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# The Response of Wives' Labor Supply to Husbands' Job Loss

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***Abstract**:* This paper examines how Japanese wives react to their husbands' involuntary job loss, and tests the existence of complementarity of a wife's labor supply to her husband's. Utilizing panel data on Japanese households from 1993 to 2004, we found that wives' labor supply is stimulated when husbands suffer involuntary job loss. The detailed statistics show that not only do working wives raise their labor hours but also nonworking wives begin to participate in the labor market. The added worker effect is evident during the period of job insecurity in Japan following the mid-1990s.

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# 1 Introduction

Unemployment rates in Japan have skyrocketed since the mid-1990s. Not only young unskilled workers but also middle-aged male workers have been laid off. These middle-aged workers are often the main income earners in a household. How have Japanese households reacted to these changes? This paper examines their reactions to husbands' involuntary job loss, focusing on wives' labor supply.

When a household's main income earner loses a job, other household members might supply more labor either sequentially or simultaneously to compensate for the job loss. This is called the *Added Worker Effect* and has been examined in several countries. Heckman and MacCurdy (1985) use data from the Panel Study of Income Dynamics for 1968 to 1975 to show that the wife participates more in labor markets when the husband is unemployed. In contrast, Lundberg (1985) and Cullen and Gruber (2000) show that the added worker effect may exist but is quite small in the United States. Spletzer (1997) shows that there is the added worker effect in the United States, but that this is largely explained by unobservable heterogeneity between wives whose husbands have lost their jobs and wives whose husbands have not. The heterogeneity causes an endogeneity between the husband's unemployment and the wife's labor supply. Bingley and Walker (2001) take this endogeneity into consideration and show that the added worker effect is small but that it becomes large when the husband's unemployment period is long. Stephens (2002) emphasizes the use of involuntary job loss as an exogenous employment shock and shows that the wife's labor supply does not react promptly to the husband's involuntary job loss. Fernandes and Felicio (2005) finds that the added worker effect exists in Brazil, focusing on non-working wives' reaction to their husbands' unexpected job loss.

The fact that wives flexibly change their labor supply might be surprising. Despite the huge research on household behavior, much of it neglects households' leisure/labor decisions and concentrates on consumption behavior. For example, many empirical investigations have examined whether households' consumption responds to idiosyncratic shocks (e.g. tests of the applicability of the life-cycle permanent income and full insurance hypotheses). There is little empirical research that deals with both consumption and leisure at the same time.[1]

The present paper clarifies whether or not household's members change their labor decisions in response to unexpected shocks surrounding them. In order to examine this, we focus on the existence of surplus labor and its reaction to shock experienced by main income earners. That is, the first purpose of our paper is to reexamine the existence of the added worker effect. Empirical analysis on the added worker effect has some difficulties such as lack of detailed information on wives' working hours, their working history, households' savings/consumption patterns, and causes of husbands' job loss. We utilize panel data containing extensive household information so that we can specify a better estimation model.

Another purpose of the paper is to clarify the existence of the added worker effect in Japan. We not only use Japanese household data but also highlight the period when the

[1] Exceptionally, Low (2005) and Pijoan-Mas (2006) describe an individual's life-cycle labor supply behavior with precautionary motive, and shows that one can change labor supply flexibly in response to his/her uncertainty as well as wages. Attanasio et al. (2005) simulate the changes in consumption, savings and wives' labor supply in relation to income uncertainty, and find that female labor supply is responsive to idiosyncratic shocks especially in those households with borrowing constraints.

added worker effect could exist if there is any in this country. That is, our sample period (1993–2004) includes the period when Japan's unemployment rate increased dramatically and stayed at a high level.

It is important to examine the existence of the added worker effect in Japan for four reasons. First, as mentioned in the last paragraph, Japan has experienced a sharp rise in unemployment and a dramatic change in the employment atmosphere in the past decade, which provides us with a suitable context in which to examine the changes in households' economic behavior such as labor supply and consumption. We can add another result to the existing arguments on the added worker effect.

Second, Japan is famous for having a large proportion of women who are housewives, especially among wealthy households. Many women become housewives after marriage or at least after having a child. It is interesting to observe how Japanese labor-risk-sharing within a household has changed (or not changed) after about a three-percentage-point rise in middle-aged male unemployment. Third, Japan is known for its households' high saving rates. As drawing down savings could be one way to cope with the main earner's job loss, the level of savings can make a difference to a household's labor-risk-sharing. The Japanese data may reveal interesting differences from other countries' results. Fourth, so far there have been no tests of the added worker effect for Japanese households, while there is research examining the negative relationship between the wife's labor force participation and the husband's income (see Higuchi (2001), for example). The present paper is the first attempt to clarify the existence of the added worker effect in Japan.

