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The Optimization of Private Investment in Education

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Abstract

In Japan, the salaries of the parents are affected by their own education level and will affect the education and salary level of their children. The children whose parents graduated from university are easy to enter university than those whose parents have not gone beyond high school. Even if the children whose parents have not gone beyond high school can enter university, their salaries tend to be at lower level than the students whose parents graduated from university. We consider the cost of son's education as parent's investment, and construct this model by using statistics of Ministry of Education, Culture, Sports, Science and Technology and Ministry of Health, Labor and Welfare. We discuss the model from the perspective of investment rate, the lowest educational level and standard of living, signaling function, and age difference between parents and children. In this model, we will prove that education and wages level tends to be fixed.

Key Words

education, human capital theory, optimization, investment of education, signaling function, father-son model

1. Introduction

The earliest study on human capital theory in Japan was started by Horiusti in the 1970s[i], but information about Japanese education was limited, most of his arguments are theoretically. The most respected studies on the theory of screening/signaling were conducted by Ohasi[ii]. A comparison of these two theories is done by Arai[iii] in1995.

Currently, there are many studies of Japanese education being undertaken based on analysis of statistical data. In most formal literature, education itself is considered as the object of the study. In this paper we consider the individuals (the children and their parents) as the object of the study, because how much education the children will receive is strongly affected by the wages and education levels of their parents.

In this study, families are divided into different types according to the education level of the parents. A model is built to find the level of education for different types of families. We

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discuss the model from the perspective of investment rate, the lowest educational level and standard of living, signaling function, and age difference between parents and children. We find that the Japanese students study to identify their trainability rather than add to their productivity, because schools in Japan focus on general, rather than professional education. The signaling function between university and high school is quite big, but quite small between high school and junior high school. The salaries of the parents are affected by their own education level and will affect the education and salary level of their children. Education and wages level tend to be fixed, i.e. more children whose parents are university graduates enter university than whose parents have not gone beyond high school; even if the children whose parents have not gone beyond high school can enter university, their salaries tend to be at lower level than the students whose parents are university graduates. This contradicts the Japanese government policy that everybody is entitled to an equal education.

These problems are caused mainly by the large cost of education. Several solutions are suggested in this paper; unifying the educational and examination systems will obviate the necessity of paying the cost of cram schools; education loans and scholarships for junior high school and high school students will help students from poor families to enter universities; for the universities, increasing tuition is not considered advisable to solve the problem of declining students enrollment, which is caused by a low birth rate. Universities are encouraged to develop programs to train students professionally or provide lifelong learning for all people.

There are several important limitations in this study. The model is based on the assumption of stability in the wage premium through the life cycle. The earnings and costs used in this paper are average earning and cost. In practice, there can be considerable variation in returns for different fields of study or particular social groups. The risk of unemployment which can be reduced by more education is not considered in this study. On the data for female is used, because many Japanese women choose to be housewife after marriage and it is difficult to measure the earning of housewives.

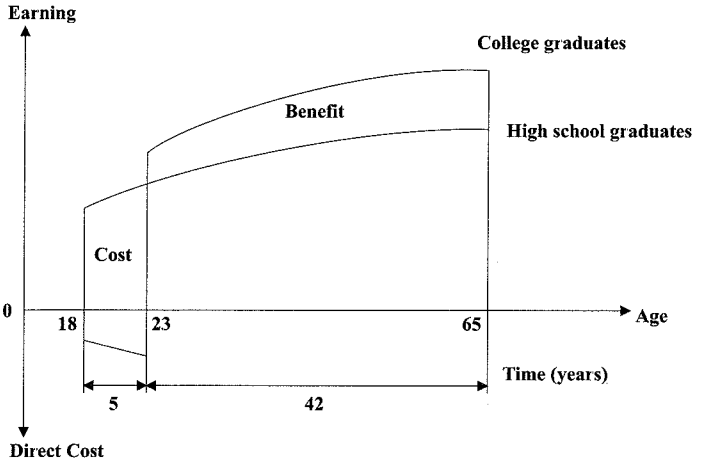
2. Father-son Model Based on the Theory of Human Capital

2.1 Methodology

The benefits of education have been broadly classified into two types-monetary and non-monetary. Education equips individuals with skills that lead to higher productivity and earning at the workplace. For example, the higher earnings of college graduates, relative to high school graduates are the monetary benefits of a college education. Several studies have estimated the incremental earnings of individuals that could be attributed to a higher education in the US (McMahon, 1998). However the incremental earnings varied across jobs. Medical and other health services had the highest incremental earnings followed by finance and insurance, indicating the higher market returns to graduates with these skills.

The costs of education include the earnings foregone by the graduates while in school, and tuition and fee paid. The foregone earnings constitute the major portion of the costs of education. For an undergraduate, for example, the foregone earnings are equivalent to the earnings they could have obtained with a high school degree during the time they are enrolled in college. (Figure 2.1-1)

Figure 2.1-1 Stylized Age-earnings Profiles



In former studies of the private return to a degree the following model is used to compute the benefit difference between the persons with and without the degree. For example the return to a bachelor degree is defined as

$$V = \sum_{t=0}^{T} (W_{ps,t} - W_{hs,t} - C_t)\cdot(1+r)^{-t}$$

where V is the present value of bachelor degree, computed over the time horizon $t = 0,...,T$, $W_{ps,t}$ is the earnings at time t for a person with the degree, $W_{hs,t}$ is the earnings at t for a person who is a high school graduate. C_t is the direct costs of the studies in period t. In computations of the net present value of the degree, the time horizon is often divided into a period of schooling, $t = 0,...,S$ (during which $W_{ps,t}$ is often assumed to be zero) and a working period, $t = S+1,...,T$ (during which $C_t = 0$, $W_{hs,t} = 0$). r is the discount rate.

