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By
Kyeongkuk Kim
Sang-Hyop Lee
Timothy J Halliday

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Kyeongkuk Kim
University of Hawaii at Manoa

Sang-Hyop Lee
University of Hawaii at Manoa

Timothy J Halliday[*]
University of Hawaii at Manoa and IZA

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Abstract

We investigate the effects of health shocks on labor supply among Korean married couples. Consistent with previous work, we find that own health shocks have substantial effects on own labor supply at the extensive margin. We also find evidence that spousal health shocks affect own labor supply, particularly, for wives. Specifically, we find that the onset of chronic illness for the husband reduces the probability of the wife exiting the labor force by 9.2 percentage points. This is the added worker effect (AWE). We find larger effects of spousal health shocks for chronic conditions than for acute conditions and accidents possibly because chronic conditions are associated with a smaller need for home care than acute conditions. Finally, we find stronger evidence of the AWE for households with co-residing adult children and for poorer household.

Key words: health, labor supply, couples

[+] Kim is a research economist at the Ministry of Strategy and Finance in South Korea. Lee and Halliday are professors in the Department of Economics and research fellows at the University of Hawaii Economic Research Organization at UHM. All errors are our own.

[*] Corresponding author. Address: 533 Saunders Hall; 2424 Maile Way; Honolulu, HI 96822. Phone: (808) 956-8615. E-mail: halliday@hawaii.edu.

I. Introduction

Health problems can have a large impact on households. This can either be due to involuntary departures from the labor force, decreases in hours worked, a greater need for in-home nursing care, or direct effects on medical expenditures. Insuring against these shocks, however, is often challenging. While disability, long-term care, and medical insurance do provide some buffer against incomes losses or increased medical expenditures, this insurance is typically incomplete. Given this, households are often forced to additionally rely on non-market insurance mechanisms to provide supplementary insurance.

When health shocks impact a member of a married couple, spousal labor supply (either on the labor market or at home) provides one such mechanism. On one hand, spouses can work more in response to a health shock to make up for lost income or increased medical expenditures. This is the so-called "added worker effect" or the AWE as initially discussed by Ashenfelter (1980), Heckman and McCurdy (1980), and Lundberg (1985). Alternatively, if the onset of a health issue necessitates increased home care, spouses can reduce their own labor supply to care for their sick spouse as discussed by Hurd (1990), Gustman and Steinmeier (2000), and Maestas (2001). We term this second effect, the "home care effect," or HCE.

In general, these two effects will work against each other. For some households, the AWE will be dominant, whereas for others, the HCE will be dominant. In the former case, labor supply will increase in response to a spousal health shock. In the latter case, it will decrease. Because of these powerful opposing effects, finding evidence of labor supply effects of health shocks can prove to be difficult and often requires a nuanced analysis of the data.

Nevertheless, understanding how labor supply responds to spousal health shocks is important as it provides insights into how well public and private insurance markets are functioning. In a world with perfect insurance markets, such labor supply responses are not necessary since insurance will pay out in response to higher medical expenditures or reduced income. Accordingly, in such a world, there is no need to adjust labor supply in response to the spouse's health status. However, in a world of missing insurance markets (*i.e.* incomplete health or disability insurance), people may need to adjust their supply in response to changes in their spouse's health status.

However, as we intimated above, empirical evidence for such labor supply responses is mixed which one would anticipate given that the AWE and HCE work against one another. Early work by Berger (1983) provides evidence that women work more in response to declines in their husbands' health status consistent with the AWE. On the other hand, McGeary (2009) finds that women are more likely to retire early to care for their sick spouses, which is more consistent with a dominant HCE. Other work by Parsons (1977) and Coile (2004) suggests that the linkage between a husband's illness and his wife's labor supply is weak. The evidence that there are impacts of the wife's health on the husband's labor supply is similarly mixed. For example, Berger (1983) finds evidence that husbands decrease their labor supply, whereas Coile (2004) reports a small increase.