Our empirical investigation shows that wives' labor supply was indeed stimulated by the husbands' involuntary job loss in Japan between 1993 and 2004. The detailed statistics suggest not only that working wives raised their work hours, but also that nonworking wives came to participate in the labor market. Moreover, we find that nonworking wives started seeking work after their husbands lost their jobs. Clearly the added worker effect was present during the high unemployment period in Japan following the mid-1990s. The effect could become large if we counted potential labor supply.

The rest of the paper consists of four sections. Section 2 explains the theoretical background and the empirical model. Section 3 introduces the data used in the empirical analysis. Section 4 presents the estimation results. The final section concludes the paper.

## 2 The Background Theory and the Estimation Model

The explanation of the added worker effect (hereafter, AWE) is descriptive, but the underlying theory is summarized as a form of risk-sharing behavior within a family. A family that maximizes their expected life time utility subject to their life time constraints faces an intertemporally optimal condition such that today's leisure and consumption equate to the discounted present values of future leisure and consumption as long as the marginal utility, which is expected lifetime wealth, is unchanged over time. The so-called Euler equations imply that a rational household does not react to temporary shocks while they may react to unexpected permanent shocks. This smoothing behavior is a central hypothesis to be tested by the evidence of a simple life-cycle permanent income hypothesis.

A household also faces intratemporally optimal conditions such that the marginal utility of leisure weighted by wage equals the marginal utility of consumption, and that this weighted marginal utility of leisure is equal between the wife and the husband. The wife's optimal leisure/labor decision depends on complementarity or substitutability between leisure and consumption, and between the husband's and the wife's leisure time.[2]

Thus, when the husband unexpectedly loses his job and family income decreases, the wife may raise her labor supply, partly as a reaction to unexpected permanent shocks and partly as complementarity between the husband's and the wife's leisure time.[3] The literature on the AWE focuses on the shock of job loss or the displacement of the main income earner, and examines the response of surplus labor in a family. Because the main income earner is usually the husband, the question to be answered is whether or not wives

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[2]Household's maximization problem is summarized as

$$\begin{aligned} & \max_{c,l^h,l^w} E_t\{\sum\nolimits_{s=t}^{T} \beta^{s-t} u(c_s, l_s^1, l_s^2)\} \\ \text{s.t. } A_{s+1} &= (1+r)\{A_s + (1-l_s^1)w_s^1 + (1-l_s^2)w_s^2 - c_s\}, \end{aligned}$$

where $\beta$ is a discount factor $(1 \geq \beta \geq 0)$, $c$ is consumption $(c \geq 0)$, $l$ is normalized leisure time $(1 \geq l \geq 0)$, and $A$ is asset holdings satisfying $A_T = 0$. The husband, denoted as subscript 1, and the wife, as 2, receive returns on assets $r$ and returns on labor $w$ (wage rates). The first-order conditions are

$$\begin{aligned} u_c(c_t, l_t^1, l_t^2) &= \beta(1+r)u_c(c_{t+1}, l_{t+1}^1, l_{t+1}^2), \\ u_{l^k}(c_t, l_t^1, l_t^2) &= \beta(1+r)u_{l^k}(c_{t+1}, l_{t+1}^1, l_{t+1}^2); k = 1, 2, \end{aligned}$$

$$u_{l^1}(c_t, l_t^1, l_t^2)/w_t^1 = u_{l^2}(c_t, l_t^1, l_t^2)/w_t^2 = u_c(c_t, l_t^1, l_t^2).$$

The first two are Euler equations where $u_c$ and $u_l$ are marginal utility of consumption and leisure in each period: $\frac{\partial u(c_t, l_t^1, l_t^2)}{\partial c_t}$ and $\frac{\partial u(c_t, l_t^1, l_t^2)}{\partial l_t^k}(k = 1, 2)$. The last one is an intratemporal relationship between consumption, the husband's leisure and the wife's leisure.

[3]If we also take home production into consideration, the wife's reservation wage for labor supply could fall according to the husband's unemployment and his increased time for home production. The realization of the wife's lower reservation wage raises her labor supply in the market.

can sacrifice their leisure and afford working time to compensate for their husbands' job loss.

We can thus test the existence of the AWE, examining if wives' labor hours increase as their husbands lose their jobs involuntarily. We can regress changes in wives' labor hours, $\Delta WL_{it}$, on the variables including husbands' job loss, $HU_{it}$, such as

$$\Delta WL_{it} = \alpha_0 HU_{it} + \sum\nolimits_{j=1} \alpha_j HU_{it-j} + \Delta \mathbf{X}_{it}\delta + \varepsilon_{it} \qquad (1)$$

where $i$ is a household and $t$ is a survey year $(i = 1, ...N, t = 1, ..., T_i)$. $WL$ is wives' paid labor hours, $HU$ is a dummy variable indicating whether or not husbands lost jobs involuntarily, and $\mathbf{X}$ is a matrix of the other households' characteristics.[4] This is a general specification that the existing literature has examined. We mainly estimate this equation, with appropriate modifications utilizing our panel data sets.

