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CHANGES IN THE LABOUR SUPPLY OF JAPANESE WOMEN BETWEEN 1993 AND 2008: A PANEL DATA ANALYSIS*

Tomoko Kishi§

ABSTRACT

In Japan a negative relationship between the labour force participation rate of married women and spouse income has been observed. It has also been remarked that the labour force participation rate of married women has almost no correlation with their level of educational attainment. This paper examines whether there has been any changes in recent cohorts. Two kinds of panel data released in Japan (the JPSC and KHPS) are used for the analyses; one with two and the other, four observed labour market outcomes as dependent variables. The results suggest that the cohort differentials in both the probability of working and attaining full-time employment are weak. The effect of spouse income on female labour force participation is significantly negative, while that of higher education on working and full-time employment is not robust. The results also indicate both younger university graduates and their older counterparts have approximately the same probability of gaining full time employment, suggesting more needs to be done to ensure higher education is beneficial for Japanese women in terms of employment outcomes.

Keywords: *labour force participation rates; spouse income; university education; cohorts*

JEL Classification: C33, J21, J24

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1. Introduction

The objectives of this study are to estimate labour force participation behaviours of Japanese women and to examine whether any cohort-related differences exist among them.

The labour force participation of Japanese women is known to have some characteristics that are unobserved in most other advanced countries. One such characteristic is that labour market participation is highly dependent on family factors such as spouse income and the existence of children. Another is that labour force participation rates do not necessarily climb in line with educational attainment.

The negative relationship between the labour force participation rate of married women and their spouse's income was once held to be evidence of the robust law of economics in Japan. The phenomenon that highly educated women do not necessarily have a higher probability of getting jobs has also been pointed out by a number of researchers in Japan.

The present paper looks at whether there have been any changes in recent cohorts in terms of labour force participation, employment status, the effect of spouse income and educational attainment on labour market outcomes. To this end, two kinds of panel data are used: the Japanese Panel Survey on Consumers (JPSC) and the Keio Household Panel Survey (KHPS).

In Japan, the Equal Employment Opportunity Law was enacted in 1986, followed by the Childcare Leave and Family Care Leave Law, enacted five years later. Researchers have since attempted to investigate the effects of these laws. However, this paper does not aim to estimate their direct effect, because Japanese firms may be slow to respond to the changes. Instead, it aims to explore the labour force behaviour of the most recent cohorts using the latest releases of panel data.

This paper is organised as follows: Section 2 explains the panel data used in the analyses. Section 3 is devoted to a brief literature review. Section 4 analyses the two kinds of panel data. Sections 5 and 6 interpret the estimated results and Section 7 concludes the paper.

2. Two Ttypes of Panel Data

2-1. The JPSC

In this paper, we use the JPSC, which was the first panel dataset available in Japan. The

survey is administered and data collected by a public research institute, the Institute for Research on Household Economics. The first wave was conducted in 1993 using a sample of 1,500 women between the ages of 24 and 34 (named Cohort A) who responded to a questionnaire[1]. The participants were all women, because the initial objective of this survey was to study the lifestyles of young women from a range of perspectives such as expenditure, savings, employment status, and family structure. In 1997, when the cumulative attrition rate for Cohort A grew to 17%, 500 new sample subjects (referred to as Cohort B), comprising of women aged between 24 and 27, were added to the panel. In 2003, when the cumulative attrition rates for Cohorts A and B grew to 42% and 35%, respectively, 836 new sample subjects (referred to as Cohort C), comprising of women aged between 24 and 29, were added. Although a Cohort D was added in 2008, it is not used in this paper[2]. The sample sizes of the three cohort groups in the JPSC are depicted in Figure 1[3].

2-2. The KHPS

The KHPS is a more comprehensive panel survey than the JPSC because its respondents are selected from both genders, from 20 to 69 years of age, using a two-stage stratified random sampling method. This survey is administered by the Keio/Kyoto Joint Global Centre of Excellence Research Program, a joint research centre established by a major private and a national university in Japan[4]. The first wave in 2004 comprised 7,000 respondents from 4005 households nationwide. The survey encompassed employment, school attendance, lifestyle, time allocation, health status, and environmental awareness. It also included comprehensive topics such as household composition, income, expenses, assets, and housing[5]. In 2007, the survey was conducted on an additional 1,419 respondents selected using the same sampling technique. The samples and the attrition rates are displayed in

[1] The questionnaire was sent to respondents and returned to the Institute by post.

[2] A brief explanation of the JPSC and the questionnaires used are provided on the English website of the institute: http://www.kakeiken.or.jp/en/JPSC/jpsc.html.

[3] Sakamoto (2006) analysed the causes and effects of sample attritions in Cohorts A and B in the JPSC. The rates of attrition for each wave are also listed in the JPSC Annual Report (in Japanese).

[4] The objectives and basic outline of the KHPS is explained on the following website: http://www.gcoe-econbus.keio.ac.jp/english/public-data.html.

[5] Unlike the JPSC, interviews are conducted for the KHPS.

Figure 2[6].

In this paper, we use data on women born in 1948 or after in waves 1–5. We do not use samples born before 1948 because they had reached retirement age by the time of the fifth wave.