In this study, we examine the effect of health shocks on household labor supply using the Korean Longitudinal Survey of Aging (KLoSA), a survey of relatively older South Korean households. South Korea (henceforth Korea) is an interesting case to study for several reasons. Korea is experiencing a rapid aging of its population but it lacks a well-developed old-age security net. Accordingly, the elderly in Korea tend to be more dependent on their labor income than public transfers compared to the elderly in other OECD countries (OECD, 2013). Moreover, out-of-pocket expenditure as a share of total health expenditure was 36.8 percent among Korean households in 2015, which was substantially higher than the OECD average of 21.3 percent. Moreover, while Korea does have a universal public health insurance system, the National Health Insurance, it has a ceiling on reimbursements and does not cover drugs and nursing home stays (OECD, 2017). Given the dearth of public insurance in Korea, this suggests that Korean households will need to utilize other means of insuring these health risks (e.g. labor supply adjustments).

There are several important features and contributions of this study. First and foremost, we investigate the effects of health shocks on couples' labor supply in a new setting, Korea. Most of the existing literature looks at the United States which has a more comprehensive social safety net for its elderly population. Second, we exploit the panel aspect of the data to construct measurements of exogenous health shocks that capture the onset of new health conditions. This circumvents many problems associated with simply using levels of health status which may be strongly associated with unobserved variables that are also correlated with labor supply. Third,

we employ detailed information on the type of health shock (e.g. severe vs. not severe, chronic vs. acute, etc.). Fourth, we employ measurements of labor force entry and exit using indicators from the previous survey wave of whether or not the individual was previously employed. Finally, we employ information on household assets and co-residence with adult children. This will allow us to conduct a more nuanced analysis of the data which is important since the AWE and the HCE may differ in their importance in different parts of the population. We view this as an important contribution as phenomena such as the AWE are very much responses to missing markets and these variables are indicative of which households would be the least likely to self-insure in the event of incomplete insurance.

Our findings are as follows. First, consistent with earlier studies we find that own health shocks are strongly associated with reduced own labor supply. Second, we find stronger evidence of the AWE for wives than for husbands. Specifically, we find that the onset of chronic illness for the husband reduces the probability of the wife exiting the labor force by 9.2 percentage points. The lack of an AWE for the husband may reflect the fact that women's earnings are usually a secondary source of household income for dual-earner couples, so that male workers may not be very sensitive to the economic impact of spousal health shocks. Third, we find that co-residence with adult children enhances the AWE for wives. The reason for this is that their presence mitigates the need for home care from the wife in response to a spousal health shock. Finally, we find that the AWE is strongest among the poorest households. These households are more likely to be liquidity constrained and are less able to rely on their savings to buffer the effects of a spousal health shock.

The remainder of the paper is organized as follows. In the next section, we discuss some of the previous work on this topic. After that, we discuss the data used. This is followed by a discussion of our research design and results. Finally, we conclude.

II. Existing Literature

Health Shocks and Own Labor Supply

We begin by discussing some mechanisms governing how health status affects own labor supply. Within the context of the canonical model of health investment from Grossman (1972), a shock to an individual's health stock constrains their stock of "healthy time" which in turn encroaches

on their ability to work. This is the first order effect. However, if one allows health to impact productivity as in a human capital model *a la* Becker (1964), matters become more nuanced as discussed by McClellan (1998). Productivity effects will behave like wage shocks in competitive labor markets and will have income and substitution effects as in the neoclassical labor supply model and so the net effect of a health shock will be ambiguous. Another channel by which health shocks can impact labor supply is the marginal utility of consumption. If health and consumption are complements then a shock to health status will reduce the marginal utility of consumption which will, in turn, dampen the incentives for working. While, on the whole, the effects of own health shocks on own labor supply are ambiguous, the bulk of the mechanisms including the first order effects from the Grossman model point towards a negative effect.

Empirical investigations into the effects of health shocks on labor supply have highlighted a number of challenges. First, as has long been documented, health and socioeconomic status are simultaneously determined (Smith and Kington, 1997; Smith 1999). For the purposes of identification in this study, what matters more is the effect of socioeconomic status on health. As discussed by Currie and Madrian (1999), labor market activities can affect health by directly though workplace injury, stress, or increasing risk-taking behaviors. A second important issue is health measurement. Also as discussed by Currie and Madrian (1999), empirical estimates of the impact of health on labor supply tend to differ depending on the measurements used. One common measure used in the literature is a self-report of health limitations on the ability to work. While this measure is more directly related to productivity and shows a significant relationship between health and labor supply in many studies, it is subject to measurement error of a particularly pernicious variety. Often individuals report worse health status to justify being out of the labor market – the so-called justification bias. Accordingly, it is advised that researchers utilize measures of health status and health shocks in which the questions are not explicitly tied to the respondent's ability to work. Using measures of this nature of the onset of new health conditions, Smith (1999) provides strong evidence of impacts of health shocks on own labor supply. We consider studies of this ilk to be the gold standard in this literature.

