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Sub Title	
Author	FURUGORI, Tomoko
Publisher	Keio Economic Society, Keio University
Publication year	1980
Jtitle	Keio economic studies Vol.17, No.2 (1980.) ,p.51- 69
JaLC DOI	
Abstract	
Notes	
Genre	Journal Article
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=AA00260492-19800002-0051

RECENT CHANGES IN THE LABOR FORCE BEHAVIOR OF WOMEN IN JAPAN: A TIME-SERIES ANALYSIS*

Tomoko FURUGORI

INTRODUCTION

The female labor force is considered to have two characteristics: it is more sensitive than the male labor force to short-run changes in employment conditions and it is secondary to supplement family income. An enormous increase in the female labor force participation in Japan in the recent few years, however, seems to suggest a new pattern that deviates from the behavior of labor supply of women exhibited previously.

This paper is to reexamine the behavior of female labor force with two different models for the labor supply of women: the first model analyzes the sensitivity of female labor force to the short-run changes in employment conditions; the second model analyzes the labor force behavior of women as the secondary marginal worker in the family context of leisure and work choices.

WOMEN IN THE LABOR FORCE

Earlier finding shows that short-run changes in female labor force are highly related to short-run changes in job opportunities. The female labor force participation rates have tended to rise in periods of increasing job opportunities and fall in periods of economic slack. Figure 1 presents such short-run variations in the female labor force with a falling secular trend. But, the dramatic increases of the female labor force participation since 1976 seems to have reversed the trend rather strongly.

According to Annual Report on the Labor Force Survey by Prime Minister's Office, the labor force participation rate of women was 46.5% in the recession of 1974, further going down to 45.7% in 1975. In 1976 when economic activities recovered, it went upward to 45.8%. The rate of increase in the industrial production lessened in 1977, but the labour force participation increased further to 46.6%, then 47.4% in 1978, and 47.6% in 1979.

The size of labor force grows when entrees into the labor force exceed withdrawals. While data to grasp population going into and out of labor force are not directly available, Table 1 provides with us up-dated information on the labor

* The author is grateful to H. Shimada of Keio University for helpful suggestions and providing research environments and to Y. Sakai of Tokai Bank for his assistance in computation.

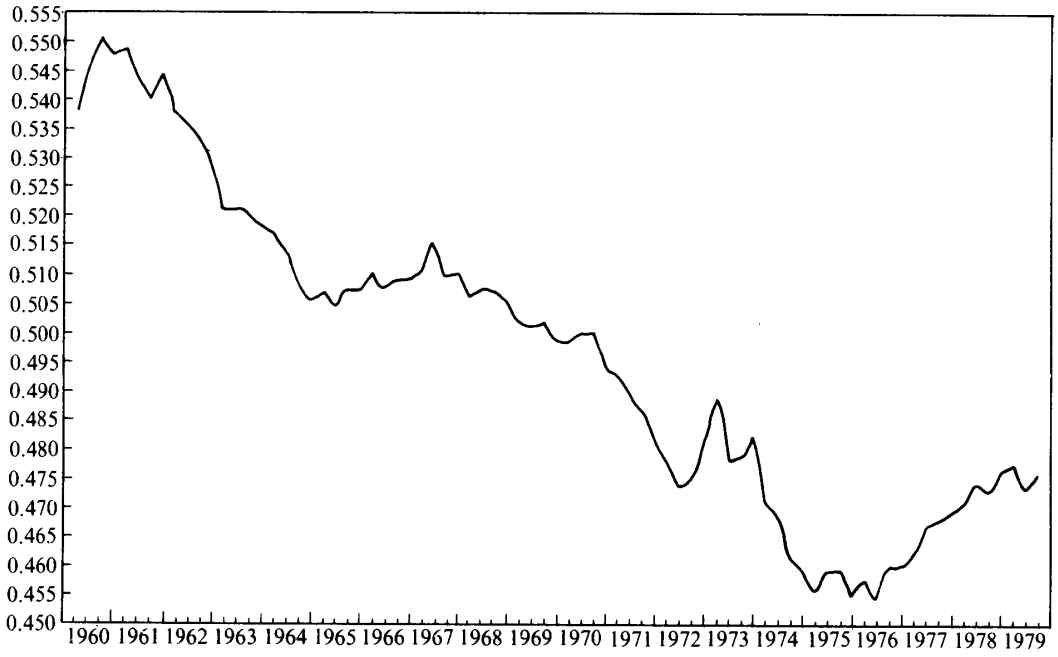

Fig. 1. Trend in the Labor Force Participation Rate of Women.
Source: Monthly Report on the Labor Fore Survey, bureau of Statistics, Office of the Prime Minister, Japan.

force status of those women who left their jobs in 1974 and after. The number of persons, among those, who withdrew from the labor force was 76% in 1976, declining to 57% in 1979.

Table 2 shows the number of persons unemployed by the length of unemployment period. Women who are unemployed by more than 3 months, particularly more than a year, are rising over time. If these facts are any indication of showing their attachment to the labor force, it seems that women tend to stay in the labor force when not unemployed and they may have become less sensitive to cyclical variations in the economic activities.

