NBER WORKING PAPER SERIES

A MULTINOMINAL LOGISTIC APPROACH TO THE LABOR FORCE BEHAVIOR OF JAPANESE MARRIED WOMEN

Tadashi Yamada

Tetsuji Yamada

Frank Chaloupka

Working Paper No. 1783

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 1985

NBER Working Paper #1783
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ABSTRACT

Using a multinomial logistic approach, we analyze the interdependencies among the labor force participation decisions of married women in Japan. These decisions are working part-time, working full-time, being unemployed (in the labor market but unable to find work), and not participating. Our focus is on the interdependency between the decision to work part-time and the decision to work full-time. Our results indicate that married women working full-time view part-time work as a good substitute, but the reverse is not observed. We also obtain estimates of the own-wage elasticity for both forms of participation and find that part-time labor force particicipation of Japanese married women is substantially more elastic than that of their full-time counterparts. These findings reinforce the view that married women in Japan with loose ties to the labor market are quite responsive to changes in the returns to work.

Tadashi Yamada
NBER
269 Mercer Street
8th Floor
New York, NY 10003

Tetsuji Yamada
Dept. of Economics
Graduate School and
University Center of CUNY
New York, NY 10036

Frank Chaloupka
NBER
269 Mercer Street
8th Floor
New York, NY 10003

A Multinomial Logistic Approach to the Labor Force Behavior of Japanese Married Women*

Tadashi Yamada, Tetsuji Yamada, and Frank Chaloupka

1. Introduction

Recent contributions from Hill (1983, 1984) and Shimada and Higuchi (1985) have made significant changes in the analysis of female labor force behavior in Japan. These studies specifically focus on female employees in the labor market by isolating self-employed and family workers in the informal sector. These recent results showed a positive effect of wages on labor force participation decisions of married women.[1] What is missing from their analyses is a systematic examination of the behavior of married women who choose to work only part-time, accounting for approximately half of the married women in urban Japan according to the 1980 Population Census of Japan. As studies using United States and Canadian data have shown, the response of part-time working married women to changes in the returns to work is quite different from that of their full-time counterparts (for example, Morgenstern and Hamovitch 1976; Long and Jones 1980; Nakamura and Nakamura 1983). The increasing importance of part-time working

*We are indebted to Michael Grossman, Bernard Okun, and Robin Carey for their helpful comments on the first draft of this paper. The opinions expressed in this paper, as well as any errors are, of course, ours.

[1] Early studies of the labor force behavior of Japanese women can be found in Hamilton (1979), Furugori (1980), Nagano (1980), and Shimada, et al. (1981). They had a major drawback in that they lumped together employees, self-employed individuals, and family workers, resulting in their observed negative effect of women's wages on labor force participation, suggesting a backward bending labor supply curve.

married women in Japan can no longer be ignored.

In this paper, we investigate the interdependency of four alternative labor force participation statuses using a multinomial logistic approach. The four mutually exclusive and exhaustive labor force participation decisions are working full-time, working part-time, unemployment, and not participating. By distinguishing among the participation decisions we can obtain separate estimates of the own-wage elasticity of married women working part-time and full-time, and also identify interdepedencies through their cross-wage elasticities.

The organization of the subsequent sections is as follows: Section II outlines the model and our a-priori expectations of the effects of the variables in the model on labor force participation behavior, Section III reports the empirical results, and, finally, Section IV gives our conclusions.