Our model is developed based on this model. The wage of an individual is affected by many factors, such as the circumstances of one's family, relationship between the family members, certainly the intelligence quotient and health condition of the individual, etc. Since all these factors are difficult to measure and calculate, in this model we simply assume that the wage only depends on how long the individual has been in schools and how much he has paid for it. The other factors are supposed to be discussed in the later research but not in this

paper. In this model, the wage W is a function of age t and depends on both the period and the cost of schooling. W is denoted as follows; $W(t|\tau, e(\tau))$ is the wage of an individual at age t. τ is the period of schooling. $e(\tau)$ is the cost during τ years.

In the research before, the return to education was often calculated. Since children can not pay for all the cost of the education by themselves, and the benefit they get in the future will not all belong to their parents, in this model we consider a family but not an individual as a whole. The purpose of this model is to maximize the profit of the parents and the child through investment in education of the child. The benefit in our model is the sum of the wage of both parents and their childe through lifetime. The cost is the indirect cost they pay for the schooling and the forgone wage when the child is enrolling in the school. PV, which presents the total wage of the parents through lifetime, is defined as follows;

$$PV = \int_{t_{p0}}^{t_p} W(t|\tau_p, e(\tau_p))\, dt$$

The above W is the wage of parents at age t, t_{p0} is the year they begin to work and t_p is the year they retire. And τ_P is the period of schooling of the parents.

The total wage of the child through lifetime CV is defined as follow.

$$CV = \int_{t_{c0}}^{t_c} W(t|\tau_C, e(\tau_C))\, dt$$

The above W is the wage of a child at age t. t_{c0} is the year he begins to work and t_c is the year he retires. τ_C is the period of schooling of the child.

Schooling cost of the child EC is defined as follows.

$$EC = \int_{t_{c0}-1-\tau_C+d}^{t_{c0}-1+d} \alpha \cdot W(t|\tau_p, e(\tau_p))\, dt$$

The above W is the wage of parents at age t, t_{c0} is the year the child begins to work and t_c is the year he retires. α is the percentage of the wage of the parents that could be invested in the education of the child. d is the difference of age between the parents and the child. τ_P is the period of schooling of the parents; τ_C is the period of schooling of the child.

F is used to present the total wage the child suppose to get in $\tau_C - \tau'(\tau_C > \tau')$ years if he only had schooling of τ' years.

$$F = \int_{(t_{c0}-1)-(\tau_C-\tau')}^{t_{c0}-1} W(t|\tau', e(\tau'))\, dt$$

W is the wage function at age t if the child had only schooling of τ' years.

Hence the model could be presented as

$V = PV + CV - EC - F$

In this paper we research for the optimal period τ of schooling and the optimal cost of schooling which maximize the family incomes.

2.2 Approximation of Wages Function by Age and Academic Career

In the model of Japan, a family is supposed to have only one male child (since many females choose to be housewives in Japan and the deviation of wage for a female individual is too big.). Only the father is supposed to work and his wage is the only income of the family. Three education levels are discussed for the father and son, junior high school, high school, and university. (In order to simple the model, the 2-year college is not considered in this model.) Since junior high school is compulsory education in Japan, one is supposed to graduate from it no matter how much he can pay for it. The child is supposed to begin schooling from 5 years old and spend 2 years in infant school, 6 years in primary school and 3 years in junior middle school. The calculations assume that the student is full-time in education and has no work activity, and hence no earnings while studying. The calculations are likely to be biased upwards as unemployment, retirement and early retirement benefits are not taken into account. And they abstract completely from any non-monetary benefits of education.

Cubic expressions are approximated for each level of education according to the data of Contractual Wages by Age and Academic Career (Ministry of Labor, 2001).

$U_H(t)$ = -0.0137 * t ^ 3 + 1.3138 * t ^ 2 - 17.161 * t + 226.08

$U_L(t)$ = -0.0163 * t ^ 3 + 1.6039 * t ^ 2 - 43.205 * t + 572.68

$H_H(t)$ = -0.0223 * t ^ 3 + 2.328 * t ^ 2 - 64.106 * t + 829.29

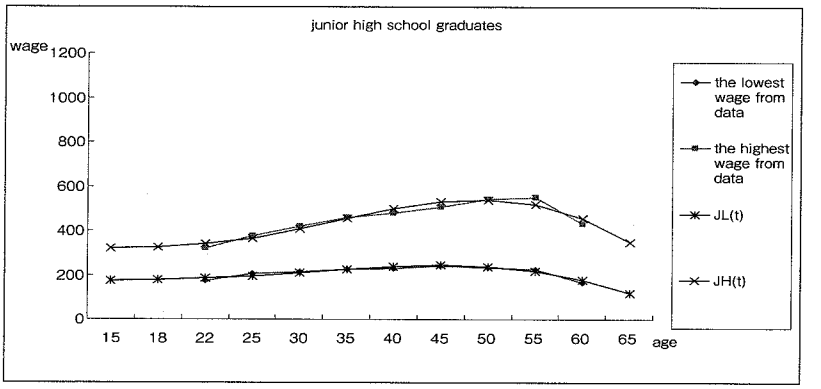
$H_L(t)$ = -0.0042 * t ^ 3 + 0.2873 * t ^ 2 - 1.3282 * t + 131.22

