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INTERNAL RATES OF RETURN TO FEMALE HIGHER EDUCATION IN JAPAN

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Abstract

The purpose of this paper is to compute internal rates of return to female university and junior college education in Japan over the past few decades. The main difficulty that arises when achieving this purpose comes from insufficiency of data for the rates of female labor force participation classified by educational careers. This paper computes internal rates of return for the past few decades using limited available data and also making several alternative assumptions. The computation results show that internal rates of return to female university and junior college education tend to be higher than (or at least close to) those to male university education.

I. *Introduction*

The purpose of this paper is to compute internal rates of return to female higher education in Japan over the past few decades. Many Japanese researchers have already analyzed internal rates of return to male higher education in Japan [see, e.g., Arai (1998a)], but those to female higher education have rarely been measured or argued with due seriousness.

There are mainly two reasons for this. One is that sufficient data were not available for such computation. In order to compute internal rates of return to university education, for example, we need age-wage data for both senior high-school and university graduates. However, it was only about the mid-1970s that female age-wage data began to be publicized separately for university, junior college, and high-school graduates. Up to that time age-wage data for these types of workers were grouped into one category, so internal rates of return to higher education could not be computed.

The other reason is that women's labor force participation behavior is much harder to analyze than is the case for men. While most men continue to work from the time of school graduation to the time of mandatory retirement, many women stop working for marriage, childbearing, or childcare, and then restart working in labor markets later. In addition, the rate of female labor force participation has been increasing especially among the young for the past several years. Complete analysis of internal rates of return with changing rates of female

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labor force participation is difficult because detailed data have not been available.

This paper computes internal rates of return to female higher education using data accumulated in Japan in the past few decades and considers some economic significance of investment in female higher education. Available data for rates of female labor force participation are not yet sufficiently detailed. Separate data for labor force participation of junior college and university graduates are available only for three years, i.e., two years in the 1980s and one year in the 1990s. Moreover, from those data we can compute only average rates of labor force participation for several age groups. Hence, this paper computes internal rates of return for many years under some alternative assumptions.

II. *The Method of Measuring Internal Rates of Return*

This paper considers internal rates of return to both female university and junior college education. (In Japan, university education is given for four years and junior college education for two years.) The internal rate of return to university education, for example, can be computed by solving the following equation for r:

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

In this equation, the subscripts correspond to different ages of university students/graduates. For example, 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 meaning 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 in the j-th year of university education. P_j^H is the rate of labor force participation of senior high-school graduates of the same age as that corresponding to j. W_j^H is the average wage for these high-school graduates of the age corresponding to j. 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 university graduates of the age corresponding to k and W_k^U is the average wage at this age. 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.

The internal rate of return to university education can be computed if data for the above variables are obtained. That to junior college education can be computed similarly, the main differences being that this type of education continues for only two years and we need to use partly different data.

It should be noted that the following computations will use cross-sectional age-wage data.

This is the method usually used for computation of internal rates of return. The resultant rates do not therefore reflect a wage increase due to economic growth. If wages increase with economic growth as they usually do and the wage structure (or the system of wage ratios) remains the same across ages and educational careers, then the real internal rate of return to higher education will be higher than when wages do not increase. The internal rate of return to higher education with consideration of a wage increase approximately equals that without consideration of it plus the rate of the wage increase.

Costs of higher education are computed relatively easily. This paper regards T_j as equal to the tuition and fees per student in private institutions and $P_j^H W_j^H$ as the gross forgone earnings per student. We ignore the costs of books and stationery for the reasons given below. Tuition and fees for private institutions are used in this paper because the majority of Japanese students are enrolled in private institutions. Strictly speaking, the forgone earnings of higher education in the j-th year is defined as the average earnings of senior high-school graduates of the age corresponding to j minus the average part-time income of university (junior college) students in that year. This is called net forgone earnings. In contrast, forgone earnings before the reduction of part-time income is called gross forgone earnings. We use here gross forgone earnings 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 the commuting costs almost equals part-time income, they can be considered to cancel each other out in the computation process of internal rates of return.

The 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. As mentioned above, in the mid-1970s *Basic Survey of Wage Structures* began to provide separate female age-wage data for different educational careers. Consequently, internal rates of return to higher education became computable from then.

