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Income growth, inequality and preference for education investment: a note

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Abstract

Based on Glomm and Ravikumar (1992), this paper described the relation between preferences for educational investment for children and income growth or income inequality. The result derived using the constant relative risk aversion (CRRA) utility function differs from that derived using the log utility function. With the CRRA utility function, even if human capital is produced using constant returns to scale inputted by educational investment and parental human capital, the income converges to the steady state and income inequality vanishes in the long run, which is not derived by the log utility function.

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1 Introduction

Glomm and Ravikumar (1992) set a simple model and derived an interesting result about income growth and inequality. In Glomm and Ravikumar (1992), parents care about their consumption and their educational investment for their children. The utility function is assumed as a log form function. Glomm and Ravikumar (1992) showed that income grows with constant income inequality under human capital produced by constant returns to scale for educational investment and parental human capital.

However, this result depends on the accumulation technology of human capital. For instance, this result is altered by the externality of human capital, e.g., Tamura (1991), Gradstein and Justman (1997), Yasuoka, Nakamura and Katahira (2008). Tamura (1991) considered externality of human capital and income inequality shrinkage. Yasuoka, Nakamura, and Katahira (2008) also considered an externality of human capital. Concretely, human capital is assumed to be produced by inputting average human capital in addition to educational investment and parental human capital. Based on this model setting, Yasuoka, Nakamura, and Katahira (2008) showed income growth with shrinking income inequality.

Some earlier papers described that income growth and inequality depend on an accumulation technology of human capital. The preference for educational investment should be considered in income growth and inequality also. However, few studies have considered the phenomenon. Of course, Glomm and Ravikumar (2001, 2003) considered a CRRA utility function that is different from log utility functions. However, Glomm and Ravikumar (2001, 2003) specifically examined public education financed by government expenditure under certain parametric conditions which maintain a stable steady state that brings constant human capital over time. On the other hand, we specifically examine private education financed by parents. Depending on a preference for educational investment, income growth and inequality change even if human capital is produced by constant returns to scale for educational investment and parental human capital. First, human capital (income) converges to the steady state and income inequality vanishes in the long run. However, we derived that human capital (income) continues increasing and decreasing based on initial human capital. Within the group that continues decreasing human capital, income inequality shrinks. In contrast, within the group that continues increasing human capital, income inequality is magnified. Glomm and Ravikumar (1992) derived this result; however, it occurs if human capital is produced using technology that offers increasing returns to scale. However, we derived this result by considering the CRRA utility function. We insist that it is important to consider a utility function form in income growth and inequality. As Glomm (1997) pointed out, human capital dynamics is affected by the model setting. Our paper presented one example.

The remainder of this paper is presented as follows. Section 2 suggests our model and we derive the equilibrium and investigate the relation between the preference of educational investment and income growth in section 3. Section 4 discusses income inequality; the final section concludes this paper.

2 The Model

We consider an overlapping generations model in which each household exists for two periods as either a child or adult household. Children receive education from their parents. The adult people as parents supply a unit of labor inelastically and allocate consumption and education investment for their children. No population growth exists. Each individual utility function u_t is assumed as

$$u_t = \frac{c_t^{1-\sigma}}{1-\sigma} + \frac{e_t^{1-\phi}}{1-\phi},\ 0 < \sigma, \phi, \tag{1}$$

where c_t and e_t respectively signify consumption in adult and education investment. Glomm and Ravikumar (2001) assumed the utility function as $\frac{n_{t-1}^{1-\sigma}+c_t^{1-\sigma}}{1-\sigma} + \frac{e_t^{1-\phi}}{1-\phi}$. They considered schooling time n_t. With $\sigma = \phi = 1$, we obtain $\ln n_{t-1} + \ln c_t + \ln e_t$. We insist on the preference for education investment as ϕ.