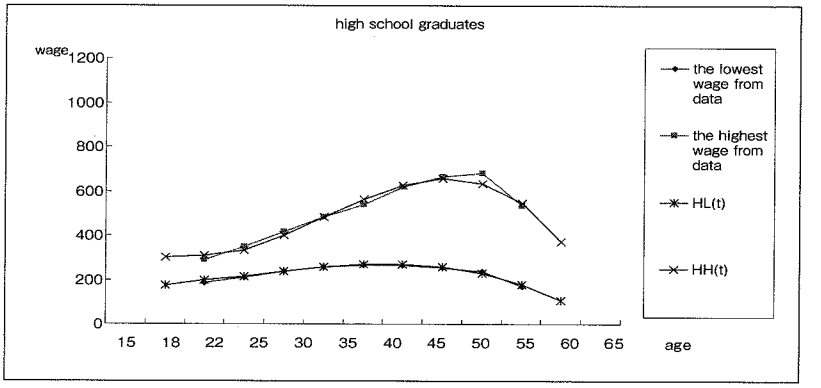
$J_H(t)$ = -0.0113 * t ^ 3 + 1.0921 * t ^ 2 - 25.448 * t + 493.35

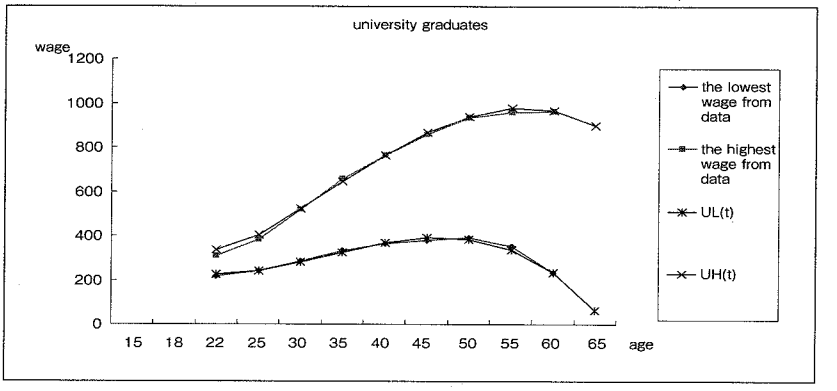
$J_L(t)$ = -0.0046 * t ^ 3 + 0.4031 * t ^ 2 - 8.3794 * t + 224.02

$J_H(t)$ is the highest wage one supposed to get with junior high school degree at age t, and $J_L(t)$ is the lowest wage he supposed to get. $H_H(t)$ is the highest wage for an individual with high school degree at age t, and $H_L(t)$ is the lowest wage. $U_H(t)$ is the highest wage for a university graduate at age t, and $U_L(t)$ is the lowest one. The graph based on the data and functions are compared in Figure 2.2-1.

Figure 2.2-1 Test of Functions of Different Education Level







Source: Contractual Wages by Age and Academic Career Ministry of Labor, 2001

Table 2.2-2 Medium Cost for Students by Academic Year

(Unit: Yen)

Academic Year	Age of the Student	Medium Tuition Public Schools		Private Schools	Medium Cost for Cramming Schools	
					Public Schools	Private Schools
Infant School 1	4	122947		333196	16398	42304
Infant School 2	5	125025		328324	42756	66849
Primary School 1	6	80482		–	94432	–
Primary School 2	7	32072		–	44157	–
Primary School 3	8	40638		–	52453	–
Primary School 4	9	39171		–	75434	–
Primary School 5	10	50413		–	105200	–
Primary School 6	11	78199		–	125457	–
Junior High School 1	12	183013		122819	169684	195222
Junior High School 2	13	97972		775328	183290	174623
Junior High School 3	14	109138		786348	301284	185647
High School 1	15	440417		10442600		131964
High School 2	16	338757		701451	107045	135486
High School 3	17	239905		605081	193940	275259
University 1	18	National 587200	Local 612500	1279900	–	–
University 2	19	587200	612500	1279900	–	–
University 3	20	587200	612500	1279900	–	–
University 4	21	587200	612500	1279900	–	–
Graduate School 1	22	575200	632300	1059900	–	–
Graduate School 2	23	575200	632300	1059900	–	–
Graduate School 3	24	646700	750800	1017600	–	–
Graduate School 4	25	646700	750800	1017600	–	–
Graduate School 5	26	646700	750800	1017600	–	–

Source: Survey of Education Cost, Ministry of Education, 2002

Table2.2-3 Range of Cost for a Degree

(Unit: Ten Thousand Yen)

Junior High School	E_{jL}	76.7256
	E_{jH}	592.09656
High School	E_{hL}	158.25192
	E_{hH}	939.31632
University	E_{uL}	346.15592
	E_{uH}	1553.66832

