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INTERNAL RATES OF RETURN TO HIGHER EDUCATION FOR NON-QUITTERS AND THE ROLE OF FEMALE HIGHER EDUCATION*

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Abstract

This paper computes internal rates of return to higher education using Japanese data for those who continued to work for the same firm. This enables a comparison between female and male rates of return under more equal ground than usual. The results show that the rates of return to university education are higher for women than for men. However, those to female junior college education are quite low especially recently, though the usual computation method generates high rates. The backgrounds for these facts and the recent rapid increase in the rate of female enrollment in university are discussed.

Key Words: Female Higher Education; Internal Rates of Return
JEL classification: I21

I. *Introduction*

Imagine a situation in which we compare the average (private) internal rate of return to higher education for women with that for men. In this situation we normally need data for rates of female labor force participation across ages because there are large proportions of women who do not work in labor markets or who experience career interruptions. In contrast, almost all men continue to work from the time of school graduation to the time of (mandatory) retirement. Thus, we normally do not need to take account of rates of male labor force participation to compute the average rate of return to male higher education, though, strictly speaking, their unemployment rates across ages should be taken account of.[1]

Suppose as a simple example that the rate of male labor force participation is 100% and that that of female labor force participation is 70% at each age between school graduation and (mandatory) retirement. Then, one can compute internal rates of return to male and female

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[1] Some comparisons of average rates of return to female and male education can be seen in Psacharopoulos (1985).

higher education using age-wage data for both sexes with different educational background and the above rates of labor force participation. However, is a comparison between these rates of return for men and women really meaningful?

To see this, suppose further as an extreme case that age-wage profiles for women with varying educational careers are exactly the same as those for men with the same careers. Then, the computed internal rate of return to higher education for women would be lower than that for men simply because the rate of female labor force participation is smaller. Even under the 70% rate of female labor force participation, however, there would be many women who continue to work like men. Such female workers would obtain exactly the same rate of return as that for men. In this example, higher education itself produces female graduates who are as productive as male counterparts. The rate of return for women would be lower only because they do not make full use of their potential created by higher education.

As another example, consider the case in which the rate of female labor force participation is much larger for university graduates than for high-school graduates. In this case, the internal rate of return to higher education may be larger for women than for men mainly because of the difference in the rate of female labor force participation between university and high-school graduates.

It should also be noted that the rate of female labor force participation affects the internal rate of return for women through wages. Career interruption for women actually lowers their wages because of depreciation and obsolescence in knowledge and skills [Mincer and Polachek (1974); Brown, Moon, and Zoloth (1980); Groshen (1991); Schumann, Ahlburg, and Mahoney (1994)]. In other words, a smaller rate of female labor force participation lowers the rate of return to female higher education through devaluation of their human capital. Again, women who continue to work from the time of school graduation to the time of (mandatory) retirement will not experience such wage reduction and thus the average rate of return to female higher education is quite irrelevant for them.

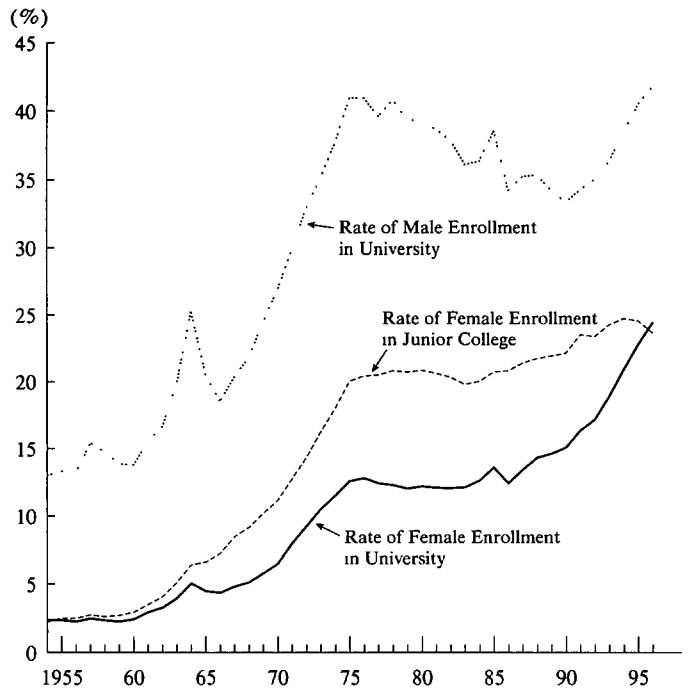
These considerations suggest that a simple comparison between average rates of return to male and female higher education is not very meaningful. This is because the average rate of return to female higher education incorporates the effects of 'distorting factors' arising from lower rates of female labor force participation. It will be more interesting, therefore, to remove these distorting factors and compare rates of return for women and men on more equal ground.

