A note on capital income taxation with involuntary unemployment

Minoru Watanabe

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Minoru Watanabe[1,2]

Abstract

This study develops a standard overlapping generations model with imperfect labor markets. The results indicate that a higher capital income tax promotes not only economic growth but also employment if pension benefits exist.

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Keywords: Capital income tax, Unemployment, Public pension

1. Introduction

According to the conventional perspective, optimal capital income tax inhibits economic growth if households live infinitely, as demonstrated by Chamley (1986). However, Uhlig and Yanagawa (1996) prove that capital income tax can promote economic growth in an overlapping generations model.

This short study analyzes how capital income tax affects not only economic growth but also unemployment. Corneo and Marquardt (2000) consider the unemployment issue with public pension in an overlapping generations model, indicating endogenous growth. Following Corneo and Marquardt (2000), Ono (2010) assumes that trade unions maximize the lifetime income of union members. Yasuoka (2021) extends Ono's (2010) study with a discussion on consumption tax. Kunze and

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[1] Hokusei Gakuen University, 2-3-1, Ohyachi-Nishi, Atsubetsu-ku, Sapporo 004-8631, Japan
E-mail: m-watanabe@hokusei.ac.jp

[2] Research Fellow, Graduate School of Economics, Kobe University

Schuppert (2010) find that the tax reform of cutting labor income tax while imposing a higher capital income tax reduces wages, which, in turn, reduces unemployment. However, studies proving the impact of capital income tax on employment in an overlapping generations model remain scarce. Therefore, this study extends Ono's (2010) and Yasuoka's (2021) research with regard to capital income tax. The present study demonstrates that increasing capital income tax promotes not only economic growth but also employment if pension benefits exist.

The remainder of this paper is organized as follows. Section 2 describes the development of the proposed model, and concluding remarks are provided in section 3.

2. Model

2.1 Households

We consider a standard overlapping generations model with the population size constant and equal to unity. Households are identical, experience two periods, and derive utility from consumption during the young and old periods. During young periods, they have one unit of labor and supply it to the labor market inelastically. Involuntary unemployment caused by trade unions is also included. Thus, we assume that households join trade unions.

If young individuals are employed, they earn wages and allocate them between consumption and savings. Similarly, if unemployed, they receive unemployment benefits and similarly allocate them. When household members are old, they retire and receive pension benefits. Older individuals in particular consume both savings and pension benefits. The utility function is expressed as follows:

$$v_{i,t} = \frac{c_{i,1t}^{1-1/\theta} - 1}{1 - 1/\theta} + \beta \frac{c_{i,2t+1}^{1-1/\theta} - 1}{1 - 1/\theta}, i = e, u. \tag{1}$$

Here, subscript i indicates the status of households. If households are employed, $i = e$, and if unemployed, $i = u$. Moreover, $c_{i,1t}$ and $c_{i,2t+1}$ are the consumption in the young and old periods, respectively, $\theta > 0$ is the intertemporal elasticity of substitution, and $\beta < 1$ is the discount factor. Note that if $\theta \to 1$, the utility function boils down to a log form from equation (1). The budget constraints for the employed individuals are as follows:

$$c_{e,1t} + s_{e,t} = \left(1 - \tau_u - \tau_p\right) w_t, \tag{2}$$

$$c_{e,2t+1} = (1 + R_{t+1}) s_{e,t} + p_{t+1}, \tag{3}$$

$$R_{t+1} \equiv (1 - \tau_r) r_{t+1}. \tag{4}$$

where $s_{e,t}$ is the savings of employed individuals; $\tau_u \in (0,1)$ and $\tau_p \in (0,1)$ are the labor income tax to finance unemployed benefits and pension benefits, respectively, w_t is the wage, $\tau_r \in (0,1)$ is the capital income tax to finance non-productive expenditure, r_{t+1} is the interest rate, p_{t+1} is the pension benefits, and R_{t+1} is the interest factor. Combining equations (2) and (3), the lifetime budget constraints for the employed individuals are as follows:

$$c_{e,1t} + \frac{c_{e,2t+1}}{1 + R_{t+1}} = \left(1 - \tau_u - \tau_p\right) w_t + \frac{p_{t+1}}{1 + R_{t+1}}. \tag{5}$$

Then, the budget constraints for unemployed individuals are as follows:

$$c_{u,1t} + s_{u,t} = b_t, \tag{6}$$

$$c_{u,2t+1} = (1 + R_{t+1}) s_{u,t} + \eta p_{t+1}, \ \ 0 < \eta < 1. \tag{7}$$

where $s_{u,t}$ is the savings of unemployed agents and b_t is the unemployment benefits. Following Yasuoka (2021), we assume $\eta \in (0,1)$. This indicates that unemployed individuals benefit from pensions without contribution, although a smaller amount compared with employed individuals. This assumption reflects the Japanese pension system. Note that $\eta < 1$ is the definitive assumption in this study. Ono (2010) assumes η as a binary variable, that is, $\eta = 0$ or $\eta = 1$.

