# Unemployment and Spousal Labor Supply:
# Evidence from South Korea

Kim, Jung Hyun[*]

실업을 당했을 때 배우자가 노동 공급을 증가시키는 현상을 부가 노동 효과(added worker effect) 라고 한다. 본 연구는 한국노동패널(KLIPS) 자료를 이용하여 가구주가 실업할 경우 발생하는 부가 노동 효과를 추정하고자 한다. 부가 노동 효과를 추정하기 위해 이중차분법을 활용하여 가구주의 배 우자의 노동공급을 외연(extensive margin) 및 심도(intensive margin) 효과로 나누어 본다. 분석 결 과 부가 노동 효과는 주로 외연 효과에서 발생하며, 가구주가 실업할 배우자의 노동공급이 약 5.54 퍼센트 포인트 증가한다. 더 나아가 배우자의 교육 수준, 자녀 수, 가구 내 유동적 자산, 가구주의 소 득별로 부가 노동 효과가 상이하게 나타난다.

주요용어 : 실업, 노동공급, 부가노동자효과, 이중차분법

# I. Introduction

Insurance mechanisms against unemployment can be divided into three levels. To smooth consumption during unemployment spells, individuals may use the private credit and insurance markets to insure against unemployment. This is an example of insurance at the individual level. At the household level, other family members may adjust their labor supply in response to unemployment through the substitution of leisure between household members. At the state level, unemployment insurance (UI) programs should be carefully designed to account for both individual and household level responses to unemployment. To minimize welfare loss, additional public benefits may be necessary if individuals are credit constrained and if other household members do not adjust their labor supply under unemployment. On the other hand, the state-provided insurance benefits may exceed the socially optimal levels, thus inefficient, if flexible labor supply adjustments at the household level are not taken into consideration. Hence, policy makers should consider not only the individual level response but also the household level response to job loss when designing UI program.

---

* 연세대학교 경제학과 석사과정, coby_kim27@yonsei.ac.kr

This paper focuses on the household-level risk sharing mechanism under unemployment. Assuming that leisure is a normal good, an exogenous unemployment of a primary earner leads to the secondary earner's increase in labor supply. Such household-level insurance through the labor market is called the "added worker effect" (AWE). The substitutability of leisure (home production) between couples, the income effect, and credit constraints are the primary channels of the AWE. Despite unambiguous predictions in theory, identifying a significant and large AWE has been difficult in the empirical literature.

In this study, I investigate the causal effect of household head's involuntary unemployment on spousal labor supply in South Korea by using difference-in-differences (DID) methodology. The main results are consistent with theoretical predictions and previous empirical studies. At the extensive margin, an involuntary unemployment of the household head increases the probability of the spouse's employment by approximately 5.54 percentage points at the 5% significance level, which corresponds to a 31.48% increase in spouse's employment probability. The result is robust to various sample restrictions. Observing household-level insurance behavior via increases in spousal labor supply response, however, does not imply that households fully insure against unemployment as spouse's earnings level is much lower than that of the household heads in South Korea.

Spouses do not increase their labor supply at the intensive margin. Therefore, focusing on the significant extensive margin response, I further examine heterogenous effects by spouse's education level, number of young children in the household, net asset level, household head's income level, and UI receipt. High-skilled spouses take advantage of the household insurance mechanism since they have better employment opportunities. Hence, the response is stronger for spouses holding a college degree or above. The added worker effect is also significant for couples with children below 18, suggesting that the substitutability of non-market time between couples is different by the age of children. I also find significant effects among households at the lowest 50% of net asset level and at the top 50% of head's earnings level, respectively. Hence, labor supply response of spouses differs by the stock and flow of income. Unlike Cullen and Gruber (2000), the crowding out effect of unemployment benefits is small.

I contribute to the existing literature in threefold. By exploring the labor supply response of spouses at extensive and intensive margins and across various subgroups, this paper identifies the types of households that use the intra-household insurance mechanism and the types that do not. From a policy perspective, the subgroup analysis can be helpful in determining the specific target of UI beneficiaries. This paper is also closely related to Halla et al. (2020) who examine the role of social norms in Austria. South Korea's high educational attainment yet low labor force participation of women provide a unique setting to investigate the added worker

effect in a country where the husbands are typically primary earners. Lastly, this study is one of the few works that consider the role of information emphasized by Stephens (2002). Since South Korean law requires employers to notify the termination of employment contract in advance, I examine the effect upon unemployment notification. Spouses of unemployed heads supply labor significantly at the quarter of unemployment notification, but the significance gets stronger after a year of the unemployment.

The rest of this paper is structured as follows. Section 2 reviews previous literature and institutional setting of South Korea. Section 3 describes the identification strategies. Section 4 introduces the data and the analysis sample. Section 5 provides empirical results, and the Section 6 concludes.