We write the error components as $\varepsilon_{it} = \mu_i + \nu_t + u_{it}$, where $\mu_i \sim IID(0, \sigma_\mu^2), \nu_t \sim IID(0, \sigma_\nu^2)$, and $u_{it} \sim IID(0, \sigma_u^2)$. $E(\mu_i u_{it}) = 0$, $E(u_{it} u_{is}) = 0$ for all $i$ and $t \neq s$. $u_{it}$ is orthogonal to all the explanatory variables in $\mathbf{X}$. The null hypothesis is no existence of the AWE; $\alpha_0 = 0$. That is, the wife does not alter her labor supply in the year when her husband loses his job, so that the household can pool the shock of job loss.

Note that a husband's resigning from a job, but not an unexpected job loss, could be

[4]Unless consumption and the wife's leisure are additively separable in the utility function, changes in a wife's leisure are influenced by the substitutability or complementarity between her leisure and consumption. We assume an additive separability and do not treat households' simultaneous decisions on consumption and leisure explicitly. As mentioned later, we cannot find any significant effect of consumption changes on wives' leisure changes, even if we include consumption changes as an explanatory variable. Further consideration of simultaneous decisions between consumption and leisure remains for future research.

endogenous in a decision regarding a wife's labor supply. As previous literature points out, the more hours a wife works, the more easily the husband may choose to resign from a job. This is not the AWE. In order to avoid this endogeneity problem, we first take $HU$ as involuntary job loss but not job resignation.

As another treatment, we regress the changes in wives' labor time but not its levels on the husbands' job loss. That is, we examine the wives' reaction to the husbands' job loss but not a simple relationship between the length of the wife's labor time and her husband's unemployment condition. Examining dynamic changes but not levels of wives' labor hours has additional merit that we can remove the problem of time-invariant omitted variables.[5]

In the equation (1), there may be a time lag between husbands' involuntary job loss, $HU_{it-j}$ $(j \geq 1)$, and wives' reaction. In this case, the coefficients of $\alpha_j$ $(j \geq 1)$ can be positive. However, the sign of $\alpha_j$ $(j \geq 1)$ can be positive even if there is no time-lagged AWE. Suppose that wives respond to their husbands' job loss in the same year: $t$ is the year in this paper, and there exists a within-one-year AWE. Also suppose that wives' labor hours are shorter in this year as their labor hours were longer in the previous year: wives' labor hours are negatively correlated between years.[6] When a husband loses his job in a given year, his wife will increase her labor supply in the same year, which in turn decrease her labor supply in the following year. If wives' labor hours are positively correlated between years, wives will raise their labor supply in the following year. That is, without a time-lagged effect of husbands' job loss, the signs of the coefficient on husbands'

[5]We attempted to analyze the levels (length) of wives' labor hours, and found the same implication for the existence of the AWE as shown in the present paper.

[6]Wives' labor hours actually have negative time dependencies in our sample.

past job loss, $\alpha_j$, could become positive, zero or even negative depending on the existence of a within-one-year AWE and time dependencies in wives' labor hours. Thus, we can test at least the existence of within-one-year AWE by $\alpha_0$, while we cannot always test the existence of the time-lagged AWE by $\alpha_j$ $(j \geq 1)$.

It is important to deal with time dependency in wives' labor hours properly if there are any, even when we test the existence of within-one-year AWE. We can include wives' past labor hour changes, $\Delta WL_{it-k}$ $(k \geq 1)$, explicitly as explanatory variables in the equation (1). The coefficients on $\Delta WL_{it-k}$ $(k \geq 1)$ are positive, negative or zero depending on the relationships of wives' labor hours between years. This estimation, however, raises a problem of autocorrelation, since the model now includes lagged dependent variables on the right-hand side. Following Arellano and Bond (1991), we take the first difference to remove individual fixed effects and conduct GMM estimation of

$$\Delta WL_{it} = \alpha_0 HU_{it} + \sum\nolimits_{j=1} \alpha_j HU_{it-j} + \sum\nolimits_{k} \beta_k \Delta WL_{it-k} + \Delta \mathbf{X}_{it}\delta + \Delta\varepsilon_{it} \qquad (2)$$

with appropriate instruments of $Z = [Z_1', Z_2', \cdots, Z_N']'$ where $E(Z_i'\Delta\varepsilon_i) = 0$. The possible instruments are $WL_{i1}, \cdots, WL_{it-2}, x_{i1}', \cdots, x_{it}'$ for $\Delta WL_{it-1}$, where $x_i$ is a vector of all the exogenous variables in $\mathbf{X}_{it}$.