II. Method of Analysis

The variables in our model are cross-sectional market averages primarily drawn from the 1980 Population Census of Japan. The units of observation are the urban areas of the 47 prefectures of Japan. The advantages of using cross-sectional market averages, as discussed by Cain and Dooley (1976) and Link and Settle (1981), are that variations in tastes and transitory wages within a given geographical area can be averaged out. By differentiating married women whose spouses are present from other women, distinguishing urban Japan from rural Japan, and separating full-time and part-time work decisions, our sample represents a relatively homogeneous group of married women, resulting in consistent estimates of the structural parameters.[2]

Our multinomial logistic approach assumes that a married woman faces four mutually exclusive alternatives with the corresponding probabilities p_1, p_2, p_3, and p_4, which represent the probability that the woman chooses full-time work, part-time work, unemployment, or non-participation, respectively. By definition, the sum of the probabilities is equal to one. The logistic probability function is:

$$(1) \qquad p_i=[\exp(\alpha_i+\Sigma_j(\beta_{ij}X_j)) \;/\; (1+\Sigma_i \exp(\alpha_i+\Sigma_j(\beta_{ij}X_j)))], \qquad i=1,2,3$$

and:

$$(2) \qquad p_4=[1/\ (1+\Sigma_i \exp(\alpha_i+\Sigma_j(\beta_{ij}X_j)))],$$

[2] Further insight into the part-time labor supply decisions of Japanese married women awaits the availability of individual and longitudinal data. See Dooley (1982) for arguments in favor of using micro data in place of aggregate cross-sectional data.

where the X_j, $j=1,\ldots,m$, are the independent variables.

By solving for the log-odds ratio of the i^{th} type of participation decision (p_i relative to p_4), the logistic equation can be expressed in the linear form:

$$(3) \qquad \ln(p_i/p_4)=\alpha_i+\Sigma_j(\beta_{ij}X_j),\ i=1,2,3.$$

The marginal effect of X_j on p_i is obtained from:

$$(4) \qquad (\partial p_i/\partial X_j)=\beta_{ij}p_i-p_i\Sigma_i(\beta_{ij}p_i),\ i=1,2,3.$$

and:

$$(5) \qquad (\partial p_4/\partial X_j)=-\Sigma_i(\partial p_i/\partial X_j).$$

In our model, the p_i are unobserved and constrained to the interval from zero to one. For the estimation of equation (3), we substitute p_f (the proportion of married women, spouse present, ages 15 and older who are full-time participants in the labor market) for p_1; p_p (the proportion of those women who are part-time participants) for p_2; p_u (the proportion of unemployed married women) for p_3; and p_n (the proportion of those women who are non-participants) for p_4.

Our theoretical framework suggests that the following variables are important in analyzing the interdependency among p_f, p_p, p_u, and p_n: full-time women's wages, part-time women's wages, men's wages, the unemployment rate, women's education, the enrollment of pre-school children in either nurseries or day-care centers, and the proportion of employment in manufacturing and wholesale and retail trade.[3]

Based on economic theory and on the empirical research of others on the labor force behavior of married women, we have the

[3] The complete definitions of the variables, their sources, and statistics are available on request.

following expectations about the effects of the independent variables.

1.) Full-time women's wages have a positive effect on full-time participation and a negative effect on part-time participation because married women may substitute full-time work for part-time work as the relative wage for full-time work rises.

2.) Part-time women's wages have a negative effect on full-time participation and a positive effect on part-time participation for reasons similar to those stated in 1.

3.) Men's wages have a negative effect on both full-time and part-time participation because of the income effect (Killingsworth 1983).

4.) The unemployment rate can have either positive or negative effects on any measure of participation depending on whether the added worker or discouraged worker effect dominates (Furugori 1980; Shimada and Higuchi 1985).

5.) Women's education can also have either positive or negative effects. If, as they acquire more education, women's reservation wages increase, the effect will be negative (Long and Jones 1980). On the other hand, higher levels of education may reflect a taste for work and/or access to jobs with nonpecuniary benefits, resulting in a positive effect (Cain and Dooley 1976).

6.) The proportion of pre-school children in nurseries and day-care centers has a positive effect on all participation decisions since married women with pre-school children can substitute the use of nurseries and day-care centers for their own time inputs in child-rearing (Schultz 1978).

7.) The proportion of employment in manufacturing and

wholesale and retail trade has a positive effect on any participation measure, reflecting indutries which heavily employ women (Japan 1982, 1984).