The rise of working wives is significant for the growth of the female labor force. Approximately, 60% of the female labor force are married, with husbands present. The increased proportions of wives, particularly in the older groups, are working part-time. On the supply side, presumably this means that women are working because they need income to pay off loans for housing, to meet expenses for higher demand of child education, and to enjoy higher level of living.[1] On the demand side the change in industry composition (*e.g.*, the on-going expansion of service

[1] The expenses related to education and housing have been increased. The shares of these expenses in the disposable income by the age of the head of household show that they are particularly high in the older age groups. For the educational expenses, they are 9.7% for the age group 40–44, 12.6% for 45–49 and 9.0% for 50–54. With respect to the expenses for housing they are 8.2% for 35–39, 8.1% for 40–44 and 8.4% for 50–54 (*Source*: Annaul Report on the Family Income and Expenditure Survey, Prime Minister's Office).

TABLE 1. LABOR FORCE STATUS OF THOSE WHO LEFT THEIR JOBS IN 1974 AND AFTER

	Persons (10 thousands)				Percentage			
	Total	Reemployed	Unemployed	Left the labor force	Total	Reemployed	Unemployed	Left the labor force
Males								
March 1974	36	5	21	10	100.0	13.9	58.3	27.8
March 1977	481	323	59	99	100.0	67.2	12.3	20.6
March 1978	673	474	64	135	100.0	70.4	9.5	20.1
March 1979	647	457	63	127	100.0	70.6	9.8	19.6
Females								
March 1974	62	5	10	47	100.0	8.1	16.1	75.8
March 1977	539	184	24	331	100.0	34.1	4.5	61.4
March 1978	727	285	24	418	100.0	39.2	3.3	57.5
March 1979	697	271	26	400	100.0	38.9	3.7	57.4
Total								
March 1974	98	10	31	57	100.0	10.2	31.6	58.2
March 1977	1,020	507	83	430	100.0	49.7	8.1	42.2
March 1978	1,397	758	87	552	100.0	54.3	6.2	39.5
March 1979	1,343	728	88	527	100.0	54.2	6.6	39.2

Source: Special Report on the Labor Force Survey, March in selected years, Bureau of Statistics, Office of the Prime Minister, Japan.

TABLE 2. UNEMPLOYED PERSONS BY THE LENGTH OF UNEMPLOYMENT PERIODS

	Persons (10 thousands)			Percentage		
	Less than 3 months	3 months and more	Particularly more than 1 year	Less than 3 months	3 months and more	Particularly more than 1 year
1972	23	7	2	67.7	20.6	5.9
1974	23	12	2	65.7	34.3	5.3
1977	25	19	4	56.8	43.2	8.9
1978	30	21	5	58.8	41.2	10.0
1979	26	24	7	52.0	48.0	14.0

Source: Special Report on the Labor Force Survey, March in selected years, Bureau of Statistics, Office of the Prime Minister, Japan.

industry) is increasing the job opportunity of women.[2] The steady increase of wages of women, declining birth rate, higher educational attainment, many consumer goods and labor-saving devices for housework, shorter hours of work, greater flexibility in work schedule etc. seem to have provided also the favorable conditions for women to work in Japan.[3]

CYCLICAL SENSITIVITY OF LABOR FORCE PARTICIPATION

There are two hypotheses to examine the responsiveness of the labor force to the business cycle. The discouraged worker effect holds when workers become discouraged and withdraw from the labor force during the economic downswing. The additional worker effect holds when "marginally attached" workers enter the labor force to support declining family income in recessionary period. These two effects may coexist and the question is which is stronger.

The question is empirical. Cross-sectional and time-series findings about labor force sensitivity are similar. They show that the discouraged worker effect is stronger than the aditional worker effect although their estimates differ in sizes and significances. For exmple, Bowen and Finegan [3], using the overall unemployment rate to estimate labor force sensitivity, has shown that the labor force participation varies inversely with the unemployment rate. While Tella [9] and Strand and Dernburg [8] use the ratio of employment to population as their measure of the cyclical forces operating in the labor market, they have shown a

[2] Statistics shows that women's employees share 47.8% in the tertiary industry. Of them 80% work part-time and most of them are married (*Source*: Annual Report on the Labor Force Survey, Prime Minister's Office).

[3] *e.g.*, the birth rate in Japan was 28.2 in 1950, 17.2 in 1960 and 14.9 in 1978 per 1000 persons (*Source*: Vital Statistics, Ministry of Welfare); In 1977, 94% of women went to high school and 34% to university & colleges (*Source*: Statistical Survey on Education, Ministry of Education).

positive and significant association between the participation rates and employment-population ratios for both males and females. (Tella used employment-population ratios for the individual age sex groups, whereas Strand and Dernburg used the aggregate employment-population ratio in their models.) These studies have also shown that the female labor force is more sensitive than the male labor force to changing job opportunities.

