Optimal asymmetric taxation in a two-sector model with population ageing

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Golden rule:

r- returns to capital; δ- capital depreciation; n - population growth (fertility); a - technological growth.

- $1 + r = \delta + n + a$, Golden rule.

Simplified version: $\delta = 1$, $a = 0$.

- $r = n$, Golden rule;

Literature:

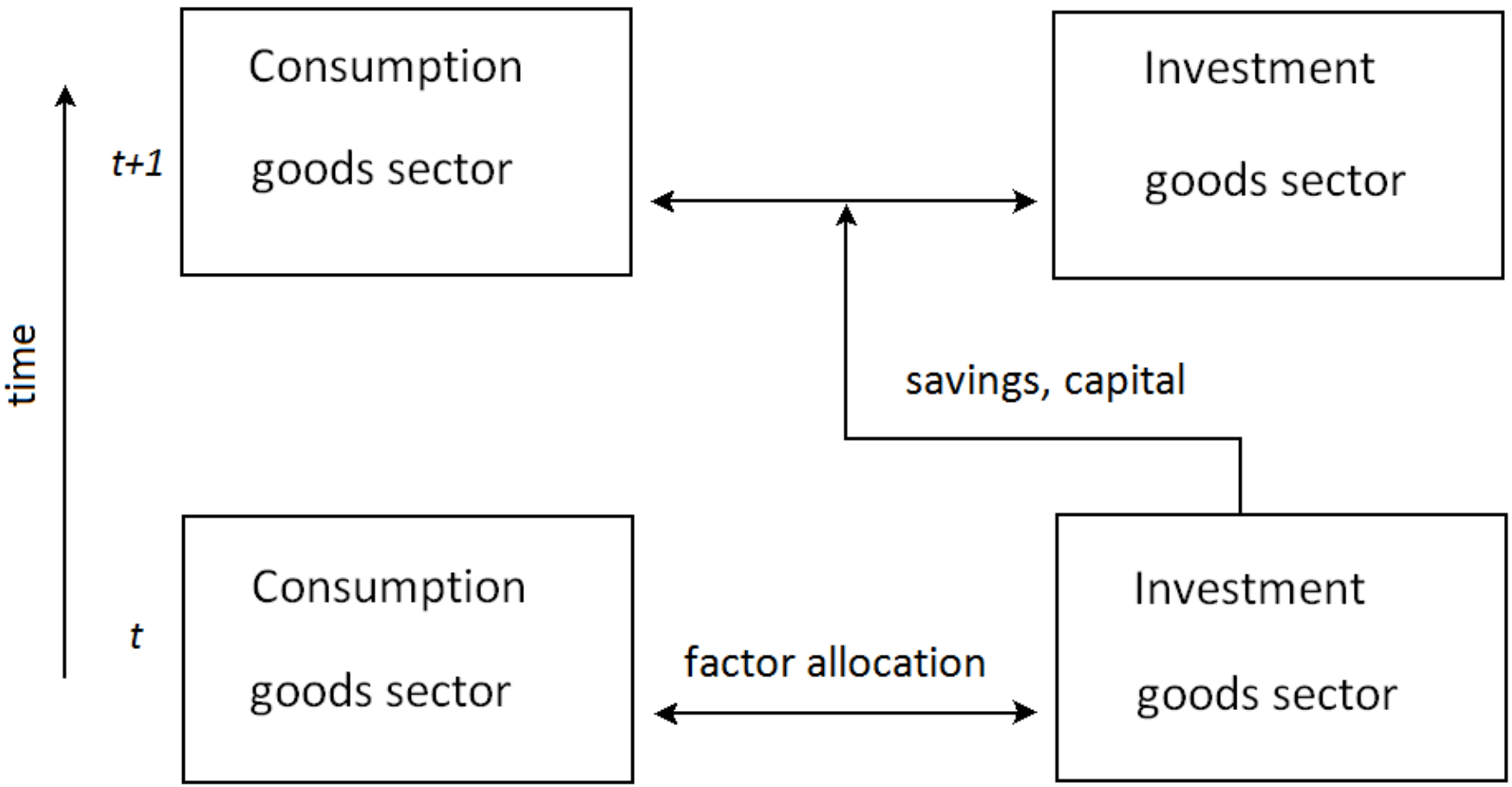
Golden rule:

- Phelps E. (1961) The golden rule of accumulation: A fable for growthmen. American Economic Review 51, 638-643.
- Aaron, H. (1966). The Social Insurance Paradox. The Canadian Journal of Economics and Political Science 32, 371-374.
- Cremers E.T. (2006). Dynamic efficiency in the two-sector overlapping generations model. Journal of Economic Dynamics and Control 30, 1915-1936.

Policies, which may lead to the Golden rule:

- It is possible to tax consumption and subsidize savings or viceversa. (Does not work with the logarithmic utility function.)
- Switch from public pensions to private or viceversa. (In many countries public pensions are already at the zero bound.)

