Higher Education and Earnings: A Cross Sectional Study of the Earnings Pattern and the Internal Rate of Return to Post-Secondary Education in Japan

by

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ABSTRACT

The purpose of this thesis is to discover the relations between higher education and earnings. I first document the recent development in the studies of human capital. The focus is on three different approaches: (1) the human capital theory, (2) the screening hypothesis and (3) the market segmentation theory. Then I describe characteristics of the educational system and the labour market in Japan. They include the competitiveness and hierarchical features of the educational system, and the persistent wage gap between sexes and employees of different firms found in the labour market. In order to investigate the impact of education on earnings I present a disaggregated regression based the segmented characteristic of the labour market. This model is found to be valid in the Japanese context and the regression results indeed support the notion of wage differential across market segments. Among the findings are: (1) the impact of university education on earnings is greatest among all other factors such as age and experience, (2) the female segment of the labour market is more stratified by educational attainment. Then I calculate the internal rate of return of higher education for workers in various segments and find that in general the rate for females is higher than that for males. In addition, the

rates in various market segments are found to be quite high compared to the returns on non-human capital. Lastly I draw some inferences of the present analysis and conclude that various theories mentioned above on human capital have some validity in the interpretation of my findings.

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Chapter 1

Introduction

The formation of human capital has significant influences on earnings and personal status. It is well-established by many economists that education is one of the most important components of human capital investments because it raises individuals' productivity. However, some researchers have developed other theories to explain the observed wage differentials in society. Some argue that education simply performs a signalling function in the labour market. Other have shown that education offers both pecuniary and non-pecuniary rewards. This study will confine itself to analyzing the effects of higher education on earnings.

The focus of this thesis is on the earnings pattern observed in various segments of the Japanese labour market. Although in reality there are many forms of segmentation, I shall develop my empirical analysis along the lines of gender and firm-size segmentation. I attempt to achieve three goals: (1) to construct an analytical framework to discover the impact of higher education on earnings in the light of the human capital theory and other relevant hypotheses, (2) to estimate the internal rate of return to college education and (3) to analyze the implication of my findings.[1]

In constructing the conceptual framework I employ the technique of multiple regression analysis to estimate the earnings functions for various firm-size-gender groups in the labour market. Subsequently I also calculate the internal rates of returns to post-secondary education from these estimated earnings profiles.

It should be pointed out that the present study is not intended to analyze the process of wage determination in Japan. As a result, the analysis is confined to identifying empirically the wage gap between educational groups across market segments. Nevertheless, a brief description of the Japanese educational system and labour market is given in chapters three and four.

The data used in the empirical analysis are average monthly earnings of regular workers in private firms with more than 10 employees in 1990. These data are group averages but the numbers of each group are also available. Therefore, the method of weighted regression analysis can be applied.

This thesis consists of eight chapters. In the next chapter, I shall present the principal arguments of various theories and hypotheses of human capital formation that are referred to in the present study. Chapter three provides some background information concerning the rise of credentialism in Japan and the impact it has on the structure of the labour market. Chapter four describes the

institutional features and the observed wage differentials in the labour market. In chapter five I shall explain the data and propose an economic model to estimate the earnings functions and the private rates of returns to higher education. Chapter six presents the empirical results from the present analysis. Then I shall interpret and evaluate these findings in the following chapter. Finally the findings and implications will be summarised in the concluding chapter.

Notes:

1. The data source used in the present study reports earnings of graduates from two types of higher educational institutions - four-year university (daigaku) and two-year junior college (tanki daigaku). The focus of this thesis is on the impact of these two types of educational qualification on earnings.

Chapter 2

Education and Earnings

The relationship between education and earnings has been intensively studied since the publications of empirical works by Mincer (1958), Schultz (1960) and Becker (1975). There is certainly evidence of complex linkages between earnings, schooling, and other social and personal characteristics. However, economists have been in disagreement about what are the most important factors that influence earnings.

The human capital theory emphasises the investment aspect of human capital formation and argues that educational investment, whether it is formal schooling or on-the-job training, enhances individuals' productivity by imparting knowledge and skills. Subsequently, individuals receive greater monetary compensation after the investment period.

The proponents of the screening hypothesis, however, argue that education acts only as a screening device for employers in the hiring process. They contend that education itself does not augment labour productivity. Some opponents of the human capital theory, however, hypothesise that labour market is segmented and internalised. The observed wage differentials in the society prompt them to

argue that workers are discriminated against in the labour market because of personal attributes such as race and gender.

There is no doubt that each of these competing theories has generated some insights regarding the observed variations in earnings. In the next three sections I shall present the essence of each approach in order to shed some light on the analysis of earnings differentials in Japan.

(1) Human Capital Theory

The analysis is essentially based on the labour market theory of the neoclassical school which argues that the labour market is operated in a flexible supply and demand framework. The demand for labour input by firms and the supply of efforts by individuals interact to determine the equilibrium wage level. It is also assumed that wages are in the long run downward flexible and education is an investment good rather than just a purely consumption good. In this analytical framework, the amount of education the marginal investor acquires critically depends on the costs and the returns of his/her investment.[1]

Essentially the theory attributes the variations in earnings to workers' qualifications which are believed to affect productivity. Education and on-the-job training increase labour productivity by raising the level of skills

and knowledge. The marginal productivity gained is then reflected in earnings and employment benefits.

Researchers in the past three decades have conducted numerous empirical studies in order to measure the effects of education and other factors on earnings. These studies have mainly been one of two types: (1) cost-benefit analysis, and (2) multiple regression analysis.

(a) Cost-Benefit Analysis

The earliest empirical works on human capital are conducted by employing the technique of cost-benefit analysis. In his early work "Capital Formation by Education" Schultz (1960) formally treats education as a form of investment, and attempts to estimate the amount of resources employed in it. After adding up all the costs, the author concludes that the investment component, not the consumption component, is the most important factor determining the amount of resources channelled into education.

Becker (1975, pp.15-44) gives a thorough analysis of the rates of returns to human capital investments. He incorporates the relations between investments, returns and time in his analysis. In particular, the earlier the investment is made, the greater the amount of rewards one can collect over the life time. He also develops the

concept of "specific" and "general" on-the-job training in determining life time earnings level.

"Specific" training refers to the knowledge and skills acquired by the workers that cannot be utilized in other firms. Human capital accumulated during "general" training, on the other hand, is usable to other institutional settings. In the former case, firms are willing to share the costs of the investment since they will be compensated by higher productivity of the trained workers after the training period. However, trainees are to bear all the costs of "general" training because firms which provide the training may not be able to capture the returns due to labour turnover. Becker argues that after either form of training, the earnings profiles of workers become steeper. The analysis of the impact of formal schooling on earnings is similar to the discussion of "general" training. Specifically, the costs of education are borne solely by students. This study laid the foundation of cost-benefit analysis in the economics of education.

Within this basic cost-benefit framework, the most common methodologies used in empirical analysis are the net-present-value approach and the rate-of-return approach.

(i) The Net-Present-Value Approach

The net present value (npv) is defined as following:

$$npv=\sum_{t=1}^{n}\frac{E_t^s-E_t^{s-1}}{(1+i)^t}-\sum_{t=-m}^{0}\frac{C_t^s+E_t^{s-1}}{(1+i)^t}\quad\ldots\ldots(1)$$

where E_t^s and E_t^{s-1} are the earnings of individuals who have s years and s-1 years of schooling in year t respectively; C_t^s is the costs of education in year t and E_t^{s-1} in the second summation term represents the foregone earnings while attending school; i is a pre-determined discount rate.

An educational investment is considered profitable, relative to the costs of borrowing capital, when npv>0. It should be noted that in the absence of consumption benefits of education, the higher the opportunity cost of alternative investments, represented by the discount rate, the lower the npv. As a result, the choice of i is the subject of disagreement among economists. Many do agree that i should be close to the prevailing market interest rate. However, in practice many empirical studies are undertaken using the rate-of-return approach instead because it enables easy comparison across studies.

(ii) The Rate-of-Return Approach

The internal rate of return to education corresponds to the discount rate that sets (1) to zero. The higher the rate of return, the higher is the yield of the investment. There are two types of rates of returns: social and private. The social rate of return to education reflects the economic impact of education on the society as a whole, and is most commonly used in educational planning. The private rate of return, on the other hand, reflects the profitability of an individual's investment in education.

Many studies have indicated that the marginal return to educational investment diminishes as more education is acquired.[2] In an international study Psacharopoulos (1973, pp.61-73) finds that rates of returns to education are higher in developing countries relative to the returns in advanced nations.

(b) Multiple Regression Analysis

Human capital theory postulates that an individual's earnings (Y_i) are a function of educational attainment and other independent factors:

$$Y=f(Ed,Z) \ldots\ldots (2)$$

where Ed is amount of education acquired, and Z stands for a vector of other variables like age, experience and sex. The availability of data on individuals' earnings and other

characteristics opens up an avenue for regression analysis. The estimated coefficients explicitly define the relative significance of each variable on earnings. Factors other than education can be isolated, so that the net effect of education can be estimated. However, critics argue that the effect of education on earnings is often overemphasised because the earnings function is not correctly specified. Particularly the variable for innate ability is often excluded or incorrectly measured.

Some researchers have indeed attempted to measure the proportion of earnings variations that are due to education alone. It is often called the "alpha coefficient". Suppose D_y is the observed income differential of two educational group, and D_y' is the adjusted differential. Then $\alpha = \frac{D_y}{D_y'}$ represents the portion of earnings differential that is due to education. Earlier studies simply make factors that were believed to have influences on earnings, such as IQ score and parental income, identical across educational groups before calculating the income differential. Presently most studies employ multiple regressions analysis to estimate earnings in terms of different independent variables. Fitting the mean values of the controlled factors into the estimated function yields the earnings of individuals across educational group. The later method of standardisation is often considered superior because hypothesis testing can be conducted regarding the statistical significance of the

controlled variables.

In previous studies, the alpha-coefficients are found to be quite comparable. Denison (1962) finds that sixty percent of earnings differential in the United States is due to education. Becker (1975) also finds in his studies that the alpha coefficient is about two-third or 67 percent. After reviewing more than twenty studies on the subject in the United States, Psacharopoulos (1975) concludes that the most probable value for the alpha coefficient is 77 percent.

Another important element studied by economists is age. Becker (1975) argues that the marginal productivity of workers declines with age as their skills becomes obsolete and their physical abilities decline. Other analysts such as Hanoch (1968) and Mincer (1975) augment the studies by postulating the effects of experience and age on earnings.

It is widely accepted that the average earnings of a worker increase with age and experience, but decline after a maximum is reached. In constructing the age-earnings profiles of workers of different educational levels, researchers have found that the profiles of more educated workers incline more steeply and reach higher earnings levels later.

Based on the fundamental notion that more educated workers are more productive, the advocates of human capital theory attribute income differentials among individuals to differences in educational attainment.

(2) The Screening Hypothesis

The proponents of the screening hypothesis, such as Taubman and Wales (1973), Spence (1974) and Arrow (1973), contend that education does not make individuals more productive; instead it only serves as a screening device for employers to sort out more able job applicants. The basic assumption of this hypothesis is that information on individuals' potential productivity is scanty and difficult to obtain; therefore, academic achievement becomes a proxy of ability in the job market. Since the costs of acquiring these signals are inversely varied with individuals' innate ability, screening also filters out individuals who cannot afford expensive educational investments. Thus the extent of screening goes far beyond identifying individuals with higher academic achievements but also those from better social and economic backgrounds.

Arrow (1973) argues that although education does not make workers more productive, it certainly convinces employers they are so. The outcome of his mathematical analysis suggests that society still benefits from education because it sorts out talented individuals, thus it helps to achieve efficient allocation of labour. Taubman and Wales (1973) estimate the expected occupation distribution by educational levels, after removing barrier to entry in all occupation categories. They find that only an insignificant

fraction of workers would like to choose blue-collar, service and clerical occupations. The findings indicate that screening filters out people without diploma from entering professional and managerial occupations. The authors also calculate the returns of B.A. degree in 1955 and 1959 for U.S., assuming that there is no screening; they find that screening accounts for as much as 50 percent of the returns.

Dore (1976, p.28) goes even further and suggests that educational credentials are often taken as "ability-filtering" and "prestige conferring" devices in many developing countries. He argues that the role of university education is not solely to "create", but also to "measure" talents.(p.29) The practices of screening in the labour market undermine the real benefits of education. In an economy where employers put a great deal of emphasis on a diploma, the quest for more education perpetuates and produces an spiral effects of "educational inflation".(pp.5-6)

Although it is recognised that screening indeed occurs in the labour market, some researchers argue that the extreme version of the screening hypothesis is not valid. If education does not equip workers with knowledge and skills, they contend, society would have developed less expensive and more convenient methods to sort out talented individuals. Psacharopoulos (1979) contends that even if

employers are willing to pay more qualified workers higher starting wages, they will not continue to do so if the employees become unproductive.

Similar to the human capital theory, the screening hypothesis attempts to explain why more educated individuals consistently earn more than the less educated. Contrary to the traditional view that education increases labour productivity, the hypothesis emphasises the importance of market signalling. It also implicitly assumes that funds for human capital formation are not readily available to every individual due to market imperfection. As a result, education cannot be regarded as the sole determinant of individuals' earnings level; other factors such as parents' social status and income levels are also crucial elements that deserve in-depth studies.

(3) Labour Market Segmentation Theory

It is observed in many parts of the world that education fails to improve income inequality. The inability of workers in some segments of the labour market to move up the earnings scale prompts some economists to develop alternative theories to explain how wages are determined. The various versions of the segmentation theory suggest that the labour market is segmented and workers' mobility between segments is very limited.[3]

(a) The Dual Labour Market Theory

According to some dualists, the labour market is divided into two self-contained segments; each has it own rules concerning promotion and wage increment. In the primary market, workers are paid high wages and enjoy good working conditions. Employers in this market often offer workers job security and on-the-job training. In contrast, jobs in the secondary market pay poorly, and offer little employment security. In addition, employers seldom offer workers on-the-job training and promotion opportunities are rare.