Combining equations (6) and (7), the lifetime budget constraint for unemployed individuals is expressed as follows:

$$c_{u,1t} + \frac{c_{u,2t+1}}{1 + R_{t+1}} = b_t + \frac{\eta p_{t+1}}{1 + R_{t+1}}. \tag{8}$$

The right-hand side (RHS) of equations (5) and (8) is the lifetime incomes of the employed and unemployed individuals, respectively. The optimal savings for both individuals are as follows:

$$s_{e,t} = \frac{1}{\beta^\theta + (1 + R_{t+1})^{1-\theta}} \left[\beta^\theta (1 - \tau_u - \tau_p) w_t - \frac{p_{t+1}}{(1 + R_{t+1})^\theta}\right], \tag{9}$$

$$s_{u,t} = \frac{1}{\beta^\theta + (1 + R_{t+1})^{1-\theta}} \left[\beta^\theta b_t - \frac{\eta p_{t+1}}{(1 + R_{t+1})^\theta}\right]. \tag{10}$$

2.2 Firms

Firms produce final goods with capital and labor inputs in competitive markets. Based on Kunze and Schuppert (2010), Ono (2010), and Yasuoka (2021), we assume the following production technology:

$$Y_t = AK_t^\alpha (E_t L_t)^{1-\alpha}, 0 < \alpha < 1. \tag{11}$$

where Y_t is the total output, $A > 0$ is the constant technology level, K_t is the aggregate capital input, E_t is the labor efficiency, L_t is the aggregate labor input, and α is a constant parameter. When the population size is unity, L_t describes employment rate. By assuming zero depreciation, the factor demand is expressed as follows:

$$w_t = (1 - \alpha) AK_t^\alpha E_t^{1-\alpha} L_t^{-\alpha}, \tag{12}$$

$$r_t = \alpha AK_t^{\alpha-1} (E_t L_t)^{1-\alpha}. \tag{13}$$

The labor efficiency is expressed as follows:

$$E_t = K_t / L_t. \tag{14}$$

The labor efficiency generates endogenous growth similar to Romer (1986).

2.3 Trade unions

According to Daveri and Tabellini (2000), Ono (2010), and Yasuoka (2021), trade unions increase unemployment. In line with Ono (2010) and Yasuoka (2021), trade unions determine wages to maximize the lifetime income of union members with given interest rates and policy variables. We obtain the following objective function for trade unions:

$$V_t = \left[(1 - \tau_u - \tau_p) w_t + \frac{p_{t+1}}{1 + R_{t+1}}\right] L_t + \left[b_t + \frac{\eta p_{t+1}}{1 + R_{t+1}}\right] (1 - L_t). \tag{15}$$

Substituting equation (12) with equation (15), the first-order condition is as follows:

$$w_t = \frac{1}{(1-\alpha)(1-\tau_u-\tau_p)}\left[b_t - \frac{(1-\eta)p_{t+1}}{1+R_{t+1}}\right]. \tag{16}$$

where $b_t - (1-\eta)p_{t+1}/1 + R_{t+1}$ is the net benefit from social security. Specifically, increased pension benefits reduce this net benefit and, thus, reduce wages. Therefore, firms have an incentive to increase their labor input as indicated by Ono (2010) and Yasuoka (2021).

2.4 Government

The government imposes a tax on labor income to finance social security and a tax on capital income to provide non-productive expenditure under balanced budgets. Note that we assume a pay-as-you-go pension system. The revenue constraints for unemployment and pension benefits are as follows:

$$\tau_u w_t L_t = b_t(1-L_t), \tag{17}$$

$$\tau_p w_t L_t = p_t L_{t-1} + \eta p_t(1-L_{t-1}). \tag{18}$$

The left-hand side (LHS) of equations (17) and (18) is the tax revenue from labor income tax to finance unemployment and pension benefits, respectively. The RHS of equations (17) and (18) is the expenditure on unemployment and pension benefits, respectively. The revenue constraint for non-productive expenditure is denoted as