## II. Literature and Institutional Setting

Assuming unemployment as a labor supply constraint, Ashenfelter (1980) examines the labor supply of other family members under a static model that jointly maximizes household utility under a household budget constraint. When a household member loses a job, other family members increase their labor supply if their non-market time is substitutable with the unemployed member. Heckman and Macurdy (1980) formulate a dynamic life-cycle model of the labor supply of married women under perfect certainty and perfect capital markets. They highlight the importance of distinguishing between a "permanent" and "transitory" income shock, and with no labor supply response of wives under transitory shocks, they find evidence supporting the permanent income hypothesis. Stephens (2002) presents a family life-cycle labor supply model with uncertainty, on which the theoretical framework and predictions of this paper rely. Consistent with previous models, this model predicts that spouses will permanently increase their work effort in response to their heads' unemployment. Furthermore, the timing and magnitude of the AWE depend on prior belief, timing of new information, and the size of the income shock.

Previous studies have made efforts to find the existence and measure the magnitude of the AWE by examining the effect of unemployment of husbands on the spousal labor supply.[2] The

---

2) Most studies use husbands as a proxy for household heads. The effect of unemployment of wives on husband's labor supply has received less attention since household structure in the past mainly followed a male breadwinner model, husbands taking the role of a primary earner. Despite the sharp rise of dual-income households in recent years, earnings of husbands are in general larger than those of wives. AWE literature focuses on the effect of husband's unemployment due to such reasons.

added worker effects, however, have been insignificant or small due to several empirical challenges. Assortative mating, by which spouses of frequently unemployed earners exhibit similar tastes for work, will impart a downward bias on AWE. Discouraged worker effect also masks the AWE. Spouses of earners who were unemployed due to adverse local or industrial shocks will also fall under similar labor market conditions and thus high unemployment risk. This is in line with concept of assortative mating if couples tend to work in similar sectors. Under perfect capital market, households draw on private savings and borrowings to smooth consumption during the unemployment spell (Mincer, 1962; Heckman and Macurdy, 1980). Using age as a proxy for savings and credit accumulation, Cullen and Gruber (2000) find that the AWE is stronger for young couples in the U.S. who typically face capital market imperfections. Spouses may make permanent adjustments in labor supply if their heads have a high risk of unemployment and pre-unemployment adjustments if they expect an increase in the likelihood of unemployment (Heckman and Macurdy, 1980; Stephens, 2002). State-provided UI crowds out spousal labor supply (Cullen and Gruber, 2000). Also, social norms, gender roles, and family structure may inhibit AWE (Halla et al., 2020).

Park (2009) studies the added worker effect in South Korea and finds that the discouraged worker effect is larger than the added worker effect due to assortative mating and that the probability of wife's employment decreases with the number of young children. However, her study uses year-level data, so the timing and dynamics of the effect are not captured. Moreover, effects on the intensive and extensive margins as well as heterogenous effects across different subgroups are not considered. Hence, with the addition of more recent data the case in South Korea is worth reexamination.

To shed light on the limited size of the AWE in previous literature, this paper explores the AWE in South Korea, focusing on the extensive margin. The setting of South Korea is an interesting case. Married women in South Korea are typically not household heads, and despite significant improvements in educational attainment of women, the labor force participation rate of women is low and the gender wage gap high. Based on the Program for International Student Assessment in 2018, female students in South Korea outperform male students in reading by 23 points in average, ranking 6th among OECD countries. Despite male students performing better in mathematics and science than female students, the scores differ by only 4 points. Moreover, 47.6% of female population aged 25 to 64 in South Korea attained tertiary education in 2019, which is above the OECD average. In contrast, South Korea's labor force participation rate of women aged between 15 and 64 in 2019 is 60%, below the OECD average of 65%, while that of men was 78.8%. The gender wage gap in South Korea is 36.7%, the highest among OECD countries as of 2019. The low labor force participation rate of women in

South Korea despite similar levels of skill in terms of educational attainment provides a unique setting to analyze the AWE at the extensive margin.

I also contribute to growing literature on the role of social norms in labor market outcomes. Although the traditional attitudes towards women are changing in South Korea, household duties like childcare and domestic chores are still expected to be performed by non-primary earners. In a national survey conducted in 2008, 75.8% of household heads thought that spouse should do all or most housework and 96.6% of the respondents agreed with the view, "It is better for mothers to take care of children under 2." In 2020, the opinions on sharing housework did change, but 41.9% of household heads still think that spouse should be responsible of most or all housework. Actual conditions of sharing housework, however, did not change with 76.2% of the respondents reporting that wives perform all or most housework (KOSIS). South Korea's fixed gender roles are also reflected in the labor market, in which women typically exit the labor market upon motherhood (OECD). I provide suggestive evidence of the importance of gender identities by examining heterogenous effects by spouse's earnings potential and by number of children.