Each market segment contains its own wage determination mechanism, and education is believed to have little influence on earnings in the secondary market. Workers' mobility between market segments is restricted because of their personal attributes and the social norms. Individuals may be barred from entering a specific labour market because of race, religion and gender. Firms justify their restrictions on hiring women on the grounds that the working lives of females are frequently interrupted by child births and family responsibilities. As a result, in many countries the governments implement affirmative employment policies to encourage employers to allow access to such restricted labour markets.

Entry to certain high pay professions is also vigorously regulated in order to maintain the monopolistic position of the professionals and the standard of the industries. The years required to study for the exacting license examination may discourage individuals from pursuing the professional designations. As a result, financial circumstances can be an implicit barrier in deterring the marginal investors from acquiring the necessary skills to enter certain markets.

Other barriers are shaped by certain values held within society. In a male dominated society women are expected to fulfil the traditional roles of wives and mothers; as a result, they find it more difficult to pursue demanding careers. Consequently barriers to mobility between labour market segments tend to internalise the wage structure.

In sum, advocates of the dual labour market theory emphatically argue that income parity cannot be achieved through education due to the entrenched labour market structure and the restricted labour mobility between market segments.

(b) Job Competition Model

The job competition model developed by Thurow (1975) is a synthesis of the screening hypothesis and the labour market segmentation theory. The author challenges the conventional assumption of the human capital theory that workers compete against each other for higher wages. Instead, he argues, they compete in a market of available training slots. Workers are ranked in a "labour queue" according to a hybrid of factors such as sex, race, job experience and education.(pp.91-97) Only those in the front of the queue are recruited into the primary market. The primary market eventually becomes internalized and mobility between the primary and secondary markets is severely restricted. The author contends that education is relevant only in securing individuals' favourable positions in the labour queue and it has little consequence in determining wages within the internal market.

The labour market segmentation thesis qualifies the human capital thesis on education. It suggests that owing to discrimination by sex, race, age, social backgrounds, etc., there are significant barriers to access into the primary segment, and certain individuals are trapped in low paid jobs regardless of their talent and qualifications. Education alone cannot correct the persistent income inequality.

The relationship between earnings and education has drawn much controversy and researchers are in disagreement concerning what the real benefits of education are. The discussion here has been focused on three approaches: (1) the human capital theory, (2) the screening hypothesis, and (3) the labour market segmentation theory. These three approaches will be frequently referred to in developing a model to analyze the earnings pattern and the internal rates of returns to higher education in Japan.

Notes:

1. See pp.71-80 in Becker (1975) for a discussion on the incentives to invest in education. Essentially these arguments are based on the neoclassical notion of a competitive labour market.

2. See table 5.5 in Cohn (1990) for a summary of private rates of returns to university education in the United States estimated in different studies.

3. Doeringer and Piore (1971) first develop the theory and later Lazear and Rosen (1981) and Oswald (1984) incorporate different models to analyze the theory formally.

Chapter 3

Competition and Credentialism in Japan

Contrary to the human capital approach which contends that education increases labour productivity, the screening hypothesis stresses the importance of certification in determining individuals' economic success. Although the existence of screening does not affect individuals' internal rates of returns to education, it does have significant long term economic impact on earnings and the demand for education. In this chapter I shall explore the topic in the Japanese context.

(1) Competition in the Educational Market

In Japan in 1990 there were 507 universities and 593 junior colleges enroling 2.6 million young people. Of the 1.7 million high school graduates annually, about 30 percent entered higher educational institutes, and about 35 percent secured employment. Over 95 percent of the nearly 2 million middle school graduates continued to study in senior high schools and only 2.8 percent entered the labour market.[1] In the last four decades, while the Japanese society grew more prosperous, the proliferation of higher education became more profound. Table 3-1 shows a significant

increase in advancement rate of secondary school graduates in the last 35 years. During the economic miracle after World War II the Japanese economy has grown rapidly. The real gross national product grew at an astounding annual rate of 10.6 percent between 1960 and 1965 and 11.2 percent between 1965 and 1970.[2] The heated economy fuelled the demand for more skilled and educated young people. The number of university and junior college enrolments increase from less than half a million in 1955 to over two and a half million in 1990.

Although many higher educational institutes have been established, the competition in the educational market has not subsided. In particular the wave of "educational inflation" affects almost every student from a very young age.[3] Competition to enter the best schools is extremely intensive at all educational levels. Critics argue that students are trained to master examination techniques, to memorise facts, rather than to learn and create.(OECD, 1971, pp.85-95) Many mothers are termed "educational mother" (kyoiku mama); they oversee every aspect of their children' study lives. Cram schools (juku and yobiko) mushroom in every corner of the country to satisfy the demand for extra tutorials and mock examination practices.[4] Every year over 20% of the college applicants refuse to settle for less famous schools and become ronin, and spend one full year preparing for next year's college entrance examination.

Table 3-1 Secondary School Graduates Advancement Rate (1955-1990)

Year	Middle School[1]		High School[2]	
	Numbers of Graduates	% of students continue through high school[3]	Numbers of Graduates	% of students continue through college[4]
1955	1,663,184	51.5	715,916	18.4
1960	1,770,483	57.7	933,738	17.2
1965	2,359,558	70.7	1,160,075	25.4
1970	1,667,064	82.1	1,402,962	24.2
1975	1,580,495	91.9	1,327,407	34.2
1980	1,723,025	94.2	1,399,292	31.9
1985	1,882,034	93.8	1,373,713	30.5
1990	1,981,503	94.4	1,700,789	30.5

Source: Nihon, Mombosho [Japan. Ministry of Education], *Gakko kihon chosa* [*Basic Surveys of Schools*], (Tokyo:various years).

Notes:
1. Including middle schools in old and new systems.
2. Including high schools in old and new systems.
3. Including technical schools but excluding correspondence courses.
4. Including junior colleges and universities.

In order to comprehend the influence of credentialism on higher education and earnings it is useful to consider the historical development of the educational system and the theoretical discussion of the Late Developer Thesis.

(a) Historical Development

The present educational system in Japan has evolved through many phrases of reforms and developments. The earliest government reforms, which essentially created Japan's higher educational system, were initiated in the late nineteen century.

The Meiji government (1868-1912) was determined to transform the country from an agricultural society to an industrialised nation. It had a strong desire to improve the level of literacy of the populace and to produce a group of educated elites at the top of the governing body. The aim was to import knowledge and technology from the west for a rapid modernization process. The government hired foreigners to teach young males practical subjects like engineering, medicine and foreign languages. It also sent students abroad to study, so that they could return to teach the younger generation. The utilitarian view toward education was firmly instilled in the society. Higher education was treated as a means to foster economic development and to defend Japan against potential foreign aggression.

Tokyo Imperial University (Teikoku Daigaku), the nation's first formal university was established in 1886. It consisted of several former higher learning institutes such as the Tokyo Daigaku of 1877 and the Kaisei Gakko of 1873. From the beginning Tokyo Imperial University accepted

students based on performance in entrance examinations and school marks. Eventually under the egalitarian schemes instituted by many universities, sons of former samurai and elites no longer had an exclusive right to education, but had to compete with sons of farmers and artisans for the slots. Therefore, higher education became a means for young males to climb up the social ladder because the graduates were usually recruited into government bureaucracies and Zaibatsu.[5]

The government's commitment to modernise Japan led to the establishment of many special colleges (Semmon Gakko) which produced a large group of trained personnel for implementing foreign technology in industries and public work. The entrance requirements of these colleges were less strict and the curricula emphasized the applications of technical skills. In addition, several other imperial universities, including Kyoto of 1897 and Tohoku of 1907, were established to feed the growing needs of the rapidly modernised society.

The private sector initiatives in higher education began with the establishment of a private school (shijuku) focused on western learning in 1858 and the Tokyo Semmon Gakko in 1882. These two institutes later to become two famous Semmon Gakko - Keio in 1890 and Waseda in 1905. In those early days private schools were plagued by the lack of funds and legal recognition. The main source of funds was

from tuition and donations from interest groups. Therefore, the curricula were inclined towards liberal arts and social science subjects which required fewer research facilities. These private schools were recognised as full universities after the University Ordinance in 1918.

Since the Ordinance, many former public Semmon Gakko were transformed into public universities in different prefectures across the country. Young men in rural area got the opportunity of pursuing college qualification without incurring large and heavy living expenses in large cities. The dramatic growth of college enrolments took off at this point. A hierarchal structure of higher education also began to develop - there were a few national universities at the apex, some relatively good public and private universities in the middle layer and a large group of poorer private schools at the bottom layer.

Since the Occupation, government's involvement in higher education has been mainly concentrated in national and public universities. This passive attitude indirectly has encouraged the private sector to flourish. In addition to a substantial growth in the number of private universities, many two year junior colleges were also founded following the model of American community colleges. These colleges teach practical subjects like nursing, accounting and office administration. Due to insufficient resources and loose regulations, the standards of private

institutes vary. Nevertheless, the number of young people who have obtained some sort of higher education exploded in the last three decades.

Table 3-2 Enrolments of Higher Education Institutes (1955-1990)

Year	Junior College		University		Total number of females [%][1]
	Numbers of students	% of female students	Numbers of students	% of female students	
1955	77,885	54.0	523,355	12.4	64,896 [10.8]
1960	83,457	67.5	626,421	13.7	85,819 [12.1]
1965	147,563	74.8	937,556	16.2	151,884 [14.0]
1970	263,219	82.7	1,406,521	18.0	217,682 [13.0]
1975	353,782	86.2	1,734,082	21.2	304,960 [14.6]
1980	371,124	89.0	1,835,312	22.1	405,603 [18.4]
1985	371,095	89.9	1,848,698	23.5	434,444 [19.6]
1990	461,849	91.1	2,133,362	27.4	584,541 [22.5]

Source: Nihon, Mombosho [Japan. Ministry of Education], *Gakko kihon chosa* [*Basic Surveys of Schools*], (Tokyo:various years).

Note: 1. % female students = total female students in higher institutes ÷ total number of students in junior colleges and universities.

(b) Late Developer Thesis

In his late developer thesis Dore (1976, pp. 35-50) contends that Japan is a late developing nation. At the time when Japan began her modernisation process at the end of the nineteenth century, many western nations had already been industrialized. As a result, she had to import packages of knowledge from the west at a rapid pace in order to "catch-up."(p.35) Instead of letting the educational system evolve slowly, the government took decisive steps to promote education at all levels. Recruitment based on qualifications was practised by government bureaucracies. The egalitarian selection process of universities encouraged male students of humble origin to pursue educational diplomas. Moreover, the young generation had the mission to "transform" the agricultural society into an advanced nation, and they put heavy emphasis on obtaining qualifications.(p.45) Japan's extraordinary economic growth in the last three decades indeed required a large educated workers. In the early stage of educational expansion even graduates from second-rate universities benefited from the spill-over effect and got relatively decent jobs simply because they held diplomas. Thus, those who did not have diplomas would be underemployed. The author argues that a process of "qualification spiral" has taken place in Japan, and the economic and social pressure to obtain educational qualifications is enormous.(pp.48-49) Based on the

assumption that demand for educational slots exceeds supply, the late development thesis suggests that those who succeed in obtaining diplomas at prestigious institutes would secure a fairly high level of returns.

(2) Educational Inflation in Japan

In the last three decades the number of middle school and high school graduates seeking employment in the labour market has dropped steadily while more young graduates enrol in higher educational institutes. As shown in table 3-3 the job openings for secondary graduates consistently exceed the number of applicants by more than one hundred percent. In fact nearly all the applicants manage to secure employment. Due to the shortage of new high school graduates in the labour market university graduates may have to do clerical work and sales. The benefits of having a diploma, except one from those top schools, gradually diminishes. This will push the quest for qualification to another level - a sharpened competition to gain entrance to the very prestigious schools.

Table 3-3 Employment Security Activity for New School Graduates (1965-1990)

(In thousands)

Year	Numbers of applicants (a)	Openings (b)	Persons who found employment (c)	b/a[1]	c/a[2]	c/b[3]
	Middle School Graduates					
1965	448	1668	413	3.72	92.1	24.7
1970	199	1144	197	5.76	99.1	17.2
1975	70	418	70	5.94	99.8	16.8
1980	46	130	46	2.82	99.8	35.4
1985	46	83	45	1.81	99.3	54.8
1990	31	92	31	2.98	99.5	33.4
	High School Graduates					
1965	632	2212	551	3.5	87.3	24.9
1970	666	4701	657	7.06	98.7	14.0
1975	481	1628	480	3.38	99.8	29.5
1980	495	925	492	1.87	99.4	53.2
1985	477	841	473	1.76	99.2	56.2
1990	523	1343	521	2.57	99.6	38.8

Source: Japan, Statistic Bureau, Management and Coordination Agency. *Japan Statistical Yearbook.* (Tokyo: 1991)

Notes:
1. Opening ratio.
2. Ratio of persons who found employment in percentage.
3. Sufficiency ratio.

(a) Screening

There is little doubt that screening exists in the Japanese labour market. In particular large firms recruit graduates exclusively from a few prestigious schools such as Tokyo University and Kyoto University. The practice of screening can be traced back to the hiring practices of Zaibatsu in the pre-war period, and it has a significant ramification on education and earnings.

Before the Occupation family-controlled business Zaibatsu often competed with government agencies in recruiting male graduates from the best universities. These employers' hiring criteria are based on applicants' qualification. On the other hand, jobs in these large enterprises were more attractive to young men mainly because they usually provided long promotion ladders and more benefits. As a result, signalling has been considered an important side-effect of education since the beginning of Japan's economic development.