This kind of comparison becomes possible if we use age-wage data for female and male workers who have never quitted a firm. Such data are available in Japan from the mid-1970s. They show the relationships between age and wages for females and males with varying educational careers who continued to work for the same firm from the time of school graduation until the data were collected. This paper will call these workers non-quitters.[2]

In this paper we will compute internal rates of return to female and male higher education using data for non-quitters and consider some features of female higher education. Thus, comparisons of rates of return will be undertaken among those who made full use of the human capital created by higher education. This paper will show for example that the internal rate of return to university education for female non-quitters is higher than that for male counterparts. It will be shown, however, that the internal rate of return to female junior

[2] They are called *hyojun rodosha* (standard workers) in Japan.

FIGURE 1. RATES OF ENROLLMENT IN HIGHER EDUCATION



college education is generally lower than those to female and male university education as far as non-quitters are concerned, though the average internal rate of return to female junior college education is not lower.

It might be more interesting to compare internal rates of return to female and male higher education not only for non-quitters but also for graduates from similar universities, for the same majors, and so on. However, this is actually impossible in the case of Japan because of data problems. At present, data for non-quitters do not allow us to progress beyond removing differences in the rate of labor force participation between men and women.

The analyses of this paper will provide some insight into the recent rapid increase in the rate of female enrollment in Japanese higher education. In fact, such a rapid increase in the rate of female enrollment is a common phenomenon in advanced countries [Arai (1998)]. In Japan the total rate of female enrollment in university and junior college exceeded that of male enrollment for the first time in 1989. As Figure 1 shows, the rate of female enrollment in higher education, especially university, increased drastically from the mid-1980s. For the past few decades Japanese higher education has been characterized by a high rate of female enrollment in junior college. However, this rate decreased recently and the rate of female enrollment in university finally exceeded it in 1996. It can be predicted that the former rate will continue to decrease and the latter to increase in the future. This paper will give some explanations for these facts.

Section II will show the average internal rates of return to male and female higher

education computed mostly by Arai (1998b) by the usual method. A brief explanation of the method and used data will also be given. These results will be compared with those for non-quitters. Section III will compute internal rates of return for non-quitters. In Section IV we will investigate the background of the higher rates of return to female university education. In Section V we will discuss why the rates of return to female junior college education for non-quitters are low. Section VI will consider whether female higher education is an attractive investment opportunity. Further, it will discuss why the rate of female enrollment in university relative to junior college has been increasing rapidly in Japan in recent years.

This paper will consider as types of higher education female university education, female junior college education, and male university education. (Universities provide four-year education and junior colleges two-year education in Japan.) Male junior college education will be ignored in this paper because the rate of enrollment has been less than 3% for the past several decades. Throughout the paper, internal rates of return will stand for private rates and will be called rates of return for short in many cases. Senior high-school graduates will be called simply high-school graduates.

II. *Average Internal Rates of Return to Higher Education*

The average internal rate of return to female university education, for example, is usually computed by solving the following equation for r:

$$(T_1+P_1^H W_1^H)+\frac{T_2+P_2^H W_2^H}{1+r}+\frac{T_3+P_3^H W_3^H}{(1+r)^2}+\frac{T_4+P_4^H W_4^H}{(1+r)^3}$$
$$=\frac{P_5^U W_5^U-P_5^H W_5^H}{(1+r)^4}+\frac{P_6^U W_6^U-P_6^H W_6^H}{(1+r)^5}+\cdots+\frac{P_R^U W_R^U-P_R^H W_R^H}{(1+r)^{R-1}}.$$

In this equation, the subscripts correspond to different ages of university students/graduates. For instance, subscript 1 corresponds to the age of the first year in university and subscript R to the age of (mandatory) retirement. (The average age of mandatory retirement in Japan is about 60 today.)