## III. Empirical Strategy

To identify the causal effects of head's unemployment on the spousal labor supply and household consumption, I use a difference-in-differences approach. The following equation is estimated.

$$Y_{itk} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_k + \beta_3 Treat_i {}^* Post_k + X_{it}{}'\pi + \mu_i + \tau_t + \epsilon_{itk}$$

(1)

$Y_{itk}$ is the outcome of interest for household $i$ in year $t$ at $k \in [-8, 8]$, where $k$ represents the number of quarters relative to the reference quarter, which is normalized to $k = 0$. To also estimate an event study version of (1), I set the size of the event window to 17 quarters, so the window begins 8 quarters before and ends 8 quarters after the reference quarter. The reference quarter is defined as the quarter before unemployment notification or two quarters before the unemployment event. Article 62 of Labor Standards Act in South Korea, which was effective throughout the time period covering the sample, requires employers to notify employees at least 1 month before dismissing their workers. The life-cycle model of Stephens (2002) predicts that spouses will update their information and make pre-unemployment labor

supply adjustments if news of unemployment arrives before the actual event. Hence, I examine the effects upon notification.

$Treat_i$ is a dummy variable indicating whether household $i$ is in the treatment group. The treatment group includes households in which heads experience unemployment due to firm closure, dismissal, resignation under instruction, or other reasons for unemployment the respondents characterized as an involuntary job loss, including insufficient duties and voluntary redundancy. Unemployment of self-employed workers is excluded since the choice of labor supply is endogenous for self-employed workers. The control group, for which $Treat_i$ equals zero, includes households in which the heads never experienced unemployment due to the aforementioned reasons. The reference quarters of control group households are chosen to match the distribution of the years of unemployment of the treatment group since unemployment events of heads do not occur in this group.. Following Halla et al. (2020), the specific years and quarters are chosen through random sampling. This means that a placebo unemployment event occurs two quarters after the reference quarter for the control group. $Post_k$ is a dummy variable indicating periods after the reference quarter, which equals to one if $k > 0$. The interaction term $Treat_i \times Post_k$ is an indicator for treated households at post-reference quarters. If the outcome variable is spouse's employment, the family life-cycle labor supply model with uncertainty predicts $\beta_3$ to be positive, especially under an unexpected unemployment and larger wealth loss.

The vector of covariates $X_{it}$ includes age of spouse, its squared term, number of children below 18, spouse's years of education, and head's years of education for household i at year $t$. I also control for household and year fixed effects. Household fixed effects will absorb time-invariant unobserved heterogeneity in household characteristics, such as ability or propensity to work, that may be correlated with both head's unemployment and the outcome variable. Year fixed effects will capture time factors that are common to all households for a given year. Standard errors are clustered at the household level.

## IV. Data and Analysis Sample

The data used in this study is the Korean Labor and Income Panel Study (KLIPS). KLIPS is an annual longitudinal study on South Korean households and individuals residing in urban areas, surveying their labor market outcomes or income activities. Waves 1 to 23 are all used, and the household, individual, and work history datasets are merged. The work history dataset

contains respondents' information on each job, including the industry, occupation, earnings, size of firm of their jobs. I transform the work history data into a quarterly panel using employment and unemployment dates as respondents provide the exact dates of employment and unemployment. The panel dataset is an unbalanced panel. As noted by Stephens (2002), using a balanced panel may mask the true effects of spousal unemployment because all couples who separate or drop out from the study due to unemployment will be excluded in the sample. Data including sex, age, marital status, number of children, consumption, and asset are obtained from the individual and household datasets. Note that these datasets only provide year-level information. However, I argue that this will not pose a serious problem since most of the variables used in the individual and household datasets are time-invariant and since the pre-treatment and post-treatment outcomes are measured over two years each.

The sample is composed of married couples between ages 19 to 65. To better capture the impact of unemployment, I also restrict the heads to be employed one quarter before the unemployment notification, ensuring that the heads have had at least 3 months of tenure. Following Halla et al. (2020), I divide the sample into two. The sample for the intensive margin uses spouses who are employed in all four quarters before the actual unemployment event (3 quarters before the reference quarter). The main sample, which is used to examine behaviors at the extensive margin, extracts spouses who are unemployed in any of the four quarters before the reference quarter. For robustness checks, I further restrict the main sample to ages between 25 to 55, couples working in different industries, and households whose heads experience longer unemployment spells.