After the dissolution of Zaibatsu, large firms have continued the practice of hiring universities' graduates upon their graduation. In addition, the harsh university entrance requirements proved to be effective in filtering out those less academically successful students from the system. Therefore, a university diploma has become the most convenient device for firms to screen potential job applicants. While more young men obtain some sort of

certificates, firms become more selective and focus their recruitment efforts in top schools. To many graduates, being hired by large firms is the first step of harvesting the returns of their investments in college education. Large firms usually pay higher wages, larger bonuses and subsidies. Besides, the practice of lifetime employment and seniority wage are not prevalent in medium and small firms. Japanese workers are company conscious, and working for large and well-known firms automatically confers status and respect.

Thurow (1975, pp.96-97) suggests that in a competitive labour market college education becomes a "defensive" weapon to protect individuals' "market shares." If this is the case, the present demand for higher education by high school graduates in Japan is not expected to subside even if the monetary returns show small decline. Firms' screening practice has been a powerful force reinforcing the Japanese society's preoccupation with credentials.

(b) Rewards of Higher Education

It is conceivable that the rise of credentialism in Japan diminishes the marginal benefits of higher education. In particular, the monetary rewards of college education may just narrowly outweigh the costs.

As competition for college slots becomes more

intensified, the costs of acquiring diploma also rise. It is essential to note that strictly speaking in Japan the costs of higher education does not only occur during the college attending years but also during the intensive examination preparation years. Some parents send their children to prestigious private high schools and pay significant amounts of tuition. Others often have to pay for their children's extra tutorials and study materials. The foregone earnings and educational costs borne by ronin should also be taken into consideration.

On the other hand, in the labour market many college graduates involuntarily accept lower paid jobs due to occupational downgrading. This trend tends to narrow the wage gap between high school and college graduates. Nakata and Mosk (1986) show that between 1958 and 1980 the internal rates of return to college education in Japan decline from eleven percent to just over six percent while the college application rate of the same period continues to climb. However, they conclude that the rates only reflect short-run economic forces and in the long run application rates are influenced by other factors such as the quality of college education and labour market discrimination.

To conclude: although the rise of credentialism is expected to have significant impact on the rewards of post secondary education, it does not significantly alter the

competitive nature of the educational system. In the next chapter I shall further explore the special features of the Japanese labour market in order to develop a conceptual framework for our empirical analysis.

Notes:

1. These figures come from the 1990 issue of Gakko kihon chosa *(Basic Survey of Schools)*.

2. See pp.43-79 in Ito (1992) for a comprehensive discussion on the growth of the Japanese economy after World War II.

3. Educational inflation in a society occurs when a college diploma is required for many ordinary jobs which can easily be held by persons with lower qualification. See pp.5-6 in Dore (1976) for a full description. Also see pp.42-43 for the phenomena of "qualification spiral" in the Japanese society.

4. Juku are attended by elementary and secondary students after their regular school hours; yobiko are special college-preparatory schools attended by senior high school students and ronin.

5. Zaibatsu organizations are family owned conglomerates which possess concentrated market power in manufacturing, trading and finance. At the top of the organization is a holding company which is solely controlled by a single family. Usually each Zaibatsu has its own financial

institution and a large number of manufacturing factories and subsidiaries. Members of a Zaibatsu often enjoy special business relations that are not offered non-members. At the end of World War II the Big Four - Mitsui, Mitsubishi, Sumitomo and Yasuda - controlling one quarter of the incorporated business in Japan.

See "Zaibatsu" in Patrick and Rosovsky (1976) for a detailed description of their business practices.

Chapter 4

Conceptual Framework - Labour Market Segmentation in Japan

The purpose of this chapter is to lay a foundation for developing a conceptual framework to analyze the relationship between college education and earnings in Japan.

Official Japanese wage statistics primarily reveal two forms of duality in the labour market: firm-size and gender. It should be pointed out that in reality there are more than two forms of segmentation in the labour market. For example, ethnic Koreans (approximately 1 percent of the total population) are often excluded from high paying jobs due to their ethnicity. In fact in the Japanese labour market factors such as school quality and family background also serve to delimit certain segments as well. However, the present data source does not contain sufficiently detailed information to permit the study of these other issues. As a result, only two lines of segmentation, firm-size and gender, will be incorporated into our regression analysis. In addition, the theories on education and earnings discussed in the previous chapter will also be used to build the analytical framework. Given the limitation of data, our assessment of the impact of higher education on earnings is certainly tentative to the model employed.

(1) Segmentation by Firm-Size

The internal wage structure of Japanese labour market reveals that wage differential by firm-size does exist, though the degree may vary.[1] As shown in table 4-1 the average monthly contract wages in large enterprises are consistently twenty percent above those in smaller firms for both male and female workers.

Given these figures it is perhaps not surprising that upon graduation many new entrants to the labour market prefer to seek employment in large firms. Nevertheless, large firm employment constitutes only less than 20 percent in the labour market in the last decade. Moreover, these firms are very selective in the recruitment of fresh graduates and they seldom hire experienced workers from smaller companies.[2] Although the starting salaries offered are comparable across different companies, the wage gap grows larger as length of service increases.[3] Generally large firms are more willing and capable of providing on-job training for workers, thus enhancing their productivity and earnings power. A study done by Shimada (1980, p.21) found that in 1974 while 95 percent of large firms (1000+ employees) provide training programs to new entrants, this figure drops to 26 percent for firms with 30 to 99 employees. Similarly 62 percent of large firms train workers already on the payroll but only 10 percent of small firms do so. Shimada concludes that "large firms are much

better equipped and more conscious of providing internal training" and that the provisions of training become an "internalised structure of a firm's labour market."(p.21)

In terms of promotion, large firms are highly internalised. Although these companies do hire "half-way" workers to fill lower position, their recruitment effort is focused on fresh graduates.[4] Job rotation and training workshops are set up to retrain "insiders" to fill middle and high positions. Naturally for university graduates, the promotion prospect is very promising since they usually pursue their career in professional and management tracks.

The wage differential observed between large and small firms is due to a hybrid of factors such as the quality of the work force and employment practices. An in-depth study into the reasons behind the observed differentials would certainly exceed the scope of this thesis. Nevertheless, I shall briefly describe two pervasive employment practices that should be considered in studying the earnings pattern in Japan. They are the practice of lifetime employment (shushin koyo) and the seniority wage system (nenko joretsu).

Table 4-1 Average Monthly Contract Earnings by Sex and Firm-Size[1] (1970-1989)

(in thousand yen)

Year	Male			Female		
	Small	Medium	Large	Small	Medium	Large
1970	61 [100]	66 [108]	75 [122]	31 [100] {51}	33 [106] {50}	41 [132] {55}
1975	133 [100]	146 [109]	163 [123]	75 [100] {56}	83 [110] {57}	96 [128] {59}
1980	197 [100]	215 [109]	250 [127]	112 [100] {57}	121 [108] {56}	144 [128] {58}
1985	239 [100]	266 [111]	316 [132]	138 [100] {58}	150 [109] {56}	184 [133] {58}
1989	270 [100]	300 [111]	363 [134]	157 [100] {58}	172 [110] {57}	215 [137] {59}
1990[2]	354 [100]	415 [117]	501 [142]	210 [100] {59}	234 [111] {56}	285 [136] {57}

Source: Japan, Statistic Bureau, Management and Coordination Agency. *Japan Statistical Yearbook.* (Tokyo: 1991)

Notes:

1. The classification of firms by size is as following: small firms have 10-99 employees; medium firms have 100-999 employees; large firms have 1000 or more employees. Contract wage does not include bi-annual bonuses.

2. Calculated from raw data, including monthly average bonuses.

3. Figures in square brackets are relative indices across firm-size while those in curly brackets indicate how much females earn compared to males(=100) in the same firm-size group.

(a) Lifetime Employment

The pure form of lifetime employment is hardly practised by Japanese employers; however, a qualified and limited version which stresses stable working environment and commitments is widely observed in large firms. According to the practice, workers are implicitly guaranteed that they will not be dismissed unless they make serious mistakes and cause enormous damage and embarrassment to the parent companies. In recession, instead of massive lay-off, firms use working hours to do in-house training or stop hiring temporary workers to secure the livelihood of regular employees. In return, workers implicitly pledge loyalty to their firms. This paternal relationship fosters cooperation, and companies often provide workers with additional subsidies, for example, housing, medical care and insurance. Some managers in large corporations also receive expensive vacation packages. It is not uncommon for many large firms to arrange jobs, which offer lower wages, for their "retired employees" in companies' subsidiaries.

Lifetime employment is seldom practised in small firms, whereas in medium size firms only a small group of management and highly skilled staff enjoys the privilege. Therefore, compared to other workers, employees of large enterprises are less likely to experience unpleasant variation in lifetime earnings.

(b) Seniority Wages

According to the pure form of seniority wage system workers' earnings are based solely on the length of service with the present employers. Of course, in reality it is never this simple. Instead seniority is considered an important factor in wage determination, in addition to other determinants such as education and labour productivity. In large firms, the effect of seniority on wages is not insignificant because workers are less likely to separate from their jobs, and thus accumulate more internal experience. In many previous studies, experience and length of tenure are found to have a significant impact on earnings and bonuses.[5]

Based on the evidence of wage differential among firm-size groups, it is plausible that wages in the Japanese labour market are determined not only by educational attainment and age, as postulated by the human capital theory, but also by the structure and practices of the labour market as suggested by the labour market segmentation theory and the screening hypothesis. The basic elements of segmentation described in the job-competition and internal labour market models are also relevant in the Japanese context. Nakata and Mosk (1986, p.390) argue that in the Japanese case an "enterprise competition" model is more appropriate because workers compete against each other to secure employment in large prestigious enterprises.

Having established the notion that firm-size has a significant impact on earnings, I shall proceed to present evidence of the linkage between gender and earnings.

(2) Duality between Male and Female Earnings

In the last two decades the role of women in Japanese society has been changing; nevertheless, the process has been very slow and the results of change are not revolutionary. In the labour market, women's rate of participation in the labour market has been only between 45 and 50 percent throughout the last few decades. Traditionally women work in family run businesses and farms. As urbanization takes place in rural Japan, more women are engaged in production works in manufacturing industries and secretarial jobs in business firms. Their status at work is usually inferior to their male counterparts. Very often females clerks, the so-called office ladies (OLs), are still expected to serve tea and run personal errands for their male co-workers. Women are almost entirely excluded from management positions. As shown in table 4-2 of all the women working in 1990, only 1% (160,000) held managerial position. Moreover, the wage rate for female workers is on average only about sixty percent of the male workers'.

Table 4-2 Trend in Female Employment Structure - Employees (1960-1990)

(in percentage)

Occupation	1960	1975	1990
Professional and technical workers	9.0	11.6	13.8
Managers and officials	0.3	0.9	1.0
Clerical and related workers	25.4	32.2	34.4
Sales workers	8.7	11.1	12.5
Agricultural, forestry and fisheries workers	3.6	0.8	0.6
Mining workers	0.7	1.5	0.5
Workers in transport and communications occupations	0.3	-	-
Craft and production process workers	35.9	24.6	20.6
Protective service workers and service workers	16.1	13.7	10.7
Labourers	-	3.7	5.6

Source: The Japan institute of Labour, *Japanese Working Life Profile 1991-1992*, figure 62. (Tokyo: 1991).

Note: 1. The numbers do not add up to 100 in the original data. This is probably due to rounding discrepancy.

Table 4-3 Average Monthly Contract Earnings by Sex and Educational Level[1] (1970-1989)

(in thousand yen)

Year	Male			Female		
	I[2]	II	III	I	II	III
1970	65 [100]	92 [142]	82 [126]	37	-	-
1975	143 [100]	176 [123]	176 [123]	87 [100] {61}	99 [114] {56}	114 [131] {65}
1980	213 [100]	231 [108]	253 [119]	127 [100] {60}	137 [108] {59}	166 [131] {66}
1985	264 [100]	261 [99]	312 [118]	155 [100] {59}	169 [109] {65}	205 [132] {66}
1989	298 [100]	283 [95]	356 [119]	175 [100] {59}	193 [110] {68}	235 [134] {66}
1990[3]	397 [100]	376 [95]	510 [128]	227 [100] {57}	254 [112] {68}	319 [141] {63}

Source: Japan, Statistic Bureau, Management and Coordination Agency. *Japan Statistical Yearbook.* (Tokyo: 1991)

Notes:

1. Including graduates from old and new school system. Contract wage does not include bi-annual bonuses.

2. Group I: graduates of high schools
   Group II: graduates of junior colleges and technical colleges
   Group III: graduates of universities.

3. Calculated from raw data, including monthly average bonuses.

4. Figures in square brackets are relative indices across educational groups while those in curly brackets indicate how much females earn compared to males(=100) in the same educational group.