The meanings of the mathematical symbols in the above equation are as follows: T_j is the sum of tuition and fees, costs of books and stationery, and commuting costs per student in the j-th year of university education. P_j^H is the rate of labor force participation of high-school graduates of the same age as that corresponding to j. W_j^H is the average wage for these high-school graduates. Thus, for j no larger than 4, $P_j^H W_j^H$ equals the annual forgone earnings of university education at the age corresponding to j, while $T_j+P_j^H W_j^H$ equals the total annual costs of university education. Strictly speaking, we should consider unemployment rates, but as they have been relatively low in Japan we ignore them in this paper.

P_k^U is the rate of labor force participation of female university graduates of the age corresponding to k, and W_k^U is their average wage. Thus, for k no smaller than 5, $P_k^U W_k^U-P_k^H W_k^H$ equals the pecuniary benefit of university education reaped in the k-th year counted from the year of university enrollment.

This paper calls the real solution to the above equation the *average* internal rate of return to female university education especially because it is computed using rates of labor force participation and average wages for all female university graduates. The average rate of return

to male university education is computed similarly but by assuming for simplicity that the rates of male labor force participation at all relevant ages equal 100%. That to female junior college education is also computed similarly, the main difference being that this type of education continues for only two years. Of course, we need to use partly different data to compute these different types of rates of return. As usual, we compute internal rates of return using cross-sectional data.

This paper regards T_j as equal to tuition and fees per student in private institutions and $P_j^H W_j^H$ as gross forgone earnings. We ignore costs of books and stationery for the reasons given below. Tuition and fees for private institutions are used here because the majority of Japanese students are enrolled in private institutions. Strictly speaking, the forgone earnings of higher education in the j-th year are defined as the average earnings of high-school graduates of the age corresponding to j minus the average part-time income of university (junior college) students in that year. Instead of these net forgone earnings, we use here gross forgone earnings, which are forgone earnings before the reduction of part-time income, for the reasons also given below.

Data for the costs of books and stationery, commuting costs, and part-time income are available for every alternate year from the *Survey of Student Life* by the Ministry of Education. But these amounts are very small compared with tuition, fees, and gross forgone earnings. Moreover, because the sum of the costs of books and stationery and commuting costs almost equals part-time income, they can be considered to cancel each other out in the computation process of rates of return.

Pecuniary benefits of (returns to) higher education $P_k^U W_k^U - P_k^H W_k^H$ can be measured using data for age-wage profiles and labor force participation rates. Age-wage data for women with varying educational careers have become available in *Basic Survey of Wage Structures* from the mid-1970s. Up to that time data for women were not sufficiently detailed, unlike those for men. Detailed data for female labor force participation classified by educational careers are scarce in Japan. Separate data for high-school, junior college, and university graduates are available for 1982, 1987, and 1992 from *Employment Status Survey* by the Statistics Bureau. Hence, this section computes average rates of return for these three years.

It might be interesting to see the actual rates of female labor force participation in these three years. *Employment Status Survey* enables us to compute the ratio of the number of females who mainly work to the total number of females of each age group for each classified educational career. (Those who do *not* mainly work consist mostly of those who do not work and those who partly work but spend most time housekeeping.) By defining this ratio as the rate of female labor force participation, Arai (1998b) computed the actual values for the above three years. Strictly speaking this ratio is not the same as the normal definition of the labor force participation rate, because among other reasons the latter includes those who are unemployed in the number of labor force participants. However, for our present purpose this ratio is likely to generate more realistic rates of return than the normal rate of labor force participation.

Using these data we can compute the average internal rates of return. It is assumed throughout this paper that the age of mandatory retirement is 59.[3] Differences of one or two

[3] *Basic Survey of Wage Structures* has wage data for each five-year age group. Though the average age of mandatory retirement is 60 today, we have chosen the age of 59 as the age of mandatory retirement for our computation of internal rates of return because age 60 is classified into the age group from 60 to 64.

TABLE 1. AVERAGE INTERNAL RATES OF RETURN TO HIGHER EDUCATION (%)

Year	Women		Men
	University	Junior College	University
1982	7.66	7.94	6.71
1987	7.37	7.40	6.62
1992	8.42	8.07	6.38
Three-Year Average	7.81	7.80	6.57

years in the mandatory retirement age would not generate significant differences in the resultant internal rates of return in the computation. Table 1 shows the computation results, a few points about which are noteworthy.