If adult people supply a unit of labor, then they gain h_t as labor income. Then h_t denotes human capital stock. Considering that labor income is distributed between consumption and education investment, the budget constraint is given as

$$c_t + e_t = h_t. \tag{2}$$

Child human capital h_{t+1} is produced by inputting education investment e_t and parental human capital h_t according to

$$h_{t+1} = Ae_t^{\alpha} h_t^{1-\alpha}, \ 0 < \alpha < 1. \tag{3}$$

Except for schooling time, this accumulation form is the same as that of Glomm and Ravikumar (1992).

3 Equilibrium

Under the budget constraint (2), each individual determines the allocation of c_t and e_t to maximize the utility as

$$c_t = e_t^{\frac{\phi}{\sigma}}, \tag{4}$$

$$e_t + e_t^{\frac{\phi}{\sigma}} = h_t. \tag{5}$$

Substituting (5) into (3), we obtain the growth of income shown as

$$\frac{h_{t+1}}{h_t} = \frac{A}{\left(1 + e_t^{\frac{\phi}{\sigma}-1}\right)^{\alpha}}. \tag{6}$$

If $\sigma = \phi = 1$, then income growth becomes $\frac{h_{t+1}}{h_t} = \frac{A}{2^{\alpha}}$. With $\frac{A}{2^{\alpha}} > 1$, income growth generates. The result is the same as that presented by Glomm and Ravikumar (1992).[1]

We consider the case of $\sigma \neq 1$ and $\phi \neq 1$. Education investment e_t increases with human capital h_t. Therefore, income growth depends on parameters σ and ϕ. With $\phi - \sigma > 0$, the income growth $\frac{h_{t+1}}{h_t}$ decreases because of an increase in h_t and eventually converges to zero. On the other hand, if $\phi - \sigma < 0$, then income growth increases with h_t to infinity. Therefore, we establish the following proposition.

Proposition 1 With $\phi - \sigma > 0$, income growth decreases. However, if $\phi - \sigma < 0$, then income growth increases.

[1] Although Glomm and Ravikumar (1992) considered schooling time, we do not consider it herein. However, the schooling time in Glomm and Ravikumar (1992) is always constant over time. This result does not depend on whether schooling time exists or not.

This proposition shows the importance of preference for education in income growth. Glomm and Ravikumar (1992) showed constant income growth in $\phi = \sigma = 1$, which brings the log utility function. In the log utility function, education investment is completely proportional to income. Therefore, constant income growth occurs. However, $\phi \neq 1$ and $\sigma \neq 1$ changes the relation between education investment and income. Figure 1 shows that educational investment e_t is positively correlated with income h_t.

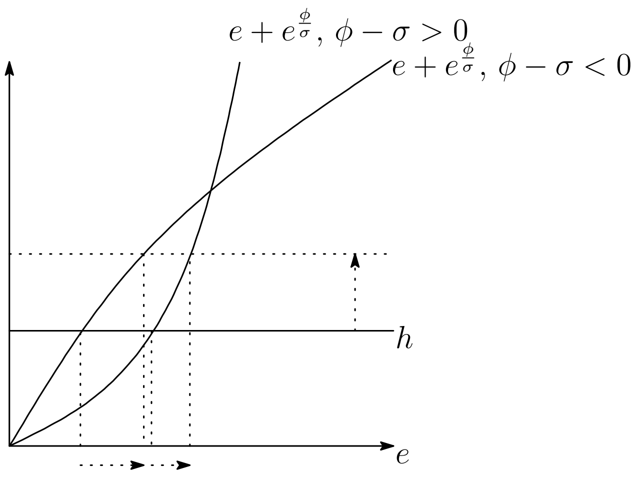

Fig. 1: ϕ and e

However, if $\phi - \sigma > 0$, then the ratio of educational investment to income decreases. Consequently, income growth decreases as well. Glomm and Ravikumar (1992) showed that if human capital is accumulated according to decreasing returns to scale, then income growth decreases. However, without a log utility function, income growth does not decrease because of an increase in education investment share to income as long as $\phi - \sigma < 0$, even if human capital is accumulated by decreasing returns to scale.