Health Shock and Spousal Labor Supply

As previously discussed, changes in the health status of an individual can have impacts on the labor supply of their spouses. This is particularly the case when insurance markets are not

complete. These effects can be positive or negative. This renders the net impact of a health shock on spousal labor supply theoretically ambiguous.

The first theoretical channel is the AWE. According to the AWE, negative health shocks which result in a loss of lifetime household income might increase spousal labor supply provided that leisure is a normal good (Ashenfelter, 1980; Heckman and McCurdy, 1980; Lundberg, 1985). The AWE is further enhanced if there is substitution in home production between husband and wife as this lowers the opportunity cost of the spouse working. As discussed by Coile (2004), liquidity constraints can also result in an AWE. When liquidity constraints are present, households may not be able to borrow to off-set medical expenses or lost income and so may need to have a spouse enter the labor market to defray the costs of illness.

On the other hand, health shocks impacting a married couple can have negative impacts on spousal labor supply via a second channel, the HCE. Illness might raise the need for care-giving at home which may need to be provided by the spouse. Liquidity constraints might exacerbate this effect (McGreary, 2009). In addition, the HCE can be further enhanced if spousal and own leisure are complements (Hurd, 1990; Maestas, 2001; Gustman and Steinmeier, 2000; Coile, 2004).

Some empirical studies have investigated the impact of health shocks on spousal labor supply. Early on, Parsons (1977) observed that husbands' illnesses have little impact on their wives' labor supply using self-reported health status measurements and the National Longitudinal Surveys. He interprets this as being the consequence of competing mechanisms (*i.e.* the AWE and HCE) netting each other out. Berger (1983) also investigated similar issues in the Current Population Survey using other markers of poor health status and finds evidence of the AWE for wives but also that husbands tend to decrease their labor supply when their spouses fall ill. McClellan (1998) investigated the same issues in the Health and Retirement Study (HRS) and does find some evidence of the AWE for wives. While this study does uses similar health measurements as our study and comparable data source (albeit American and not Korean data), this study mainly focuses on the individual health events, as opposed to health events in the context of couples. In a study that is more similar to our own, Coile (2004) uses the first six waves of the HRS to investigate the effects of health shocks on spousal labor supply. Her results show that spousal health shocks result in only a small increase in the labor supply for men but

have no effects on women, but she also shows that there is an AWE for wives when the husband's health shock is severe. McGeary (2009) also investigates the same question using more waves of the HRS and finds evidence of the AWE for wives, particularly, when they have fewer social security benefits.

III. Data

We employ five waves of the KLoSA, which is a biennial survey, spanning the years 2006-2014. The KLoSA began in 2006 with10,254 respondents who were at least 45 years old at baseline. The survey includes detailed information on demographics, health outcomes, employment, income, and assets. One important aspect of the KLoSA is that it contains detailed information on spousal health. The primary sample that we employ in this study includes married individuals between 45 and 70 years old, were working during the previous wave, whose spouse was working during the previous wave, and who were interviewed for at least two consecutive waves. The final sample consists of 4,711 individual-wave observations (2,257 males and 2,454 females). We employ this particular sample to investigate how health shocks impact labor force exit. We call this is the "labor force exit sample." We will also employ another sample, which we call the "labor force entry sample," to investigate the effects of health shocks on labor force entry which we will discuss later on.