We examine the length of lag in the cyclical sensitivity of labor force participation in time-series data. To provide employment opportunities at appropriate level toward full-employment policies, better understanding of the lag between labor force participation and unemployment is rquired. Since the labor force behavior of younger females seem to be different from that of older females, we expect differences in the responsiveness of labor force participation rates between the age groups. It is therefore desirable to analyze the lag structure using a narrow age breakdown.

In our model, the equation takes a simple form:

$$\frac{L}{P} = f(u, T) \tag{1}$$

where L/P is the labor force participation rate, u is the aggregate unemployment rate (or the ratio of effective job offers to effective job applicants—we call it labor demand to supply ratio hereafter) and T is trend. Several linear regressions were run for u with different lengths of lag, in the first run without a lag, in the second a lag of a quarter and so on up to a lag of 6 quarters in the final run. The trend is introduced to take account of secular changes in the labor force participation rate. T represents taste, economic and demographic factors not explicitly controlled by the regression.

Equations were estimated for men age 15 years and over, for women age 15 years and over, and also for women 15–19, 20–24, 25–29, 30–34, 35–39, 40–54, 55–64 and 65 over. We used quarterly data spanning the period 1967IQ–1978IVQ, with $T=100$ in 1967IQ for all groups. The data on L/P and u were obtained respectively from Monthly Report on the Labor Force Survey and Employment Status Survey, both by Prime Minister's Office.

The Results

The results are presented in Tables 3 and 4 and Figs. 2 and 3. The regression coefficients for the unemployment bear negative signs and the coefficients for the labor demand to supply ratio positive signs, indicating the consistent results of these estimates. The absolute values of the coefficients are greater for women than for men and they are significant only for women, as seen in Tables 3 and 4. These findings are in accord with those found in other studies referenced earlier. The male labor force, prime-age males in particular, is more or less permanently attached to the labor force, whether employed or unemployed.

The results show that the discouraged worker effect is dominant, but it tends to

TABLE 3(A). REGRESSION RESULTS: EQUATION (1)
—LABOR FORCE PARTICIPATION OF WOMEN

Constant	The rate of unemployment							T	T^2	$\bar{R}^2$	S.E.	D.W.
	t	$t-1$	$t-2$	$t-3$	$t-4$	$t-5$	$t-6$					
0.5632	−0.0339							−0.0010	0.000007	0.9129	0.0054	0.4923
(68.16)	(−5.27)							(−12.76)	(8.33)			
0.5513		−0.0236						−0.0010	0.000006	0.8837	0.0063	0.6194
(55.40)		(−3.13)						(−10.32)	(6.01)			
0.5420			−0.0159					−0.0010	0.000005	0.8695	0.0066	0.4416
(50.06)			(−1.97)					(−9.06)	(−4.85)			
0.5305				−0.0069				−0.0009	0.000004	0.8600	0.0069	0.3984
(46.23)				(−0.82)				(−7.92)	(3.77)			
0.5179					0.0026			−0.0008	0.000003	0.8582	0.0069	0.3831
(43.52)					(0.30)			(−6.88)	(2.77)			
0.5051						0.0118		−0.0008	0.000002	0.8638	0.0068	0.4021
(41.80)						(1.38)		(−5.95)	(1.83)			
0.4956							0.0184	−0.0007	0.000001	0.8722	0.0066	0.4847
(41.50)							(2.22)	(−5.35)	(1.19)			

Note: T and T^2: trend variable.
( ): t value of the regression coefficient.
$\bar{R}^2$: coefficient of determination adjusted for degrees of freedom.
S.E.: Standard error.
D.W.: Durbin-Watson statistic.
Period: 1967IQ–1978IVQ.

TABLE 3(B). REGRESSION RESULTS: EQUATION (1)
—LABOR FORCE PARTICIPATION OF WOMEN

Constant	The labor demand to supply ratio							T	T^2	$\bar{R}^2$	S.E.	D.W.
	t	$t-1$	$t-2$	$t-3$	$t-4$	$t-5$	$t-6$					
0.5033	−0.0184							−0.0011	0.000006	0.9242	0.0051	0.5575
(138.65)	(−6.21)							(−13.90)	(9.46)			
0.5071		−0.0159						−0.0011	0.000006	0.9048	0.0057	0.5583
(129.56)		(4.65)						(−11.79)	(7.84)			
0.5119			−0.0117					−0.0011	0.000005	0.8823	0.0063	0.4489
(123.17)			(3.02)					(−9.65)	(6.16)			
0.5171				−0.0059				−0.0010	0.000004	0.8640	0.0068	0.3969
(121.96)				(1.40)				(−7.75)	(4.60)			
0.5218					−0.0007			−0.0009	0.000003	0.8580	0.0069	0.3855
(127.84)					(−0.16)			(−6.17)	(3.22)			
0.5253						−0.0070		−0.0007	0.000002	0.8660	0.0067	0.3917
(140.76)						(−1.63)		(−4.93)	(2.07)			
0.5271							−0.0118	−0.0006	0.000001	0.8805	0.0064	0.4334
(157.24)							(−2.88)	(−4.08)	(1.22)			

Note: See footnote below Table 3(A) for $\bar{R}^2$, S.E. D.W. and estimation period.