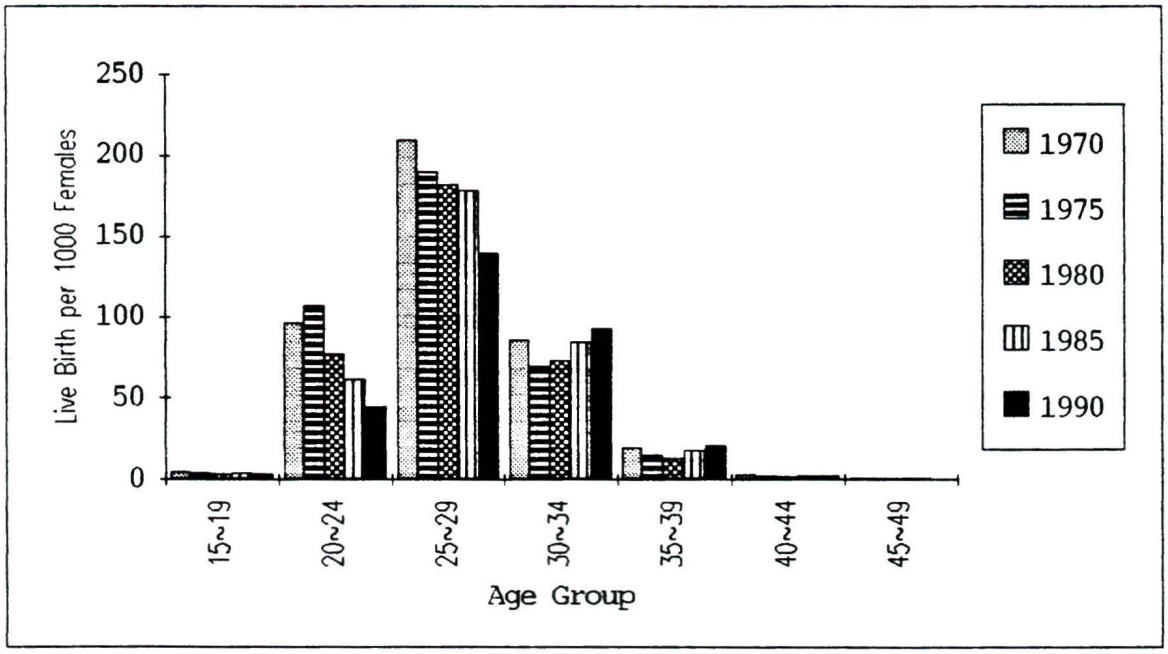
(a) Female Labour Force Participation in Modern Japan

Although an increasing number of women continue to work even after their marriages, it is not uncommon for women to leave their jobs in their late twenties to have children and take care of their parents-in-law. Even after child birth, few women reenter the labour force until their children have grown up. As shown in figure 4-1a the female labour participation rate drops sharply in the 25-34 age group. It is also noticeable that the rate in subsequent age cohorts remains quite low. On the other hand, the live birth rate for women in the age group 25-34 is extremely high. These figures accurately reflect the life cycle of women. One reason behind the low participation rate is undoubtedly due to child births and subsequently child-rearing. During the child-rearing years it is not uncommon for women in Japan to put their careers on hold for years in order to bring up their children. When they eventually reenter the labour market in their early forties, they usually enter into menial part-time work which pays substantially less since their seniority positions at work are never established.

Figure 4-1a Female Labour Force Participation Rate in Japan (1970-1990)

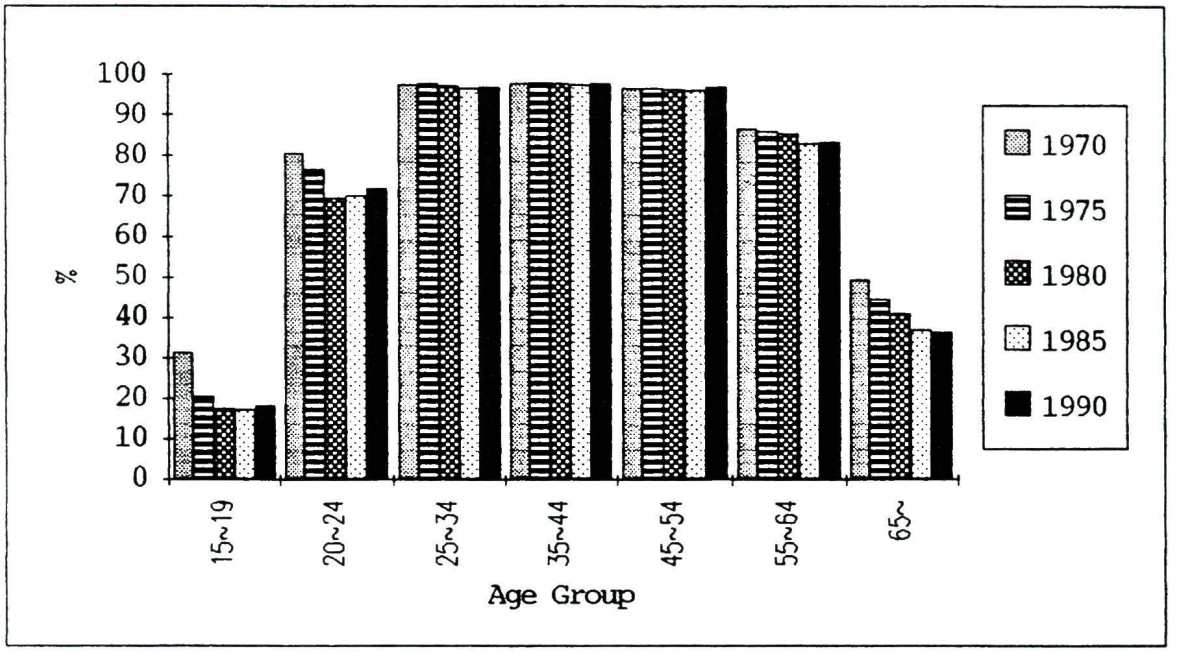
Source: Japan, Statistic Bureau, Management and Coordination Agency. Japan Statistical Yearbook. (Tokyo:1991)

Figure 4-1b Live Birth Rate by Age Group of Mother in Japan (1970-1990)



Source: See Figure 4-1a.

Figure 4-2 Male Labour Force Participation Rate in Japan (1970-1990)



Source: See Figure 4-1a.

(b) Firms' Economic Concerns

It is plausible that profit-maximizing firms in competitive labour markets might be reluctant to hire women for important positions due to their interrupted working lives.[6] Replacement workers must be hired during female workers' maternity leave and this may entail some loss of efficiency. Although the Japanese government has tried to promote equal opportunities for female workers by passing the Equal Opportunity Law in the late 1980's, there is hardly any enforcement mechanism. Observed earnings data show little improvement in women's wage rate. Firms are not prepared to invest heavily in human capital formation of female workers because apparently employers argue that it is more difficult to recover the training costs. The discontinuity of women's working lives makes such investment less profitable relative to investment in training male workers. Even when female workers receive some form of training, it is likely that they bear the costs in term of lower wages. It should be noted that this discussion is only relevant to the mass majority of marginal workers. There are indeed a few exceptionally able women commanding high salaries and enormous status in the Japanese labour force.

Employers' attitude about women and their position in the labour market clearly pose significant barriers to women's decision to participate, and an asymmetry of

earnings persists between male and female workers.

Given the characteristics of the Japanese labour market and the restricted nature of the raw data, it is not unreasonable to construct an analytical framework along the lines of firm-size and gender segmentation. I propose a disaggregated approach in our regression analysis. It is based on the notion that within each firm-size-gender group, the effects of education, age and experience on earnings may vary. The goals of this approach are: (1) to discover the relative importance of higher education on earnings in different market segments, (2) to examine the shape of age-earnings profiles among different educational groups, and (3) to estimate the internal rates of returns to college education in the Japanese institutional context. In the next chapter I will develop an economic model to achieve these three goals.

Notes:

1. The concept of firm-size segmentation is used in previous studies. For example, see Hashimoto and Raisian (1985), Hashimoto (1979), Mosk (1992), pp.589-627 in Patrick and Rosovsky (1976) and Shimada (1981).

2. It is not common for firms to "lure" workers from each other because these workers may carry a stigma of disloyalty.

3. See Table 2 in Hashimoto (1979), table 6 in Hashimoto and Raisian (1985) and p.99 in Shimada (1981).

4. "Halfway workers" refer to those who change jobs in the middle of their career; unlike fresh graduates, they usually have relevant working experience.

5. See pp.66-74 in Shimada (1981), table 5 in Hashimoto and Raisian (1985) and table 3 in Hashimoto (1979).

6. Figure 64 in The Japan Institute of Labour (1991) shows that in the last 25 years the average years of service for males is nearly double that for females. In the survey of 1990, it shows that the average length of service in private

establishments for men is 12.4 years, while it is 7.3 years for women.

Chapter 5

Economic Models

In the previous chapters I have presented the characteristics of the Japanese labour market and educational system and in this chapter I shall construct an economic model to examine the relationship between higher education and earnings. The objectives of the empirical model are: (1) to examine the impact of college education and other factors on earnings across different labour market segments, (2) to compare the age-earnings profiles across different educational and gender groups, (3) to calculate the internal rates of returns to higher education for men and women in different segments of the labour market.

Recall that individuals' earnings (Y) can be expressed as a function of educational attainment and a group of other variables:

$$Y=f(Ed,Z).....(1)$$

where Ed is amount of education acquired, and Z is a vector of other determinants such as age, experience and sex. A disaggregated earnings regression model is developed using this basic formula. The functional form chosen for the model is log-linear since our interest here lies in the marginal percentage change of income with respect to an

absolute change in one of the independent variables. Thus (1) is written as:

$$Y=e^{\alpha+\beta Ed+Z'\Omega}e^{\varepsilon}.....(2)$$

or

$$\ln Y=\alpha+\beta Ed+Z'\Omega+\varepsilon.....(3)$$

where Ω is a vector of coefficients and ε is the random residual term.

(1) Data Sources

(a) Wage Data

Since individual (micro) data on wages are not available for Japan, grouped industry average data are used in this analysis.[1] The 1,220 cross-sectional observations are drawn from the *Wage Census (chingin sensasu)* of 1990. The data cover age, years of experience with present employers or internal experience, wages, bonuses, hours of work in private enterprises and level of education. Government employees and workers in firms with less than 10 employees are excluded. Regression analysis using grouped data usually suffers from the problem of groupwise heteroscedasticity; as a result, the method of weighted least squares is used to handle the problem.[2]

(b) School Costs Data

Data on the costs of education are primarily used to calculate the internal rate of return to college education. The data for tuition and other expenses are drawn from *Survey of Student Life* (*gakusei seikatsu chosa*) for the year 1990. Since individual micro costs data are not available, weighted averages are computed.[3] Part-time earnings while attending college are also reported and they will be used to calculate the net foregone earnings of students.

(2) Disaggregated Regression Model

Integrating the special properties of Japan's labour market, the disaggregated earnings functions are formulated.

The purpose of this model is to estimate a separate earnings function for workers within each of the six labour market segments after isolating the effects of firm-size *and* gender. Essentially this model includes only standard human capital variables, that is education, age and experience.

$$\ln Y_i=\beta_0+\beta_1 J_i+\beta_2 U_i+\beta_3 E_i+\beta_4 E^2{}_i+\beta_5 (JE)_i+\beta_6 (UE)_i+\beta_7 A_{1i}+\beta_8 A_{2i}+\varepsilon_i \ldots\ldots (4)$$

where Y is the hourly rate of earnings[4]; J and U are dummy variables corresponding to junior college and university education; E stands for years of experience with present employer; A_1 and A_2 are variables representing the actual age of two categories: under and above 55 years old. JE and

UE are terms representing the cross-effect of education and experience. The slope coefficients β_1 and β_2 represent the marginal effects of college education on earnings. It is postulated that experience exerts non-linear effects on earnings; therefore, the square of experience (E^2) is also incorporated. Moreover, according to the human capital theory the accumulation of on-job experience increase workers' productivity; on the other hand, their skills become obsolete as they age. Hence, the earnings function should not be monotonic increasing but concave in age. That means the earnings profiles of workers who have more education are expected to be steeper and reach the peaks later than those of the less educated.

This formulation also allows easy comparison of the slope coefficients across segments. Education, age and experience are expected to have different effects on earnings across different institutional settings.

(3) Internal Rates of Returns to Higher Education

The internal rate of return to educational investment reflects the marginal benefits of schooling on earnings. The expected rate of return is useful for comparing the profitability of various investment options. In particular, it influences students' expectation of future earnings and affects their decisions to acquire education. In the

present studies, due to the apparent wage differentials across market segments, I shall proceed to calculate the internal rate of return to college education within each segment. This formulation is more sensitive to the market structure.

The internal rate of return (R) is the discount rate which sets the following expression to zero.

$$\sum_{t=t_1}^{n} \frac{B_t}{(1+R)^t} \quad \ldots\ldots (5)$$

where t_1 is the year additional schooling starts, n is the age of retirement and B_t is the marginal monetary benefits of acquiring an additional year of schooling. In particular, the net earnings during the years of attending college will be negative reflecting the costs of education and foregone earnings.

Since the purpose of the present study is to investigate the effect of post-secondary education on individuals' earnings in Japan, only the internal (private) rates of returns to junior college and university education are calculated.

(a) Age-Earnings Profiles

A separate earnings profile is estimated for each educational group within the six labour market segments described in the disaggregated earnings model. The earnings are estimated by feeding the observed group averages into the estimated earnings functions. As a result, eighteen different earnings profiles are produced.

It is assumed that high school graduates enter the labour force at age nineteen, junior college graduates at twenty-one and university graduates at twenty-three. The standard hours of work are 175 hours per month for female workers, and 180 hours for male workers.

I shall first adjust the estimated lifetime earnings before using them to calculate the internal rate of return to university and junior college education.[5]

(b) Adjustment

(i) Labour Force Participation Rate

Since the yearly earnings reported in the *Wage Census* implicitly account for the unemployment rate of the various educational group, further adjustment is not needed. However, women's labour force participation rate is generally lower than men's; therefore, the rate must be applied in the estimation process to reflect more accurately the expected lifetime earnings of women.

(ii) Survival Rate

The earnings stream enjoyed by an individual is closely associated to his or her probability of survival. Human capital is not transferable, so the expected earnings flow must be multiplied by the gender-age specific survival rate. This downward adjustment reflects the benefits individuals can expect from their educational investments.

(iii) Secular Growth

The lifetime earnings profiles estimated from cross-sectional data are stationary and do not accurately reflect the earnings streams generated over a thirty to forty years period. Economic growth often takes place because of automation and technological advancement. Therefore, the estimated earnings profiles must be adjusted upward. In this study, a moderate growth rate of two percent per year is chosen. The experience of developed countries in the west indeed indicates that two percent is a reasonable growth rate for industrialized countries.[6] Thus, the earnings at age t are multiplied by $(1.02)^{t-t_1}$, where t_1 is the age at which the individual enters the labour force.