The summary statistics of the head characteristics and spouse characteristics for the main sample (the sample for the extensive margin) at the reference quarter are presented in Tables 1 and 2, respectively. The heads in the treatment group are older than heads in the control group. The treated heads are less educated, work in smaller-sized firms, and earn less than control heads. heads of the treatment group are more likely to work in the manufacturing industry and less in the service industry. Both treatment and control households have similar number of children under 18. Likewise, the spouses in the treatment group are older, less educated, earn less, more likely to work in the manufacturing industry, and less likely to work in the service industry than those of the control group. Since spouses who are unemployed in any of the four quarters before the reference quarter are selected for the main sample, the

<Table 1> Summary Statistics of Household Head

|  | Control | Treatment |
| --- | --- | --- |
| Age | 39.71 | 42.89 |
|  | (8.714) | (9.663) |
| Years of Education | 13.57 | 12.07 |
|  | (2.817) | (3.124) |
| No. of Young Children | 1.204 | 1.207 |
|  | (0.924) | (0.957) |
| Earnings | 293.2 | 247.4 |
|  | (204.7) | (146.9) |
| Size of Firm | 474.4 | 135.3 |
|  | (1812.5) | (308.2) |
| Manufacture | 0.320 | 0.344 |
|  | (0.467) | (0.476) |
| Service | 0.483 | 0.408 |
|  | (0.500) | (0.492) |
| Number of Households | 793 | 387 |
| Observations | 1180 | |

Note: The values are means and standard deviations at the reference date using 1999-2018 Korean Labor and Income Panel Study (KLIPS). Standard deviations are in parenthesis. Earnings are presented in real terms using the Consumer Price Index (CPI) with a base year of 2015. Missing values due to non-response or "don't know" responses are imputed with individual mean. Respondents answered the size of firm as categories if they do not know the exact number of employees in their firm. I used the average value of each range to obtain a continuous variable.

employment rates of spouses at the reference quarter are low, about 11% for the control group and 17.6% for the treatment group. Among the employed spouses, the difference in hours worked in week is small between the control and treatment groups. In average, employed spouses in the control group work 46.29 hours per week, and those in the treatment group work 44.84 hours per week. Note that the earnings level of heads is more than twice than the level of spouses They differ by more than one million won in real terms for both treated and control groups, showing a large household wage gap for the main sample. Therefore, low earnings level of spouses may reduce the magnitude of the added worker effect and prevent households to smooth consumption via labor supply adjustments.

$$Y_{itk} = \alpha + \gamma Treat_i + \sum_{j=-8}^{8} 1(k=j)^* Treat_i + X_{it}'\theta + \nu_i + \phi_t + u_{itk} \qquad (2)$$

<Table 2> Summary Statistics of Spouses

| | Control | Treatment | Unemployed Control | Unemployed Treatment | Employed Control | Employed Treatment |
|---|---|---|---|---|---|---|
| Employed | 0.110 (0.313) | 0.176 (0.381) | | | | |
| Hours Worked (weekly) | 46.29 (15.05) | 44.84 (16.64) | | | 46.29 (15.05) | 44.84 (16.64) |
| Age | 37.14 (8.469) | 39.91 (9.450) | 37.12 (8.534) | 39.76 (9.633) | 37.26 (7.967) | 40.63 (8.564) |
| Years of Education | 12.90 (2.733) | 11.45 (3.217) | 12.94 (2.712) | 11.58 (3.241) | 12.52 (2.881) | 10.88 (3.059) |
| No. of Young Children | 1.204 (0.924) | 1.207 (0.957) | 1.204 (0.938) | 1.197 (0.946) | 1.207 (0.809) | 1.250 (1.013) |
| Earnings | | | | | 131.0 (83.64) | 111.8 (67.42) |
| Size of Firm | | | | | 233.1 (374.3) | 131.0 (284.7) |
| Manufacture | | | | | 0.264 (0.444) | 0.353 (0.481) |
| Service | | | | | 0.701 (0.460) | 0.618 (0.490) |
| Observations | 1180 | | 1025 | | 155 | |