The most serious problem that arises in the computation of internal rates of return to Japanese female higher education concerns the rate of labor force participation for each educational career at each age. While separate age-wage data for high-school, junior college, and university graduates are available for each year from the mid-1970s, separate data for labor force participation are not available every year. *Annual Report on the Labor Force Survey* (Rodoryoku Chosa Nempo) by the Ministry of Labor reports age-grouped female labor force participation rates for each year, but the data are not classified by educational careers. It is possible to compute labor force participation rates by educational careers from *Employment Status Survey* by the Statistics Bureau but only for three years. (Combined data for junior college and university graduates are available for another three years.) Hence, this paper makes some reasonable assumptions when applying rates of labor force participation.

III. *Assuming Equal Rates of Labor Force Participation across Educational Careers*

As the first step, this section computes internal rates of return to female higher education

under the premise that the rate of labor force participation is the same across different educational careers in each age group. There are two ways to apply this premise. One is to assume that the labor force participation rates of all types of female workers are 100% at each age. The other is to assume that all those types at each age group have the common rate of labor force participation publicized in *Annual Report on the Labor Force Survey*.

The first assumption is the same as that usually used for male workers. Because women's rates of labor force participation are much lower than men's, this assumption may be unrealistic for the computation of internal rates of return. However, it is interesting to see how much the internal rates of return computed under this assumption differ from those computed under assumptions of more realistic rates of labor force participation.

The second assumption is more realistic than the first one, though it does not take account of differences in labor force participation among different educational careers. An advantage of this assumption is that we can use data that are available continuously for the past few decades for female labor force participation of each age group.

We start with computation under the first assumption. Age-wage data for this computation are available each year since 1974 from the *Basic Survey of Wage Structures* by the Ministry of Labor. Separate age-wage data are obtainable for senior high-school, junior college, and university graduates for various industries and firm sizes. The following computation is based on averages across all industries and firm sizes. It is assumed here that all workers continue to work up to the age of 59 from the time of graduation from school. Further, workers of each age group with each educational background are assumed to receive the relevant average wage.[1] Internal rates of return are computed on the basis of before-tax annual wages, which are obtained by multiplying monthly wages by twelve and adding annual bonuses.[2] Strictly speaking, after-tax wages should be used, but before-tax wages are used here to save research costs.

As mentioned above, we consider only tuition and fees for private institutions and gross forgone earnings as the costs of higher education. The amount of tuition and fees per student can be computed from *Survey of the Financial Situations of Private Schools* and *Basic School Survey* both by the Ministry of Education. On the other hand, the amount of gross forgone earnings can be computed from the *Basic Survey of Wage Structures*. Strictly speaking again, after-tax wages should be used for gross forgone earnings. However, because both pecuniary benefits and costs of higher education are overestimated by the amounts of tax, the overestimation is canceled out to some extent in the process of computing internal rates of return.

The computation results are shown in Table 1. The internal rate of return to female university education was higher in the mid-1970s than in the subsequent years. In the latter period, the level was quite stable. That to female junior college education was much higher than that to university education in 1974 and 1975, but declined more steeply than the latter in the subsequent years. Of course, high rates of return to junior college education do not

[1] *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. Differences of one or two years in the mandatory retirement age would not generate significant differences in the resultant internal rates of return in the computation.

[2] *Basic Survey of Wage Structures* reports monthly wages surveyed in June and annual bonuses in the previous year.

TABLE 1: INTERNAL RATES OF RETURN UNDER THE ASSUMPTION OF 100% RATE OF LABOR FORCE PARTICIPATION

(%)

Year	University Education	Junior College Education
1974	9.91	11.44
1975	9.94	11.47
1976	9.40	9.02
1977	9.45	9.44
1978	8.88	9.40
1979	8.79	8.78
1980	8.91	8.82
1981	8.72	9.28
1982	8.93	9.01
1983	8.63	8.96
1984	8.77	8.95
1985	8.81	8.75
1986	8.87	9.06
1987	8.57	8.95
1988	8.63	8.78
1989	8.91	8.86
1990	8.96	8.72
1991	8.67	8.49
1992	8.95	8.61
1993	8.83	8.53

imply that those from junior college earn more than those from university. Because the amount of education investment per person of the former is smaller than that of the latter, a university graduate earns more on average.