There are additional considerations regarding this specification. First, there may be a problem of multicollinearity between husbands' past job loss, $HU_{it-j}$ $(j \geq 1)$ and wives' past labor hour changes, $WL_{it-k}$ $(k \geq 1)$. Therefore, we examine the case excluding husbands' past job loss from the explanatory variables. Second, we include the amount of financial asset holdings one year before the time period of labor hour changes in $\mathbf{X}_{it}$. This can be important since family decisions on labor supply could be related to the behavior of its precautionary savings. Households' precautionary behaviors may differ, which then affects wives' reaction to husbands' employment shocks. We include the amounts of savings accumulated by the end of the previous year, $S_{it}$, as an additional explanatory variable in (1) and (2). The amount of savings, $S_{it}$, might be endogenous: $E(S_{it}\varepsilon_{is}) \neq 0$ $\forall\ s \leq t$, since the wife's labor decisions may affect the household saving decisions, or unobserved components in the error term may be correlated with amounts of savings. In this case, the instruments are $WL_{i1}, \cdots, WL_{it-2}$, $S_{i1}, \cdots, S_{it-2}$, $x'_{i1}, \cdots, x'_{it}$ for $\Delta WL_{it-1}$.

Controlled variables in $\mathbf{X}_{it}$ are mostly based on the past literature testing the AWE, such as family needs and a wife's age. Time-invariant variables are dropped by the first-difference operation. The interaction terms with a wife's educational attainments are included, as educational attainments may be essential factors in the Japanese household's economic decisions. We can simply estimate (1) if there is no time dependency in the wife's labor hours, while we should estimate (2) if there is.[7]

# 3 The Data

The present paper uses the *Japanese Panel Survey of Consumers* (JPSC, hereafter) conducted by the Institute for Household Economy in Japan. This is one of the few panel data sets in Japan. The survey questions women aged between 24 and 34 in the starting

[7] In order to control for differences in risks surrounding households, we estimated the model including income or consumption variances over the past four years within a household. Inclusion of them does not alter the implications of the following results at all. We also controlled for consumption changes as an endogenous explanatory variable, and the coefficient on consumption changes was not statistically significant while the exogeneity was accepted.

year of 1993. The women are asked about their families and themselves in regard to labor status including questions about job change, income, occupation and labor hours, consumption and saving behavior, and asset holdings.

The survey collects detailed information on job changes by the husband during the previous year. Using the survey information, we can identify those husbands who lost their jobs at least once during the previous year between the last survey and the present survey. The reason why we limit this to one year is that most unemployed in Japan start working within a year after they lose a job.[8] We can further distinguish whether or not the job loss was involuntary by looking at the reasons for it. Involuntary reasons include being laid off, the plant closing, or bankruptcy.

The JSPC asks respondents separate questions about their paid regular working hours, their paid overtime working hours, and their unpaid overtime working hours per week. We sum paid regular and overtime working hours because we are interested in looking at whether the wife compensates for the husband's negative shocks. An increase in unpaid working hours does not mean compensation for the husband's loss. The defined working hours are zero for non-workers. This may cause a nonlinearity in dependent variables, since the changes in labor hours for working wives may be different from those for non-working wives. To check this possibility, we took the log of changes in wives' labor hours and conducted the same estimation, but the sign and significance were unchanged.[9]

[8]We do not divide a year into shorter time periods, since it decreases the number of households who experienced the husband's unexpected job loss. We also do not utilize the information on unemployed periods, since the characteristics of such a limited number of households make the results unstable.

[9]The present paper includes non-workers together with workers, since we do not want to loose the information on changes from non-workers to workers. We cannot conduct the empirical estimation for

As expected, factors other than complementarity with the husband's job loss could also cause an increase in the wife's labor supply. For example, if the wife's firm is growing or if she is promoted as her job tenure increases, her working hours may increase. To control for these effects, we include the wife's age and the interaction of several characteristics with educational attainment as control variables. As mentioned, time-invariant variables, such as wives' educational attainments and time-invariant characteristics of their working environments, are dropped by the first-difference operation. Other controlled variables are the number of children, and the stock of saving (the outstanding balance of savings accounts and holdings of securities) at each survey point.

Twelve waves of the JPSC, from 1993 till 2004, are available, but our estimation uses (at most) nine differenced periods from 1995–96 to 2003–04. This is because two-year lagged information is needed to instrument for the first-differenced transformation of one-year lagged wife's labor hours. The sample is also limited to married women, to the non-self-employed sample, and to the sample containing sufficient variables required in the regressions. The total number of observation is 4212 (884 households) for the estimation under an assumption of exogenous financial assets, and 4052 (856 households) under an assumption of endogenous financial assets. The descriptive statistics are summarized in Table 1.

Before introducing the estimation results, we first overview the movements of husbands' and wives' employment rates in Japan, using our JPSC data. According to Figure 1, husbands' and wives' employment rates move in opposite directions, suggesting the

non-workers because of insufficient observations. We will discuss the difference between non-workers and workers later at the end of the Results section.

possibility that wives' labor supply is complementary to husbands' job loss. In our sample, about 1.5% of the households experienced the husband's involuntary job loss during the previous year, between 1993 and 2004. This small percentage is close to what the macro statistics show: the unemployment rate of household heads was about 1.5% in 1999 according to the *National Survey of Family Income and Expenditure* (Statistics Bureau). The JPSC asks about income sources when the husband was laid off, which is listed in Table 2. Although 40% do not have unemployment periods, a quite high percentage answers *wife's* or *parent's income*. The wife's labor may be an important candidate for complementing the husband's labor. Savings may be another important income source for unemployed households. In the following regressions, we estimate the effect of the husband's involuntary job loss on the wife's labor supply after controlling for household savings.