Note: The values are means and standard deviations at the reference date using 1999-2018 Korean Labor and Income Panel Study (KLIPS) surveys. Standard deviations are in parenthesis. Earnings are presented in real terms using the Consumer Price Index (CPI) with a base year of 2015. Missing values due to non-response or "don't know" responses are imputed with individual mean. Respondents answered the size of firm as categories if they do not know the exact number of employees in their firm. I used the average value of each range to obtain a continuous variable.
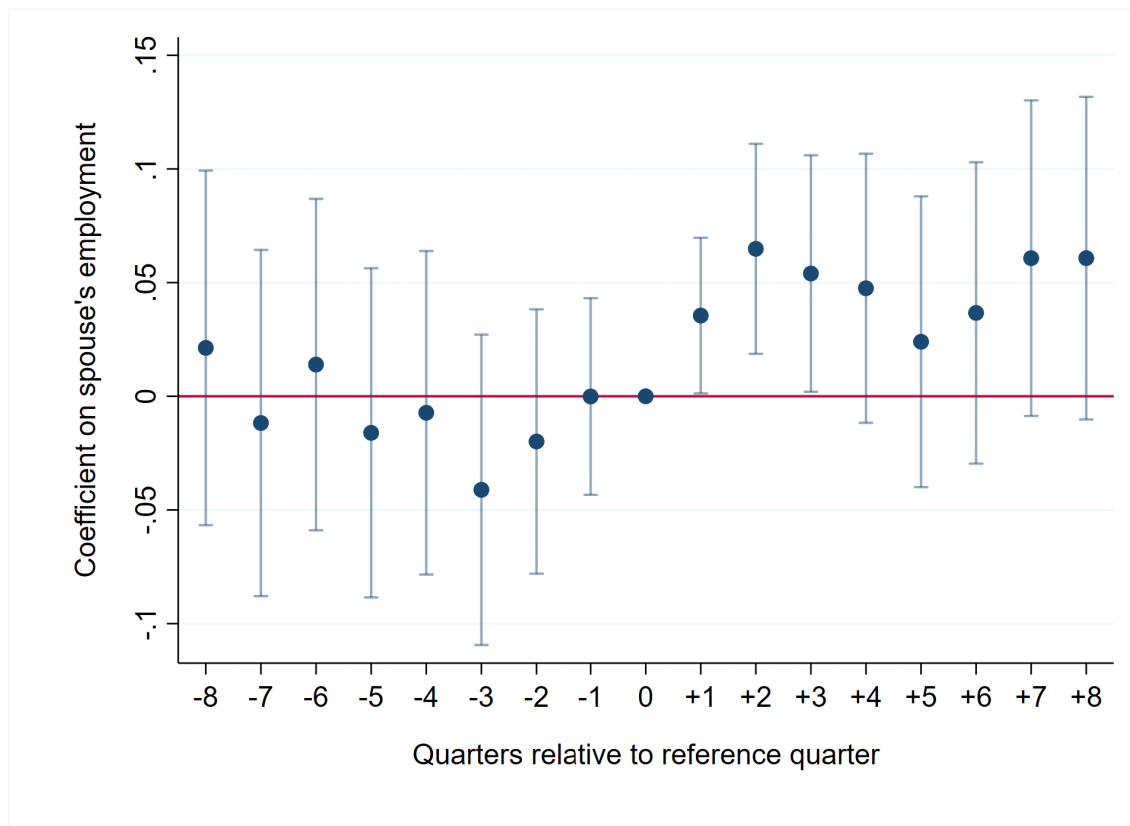
<Table 3> Pre-Treatment Effects on Spouse's Employment

|  | Employment |
|---|---|
| $\delta_{-8}$ | 0.0213 |
|  | (0.0398) |
| $\delta_{-7}$ | −0.0118 |
|  | (0.0388) |
| $\delta_{-6}$ | 0.0140 |
|  | (0.0372) |
| $\delta_{-5}$ | −0.0161 |
|  | (0.0369) |
| $\delta_{-4}$ | −0.00726 |
|  | (0.0363) |
| $\delta_{-3}$ | −0.0411 |
|  | (0.0348) |
| $\delta_{-2}$ | −0.0199 |
|  | (0.0296) |
| $\delta_{-1}$ | −7.84e−05 |
|  | (0.0220) |
| Observations | 16,088 |
| No. of Households | 1,250 |
| R-squared | 0.058 |

Note: Only the pre-treatment coefficients of the interaction term for Equation (2) are presented. The base level of the regression is set to the reference quarter ($k = 0$). Robust standard errors, shown in parentheses, are clustered at the household level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Before presenting the main results, I first check the identifying assumption of the empirical approach. The key identifying assumption of the difference-in-differences strategy is that the outcomes for treatment and control groups follow parallel time trends in the absence of treatment. To test the parallel trends assumption, I show that the pre-trends between the two groups in the main sample are similar. I regress the following equation on spouse's employment, using the same set of covariates and fixed effects, and also plot the coefficients of the interaction term in Equation 2.

Table 3 shows that labor supply responses in the quarters leading up to the unemployment notification are close to zero and insignificant at the 5% significance level. The parallel trends prior to unemployment notification support that households whose heads do not experience an involuntary unemployment provide a valid counterfactual. The plots of spouses' mean employment rates and coefficients of head's unemployment effects on spouse's employment probability are shown in Figure 1. These plots show that the employment behaviors of spouses of the treatment and control groups follow a similar trend until the reference quarter. Such visual presentation of pre-treatment parallel trends further validates the identifying assumption.