(iv) Taxation

In calculating the private rate of return to education, taxes must be deducted from individuals' earnings in order to derive the net earnings flow. Progressive taxation in effect smooths out the income differentials and diminishes the rate of return to higher education. In Japan, although the individual marginal tax rate is quite high compared to many western nations, the allowable deductions are very generous.[7] The deduction scheme used here also assumes women continue to work even after marriage and child births since the probability of their leaving their jobs is already accounted for by the labour force participation rate. Nevertheless, for women who actually leave the labour force during child-rearing years the internal rates of returns to their educational investments will be substantially smaller.

(c) Educational Costs and Foregone Earnings

The costs of education are not confined only to tuition; they should include the earnings foregone by students while attending schools. By definition, foregone earnings are the opportunity costs of acquiring education. At college level the amount is rather substantial. A large amount of foregone earnings not only reduces the internal rate of return, but also induces students to postpone or give up college education.

The educational costs used here are weighted averages of the costs of attending national, public and private higher institutions. Students living in dormitory incur larger expenses, so the costs of education are higher. Nevertheless, since living expenses, in various levels depending on personal taste, occur no matter whether a person attends college or not, they are excluded in the calculation of educational costs. The average costs for female students are higher since a large portion attends private schools, but at the same time their average in school earnings are higher.

For college graduates, their yearly net earnings while at school are calculated as follows:

$$B_t = PE_t - EC_t - FE_t \quad \ldots\ldots (6)$$

PE corresponds to the part-time earnings while attending school; EC stands for the yearly educational costs; FE represents the foregone earnings. Foregone earnings are assumed to be the estimated earnings of high school graduates at age t in the same labour market segment.

There is not sufficient information on the educational costs for ronin; therefore, our analysis does not account for these extra costs. Including these costs and one or more years of foregone earnings will definitely diminish the rate of return to university education. On the other hand,

those ronin who succeed in entering prestigious schools would probably secure employment in higher salary jobs. Thus their earnings would be higher than otherwise.

The net benefits of university education are obtained by subtracting the earnings stream of high school graduates from that of university graduates. In particular, in equation (7), B_t will be negative from age 19 to 23 and gradually grows larger as age increases.

$$\sum_{t=t_1}^{n} \frac{B_t}{(1+R)^t} = 0 \quad \ldots\ldots (7)$$

A similar method is used to calculate the net earnings benefits of junior college education. The solution R will be the internal rate of return for the relevant educational group. In the next chapter I shall present the empirical results of the estimation.

Note:

1. The data cover the following categories of industry in the *Wage Census*:

D. Mining

E. Construction

F. Manufacturing

I. Whole sales, retails and food

J. Finance and insurance

K. Real estate

L. Services.

2. For group data, the variance of each group varies proportionally and inversely with the number of observations in each cell and should not be treated as equal. Suppose the original regression equation is

$$Y_i=\beta_0+\beta_1 X_{1i}+\ldots+\beta_k X_{ki}+\varepsilon_i,$$

and such that $Var(Y_i)=E(\varepsilon_i^2)=\frac{\sigma^2}{n_i}$, where σ^2 is the true variance and n_i is the number of observations in group i. If we let the weight be $\frac{1}{\sqrt{n_i}}$, then the original equation is transformed as follows:

$$\sqrt{n_i}Y_i=\beta_0\sqrt{n_i}+\beta_1\sqrt{n_i}X_{1i}+\ldots+\beta_k\sqrt{n_i}X_{ki}+\sqrt{n_i}\varepsilon_i.$$

Suppose we let $\nu_i=\sqrt{n_i}\varepsilon_i$, then the transformed regression equation has constant variance across groups.

$$Var(\nu_i)=(\sqrt{n_i})^2 Var(\varepsilon_i^2)=n_i\frac{\sigma^2}{n_i}=\sigma^2$$

The estimated slope coefficients are BLUE (best linear unbiased estimator).

Since in our formulation the dependent variable is in logarithm, the transformation does not totally eliminate heteroscedasticity even after applying White's heteroscedastic-consistent covariance matrix estimation method. The Breusch-Pagan-Godfrey (B-P-G) test gives a test statistics of 270.939 with 8 d.f. Since it is obviously larger than the chi-square statistic at any confidence level, therefore, the homogeneity of variances assumption is rejected. Nevertheless, since the heteroscedasticity is not correlated with the dependent or independent variables, the ordinary least square method in large sample (1220 group observations) is still reliable.

3. See appendix 1 for the estimated costs data.

4. Average hourly earnings = {total monthly earning + total bonuses÷12}÷{total monthly hours of work, including overtime}.

5. See appendix 2 for the unadjusted predicted earnings.

6. See the growth rates of OECD countries in the past 30 years in OECD (1992).

7. For a description of the taxation scheme used in the adjustment process, see appendix 3.

Chapter 6

Empirical Analysis

In this chapter I shall present the findings of the present analysis. I shall begin with the presentation of the estimated slope coefficients of various regressions developed in chapter 5. Then in the second section the internal rates of returns to higher education calculated using the regression results will be reported.

(1) Regression Results

(a) Slope Coefficients

Based on the notion that the Japanese labour market is segmented, it is necessary to examine and compare the impact of education on earnings in different market segments. Tables 6-1a and 6-1b present the results of the disaggregated regressions.

As expected the estimated coefficients for university and junior college education are comparatively large. However, except in the large firm segment, the marginal impact of college education is greater for females than for males. The results suggest that for women who attend universities, their investments could be rewarding even though their working lives are usually short and

interrupted. Similarly the impact of junior college education in the female segments is larger. It should be noted that junior college education is found to be statistically insignificant in large enterprises. The results are in line with the observation that large enterprises focus their recruitment effort on male university graduates. In many cases female university graduates are assigned more responsibilities in smaller firms than those in larger establishments where male university graduates usually hold all managerial positions.

For both sexes, the marginal impact of experience is largest in small firms and smallest in large firms. It should be noted that the presence of the age variables undoubtedly lessens the marginal impact of experience on earnings. The non-linear effect of experience is well captured by the square term (E^2) with a significant negative slope coefficient across segments. However the interaction coefficients (JE and UE) show that while the combination of university education and experience affects earnings positively, the junior college-experience cross effect is smaller. Moreover, they are most prominent in the large firm-male segment. These results suggest that in our cross-sectional study large firms indeed appear to have a better developed wage-seniority system.

For female workers in medium and small firms, age also has a negative impact on earnings. On the other hand, for

men the marginal impact of age on earnings is small and insignificant relative to the effect of experience. These results are not unusual in view of the more prevalent use of "half-way" workers in small firms and the higher separation rates of female employees.

The findings of the disaggregated model can be summarised into two major points: (1) when the effects of gender and firm-size are controlled, university education has the largest marginal impact on earnings and (2) the large difference in the size of educational coefficients among females suggests that all three female market segments are highly stratified with respect to educational attainments.

Table 6-1a **Regression Results of the Disaggregated Model - Male,1990**

	Large Firms	Medium Firms	Small Firms
Variable Name	Estimated Coefficient (T-Ratio 201 d.f.)	Estimated Coefficient (T-Ratio 201 d.f.)	Estimated Coefficient (T-Ratio 201 d.f.)
K	-.11710 (-1.8496)	-.24516 (-4.4383)	-.15355 (-3.0071)
J	.078195 (2.3889)	.12868 (4.8395)	.087009 (3.7453)
U	.26833 (5.5426)	.29027 (8.0816)	.18243 (5.0635)
JE	.0023088 (.94306)	-.00059501 (-.25796)	.007422 (2.8277)
UE	.0071835 (2.6253)	.0048169 (1.7751)	.00995255 (3.0377)
E	.070440 (7.4501)	.070712 (10.476)	.10065 (9.9749)
E^2	-.0011277 (-5.2969)	-.0012575 (-5.7597)	-.0024608 (-7.7289)
A_1	.0065502 (1.9736)	.0066771 (2.3864)	-.0011694 (-.41187)
A_2	.004117 (1.5714)	.0049422 (2.5457)	-.0028202 (-1.2856)
R-Square	.9785	.9758	.9587

Note: (1) The regression model applied to six different data sets is:

$$\ln Y_i=\beta_0+\beta_1 J_i+\beta_2 U_i+\beta_3 E_i+\beta_4 E^2{}_i+\beta_5 (JE)_i+\beta_6 (UE)_i+\beta_7 A_{1i}+\beta_8 A_{2i}+\varepsilon_i .$$

Table 6-1b Regression Results of the Disaggregated Model - Female, 1990

	Large Firms	Medium Firms	Small Firms
Variable Name	Estimated Coefficient (T-Ratio 177 d.f.)	Estimated Coefficient (T-Ratio 179 d.f.)	Estimated Coefficient (T-Ratio 194 d.f.)
K	-.061090 (-11.872)	.031627 (.33979)	-.065349 (-.83214)
J	.084897 (1.7659)	.19368 (4.1953)	.14297 (3.6246)
U	.11341 (2.9963)	.38707 (7.2362)	.39354 (7.6714)
JE	.0086543 (1.6997)	.01826 (2.7642)	.012897 (1.8490)
UE	.024862 (5.6800)	.02039 (2.5462)	.015319 (1.9560)
E	.058929 (5.6819)	.092994 (4.6231)	.13217 (7.1768)
E^2	-.003682 (-8.5789)	-.0014452 (-1.4677)	-.0033961 (-5.1677)
A_1	.029099 (13.846)	-.013297 (-2.4162)	-.01659 (-3.3597)
A_2	.02959 (15.728)	-.011753 (-2.7776)	-.016029 (-3.4387)
R-Square	.9424	.7481	.6584

Note: (1) The regression model applied to six different data sets is:

$$\ln Y_i=\beta_0+\beta_1 J_i+\beta_2 U_i+\beta_3 E_i+\beta_4 E^2{}_i+\beta_5 (JE)_i+\beta_6 (UE)_i+\beta_7 A_{1i}+\beta_8 A_{2i}+\varepsilon_i .$$

(b) Hypothesis Testing

In the previous section I have discussed the effects of individual coefficients on earnings within the prescribed market segment. In order to show that the disaggregated model is indeed valid I shall proceed to present the statistical results on the equality of coefficients across segments. Since heteroscedasticity is not totally eliminated from the transformed data set, all the tests are performed using the Wald chi-square statistics. The tests are mainly of three categories: (1) to test the equality of coefficients of regressions between sexes, (2) to test the equality of coefficients of regression between firm-size groups, and (3) to test whether the assumption of six different regression functions is correct. The test results are presented in tables 6-2a and 6-2b.

(i) Between Sexes

It is notable that the coefficients for university education are statistically different between male and female in large and small firms, but not so in medium firms. This implies that the marginal impact of university education on earnings is comparable between sexes in medium firms. Similarly, the coefficients representing junior college education are not statistically different from each other between male and female workers. On the other hand,

the null hypothesis which states that the age variables for both sexes are the same is not valid since our test results show very large Wald statistics. By contrast, in terms of experience the difference between the two sexes appears to be insignificant in large firms.

(ii) Between Firm-Size Groups

The test results suggest that the coefficients for university education are statistically different between firms for both sexes. It strongly supports the notion that the monetary rewards of a university diploma vary with the size of firm. It is obvious from the regression results that the impact of university education is least for males in small firms and for females in large firms. This supports the observation that university males employed in large enterprises are better off in terms of earnings. The hypothesis of equality of the age and experience coefficients across firm-size is rejected because of the large Wald statistics. It is perhaps not surprising because large firms have a better developed wage-seniority system. On the other hand, it is rather difficult to draw conclusions on the cross-effects of education and experience since they appear to be statistically insignificant.

Table 6-2a Results of Hypothesis Testing of the Equality of Coefficients Between Sexes

Hypothesis	Test Statistic
Ho: $\beta_1^{1,1}=\beta_1^{0,1}$	W = 0.875 (1 d.f.)
Ho: $\beta_1^{1,2}=\beta_1^{0,2}$	W = 1.284 (1 d.f.)
Ho: $\beta_1^{1,3}=\beta_1^{0,3}$	W = 0.689 (1 d.f.)
Ho: $\beta_2^{1,1}=\beta_2^{0,1}$	W = 5.939 (1 d.f.)
Ho: $\beta_2^{1,2}=\beta_2^{0,2}$	W = 2.098 (1 d.f.)
Ho: $\beta_2^{1,3}=\beta_2^{0,3}$	W = 5.815 (1 d.f.)
Ho: $\beta_3^{1,1}=\beta_3^{0,1}$	W = 1.121 (1 d.f.)
Ho: $\beta_3^{1,2}=\beta_3^{0,2}$	W = 3.014 (1 d.f.)
Ho: $\beta_3^{1,3}=\beta_3^{0,3}$	W = 3.116 (1 d.f.)
Ho: $\beta_5^{1,1}=\beta_5^{0,1}$	W = 0.861 (1 d.f.)
Ho: $\beta_5^{1,2}=\beta_5^{0,2}$	W = 6.795 (1 d.f.)
Ho: $\beta_5^{1,3}=\beta_5^{0,3}$	W = 0.377 (1 d.f.)
Ho: $\beta_6^{1,1}=\beta_6^{0,1}$	W = 4.360 (1 d.f.)
Ho: $\beta_6^{1,2}=\beta_6^{0,2}$	W = 2.897 (1 d.f.)
Ho: $\beta_6^{1,3}=\beta_6^{0,3}$	W = 0.249 (1 d.f.)