First, the average rates of return to female university and junior college education are quite close and are higher than those to male university education. These higher rates of return are due partly to the higher rates of labor force participation of female university and junior college graduates compared with female high-school graduates. As can be seen in Tables 4 and 5 in Arai (1998b), the differences in the rate of labor force participation are quite large at ages younger than 35. These differences are especially salient for university graduates.

Secondly, the rates of return to female university and junior college education decreased from 1982 to 1987 and then increased from 1987 to 1992, though that to male university education decreased steadily. The increases in the latter period are partly due to increases in the rates of female labor force participation of college graduates. In particular, the rates of labor force participation of university graduates younger than 35 increased drastically in that period.

Thirdly, the rates of return in Table 1 are much lower than the average in advanced countries (12%) shown in Table 1 of Psacharopoulos (1985), though the former are concerned with more recent years. It will be argued in Section VI that the rates in Table 1 are still high enough to attract investment in Japanese higher education.

III. *Internal Rates of Return to Higher Education for Non-quitters*

Basic Survey of Wage Structures contains age-wage data for those who continued to work for the same firm from the time of school graduation until the data were collected. Wage data for these non-quitters have become available since the mid-1970s for university, junior college, and high-school graduates of both sexes. Use of such data enables us to compare internal rates of return to male and female higher education under the common condition as to labor force participation. In addition, it can avoid computation complexity associated with female labor force participation, because non-quitters' rate of labor force participation is 100% by definition.

Unfortunately, however, there is a minor problem of sample size. Though the above data have large samples of young non-quitters, the sample sizes of older female non-quitters, especially those in their fifties, are quite small. This is simply because there are not many women who continue to work for the same firm until those ages. Drawing figures of cross-sectional age-wage profiles for female non-quitters would reveal that the relationships between age and wages are "unstable" after about the mid-forties. This is especially the case

before the mid-1980s when sample sizes for university and junior college graduates were comparatively smaller. For this reason, we compute rates of return for non-quitters under some reasonable assumptions.

In order to choose assumptions, the author has applied the method of ordinary least squares with the following specification to the age-wage data of each year for each sex of non-quitters with each educational background:

$$\text{wage}=\beta_0+\beta_1\,\text{age}+\beta_2\,\text{age}^2+\beta_3\,\text{age}^3+\beta_4\,\text{age}^4+u,$$

where "wage" is the average wage of non-quitters at a particular age, "age" is their age, β_0 through β_4 are constants or coefficients, and u is a stochastic term.

Then the estimated age-wage profile was compared with the profile based on the original data. This comparison revealed that the estimated female wage profiles fit the original profiles quite well up to the age of 50 for the data from 1976 to 1984. For the data after 1984, the estimated female wage profiles fit the original profiles quite well up to the age of 55. For this reason, this section computes internal rates of return using basically these parts of estimated age-wage profiles with high fitness. The fitness for male non-quitters is better than for female non-quitters, but we want to undertake male-female comparisons under the same conditions.

Thus, we compute internal rates of return to higher education first by assuming that all non-quitters continue to work up to 50 years of age and then retire for the data from 1976 to 1984. For the data from 1985 to 1995, those workers are assumed to work up to 55 and then retire. (Because this assumption is unrealistic especially for males, in the following we will not make much of the results so obtained.)

Since the above assumption shortens work life, the computed rates of return will be smaller than those that accrue to non-quitters who work up to the age of (mandatory) retirement. Hence, adjustments are made by an alternative assumption: it is assumed that for the first group of data the estimated wage difference between university (junior college) graduates and high-school graduates at the age of 50 also holds for older ages up to 59. Similarly, for the second group of data the estimated wage difference between those types of graduates at the age of 55 is assumed to hold also for older ages up to 59. Since wage differences between varying educational careers normally widen with age, this second assumption is likely to estimate the lower bounds of rates of return to higher education for non-quitters.

The computed internal rates of return are shown in Table 2. The following four points are noteworthy here. First, for non-quitters the rates of return to female university education after adjustments are higher than those to male university education in all the years. (The same holds for the rates before adjustments.) Table 1 in the previous section showed that a similar characteristic can be observed as to average rates of return.