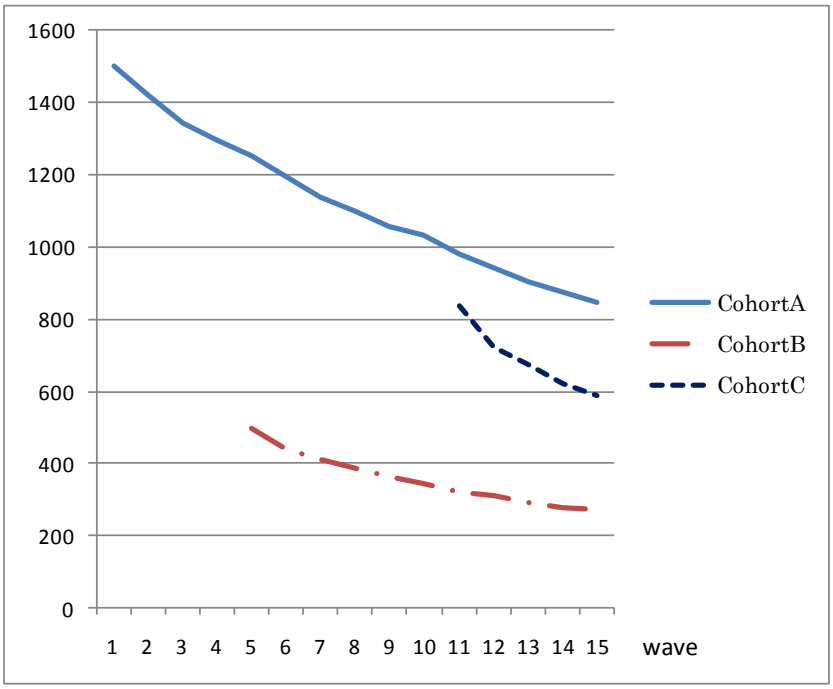

Figure 1 Respondents from the three cohort groups in the JPSC

[6] The problem of attrition is reviewed in each volume of the series titled 'The Dynamics of the Japanese Household', which is a collection of discussion papers by the KHPS.

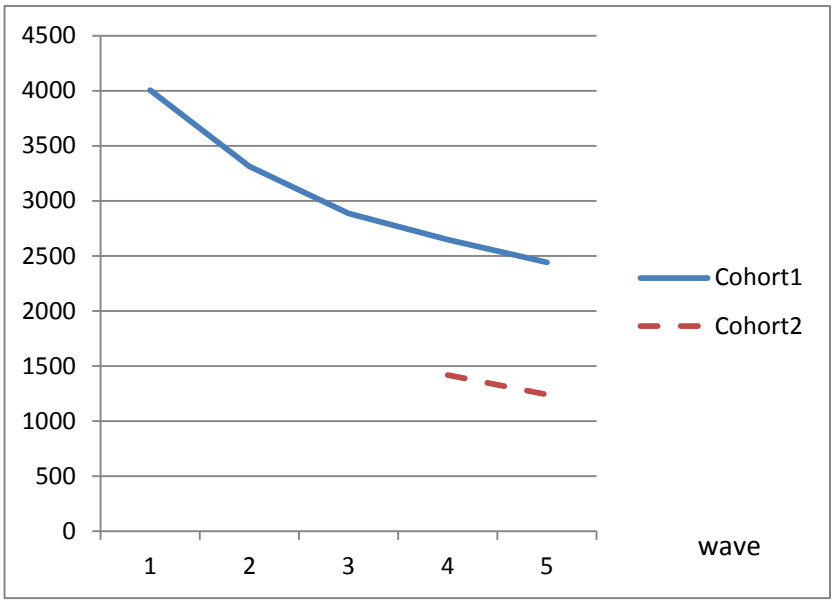

Figure 2 Respondents from the two cohort groups in the KHPS

3. Literature Review

3-1. Spouse income and the labour force participation of women

The relationship between women's labour force participation and spouse income has been studied in Japan for many years. Professor Arisawa of Tokyo University observed a negative relationship between the labour force participation rate of married women and their spouse's income in the Japanese labour market in the 1950s. Because this phenomenon had already been identified by Douglas (1934), researchers named it the Douglas–Arisawa Law (Tsujimura, Sasaki, & Nakamura, 1959).

In the 1960s and 1970s, Professor Keiichiro Obi of Keio University estimated the labour supply functions of women based on the utility functions for which wages and leisure are substitutes (Obi, 1969a, 1969b, 1979). He elaborated on the Douglas–Arisawa Law in the following manner:

1) The labour force participation of a household's primary earner is not affected by the income of other family members, nor by the primary earner's own expected wage rates.

2) However, the labour force participation of other family members depends positively on

their expected wage rate and negatively on the income of the primary earner.

Professor Obi estimated the functions of labour force participation by women for various types of households on the assumption that the Douglas–Arisawa Law was a robust empirical law of economics. However, in the late 1990s, labour economists began to doubt this law and to re-estimate women's participation rates in the labour force using panel data that a research institute had begun to release at the time.

Almost half of the various research papers based on these panel data are concerned with labour force participation by women, and they have mainly been published in Japanese. The following details some of the research papers published in English on women's labour force participation which are based on the JPSC data.

Nagase (1997) concluded that the labour supply of married women was strongly affected by the childcare support available from their mothers, their husband's income, and whether they were employed or self-employed.

Nawata and Ii (2004) estimated the labour supply function and wage function of women by applying a simultaneous equation method to the first wave of the JPSC dataset. They found that spouse income had significant negative effects on the labour supply of married women.

Kohara (2006) challenged the myth that homemakers were not working because of their husband's high income. She found that the labour supply of wives was unaffected by the income of their husbands for younger cohorts. However, Kohara (2010), found that married women tended to start working in response to their husbands losing their jobs.

Among the studies of women's labour force participation that use the KHPS dataset, the only paper in English was based on a household utility function. This study analysed the joint decisions of households to work and found that the market work of the husband reduced the wife's market work, whereas the wife's market work did not affect the husband's. (Miyoshi, 2009).

