
Munich Personal RePEc Archive

Intergenerational Mobility and Policy in an Aging Population

Miyake, Yusuke and Yasuoka, Masaya

Shigakukan University, Kwansei Gakuin University

23 September 2018

Online at https://mpra.ub.uni-muenchen.de/89139/
MPRA Paper No. 89139, posted 24 Sep 2018 13:22 UTC

Intergenerational Mobility and Policy in an Aging Population[†]

Yusuke Miyake[‡] Masaya Yasuoka[§]

Abstract

In an aging society, income inequality persists as a severe social problem. Many factors bring about income inequality. Our paper presents consideration of intergenerational mobility and income inequality. Children can not obtain an education investment from their parents if the parents are poor. However, children that are reared by rich parents have a high probability of becoming skilled workers because of sufficient education investment without expending a large amount of effort. Not only education subsidies, but also postponing retirement timing and an increase in pension benefit increase the effort to become a skilled laborer. Therefore the intergenerational mobility from poor to the rich is increased. This paper presents an examination of the effects of an aging population on intergenerational mobility.

Keywords: Aging population, Education, Intergenerational mobility, Skilled and unskilled labor
JEL Classifications: I24, H23

[†] We thank the seminar participants for helpful comments. Our paper is financially supported by JSPS KAKENHI (No. 17K03746, 17K03791). However, any remaining errors are the authors' responsibility.
[‡] Shigakukan University
[§] Corresponding to: Kwansei Gakuin University, 1-155 Ichiban-Cho Uegahara Nishinomiya Hyogo Japan 662-8501, Email: yasuoka@kwansei.ac.jp

1. Introduction

OECD (Organization for Economic Co-operation and Development) Data show that income inequality, as represented by the Gini coefficient, increased during 1985–2011 in OECD countries.[1] The OECD data show that inequality between a low income group and other income groups increases. Income inequality is resolved by a redistribution policy or education policy. If parents are poor, their children are unable to obtain a sufficient level of education investment. The children then can not obtain sufficient wage income as skilled workers because of a lack of education. This is intergenerational immobilization of the hierarchy. However, by virtue of adequate policy, we can obtain results by which intergenerational mobility is facilitated by a decrease in income inequality or in the poverty rate.

Many related studies have examined income inequality. Based on Maoz and Moav (1999), Nakamura and Murayama (2011) derive the dynamics of income inequality and intergenerational mobility and the effect of technological changes on inequality. Hassler, Mora, and Zeira (2007) set a model with intergenerational mobility and derive wage inequality as strongly correlated with intergenerational mobility.

This paper sets a model with intergenerational mobility and uses it to examine how a policy such as redistribution policy affects intergenerational mobility. Similarly to Owen and Weil (1998), we endogenize education investment by parents in children and examine education subsidies to ascertain whether intergenerational mobility is facilitated or not. Iyigun (1999) examines effect of public education on intergenerational mobility. This paper is based on private education that is partially subsidized.

In addition, this paper presents examination of how an increase in pension benefits affects intergenerational mobility. Le Garrec (2015) derives that education investment increases if the pension benefit depends on the wage level. Our paper presents examination of the model with intergenerational mobility.

Moreover, this paper presents an examination of the effects of postponing retirement timing. As described by Hirazawa and Yakita (2017) and others, many related papers examine the effects of elderly laborers on macroeconomic variables. Our paper presents an examination of how postponing retirement affects intergenerational mobility. Moreover, we give some consideration to policy variables that are given exogenously. One can regard endogenous variables as political equilibrium, as demonstrated by Arawatari and Ono (2013).

The results obtained through his study are the following. Postponing retirement raises the number of skilled workers. Then intergenerational mobility increases. The intergenerational mobility is facilitated if the pension benefit depends on the wage level in the working generation.

The remainder of this paper is presented as follows. Section 2 explains the model. Section 3

[1] Data: OECD Statistics.

examines effects of postponing retirement. Sections 4 and 5 respectively present examinations of the effects of the education subsidy and pension. The final section concludes our manuscript.