Figure: General structure of the model



Selim's papers:

- Selim, S. (2009). Optimal capital income taxation in a two sector economy. In: Duffy D, Shinnick E (eds) Public good, public policy and taxation: a European perspective. LIT, Verlag, Berlin.
- Selim, S. (2010). Optimal taxation in a two sector economy with heterogeneous agents. Economics Bulletin 30 (1), 534-542.
- Selim, S. (2011). Optimal taxation and redistribution in a two sector two class agents' economy. Cardiff economics working papers, Nr. E2011/6.

The model:

- Dynamic framework (two-period overlapping generations).
- Two-sector model:
  - consumption goods, which can be consumed, and cannot be invested;
  - investment goods, which can be invested, but cannot be consumed.
- Agents may die before the second period of life.
- I focus on the labour taxes, but capital taxation and VAT give very similar results.

Production functions

Production functions in two sectors:

$$Y_C(t) = K_C^{\alpha}(t) L_C^{1-\alpha}(t), \tag{1}$$

$$Y_I(t) = K_I^{\beta}(t) L_I^{1-\beta}(t). \tag{2}$$

- Y- Output, K - capital, L -labour.
- C, I - indexes for consumption and investment good sectors.
- Wages and interest rates are equal to the marginal products and expressed in consumption goods.

Households

Log-linear utility function:

$$U_x(t) = \log C_x^y(t) + \frac{\psi}{1+\rho} \log C_x^o(t+1), \quad x \in \{C, I\}, \tag{3}$$

- C_x^y - Consumption when young;
- C_x^o - Consumption when old;
- ρ - Discount rate;
- ψ - Longevity (probability of surviaval before the second period of life);
- Agents work when young, get wages, consume and invest;
- Agents consume when old from savings.

Budget constraints:

$$C_x^y(t) = w_x(t)(1-\tau_x) - s_x(t), \tag{4}$$

$$C_x^o(t+1) = (1+R_x(t+1))s_x(t), \quad x \in \{C, I\}. \tag{5}$$

- s_x - Savings;
- R_x - Interest rate adjusted for annuities;
- w_x - Wage;
- τ_x -Sector specific taxes/subsidies.

FOC of utility maximization:

$$\Longrightarrow s_x(t) = \frac{\psi w_x(t)(1-\tau_x)}{1+\rho+\psi}, \quad x \in \{C, I\}. \tag{6}$$

Equilibrium

- Production factor mobility: net returns to labour and capital equalise in the sectors;
- Market clearing: All consumption goods are consumed and investment goods are invested.

Government budget

- Government's task: To choose τ_C and τ_I, which maximize agents' utilities (for labour or capital taxes equivalent to Y_C maximization);
- Budget constraint: $L_C w_C \tau_C + L_I w_I \tau_I = G = 0$.

$$\tau_C = -\frac{\tau_I \psi(1-\beta)}{1+\rho+\beta\psi}. \tag{7}$$

Optimal labour taxation

- Optimal tax in sector I:

$$\tau_I^* = \frac{1-\alpha-\beta-\alpha(1+\rho)/\psi}{1-\beta}. \tag{8}$$

- Alternative optimality condition:

$$r^* = \frac{n(\alpha\rho+\beta\psi+\alpha)}{\psi(1-\alpha)}. \tag{9}$$

- n - population growth in terms of fertility.

Numerical example

- Parameter values widely used in the literature $\beta = 0.4$, $\rho = 0.4166$, $\psi = 0.9$.