3-2. Labour force participation by women and education

Only a small number of research papers based on either the JPSC or KHPS datasets have focused on the relationship between education and employment. However, a number of researchers have estimated the effect of women's educational attainment on their

subsequent employment. Edwards and Pasquale (2003) analysed the JPSC to find that the most important factor determining whether or not a young woman attends university in Japan is her mother's attendance or non-attendance. That is, their analysis suggests that university education for women in Japan has not always been job-oriented.

Waldfogel, Higuchi, and Abe (1999) compared the effects of family leave policies on employment retention rates for women in the United States, Great Britain, and Japan. Their estimated results based on the JPSC dataset, (ignoring the effects of maternity leave) showed that higher education levels do not lead to higher job retention rates for Japanese women.

Aside from analyses based on the panel data, Abe (2011) analysed employment status survey data and found that regular employment ratios are higher for women graduates than for those that have lower education levels. However, Abe also found that the proportion of those working full-time was no higher for the post-EEOL (Equal Employment Opportunity Law) cohorts than for the older cohorts.

4. Estimations

4-1. The model

Two kinds of analyses are performed. The first analysis is based on a random-effect probit model. In equation (1), the suffix *it* refers to the i^{th} individual in the t^{th} wave.

$$y^{*}_{it} = x'_{it}\,\beta + \alpha_i + u_{it} \tag{1}$$

y^{*}_{it} is the latent dependent variable and y_{it} is the observed binary outcome variable, defined as in equation (2). Working means that the respondent is part of the labour force, whether in full-time employment, part-time employment, or self-employment.

$$y_{it} = \begin{cases} 1 \;\; (working = yes) \;\; if \quad y^{*}_{it} \geq 0 \\ 0 \;\; (working = no) \;\; otherwise \end{cases} \tag{2}$$

x_{it} is a vector of explanatory variables and $u_{it} \sim N(0, \sigma^2{}_u)$. The composite error tem $v_{it} = \alpha_i + u_{it}$ will be correlated over time owing to individual-specific time-invariant α_i terms.

On the other hand, the second analysis is based on an ordinal model. The outcome variable with four observed outcomes is defined as in equation (3).

$$y_{it} = \begin{cases} 0 \ (not\ working) & if \ \ y_{it}{}^* \le \kappa_1 \\ 1 \ (self\ employed) & if \ \ \kappa_1 < y_{it}{}^* \le \kappa_2 \\ 2 \ (working\ part\ time) & if \ \ \kappa_2 < y_{it}{}^* \le \kappa_3 \\ 3 \ (working\ full\ time) & if \ \ \kappa_3 < y_{it}{}^* \end{cases}$$

(3)

The probabilities for the four response categories are expressed as equation (4), where 'a' is either 0, 1, 2, or 3.

$$P(y_{it} = a) = \Pr(\kappa_a < y_{it}{}^* \le \kappa_{a+1})$$

(4)

4-2. Variables

For the analysis of the JPSC dataset, the vector x_{it} includes the following explanatory variables:

Dummy variable for the period of birth (the reference group is respondents born in the period 1958–1964)

Born in the period 1965–1974

Born in the period 1975–1979

Respondent's age (as in September of each wave)

Dummy variable for being married (the reference group is unmarried respondents)

Husband's 'permanent' income ($= (\frac{income_{t-3} + income_{t-2} + income_{t-1}}{3})$, in ten thousand

yen, deflated by the CPI)[7]

Marital status × husband's 'permanent' income (an interactive term)

Marital status × husband's 'permanent' income × born in the period 1965–1974

Marital status × husband's 'permanent' income × born in the period 1975–1979

Number of children aged 0–5, living together

Number of children aged 6–12, living together

Dummy variable for the highest level of education achieved[8] (the reference group is respondents that have 12 years of education or less)

Technical school or technical college

Junior college

University or graduate school

University or graduate school × born in the period 1965–1974

University or graduate school × born in the period 1975–1979

Year 1999–2000

Year 2001–2002

Year 2003–2004

Year 2005–2006

Year 2007

The reason for using the husband's 'permanent' income, that is, the husband's average income for the past three years, is that they have already been found to have significant negative effects on the labour supply of wives (Higuchi, 2001).

We use an interactive term between marital status and husband's 'permanent' income, and the period in which respondents are born, in order to test whether there are any cohort differentials in the effect that spouse income exerts on the labour force

[7] The definition of the term, 'permanent' income' in this paper, is consistent with that in Higuchi (2001) and Okamura and Islam (2011).

[8] Here, highest level of education refers to the highest degree or qualification that the respondent has obtained from the educational institutions he or she has graduated from or completed. The JPSC renews the education for each respondent in each wave.

participation of wives. For the same reason, we use the interactive terms between education and the cohort dummies.

In the analysis of the KHPS dataset, the vector X_{it} includes the following explanatory variables:

Dummy variable for the period of birth (the reference group is respondents born in the period 1948–1965)

Born in the period 1966–1975

Born in the period 1976–1984

Age of the respondents (as in January of each wave)

Dummy variable for being married (the reference group is unmarried respondents)

Husband's 'permanent' income $(=(\frac{income_{t-3}+income_{t-2}+income_{t-1}}{3})$ in million yen, deflated by the CPI, in ten thousand yen)[9]

Husband's 'permanent' income × wife born in the period 1966–1975 (an interactive term)

Husband's 'permanent' income × wife born in the period 1975–1984

Number of children aged 0–5, living together

Number of children aged 6–12, living together

Dummy variable for the highest education achieved (reference: 12 years of education),

Junior college or technical college[10]

University or a postgraduate course

[9] In the first wave of the survey, there were questions about spouse income for three consecutive years. We used them to calculate the 'permanent' income' for the first and the second waves. From the third wave onwards, 'permanent' income are calculated by also utilising the spouse income reported in the $(t-1)^{th}$ and the $(t-2)^{th}$ waves.

