equilibrium, a borrower wants to borrow as much as possible, and hence the resource constraint binds.
- The larger the fraction of lenders θ (relative to borrowers), the greater the size of external financing for each project, making the project more reliant on external financing.

The Model: Credit Market Equil.

- Solution of the optimal contract:

$\Phi_t = \Phi = \varepsilon/\{\gamma A[(1 - \pi)\kappa - \theta\pi\delta] (1 - \tau_\rho)\}$,
$R_t = \varepsilon\kappa/\{[(1 - \pi)\kappa - \theta\pi\delta] (1 - \tau_\rho)\}$,
$q_t = \theta(1 - \tau_w)w_t/(1- \theta)$.

We have: $0< \Phi <1$, $\partial\Phi/\partial\tau_\rho > 0$ and $\partial\Phi/\partial\theta > 0$.

The Model: Credit Market Equil.

- The equilibrium monitoring probability increases with the tax rate on capital income, because the a higher tax increases the incentive to "cheat".

- The equilibrium monitoring probability also increases with the extent of external financing, because the incentive to "cheat" also rises with the amount of external financing.

- Since monitoring entails loss of resource (a form of inefficiency), our results suggest that both capital income taxation and reliance on external finance exacerbate the information distortions in the credit market.

Optimal Taxation – Growth Maximizing Case

- Solve it for the growth maximizing capital income tax rate:

$\partial \ln(g)/\partial \tau_\rho = 0 \rightarrow$

$$\tau_\rho^* = 1 - \frac{\theta}{\gamma}\sqrt{\frac{(1-\alpha)\pi\delta\varepsilon}{A(1-\pi)\kappa\left[(1-\pi)\kappa - \theta\pi\delta\right]}}$$

We have:

$$0 < \tau_\rho^* < 1,\ \ \partial\tau_\rho^* / \partial\delta < 0,\ \ \partial\tau_\rho^* / \partial\theta < 0.$$

Optimal Taxation – Growth Maximizing Case

- The auditing probability under the optimal tax policy of τ_{ρ}^{*} is:

$$\phi^{*} = \sqrt{\frac{(1-\pi)\kappa\varepsilon}{A(1-\alpha)\pi\delta\left[(1-\pi)\kappa-\theta\pi\delta\right]}}$$

Note that Φ^{*} is

(i) increasing with θ: $\partial\Phi^{*}/\partial\theta > 0$;

(ii) U-shaped and non-monotonic in δ:

$\partial\Phi^{*}/\partial\delta < 0$ when $0 < \delta < (1-\pi)\kappa/2\theta\pi$

$\partial\Phi^{*}/\partial\delta > 0$ when $(1-\pi)\kappa/2\theta\pi < \delta < (1-\pi)\kappa/\theta\pi$

Optimal Taxation – Growth Maximizing Case

- The optimal growth rate is:

$$g^* = A(1-\gamma)\left[(1-\pi)\kappa - \theta\sqrt{\frac{(1-\pi)\kappa\varepsilon\pi\delta}{A(1-\alpha)\left[(1-\pi)\kappa - \theta\pi\delta\right]}}\right]\left(1-\frac{\alpha-\gamma\tau_\rho^*}{1-\gamma}\right)$$

Note that:

$$\partial g^* / \partial \delta < 0, \quad \partial g^* / \partial \theta < 0.$$

Optimal Taxation – Welfare Maximizing Case

- The welfare of all generations can be expressed by:

$$\Pi = \Pi_0 + \beta\Pi_1 + \beta^2\Pi_2 + \ldots = \sum_{t=0}^{+\infty} \beta^t \Pi_t$$

where Π_t denotes the total payoffs to all (old) members in period t.

- Denote τ_ρ^{**} the welfare-maximizing tax rate on capital. We can show that:

$$0 < \tau_\rho^{**} < \tau_\rho^{*}, \ \ \partial\tau_\rho^{**} / \partial\delta < 0, \ \partial\tau_\rho^{**} / \partial\theta < 0.$$

Concluding Remarks

- In the presence of information friction, both capital taxation and external financing worsen the incentive condition in the credit market, which in turn lead to more stringent contract enforcement/monitoring.
- Since enforcement is costly, from both the growth- and welfare-maximizing perspectives, a more conservative tax on capital is called for to mitigate the distortions resulted from asymmetric information as well as from external financing.
- Empirical implications: economies with more severe information frictions in the credit market and/or greater reliance on external financing should tax capital less and tax labor more.
- Some quantitative exercise would be helpful…