# 4 The Results

## 4.1 Does the AWE exist in Japan?

Table 3 summarizes the results using a fixed-effects model including husbands' job loss.[10] Column (1) does not include their past job loss, and columns (2) to (4) do include one-, two-, and three-year lagged effects. Either result shows that the husbands' job loss during the previous year has a positive effect in the present year. This is statistically significant mostly at the 5% significance level. The coefficient on husbands' job loss in the previous year (which occurred from 12 to 24 months before) is negative and significant at the 1%

[10] We also attempted a random-effects model and found the same implications.

level, the two-year lagged job loss is negative and significant at the 10% level, but the three-year lagged job loss is insignificant. As mentioned before in the model, the negative effects of the husbands' past job loss do not deny the existence of the wives' added worker effect. If wives' labor hours in the previous year were responsive to that year's husbands' job loss, and if wives' labor hours had persistence, the negative sign would be expected. The results in Table 3 suggest that wives' added worker effect exists in Japan.

In order to take account of persistences in wives' labor hours over time, Table 4 shows the results of GMM estimation including wives' lagged labor hour changes.[11] Columns (1a) and (1b) in Table 4 drop the husbands' job loss in the previous year, while columns (2a) and (2b) include it, and columns (3a) and (3b) include additionally the two-year lagged job loss. We do not show the results including three-year lagged job loss, since this is not statistically significant in any estimation. The difference between (a) and (b) is whether or not we include the previous year's financial asset holdings.

In either estimation, the husbands' job loss coefficient in the present year is positive and significant at the 1% level. On the other hand, husbands' job loss in the previous years mostly become statistically insignificant even at the 10% level. That is, if we control for dynamic persistence of wives' labor hours, we cannot find a negative effect for husbands' past job loss, while we still have a positive effect of husbands' job loss on the wives' labor hours in the present year. The husbands' job loss increases the wives' paid labor hours

[11]Simply including the lagged dependent variables in the estimation of Table 3 raises a problem of autocorrelation: modified Durbin-Watson statistics in the case including wives' past labor hour changes are 1.863, 1.866, 1.865 and 1.866 respectively for columns (1), (2), (3) and (4) of Table 3, implying existence of AR(1) serial correlation.

by about 2.1–2.8 hours per week. There exists at least within-one-year AWE in Japan.

As another important point, the coefficients on changes in financial asset holdings in this year and the previous year are negative and significant at the 1% level. This suggests that labor supply and savings should be substitutes, and households with more savings supply less labor and more leisure. This may suggest the importance of taking account of precautionary saving behaviors in explaining households' decisions. We found the same implication even when taking financial asset holdings as endogenous variables: the coefficients on the present husbands' job loss are 2.05, 2.28 and 2.44, respectively in (1b), (2b) and (3b), and all of them are statistically significant at least at the 12% level; the coefficients on the previous year's husbands' job loss are not significant; and the coefficients on wives' paid labor hour changes in the past years are all the same signs, size, and significance, as is shown in Table 4.[12]

As for the specification, the wives' labor hour changes in the past years are negative and significant at the 1% level. It is important to consider dynamic persistence of wives' labor hours. We show the results including only one- and two-year lags, as we do not find any statistically significant effect of more lagged values. As for other significant variables, households with more children decrease the wife's labor hours. This is a natural result for mothers' labor supply.

The estimation models in table 4 satisfy over-identification conditions and there is no second-order serial correlation for the disturbances of the first-differenced equation ($E(\Delta u_{it}\Delta u_{it-2}) = 0$). Because our estimation is derived from about 1000 households over

[12]The present paper points out the importance of households' precautionary savings but does not deal with it explicitly. More detailed investigation should be considered in future research.

a maximum of nine years, an Arellano-Bond GMM estimator may have a finite-sample downward bias, as usually criticized. So, we conducted one-step GMM estimation and found that the coefficients on the husbands' job loss are 3.55, 4.05 and 3.58, and all of them are statistically significant at least at the 5% level, respectively for (1b), (2b) and (3b). The husbands' previous year's job loss are not statistically significant and the wives' past labor hour changes are negative and significant, which are all the same as the implications in Table 4. Wives raise their labor hours in response to their husbands' involuntary job loss by 3–4 hours per week.