[10] The classification of educational attainment for the KHPS is different from that of the JPSC. In the KHPS there is no category for technical schools. Therefore this is included in the category 'other education'.

University/postgraduate course × born in the period 1966–1975 (an interactive term)

University/postgraduate course × born in the period 1976–1984

Other education

Year 2005

Year 2006

Year 2007

Year 2008

The reason for using the interactive terms is the same as that in the estimation of the JPSC.

4-3. Data

For the JPSC, we use data on Cohorts A, B, and C from waves 1–15. Samples that have missing values about spouse income in the three consecutive years are deleted as it is impossible to obtain 'permanent' incomes for them. The number of effective samples is 24,217. The descriptive statistics for the variables are presented in Table 1.

For the KHPS, we used samples from waves 1–5, both Cohorts 1 and 2. Also for the KHPS, samples that have missing values for spouse income in the three consecutive years, the employment status in the previous years, or variables such as the number of children and husband's incomes are excluded. The number of effective samples is 6,633. The descriptive statistics are presented in Table 2.

(Table 1 inserted here)

(Table 2 inserted here)

4-4. Methods of estimation

For both the JPSC and the KHPS, we estimated two models, one with the latent dependent variable working/not working and the other with the latent variable consisting of four labour market outcomes. For the former model, we applied random-effect probit estimation, while for the latter we applied generalized linear latent and mixed (GLLAMM)

estimation method (Rabe-Hesketh and Skrondal, 2008). The two models were first estimated without the interactive terms and then with the interactive terms: the interactive term between cohorts and husband's incomes and that between cohorts and higher education.

5. Estimated Results

5-1. Estimated results from the JPSC dataset[11]

The JPSC results are presented in Tables 3 and 4. The dependent variable for Table 3 is the latent variable for working as against not working, while that for Table 4 is the latent variable for the four employment statuses—working full-time, working part-time, being self-employed, and out of labour force.

(Table 3 inserted here)

(Table 4 inserted here)

Table 3 shows that the respondent's ages have significant positive effects on the probability that they are working. This could be related to the fact that the younger respondents do not work because of their small children as mentioned below. The estimated coefficient for the cohort dummy 'born in the period 1965–1974' has no statistical significance while that for the cohort dummy 'born in the period 1975–1979', has significant positive effects, although at the 10% significance level for the model without the interactive terms and 5% significance level for the model with interactive terms. This means that the youngest cohorts born in the late 1970s have a higher probability of working than the older cohorts, other factors being controlled. Marriage significantly lowers the probability of working and so does the number of children between 0 and 5 years of age. On the other hand, number of children between 6 and 12 years of age does not affect the probability that their mother

[11] Among the working respondents, there are 1,522 (10.8%) public servants. We also tried estimation for the sample excluding them. The estimated coefficients for cohorts, husband's incomes, and their interactions are not significantly different from those for the entire samples including them.

works. For the estimation without interactive terms, the husband's 'permanent' income has significant negative effect on the probability that the respondent is working. As for the estimation with interactive terms, the estimated coefficient for 'husband's "permanent" income × born in the period 1965–74' and 'husband's "permanent" income × born in the period 1975–79' have significant negative effect on the probability of working. This suggests that labour supply of the younger generations is no less responsive to spouse incomes than that of the older generations.

Technical school or college and university or graduate course raises the probability of working as against non-working, although the effect of university or graduate course is weak in terms of significance level.

Table 4 shows the estimated results for the 4 categories of labour market outcomes: full-time employment, part-time employment, self-employment, and out of the labour force. Full-time employment, part-time employment, self-employment, and not working are scored as 3, 2, 1, and 0, respectively.

The respondent's age has significant positive effect, while both being married and the husband's 'permanent income' has significant negative effect on the selection from the four categories of employment status. As for the interactive terms between spouse income and cohort dummies, husband's income × born in the period 1965–74 significantly lowers the probability of a high score in the employment status category, while husband's income × born in the period 1975–79 does not.

The number of preschool and elementary school children has significant negative effect on the selection of full-time employment.

Higher education, that is, graduation from technical school or college, junior college, university or graduate school, significantly raises the probability of having a high employment status score. However, there are no cohort effects on university or postgraduate education, as the estimated coefficients for the interactive terms between the dummy variable for university/graduate school and cohort dummies are not statistically significant.

5-2. Estimated results from the KHPS dataset[12]

The estimated results for the waves 1–5 of the KHPS are presented in Tables 5 and 6. Table 5 lists the estimated results for the probability that the respondent works, while Table 6 shows the estimated results for the probability that the respondents belongs to one of the four categories of labour market outcomes as in Table 4.

(Table 5 inserted here)

(Table 6 inserted here)

Table 5 shows that the respondent's age has no effect on the probability of working. In the first row, the effect of the two cohort dummies is significantly negative, while in the second row, they are almost insignificant. Cohort 1966–75 has a negative effect on working; however, only at the 10% significance level. Marriage, husband's 'permanent' income, and the number of children below school age significantly lower the probability that the respondent works. For the second row, the estimated coefficients for the interactive terms between husband's income and cohorts are significantly negative. This means that the labour force participation of cohorts 1966–75 and 1976–84 are more responsive to their husband's income than that of the older cohorts. Education has no significant effect on the probability that the respondent is working. There are also no cohort-related differences in the effect of education on labour force participation.