Next we would like to compute internal rates of return under the second assumption. That is, we now assume that the rate of labor force participation is less than 100% but that it is the same across different educational careers. Data for rates of labor force participation are available from the *Annual Report on the Labor Force Survey* by the Statistics Bureau. This report shows the labor force participation rate for each five-year age group from fifteen years of age. Since labor force participation rates are not classified according to educational careers, we assume here first that the rate is 100% up to 24 years of age. This assumption will ease computation of forgone earnings of higher education. (Later this assumption will be modified.) To the age group older than 24 we apply the rate of labor force participation which is shown in the report and is common across different educational careers. The other parts of computation are the same as in the previous case for Table 1.

The internal rates of return shown in Table 2 are lower than in Table 1 by more than two percentage points. This is obviously because the rates of female labor force participation are far less than 100%. In general, the values in Table 2 are more stable than those in Table 1, partly reflecting increased rates of female labor force participation especially at the ages of the mid to late twenties.

The above assumption of 100% labor force participation of senior high-school graduates at college attendance ages is likely to overestimate forgone earnings of higher education and thus to underestimate true internal rates of return. Hence, we next use alternative assumptions

TABLE 2: INTERNAL RATES OF RETURN UNDER THE ASSUMPTION OF COMMON RATES OF LABOR FORCE PARTICIPATION ACROSS EDUCATIONAL CAREERS

(%)

Year	University Education	Junior College Education
1974	6.48	8.16
1975	6.41	7.97
1976	6.05	5.89
1977	6.29	6.32
1978	5.94	6.37
1979	5.86	5.91
1980	6.02	5.97
1981	5.97	6.38
1982	6.26	6.27
1983	6.05	6.32
1984	6.15	6.31
1985	6.19	6.16
1986	6.27	6.37
1987	6.04	6.32
1988	6.10	6.21
1989	6.36	6.36
1990	6.47	6.26
1991	6.28	6.12
1992	6.53	6.23
1993	6.38	6.16

to obtain more realistic values. That is, we now assume a rate of labor force participation lower than 100% for those ages. Table 5 below is useful for this purpose because it provides some information about the magnitude of the labor force participation rate of young senior high-school graduates. It suggests that the rate be approximately between 70% and 80% for those aged from 18 to 22. This is especially true in more recent years. (In 1974 and 1977, the rates for those aged between 20 and 24 were lower than 70%. This seems mainly due to marriage at the ages of 23 and 24. The observed increase in the rate of labor force participation of this age group seems mainly due to an increase in marriage age.)

The above observation suggests that the following two alternative assumptions are likely to generate more realistic internal rates of return. The first is to assume that the rate of labor force participation of senior high-school graduates at college attendance ages is 70%. The second is to assume that it is 80%. Because these assumptions lower forgone earnings of higher education, they will generate higher internal rates of return than in Table 2. As the first assumption leads to smaller forgone earnings, it will produce higher internal rates of return than the second.

The computation results are shown in Table 3. The internal rates of return to university education under the assumption of 70% rate of labor force participation of high-school graduates are roughly four to five percentage points higher than those under the assumption of 100% rate of labor force participation shown in Table 2. The differences in values between the 70% and 80% columns for university education are less than one percentage point. Similar properties also hold for junior college education.

TABLE 3: INTERNAL RATES OF RETURN UNDER THE ASSUMPTION OF COMMON RATES OF LABOR FORCE PARTICIPATION ACROSS EDUCATIONAL CAREERS AFTER ADJUSTMENTS FOR LABOR FORCE PARTICIPATION RATES OF YOUNG HIGH-SCHOOL GRADUATES

(%)

	University Education		Junior College Education	
Year	70%	80%	70%	80%
1974	11.73	11.04	13.06	12.46
1975	11.78	11.09	13.19	12.55
1976	11.11	10.47	10.45	9.92
1977	11.07	10.46	10.88	10.35
1978	10.37	9.82	10.79	10.28
1979	10.27	9.72	10.08	9.61
1980	10.37	9.83	10.12	9.64
1981	10.11	9.60	10.65	10.15
1982	10.29	9.79	10.34	9.85
1983	9.97	9.48	10.28	9.79
1984	10.14	9.63	10.28	9.79
1985	10.18	9.68	10.04	9.57
1986	10.26	9.75	10.42	9.92
1987	9.92	9.42	10.32	9.82
1988	10.03	9.52	10.14	9.64
1989	10.37	9.83	10.23	9.73
1990	10.45	9.90	10.10	9.59
1991	10.14	9.60	9.88	9.37
1992	10.43	9.88	10.03	9.51
1993	10.31	9.77	9.96	9.43

Notes: The values in the 70% columns are obtained by assuming that the rate of labor force participation of senior high-school graduates at the college attendance ages is 70%. The values in the 80% columns are obtained by assuming it is 80%.