2. Model

Labor of two types is used: skilled labor and unskilled labor. The wages of skilled laborers and unskilled laborers are represented respectively by w^s and w^u. Our paper assumes a small open economy in which the wage rate and interest rate are given exogenously.

Individuals can live in childhood and in adulthood. However, during the old period, there exist individuals who can not live during the old period. Our paper presents consideration of the survival rate p as life expectancy ($0 < p < 1$). Individuals devote attention to education investment for children e_t and consumption during the old period c_{t+1}. However, in childhood, the individuals have disutility for education effort.

Our paper assumes no population growth and sets the population size as unity. Then, the utility function is assumed as

$$u_t = \alpha lne_t + p(1-\alpha)lnc_{t+1} - \phi v_t, 0 < \alpha < 1. \quad (1)$$

The $-\phi v_t$ value represents disutility for educational effort. Also, v_t is assumed as

$$v_t = a - e_{t-1}. \quad (2)$$

Therein, e_{t-1} denotes the education investment from the parents. Also, *a* expresses education effort, which differs among individuals. For these analyses, we assume that education effort *a* is distributed by the uniform distribution between $[0, \bar{a}]$.

If the individuals decide to consume education time, then $\phi = 1$ is given. Otherwise, $\phi = 0$.

The budget constraint in the young period is presented as

$$(1-\tau)w^i = s_t + (1-x)e_{t-1}, i = s, u. \quad (3)$$

As shown there, s_t represents saving for consumption during the old period. τ stands for the income tax rate. The government collects tax revenues with income taxation and provides an education subsidy (subsidy rate: x) and pension benefit p_{t+1}. The budget constraint for the older period is

$$Rs_t + p_{t+1} = c_{t+1}. \quad (4)$$

In that equation, R signifies the interest rate of an annuity. If the interest rate is given by r and the capital income and saving that deceased people have are distributed equally among older people, then $R = \frac{1+r}{p}$ is obtainable. The lifetime budget constraint is

$$(1-\tau)w^i + \frac{p_{t+1}}{R_{t+1}} = (1-x)e_{t-1} + \frac{c_{t+1}}{R_{t+1}}. \quad (5)$$

Without policies, $x = 0, \tau = 0, p_{t+1} = 0$, the household optimal allocations are

$$e_t = \frac{\alpha}{\alpha + p(1-\alpha)} w^i, \quad (6)$$

$$c_{t+1} = \frac{Rp(1-\alpha)}{\alpha + p(1-\alpha)} w^i \,. \tag{7}$$

To be a skilled laborer, individuals must expend education effort *a*. Otherwise, the individuals must work as unskilled laborers. If the individual works as a skilled laborer, then the utility is

$$u_t^s = \big(\alpha + p(1-\alpha)\big) ln w^s + \alpha ln \frac{\alpha}{\alpha + p(1-\alpha)} + p(1-\alpha) ln \frac{Rp(1-\alpha)}{\alpha + p(1-\alpha)} - \big(a - e_{t-1}^i\big), \tag{8}$$

However, if the individuals work as unskilled laborers, then the utility is

$$u_t^u = \big(\alpha + p(1-\alpha)\big) ln w^u + \alpha ln \frac{\alpha}{\alpha + p(1-\alpha)} + p(1-\alpha) ln \frac{Rp(1-\alpha)}{\alpha + p(1-\alpha)}, \tag{9}$$

As long as $u_t^u < u_t^s$, the individuals expend the effort for education. However, whether the individuals pay for educational effort or not depends on the education investment from parents e_{t-1}^i.