Year dummies: year 2005, year 2006, year 2007, and year 2008 have significant positive effect on the probability that the respondents are working. It suggests that there has been a rising trend in the labour force participation rates for the KHPS respondents.

In Table 6, in the table for the four categories of labour market outcomes, the estimated results for the first and the second rows are different in some respects. Cohort effects are not observed in the first row while a significant positive effect of the cohort 1976–84 is observed in the second row. Number of children from 6 to 12 years of age has a significant positive effect only in the second row.

[12] Among the working respondents, there are 154 (3.4%) public servants. We also tried estimating the sample excluding them. The estimated coefficients for cohorts, husband's incomes, and their interactions are not significantly different from those for the entire samples including them.

Marriage and the number of pre-school children have significant negative effect on labour force participation behaviours for both rows. Spouse income has no effect on the labour force outcomes in four categories. On the other hand, the two interactive terms—husband's 'permanent' income× born in the period 1966–75 and husband's 'permanent' income × born in the period 1976–84have significant negative effect on labour force outcomes. This also suggests that the labour force participation of the cohorts 1966–75 and 1976–84 are more elastic to their husband's income than that of the older cohorts. Education dummies, that is, technical college, junior college, university or graduate courses, and other education, have no effect on employment status. The interactive terms between university or graduate courses and dummy variables pertaining to the cohort 1966–1975 and cohort 1976–1984 are also statistically non-significant. This means that the effect of university education on full-time employment is the same across cohorts.

5-3. Comparison of results from the JPSC and KHPS datasets

Five common results were obtained from the JPSC and KHPS datasets.

1) The cohorts are not observed to have positive significant effects in any of the estimated results. This implies that the younger cohorts do not necessarily have a higher probability to work or to be full-time employees.
2) The interactive terms between husband's income and cohort dummies have significant negative effect on the labour market outcomes, both in terms of the probability of working and of getting a full-time job.
3) Compared with unmarried women, married women are less likely to work or be full-time employees.
4) The number of pre-school children has a negative effect on women's labour force participation. The number of children at primary school also negatively affects labour force participation of mother, although their effects are weaker than that of pre-school children.
5) The cohort effects of university education are not observed in both results. In other words, the effect of university education on full-time employment is almost uniform across cohorts.

There are two major differences between the JPSC and KHPS results.

1) The positive effect of the youngest cohorts on the probability of working are observed only in the JPSC results. In contrast, the effect of the youngest cohorts on the four employment status categories are observed only in the KHPS results.
2) The positive effect of higher education on labour market outcomes are observed in the JPSC results, but not in the KHPS results.

6. The Meaning of Higher Education

As shown in section 5, the effect of higher education on the probability that a woman works is not robust. This result is consistent with those of preceding analyses. Okamura and Islam (2011) point out that childbirth is more likely to have a negative effect on labour force participation of highly educated women than that of poorly educated women as it is hard for the Japanese women to regain full-time jobs after career interruption.

However, the result that university education is undifferentiated across age groups is surprising as the quality of university education for women has changed significantly. Table 7 lists the distribution of university studies for the three cohorts in the KHPS. This table shows that the proportion of university graduates who studied home science in their alma mater[13] is only 5.4% for the cohort 1976–1984, whereas it is 24.5% for the cohort 1948–1965. In contrast, the proportion of university graduates who studied social sciences is 17.2% for the 1976–1984 cohorts, whereas it is 7.6 % for the 1948–1965 cohorts. The proportion of education studies graduates has also decreased, from 21.2% for the 1948–1965 cohorts to 15.5% for the 1976–84 cohorts.

(Table 7 inserted here)

Our results indicate that women's employment status does not respond to changes in the quality of their university education. Therefore, in order to find out the effect of the different fields of university study, we added three dummy variables to the previously used

[13] In some universities, departments of home sciences have changed their names. For this reason, the field classified as 'others' could include some departments related to home sciences.

labour force participation functions: a dummy variable for home sciences, one for social sciences, and one for education. The estimated results are shown in Table 8. The second column presents results corresponding to the model for working/not working and the third column presents results corresponding to the model for the four employment statuses. The estimated coefficient for the social sciences in case of working/not working is significantly positive at the 5% significance level. For the other two interaction terms, estimated coefficients are zero. This result indicates that the effect of the field of study on the job market performance of women graduates is weak.

(Table 8 inserted here)

Japanese firms typically provide intensive on-the-job training to new employees, expecting that this investment will yield returns after many years of service within the firm, as employees obtain high skills from their greater levels of experience (Koike, 1991; Koike and Inoki, 2003). They do not value skills obtained from other firms highly. It is possible that recent changes in university education for women have not led to changes in the demand for women's labour in such firms.

7. Conclusions

This paper examined the effects of cohorts on labour market outcomes for women using two types of panel data. Both cohort effects on labour force participation behaviour and the cohort-related differentials in the influence of spouse income and education were estimated. The results are summarised below.

Firstly, if other factors are controlled, the cohort differentials in both the probability of working and full-time employment are weak. This result confirms that of Abe (2011). However, the positive effect of the youngest cohorts—born in the latter half of the 1970s and after—are observed in some estimated results.

Secondly, a negative relationship between labour force participation rates for married women and husband's 'permanent' income continues in Japan. This relationship is not necessarily weaker for younger cohorts. Thus, we cannot conclude that the Douglas-Arisawa law is completely obsolete.