Figure: Utility

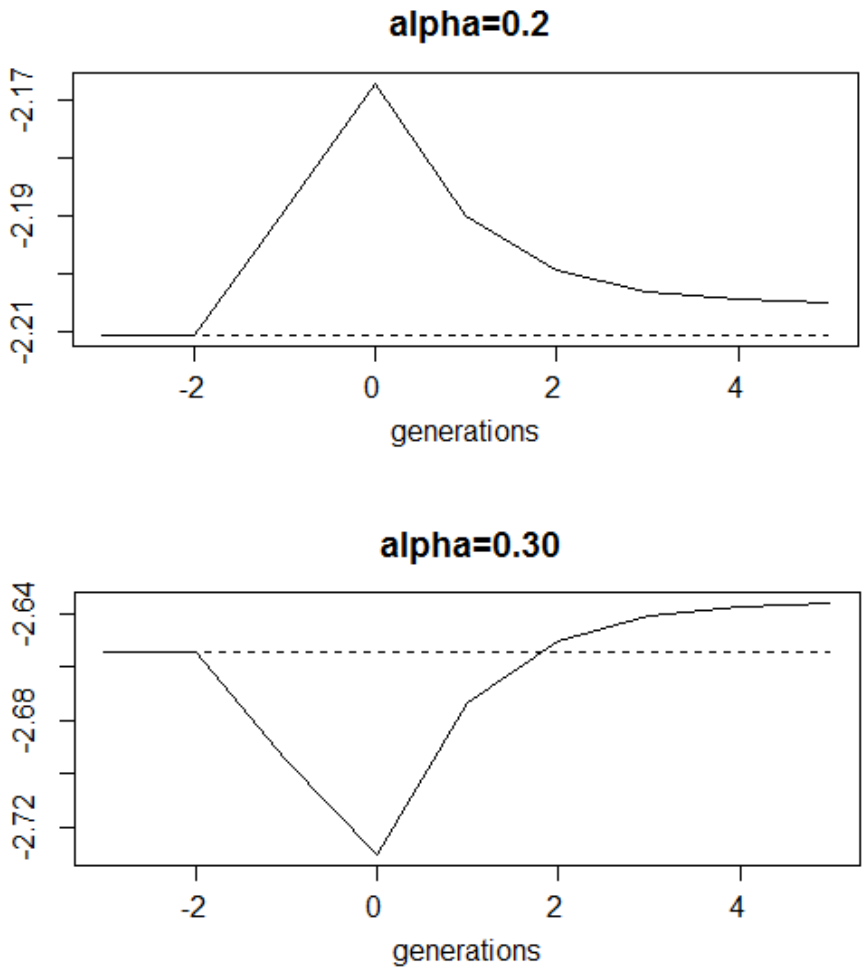
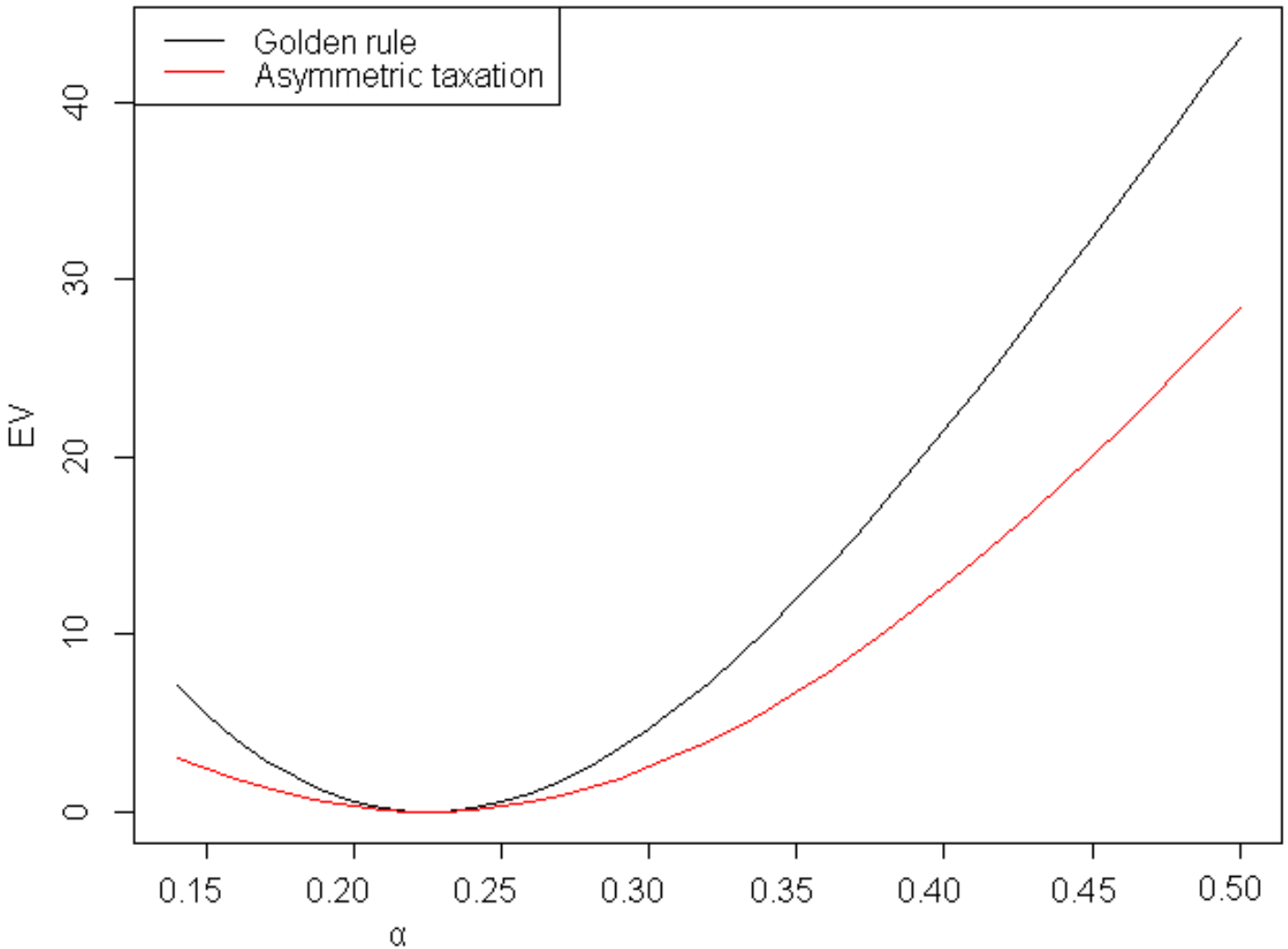


Figure: Comparison with the Golden Rule



Conclusions

- Asymmetric taxation may increase welfare;
- Asymmetric taxation is suboptimal compared to the policies, which lead to the golden rule.