Second, the rates of return to female junior college education are low. This holds for rates both before and after adjustments. They are markedly lower than those to female university education in almost all the years. This is especially the case in the period from 1986 to 1995. In fact, the rate of return to female junior college education displays a tendency to decline. Such differences between female university and junior college education could not be found in Table 1 or for average female workers. In other words, those differences are salient among non-quitters.

Third, the rates of return to female and male university education are not low. Those to

TABLE 2. INTERNAL RATES OF RETURN TO HIGHER EDUCATION FOR NON-QUITTERS (%)

	Female Higher Education				Male Higher Education	
	University		Junior College		University	
Year / Adjustments	Before	After	Before	After	Before	After
1976	6.24*	6.67	4.24*	5.55	5.34*	6.63
1977	6.00*	6.70	4.02*	4.61	5.28*	6.61
1978	6.38*	7.42	4.02*	5.18	5.02*	6.42
1979	5.81*	6.80	2.98*	4.68	4.94*	6.43
1980	5.68*	6.79	3.79*	5.41	4.44*	6.04
1981	4.80*	6.10	4.56*	6.21	3.80*	5.59
1982	4.68*	5.98	2.45*	4.56	3.62*	5.49
1983	4.88*	6.20	3.01*	4.23	3.46*	5.21
1984	5.32*	6.65	4.00*	5.04	3.31*	4.97
1985	6.02	6.51	4.83	5.31	4.89	5.50
1986	6.14	6.61	3.72	4.64	4.81	5.37
1987	5.56	6.02	1.77	2.06	4.68	5.26
1988	5.40	5.96	2.74	3.36	4.88	5.48
1989	5.72	6.19	3.47	4.24	4.95	5.51
1990	6.02	6.50	4.42	5.20	4.94	5.47
1991	6.32	6.72	4.07	4.52	4.96	5.49
1992	5.82	6.36	2.81	3.68	4.82	5.36
1993	6.04	6.57	2.77	3.71	4.75	5.30
1994	6.11	6.59	4.48	5.15	4.65	5.16
1995	6.21	6.69	4.28	4.77	4.71	5.20
'76-'85 Average	5.58	6.58	3.79	5.08	4.41	5.89
'86-'95 Average	5.93	6.42	3.45	4.13	4.81	5.36

Notes: The values before adjustments up to 1984, which have asterisks, are derived under the assumption that workers continue to work up to 50 years of age and then retire. The other values before adjustments are derived under the assumption that workers do so up to 55 years of age and then retire. The values after adjustments are obtained by assuming that the wage difference between college and high-school graduates at 50 (55) years of age continues to hold up to the age of 59 for years from 1976 to 1984 (from 1985 to 1995).

female university education after adjustments are no lower than 6% in almost all the years, though they are lower than the rates in Table 1. Those to male university education are higher than 5% in almost all the years, though again they are lower than the rates in Table 1. These rates in Table 2 can be regarded as high in Japan as will be discussed in Section VI.

Finally, the rates of return to male and female university education were stable in the 1980s and the first half of the 1990s. This might be slightly surprising since tuition and the number of university graduates increased markedly in this period.[4] These four points will be discussed in the subsequent sections.

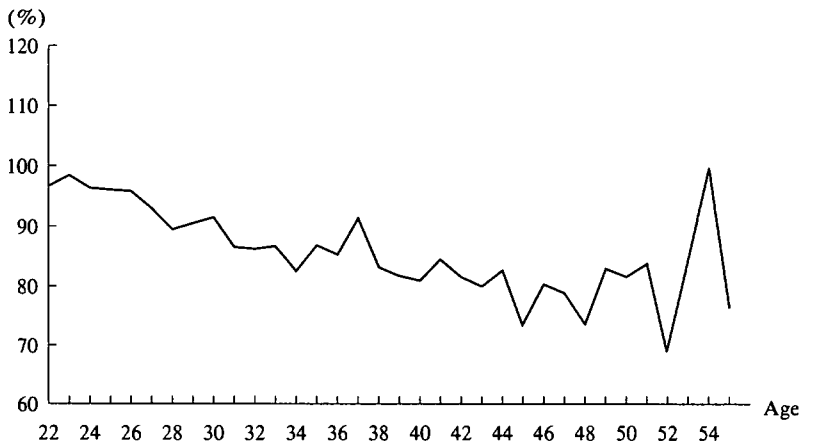
IV. *Wage Differentials Between Male and Female University Graduate Non-quitters*

This section investigates the background of the above first point or the fact that rates of return to university education are higher for female non-quitters than for male non-quitters. It is useful for this purpose to examine in some detail the female-male wage differentials among

[4] The average *real* tuition per student for private universities increased by 66% from 1980 to 1995.