The cost one may spend for a degree is calculated according to the Survey on Education Fee [iv] (Table 2.2-2). There are public and private schools at almost each education level (There are only public schools at junior high school level.) The cost in a private school is generally high than in a public school. 36.9% of students of primary school, 71.8% of students of junior high school and 35.1% of students of high school go to cramming schools at evening and weekend. The medium cost for cramming schools for the students in public and private schools are found different too (Table 2.2-2) The lowest cost for a degree is calculated as 80% of the sum of the medium cost for each academic year in public schools. The highest cost for a degree is calculated as 120% of the sum of the medium cost for each academic year in private schools (the cost for junior high school is calculated according to the data of public schools) and the cramming schools. The highest cost for a degree of junior high school is E_{jH}; the lowest one is E_{jL}. E_{hH} is defined as the highest cost for a degree of high school, and EhL is the lowest one. E_{uH} is the highest for university, and E_{uL} is the lowest one. The exact value for each cost is presented as Table 2.2-3. The cost for clearing each academic year is presented in Table 2.2-4. The lowest cost for each academic year is defined as E_k (k=1, 2, ..., 12). The total tuition that the parents can offer until each academic year is defined as e_k (k=1, 2, ..., 12). If $e_k > E_k$ the student can continue to next academic year k+1, otherwise, the student have to give up the studies and begin to work.

Table 2.2-4 the Lowest Cost for Clearing an Academic Year

(Unit: Ten Thousand Yen)

	$E0$	76.7256
High School 1	$E1$	111.95896
High School 2	$E2$	139.05952
High School 3	$E3$	158.25192
University 1	$E4$	205.22792
University 2	$E5$	252.20392
University 3	$E6$	299.17992
University 4	$E7$	346.15592
Graduate School 1	$E8$	392.17192
Graduate School 2	$E9$	438.18792
Graduate School 3	$E10$	489.92392
Graduate School 4	$E11$	541.65992
Graduate School 5	$E12$	593.39592

Since one is supposed to graduate from junior high school, we define that t is the period of schooling after junior high school. The total period of schooling is $15+t$.

For the fathers, we divide them into three groups, the junior high school graduates, where $t_P=0$ high school graduated, where $t_P=3$ and university graduates, where $t_P=7$. In each group it is divided into n grades. If the father is supposed to be at grade l, then the cost of his education $e(\tau_P, n, l)$ would be presented as follows.

$$e(\tau_p,n,l)=\begin{cases}\dfrac{l\cdot E_{jH}+(n-l)\cdot E_{jL}}{n} & where \quad \tau_p=0\\ \dfrac{l\cdot E_{hH}+(n-l)\cdot E_{hL}}{n} & where \quad \tau_p=3\\ \dfrac{l\cdot E_{uH}+(n-l)\cdot E_{uL}}{n} & where \quad \tau_p=7\end{cases}$$

E_{jL}, E_{jH}, E_{hL}, E_{hH}, E_{uL}, E_{uH} are according to the values in Table2.2-3.

For the son the cost of the schooling is supposed to depend on the wage of his father.

$$e(\tau c)=\int_{d+5}^{d+15+\tau_C}\alpha\cdot W(t|\tau_p,e(\tau_p,n,l))\,dt$$

$e(\tau_C)$ presents the cost of schooling for the son. τ_C is the period of schooling for the son after junior high school. d is the difference of age between the father and the son. W is the wage of the father. α is the percentage of the wage of the father that would be invested in the education of the son.

The function for the wage is defined as follows. $e(\tau)$ is the cost of schooling. One can only go to the next academic year when he has cleared the cost of this academic year. The wage he can get is determined by the degree of him. No matter how much more he has paid, one can not get a wage higher than the highest wage of this degree. For example, an individual whose τ is 6 is supposed to finish study at the third year in university. Even if he may have paid more than E_{uL}, the lowest cost for getting a bachelor degree. He can only get the wage according to W where $3\leq t\leq 7$, because he only has the degree for a high school. The highest wage he can get at age t is $H_H(t)$.

$$W(t|\tau,e(\tau))=\begin{cases}\dfrac{Max\{E_{jH}-e(\tau),0\}\cdot J_L(t)+Max\{e(\tau)-E_{jL},0\}\cdot J_H(t)}{Max\{E_{jH}-e(\tau),0\}+Max\{e(\tau)-E_{jL},0\}} & where \quad \tau<3\\ \dfrac{Max\{E_{hH}-e(\tau),0\}\cdot H_L(t)+Max\{e(\tau)-E_{hL},0\}\cdot H_H(t)}{Max\{E_{hH}-e(\tau),0\}+Max\{e(\tau)-E_{hL},0\}} & where \quad 3\leq\tau\leq 7\\ \dfrac{Max\{E_{uH}-e(\tau),0\}\cdot U_L(t)+Max\{e(\tau)-E_{uL},0\}\cdot U_H(t)}{Max\{E_{uH}-e(\tau),0\}+Max\{e(\tau)-E_{uL},0\}} & where \quad \tau>7\end{cases}$$

The foregone wage for enrolling in school for t_C years after junior high school is

$$F(\tau_C) = \int_{15}^{Min\ \{15+\tau_C\ 18\}} W(t|0,e(0))\,dt + \int_{Min\ \{15+\tau_C\ 18\}}^{Min\ \{15+\tau_C\ 22\}} W(t|3,e(3))\,dt + \int_{Min\ \{15+\tau_C\ 22\}}^{15+\tau_C} W(t|7,e(7))\,dt$$

The benefit for family model can be written as

$$V = \int_{t_{P0}}^{t_P} W(t|\tau_p,e(\tau_p,n,l)\,dt + \int_{t_{c0}}^{t_C} W(t|\tau_C,e_C(\tau_C))\,dt - e(\tau_C) - F(\tau_C)$$

t_{P0} is the age when the father begin to work and t_P is the age he retires. t_{c0} is the age when the son begin to work and t_c is the age he retires. t_P is the education group of the father. l/n is the grade where the father is in the education group. t_C is the period enrolling in school of the son after junior high school.