To mitigate endogeneity concerns, many studies in this literature employ self-reports of objective health shocks rather than subjective measures such as self-reported health status (McClellan, 1998; Smith, 1998; Smith, 1999; Riphahn, 1999; Wu, 2003; Coile, 2004; Wagstaff, 2007; Lee and Kim, 2008; McGeary, 2009; Ham, 2016). Following Coile (2004) and McClellan (1998), this study also utilizes objective health shocks as our primary independent variable. We categorize these into three types: (1) acute health events (*e.g.* heart attack, stroke, and cancer); (2) new chronic illnesses (*e.g.* diabetes, lung disease, heart failure, and arthritis); (3) accidental injuries or falls. McClellan (1998) suggests that these three types of health shocks may result in different consequences due to heterogeneity in the extent to which they lead to differing levels of impairment. We also control for other health-related confounds including self-reported health status from the previous survey year, dummies for whether the respondent has already suffered an acute or chronic disease, and measures of activities of daily living (ADLs).

In Table 1b, we discuss descriptive statistics for the labor force exit sample. First, we see that over a two-year period, 7.7 percent of male workers exit the labor force and 15.6 percent of female workers exit. Next, we see that across a two year period, 2.7 percent of male workers experience an acute health event, 2.9 percent are diagnosed with a new chronic illness, and 1.6 percent is injured in an accident. In total, 6.8 percent of men had at least one health shock. Turning to the presence of health conditions, 5.8 percent of male workers have previously suffered an acute condition and 17.0 percent report having a chronic illness. The statistics on health shocks and existing conditions are relatively similar for females as they are for males. Next, we see that male workers are, on average, around two years older than female workers. Finally, the median value of household net assets is about $150,000 (in 2008 USD) for both males and females.

We also consider the impacts of health shocks on labor force entry. The labor force entry sample includes married individuals between 45 and 70 years old who were not working during the previous wave and were interviewed for at least two consecutive waves. However, the individual's spouse may or may not have been working in the previous period. Accordingly, we control for the spouse's labor supply in the previous wave.[1] The final entry sample consists of 6,593 individual-wave observations (1,687 males and 4,906 females).

We report the descriptive statistics for the labor force entry sample in Table 1b. Interestingly, we see more labor force entry than we see exit with 17.2 percent of men who were previously out of the labor force entering it two years subsequent. The corresponding statistic for women is 12 percent which is lower than the percentage of women exiting the labor market from Table 1a. About 10 percent of both women and men experience new health shocks over a two year period in this sample. Not surprisingly, the prevalence of existing conditions is higher in this sample than the exit sample which presumably reflects that earlier health issues had caused them to previously exit the labor market.

IV. Methods and Results

Estimation Equation

[1] We attempted to examine the case that both husband and wife were not working in the previous wave, but the sample size was too small to do this.

We let y_{it} denote our dependent variable which will either be labor force exit or entry across two successive survey waves, although most of our analysis will focus on labor force exit. Note that we use the sample described in Table 1a when labor force exit is the dependent variable and the sample from Table 1b when labor force entry is the dependent variable. We consider a simple linear probability model of the form

$$y_{it} = \beta_0 + \beta_1 ownshock_{it} + \beta_2 spshock_{it} + \beta_3 X_{it}^{own} + \beta_4 X_{it}^{sp} + \varepsilon_{it} \quad (1)$$

where $ownshock_{it}$ and $spshock_{it}$ denote vectors of own and spousal health shocks occurring between survey waves and X_{it}^{own} and X_{it}^{sp} are vectors of controls for own and spousal characteristics. Own characteristics include age, education, place of residence, employment status in the previous survey wave, pre-existing conditions for acute and chronic illness, self-reported health status (SRHS), changes in SRHS, and net household assets. Spousal characteristics are essentially the same as the own characteristics except in cases where they would have been redundancy. We also include dummy variables for each survey wave. We estimate the models separately by gender. Finally, all standard errors are clustered by household.

Baseline Results on Labor Force Exit

We begin with some descriptive evidence in Table 2 on the relationship between own health shocks and labor force exit, ADL's, and changes in household income. First, we see that the exit rates are 35.8 percent for people who suffer an acute health event, 21 percent for people who are injured in an accident, and 18.7 percent for people who are diagnosed with a new chronic illness. So, of the three types of shocks that we consider, acute shocks have the largest impact. On the other hand, individuals who experience no health shock have a probability of exiting the work force of 10.9 percent. Consistent with the effects on labor force exit, an acute health event is accompanied by the highest probability of a limitation in daily activities at 48.6 percent and onset of a chronic illness has the lowest impact on loss of function at 30.6 percent. Moreover, acute health shocks are also associated with the largest earnings losses at $5,318.