If the parents work as skilled laborers, then indifference *a* to becoming a skilled laborer or unskilled laborer is represented as

$$a_t^s = \big(\alpha + p(1-\alpha)\big) ln \frac{w^s}{w^u} + \frac{\alpha}{\alpha + p(1-\alpha)} w^s \,. \tag{10}$$

If the parents work as unskilled laborers, then indifference *a* to being a skilled laborer or unskilled laborer is given such that the following equation holds:

$$a_t^u = \big(\alpha + p(1-\alpha)\big) ln \frac{w^s}{w^u} + \frac{\alpha}{\alpha + p(1-\alpha)} w^u. \tag{11}$$

The share of $\frac{a_t^s}{\bar{a}}$ of the children among parents who work as skilled laborers work as skilled laborers; the share of $\frac{\bar{a} - a_t^s}{\bar{a}}$ work as unskilled laborers. However, the share of $\frac{a_t^u}{\bar{a}}$ of children of parents who work as unskilled laborers work as skilled laborers. The share of $\frac{\bar{a} - a_t^u}{\bar{a}}$ work as unskilled laborers.

We derive how an increase in p affects an aging population. We can obtain the following condition to obtain $\frac{da_t^i}{dp}$.

$$p > \frac{\sqrt{\frac{\alpha w^i}{ln \frac{w^s}{w^u}}}}{1-\alpha} - \frac{\alpha}{1-\alpha}, i = s, u \tag{12}$$

An increase in p raises demand for education because an increase in p increases the utility from consumption that is given by the wage rate. However, an increase in p decreases the relative share of education investment from parents. These two countervailing effects derive the condition represented as (12).

3. Elderly labor

If the household works not only in adulthood but also during the old period, how does the skilled laborer share change? The budget constraint in the old period changes to the following:

$$Rs_t + \lambda w^i = c_{t+1}. \tag{13}$$

For simplicity, we omit the pension benefit p_{t+1}. In the equation, λ denotes the length of elderly labor within $0 < \lambda < 1$. This setting is the same as that used by Kunze (2014), Tanaka (2017) and others. Then, the lifetime budget constraint is given as

$$\left(1 + \frac{\lambda}{R}\right) w^i = e_t + \frac{c_{t+1}}{R}. \tag{14}$$

If the individual works as a skilled laborer, then the utility is given as

$$\begin{aligned} u_t^s = \big(\alpha + p(1-\alpha)\big) ln\left(1 + \frac{\lambda}{R}\right) w^s + \alpha ln \frac{\alpha}{\alpha + p(1-\alpha)} \\ + p(1-\alpha) ln \frac{Rp(1-\alpha)}{\alpha + p(1-\alpha)} - \big(a - e_{t-1}^i\big). \end{aligned} \tag{15}$$

However, if the individuals work as an unskilled laborer, then the utility is given as

$$\begin{aligned} u_t^u = \big(\alpha + p(1-\alpha)\big) ln\left(1 + \frac{\lambda}{R}\right) w^u + \alpha ln \frac{\alpha}{\alpha + p(1-\alpha)} \\ + p(1-\alpha) ln \frac{Rp(1-\alpha)}{\alpha + p(1-\alpha)}. \end{aligned} \tag{16}$$

As long as $u_t^u < u_t^s$, the individuals expend the effort for education. However, whether the individuals pay for education effort or not depends on the education investment from the parents e_{t-1}^i., which is given as

$$e_{t-1}^i = \frac{\alpha}{\alpha + p(1-\alpha)} \left(1 + \frac{\lambda}{R}\right) w^i . \tag{17}$$

If the parents work as skilled laborers, then indifference *a* to becoming a skilled laborer or unskilled laborer is given such that the following equation holds:

$$a_t^s = \big(\alpha + p(1-\alpha)\big) ln \frac{w^s}{w^u} + \frac{\alpha}{\alpha + p(1-\alpha)} \left(1 + \frac{\lambda}{R}\right) w^s . \tag{18}$$

If parents work as unskilled laborers, then indifference *a* to becoming skilled laborers or unskilled laborers is given as

$$a_t^u = \big(\alpha + p(1-\alpha)\big) ln \frac{w^s}{w^u} + \frac{\alpha}{\alpha + p(1-\alpha)} \left(1 + \frac{\lambda}{R}\right) w^u . \tag{19}$$

Thanks to λ, both a_t^s and a_t^u increase: the share of skilled laborer nevertheless raises the type of parents.