Ho: $\beta_7^{1,1}=\beta_7^{0,1}$	W = 38.40 (1 d.f.)
Ho: $\beta_7^{1,2}=\beta_7^{0,2}$	W = 29.71 (1 d.f.)
Ho: $\beta_7^{1,3}=\beta_7^{0,3}$	W = 14.12 (1 d.f.)
Ho: $\beta_8^{1,1}=\beta_8^{0,1}$	W = 67.77 (1 d.f.)
Ho: $\beta_8^{1,2}=\beta_8^{0,2}$	W = 27.69 (1 d.f.)
Ho: $\beta_8^{1,3}=\beta_8^{0,3}$	W = 12.73 (1 d.f.)

Notes: (1) The regression model applied to six different data sets is:

$$\ln Y_i=\beta_0+\beta_1 J_i+\beta_2 U_i+\beta_3 E_i+\beta_4 E^2{}_i+\beta_5 (JE)_i+\beta_6 (UE)_i+\beta_7 A_{1i}+\beta_8 A_{2i}+\varepsilon_i .$$

(2) The alternative hypothesis in all instances is H_a: H_o not true.

(3) The notation for $\beta_k^{s,f}$ is as follows:

s=0 female,
=1 male;
f=1 large firms,
=2 medium firms,
=3 small firms.

Table 6-2b **Results of Hypothesis Testing of the Equality of Coefficients Between Firm-Size Groups**

Hypothesis	Test Statistic
Ho: $\beta_1^{1,1}=\beta_1^{1,2}=\beta_1^{1,3}$	W = 0.639 (2 d.f.)
Ho: $\beta_2^{1,1}=\beta_2^{1,2}=\beta_2^{1,3}$	W = 4.227 (2 d.f.)
Ho: $\beta_3^{1,1}=\beta_3^{1,2}=\beta_3^{1,3}$	W = 9.002 (2 d.f.)
Ho: $\beta_5^{1,1}=\beta_5^{1,2}=\beta_5^{1,3}$	W = 1.305 (2 d.f.)
Ho: $\beta_6^{1,1}=\beta_6^{1,2}=\beta_6^{1,3}$	W = 1.475 (2 d.f.)
Ho: $\beta_7^{1,1}=\beta_7^{1,2}=\beta_7^{1,3}$	W = 6.946 (2 d.f.)
Ho: $\beta_8^{1,1}=\beta_8^{1,2}=\beta_8^{1,3}$	W = 11.55 (2 d.f.)
Ho: $\beta_1^{0,1}=\beta_1^{0,2}=\beta_1^{0,3}$	W = 3.802 (2 d.f.)
Ho: $\beta_2^{0,1}=\beta_2^{0,2}=\beta_2^{0,3}$	W = 14.22 (2 d.f.)
Ho: $\beta_3^{0,1}=\beta_3^{0,2}=\beta_3^{0,3}$	W = 17.52 (2 d.f.)
Ho: $\beta_5^{0,1}=\beta_5^{0,2}=\beta_5^{0,3}$	W = 1.362 (2 d.f.)
Ho: $\beta_6^{0,1}=\beta_6^{0,2}=\beta_6^{0,3}$	W = 0.551 (2 d.f.)
Ho: $\beta_7^{0,1}=\beta_7^{0,2}=\beta_7^{0,3}$	W = 191.4 (2 d.f.)
Ho: $\beta_8^{0,1}=\beta_8^{0,2}=\beta_8^{0,3}$	W = 211.5 (2 d.f.)

Notes: (1) The regression model applied to six different data sets is:

$$\ln Y_i=\beta_0+\beta_1 J_i+\beta_2 U_i+\beta_3 E_i+\beta_4 E^2{}_i+\beta_5 (JE)_i+\beta_6 (UE)_i+\beta_7 A_{1i}+\beta_8 A_{2i}+\varepsilon_i.$$

(2) The alternative hypothesis in all instances is H_a: H_o not true.

(3) The notation for $\beta_k^{s,f}$ is as follows:

s=0 female,
=1 male;
f=1 large firms,
=2 medium firms,
=3 small firms.

(iii) Test for Structural Difference

The purpose of the test is to investigate whether there is structural difference between all six equations. If there is none, then a restricted model with a single regression equation that applies to all the data should be the correct model. By contrast, the alternative hypothesis states that the regression function should apply to six different sets of data categorized according to firm-size and gender. Since our sample size is large, the Wald statistic is valid whether or not the variances are identical. The test statistic obtained is 1777.77 with 45 d.f. and is obviously greater than the chi-square statistic at all confidence levels. Thus, I conclude that the coefficient vectors are indeed different across the six market segments and that the disaggregated model is valid.

(2) Age-Earnings Profiles

Using the regression results of the disaggregated models I have estimated eighteen different series of life-time after-tax earnings. They are further adjusted for mortality, labour force participation and secular growth. Each of these series corresponds to a specific educational level within each market segment. Figures 6-1a to 6-1c depict the smoothed earnings profiles of both sexes within each firm-size group.[1] Figures 6-2a and 6-2b show the profiles within each gender group.

It is obvious that almost in all instances the male earnings profiles are above those for female. However, in large firms the earnings of college educated women exceed those of high school and junior college men after the age of 55. This findings should be interpreted with caution since only 3.4 percent of the total number of female workers in large enterprises are aged 55 or over. In medium and large firms the profiles for men with university degrees appear to be much steeper. In general the earnings levels fall sharply after 55 years old due to the lower participation rates and reduced wages.

There are at least two noticeable differences between the male and female earnings profiles. For men their prime earnings years are confined between the age of 52 to 55. By contrast, in most cases the earnings profiles for women exhibit two peaks. Second, the profiles for female high

school graduates are relatively flat. On the other hand, the earnings profiles for men of all educational level are relatively steeper and concave.

Figure 6-1a Estimated Earnings Profiles within Large Firms by Educational Level and Gender (after tax)

Figure 6-1b Estimated Earnings Profiles within Medium Firms by Educational Level and Gender (after tax)

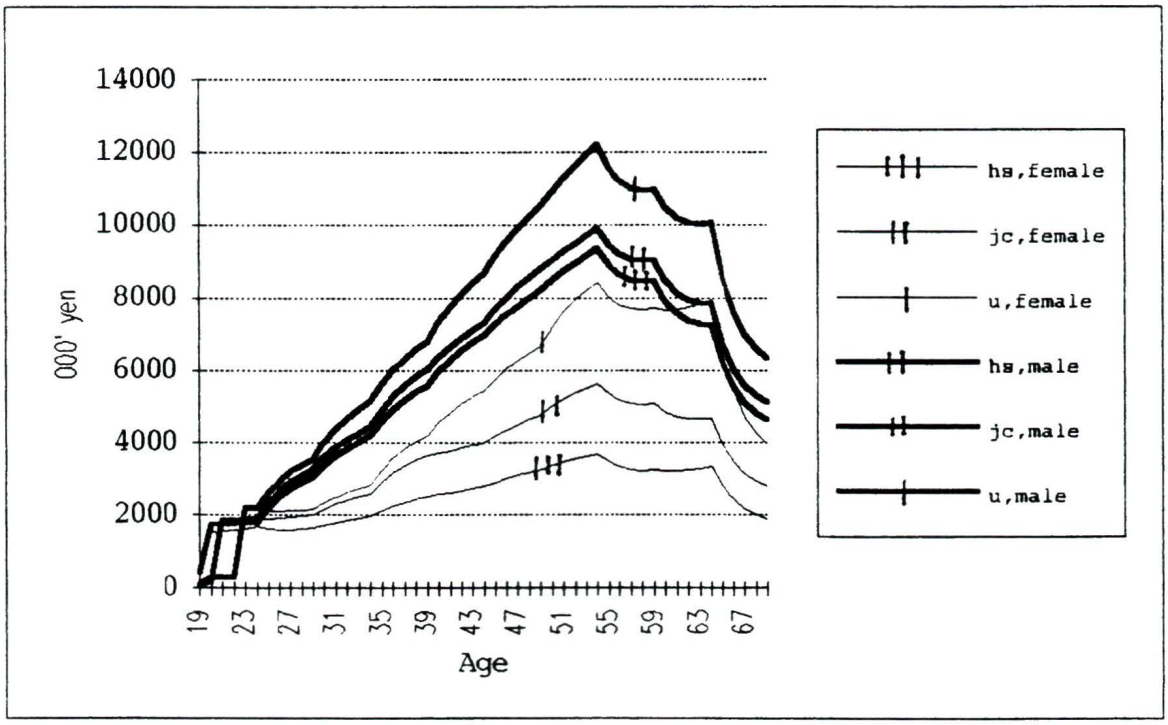


Figure 6-1c Estimated Earnings Profiles within Small Firms by Educational Level and Gender (after tax)

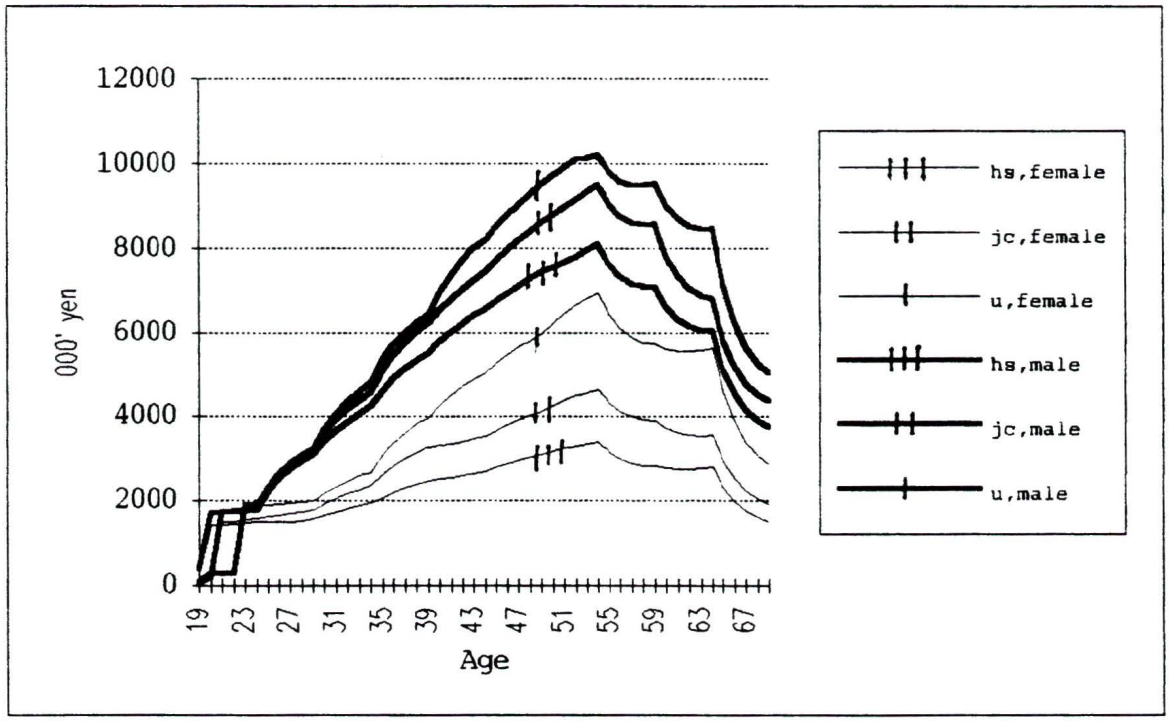


Figure 6-2a Estimated Earnings Profiles for Male Workers by Educational Level and Firm Size (after tax