Thirdly, the effect of higher education on working and on employment status is not robust. That is, higher education levels do not always lead to a higher likelihood of working or getting a full-time job.

Fourthly, in terms of the fields of study, the university education provided for younger cohorts is different from that offered to older cohorts. Despite this, younger university graduates and their older counterparts have the same probability of getting a full-time job. This could be related to the outcome that fields of study have little connection to the labour force participation behaviour for the Japanese women.

The weak cohort effects could be attributed to the fact that, in our data, the sample size of respondents born in the 1970s and thereafter is small. We could not estimate the cohort effects of university education on labour market outcomes in a precise manner, either. Furthermore, as the number of respondents that had MAs and PhDs was not sufficiently large for panel data analysis with the existing longitudinal data, we also could not estimate the effects of postgraduate education. It would be beneficial if in future research samples were added for younger cohorts.

In order to assess firm demand for highly educated women, we need to undertake another analysis based on a firm survey. This is also left for future research. However, we have to keep in mind that contemporary university education is no more helpful than it was in the past for women graduates entering the labour market. We must search for ways to ensure that a university education is more useful for Japanese women.

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Table 1 Descriptive statistics for the JPSC

Variable	Distribution
Employment status	Working full-time 7,771 (32.09%) Working part-time 6,364 (26.28%) Self-employed 1,254 (5.20%) Not in the labour force 9,094 (36.43%)
Cohort	Born during 1958–64 (base) 8,949 (36.95%) Born during 1965–74 12,427 (51.32%) Born during 1975–79 2,841 (11.73%)
Marital status	Married 17,177 (70.93%) Unmarried 7,040 (29.07%)
Education	12 years or less 11,582 (47.83%) Technical school/college 4,144 (17.11%) Junior college 5,110 (21.10%) University or graduate school 3,381 (13.96%)

Variable	Mean	Standard deviation	Minimum	Maximum
Age	33.35	5.522	24	48
Husband's 'permanent' income (average income over the last three years, 10,000 yen)	285.973	312.728	0	4223.662
Husband's 'permanent' income ×born in the period 1965–74	131.798	243.991	0	3007.988
Husband's 'permanent' income ×born in the period 1975–84	12.354	80.165	0	4223.662
Number of children aged 0 to 5	0.327	0.652	0	4
Number of children aged 6 to 12	0.262	0.602	0	3

Source: Author's calculation based on waves 1–15, JPSC.

Note 1: Samples with missing values were excluded.

Note 2: The number of observations was 24,217.

Table 2 Descriptive statistics for the KHPS

Variable	Distribution			
Employment status	Working full-time 1,521 (22.93%) Working part-time 2,032 (30.63%) Self-employed 1,084 (16.34%) Not in the labour force 1,996 (30.093%)			
Cohorts	Born 1948–65 (base) 3,571 (53.64%) Born 1966–75 1,903 (28.69%) Born 1976–84 1,159 (17.47%)			
Marital status	Married 17,177 (70.93%) Unmarried 7,040 (29.07%)			
Education	12 years or less 3,496(52.71%) Technical college/ junior college 1,655 (24.95%) University or graduate school 984 (14.83%) Other education 498 (7.51%)			
Variable	Mean	Standard deviation	Minimum	Maximum
Age	41.48	10.210	19	60
Husband's 'permanent' income (average income over the last three years, 10,000 yen)	321.917	364.5539	0	3472.229
Husband's 'permanent' income ×born in the period 1966–75	91.403	220.166	0	1910.132
Husband's 'permanent' income ×born in the period 1976–84	15.944	78.825	0	933.333
Number of children aged 0 to 5	0.169	0.462	0	4
Number of children aged 6 to 12	0.315	0.644	0	4

Source: Author's calculation based on waves 1–5, KHPS.

Note 1: Samples with missing values were excluded.

Note 2: The number of observations was 6633.

Table 3 Labour force participation based on the JPSC (1)

Method of Estimation	Random-Effect Probit Estimation					
Dependent Variable	Working = 1, Not Working = 0					
	Estimated Coefficient	z-value	P>z	Estimated Coefficient	z-value	P>z
Age	0.0638	6.44	***	0.0578	5.80	***
Generation (base: born in the period 1958–64)						
Born in the period 1965–74	0.0282	0.26		0.1766	1.54	
Born in the period 1975–79	0.3447	1.98	*	0.3771	2.08	**
Married	-1.6549	-29.85	***	-1.6174	-28.89	***
Married × husband's 'permanent' income	-0.0003	-5.09	***	-0.0001	-0.74	
Husband's 'permanent' income × born in the period 1965–74				-0.0005	-4.43	***
Husband's 'permanent' income × born in the period 1975–79				-0.0007	-2.84	**
× No. of children 0–5	-0.6760	-24.80	***	-0.6625	-24.13	***
× No. of children 6–12	-0.0342	-1.28		-0.0266	-0.99	
Education (twelve years or less)						
Technical school/college	0.2231	2.24	**	0.2215	2.23	***
Junior college	-0.0301	-0.33		-0.0322	-0.35	
University or graduate course	0.2566	2.41	**	0.3510	1.66	*
× born in the period 1965–74				-0.2603	-1.03	
× born in the period 1975–84				0.1113	0.39	
Year 1999–2000	-0.0265	-0.51		-0.0086	-0.16	
Year 2001–2002	-0.2350	-3.51	***	-0.1944	-2.88	***
Year 2003–2004	-0.4597	-5.52	***	-0.4141	-4.92	**
Year 2005–2006	-0.3999	-4.01	***	-0.3115	-3.08	***
Year 2007	-0.3787	-3.24	***	-0.2750	-2.31	**
Intercept	0.2105	0.61		0.2559	0.74	
Number of observation	24,217			24,217		

Number of groups	2,836	2,836
Sigma_u	1.5738	1.5700
Rho	0.7124	0.7114
Wald chi^2	Wald $chi^2(15)$ = 2281.02 Prob > chi^2 = 0.000	Wald $chi^2(15)$ = 2301.16 Prob > chi^2 = 0.000
Log likelihood	-9773.6347	-9760.779

Source: Author's calculation based on waves 1–15, JPSC.