TABLE 4(A). REGRESSION RESULTS: EQUATION (1)
—LABOR FORCE PARTICIPATION OF MEN

Constant	The rate of unemployment							T	T^2	$\bar{R}^2$	S.E.	D.W.
	t	$t-1$	$t-2$	$t-3$	$t-4$	$t-5$	$t-6$					
0.8180	−0.0019							0.0002	−0.000002	0.8865	0.0021	1.0571
(258.02)	(−0.76)							(6.64)	(−7.02)			
0.8146		0.0009						0.0002	−0.000002	0.8855	0.0021	1.0368
(245.20)		(0.34)						(6.74)	(−7.47)			
0.8142			0.0012					0.0002	−0.000002	0.8855	0.0021	1.0601
(238.92)			(0.46)					(6.57)	(−7.40)			
0.8130				0.0020				0.0002	−0.000002	0.8869	0.0021	1.0532
(234.23)				(0.79)				(6.59)	(−7.60)			
0.8133					0.0017			0.0002	−0.000002	0.8863	0.0021	1.0522
(226.99)					(0.67)			(6.27)	(−7.33)			
0.8146						0.0008		0.0002	−0.000002	0.8853	0.0021	1.0553
(218.44)						(0.30)		(5.76)	(−6.78)			
0.8146							0.0008	0.0002	−0.000002	0.8852	0.0021	1.0539
(214.11)							(0.28)	(5.59)	(−6.69)			

Note: See footnote below Table 3(A) for $\bar{R}^2$, S.E., D.W. and estimation period.

TABLE 4(B). REGRESSION RESULTS: EQUATION (1)
—LABOR FORCE PARTICIPATION OF MEN

Constant	The labor demand to supply ratio							T	T^2	$\bar{R}^2$	S.E.	D.W.
	t	$t-1$	$t-2$	$t-3$	$t-4$	$t-5$	$t-6$					
0.8139	0.0018							0.0002	−0.000002	0.8906	0.0020	1.0922
(554.77)	(1.48)							(5.95)	(−8.34)			
0.8143		0.0015						0.0002	−0.000002	0.8890	0.0021	1.0853
(573.00)		(1.24)						(5.56)	(−7.88)			
0.8147			0.0012					0.0002	−0.000002	0.8873	0.0021	1.0595
(596.03)			(0.93)					(5.27)	(−7.56)			
0.8154				0.0004				0.0002	−0.000002	0.8855	0.0021	1.0514
(623.17)				(0.34)				(5.25)	(−7.55)			
0.8159					−0.0003			0.0002	−0.000002	0.8851	0.0021	1.0498
(661.11)					(−0.21)			(5.33)	(−7.66)			
0.8163						−0.0011		0.0002	−0.000002	0.8867	0.0021	1.0617
(707.81)						(−0.82)		(5.58)	(−7.96)			
0.8165							−0.0018	0.0003	−0.000003	0.8897	0.0021	0.0621
(754.01)							(−1.35)	(5.91)	(−8.39)			

Note: See footnote below Table 3(A) for $\bar{R}^2$, S.E., D.W. and estimation period.

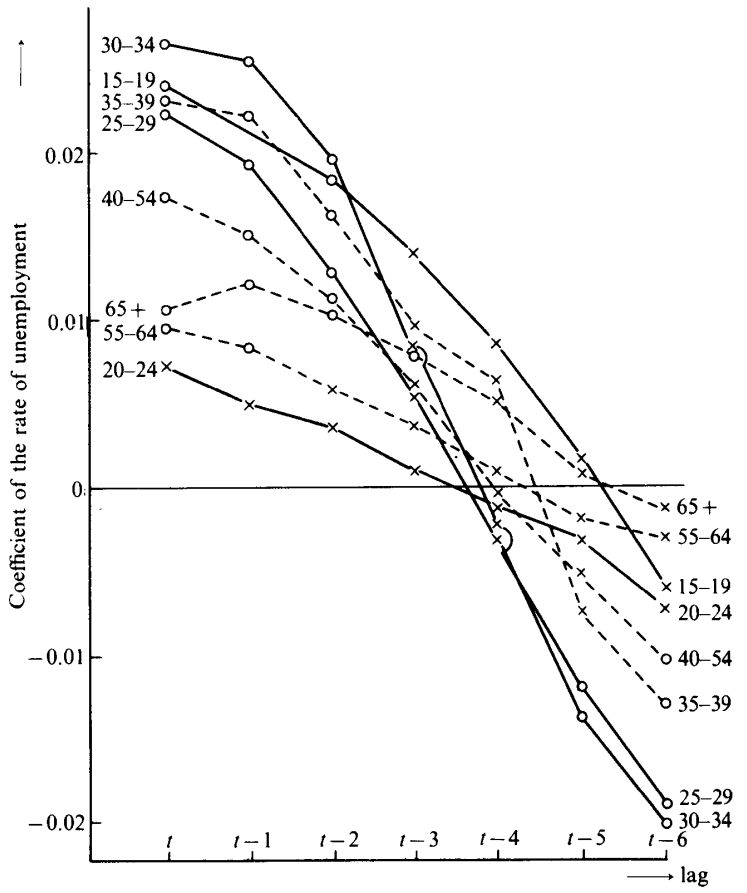

Fig. 2. Labor Force Sensitivity by Age, Lag.
Note: ○ sign indicates t-value $\geqq 1.96$; × sign indicates t-value < 1.96.