FIGURE 2. WAGE RATIOS BETWEEN FEMALE AND MALE UNIVERSITY GRADUATE NON-QUITTERS (1983)

FIGURE 3. WAGE RATIOS BETWEEN FEMALE AND MALE UNIVERSITY GRADUATE NON-QUITTERS (1993)



non-quitters. Figures 2 and 3 show wage ratios between female and male university graduate non-quitters in 1983 and 1993, respectively, as example years.

The two figures demonstrate first that female university graduate non-quitters earn less than male counterparts at all ages. Secondly, they also show that the wage differential is small at younger ages but increases in age, though the ratios are 'unstable' at older ages because of the above-mentioned sample size problem. On average these females earn about 85% of male counterparts. It can be seen in addition that the ratios in 1993 are in general slightly closer to 1 than those in 1983.

These figures imply that the above first point holds not because female university graduate non-quitters earn more than male counterparts. When one finds that the average rate of return to higher education is higher for women than for men, one easily understands that it is not due to women's higher wages, because it is well-known that they earn less than men on average mainly because of their career discontinuity. What we have found here is that women earn less than men even if a comparison is made between university graduate non-quitters. Thus we can realize that female non-quitters obtain higher rates of return to university education because female high-school graduate non-quitters earn pronouncedly less. In other words, wage differences between university and high-school graduate non-quitters are larger for women than for men.

It might be interesting to include the reasons that female university graduate non-quitters earn less than male counterparts, of which there are several. The first is that there are much fewer female students in leading universities in Japan as in most other countries. Because there is a high positive correlation between graduation from leading universities and promotion (or acquisition of high wage jobs), women are less likely to earn high wages. This also explains why the wage ratios in Figures 2 and 3 are decreasing in age. Promotion becomes a very important wage determinant at older ages in Japanese firms, which are characterized by late promotion as compared with firms in other countries.

The second conceivable reason relates to women's taste and ability. Female college students tend to major in such fields as humanities. But such graduates are less likely to obtain high wage jobs [Polachek (1978)]. Paglin and Rufolo (1990) suggest that women's mathematical ability is partly related to their lower wages.

Thirdly, as Becker (1985) suggests, even women who intend to work continuously may choose low wage jobs. Because women spend more energy than men on housekeeping and childcare, they tend to avoid tough but high wage jobs to conserve energy. This tendency reduces average female wages.

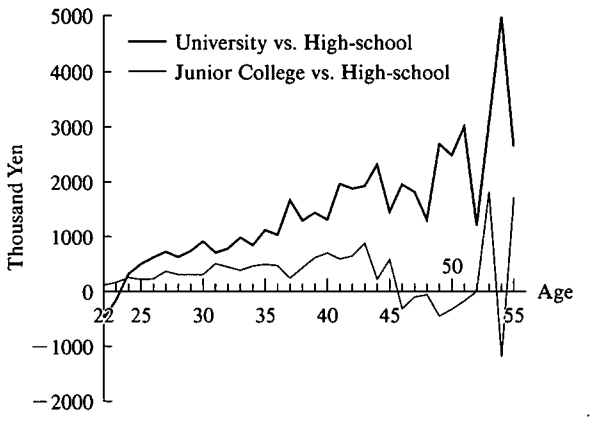
The fourth reason concerns the Japanese wage system. One of its characteristics is that it pays heads of households family allowances, which are not negligible amounts. Because few women are house heads, they tend to be paid less.

Fifthly, there may be statistical discrimination against women, who have a higher average quit rate. Though the data used above are for those who continued to work for the same firm, the firm may not have been sure whether those women would continue with it until the distant future. The firm may have believed that they were more likely to quit than men with the same length of service. King's (1977) study relates to this point. It shows that there was a significant sex difference in the United States in the effect of labor market experience on wages for such professionals as accountants and computer specialists even when unmarried men and women were compared. In essence, even though the length of service is exactly the same between men and women, their employer's expectations towards them may be quite different.