IV. *Differential Rates of Labor Force Participation across Educational Careers*

The previous section computed internal rates of return by assuming that the rate of labor force participation is the same across different educational careers. This section will relax this assumption using data for female labor force participation classified by educational careers. These data are obtained from the *Employment Status Survey* by Statistics Bureau. They enable us to compute rates of labor force participation for high-school, junior college, and university graduates for several different age groups. Unfortunately, this survey has data only for a limited number of years, i.e., 1974, 1977, 1979, 1982, 1987, and 1992. Moreover, only aggregate data are available for junior college and university graduates for the first three years, though the data for high-school graduates are available separately. Thus, this section will focus mainly on computation of internal rates of return in the second three years.

Let us first use this survey to see the percentages of women actually working in each of the above six years. The survey enables us to compute the ratio of the number of females who

TABLE 4: RATES OF FEMALE LABOR FORCE PARTICIPATION OF UNIVERSITY AND JUNIOR COLLEGE GRADUATES

(%)

Age Group	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1974 (UJ)	70.57	36.82	29.89	33.33		39.61		26.34	
1977 (UJ)	76.58	42.25	30.02	30.18		43.41		28.24	
1979 (UJ)	77.82	42.99	30.12	30.59	36.14	42.99	44.51	35.90	21.54
1982 (U)	83.02	52.09	37.42	35.29	39.52	41.98	49.02	36.36	40.00
(J)	81.84	47.07	31.90	28.71	33.47	37.88	39.35	30.65	20.83
1987 (U)	85.97	58.11	38.90	38.53	38.16	42.98	41.57	39.13	33.33
(J)	83.56	49.73	32.46	33.12	33.65	35.98	36.10	32.21	17.05
1992 (U)	90.31	70.32	45.53	40.09	41.19	40.19	41.86	37.78	27.45
(J)	88.18	57.77	35.72	35.27	37.52	37.19	37.76	30.88	20.38

Notes: UJ stands for combined graduates from university and junior college. U and J stand for separate university and junior college graduates, respectively. The values shown for 45–49 years of age in 1974 and 1977 are the averages for 40–54 years of age. Similarly, the averages for 55–64 are shown between the columns for 55–59 and 60–64.

mainly work to the total number of females of each age group for each classified educational career.[3] Here we define this ratio as the rate of female labor force participation. 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 of computing internal rates of return, this ratio may generate more realistic internal rates of return than the normal rate of labor force participation. The rates of female labor force participation so computed for university and junior college graduates are shown in Table 4, while those for senior high-school graduates are in Table 5.

It is relatively easy to observe general trends in the rate of labor force participation in the last three years shown in these two tables, that is 1982, 1987, and 1992. On the basis of the data for these years, Figures 1, 2, and 3 visualize the rates of labor force participation of university, junior college, and high-school graduates, respectively.

It is seen in these tables and figures that the rates of labor force participation for women in their twenties and thirties increased from 1982 to 1992 for each educational career. A simple computation will reveal that this increase was especially salient among university graduates. On the other hand, the increase for women in their forties and fifties was prominent among high-school graduates. The rates of labor force participation for university and junior college graduates at these ages do not show a clear-cut tendency.

We see in addition that the rate of labor force participation is higher for university graduates than for others in these three years for almost all age groups. In contrast, the rate for junior college graduates is higher than that for high-school graduates mainly among those younger than 35.

Let us next extend our observation to the more distant past. Table 5 implies that the rate of labor force participation of high-school graduates no younger than 20 increased almost

[3] Those who do *not* mainly work consist mostly of those who do not work and those who partly work but spend most time for house keeping.