3. Interpretation of Some Numerical Examples

3.1 Case 1: Optimization According to Father's Education Level

In case 1, we suppose the age of retirement for both father and son are 65, t_P = 65, t_C = 65. The father is supposed to start working at age of 22, t_{P0} = 22. The rate of investment in education a is changed for 5% to 20% (The cost for the education of one child has increased from 5.8% of total expansion of a family to 12.6% from 1974 to 2001. 5% and 10% present the rate of investment in the past; 15% is for now; and 20% is supposed to be for the future.). It is found that the family in which the father is a junior high school graduate or high school graduate can only get to the optimization when 20% of the family income is invested to the education of the child. For the family in which father is a university graduate, the optimization appear exactly at the same point for investment rate of 15% and 20%. The optimization for the family in which father is a university graduate is highest, about 550 million Yen, following by the family in which father is a high school graduate, bout 475 million Yen. The optimization for the family in which father is a junior high school graduate is the lowest, about 450 million Yen. (Figure 3.1-1)

3.2 Case 2: Difficulties in Reaching the Optimization

In case 1 it is found that for the family in which the father is a junior high school graduate or high school graduate, the optimization can is around investment rate of 20%. Concretely the optimization for the family in which the father is a junior high school graduate is 23%; 20% for the family in which the father is a high school graduate; and 14% is for the family in which the father is a university graduate. In case 2 we test and find that it is impossible for some families in which the income of the father is at the bottom level of the groups of junior high school graduate and high school graduate.

Suppose every type of family would invest to get the optimization, the rest will be 77% of the family income for the family in which the father is a junior high school graduate; 80% for the family in which the father is a high school graduate; and 86% for the family in which the

father is a university graduate. The range of the rest of yearly income for each family type is presented in Figure 3.2-1 by "top wage" and "bottom wage". The straight line in each graph presents for the lowest living level for a standard 3-person-family in a year[v]. For the families under the lowest standard line the rest of income after investing in education are not enough for them to live even at the lowest level. It can be conclude that in these families it is impossible for the child to be enrolled in university and achieve the optimization. The model is under the estimation of only one child. It can be concluded in reality there are more families with more children that are incapable to make their children go to university.

According to a survey Japanese government[vi], parents' expectation of children's education level is different by the education level of the parents. The parents who are university graduates have the strongest hope on their children to graduate from university. Education level effect mothers' expectation more than fathers'. 68.2% mothers who are junior high school graduate just expect their children to finish junior high school, while only 9.1% have the expectation of university. For mothers who are university graduates the total percentage of expectation of university and graduate school is more than 91%, which is much higher than 75.5% of university graduate fathers.

3.3 Case 3: Fixed Salary Level

In case 2 it is found that some families in which the father has not gone beyond high school have difficulties to reach the optimization. In this case we will discuss that even if the child from family at low educational and salary level can enter a university, his salary is comparatively low than the child from high level family. It is presented in Figure 3.3-1.

In this case all the children is supposed to aim at graduate from a university, $\tau_c = 7$. The investment rate is *12%*, which is near to 12.6%, the rate in 2001. The education of father is divided into 5 levels at each group, $n=5,\ l=1, 2...5$. The range of salary is the lowest and highest salary of all the graduates at the age. It is found in one group the children whose father's education level is high tend to earn high salary in the group. And most children of university graduates remain at the upper part in the salary range; while the children of high school graduates and junior high school graduates remain at the middle and low part.

3.4 Case 4: Signaling Function in Relation to Level of Education

In case 3 we find the signaling effectiveness of university graduate is very big, while the degree of junior high school and high school doesn't make quite difference on lifelong income.

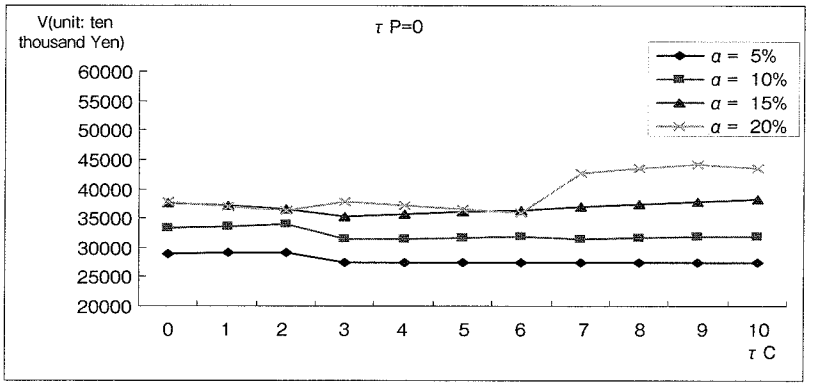
The three graphs are the lifelong income for child with different degrees. It is found that when the child is a junior high school graduate, $t_c=0$, the education level of the father t_P doesn't make quite difference when the investment rate of education $\alpha=0.13$, which is near to what it is now. Especially when the father is a junior high school graduate or high school