grow weaker as the length of the lag in the unemployment rate (or the labor demand to supply ratio) is increased. When the unemployment rate (or the labor demand to supply ratio) is lagged 4 quarters and more, the regression coefficients turn positive (or negative). This means that the aditional worker effect becomes more than offset the discouraged worker effect as the lag is lengthened.[4]

The regression coefficients by age groups are plotted against the lag in Figs. 2 and 3. The participation rate of the older females would be expected to be more responsive to changes in market conditions than the younger females on intuitive grounds. The regression coefficients, however, show a u-shape curve over the age spectrum, with the highest sensitivity of labor force participation for 30–34 females which indicates the effect of responsibilities of child care and child rearing. For all age groups, an initial decline in employment discourages labor force participation, while additional decline in employment tends to accelerate countercyclical flow into the labor force. When the unemployment rate rises, the marginal particpants are discouraged and leave the labor force or postpone their entry into

[4] A similar finding is reported in Bowen & Finegan [3] and Strand & Dernburg [8].

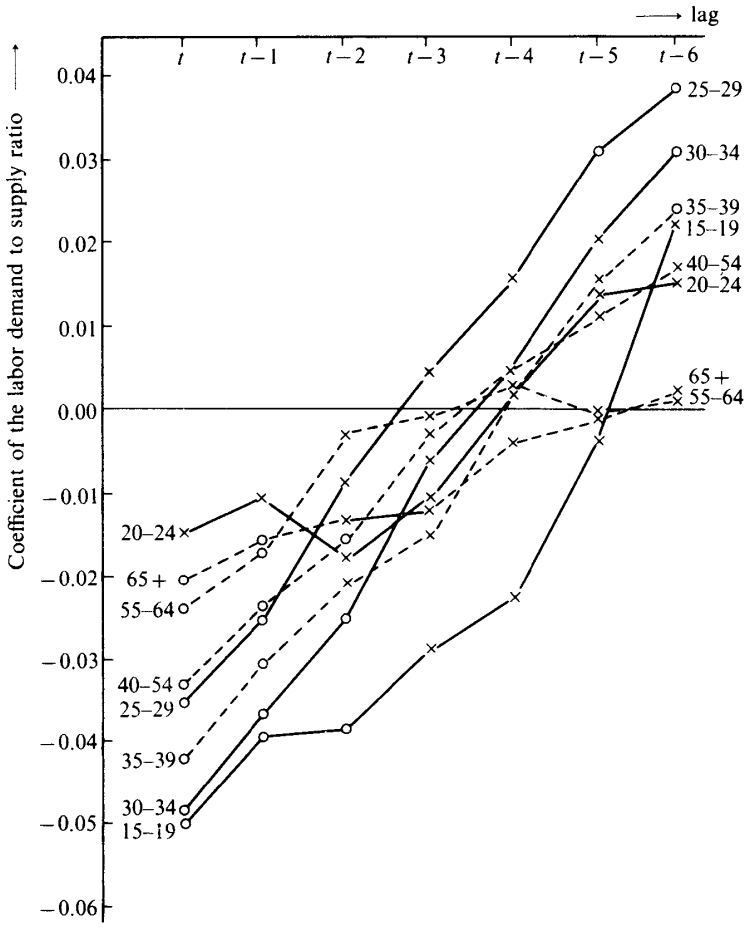

Fig. 3. Labor Force Sensitivity by Age, Lag.
Note: ○ sign indicates t-value $\geqq 1.96$; × sign indicates t-value < 1.96.

the labor force. Family will try to maintain consumption level by dissaving or borrowing money from the bank in face of the loss of jobs and incomes. As the adverse condition continues, however, pressure builds up on women to enter the labor force.

Overall sensitivity estimates are higher for females than for males. It may therefore be reasonable to expect that labor market conditions give much larger impacts on the participation decision of women. The current trend of increasing participation among women might imply some changes in women's worklife pattern, however. To test whether women reduced their labor force sensitivity, separate regressions were estimated for the shorter period 1973IVQ–1979IIQ, with results in Table 5. The regression coefficients show no significant changes but reveal a much greater sensitivity of the male participation rates to cyclical changes in unemployment. The regression coefficient for men has a larger negative value, significant in sign. The male labor force appears to be more sensitive in this regression.