[Figure 1] Dynamic DID Estimates on Spouse's Employment



## V. Results

### 1. Main Results

Estimates of the Equation 1 are presented in Table 4. As shown in column 3, an involuntary unemployment of head increases the probability of spouse's employment by approximately 5.5 percentage points at the 5% significance level. Given that the employment rate of spouses in the treatment group at the reference quarter is 0.176, this corresponds to a 31.48% increase in employment probability. Despite the increase, the added worker effect is still insufficient to fully insure against the loss in head's income since spouses can compensate only half of the loss, considering the household wage gap explained in Section 4. In terms of magnitude, the effect at the extensive margin is comparable with the effect in the Austrian setting, in which the pre-event employment rate is 0.111 and the DID estimate is 0.019, corresponding to a 17.11% increase in employment probability under head's displacement (Halla et al., 2020). Columns 1

<Table 4> Estimates of the Added Worker Effect at the Extensive Margin

| | Employment | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Treat×Post | 0.0686*** | 0.0700*** | 0.0554** |
| | (0.0251) | (0.0248) | (0.0246) |
| Age of spouse | | 0.0487*** | 0.117*** |
| | | (0.00840) | (0.0288) |
| Age of spouse^2 | | −0.000554*** | −0.00104*** |
| | | (0.000106) | (0.000354) |
| No. of young children | | −0.0234** | −0.0744*** |
| | | (0.00942) | (0.0187) |
| Years of Education (Spouse) | | 0.00784* | −0.0252 |
| | | (0.00427) | (0.0314) |
| Years of Education (Head) | | −0.0125*** | 0.0346 |
| | | (0.00403) | (0.0367) |
| Household fixed effect | No | No | Yes |
| Year fixed effect | No | No | Yes |
| Observations | 16,088 | 16,088 | 16,088 |
| R-squared | 0.015 | 0.035 | 0.041 |
| No. of households | | 1,250 | |

Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

and 2 show the regression results without any controls and without fixed effects, respectively. The causal estimate of the added worker effect in the full model is higher than the estimates in columns 1 and 2. This implies that discouraged worker effect due to macroeconomic shocks and assortative mating with respect to unobservables like ability impart a downward bias on the added worker effect.

Since spouses increase their labor supply at the extensive margin under the unemployment of heads, a natural question to ask next is the timing of the effect. Table 5 reports the estimation results of Equation 2 for the post-reference quarters. The post-treatment effects are in general positive. There is an immediate labor supply response of spouses during the quarter right after the head's unemployment notification, which is strong and significant at the 5% significance level. The effect exists long term, during the last quarters of the window. After 7 and 8 quarters of heads' unemployment notification, spouses increase their labor supply by roughly 6 percentage points at 10% significance levels, respectively. This suggests that immediate labor adjustments through information updates may be limited for some households due to labor market frictions and job search periods.

<Table 5> Dynamic Labor Supply Response at the Extensive Margin

|  | Employment |
|---|---|
| $\delta_1$ | 0.0355** |
|  | (0.0174) |
| $\delta_2$ | 0.0649*** |
|  | (0.0235) |
| $\delta_3$ | 0.0540** |
|  | (0.0265) |
| $\delta_4$ | 0.0475 |
|  | (0.0302) |
| $\delta_5$ | 0.0240 |
|  | (0.0326) |
| $\delta_6$ | 0.0367 |
|  | (0.0338) |
| $\delta_7$ | 0.0608* |
|  | (0.0354) |
| $\delta_8$ | 0.0608* |
|  | (0.0362) |
| Control variables | Yes |
| Household fixed effect | Yes |
| Year fixed effect | Yes |
| Observations | 16,088 |
| No. of Households | 1,250 |
| R-squared | 0.058 |

Note: Robust standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

## 2. Effect at the Intensive Margin

The added worker effect of spouses under heads' unemployment can be different by the margins of response. spouses who are not employed first make a participation decision under the unemployment of heads. They enter the labor market if such participation can reduce the loss of expected household lifetime utility from heads' unemployment. For spouses who are already employed, they decide whether or not to increase the hours of work by, for instance, finding a new job. In this section, I examine the latter case and find out whether the people who are already in the labor market work more to compensate the income loss from head's unemployment. Column 1 and 2 of Table 6 presents the effect of head's unemployment on spouse's labor market outcomes at the intensive margin, using the sample defined in Section 4. Here, the results are unconditional on post-reference employment. An unemployment of head has no effect on the hours of work of spouses who are already participating in the labor market by Therefore, added worker effect is not observed at the intensive margin.