4. Education subsidy

The government budget constraint is presented below.

$$\tau(w^s L_t^s + w^u L_t^u) = x(e_t^s L_t^s + e_t^u L_t^u), \tag{20}$$

As shown there, L_t^s and L_t^u respectively denote skilled and unskilled workers. Then, a_t^s and a_t^u change to the following:

$$a_t^s = \big(\alpha + p(1-\alpha)\big) ln \frac{w^s}{w^u} + \frac{1-\tau}{1-x} \frac{\alpha}{\alpha + p(1-\alpha)} w^s . \tag{21}$$

$$a_t^u = \big(\alpha + p(1-\alpha)\big) ln \frac{w_t^s}{w_t^u} + \frac{1-\tau}{1-x} \frac{\alpha}{\alpha + p(1-\alpha)} \left(1 + \frac{\lambda}{R}\right) w_t^u. \tag{22}$$

Differentiation of $\frac{1-\tau}{1-x}$ with respect to x is reduced to $1 - \frac{d\tau}{dx}$ at the approximation of $x = 0$ and we can obtain the results that an increase in x raises a_t^s and a_t^u because $\frac{d\tau}{dx} = \frac{\alpha}{\alpha + p(1-\alpha)} < 1$. Therefore, the subsidy for education raises the share of skilled laborers among parents of both types.

5. Pension

The government provides a pension policy and education subsidy with a balanced budget. The government budget constraint is given as

$$\tau(w^s L_t^s + w^u L_t^u) = p p_{t+1}. \tag{23}$$

We can consider pension benefits of two types: Beverage type pension and Bismarkian type pension. The Beverage type pension is a pension benefit that is distributed equally irrespective of the income level.

$$p_{t+1} = \frac{\tau\ (w^s L_t^s + w^u L_t^u)}{p}. \tag{24}$$

Then, the lifetime budget constraint is given as

$$(1-\tau) w^i\ + \frac{p_{t+1}}{R} = e_t + \frac{c_{t+1}}{R}. \tag{25}$$

Then, a_t^s and a_t^u change to the following.

$$a_t^s = \big(\alpha + p(1-\alpha)\big) ln \frac{w^s}{w^u} + \frac{\alpha}{\alpha + p(1-\alpha)} \left((1-\tau) w^s\ + \frac{p_{t+1}}{R}\right). \tag{26}$$

$$a_t^u = \big(\alpha + p(1-\alpha)\big) ln \frac{w^s}{w^u} + \frac{\alpha}{\alpha + p(1-\alpha)} \left((1-\tau) w^u\ + \frac{p_{t+1}}{R}\right). \tag{27}$$

Actually, a_t^u rises because the net pension benefit of unskilled laborer always rises by virtue of the

redistribution from skilled laborers.[2] However, skilled laborers' net pension benefit can not rise. Therefore, a_t^s is reduced.[3]

We consider the Bismarkian pension as the other type of pension. Consequently, the government budget constraints are

$$p_{t+1}^s = \frac{\tau\, w^s\, L_t^s}{pL_{t-1}^s}. \tag{28}$$

$$p_{t+1}^u = \frac{\tau\, w^s\, L_t^u}{pL_{t-1}^u}. \tag{29}$$

The lifetime budget constraint is

$$\left(1+\tau\left(\frac{L_t^s}{pL_{t-1}^s}\frac{1}{R}-1\right)\right)w^s = e_t + \frac{c_{t+1}}{R}. \tag{30}$$

$$\left(1+\tau\left(\frac{L_t^s}{pL_{t-1}^s}\frac{1}{R}-1\right)\right)w^u = e_t + \frac{c_{t+1}}{R}. \tag{31}$$

Then, a_t^s and a_t^u change to the following:

$$a_t^s = \big(\alpha+p(1-\alpha)\big)ln\frac{w^s}{w^u} + \frac{\alpha}{\alpha+p(1-\alpha)}\left((1-\tau)w^s + \tau\frac{L_t^s}{pL_{t-1}^s}\frac{w^s}{R}\right). \tag{32}$$

$$a_t^u = \big(\alpha+p(1-\alpha)\big)ln\frac{w^s}{w^u} + \frac{\alpha}{\alpha+p(1-\alpha)}\left((1-\tau)w^u + \tau\frac{L_t^u}{pL_{t-1}^u}\frac{w^u}{R}\right). \tag{33}$$