III. Empirical Results

Using a multinomial logistic approach, we estimate a model of the labor force participation decisions of Japanese married women, using data from the 1980 Population Census for the urban areas of the 47 prefectures of Japan. The parameter estimates are given in Table 1, and the marginal effects of the independent variables and their estimated elasticities calculated at the sample means are reported in Table 2.

Full-time women's wages have a statistically significant coefficient in the full-time equation ($\ln(p_f/p_n)$ dependent) and in the unemployment equation ($\ln(p_u/p_n)$ dependent), but are not significant in the part-time equation ($\ln(p_p/p_n)$ dependent).[4] The sign of the marginal effect is not directly obtained from the sign of the estimated logit coefficient, but from the application of equations (4) and (5) of Section II. The signs of the marginal effects of full-time wages, positive for full-time participation and negative for part time participation, are as expected. The positive marginal effect on unemployed participants and the negative effect on non-participants shows movement into the labor force of women attracted by a relatively higher wage but who were unable to find work.

Our estimated own-wage elasticity for full-time participation is 0.15. Hill (1984), using 1970 Japanese Population Census data, found this elasticity to be 0.44 for all women, large

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[4] Each equation in this study is estimated using the generalized least squares method so as to correct for heteroscedasticty. The weights used are: $\text{Weight}_i = [(\text{Total Married Women})p_i p_n]^{1/2}$, $i=f,p,u$ (Theil 1971, p. 635)

relative to our estimate as a result of the lumping together of full-time and part-time, single and married women. Shimada and Higuchi (1985), using cross-sectional micro data for 1977, estimated own-wage elasticities in the range 0.04 to 0.22 for married women ages 35 and older, results which are comparable to ours. Looking at U.S. and Canadian studies, we find that our estimate is similar to the 0.27 estimate for full-time U.S. married women (those whose average weekly hours exceed 32) of Morgenstern and Hamovitch (1976), but is significantly different from that of Nakamura and Nakamura (1983) whose estimates for U.S. and Canadian full time working married women (those whose annual hours of work are greater than or equal to 1,400) range from -0.03 to -0.09.

The coefficient of part-time women's wages is statistically significant in both the full-time and the part-time equations, but is not in the unemployment equation. The marginal effect of part-time wages on the probability of part-time participation is positive as hypothesized. The strong negative marginal effect of the part-time wage on the full-time participation probability is indicative of movement from full-time work to part-time work as the relative part-time wage rises.

There are no related studies of Japanese women's part-time labor participation for us to compare our results to, however there have been some done using U.S. data. Our estimated own-wage elasticity for part-time married women's labor participation in Japan is 0.79, as compared with estimates of 0.25 and 0.55 reported by Long and Jones (1980) and Morgenstern and Hamovitch (1976), respectively. Their lower estimates may be the result of

the omission of a full-time women's wage variable from their part-time labor supply regressions producing estimates which are biased downwards.[5] Also, Japanese married women are more loosely attached to the labor market, putting household work ahead of part-time work.

Men's wages have a statistically significant coefficient in all three equations, and the marginal effect is negative in all three, as anticipated. Our men's wage elasticities are -0.62 and -0.51 for full-time and part-time married women's participation decisions, respectively. These are similar to the estimates found by Hill (1984) of -0.52, Nagano (1980) in the range -0.38 to -0.72, Shimada et al. (1981) in the range -0.02 to -0.31, and Shimada and Higuchi (1985) in the range -0.02 to -0.40 leading to the conclusion that women's labor force participation is inelastic with respect to men's wages.