We begin with the baseline estimations of equation (1) in Table 3. First, we see that own health shocks are positively and significantly associated with labor force exit for both men and women, although the effects are substantially larger for men. We see that any health shock increases the probability of labor force exit by 13.8 percentage points (PP) for men and 5.6 PP for women.

Consistent with Table 2, the bulk of these effects is driven by acute events and, to a lesser extent, accidents. For men, we see that an acute health event leads to a 27.5 PP increase in the probability of exit from the labor force and an accident raises the probability of exit by 12.8 percentage PP. These effects are statistically significant and very large relative to the average probability of exit for men of 7.7 percent reported in Table 1a. Interestingly, the impact of a chronic illness for men is relatively small and not significant. For women, an acute health event results in a 9.7 PP increase in labor force exit. This effect is marginally significant with a *p*-value of 0.117. These results imply that the substitution effect of reduced wages due to the health shock dominate any potential income effect.

In Table 3, we also report the effects of spousal health shocks on the probability of labor force exit. For both men and women, our composite shock measure, which is inclusive of acute and chronic events as well as accidents, is not associated with labor force exit. However, for women, we see that the onset of a chronic illness for the spouse is associated with a 9.2 PP decrease in the probability of labor force exit. This effect is significant at the 1 percent level. The probability of labor force exit for women in Table 1a is 15.6 percent and so this constitutes a 59 percent decline which is quite substantial. We do not find similar effects for men. Thus, we uncover evidence of the AWE for wives but not for husbands, but no evidence of the HCE. One interesting finding is that chronic illness onset has larger effects on spousal labor supply whereas acute events have larger effects on own labor supply.

This raises two questions. First, why do we not observe the AWE for husbands? Second, why is the AWE for wives only present in response to the onset of chronic illness? We now shed light on these issues by examining how different types of health shocks impact household earnings and care-giving needs.

One possible explanation for the absence of the AWE for husbands is that health shocks impacting wives triggered an increase in care giving needs for their newly sick spouses so that there was a strong underlying HCE offsetting the AWE. We do not think that this is the case. As can be seen in Table 4, only 1.6% of female workers receiving new health shocks obtain care-giving from their husbands despite these health shocks limiting their daily activities.[2] The

[2] In Korea, the smaller amount of care-giving by males for their wives may arise because it is difficult for male workers to stop work due to often being the primary source of income.

corresponding number for male workers is 18.1% and this is true despite seeing evidence of the AWE for wives.

Another explanation for the small impact of spousal health shocks on male workers could be that the earnings of women are usually smaller than those of men and often a secondary income source in dual-earner couples in Korea. As a consequence, male workers may not be sensitive to the economic impact of spousal health shocks. This would result in a small AWE for husbands. In Table 4, we see that the average annual earned income at the previous survey year was $22,932 for husbands. This is more than double of wives' annual earnings of $9,824.

The AWE for wives in response to the onset of chronic illness could be larger than it is for husbands if chronic illness is not associated with a large demand for increased home-care or if it results in higher medical expenditures. In Table 4, we see that only 4.4 percent of husbands who are diagnosed with a chronic illness receive care-giving from their wife while an acute health event and an accident are associated with 30.6 percent and 13.3 percent husbands receiving care-giving.[3] The relatively small care-giving needs of men with chronic illnesses might explain the large AWE that we observe for wives since this suggests a very weak offsetting HCE.

Labor Force Exit by Severity of Shock

In Table 5, we report estimations of a variant of equation (1) in which we interact the health shock variables with dummies for severity. While the health shock measures that we employ from the KLoSA do not allow us to directly differentiate between moderate and severe health shocks, there is auxiliary information that we can employ. Specifically, we utilize questions from the survey about whether a health shock limits a respondent's activities of daily living as a proxy for severity. We then classify a given health shock as severe if the respondent also reports some limitations on ADLs. The reference group in all estimations reported in the table is people who were not impacted by any health shock.