It might be surprising that wives reacted to their husbands' job loss during a severe recession in Japan. During a recession, there may be a *discouraged worker effect* such that wives do not try to supply labor because of fewer employment opportunities. Even in such state of the economy, there are possible reasons why we found wives' positive labor supply responses. First, our definition of the husband's involuntary job loss is job loss *during the previous one year*, which includes not only a present condition of unemployment but also experiences of unemployment during the previous one year between the last survey and the next survey. Wives' responses may look rapid but they actually include responses one year after their husbands' job loss. Second, the job loss of a husband, who is usually the main income earner, may give a severe shock to a household. Serious economic conditions during this sample period made households expect the shock to last rather a long time, lowering their life-time wealth. Third, there was indeed surplus labor in many families in Japan. As is well known, the rate of labor participation of married women is low and their labor hours are short in Japan. The changes in the labor market, where many full-time jobs were replaced by part-time jobs during the recession of post mid-1990, may have motivated them to participate in the labor market.

### 4.2 Who raises working hours?

We found that many Japanese wives actively reacted to their husbands' job loss. Did working wives raise their labor hours? Or did nonworking wives start working? Table 5 summarizes how either working wives or nonworking wives reacted to their husbands' involuntary job loss. Although we do not have a sufficiently large sample to examine empirically the changes in nonworking wives' job status, the table shows an interesting feature. First, the wives who experienced their husbands' involuntary job loss raised their paid working hours much more than those who did not: the paid working hours increased by 0.90 hours on average for those without job loss but by 4.12 hours for those with job loss. Panel A shows the working hour changes for the wives who had worked in the previous year. Among them, those who experienced the husbands' involuntary job loss raised their paid working hours by 0.75 hours (45 minutes) per week, although the wives who did not experience their husbands' job loss indeed decreased their working hours by 1.5 hours per week during the sample period from 1993 to 2004.

Panel B shows the changes for the wives who had not worked in the previous year. Those who experienced their husbands' job loss raised their working hours by 8.6 hours per week, which is three times more than those who did not. 33% among previously nonworking wives started working, while only 13.5% of those who did not face their husbands' job loss started working. Furthermore, previously nonworking wives who faced their husbands' job loss started seeking work more frequently. The percentage of wives who started working or seeking jobs is more than twice as much as those without husbands' involuntary job loss. These statistics emphasize that the AWE exists, and the potential AWE could be even larger.

Japanese wives' labor supply responds to their husbands' job loss. During the high unemployment period following the mid-1990s, there existed the added worker effect not only for working wives' labor hours but also for nonworking wives' new labor supply. The added worker effect could be greater, including a larger potential labor supply in the market.

The married female labor supply seems more flexible than we expect. Although most of the economic literature on households' behaviors focuses on consumption but not on the labor (leisure) decisions, we should take leisure into account when we describe the behavior and welfare of economic agents.

# 5 Conclusion

In this paper, we examined how a wife's labor supply responded to her husband's involuntary job loss following the mid-1990s. We utilized panel data containing extensive household information, which are indispensable for our analysis. This makes it possible for us to investigate wives' leisure decisions as well as households' savings behavior against unexpected shocks. Furthermore, our sample period (1993–2004) included a period when Japan's unemployment rates were very high and growing, which was advantageous when analyzing behavioral responses to changed economic conditions.

We found that a wife's labor supply was actually stimulated by her husband's involuntary job loss. The additional statistics indicate that not only working wives raised their labor hours but also nonworking wives began to participate in the labor market. In addition, nonworking wives started looking for jobs in response to their husband's job loss. There exists an added worker effect during a period of job insecurity in Japan following the mid-1990s, and the effect would be larger if we included potential labor supply.

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Figure1. Husband's and Wife's employment rates