TABLE 5. REGRESSION RESULTS FOR 1972IVQ–1979IIQ

	Constant	The labor demand to supply ratio	T	T^2	D_1	D_2	$\bar{R}^2$	S.E.	D.W.
Females									
(1)	0.4437 (65.61)	0.0219 (5.96)	0.0012 (6.02)		−0.0123 (−3.39)		0.7500	0.0048	1.3685
(2)	0.4480 (93.94)	0.0192 (6.60)		0.00002 (3.36)		−0.0063 (−2.65)	0.8016	0.0043	0.9973
Males									
(1)	0.8166 (304.29)	0.0027 (1.87)	−0.0008 (−9.51)		0.0022 (1.51)		0.9218	0.0019	1.2990
(2)	0.8089 (431.42)	0.0064 (5.60)		−0.00002 (−6.32)		0.0019 (2.09)	0.9390	0.0017	1.4909

Note: D_1: a dummy variable with the value of zero for all quarters prior to 1973IVQ and 1 thereafter.
D_2: a dummy variable with the value of 1 for 1974IIIQ–1976IIQ and 0 for all other quarters.
( ): t value.
See footnote below Table 3(A) for $\bar{R}^2$, S.E. and D.W.

Women's labor force sensitivity indicates no significant changes between the two periods under the consideration. The difference in the sensitivity between men and women is expected as far as there are women whose market and non-market work are very substitutable.[5] Yet, the labor force data in Table 1 may suggest that the labor supply behavior of women, at least those who are already in the labor force, has been more stable.

THE MICROECONOMIC MODEL OF LABOR SUPPLY OF WOMEN

The labor supply models for women are mainly found in the cross section studies. Some models seen in the time-series are generally represented by "business-cycle" type model. However, the business cycle type model ignores the effect of wage rates on the labor force participation, assuming in effect that the labor force is completely inelastic with respect to the wage rate. Also it does not take into account the family context of work-leisure choices.

The supply behavior of females are determined through interdependency among family members, with family as the decision making unit. In order to understand the labor supply mechanism of women, we would like to have a framework in which the allocation of time between leisure, howework and market jobs is made as family decisions. Such a framework is constructed here by applying Mincer's

[5] See Bednarzik & Klein [2].

approach to time-series data. The model with microeconomic foundation would be helpful to analyze what has happened to the traditional role of women to supplement the earnings of their husbands under the increasing trend of their labor force participation.

The secular increase in the labor force participation rates of females since 1976 may have occurred to supplement family income. The "poverty" was traditionally considered to be the major force to let wives enter the labor force. Women today, however, seems to work for different reasons, *e.g.*, to pay off loans on housing, to meet an increase in educational expenses, and to maintain the standard of living. The way in which they provide for their economic welfare may have changed. In addition, relatively favorable demand conditions such as increase in job opportunities and rise in the female wage rate seem to be making women's working patterns more stable now than before.

According to the previous findings,

(1) The labor force behavior of wives are negatively related to incomes of their husbands, and

(2) Keeping incomes of their husbands constant, the higher the female wage rate, the greater the labor supply of women.

These are called in Japan the law of Douglas-Arisawa. The findings, pioneered by Douglas [4] and verified in the various cross-section studies, were confirmed in Japan by H. Arisawa using data from a 1954 Report on the Family Income and Expenditure Survey by Prime Minister's Office. [1] Let us call (1) as the first law, (2) as the second law.

The law of Douglas-Arisawa would imply the following. First, household has autonomy as the decision-making unit in studying the labor supply behavior. Second, wives' employment are considered to be "secondary" to supplyment the declining family income, in contrast to husbands' market work that are assumed obligatory.

Despite the growth in the real income of the household, the labor participation rates of females, particularly of married women are increasing. This fact is contradictory to the law of Douglas-Arisawa. Based on the permanent income theory [7], Mincer tried to reconcile this apparent contradiction between time-series and cross-sections.

Wives' labor force behavior and their time allocation among work in the market, work at home, and leisure tend to be influenced by cyclical and random variations of factors such as husbands' income, employment conditions on the family members, the wage rate, and job opportunities. The first law of Douglas-Arisawa says that the husbands' income and the wives' labor force participation are strongly related. If so, depending on whether the income variation is transitory or permanent, we can make two distinctions on the effect of husbands' income on the wives' labor force participation. Wives' response to transitory income variation may be different from the response to permanent income variation. Generally it seems that married women respond more to transitory than to

permanent income.

The permanent income hypothesis suggests that aggregate family consumption is determined by long-run levels of family income. Adjustments between planned consumption and actual income received are made through changes in assets and debts. If these channels are not available in the face of a drop in current income, family may try to maintain the consumption level via a transitory increase in wife's labor force participation.

From this reasoning, inclusion of the transitory income along the permanent income into a model of labor supply would be strongly supported to analyze the effect of family (or husband's) income on the wife's labor force participation. The basic model tested in this study thus becomes

$$\frac{L}{P} = a_0 + a_1 Y + a_2 y + a_3 w_f + a_4 u + v$$

$$= a_0 + a_1 \left(\frac{w}{p}\right)^* + a_2 \left[\left(\frac{w}{p}\right) - \left(\frac{w}{p}\right)^*\right] + a_3 \left(\frac{w_f}{p}\right) + a_4 u + v \qquad (2)$$

where L/P is the labor force participation rate for women,[6] Y is permanent level of family income, y is transitory level of family income, w_f is the female market wage rate, u is unemployment rate (or the labor demand to supply ratio), and v is the error term.