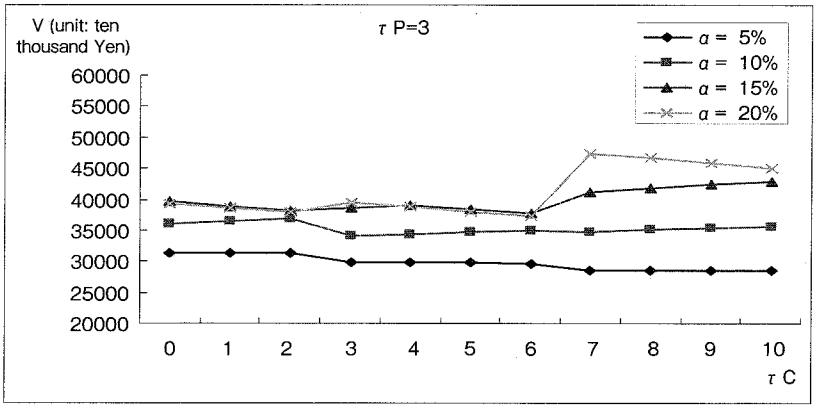
graduate, the difference of the lifelong income for their children are almost same. The lifelong income for the child become to be the same soon as the investment rate rising.

When the investment rate of education is around 0.13, the lifelong income of the child with junior high school degree and high school degree is almost the same no matter what the education level of his father is. The lifelong income for a child with junior high school degree is found even a little higher than what for a high school child, which can be explained that working experience is more important than degree at this level. (Figure 3.4-1)

Figure 3.1-1: Case 1

n	l	d	t_{P0}	t_P	t_C
5	3	30	22	65	65





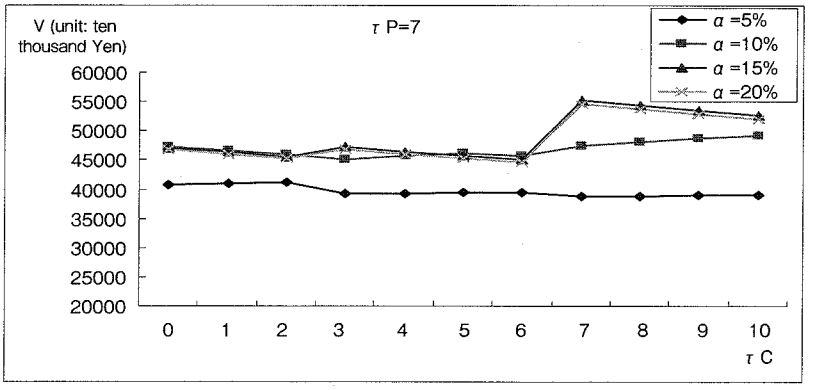
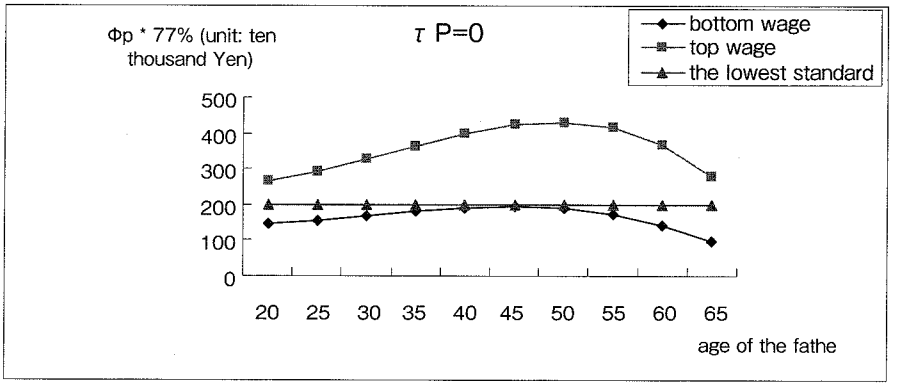
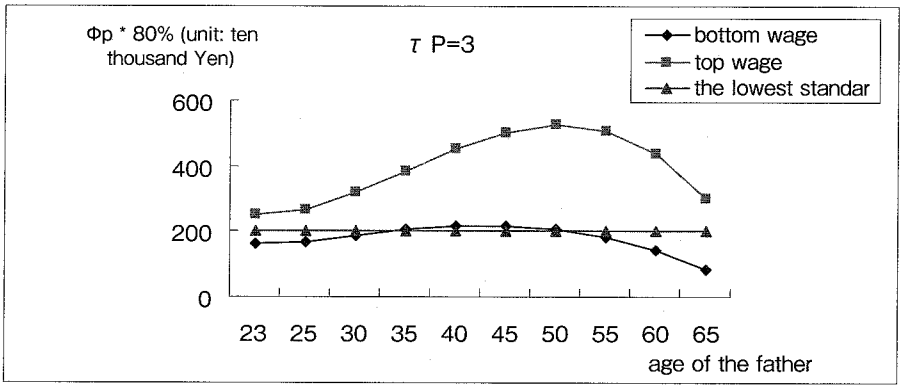