TABLE 5: RATES OF FEMALE LABOR FORCE PARTICIPATION OF SENIOR HIGH-SCHOOL GRADUATES

(%)

Age Group	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
1974	84.28	64.13	29.18	22.63	26.76		32.80		21.82	
1977	82.40	67.28	31.09	24.09	27.36		33.93		24.73	
1979	72.77		31.86	25.36	29.44	33.69	34.56	34.41	26.78	18.31
1982	81.10	70.46	34.93	27.24	30.07	35.81	36.40	35.10	28.98	20.00
1987	80.19	72.81	39.14	29.14	32.49	37.37	38.56	36.79	29.19	19.14
1992	80.00	75.47	45.19	31.51	35.58	39.68	41.93	41.00	33.31	21.32

Notes: Notes similar to those to Table 4 apply to the values after 40 years of age in 1974 and 1977 and the values between 15 and 24 years of age in 1979.

FIG. 1. LABOR FORCE PARTICIPATION RATES OF FEMALE UNIVERSITY GRADUATES

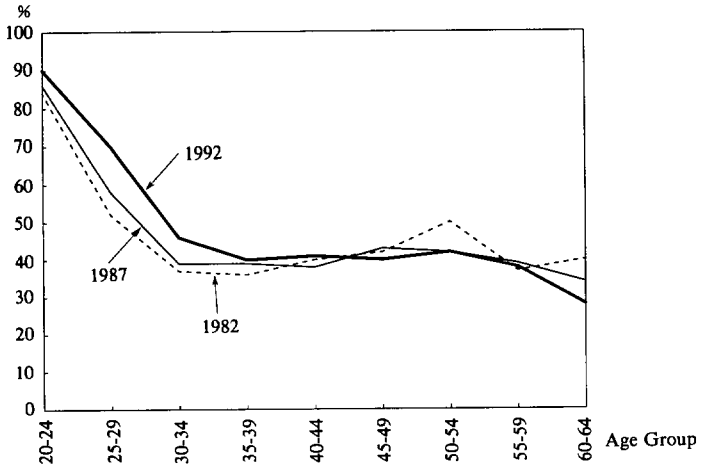


FIG. 2. LABOR FORCE PARTICIPATION RATES OF FEMALE JUNIOR COLLEGE GRADUATES

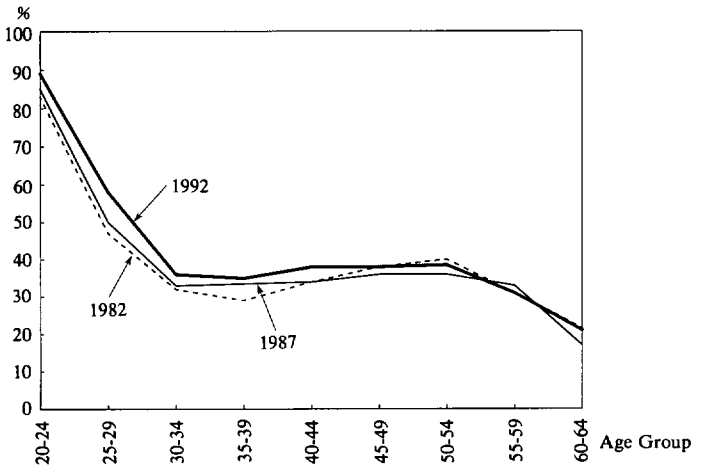


FIG. 3. LABOR FORCE PARTICIPATION RATES OF FEMALE SENIOR HIGH-SCHOOL GRADUATES

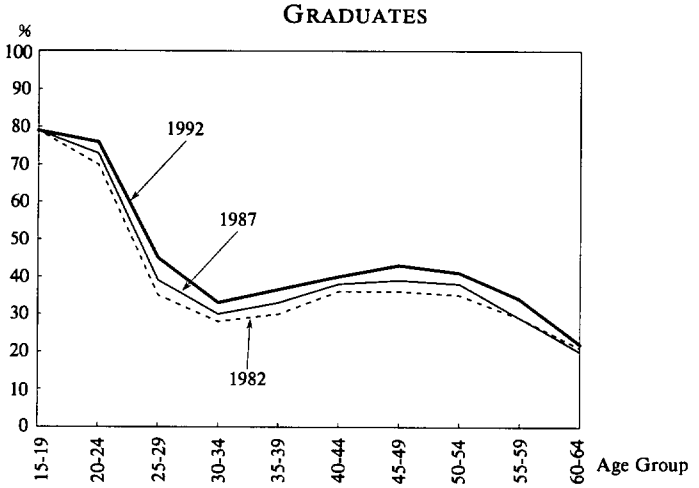
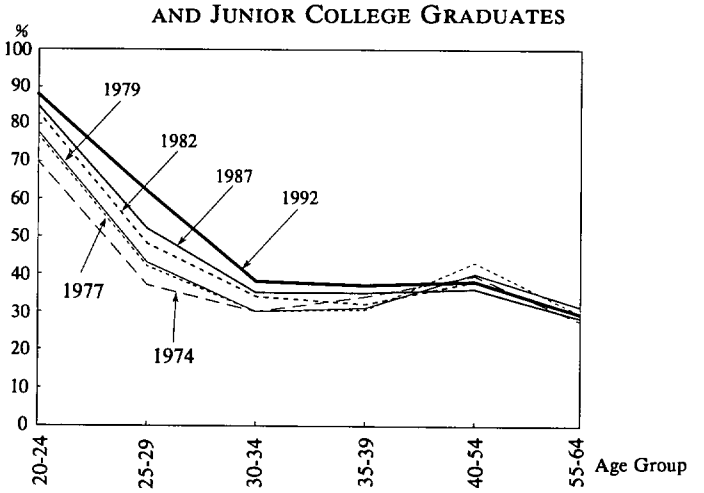


FIG. 4. LABOR FORCE PARTICIPATION RATES OF FEMALE UNIVERSITY AND JUNIOR COLLEGE GRADUATES



steadily from 1974 to 1992. In order to obtain comparable data, Figure 4 is drawn by computing the weighted averages of the rates of labor force participation of university and junior college graduates, where age groups are chosen in accordance with the older data. This figure shows that the aggregate rate of labor force participation increased almost steadily for younger university and junior college graduates, but that there is not a clear-cut trend for older women with higher education.

With these observations in mind, we now compute internal rates of return to female higher education. We first focus attention on 1982, 1987, and 1992, for which differential data are available for university and junior college graduates. For these years, internal rates of return are computed using the data for labor force participation rates shown in Tables 4 and 5 on the one hand, and those for wages used in the previous section on the other. Table 6 shows