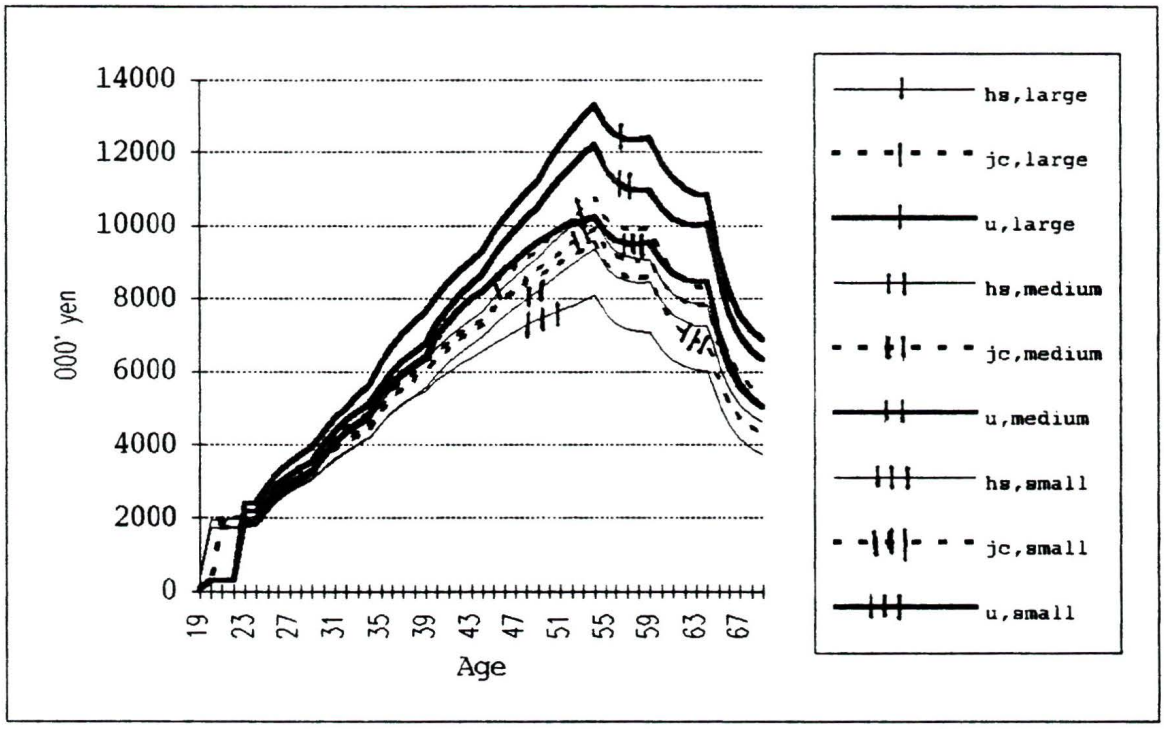
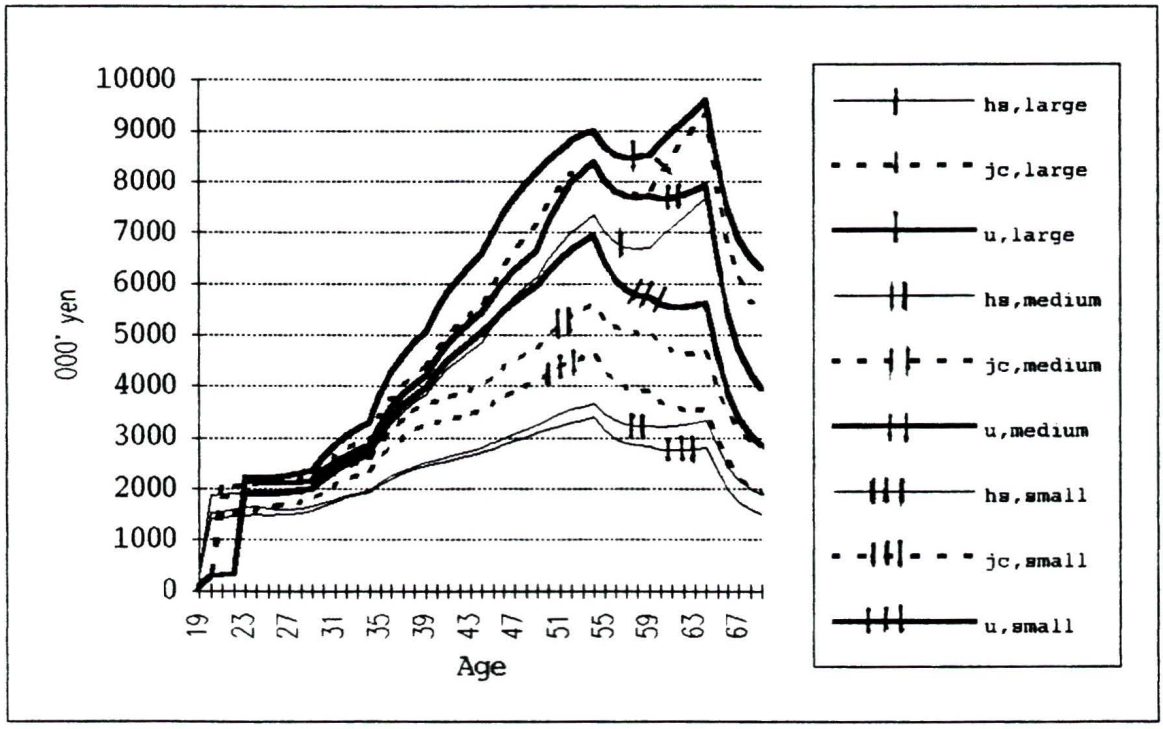


Figure 6-2b Estimated Earnings Profiles for Female Workers by Educational Level and Firm Size (after tax)



(3) Private Rates of Return

The adjusted lifetime earnings are used to calculate the private rates of return to higher education. The results are presented in table 6-3.

The rates of return to junior college education in different market segments vary widely - it is as high as 15 percent (before tax) for women in medium firms and only 8 percent for men in large establishments. The differences in rates of return to university education are smaller.

In general the rates of return for females are higher within each institutional setting, with the exception of university educated females in large establishments - only 10 percent before tax and 9 percent after tax. The rates are highest for females in medium firms.

Danielsen and Okachi (1970) estimate the rates of return to university and junior college for males in 1969 and find the rates to be 14.5 percent and 7.8 percent respectively. They, however, assume that school costs and part-time earnings while attending college cancel each other. Since the method of estimation in their study is quite different from the present analysis, a comparison of the results would be inappropriate. However it can be concluded that the internal rates of return have fallen a few percentage points since 1969.

As expected the rates of return to post-secondary education are higher than the basic interest rates in the

loan market which are quite close to the rate set by the Bank of Japan in the last 10 years - between 3.5 to 9 percent.[2] Even the real after tax internal rates of return are quite high - in most cases they are close to 10 percent. Therefore, it can be concluded that in general college education in Japan is a fairly profitable investment option.

Table 6-3 Private Rates of Return to Higher Education in Japan 1990

	Male			Female		
	Large Firms	Medium Firms	Small Firms	Large Firms	Medium Firms	Small Firms
Before tax						
Junior college over high school	8	10	11	10	15	11
University over high school	13	13	10	10	13	12
After tax[1]						
Junior college over high school	5	8	10	10	14	11
University over high school	10	10	8	9	12	12

Note: (1) See appendix 3 for detailed description of tax scheme.

Before turning to the next chapter a few comments on the limitations and drawbacks of the present analysis are in order. First, the effect of ability on earnings is not measured. It is usually assumed that college educated people have higher levels of intelligence; therefore, the true effect of higher education may be overestimated. Thus, it is plausible that the internal rates of return to college education are biased upwards.

Second, the non-pecuniary benefits of education are also left out in the present studies. Haveman and Wolfe (1984) illustrate that knowledge provides individuals with better quality of lives. It is plausible that people who receive more education have higher efficiency in consumption and greater ability to provide their offspring with more educational opportunities. As a result the rates do not reflect the inter-generation benefits of college education.

Although the profiles are adjusted for labour force participation, the rates of return for women are still biased upward. In Japan many women actually stop working after marriage or child birth. The erratic nature of the female earnings profiles suggests that more refined data on women's earnings, educational background and family responsibilities are needed to discover their earnings pattern.

Finally the after-tax estimated earnings are not invariant to the deduction scheme applied. In this study

many deductions such as life insurance premiums and saving bond contributions, are not incorporated due to the lack of information. As a result, the after-tax rates of return are perhaps biased downward.

Despite these reservations, the present findings are still useful in illustrating the impacts of education on earnings in Japan. In the next chapter I shall interpret the results with reference to the various theories and hypotheses of human capital.

Notes:

1. Since the estimated earnings are averages over five year cohorts, an exponential smoothing technique is applied to connect fragmentary segments.

$$Y^*_t = \alpha Y_t + (1-\alpha) Y^*_{t-1},$$

where Y^*_t is the smoothed series and Y_t is the original series. A small α means a heavily smoothed series. In general smoothing methods are rather ad hoc, so the choice of method and parameter employed is quite arbitrary. Nevertheless, here the technique is only applied to smooth the lifetime earnings profiles graphically. Since the smoothed values are not used for further calculation of rates or for forecasting purposes, the choices of parameters are not crucial as long as the desired smoothness is obtained. Here the choice of α is 0.7.

2. See table 12-7 in Japan Statistical Yearbook, 1991.

Chapter 7

Evaluation and Interpretation

In this chapter I shall interpret the empirical findings of the present analysis. In the first section the relationship between education and earnings will be examined. Particularly I shall refer to the relevance of different human capital theories in the Japanese context. In the second section I shall discuss the implications behind the estimated internal rates of returns to higher education.

(1) Earnings and Education

The age-earnings profiles of workers in various Japanese labour market segments display two common characteristics: (1) more educated workers have higher rate of earnings increments and (2) earnings increase with age up to retirement age of 55 and then decline gradually.

In our regression analysis, it is in fact the case that the coefficients for junior college and university education are positive and significant. Specifically, the marginal impact of university education in most cases is twice as large as that of junior college education.

It is notable that the age-earnings profiles of

university graduates lie on the top. In medium and large firms the earnings levels of university educated males are substantially higher than those of the less educated. Similarly the earnings of female university graduates in large firms are relatively high even after the retirement age. Therefore, it is difficult to reject the proposition that there is a positive relation between education attainments and earnings.

However, it is still unclear in what way education affects earnings. According to the human capital theory, education and on-job training have positive impacts on earnings because they improve workers' skills and thus raise labour productivity. Alternatively the screening hypothesis suggests that signalling is the real impact.

The earnings profile of university graduates rise steeply after a few years of employment. Wage increments for this group can be attributed to the accumulation of experience and their educational background. It is not unreasonable to consider college educated workers to be more productive due to the extra years of education they receive. Moreover, they often receive more on-job training due to their higher potential and long term employment commitments. Previous studies indeed found that a larger portion of college graduates receive training programs.[1] As a result, the growth of their income can be partly explained by the accumulation of human capital both at school and on the job.

If the explanation above is accepted, then the human capital thesis does not seem unreasonable. In particular, it emphasises the roles of education and experience in raising individuals' earnings levels. In view of the lack of detailed data on training, it is not possible to empirically investigate the impact of on-job training on earnings. However, given the institutional setting of the Japanese labour market, it is not unrealistic to attribute part of the income increment to this hidden factor. On the other hand, the screening hypothesis cannot be totally discredited because firms do carefully select employees with respect to their qualifications and background. Since the nominal starting wages are comparable among different educational groups, employers are more inclined to hire graduates that are believed to be more intelligent and easier to train. In this instance a college diploma serves as a signalling device in the job market.

The age-earnings profiles show that earnings are more stratified by educational levels in small and medium firms, and in the female segment. Since the Japanese labour market is highly structured, individuals who have secured employment in large firms receive higher pay across educational levels. Our findings show that in large firms while university graduates earns substantially more, the earnings gaps between other educational groups are relatively moderate. The average earnings in large and

medium enterprises are comparable while they are substantially lower in small firms, especially for female employees. This shows that a university diploma is unable to raise earnings in small firms up to the level of larger enterprises, though it has a strong impact within the market segments.

It is plausible that educational attainment and personal characteristics implicitly put individuals into different labour market groups. Underlying this argument is the strong assumption that screening is rigidly practised by large enterprises. Without this assumption it is therefore unclear whether rigid divisions between the segments would be maintained.

However, since large enterprises often exclusively recruit male graduates from the best schools which are known to produce disciplined and diligent students, it is natural that workers in large enterprises receive higher wages because the qualities of their education are higher. If this is indeed the case, then wage differential is due to the quantity *and* quality of education individuals receive.

Regardless of the different views, it should be noted that the impact of education can be overestimated because the analysis does not take into account the impacts of ability and talent on earnings. It in plausible that university graduates are indeed more talented since they have passed many rigorous examinations. The differences in

earnings thus also reflect the differences in innate ability and cannot be fully explained by education and training. Nevertheless, the present data source does not provide enough information about the Japanese students to explore this proposition in great detail.

In sum the present findings support the hypothesis of the human capital theory that education and experience have positive impacts on earnings. Nevertheless, they do not imply that the theory can fully explain the observed earnings variations in Japan, since other factors such as on-job training, the quality of school and parental backgrounds are not examined due to the lack of detailed micro data. The present findings focus narrowly on the educational impact on earnings; nevertheless, the results broaden our understanding of the significance of human capital investments in the Japanese context.

(2) Internal Rate of Return and Educational Investment

The estimated rates of return in the present analysis appear to indicate that in Japan post-secondary educational investments are profitable. The rates are higher than the yields of government bonds and are comparable to non-human capital investments. It is also notable that the rates of return for females are higher than those for males, despite the low female labour force participation rate. Given these

results I shall further explore the relationship between the rate of return and educational investment.

(a) Competition and Credentials

The discussion in this section will be focused on how the internal rate of return affects competition in the educational system.

In the past few decades responding to the favourable economic environment, more high school graduates in Japan have been able to go to college. In the labour market, an increased supply of college graduates tends to dampen their average wages. Some university graduates have to accept jobs that do not fully utilise their skills. As a result, the internal rate of return to college education shows a decline overtime. Does this imply that the demand for higher education will decrease? Nakata and Mosk (1986) argue that in Japan the demand of college education is only sensitive to the rate of return in the short run; however; other factors are perhaps more important in shaping the demand in the long run. Even if this is the case, investors in college education would not be totally indifferent to the rate of return. Integrating the short term response and long run prospect, I shall illustrate, with references to our estimates and the structure of the labour market, that competition in the educational system is unlikely to dampen

in the near future.

Our estimates show that (1) the real after-tax rate of return to university education for males is quite high in large firms - 10 percent and (2) the rates are relatively high for both sexes in medium firms as well. The first point indicates that employment in large enterprises is particularly attractive for male undergraduates. The second point implies that in general college graduates can expect a fairly high return to their investments since more than 30 percent of the work force of nearly 60 million are employed in medium firms. In Japan, the favourable employment conditions in large enterprises undoubtedly induce fresh graduates to compete against each other to enter this segment of the labour market. Since these establishments set rather tough hiring standards, a diploma from the very prestigious universities becomes the most convenient screening device. Graduates from ordinary schools would not have access to this market segment. Thus, a spin-off effect is generated through the educational system. Competition to enter those respected schools becomes tougher, given that the number of educational slots is not increased in these institutes. Subsequently the competition to enter good high schools is sharpened as well. Inevitably a spiral effect works through the whole educational system, making it more competitive and hierarchial.

In an economic boom large firms may open their gates a

bit wider for graduates from second rate colleges. However, in the last few years Japan has experienced economic slow-down and these graduates' chances have been especially set back. Moreover, firms also let female employees go and hire fewer new employees. The end result is that competition in the educational system will continue despite the overall increase in the number of college slots in the past decade.

On the other hand the comparatively high rates of return to college education for graduates in medium firms will possibly induce more young students to pursue college diploma. As mentioned before students' decisions to enter college are based on a hybrid of factors such as family backgrounds, financial capability and aspiration - perhaps the most important one. In Japan people generally put a very high values on education regardless of the financial rewards. Apparently the high yields to college investments further encourage students to go to university and junior college. Obtaining some sort of post-secondary qualification becomes the norm of the society and the process of educational expansion is unlikely to subside.