Note 1: Samples with missing values were excluded.

Note 2: *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance levels, respectively.

Table 4 Four employment outcomes based on the JPSC

Method of Estimation	Generalized Linear Latent and Mixed Model					
Dependent Variable	Working FT = 3, Working PT = 2,Self-Employed = 1, Not Working = 0					
	Estimated Coefficient	z-value	P>z	Estimated coefficient	z-value	P>z
Age	0.0140	3.28	***	0.0069	1.78	*
Generation (base: born in the period 1958–64)						
Born in the period 1965–74	-0.0864	-1.76	*	-0.0889	-2.07	**
Born in the period 1975–79	-0.0539	-0.76		-0.1056	-1.51	
Married (base: unmarried)	-0.9390	-46.86	***	-0.9284	-47.22	***
Married × husband's 'permanent' income	-0.9390	-46.86	***	0.0000	-0.66	
Married × husband's 'permanent' income × Born in the period 1965–74				-0.0004	-9.16	***
Married × husband's 'permanent' income × born in the period 1975–79				-0.0003	-2.86	***
× No. of children 0–5	-0.9390	-46.86	***	-0.3381	-30.32	***
× No. of children 6–12	-0.3410	-29.33	***	-0.0637	-5.57	***
education (twelve years or less)						
Technical school/college	0.0730	2.42	**	0.1010	3.62	***
Junior college	0.0652	1.73	*	0.0571	1.68	*
University or graduate course	0.2021	7.00	***	0.2087	5.38	***
× born in the period 1965–74				-0.0025	-0.04	
× born in the period 1975–84				0.0059	0.09	
Year 1999–2000	-0.0176	-0.79		0.0176	0.83	
Year 2001–2002	-0.1065	-3.70	***	-0.0498	-1.82	*
Year 2003–2004	-0.0874	-2.46	**	-0.0145	-0.43	
Year 2005–2006	-0.0272	-0.63		0.0747	1.85	*
Year 2007	-0.0082	-0.16		0.1070	2.25	**
Intercept	2.0281	13.40	***	2.1916	16.34	***
Number of observation	24,217			24,217		
Number of groups	2,836			2,836		

Random intercept variance	0.6090 (0.0058)	0.6078 (0.0058)
Random slope variance	0.5698 (0.0122)	0.5890 (0.0127)
Log likelihood	-31221.18	-31184.582

Source: Author's calculation based on waves 1–15, JPSC.

Note 1: Samples with missing values were excluded.

Note 2: *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance levels, respectively.

Table 5 Labour force participation, based on the KHPS (1)

Dependent variable: latent variable for y_{it} (1 if working, 0 if not working)

Method of Estimation	Random-Effect Probit Estimation					
Dependent Variable	Working=1, Not Working=0					
	Estimated Coefficient	z-value	P>z	Estimated Coefficient	z-value	P>z
Age	-0.0203	-1.41		-0.0158	-1.10	
Generation (base: born 1948–1965)						
Born in the period 1966–75	-0.7709	-3.16	***	-0.4673	-1.69	*
Born in the period 1976–84	-0.8659	-2.32	**	-0.2674	-0.66	
Married	-1.5231	-9.45	***	-1.4206	-8.67	***
Husband's 'permanent' income	-0.0004	-2.56	**	-0.0001	-0.79	
Husband's 'permanent' income × born in the period 1966–74				-0.0008	-2.55	**
Husband's 'permanent' income × born in the period 1976–84				-0.0021	-3.08	***
No. of children aged 0–5	-0.9954	-10.58	***	-0.9959	-10.53	***
No. of children aged 6–12	-0.0022	-0.03		0.0234	0.36	
Education (base: 12 years or less)						
Technical college or junior college	-0.1866	-1.25		-0.2103	-1.40	
University or graduate course	-0.1210	-0.66		-0.1526	-0.55	
Other education	0.0365	0.15		0.0222	0.09	
University or graduate course × born in the period 1966–75				0.4228	1.01	
University or graduate course × born in the period 1976–84				-0.4737	-1.12	
Year 2005	0.3095	3.64	***	0.3077	3.62	***
Year 2006	0.2240	2.45	**	0.2270	2.48	**

Year 2007	0.3799	4.02	***	0.3896	4.12	***
Year 2008	0.5292	5.12	***	0.5455	5.27	***
Intercept	3.6455	5.16	***	3.2291	4.53	***
Number of observation	6,633			6,633		
Number of groups	2,048			2,048		
Sigma_u	2.1775			2.1731		
Rho	0.8258			0.8253		
Wald chi^2	Wald $chi^2(14) = 333.30$ Prob > $chi^2 = 0.000$			Wald $chi^2(14) = 340.93$ Prob > $chi^2 = 0.000$		
Log likelihood	-2767.2963			-2759.3024		

Source: Author's calculation based on waves 1–5, KHPS.

Note 1: Samples with missing values were excluded.

Note 2: *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance levels, respectively.