$$\tau_r r_t s_{t-1} = G_t, \tag{19}$$

where s_{t-1} is the aggregate savings in the previous periods and G_t is the non-productive expenditure. This is in agreement with the findings of Chamley (1986). The LHS of equation (19) denotes the tax revenue for the capital income tax. The aggregate savings in the present period are described as follows:

$$s_t = s_{e,t}L_t + s_{u,t}(1-L_t). \tag{20}$$

2.5 Equilibrium

The clearing condition of the capital market is expressed as follows:

$$K_{t+1} = s_t. \tag{21}$$

We denote $g_t \equiv Y_{t+1}/Y_t = K_{t+1}/K_t$ as the growth rate. Using equations (9), (10), (12), (13), (14), (16), (17), (18), and (20), we obtain the following constant growth rate:

$$g = \frac{\beta^{\theta}(1-\tau_p)(1-\alpha)A}{\beta^{\theta} + (1+R)^{1-\theta} + (1+R)^{-\theta}\tau_p(1-\alpha)A}, \tag{22}$$

$$R \equiv (1-\tau_r)\alpha A. \tag{23}$$

Differentiating equation (22) with respect to τ_r, we derive

$$\frac{dg}{d\tau_r} = \frac{\beta^{\theta}(1-\tau_p)\alpha(1-\alpha)A^2\left\{1-\theta\left[1+\frac{\tau_p(1-\alpha)A}{1+R}\right]\right\}}{(1+R)^{\theta}\left[\beta^{\theta} + (1+R)^{1-\theta} + (1+R)^{-\theta}\tau_p(1-\alpha)A\right]^2}. \tag{24}$$

The sign of $dg/d\tau_r$ is ambiguous, and we obtain the following condition:

$$dg/d\tau_r > 0, if\ \theta < \underline{\theta} \equiv \frac{1}{1+\frac{\tau_p(1-\alpha)A}{1+R}} < 1. \tag{25}$$

Increased capital income tax reduces the interest factor, $R \equiv (1-\tau_r)\alpha A$, which has the following opposite effects on aggregate savings. First, if the income effect dominates substitution effects, a decline in the interest factor increases aggregate savings, as in Uhlig and Yanagawa (1996). Second, a decline in the interest factor increases the discounted pension benefits, thereby reducing aggregate savings. Therefore, if the first effect is relatively large compared to the second effect, a higher capital income tax promotes aggregate savings and, hence, economic growth. Note that if $\theta \to 1$, equation (24) can be rewritten as follows:

$$\frac{dg}{d\tau_r} = \frac{-\beta\tau_p(1-\tau_p)\alpha(1-\alpha)^2A^3}{\left[(1+R)(1+\beta) + \tau_p(1-\alpha)A\right]^2} < 0. \tag{26}$$

From equation (26), $dg/d\tau_r < 0$ holds. If the utility function is log form, the income and substitution effects are canceled. In this case, increasing the capital income tax increases the discounted pension benefits, thereby reducing savings. Thus, a higher capital income tax inhibits economic growth.

We now investigate the impact of capital income tax on the employment rate. Substituting equations (12), (14), (17), and (18) into (16), we obtain the following equilibrium employment rate:

$$\frac{(1-\alpha)(1-\tau_u-\tau_p)}{\frac{L}{1-L}} + \frac{(1-\eta)\tau_p g}{(1+R)\left[\frac{L}{1-L}+\eta\right]} = \tau_u. \tag{27}$$

Figure 1 illustrates how the equilibrium employment rate is derived.

[Figure 1 here]

The equilibrium employment rate is constant and has a unique solution, as shown in Figure 1. Recall that g and R are described in equations (22) and (23), respectively. From the total differentiation of equation (27) with respect to L and τ_r, we derive

$$\frac{dL}{d\tau_r} = \frac{(1-\eta)\tau_p(1-L)}{\frac{(1-\alpha)\left(1-\tau_u-\tau_p\right)(1+R)[L+\eta(1-L)]}{L^2} + \frac{(1-\eta)\tau_p g}{L+\eta(1-L)}} \times \left[\overbrace{\frac{\alpha A g}{1+R}}^{(*1)} + \overbrace{\frac{dg}{d\tau_r}}^{(*2)}\right]. \tag{28}$$