In what follows, we take a 3-year average of the real wage rate, $(w/p)^*$, as the permanent level of real income (or wage rate), the difference between the current level of real wage rate and the permanent level of real wage rate, $[(w/p) - (w/p)^*]$, as the transitory level of real income (or wage rate). The female wage rate, w_f, is given by the current level of the real female wages, (w_f/p).[7] u is designed to control for the disequilibrium position in the labor market which is not explained by the neoclassical theory. The data for (L/P) and u are the same as that used in the business cycle model. The real wage rate is the aggregate wage index with 1975 as 100, deflated by the consumer price index. The real female wages (w_f/p), w_f deflated by the consumer price index, is also indexed. Regressions were run by age group using seasonally adjusted quarterly data. The data cover the period 1972IVQ–1979IIQ for females 15 years over, and 1972IVQ–1978IVQ for females in the eight age groups.

[6] The working women in the self-employed households have a large share in Japan, about 24% in 1975 (*cf.* 9% in the U.S.). It may therefore be more desirable to use the separate data for the self-employed and the employees' households to study the labor force participation of women. However, the quarterly based data are unavailable for the present purpose.

[7] In cross section studies, we can separate the wages (or income) of husbands and wives. But, wages (or income) for all the age-groups tend to move into the same direction with the aggregate wages in time-series. Therefore, Y and w_f may be positively related. This problem were tried to control by using the 3-year average wage on the one hand and the current wages on the other.

TABLE 6. REGRESSION RESULTS (USING THE RATE OF UNEMPLOYMENT FOR u): EQUATION (2)

Age group	a_0 Constant	a_1 $(w/p)^*$	a_2 $[(w/p)-(w/p)^*]$	a_3 u	a_4 (w_f/p)	$\bar{R}^2$	S.E.	D.W.
15+	0.6017 (9.62)	−0.8887 (−3.38)	−0.6930 (−2.82)	0.0278 (−2.28)	0.7934 (3.57)	0.4177	0.0074	0.9206
15–19	0.5616 (5.57)	−0.8278 (−1.85)	−0.2582 (−0.62)	−0.0293 (−1.35)	0.5114 (1.30)	0.8676	0.0120	1.1910
20–24	0.7728 (9.07)	−0.8513 (−2.26)	−0.6594 (−1.88)	−0.0022 (−0.12)	0.7412 (2.23)	0.1828	0.0101	1.2553
25–29	0.4524 (4.60)	−0.0318 (−2.37)	−0.9302 (−2.29)	−0.0341 (−1.61)	1.0792 (2.81)	0.3998	0.0117	0.9938
30–34	0.6690 (6.07)	−1.6959 (−3.48)	−1.4702 (−3.23)	−0.0478 (−2.01)	1.5557 (3.62)	0.2800	0.0131	0.6895
35–39	0.6602 (7.44)	−1.1402 (−2.90)	−1.0005 (−2.73)	−0.0416 (−2.18)	1.1000 (3.18)	0.2224	0.0105	0.9574
40–54	0.6938 (10.55)	−0.8080 (−2.78)	−0.7211 (−2.66)	−0.0274 (−1.94)	0.7666 (2.99)	0.1807	1.0323	0.0078
55–64	0.4862 (8.50)	−0.7312 (−2.89)	−0.6490 (−2.75)	−0.0283 (−2.30)	0.7331 (3.29)	0.2870	0.0068	1.4741
65+	0.1201 (2.72)	−0.0150 (−0.08)	0.0036 (0.02)	−0.0227 (−2.38)	0.0917 (0.53)	0.3448	0.0052	1.3221

Note: See footnote below Table3(A) for $\bar{R}^2$, S.E. and D.W.
Period: 1972IVQ–1979IIQ for females 15+.
1972IVQ–1978IVQ for females in all other groups.

TABLE 7. REGRESSION RESULTS (USING THE LABOR DEMAND TO SUPPLY RATIO FOR u): EQUATIONS (2)

Age group	Constant	$(w/p)^*$	$[(w/p)-(w/p)^*]$	u	(w_f/p)	$\bar{R}^2$	S.E.	D.W.
15+	0.4776 (9.52)	−0.6693 (−3.77)	−0.5612 (−3.58)	0.0268 (5.59)	0.6287 (4.52)	0.7077	0.0053	1.2847
15–19	0.4419 (4.21)	−0.5992 (−1.61)	−0.1089 (−0.33)	0.0260 (2.53)	0.3308 (1.11)	0.8906	0.0109	1.2779
20–24	0.7152 (7.63)	−0.8370 (−2.51)	−0.7014 (−2.39)	0.0116 (1.27)	0.7729 (2.91)	0.2434	0.0097	1.3979
25–29	0.2778 (3.31)	−0.7679 (−2.57)	−0.7951 (−3.03)	0.0373 (4.54)	1.9019 (3.79)	0.6658	0.0087	1.4087
30–34	0.4519 (5.14)	−1.3247 (−4.24)	−1.2509 (−4.55)	0.0467 (5.43)	1.2817 (5.14)	0.6500	0.0091	0.9907
35–39	0.4768 (7.05)	−0.8162 (−3.39)	−0.8028 (−3.80)	0.0395 (5.98)	0.8556 (4.46)	0.6547	0.0070	1.4277
40–54	0.5932 (10.15)	−0.5944 (−2.96)	−0.5906 (−3.35)	0.0260 (4.71)	0.6054 (3.78)	0.5387	0.0059	1.5222
55–64	0.3947 (6.91)	−0.5089 (−2.50)	−0.4784 (−2.68)	0.0203 (3.62)	0.5362 (3.31)	0.4562	0.0059	1.8647
65+	0.0326 (0.88)	0.1624 (1.23)	0.1249 (1.07)	0.0191 (5.24)	−0.0530 (−0.50)	0.6458	0.0039	1.8642