TABLE 6: INTERNAL RATES OF RETURN UNDER THE ASSUMPTION OF DIFFERENTIAL RATES OF LABOR FORCE PARTICIPATION ACROSS EDUCATIONAL CAREERS

(%)

	University	Junior College
1982	7.66	7.94
1987	7.37	7.40
1992	8.42	8.07

TABLE 7: INTERNAL RATES OF RETURN UNDER THE ASSUMPTION OF A COMMON RATE OF LABOR FORCE PARTICIPATION AMONG UNIVERSITY AND JUNIOR COLLEGE GRADUATES

(%)

	University	Junior College
1974	7.33	9.67
1977	7.32	9.09
1979	6.22	7.89
1982	6.41	8.76
1987	5.80	8.39
1992	6.65	9.35

the computation results.

Comparison of the results for university education in Table 1 with those in Table 6 shows that the former are higher than the latter by 0.5 to 1.3 percentage points. It is noteworthy that the difference in 1992 is the smallest. As for junior college education, the corresponding values in Table 1 are higher than those in Table 6 by 0.5 to 1.6 percentage points. Here again the difference in 1992 is the smallest.

On the other hand, the internal rates of return to university education in Table 6 are higher than the corresponding rates in Table 2 by 1.3 to 1.9 percentage points. As to junior college education, the values in Table 6 are higher than those in Table 2 by 1.1 to 1.8 percentage points. Thus, as far as available data for labor force participation are concerned, use of differential rates of labor force participation across educational careers generates significantly higher rates of return to higher education. In particular, the rates of return in 1992 are quite close to the corresponding rates in Table 1.

These high internal rates of return to higher education are due mainly to the high rates of labor force participation of university and junior college graduates compared with high-school graduates. As can be seen in Tables 4 and 5, the difference in labor force participation is quite large at the ages younger than 35. This difference is especially salient for university graduates. In particular, the large difference for those between 25 and 29 years of age in 1992 is a cause of the high internal rate of return to university education in that year.