<Table 6> Estimates of the Added Worker Effect at the Intensive Margin

| | (1) Employment (Unconditioned) | (2) Hours of Work (Unconditioned) | (3) Hours of Work (Conditioned) |
|---|---|---|---|
| Treat×Post | −0.00420 (0.0193) | 0.323 (0.783) | −0.0348 (0.778) |
| Control variables | Yes | Yes | Yes |
| Household fixed effect | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes |
| Observations | 12,114 | 11,127 | 7,853 |
| R−squared | 0.043 | 0.014 | 0.028 |
| Number of pid | 802 | 802 | 519 |

Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Among the sample of spouses for the preceding models, column 3 specifically examines spouses who continue to work until a quarter after the head is actually unemployed ($k = 3$). Conditional on pre-reference and post-reference employment, spouses do not adjust their hours of work. Because the exogenous unemployment of heads is associated with the unemployment of spouses, I argue that the discouraged worker effect dominates the added worker effect in this case.

## 3. Heterogenous Effects

Identifying which type of households are responsive to the income loss from unemployment can be important in designing effective unemployment insurance programs. Married couples who can flexibly switch the primary-earner role with same earnings potential can fully insure against an unexpected unemployment without the need for public insurance mechanisms. A cost-effective unemployment insurance program would target those couples whose household insurance mechanisms cannot fully insure against unemployment. Therefore, I now turn to heterogeneity analysis and examine differential impacts of head's unemployment by number of children, spouse's education level, household asset level, and head's income level at the reference quarter.

Table 7 reports the extensive margin of the added worker effect by the number of children at 18 or below. The added worker effect is strong and statistically significant for couples with children below, shown by column 2. Treated spouses increase their labor supply by 5.9

<Table 7> Spouse's Labor Supply Response by Number of Children and Education Level

| | (1) No child or Child above 18 | (2) Children 18 or below | (3) College degree or above | (4) Below college |
|---|---|---|---|---|
| Treat×Post | 0.0455 | 0.0589** | 0.104** | 0.0318 |
| | (0.0494) | (0.0286) | (0.0439) | (0.0298) |
| Control variables | Yes | Yes | Yes | Yes |
| Household fixed effect | Yes | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes | Yes |
| Observations | 4,539 | 11,549 | 5,657 | 10,431 |
| R-squared | 0.031 | 0.059 | 0.072 | 0.042 |
| No. of Households | 396 | 854 | 468 | 782 |

Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

percentage points upon their heads' unemployment notification. Column 1 shows an insignificant effect for households without children aged below 18. Most of the spouses in these households are in their pre-motherhood stage or near their retirement age, a suggestive evidence for the insignificance. This suggests that leisure, specifically time spent on childcare, is not substitutable for these couples with children aged 18 or below.

Spouses who assume more childcare duties will have higher reservation wage, preventing them to participate in the labor market. Overall, these results are consistent with South Korea's fixed gender role, considering that most non-working members among married couples are women in South Korea. Education, an investment in human capital, increases worker's earnings potential. Because spouses with higher earnings potential will have higher reservation wage, they are not likely to respond to their head's unemployment unless offered with high paying jobs. On the other hand, the substitutability of leisure, specifically time spent on housework, between couples with well-paid spouses will be higher than the substitutability with low-paid spouses. Theoretical prediction of the added worker effect by education level is ambiguous due to these two counteracting forces from skill accumulation. As shown in columns 3 and 4 in Table 7, the added worker effect is strong and significant for spouses with a college degree or above. This means that the cross-substitution effect is large enough to increase the labor supply of skilled spouses with higher earnings potential.

Table 8 reports heterogeneous effects by net asset and head's income at the reference quarter. I divide these characteristics into high-level and low-level groups. In theory, countervailing channels also exist based on the family life-cycle labor supply model (Stephens, 2002). Low-asset households are less capable of smoothing the earnings loss, which results in a

<Table 8> Spouse's Labor Supply Response by Net Asset and Household Head's Income

|  | Net Asset | | Head's Income | |
|---|---|---|---|---|
|  | (1) Lowest 50% | (2) Top 50% | (1) Lowest 50% | (2) Top 50% |
| Treat×Post | 0.0584* (0.0312) | 0.0558 (0.0395) | −0.0110 (0.0326) | 0.114*** (0.0373) |
| Control variables | Yes | Yes | Yes | Yes |
| Household fixed effect | Yes | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes | Yes |
| Observations | 7,990 | 8,081 | 7,888 | 7,979 |
| R-squared | 0.067 | 0.031 | 0.045 | 0.050 |
| Number of pid | 624 | 624 | 617 | 616 |

Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

larger added worker effect compared to high-asset households. On the other hand, heads of low-asset households, whose skills and earnings are typically low, face higher probability of job loss. Hence, the households respond ex ante by increasing spouse's labor supply and/or by decreasing the household consumption level, which results in a small added worker effect. For high-asset households whose prior belief is a low unemployment risk, the head's unemployment will be unexpected, leading to a large added worker effect. Results in columns 1 and 2 show that the households at the lowest quartile of asset distribution. In terms of head's income before unemployment, an additional effect of the magnitude of the earnings loss also takes place on top of the countervailing channels. The larger the magnitude of earnings loss due to unemployment, the larger the added worker effect. Based on columns 3 and 4, the households at top 50% of the head's income at the reference date are affected by the head's unemployment shock.