Note: See footnote below Table3(A) for $\bar{R}^2$, S.E. and D.W.
See footote below Table 6 for estimation period.

The Results

The results are presented in Tables 6 and 7. The coefficients for the permanent income (or wages) are negative for all the age groups except one: for 65 and over, the coefficient is positive and not significant. This means that the higher the earnings of the male family head, the main source of the permanent family income, the lower the level of labor force participation of women. This is consistent with the first law of Douglas-Arisawa. The negative relation is greatest for females in the child-rearing years, 30–34.

The coefficients for the transitory income (or wages) are also negative except for 65 and over. This indicates that women would increase market work at the sacrifice of leisure and household works when family income declines temporarily. The finding that the negative coefficients are highest for females in 30–34 and 35–39 may be due to the fact that women in these two age groups have a strong tendency to leave the labor force as the transitory income becomes positive. The negative effect of the transitory income on the labor force participation would depend on the degree of the substitutability between the market goods (or services) and the home produced goods (or services) in the presence of children. The higher estimate of the coefficient in the young age group implies strong preference toword taking leisure or going to school. Women in 65 and over respond positively to the transitory income. They appear to retire when current income declines below the level of permanent income.

The results for the unemployment rate (or the labor demand to supply ratio) suggest that the discouraged worker effect dominates the additional worker effect, the effect being greatest in 30–34. This is consistent with the findings from the business cycle model in the previous section.

The coefficient of the female wage rate is found to be positive and significant. When the female wage rate goes up, the opportunity costs of leisure and household works will go up also. In other words, a positive effect toward market work is exerted via substitution effect. This result is in contradiction to the previous findings in the cross section studies in Japan which indicate no clear effect of the female wages on the labor force participation of women.

The labor force behavior of females in 15–19 and 65 and over seem to be unstable and the results for these two groups are not significant except for the unemployment rate variable. However, the overall empirical results are convincing. Of particular importance is the relative size of the coefficients, between the permanent income and the female wages, which implies potential labor supply in the long-run. The short-run transitory income accentuate the negative relation between husbands' income and wives' participation. However, the transitory components of income are irrelevant in the long period. Over the long-run, threfore, the female labor supply would depend upon the coefficients for the permanent income and the female wage rate. When we compare the coefficient for the permanent income, (a_1), to (a_3) for the female wage rate, the results show $a_3 > a_1$ for females 25–29, 35–39, 40–54 and 55–64. This results imply that the

effect of the second law of Douglas-Arisawa dominates the effect of the first law. Stated differently, the labor force participation of women in these age groups are expected to rise in the long-run.

Because of such alternatives to the market work as going to college or taking leisure for females 15–19 and 20–24, and child-rearing activities for 30–34, their labor force participation seem to be reduced with the increase in the permanent income.

CONCLUSION

We considered the two different models for the labor supply of women to estimate the labor force sensitivity and to analyze the responsiveness of labor force behavior to the two components of income. Because the results we gained tend to be susceptible to the period of time covered by the analysis, a care must be taken to interpret the findings of the time-series regressions.

We did not directly consider in the model the labor supply variables such as changes in tastes, population structure, higher educational attainment, retirement patterns, and the like. Nevertheless, the results would seem to support at least the following points:

(1) The cyclical sensitivity of participation is still higher for females than for males.

(2) The discouraged worker effect dominates the additional worker effect. The additional worker effect becomes stronger as the lag is lengthened, however.

(3) The distinction between permanent and transitory income (or wages) is necessary and women respond more readily to transitory than to permanent levels of income.

(4) While (1), (2) and (3) hold, women seem to have become more work oriented, *i.e.*, once they enter the labor force they tend to stay in the labor force.

(5) The labor supply of women in the age groups 25–29, 35–39, 40–54 and 55–64 appear to increase in the long-run.

There have been inflows of wives into labor force in the process of economic adjustment since the first oil-crisis. If the trend continues in the long-run is uncertain. However, it seems reasonable to say that the favorable demand conditions facing women and other factors such as change in lifestyle, the higher level of education, etc. that surround women in Japan are likely to reinforce the participation of women in the job market.

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