As before, we see that own health shocks increase the probability of labor force exit. However, these effects are primarily driven by severe shocks. Own health shocks that do not limits ADLs are not associated labor force exits at significance levels greater than ten percent. On the other hand, severe own health shocks are. Specifically, we see that own severe health shocks increase

[3]Unfortunately, we do not observe medical expenditures in the KLoSA.

the probability of labor force exit by 24.6 PP for husbands and 13.0 PP for wives compared to the reference group. These effects are the strongest for acute events which is consistent with the results in Table 3.

The results in Table 5 also reveal some association between severe spousal health shocks and labor force exit. As was the case with Table 3, there is not a strong association when we do not separate the shocks out by whether they are chronic or acute. However, we do see in the third column that a non-severe spousal health shock is associated with a 6.0 PP decline in the wife's probability of labor force exit and that this estimate is significant at the ten percent level. Next, when we separate the shocks out further, we see that it is the onset of a severe chronic condition that that has the largest effect on labor force exit. The estimate is 8.5 PP for husbands and 15.4 PP for wives. Accordingly, further parsing the shocks by level of severity leads to additional evidence of an AWE for husbands that was not present in Table 3. Finally and as before, we find stronger evidence of the AWE for wives than husbands. This is consistent with previous work such as Heckman and McCurdy (1980) who claim that the AWE tends to be more substantial if the income loss is larger.

Labor Force Exit and the Presence of Adult Children

In Table 6, we explore how living arrangements mediate the effects of health shocks on labor force exit. Specifically, the presence of adult children in a household may impact labor supply decisions since adult children can be an alternative caregiver for the sick worker. This would attenuate the HCE and, hence, enhance the AWE. To investigate this, we interact the health shocks with dummies for dummy variables for co-residence with adult children.

We find that living arrangements enhances the AWE for wives. Specifically, co-residence with adult children lowers the probability of exit from the labor force exit for wives by 8.6 PP in response to spousal health shocks so that the presence of adult children enhances the AWE. We also see that the presence of adult children lowers the impact of an accident by 20.5 PP. This suggests that home care from adult children substitutes for home care from wives when caring for sick husbands.

Labor Force Exit and Net Assets

As previously discussed, the AWE may be less powerful in wealthier households since they are less likely face liquidity constraints. These households might be better able to rely on their assets to make up for the income shortfall of an ill husband or wife.[4] This may be particularly important in Korea since many older Koreans were not able to accumulate wealth due to the high cost of raising children and limitations on eligibility for public pensions. To investigate this, we construct a dummy variable if the household has assets in the bottom 25 percent of the wealth distribution. We then interact this variable with our varoius health shocks.

We report the results from this exercise in Table 7. We do not see any direct effects of the wealth dummy on labor force exit. However, in the first column, we do see that assets affect the impact of spousal health shocks on husband's labor supply. Particularly, the interaction of the low asset dummy with the dummy for any spousal health shock is -0.137 indicating that poorer husbands whose wives are ill are 13.7 PP less likely to exit the labor force than husbands without ill wives. In contrast, relatively wealthier husbands are 5.9 PP *more* likely to exit the labor force. This indicates that the AWE is prevalent for poorer husbands. We see a similar phenomenon in the second column in that the estimates of the coefficients on the dummies for sustaining the three disaggregated spousal health shocks are systematically larger for wealthier husbands than husbands in the bottom 25 percentile of the wealth distribution.

However, while we do see evidence that the AWE is stronger for husbands from poorer households, we find no such evidence for wives. For example, in the third column, the coefficient estimates on the dummies for any spousal health shock and its interaction with the low asset dummy are very similar at -0.042 and -0.046, respectively. Neither estimate is significant at the ten percent level. In the final column, there is some evidence of the AWE for wives associated with the onset of a chronic illness, but we only see it for wives from households in the top 75 percent of all households, but not for those in the bottom quarter. Note that this is contrary to what a theory with liquidity constraints would imply.

Impacts on Labor Force Entry

[4] Household assets and access to credit are closely related. Some studies such as Juster and Shay (1964), Zeldes (1989), and Runkle (1991) argue that low-wealth households are more likely to be liquidity-constrained, while high-wealth households have easier access to credit markets and/or less of a need to borrow.