Figure 3.2-1: Case 2

τ_C	t_{P0}	t_P	t_C
7	22	65	65





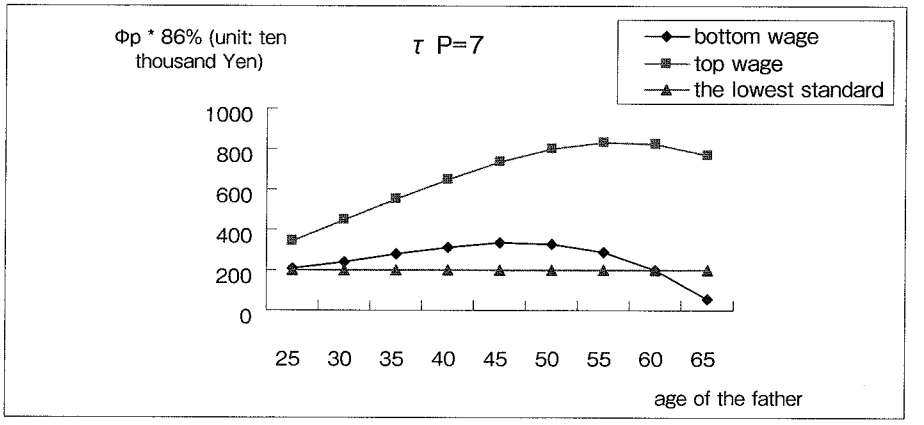
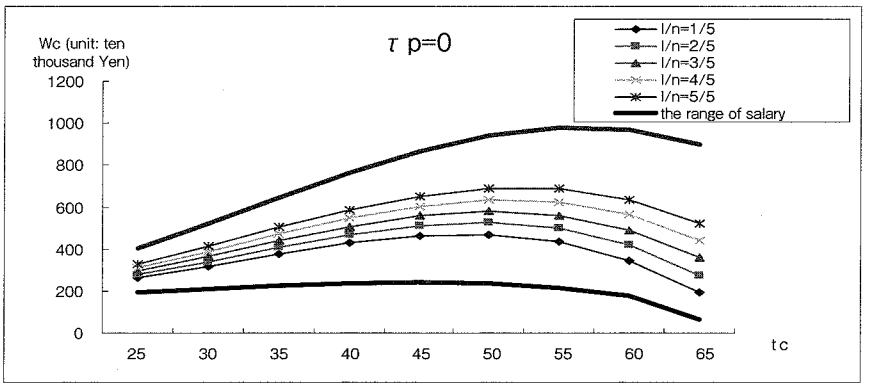
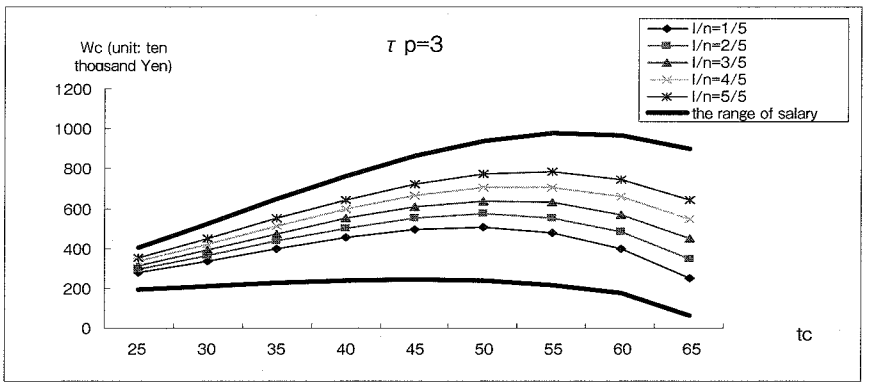


Figure 3.3-1 Case 3

τ_c	α
7	12%





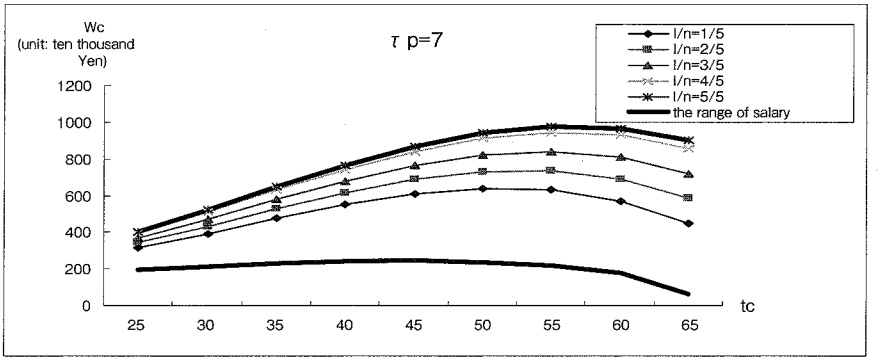
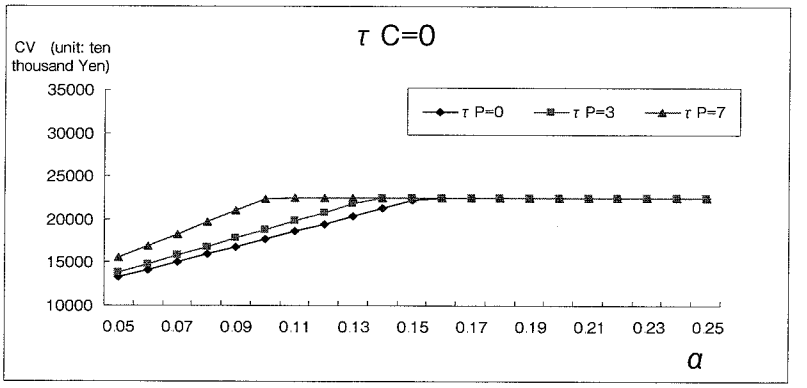
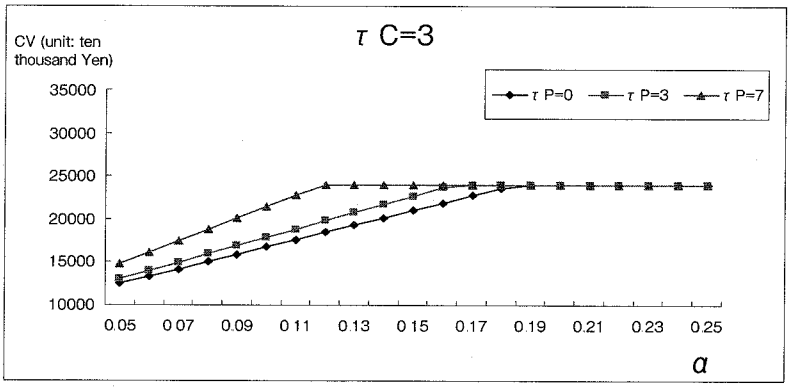
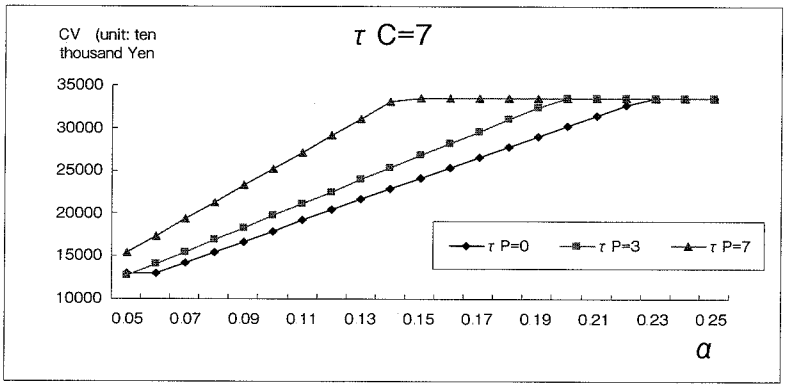