The above computation was concerned with only three years. It might be more informa-

tive to extend our computation to the more distant past. Because of the above-mentioned data insufficiency problem, however, differential rates of labor force participation between university and junior college graduates cannot be obtained. Hence, we would like to compute internal rates of return for all the years shown in Table 4 under the assumption that these two types of graduates have the same rates of labor force participation which differ from those for high-school graduates. For this purpose, we compute the weighted average labor force participation rate among university and junior college graduates for each age group in each year. As for wages, we use different data for different educational careers as above.

The computation results are shown in Table 7. Comparison between Tables 6 and 7 reveals that the results in Table 7 are underestimates for university education in the last three years of the table while they are overestimates for junior college education. Generally speaking, these results show higher internal rates of return than those in Table 2.

V. *Discussion*

We would like to evaluate whether or not the internal rates of return computed above are high enough to attract investment in higher education. The values in Table 1 are quite high for both university and junior college education. Of course these high internal rates of return are obtained by assuming that the rate of female labor force participation is 100% up to the time of mandatory retirement.

If common rates of labor force participation based on data for all educational careers are used in computation as in Table 2, internal rates of return decrease by a few percentage points. Still, almost all computed rates are higher than 6%. It may be informative to make a comparison between returns to female and male university education. Arai (1990) shows internal rates of return to male university education from the mid-1960s to the mid-1980s. The values from the mid-1970s to the mid-1980s are approximately between 7.5% and 6.5%. Hence, the rates for female higher education are not significantly lower.

The values shown in Table 3 have been obtained by assuming more realistic rates of labor force participation of young senior high-school graduates. These internal rates of return are outstandingly high and imply that both university education and junior college education were very profitable investment opportunities.

Probably the values shown in Table 6 are the most reasonable estimates of the internal rates of return to female higher education, because the assumptions about rates of labor force participation are least restrictive. Unfortunately, we have computation results only for three years. According to Arai (1990), the internal rate of return to male university education in 1982 is 6.71%. Hence, the rates of return to female university and junior college education in the same year exceed the rate of return to male university education. It is quite likely that internal rates of return to female higher education are generally quite close to or even higher than those to male higher education. It should be emphasized that this property holds when the rate of female labor force participation is far less than 100%.

Of course these high rates of return to female higher education do not mean that female college graduates earn more than male college graduates. Those rates are high partly because female high-school graduates earn significantly less than female college graduates. The high rates of return become incentives for a woman to invest in higher education, because her

future earnings will be low if she does not invest.

Economic theory suggests that the returns to alternative investment opportunities are very important when making an investment decision. Regarding this point, it should be added that ordinary Japanese individuals have not had other investment opportunities that generate such high returns. 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, however, was almost 0% if averaged over this period. Of course the nominal rate was higher, but the rate of increase in the consumer price index was almost equally high on average. In contrast, the internal rates of return shown in this paper are real rates, since they have been computed using cross-sectional data. Therefore, the internal rates of return to female higher education were much higher than the real interest rate of bank term deposits so that investment in such education was quite advantageous.

It may be necessary to explain why the interest rate for bank term deposits was so low. For a long period, interest rates were regulated to very low levels in Japan. This was called the low-interest-rate policy. One purpose of this policy was to enable small financial institutions to gain enough profits to avoid bankruptcies and thereby protect depositors. This principle of avoiding small financial institutions becoming bankrupt is called a convoy system. Another purpose was to give priority to large corporations in the allocation of the capital collected at such low interest rates. It should be added, however, that there is a factor besides the low-interest-rate policy which tends to lower the interest rate for bank term deposits. This derives from the nature of bank term deposits, which have difficulty responding flexibly to changing rates of inflation and economic growth.

This paper has demonstrated that investment in female higher education has achieved high rates of return. In particular, such investment has been no less advantageous than that in male university education. The findings of this paper are consistent with the recent rapid increase in female enrollment in higher education, especially in university education. In 1989 the rate of female enrollment in higher education exceeded that of male enrollment in Japan. The rate of female enrollment in university increased very rapidly since the mid-1980s and exceeded that in junior college in 1996 [Arai, (1998a; 1998b)]. There are a variety of factors that generated these changes. Among them an increase in family income may be one important factor, because it enables many households to have sufficient funds for investment in female higher education. The results of this paper suggest that the recent intention of young women to work longer and continuously is another remarkable factor especially in the rapid increase in the rate of female enrollment in university.

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