In fact, we consider the alternative utility function as $\beta \ln c_t + (1-\beta) \ln e_t$ $(0 < \beta < 1)$. Then, we derive the first order condition as $e_t = \frac{1-\beta}{\beta} c_t$. We consider a decrease in β as an increase in preference for educational investment. However, the result—that the educational investment share to income is constant—does not change. Therefore, the difference between CRRA and the log utility function yields a substantially different result.

We calculate $\frac{dh_{t+1}}{dh_t}$ at the steady state, which is defined by $h_{t+1} = h_t$ as

$$\frac{dh_{t+1}}{dh_t} = \frac{\alpha \left(e + e^{\frac{\phi}{\sigma}} \right)}{e + \frac{\phi}{\sigma} e^{\frac{\phi}{\sigma}}} + 1 - \alpha, \tag{7}$$

where e denotes education investment at the steady state. We find $0 < \frac{dh_{t+1}}{dh_t} < 1$ in $\phi - \sigma > 0$ and $1 < \frac{dh_{t+1}}{dh_t}$ in $\phi - \sigma < 0$. In $\phi - \sigma < 0$, if an initial human capital h_0 is more than h, which denotes the human capital at the steady state, then income increases over time. Otherwise, income decreases. On the other hand, with $\phi - \sigma > 0$, human capital converges to h irrespective of an initial human capital h_0 (See Fig. 2).

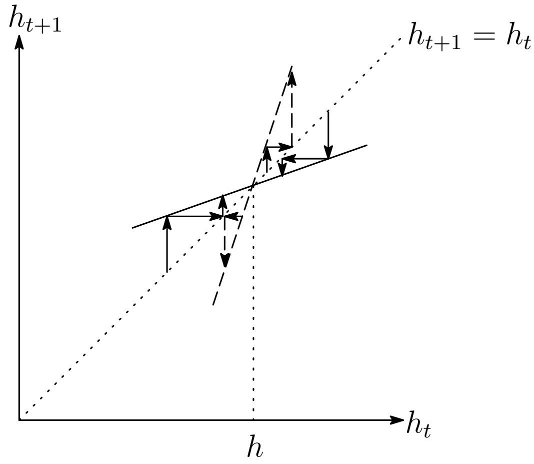

Fig. 2: Convergence or Divergence

4 Discussion

Glomm and Ravikumar (1992) assumed income inequality among households: an initial income (human capital) h_0 is distributed based on a lognormal distribution. With log utility preference ($\sigma = \phi = 1$) and constant returns to scale of human capital accumulation, the income inequality does not shrink.

However, we show that the preference for educational investment plays an important role in deciding the process of income inequality. With $\phi - \sigma > 0$, human capital converges to h for any h_0 because income growth decreases. Therefore, income inequality vanishes. We can explain this result. If $\phi - \sigma > 0$, then the education investment share to income decreases even if income increases. The low h_t household gives a high education investment share to income for children; however, the high h_t household gives a low education investment share to income for children.

With $\phi - \sigma < 0$, the steady state becomes unstable. Therefore, if $h_0 < h$, then income continues decreasing with shrinking income inequality among the households specified by $h_0 < h$. On the other hand, if $h_0 > h$, then income continues increasing. Moreover, the growth rate of income also increases. Therefore, income inequality among the households specified by $h_0 > h$ is magnified, which is one example illustrating between and within income inequality.

5 Conclusions

This paper presented how a household's preference for educational investment for their children affects income growth and income inequality. Depending on the preference for educational investment, income converges to a steady state with no income inequality even if human capital is produced using constant returns to scale technology. This result differs from the log utility function. We used the constant relative risk aversion (CRRA) utility function. The log utility function is given as the specific function of CRRA.

This paper presupposes an importance of preference for educational investment in determining income growth and inequality. However, it is natural that income growth and inequality depend on the preference for educational investment because the preference determines the amount of education for children.

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