Figure 3.4-1: Case 4

n	l	d	t_{P0}	t_P	t_C
5	3	30	22	65	65







4. Conclusion

Though in Japan compulsory education is until junior high school and the enrollment in high school keeps at a high level about 95%, the education chance is unequal. It is because what students learn at cramming schools rather than at formal schools plays more important role in determining the entering of university. In the family that the father is a junior high school graduate or high school graduate, it is generally impossible to get to the optimization of father-son model. By contrast, the family that father is a university graduate can easily get to the optimization. It is found that the education and income level of parents make big difference on the income of the children. The children whose father's education level is high tend to earn high salary. It is found that education and wages level tends to fixed, though Japanese government insists that everybody is entitled to equal education.

References

Becker, G, 1993, *Human Capital, Third Edition*, The University of Chicago Press.

Andrew Weiss, "Human Capital vs. Signaling Explanations of Wages", *The Journal of Economic Perspectives*, Volume 9, Issue 4 (Autumn, 1995), 133-154

Ching-to Albert Ma and Andrew M. Weiss, "A Signaling Theory of Unemployment", *European Economic Review*, 37 (1993) 135-157. North-Holland

Sveinbjorn Blondal, 2002, "Investment in Human Capital through Upper-secondary and Tertiary Education", *OECD Economic Studies*, No. 34, 2003/I

Tachibanaki, T. 1989, "Education, Occupation, Hierarchy and Earnings", *Economics of Education Review*, Vol.7, No.2, 221-229.

LeTendre, Gerald, 1996, "Constructed Aspirations: Decision-Making Processes in Japanese Education Selection" *Sociology of Education* 69: 193-216.

Card, D. 1999, "The Causal Effect on Education on Earning" in *Handbook of Labor Economics*, Vol. 3B, 1801-1863.

Kelly Bedard, "Human Capital versus Signaling Model: University Access and High School Dropouts", Journal of Political Economy, 2001, Vol.109, no.4

荒井和博,「シグナリングとしての大学進学行動」,『経済セミナー』No.585, October, 2003

赤林英夫,「人的資本理論と教育」,『経済セミナー』No.585, October, 2003

西村和雄, 2001a,「ゆとり教育を奪った「ゆとり教育」, 『教育が危ない2』, 日本経済新聞社。

盛山和夫, 野口裕二, 1984,「高校進学における学校外教育投資の効果」,『教育社会学研究』第39集, pp173-221.

信国真載, 1980,「大学教育投資の私的効率」,『文部時報』8月号, pp47-54.

渡辺行郎, 1987,「学校歴による人材選別の経済効果」, 市川昭午編 (1987)『教育の効果』東信堂, pp42-61.

[i] 堀内昭義(1973)「大学教育の利益、費用および補助金」『日本労働協会雑誌』第169号, pp. 28-39

[ii] 大橋勇雄(1995)「会社の中の学歴社会」橘木俊詔・連合総合生活開発研究所編『昇進の経済学』東洋経済新報社, pp181-203

[iii] 荒井和博(1995)「教育の経済学—大学進学行動の分析」, 有斐閣

[iv] 幼稚園から高校までは「平成14年子供学習費調査」による；大学は「平成12年学生生活調査」による, 文部省

[v] http://www.city.saga.saga.jp/doc/391e53cf1820edf64925686e0003e270.html

[vi] 2000,「青少年の生活と意識に関する基本調査」, 内閣府