The two most consistently significant variables in the three equations are the unemployment rate and the proportion of children in nurseries and day-care centers. The negative marginal effect of the unemployment rate on the probabilities of full-time and part-time participation reflects the dominance of the discouraged worker effect over the added worker effect, supporting the earlier findings of Furugori (1980) and Shimada and Higuchi (1985). The strong positive effect of the nursery/day-care variable on any participation decision indicates that greater availability of these facilities enables married women to sub-

[5] The omission of a full-time women's wage variable would cause the estimated coefficient on the part-time women's wage variable to be biased downwards. This happens if a rise in the relative full-time wage results in the substitution of full-time work for part-time work, if the two wages are positively correlated.

stitute for their own time in child-care making it easier for them to participate in the labor market.

The results obtained for the women's education and industry mix variables are in general disappointing. We reestimated the three equations leaving out the education variable, but there were almost no qualtitative or quantitative differences from the results reported here. The marginal effect of the variable for the proportion of employment in manufacturing and wholesale and retail trade is negative in the full-time equation and positive in the part-time equation. These industries are particularly vulnerable to seasonal and cyclical variations. Employers find it advantageous to hire part-time working married women with lower wages and quasi-fixed costs than their full-time counterparts.

IV. Conclusions

Our major interest in this study was the interdependency among the labor force participation decisions of Japanese married women, particularly between the decisions to work part-time and full-time. Based on our multinomial logistic approach, we can conclude that full-time working married women view working part-time as a good substitute, but the reverse is not witnessed. A possible reason for this is that full-time work requires a much stronger commitment to the labor market that married part-time participants are unwilling to make even at higher wages.

We also find a major difference between the own-wage elasticities of part-time and full-time working married women. The estimate for the former is substantially higher than that for the latter, while both estimates are positive. These findings reinforce the view that Japanese married women with loose attachments to the labor market are quite responsive to changes in the returns to work.

TABLE 1
Empirical Results[a]

Independent Variable	Dependent Variable $\ln(p_f/p_n)$ full-time	$\ln(p_p/p_n)$ part-time	$\ln(p_u/p_n)$ unemployed
Intercept	-2.591	-1.423	-6.302
	(-2.87)	(-3.04)	(-11.49)
Full-time Women's Wage[b]	0.207	0.014	0.130
	(2.60)	(0.37)	(2.51)
Part-time Women's Wage[b]	-1.125	0.658	-0.369
	(-1.73)	(1.98)	(-0.92)
Men's Wage[b]	-1.134	-1.023	-0.717
	(-1.78)	(-3.11)	(-1.70)
Unemployment	-8.889	-7.091	8.128
	(-2.13)	(-3.28)	(3.41)
Women's Education	-0.761	-0.645	-0.129
	(-1.12)	(-1.81)	(-0.30)
Nursery/Day-Care	1.408	1.358	1.044
	(3.02)	(5.70)	(3.53)
Industry Mix	0.278	1.544	0.138
	(0.35)	(3.86)	(0.28)
F-Statistic	31.40	39.96	21.99
R-Squared	0.85	0.88	0.80

[a]Asymptotic t-ratio in parentheses.
[b]The natural logarithm of the variable.

TABLE 2
Marginal Effects and Elasticities[a]

Independent Variable	p_f full-time	p_p part-time	p_u unemployed
Full-time Women's Wage	0.01E-1	-0.03E-2	0.01E-3
	(0.15)	(-0.04)	(0.08)
Part-time Women's Wage	-0.51	0.37	-0.02E-1
	(-1.00)	(0.79)	(-0.24)
Men's Wages	-0.14	-0.11	-0.08E-2
	(-0.62)	(-0.51)	(-0.20)
Unemployment	-1.29	-0.77	0.05
	(-0.14)	(-0.09)	(0.32)
Women's Education	-0.10	-0.07	-0.08E-2
	(-0.21)	(-0.16)	(-0.10)
Nursery/Day-Care	0.19	0.16	0.01E-1
	(0.50)	(0.46)	(0.25)
Industry Mix	-0.04	0.25	-0.01E-1
	(-0.07)	(0.53)	(-0.13)

[a]These values are calculated based on the coefficients reported in Table 1. Estimated elasticities calculated at the sample means are in parentheses.

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