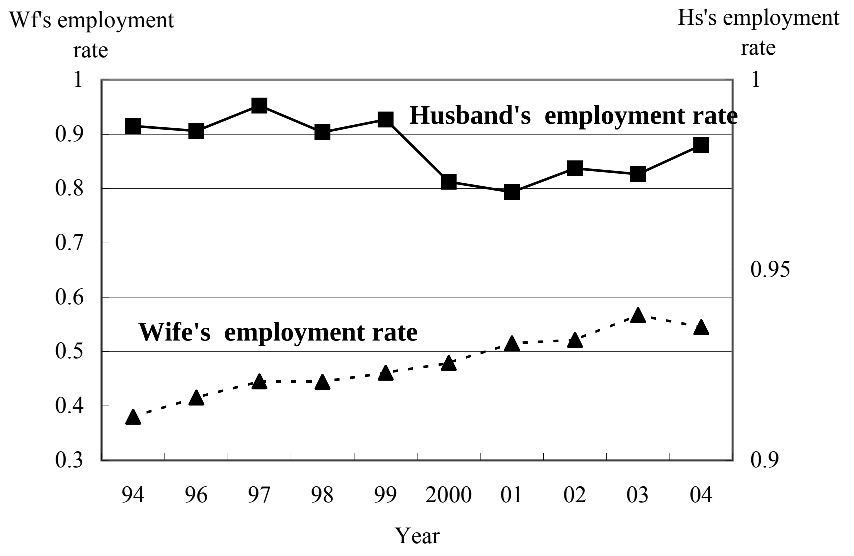

**Table1. Descriptive Statistics**

| | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| Wife's paid labor hours | 14.6802 | 16.8642 | 0 | 65 |
| Wife's paid labor hours in the last year | 13.7352 | 16.6856 | 0 | 65 |
| Husband's job loss | 0.0150 | 0.1214 | 0 | 1 |
| Husband's job loss in the last year | 0.0138 | 0.1165 | 0 | 1 |
| Husband's job loss 2 years before | 0.0140 | 0.1175 | 0 | 1 |
| Husband's job loss 3 years before | 0.0131 | 0.1135 | 0 | 1 |
| Financial asset holdings | 445.4084 | 738.4616 | 0 | 8700 |
| Wife's age | 36.6833 | 4.1134 | 28 | 46 |
| Wife's age * wife low education | 18.6880 | 18.4898 | 0 | 46 |
| Number of children | 1.9839 | 0.8838 | 0 | 7 |
| Number of children * wife low education | 1.0527 | 1.2124 | 0 | 7 |
| [after taking the first difference] | | | | |
| △Wife's paid labor hour in the last year | 0.9450 | 10.2127 | -65 | 65 |
| △Financial asset holdings | 11.6453 | 398.3604 | -7300 | 6900 |
| △Number of children | 0.0427 | 0.2213 | -2 | 2 |
| △Number of children * wife low education | 0.0176 | 0.1515 | -2 | 2 |

Note. Total number of the observations to be used for the main estimations is 4212.

**Table2. The Source of Living after the Husbands' Job loss**

| | |
|---|---|
| Savings | 39.68% |
| No unemployed periods | 34.92% |
| Retirement allowance or unemployment insurance | 28.57% |
| Wife's income or transfers from parents | 23.81% |
| Borrowings or use of credit card | 3.17% |
| Others | 4.76% |

**Table 3. Wives' Reaction to the Husbands' Job Loss (1)**

*Dependent variable: Wife's paid labor hour changes from the previous year*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Husband's job loss | 2.7639 * | 2.3580 ** | 2.1240 ** | 2.1716 ** |
| | (1.5949) | (1.6010) | (1.6302) | (1.6298) |
| Husband's job loss in the last year | | -2.8198 *** | -3.0518 *** | -2.9066 *** |
| | | (1.8510) | (1.8527) | (1.8619) |
| Husband's job loss 2 years before | | | -1.2841 * | -1.1523 * |
| | | | (1.9381) | 1.9689) |
| Husband's job loss 3 years before | | | | 0.8952 |
| | | | | (2.1491) |
| Financial asset holdings | -0.0008 ** | -0.0008 *** | -0.0008 *** | -0.0008 *** |
| | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| Wife's age | 0.0903 | 0.0924 | 0.0918 | 0.0919 |
| | (0.1313) | (0.1311) | (0.1311) | (0.1310) |
| Wife's age * Wife's low educational attainment | -0.1607 | -0.1556 | -0.1520 | -0.1529 |
| | (0.1599) | (0.1597) | (0.1596) | (0.1598) |
| Number of children | -3.3595 *** | -3.4138 *** | -3.3777 *** | -3.3808 *** |
| | (1.0407) | (1.0404) | (1.0366) | (1.0365) |
| Number of children * Wife's low educational attainment | 0.8525 | 0.9040 | 0.8789 | 0.8735 |
| | (1.8136) | (1.8145) | (1.8130) | (1.8128) |
| Constant | 0.4765 | 0.3422 | 0.3312 | 0.3266 |
| | (3.7367) | (3.7384) | (3.7446) | (3.7437) |
| Number of the observations | 4212 | 4212 | 4212 | 4212 |
| Number of the individuals | 884 | 884 | 884 | 884 |
| R-squared | 0.01 | 0.01 | 0.01 | 0.01 |
| F stat. for all the exclusion restrictions | 2.14*** | 2.16*** | 2.04** | 1.92** |
| F stat. for no individual effects | 0.53 | 0.53 | 0.53 | 0.53 |

Notes.1. Fixed effects model is applied to all the estimations. Robust standard errors are in parentheses.

2. Asterisks, *, **, *** show that the variable is statistically significant at 10%, 5%, and 1%, respectively.

3. All the estimation models include year dummy variables for 1995-2004.

4. Wife's labor hour changes, Financial asset holdings, Number of children are changes from the last year.

5. Modified Durbin-Watson Statistics are 2.309, 2.313, 2.312 and 2.313 respectively in (1), (2), (3) and (4), which imply no AR1 serial correlations at 5% significance level (Table II in Bhargava et al. (1982)).