However, if $\frac{L_t^s}{pL_{t-1}^s}\frac{1}{R}-1>0$, then an increase in contribution rate τ increases a_t^s and a_t^u because the education investment increases. However, if $L_t^s = L_{t-1}^s$ and $L_t^u = L_{t-1}^u$ as the equilibrium in the long run, we obtain $\frac{1}{pR}-1<0$. Therefore, an increase in τ reduces a_t^s and a_t^u.

6. Conclusions

For the analyses explained in this paper, we set a model with intergenerational mobility and income inequality. Many papers have described research related to this topic. In contrast to them, our paper presents examination of how an aging population and the policy affect intergenerational mobility. An aging population can provide increased numbers of skilled workers. However, because of a decrease in education investment from parents to children, an aging population might reduce the skilled workers. Postponement of retirement raises the share of skilled workers because the education investment

---

[2] With differentiation $(1-\tau)w^u + \frac{p_{t+1}}{R}$ with respect to τ at the approximation of $\tau=0$, we obtain the condition to increase $(1-\tau)w^u + \frac{p_{t+1}}{R}$ as $\frac{\frac{w^s}{w^u}L_t^s+L_t^u}{1+r}>1$. With $\frac{\frac{w^s}{w^u}L_t^s+L_t^u}{1+r}>1$, we can obtain $\frac{da_t^u}{d\tau}>0$.

[3] With differentiation $(1-\tau)w^s + \frac{p_{t+1}}{R}$ with respect to τ at the approximation of $\tau=0$, we obtain $\frac{L_t^s+\frac{w^u}{w^s}L_t^u}{1+r}<1$. Then, a_t^s decreases.

increases the lifetime wage income. Moreover, by providing the pension benefit, many individuals who have unskilled laborers as parents can become skilled laborers. As demonstrated by the analyses presented in this paper, instead of an education subsidy to increase skilled workers, these policies can raise the share of skilled workers.

References

Arawatari, R. & Ono, T. 2013. "Inequality, mobility and redistributive politics," Journal of Economic Theory, Elsevier, vol. 148(1), pages 353-375.

Hassler J., Mora J. R. & Zeira J. 2007. "Inequality and mobility," Journal of Economic Growth, Springer, vol. 12(3), pages 235-259.

Hirazawa, M. & Yakita, A. 2017. "Labor supply of elderly people, fertility, and economic development," Journal of Macroeconomics, Elsevier, vol. 51(C), pages 75-96.

Iyigun, M. F. 1999. "Public education and intergenerational economic mobility," International Economic Review, Department of Economics, University of Pennsylvania and Osaka University Institute of Social and Economic Research Association, vol. 40(3), pages 697-710.

Kunze, L. 2014. "Mandatory retirement and economic growth: An inverted U-shaped relationship," Economics Bulletin, vol. 34(2), pages 885-891.

Le Garrec, G. 2015. "Increased longevity and social security reform: questioning the optimality of individual accounts when education matters," Journal of Population Economics, Springer, vol. 28(2), pages 329-352.

Maoz, Y. D. & Moav, O. 1999. "Intergenerational Mobility and the Process of Development," Economic Journal, Royal Economic Society, vol. 109(458), pages 677-697.

Nakamura, T. & Murayama, Y. 2011. "Education cost, intergenerational mobility, and income inequality," Economics Letters, Elsevier, vol. 112(3), pages 266-269.

Owen, A. L. & Weil, D. N. 1998. "Intergenerational earnings mobility, inequality and growth," Journal of Monetary Economics, Elsevier, vol. 41(1), pages 71-104.

Tanaka, J. 2017. "A Note on “Raising the mandatory retirement age and its effect on long-run income and pay as you go (PAYG) pensions," The Society for Economic Studies The University of Kitakyushu Working Paper Series No.2017-5, pages 1-13.