Table 6 Full-time employment, based on the KHPS (2)

Dependent variable: latent variable for y_{it} (1 if working full-time, 0 if working part-time, self-employed, or not working)

Method of Estimation	Generalized Linear Latent and Mixed Model					
Dependent Variable	Working FT = 3, Working PT = 2, Self-employed = 1, Not Working = 0					
	Estimated Coefficient	z-value	P>z	Estimated Coefficient	z-value	P>z
Age	-0.0048	-1.66	*	-0.001	-0.22	
Generation (base: born in the period 1948–1965)						
Born in the period 1966–75	-0.0533	-1.09		-0.077	-1.14	
Born in the period 1976–84	-0.0824	-0.98		0.706	8.38	***
Married	-0.8315	-22.86	***	-0.250	-7.00	***
Married × husband's 'permanent' income	0.0000	-0.54		0.000	1.36	
Married × husband's 'permanent' income × born in the period 1966–74				0.000	-3.74	***
Married × husband's 'permanent' income × born in the period 1976–84				-0.001	-6.31	***
No. of children aged 0–5	-0.2258	-6.22	***	-0.381	-13.06	***
No. of children aged 6–12	0.0125	0.72		0.059	3.24	***
Education (base: 12 years or less)						
Technical college or junior college	-0.0042	-0.14		-0.024	-0.71	
University or graduate course	0.0145	0.38		0.007	0.14	
Other education	0.0242	0.53		0.001	0.01	
University or graduate course × born in the period 1966–75				-0.096	-0.98	
University or graduate course × born in the period 1976–84				-0.631	-7.35	***
Year 2005	0.0982	3.98	***	0.077	3.11	***
Year 2006	0.1042	3.97	***	0.072	2.74	***
Year 2007	0.1326	5.12	***	0.123	4.65	***
Year 2008	0.1406	5.15	***	0.122	4.36	***
Intercept	2.4533	17.24	***	1.625	10.95	***
Number of observation	6,633			6,633		

Number of groups	2,048	2,048
Random intercept variance	0.3632 (0.0077)	0.3694 (0.0075)
Random slope variance	0.7236 (0.0160)	0.7420 (0.0175)
Log likelihood	-8165.6362	-8128.0741

Source: Author's calculation based on waves 1–5, KHPS.

Note 1: Samples with missing values were excluded.

Note 2: *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance levels, respectively.

Table 7 Fields of university study for the three cohorts (%)

	Born in the period 1948–65	Born in the period 1966–75	Born in the period 1976–84	Total
Humanities	22.75	26.95	22.95	24.07
Social Sciences	7.58	12.08	17.17	11.10
Mathematical Sciences	0.47	0.00	1.00	0.45
Engineering	0.95	3.83	5.39	2.82
Agriculture and Life Sciences	0.00	1.18	0.40	0.45
Medicine and Dentistry	3.41	3.39	4.79	3.71
Pharmacy	1.52	0.29	0.60	0.94
Education	21.23	16.79	15.37	18.57
Home Sciences	24.45	16.35	5.39	17.72
Others	17.63	19.15	26.95	20.18
Total	100.00	100.00	100.00	100.00
Number of observation	1,055	679	501	2,235

Source: Author's calculation based on waves 1–5, KHPS.

Note: The figures are for the samples used in the estimations.

Table 8 Employment statuses and fields of study, based on the KHPS (3)

Method of Estimation	Random-Effect Probit Estimation			Generalized Linear Latent and Mixed Model		
Dependent Cariable	Working = 1, Not Working = 0			Working FT = 3, Working PT = 2, Self-Employed = 1, Not Working =0		
	Estimated Coefficient	z-value	P>z	Estimated Coefficient	z-value	P>z
Age	-0.0215	-1.40		-0.0035	-1.33	
Generation (base: born 1948–1965)						
Born in the period 1966–75	-0.7940	-3.04	***	-0.0348	-0.80	
Born in the period 1976–84	-0.8747	-2.19	**	-0.0170	-0.25	
Married	-1.6443	-9.68	***	-0.8458	-26.69	***
Married × husband's 'permanent' income	-0.0004	-2.23	**	0.0000	0.22	
No. of children aged 0–5	-0.9188	-9.46	***	-0.1477	-6.17	***
No. of children aged 6–12	-0.0212	-0.32		0.0080	0.50	
Education (base: 12 years or less)						
Technical college or junior college	-0.1966	-1.11		-0.0005	-0.02	
University or graduate course	-0.1278	-0.61		-0.0222	-0.62	
Other education	0.0599	0.23		0.0153	0.38	
University or graduate course × Social Sciences	0.7110	2.11	**	0.0691	1.32	
University or graduate course × Home Sciences	0.0519	0.20		-0.0488	-1.02	
University or graduate course × education	0.1241	0.44		0.0513	1.19	
Year 2005	0.2936	3.33	***	0.0847	3.63	***
Year 2006	0.2278	2.39	**	0.0984	3.98	***
Year 2007	0.3576	3.61	***	0.1204	4.94	***
Year 2008	0.5035	4.65	***	0.1308	5.11	***
Intercept	3.9152	5.18	***	2.4092	19.10	***
Number of observation	6,633			6,633		
Number of groups	2,048			2,048		

Sigma_u	2.3620	
Rho	0.8480	
Wald chi^2	Wald $chi^2(17)$ = 313.88 Prob > chi^2 = 0.000	
Random intercept variance		0.3253 (0.0066)
Random is slope variance		0.7451 (0.0142)
Log likelihood	-2689.950	-7946.738

Source: Author's calculation based on waves 1–5, KHPS.

Note 1: Samples with missing values were excluded.

Note 2: *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance levels, respectively.

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