To conclude: although more educational opportunities become available, competition to enter top schools will remain heated as long as the wage differential in the labour market persists and large firms hire exclusively from top universities.

(b) Female Education

Given the high rates of return to higher education, it would not be surprising to find that female enrolments at universities and junior colleges increase in the near future. Presently only one quarter of the total higher education graduates are females. As a result, on average men have higher qualification and receive higher wages. It may be possible to adjust this imbalance through a better educated female work force. However it should be emphasised that the earnings gap between men and women is not due just to the differences in their educational attainments. Thus whether women will actually pursue more education also depends on several other factors.

One of the most important factors affecting women's decision is the probability of participation. In Japanese society women are expected to be good housewives and mothers. Their work outside is considered less important. In fact, the participation rate of women is significantly lower than men's. This implies that many female graduates do not get the full benefits of their educational investments. The expectation of non-participation in the labour force undermines women's ambitions to obtain higher education even though the internal rates of return to their investments are high.

The results also suggest that investing in junior college education is as profitable as university education.

From a financial standpoint, however, it is perhaps more profitable for women to go to junior colleges. Paying for two years of tuition at junior colleges is a smaller burden to their parents. In a male dominated society, parents are generally more eager to finance their sons' education than their daughters'. It should be pointed out that in Japan due to the fierce competition to enter college, the costs of education are quite high. These costs include not only the direct costs of college and living expenses, but also *the costs of preparation*. Many mothers in fact sacrifice their potential earnings outside because of their children's education. Since women tend to have maternal interruption in their working lives, they are better off to enter the labour market early after acquiring a "sufficient" amount of post-secondary education.[2] Apparently financial considerations of the extra two years of education also influence women's decision to acquire college education.

To summarize: although the rate of return to higher education is quite high for female graduates, a further expansion in female college enrolments will not necessarily follow. Other social and cultural factors also play important roles in shaping the pattern of college education. As a result, it is not likely that women's skill and wage levels will rise dramatically in the near future.

In this chapter I have drawn inferences from the

results of regression analysis and from the estimates of internal rates of return to college education. I found evidence in the Japanese labour market supporting the notion that education raise individuals' earnings level, although the real impact of education is still obscure. Alternative theories on human capital such as the screening hypothesis and the market segmentation theory are also useful in exploring the impact of the institutional setting in the present analysis. The favourable internal rates of return to college education and the special characteristics of the labour market also suggest that the Japanese society's obsession with diplomas will continue.

Notes:

1. Shimada reports that in 1974 70 percent of college graduates, 66 percent of high school graduates and only 54 percent of middle school graduates receive on-job training. (1980, p.21)

2. Here "sufficient" means the amount of education which enables these women to obtain a certification of some practical skills, such as nursing, medical assistance and office administration. These jobs often offer higher salaries than mundane manual work occupied by high school graduates.

Chapter 8

Concluding Remarks

The present research project had three objectives: first, to construct an analytical framework to conduct empirical studies on the impact of post-secondary education on earnings in Japan; second, to estimate the internal rate of return to higher education; third, to explain the findings with reference to the human capital theory and other hypotheses. The following is a summary of the findings.

(1) Analytical Framework and Regression Results

The *Wage Census* published by the Japan's Ministry of Labour reports workers' average earnings by gender and by size of establishment, thus it enables us to detect the earnings differential between groups in the labour market. After taking the cultural factors and the unique institutions in the Japanese labour market such as lifetime employment and seniority wages into consideration, I decided to conduct the analysis along the line of disaggregated labour market.

The findings of the regressions show that university education among the other factors has the largest marginal

impact on earnings. They also demonstrate that the female market segments are highly stratified by different levels of educational attainments.

(2) Internal Rate of Return to College Education

In addition to estimating the internal rate of return to post-secondary education, I also construct the age-earnings profiles for different educational groups within each market segment. The profiles reveal three important characteristics: first, the profiles for male workers are steeper, concave and rise in a monotonic fashion until the retirement age; second, the profiles for female workers exhibit two earnings peaks; third, the earnings in large enterprises are consistently above those in medium and small firms.

A careful examination of the internal rates of return to junior college and university education reveals that in general the rates of return for female graduates are one to two percentage points higher than those for male graduates. The results suggest that even though women tend to have shorter working lives, their educational investments still pay off fairly well. For men, a relatively high rate of return to university education is found in large and medium enterprises. This supports the notion that employment in large firms is highly attractive for male undergraduates.

(3) Implications of the Findings

Although our findings show that education and experience have positive influences on earnings, the reasons behind this relationship are still unclear. It is plausible that college education indeed makes students more capable, and thus raises their productivity at work. On the other hand, the social institutions in the Japanese society appear to support the notion that education also acts as a signalling device in the labour market. As a result, I conclude that both the human capital theory and the screening hypothesis have shown validity in the Japanese context. The inquiry into the true effect of college education on earnings remains inconclusive.

On the other hand, our statistical findings appear to support the view that the impact of education is different across labour market segments. The estimated coefficients of different earnings functions are found to be statistically different. Moreover, the estimated earnings level in large firms is substantially larger than that in smaller firms. Similarly, male workers are found to earn almost twice as much as female within each firm-size segment.

Regarding the net benefits of higher education, it is possible that the internal rates of return will have short term impacts on the educational system; however, in the long run the system is shaped by other social and cultural

factors. The Japanese people's obsession with diplomas is unlikely to subside. Thus, competition to enter the best schools is expected to remain fierce, especially given the favourable rates of return.

Although the estimated internal rates of returns to college education are quite high for women, their participation in higher education and the labour market is not expected to jump dramatically due to the constraints they encounter in the male dominated society.

To conclude: this thesis has investigated the earnings pattern and the internal rates of return to post-secondary education in Japan; the findings suggest that a hybrid of theories and hypotheses on the impacts of human capital is found illuminative in the Japanese context. It is interesting to see what direction the educational system will take in the future if the labour market continues to experience a surplus of college graduates. On the other hand, it is possible that large firms will slowly dismantle the practices of lifetime employment and seniority wages in the coming decade when facing economic slow-down. If this is the case, it is questionable whether the labour market will remain segmented. Will the wage gap between sexes become narrower when women make further improvement in their employment skill levels through college education? I found that these issues are inextricably linked not only to wider issues in the Japanese economy but also to social and

cultural institutions. They remain to be researched and studied in the future.

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Appendix 1

Educational Costs

Estimated Costs of Post-Secondary Education*

	University	Junior College
Male	854.7219	799.8615
Female	871.9275	846.2999

Estimated Part-time Income While Attending College*

	University	Junior College
Male	392.6134	275.6433
Female	401.2517	292.6941

Total Costs of University Education (growth at 2%p.a.)

	Year 1	Year 2	Year 3	Year 4
Male	854.7219	871.8164	889.2527	907.0378
Female	871.9275	889.3661	907.1534	925.2964

Total Part-time Income while attending University (growth at 2%p.a.)

	Year 1	Year 2	Year 3	Year 4
Male	392.6134	400.4656	408.4749	416.6444
Female	401.2517	409.2768	417.4623	425.8115

Total Costs of Junior College Education (growth at 2%p.a.)

	Year 1	Year 2
Male	799.8615	815.8587
Female	846.2999	863.2259

Total Part-time Income while attending Junior College (growth at 2%p.a.)

	Year 1	Year 2
Male	275.6433	281.1562
Female	292.6941	298.548

* These estimates are obtained by weighing the data across types of institution and then across types of accommodation.

Appendix 2

Predicted Unadjusted Earnings

Predicted Average Monthly Earnings, Female in Large Firms*, 1990 (in thousand yen)**

Age Group	High School	Junior College	University
1~17	164.44	0.00	0.00
18~19	174.12	0.00	0.00
20~24	210.63	222.68	234.33
25~29	260.34	289.22	300.94
30~34	308.69	357.68	399.31
34~39	359.15	418.44	499.89
40~44	408.42	481.00	584.99
45~49	464.50	550.93	670.51
50~54	512.84	608.47	676.52
55~59	572.36	687.58	766.30
60~64	643.51	843.97	866.41
65~69	607.27	885.98	1134.74

Predicted Average Monthly Earnings, Female in Medium Firms, 1990 (in thousand yen)**

Age Group	High School	Junior College	University
1~17	152.64	0.00	0.00
18~19	152.16	0.00	0.00
20~24	176.67	200.02	224.67
25~29	207.35	255.07	274.22
30~34	222.08	305.72	337.57
34~39	223.25	339.55	398.71
40~44	218.54	321.23	469.24
45~49	222.90	341.19	506.03
50~54	229.58	373.64	630.84
55~59	255.39	417.41	679.49
60~64	248.69	346.37	654.50
65~69	275.53	411.46	569.89

Predicted Average Monthly Earnings, Female in Small Firms, 1990 (in thousand yen)**

Age Group	High School	Junior College	University
1~17	134.29	0.00	0.00
18~19	134.12	0.00	0.00
20~24	165.10	169.69	197.84
25~29	202.64	226.69	252.65
30~34	218.38	273.89	318.49
34~39	217.30	299.29	373.59
40~44	209.93	278.59	425.65
45~49	210.31	287.57	438.19
50~54	210.95	300.47	479.60
55~59	214.29	304.73	466.89
60~64	202.31	256.54	435.64
65~69	196.70	272.69	378.39

Predicted Average Monthly Earnings, Male in Large Firms, 1990 (in thousand yen)***

Age Group	High School	Junior College	University
18~19	193.15	0.00	0.00
20~24	228.32	229.43	270.18
25~29	284.11	293.15	333.37
30~34	349.37	365.96	442.87
34~39	428.17	460.74	562.67
40~44	493.48	539.29	710.19
45~49	568.03	620.95	896.47
50~54	602.45	667.76	988.39
55~59	504.29	571.10	839.74
60~64	373.59	399.24	589.35
65~69	421.51	473.16	615.19

Predicted Average Monthly Earnings, Male in Medium Firms, 1990 (in thousand yen)***

Age Group	High School	Junior College	University
18~19	170.37	0.00	0.00
20~24	201.37	211.75	243.00
25~29	250.01	267.57	297.81
30~34	305.84	329.40	390.34
34~39	371.25	406.20	487.88
40~44	423.58	466.56	601.41
45~49	480.17	525.89	737.29
50~54	506.78	559.85	790.95
55~59	447.60	505.26	711.66
60~64	342.43	375.29	533.40
65~69	386.20	439.76	559.03

Predicted Average Monthly Earnings, Male in Small Firms, 1990 (in thousand yen)***

Age Group	High School	Junior College	University
18~19	164.95	0.00	0.00
20~24	200.63	199.65	207.18
25~29	253.84	267.72	266.03
30~34	309.66	340.18	363.84
34~39	364.60	423.67	456.82
40~44	394.15	475.44	547.45
45~49	408.42	508.42	596.56
50~54	406.09	514.50	600.86
55~59	363.44	454.71	545.25
60~64	277.19	311.98	415.49
65~69	300.26	361.69	413.73

*In 1990 the bonuses for female workers in large firms appeared to be extremely large; therefore these figures should be interpreted with caution.

** The number of total monthly working hours is assumed to be 175.

*** The number of total monthly working hours is assumed to be 180.

Appendix 3

Japan's Employment Income Tax Scheme

In Japan employment income consists remuneration, basic salary, bonuses, pensions and other living allowances. Individuals have to pay two types of tax: national income tax and local inhabitant tax, which consists of prefectural and municipal tax. The taxable employment income is the gross amount minus the standard employment income deduction as illustrated:

Standard Employment Income Deduction (in thousand Yens)

Gross Income	**Deduction**
Less than 1,650	40% (minimum amount 570)
Over 1,650 but not over 3,300	30% + 660
Over 3,300 but not over 6,000	20% + 1,155
Over 6,000 but not over 10,000	10% + 1,695
Over 10,000	5% + 2,095

In addition to the standard deduction, there are another fifteen kinds of deduction that can be made. Here I list some of those used in the estimation of after tax earnings in our analysis.

(1) Basic Deduction
¥350,000 for national income tax purposes and ¥300,000 for inhabitant tax purposes.

(2) Allowance for Dependents
¥350,000 for each dependent is deductible for national income tax purposes. However, if the dependent is between 16 and 22 years old, the allowed amount is ¥450,000. The amount is ¥300,000 and ¥350,000 for inhabitant tax purposes.

(3) Special Deduction for Aged Person
¥500,000 is allowed to be deducted if the taxpayer's age is above 65 and if the total income does not exceed

¥10,000,000.

(4) Allowance for Working Student
¥270,000 is allowed to be deducted if the taxpayer is a working student and if the total income does not exceed ¥620,000.

The marginal tax rates are applied to the net taxable income after all the deductions are made. The rates are shown as below:

Tax Rates since 1988

Net Taxable Income	**National Income Tax**	**Inhabitant Tax**	
		Prefectural	**Municipal**
(in thousand Yens)	%	%	%
Up to 1,200	10	2	3
3,000	10	2	8
5,000	20	2	8
6,000	20	4	11
10,000	30	4	11
20,000	40	4	11
Over 20,000	50	4	11

In our analysis I assumed the followings in calculating the deduction:

a. no deduction for spouse*,

b. each individual claims one child deduction,

c. women claims the first child when she is 29 years old and men claims the second child when he is 31 and the length of the deduction is 22 years,

e. students and old age persons are entitled to additional deductions,

f. all deductions are adjusted by 2% on a yearly basis,

g. basic deduction for everyone at every age,

i. no other deductions, such as medical expenses and life insurance, are included because a lot of scenario must be created for such speculation.

*In many case men can deduct spouse allowance because their

wives usually do not have employment income, but women can rarely make such deduction since men seldom become homemakers. As a result, I did not include spouse deduction since the taxable income for both sexes would be quite different.

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