The final conceivable reason relates to dual labor markets. Men have traditionally occupied jobs in the primary sector. This does not necessarily mean that women have been discriminated against. They were not employed to those high wage jobs because their productivity would have been low in a male-dominated organization where interdependence or mutual cooperation among members is very important in production [Arai (1997b)].

For these reasons female university graduate non-quitters have earned less than male counterparts. However, the former obtain higher rates of return because wage differences

FIGURE 4. WAGE DIFFERENCES BETWEEN FEMALE NON-QUITTERS OF DIFFERENT EDUCATIONAL CAREERS (1993)



between university and high-school graduate non-quitters are larger for women. Therefore, higher education itself either increased productivity more for women than for men or sent female graduates to long-term jobs with much better working environments than those under which female high-school graduate non-quitters work.

V. *Role Differences Between University and Junior College Education*

We now consider the second point brought out in Section III or why rates of return to junior college education for non-quitters were low especially in the last ten years in Table 2. To do this, we go back to the original age-wage data for non-quitters. Figure 4 shows as an example yearly wage differences between female university and high-school graduate non-quitters and those between female junior college and high-school graduate non-quitters in 1993. (The yen exchange rate was 107 yen/dollar in 1993.) Because of the above-mentioned sample size problem, the Figure shows wage differences up to 55 years of age. We see that wage differences are rather unstable in older ages, but we can still recognize general tendencies if we apply fitted smooth curves.

The Figure suggests that the wage difference between university and high-school graduate non-quitters increases quite rapidly in age, whereas that between junior college and high-school graduate non-quitters does not increase so much. In other words, junior college graduate non-quitters do not earn much more than high-school graduate non-quitters especially when older. This is the basic reason for the low internal rates of return to female junior college education for non-quitters relative to university education.

It should be stressed that the above wage differences are concerned with non-quitters. We have already seen in Section II that average rates of return to junior college education are quite high. That means that female junior college graduates actually earn much more than female high-school graduates when the comparison is between those of both types who have job

interruptions or career discontinuity.

This observation suggests differences in roles or characteristics of different types of female higher education. That is, junior college education produces female workers who are sufficiently more productive than female high-school graduates in short-term jobs. However, female junior college graduates do not become very productive in long-term jobs or are not promoted to high positions (with high wages) even if they continue to work for the same firm. In contrast, female university graduates become quite productive or are promoted to high positions relative to female high-school graduates in long-term jobs.

It should be emphasized in relation to these observations that the purpose of higher education is not merely to provide specialized knowledge or skills which will be immediately and directly useful after graduation. An important element of its purpose is to develop students' abilities to apply, analyze, think, judge, and so on [Nelson and Phelps (1966); Welch (1970); Schultz (1975); Wozniak (1987); Bartel and Lichtenberg (1987); and Arai (1998)].

This purpose is more strictly pursued in university education than in junior college education. If students acquire the above abilities, they will be able to collect and interpret new information and respond to it easily, adapt themselves flexibly and promptly to technological or economic changes, and undertake innovation themselves. This productivity-enhancing effect of higher education is particularly large when there are rapid technological or economic changes or in cases where high-level decision making is required. This seems the fundamental reason for the wage difference increasing in age between university and high-school graduate non-quitters, because one faces more opportunities to exhibit such abilities as one becomes older and is promoted.

Junior college education does aim to provide more specialized knowledge or skills than high-school education, but the knowledge and skills are not as advanced as those provided in university education. Moreover, junior college education does not highly develop the other above-mentioned abilities. This is likely to restrict in-firm promotion of female junior college graduates, especially older graduates. In essence, junior college education is not sufficiently suited to high-level decision making or rapid technological and economic change, so that the pecuniary returns to this type of education are not very large especially to older non-quitters.

The large decrease in the rate of return to female junior college education in the last ten years that we observed in Table 2 is mainly due to recent rapid economic and technological change. This change has made the economy increasingly complex and has required high levels of decision making. Thus, the demand for abilities acquired in university rather than in junior college has been increasing.