## 4. Robustness Checks

As robustness checks, four exercises are performed. First, under assortative mating, couples are likely to work in the same industry. If the unemployment of heads is driven by adverse economic shocks at the industry level, then spouses who work in the same industry will have low employment prospects. In such a case, the discouraged worker effect may bias the added worker effect downwards. I restrict the sample to couples who work in the different industry at

<Table 9> Robustness Checks

|  | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Treat×Post | 0.0741*** | 0.0620* | 0.0853* | 0.0553** |
|  | (0.0278) | (0.0332) | (0.0440) | (0.0278) |
| Control variables | Yes | Yes | Yes | Yes |
| Household fixed effect | Yes | Yes | Yes | Yes |
| Year fixed effect | Yes | Yes | Yes | Yes |
| Observations | 10,480 | 12,762 | 11,614 | 12,976 |
| R-squared | 0.044 | 0.036 | 0.036 | 0.046 |
| Number of pid | 828 | 1,024 | 946 | 991 |

Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

the reference date to rule out this effect. For spouses who are not employed at the reference date, I used the industry in which they most recently worked. The difference-in-differences estimate in column 1 is consistent with the main result reported in Table 4, suggesting that the estimation is insensitive to industry shocks correlated at the household level.

Columns 2 and 3 use stricter sample definitions to confirm the robustness of the results. The main analysis does not restrict the employment of heads after the reference period. The estimation in columns 2 and 3, however, chooses couples whose heads were unemployed for 2 quarters and 1 year after the reference quarter, respectively. Results in columns 3 and 4 are positive and statistically significant at 10% significance levels, confirming the robustness of the findings.

Lastly, further age restriction is made since different labor supply behavior of young and old workers can possibly affect the main outcome of interest. South Korea has a high tertiary enrollment rate, which has been above 66% since 1998, and old workers will typically prepare for retirement. The inelastic labor supply of college students and old workers can therefore bias the added worker effect downwards. To address this concern, I further restrict the sample to ages between 25 and 54. The estimation result under the age restriction is reported in the last column of Table 9.

## VI. Conclusion

This study examines the added worker effect in South Korea. An involuntary unemployment of head increases the probability of spouse's employment by approximately 5.54 percentage

points at the 5% significance level. The response is observed upon notification of unemployment and long term. The effect is significant at the extensive margin, but not at the intensive margin. There is a large response among educated spouses (high-skilled spouses) and among households with children below 18. The spousal labor supply response is also driven by households at the bottom 50% of the asset distribution and at the top 50% of the head's income level prior to unemployment. Overall, the spousal labor supply response fails to offset the income loss from head's unemployment due to the household wage gap.

## Reference

Ashenfelter, Orley, "Unemployment as Disequilibrium in a Model of Aggregate Labor Supply," Econometrica, 1980, 48 (3), 547‐564.

Cullen, Julie Berry and Jonathan Gruber, "Does Unemployment Insurance Crowd out Spousal Labor Supply?," Journal of Labor Economics, 2000, 18 (3), 546‐572.

Halla, Martin, Julia Schmieder, and Andrea Weber, "Job Displacement, Family Dynamics, and Spousal Labor Supply," American Economic Journal: Applied Economics, October 2020, 12 (4), 253‐87.

Heckman, James J. and Thomas E. Macurdy, "A Life Cycle Model of Female Labour Supply," The Review of Economic Studies, 1980, 47 (1), 47‐74.

OECD, *Rejuvenating Korea: Policies for a Changing Society*, OECD Publishing, Paris, 2019.

___, *Adult education level (indicator)*, OECD Education Statistics, 2021.

___, *Gender wage gap (indicator)*, OECD Employment and Labour Market Statistics, 2021.

___, *Labour Market Statistics: Labour force statistics by sex and age: indicators (Edition 2020)*, OECD Employment and Labour Market Statistics (database), 2021.

Park, Jin Hee, "The Effect of Husband's Non-Employment Status on Wife's Labor Supply," Proceedings of the 10th Korean Labor and Income Panel Study Conference, 2009. (in Korean).

Stephens, Melvin Jr., "Worker Displacement and the Added Worker Effect," Journal of Labor Economics, 2002, 20 (3), 504‐537.