A higher capital income tax reduces the interest factor, $R \equiv (1-\tau_r)\alpha A$, which has the following effects on the employment rate. First, a decline in the interest factor directly increases discounted pension benefits. According to Ono (2010) and Yasuoka (2021), increased pension benefits increase employment. In equation (28), the term $(*1)$ describes the first effect. Second, a higher capital income tax reduces the interest factor, thereby affecting the growth rate. Recall that the sign of $dg/d\tau_r$ is ambiguous from equation (24). If a higher capital income tax promotes economic growth, then the discounted pension benefits increase, thus promoting employment. In equation (28), the term $(*2)$ describes the second effect. Substituting equations (22) and (24) into equation (28), we derive:

$$\frac{dL}{d\tau_r} = \frac{(1-\eta)\tau_p(1-L)}{\frac{(1-\alpha)\left(1-\tau_u-\tau_p\right)(1+R)[L+\eta(1-L)]}{L^2} + \frac{(1-\eta)\tau_p g}{L+\eta(1-L)}} \times \frac{\beta^\theta \alpha(1-\alpha)\left(1-\tau_p\right)\left[(1+R)^\theta \beta^\theta + (1+R)(2-\theta) + (1-\theta)\tau_p(1-\alpha)A\right]A^2}{(1+R)^{1+\theta}\left[\beta^\theta + (1+R)^{1-\theta} + (1+R)^{-\theta}\tau_p(1-\alpha)A\right]^2}. \tag{29}$$

Recall that a higher capital income tax accelerates economic growth if $\theta < \underline{\theta}$ holds and $\underline{\theta}$ is less than unity from equation (25). Further, equation (29) indicates that $dL/d\tau_r > 0$ holds if $\theta < 1$. Thus, we obtain the following proposition.

Proposition 1.

If pension benefits exist and the intertemporal elasticity of substitution is sufficiently small, that is, $\theta < \underline{\theta}$, a higher capital income tax promotes not only economic growth but also employment.

Wang (2015) demonstrates that child allowance improves employment if pension benefits exist. Similarly, the present study shows that capital income tax promotes employment if pension benefits exist.

Next, we analyze how the capital income tax affects employment under the log utility function. Taking $\theta \to 1$, equation (29) can be rewritten as follows:

$$\frac{dL}{d\tau_r} = \frac{(1-\eta)\tau_p(1-L)}{\frac{(1-\alpha)\left(1-\tau_u-\tau_p\right)(1+R)[L+\eta(1-L)]}{L^2} + \frac{(1-\eta)\tau_p\hat{g}}{L+\eta(1-L)}} \times \frac{\beta\alpha(1-\alpha)\left(1-\tau_p\right)(1+R)(1+\beta)A^2}{\left[(1+R)(1+\beta)+\tau_p(1-\alpha)A\right]^2} > 0, \tag{30}$$

$$\hat{g} \equiv \frac{\beta\left(1-\tau_p\right)(1-\alpha)A}{1+\beta+(1+R)^{-1}\tau_p(1-\alpha)A}. \tag{31}$$

Therefore, the following proposition holds.

Proposition 2.

If pension benefits exist and $\theta \to 1$, a higher capital income tax improves employment, although the growth rate declines.

Recall that $dg/d\tau_r < 0$ holds if $\theta \to 1$ from equation (26). Further, the term $(*\,1)$ in equation (28) is larger than the term $(*\,2)$ in equation (28) if $\theta \to 1$. Therefore, increased capital income tax improves employment.

3. Conclusion

The present study constructs a standard overlapping generations model to investigate the impact of capital income tax on employment. It reveals that if a higher capital income tax promotes economic growth, it also promotes employment.

References

Chamley, C. (1986). Optimal taxation of capital income in general equilibrium with infinite lives. *Econometrica*, *54*(3), 607-622.

Corneo, G., and Marquardt, M. (2000). Public pensions, unemployment insurance, and growth. *Journal of Public Economics*, *75*(2), 293-311.

Daveri, F., and Tabellini, G. (2000). Unemployment, growth and taxation in industrial countries. *Economic Policy*, *15*(30), 48-104.

Kunze, L., and Schuppert, C. (2010). Financing social security by taxing capital income: A bad idea? *FinanzArchiv: Public Finance Analysis*, 243-262.

Ono, T. (2010). Growth and unemployment in an OLG economy with public pensions. *Journal of Population Economics*, *23*(2), 737-767.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, *94*(5), 1002-1037.

Uhlig, H., and Yanagawa, N. (1996). Increasing the capital income tax may lead to faster growth. *European Economic Review*, *40*(8), 1521-1540.

Wang, L. (2015). Fertility and unemployment in a social security system. *Economics Letters*, *133*, 19-23.

Yasuoka, M. (2021). How should a government finance pension benefits? *Australian Economic Papers*, *60*(1), 138-152.

Figure 1 Equilibrium employment rate