VI. *Are the Rates of Return High Enough to Attract Investment in Higher Education?*

In this section we briefly discuss the third point brought out in Section III. That is, that the internal rates of return to university education computed in this paper were high enough to attract investment. Remember that the average rates of return in Table 1 are higher than 6% and the rates of return to university education for non-quitters in Table 2 are higher than 5% (except in one year).

It may be useful to compare these values with those of the rates of returns to alternative investment opportunities. Ordinary Japanese individuals have not had other investment

opportunities that generate such high returns because of the low-interest-rate policy as discussed in Arai (1998b). For the past several decades bank term deposits have been the most popular investment opportunity for Japanese people. The real rate of interest for bank term deposits was almost 0% if averaged over this period. Therefore, the rates of return to university education were much higher than the real interest rate of bank term deposits so that investment in such education was quite advantageous.

As pointed out in Section II, the rates of return to Japanese higher education are lower than the world average. This is likely to be due to a few different Japanese factors such as the relatively high rate of enrollment in higher education and the equal wage determination among different educational careers. But what is rarely mentioned in the economics of education is the fact that Japanese age-wage profiles are quite steep [Hashimoto and Raisian (1985); Arai (1997a)]. The rates of return to Japanese higher education are low to a large extent because wage differences between different educational careers are small when young.

The internal rates of return to junior college education for non-quitters were low especially in the past ten years. This result suggests that if a woman intends to continue to work for the same firm till the time of (mandatory) retirement, she should invest in university education rather than in junior college education as far as she has sufficient funds for investment. On the other hand, if she expects future career interruptions and does not have sufficient funds, she can obtain a reasonably high rate of return by investing in junior college education.

VII. *Concluding Remarks*

This paper has demonstrated that the internal rates of return to university education for non-quitters are high and that they are higher for women than for men. The rates of return to junior college education for female non-quitters have been low especially in the past ten years.

As shown in Section I, the rate of female enrollment in higher education exceeded that of male enrollment for the first time in 1989 in Japan. The rate of female enrollment in university exceeded that in junior college in 1996. The results of this paper suggest that the recent intention of young women to work longer and continuously is an important factor in the rapid increase in the rate of female enrollment in university.

Arai (1998b) showed that the rate of labor force participation of young female university graduates is increasing rapidly. Though not so apparent in Arai (1998b), increasingly more young Japanese women today are planning to work continuously throughout their careers. The results of this paper suggest that investment in junior college education is not so advantageous to these workers. It is much more advantageous for such women to invest in university education. This is why the rate of female enrollment in university has been increasing dramatically since the mid-1980s and that of female enrollment in junior college began recently to decrease.

Junior college education for women seems to have played an intermediate role between high-school and university education in a special period in Japan. The rate of female enrollment in junior college increased more rapidly than in university in the 1960s and the early 1970s, roughly the 'period of high growth' of the Japanese economy. In this period there were much fewer women than today who intended to work continuously in hierarchical

organizations. In addition, though family incomes were increasing, those of many households were not high enough to finance university education. For these reasons, many women and their parents chose junior college education as a post-high-school education. It could be purchased at a relatively low cost especially because junior colleges did not concentrate in large cities but spread more uniformly all over Japan than universities.[5]

About in the second half of the 1980s, many women began to intend to work continuously in hierarchical organizations. The Equal Employment Act enforced in 1986 must also have prompted this. Moreover, their parents' incomes were already high enough to send them to university. In addition, the rapid technological and economic changes that occurred about this time demanded more university graduates than junior college graduates. This is probably the most important reason for the above-mentioned fact that the rates of return to university education were stable in the 1980s and the first half of the 1990s. These have brought about the rapid increase in the rate of female enrollment in university relative to junior college from the mid-1980s.

In Japan the number of women enrolled in junior college peaked at 486,810 in 1993 and then decreased to 429,290 in 1996. The rate of female enrollment in junior college peaked at 24.87% in 1994 and decreased to 23.69% in 1996. Many junior colleges are now converting or thinking about converting themselves into universities. It is almost certain from the above considerations that in Japan the age has ended when junior college education played such an important role in the education of women. It is not difficult to predict that the rate of female enrollment in junior college will decrease and that in university will increase steadily in the coming few decades.

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[5] According to Arai's (1998a) cross-sectional analysis, the rate of female enrollment in junior college is significantly affected by proximity to institutions.

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