We begin the discussion of the effects of health shocks on labor force entry with Table 8 which reports summary statistics on care-giving from the labor force entry sample. The table shows the share of individuals who receive care-giving from a spouse after they suffered health shocks which limited daily activities. The statistics show that 30.6 percent of males and 14.1 percent of females received care-giving from their spouse after sustaining any health shock. This stands in contrast to the labor force exit sample in which only 1.6% of wives reported receiving some care-giving from their husbands. The reason underlying this difference is that 45.1 percent of husbands in this sample were not working in the previous survey period and so, presumably, this provided more time for them to care for their ill wives.

Next, we report estimation results of the model in equation (1) using labor force entry as the dependent variable in Table 9. On the whole, we find no effects of spousal health shocks for husbands, but there are some effects for wives. In the third column, we see that a spousal health shock increases the probability of labor force entry by 2.6 PP for wives, although this effect is only marginally significant with a *p*-value of 0.120. Accordingly, this provides additional (albeit weak) evidence of the AWE for wives. We also see some stronger evidence in the fourth column that own acute health shocks reduce the probability of labor force entry of wives by 6.6 PP which is consistent with some of the results on own health shocks from the previous tables that look at labor force entry.

Finally, in Table 10, we investigate how the effects of health shocks on labor force entry interact with household wealth which is analogous to what we did in Table 7. We do not see any effects for husbands but, we do see effects for wives. For example, in the third column, we see that any spousal shock increases the probability of labor force entry by 11.8 PP for households in the bottom quartile of the wealth distribution, but we do not see any impacts for wealthier households. Once again, this is consistent with liquidity constraints increasing the need for labor supply to offset the effects of spousal health shocks.

We see similar effects for acute spousal health shocks in the fourth column. Specifically, an acute spousal health shock increases the probability of labor force entry of the wife by 19.4 PP for poorer households (relative to other households with husbands experiencing acute health events). Interestingly, the same shock *decreases* the probability of labor force entry by 4.2 PP for relatively richer households. Respectively, these effects are significant at the one and five

percent levels. The positive effects for poorer households and the negative effects for relatively wealthier households indicate that the AWE is prominent for poorer households whereas the HCE is dominant for richer households.

V. Conclusions

In this paper, we investigated the impact of own and spousal health shocks on the labor supply of Korean couples. Consistent with previous studies, we found that adverse own health shocks reduced labor supply at the extensive margin. We also found that spousal health shocks increased the labor supply of the wife which is consistent with the added worker effect (AWE). This evidence was most pronounced for the onset of chronic illness. Interestingly, we showed that the onset of chronic illness was *less* associated with the need for home care than acute health shocks and accidents which suggests that the AWE might be more powerful for the onset of chronic illness than it is for the other health shocks. We find little evidence of the AWE for husbands. This can be explained by the fact that wives' earnings tend to lower than husbands' in Korea and so there is a much smaller scope for health shocks impacting wives to lead to substantial income loss.

We also investigated how co-residing adult children and household net assets affected the effects of health shocks on couple's labor supply. First, our findings indicate that co-residence with adult children decreases the probability of exit from the labor force by wives if their husband experiences a health shock. Accordingly, living with adult children appears to intensify the AWE. The reason is that co-residing adult children may substitute for the wife in care-giving for their sick husband. Next, our most important finding is that lower household assets reduce the probability of exit from the labor force exit for husbands and raise the probability of labor force entry for wives in response to spousal health shocks. These results suggest that lack of sufficient savings and/or liquidity constraints enhance the AWE in Korea.

Given the current concerns about poverty in a rapidly aging population in Korea, our findings have two important implications. First, the elderly in Korea tend to depend more on labor income than public transfers to a larger degree than in other developed countries. As a consequence, negative health shocks affecting elderly Korean couples might have relatively larger effects on earnings than they otherwise would if there was greater access to public pensions. Second, there are also policy implications of the evidence that we provided of the

AWE, which is most prevalent among poorer households. These results indicate that spousal health shocks tend to increase the labor force participation of poorer elderly Korean women at a time in their life-cycle when working less is probably better than working more. Better access to pensions might obviate the need to work to make up for the income shortfall associated with a sick husband. This would free up time to provide home care for their spouses.