**Table 4. Wives' Reaction to the Husbands' Job Loss (2): Dynamic model**

*Dependent variable: Wife's paid labor hour changes from the last year*

| | (1a) | (1b) | (2a) | (2b) | (3a) | (3b) |
|---|---|---|---|---|---|---|
| Husband's job loss | 2.8083 *** | 2.0524 *** | 2.5493 *** | 2.2766 *** | 2.2372 *** | 2.4443 *** |
| | (1.3796) | (1.3019) | (1.5209) | (1.4391) | (1.5178) | (1.4418) |
| Husband's job loss in the previous year | | | -0.6182 | 0.4686 | -1.1599 * | 0.7386 |
| | | | (1.3387) | (1.1989) | (1.3712) | (1.3121) |
| Husband's job loss 2 years before | | | | | -1.0415 | 0.1911 |
| | | | | | (1.5953) | (1.4449) |
| Wife's paid labor hour changes in the previous year | -0.2914 *** | -0.2907 *** | -0.2913 *** | -0.2905 *** | -0.2911 *** | -0.2896 *** |
| | (0.0234) | (0.0214) | (0.0234) | (0.0214) | (0.0234) | (0.0213) |
| Wife's paid labor hour changes 2 years before | -0.1027 *** | -0.0897 *** | -0.1030 *** | -0.0897 *** | -0.1031 *** | -0.0893 *** |
| | (0.0183) | (0.0171) | (0.0183) | (0.0171) | (0.0183) | (0.0171) |
| Financial asset holdings | -0.0007 ** | -0.0002 *** | -0.0007 ** | -0.0002 *** | -0.0007 ** | -0.0002 *** |
| | (0.0003) | (0.0005) | (0.0003) | (0.0005) | (0.0003) | (0.0006) |
| Financial asset holdings in the previous year | | -0.0004 ** | | -0.0004 ** | | -0.0004 ** |
| | | (0.0007) | | (0.0007) | | (0.0007) |
| Wife's age | 0.0803 | 0.1157 | 0.0838 | 0.1174 | 0.0757 | 0.1057 |
| | (0.6971) | (0.5564) | (0.6928) | (0.5525) | (0.6920) | (0.5530) |
| Wife's age * Wife low educational attainment | 0.1362 | 0.0633 | 0.1360 | 0.0679 | 0.1440 | 0.0746 |
| | (0.1771) | (0.1683) | (0.1771) | (0.1684) | (0.1775) | (0.1691) |
| Number of children | -2.2351 *** | -2.0300 *** | -2.2489 *** | -2.0267 *** | -2.2551 *** | -2.0573 *** |
| | (0.7459) | (0.7478) | (0.7447) | (0.7461) | (0.7437) | (0.7456) |
| Number of children * wife low educational attainment | 0.4032 | 0.7720 | 0.4192 | 0.7766 | 0.4330 * | 0.8168 |
| | (1.3096) | (1.2583) | (1.3094) | (1.2581) | (1.3081) | (1.2581) |
| Constant | -0.0725 | 0.0709 | -0.0843 | 0.0675 | -0.0919 | 0.0779 |
| | (0.8381) | (0.5456) | (0.8347) | (0.5417) | (0.8334) | (0.5420) |
| Number of the observations | 4212 | 4052 | 4212 | 4052 | 4212 | 4052 |
| Number of the individuals | 884 | 856 | 884 | 856 | 884 | 856 |
| Wald-test for all the exclusion restrictions | 210.36 *** | 237.46 *** | 211.55 *** | 237.27 *** | 212.14 *** | 236.69 *** |
| Sargan's OID test | 50.00 | 101.35 | 49.88 | 101.48 | 49.73 | 101.9 |
| Test for $E(\Delta u_{it}\Delta u_{it-2}) = 0$ | 0.51 | 0.11 | 0.52 | 0.11 | 0.53 | 0.12 |

Notes. 1. To treat dynamic aspects of wife's labor supply, we conduct GMM estimations (Arellano- Bond (1991)).

2. All the estimations include year dummy variables for 1995-2004.

3. Instruments used in the estimation (1) are two-year-lagged wife's labor hours, and levels and lagged variables of all the other explanatory variables. Those in the estimation (2) are two-year-lagged wife's labor hours, two or more lagged husband's job loss, and all the other explanatory variables.

4. See the notes in Table3.

**Table 5. Who Raised Working Hours?**

| | The Entire Households | Without husband's job-loss | With husband's job-loss |
|---|---|---|---|
| | Mean (Standard Deviation) | Mean (Standard Deviation) | Mean (Standard Deviation) |
| Changes in wife's paid working hours from the previous year | 0.945 (10.213) | 0.897 (10.179) | 4.119 (11.901) |
| Panel A: for the wife who was working in the last year | | | |
| Changes in paid working hours | -1.460 (11.263) | -1.502 (11.308) | 0.750 (8.421) |
| Panel B: for the wife who was not working in the last year | | | |
| Changes in paid working hours | 2.958 (8.750) | 2.891 (8.645) | 8.611 (14.339) |
| % Started working | 13.76% | 13.52% | 33.33% |
| [as a full time worker] | 8.30% | 8.18% | 12.50% |
| % Started working or Seeking Jobs | 14.72% | 14.45% | 37.04% |

Note. We summarize characteristics for the estimated samples; the number of the entire observations is 4212. The family who faced the husband's job-loss is 1.50%.