References

Ashenfelter, O. (1980). Unemployment as disequilibrium in a model of aggregate labor supply. *Econometrica: Journal of the Econometric Society*, 547-564.

Becker, G. S. (1964). Human capital theory. *Columbia, New York.*

Berger, M. C. (1983). Labor supply and spouse's health: The effects of illness, disability, and mortality. *Social Science Quarterly*, *64*(3), 494.

Coile, C. C. (2004). Health shocks and couples' labor supply decisions (No. w10810). *National Bureau of Economic Research.*

Currie, J., & Madrian, B. C. (1999). Health, health insurance and the labor market. *Handbook of Labor Economics*, *3*, 3309-3416.

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy*, *80*(2), 223-255.

Gustman, A. L., & Steinmeier, T. L. (2000). Retirement in dual-career families: a structural model. *Journal of Labor Economics*, *18*(3), 503-545.

Ham, S. (2016). The effect of health problems on old aged couples' labor supply in Korea. *Health and Social Welfare Review*, 36(4), 157-186.

Heckman, J. & McCurdy, T. (1980). A Life Cycle Model of Female Labour Supply." *Review of Economic Studies*, 47.

Hurd, M. D. (1990). The joint retirement decision of husbands and wives. *In Issues in the Economics of Aging* (pp. 231-258). University of Chicago Press.

Juster, F. T., & Shay, R. P. (1964). Consumer sensitivity to finance rates. In *Consumer Sensitivity to Finance Rates: An Empirical and Analytical Investigation* (pp. 6-46). NBER.

Lee, J., & Kim, H. (2008). A longitudinal analysis of the impact of health shocks on the wealth of elders. *Journal of Population Economics*, 21(1), 217-230.

Lundberg, S. (1985). The added worker effect. *Journal of Labor Economics*, *3*(1, Part 1), 11-37.

Maestas, N. (2001). Labor, Love, and Leisure: Complementarity and the Timing of Retirement by Working Couples, *mimeo, University of California at Berkeley*.

McClellan, M. B. (1998). Health events, health insurance, and labor supply: evidence from the health and retirement survey. *In Frontiers in the Economics of Aging* (pp. 301-350). University of Chicago Press.

McGeary, K. A. (2009). How do health shocks influence retirement decisions?. *Review of Economics of the Household,* 7(3), 307-321.

OECD (2013*), Pensions at a Glance 2013: OECD and G20 indicators*, OECD Publishing, Paris.

OECD (2017), Health spending (indicator). doi: 10.1787/8643de7e-en (Accessed on 20 August 2017)

Parsons, D. O. (1977). Health, family structure, and labor supply. *American Economic Review* 67: 703-712.

Riphahn, R. T. (1999). Income and employment effects of health shocks A test case for the German welfare state. *Journal of Population Economics,* 12(3), 363-389.

Runkle, D. E. (1991). Liquidity constraints and the permanent-income hypothesis: Evidence from panel data. *Journal of Monetary Economics,* 27(1), 73-98.

Smith, J. P. (1998). Socioeconomic status and health. *The American Economic Review*, 88(2), 192-196.

_____. (1999). Healthy bodies and thick wallets: the dual relation between health and economic status. *The Journal of Economic Perspectives*, 13(2), 144.

Smith, J. P., & Kington, R. S. (1997). Race, socioeconomic status, and health in late life. *Racial and ethnic differences in the health of older Americans* (106-62). National Academy Press.

Wagstaff, A. (2007). The economic consequences of health shocks: evidence from Vietnam. *Journal of Health Economics*, 26(1), 82-100.

Wu, S. (2003). The effects of health events on the economic status of married couples. *Journal of Human Resources,* 38(1), 219-230.

Zeldes, S. P. (1989). Consumption and liquidity constraints: an empirical investigation. *Journal of Political Economy,* 97(2), 305-346.

Table 1a Summary Statistics: Labor Force Exit Sample

	Males		Females	
	Mean	S.D.	Mean	S.D.
Exit labor force?	0.077	0.266	0.156	0.363
New health shock	0.068	0.252	0.077	0.267
Acute health event	0.027	0.160	0.020	0.140
Chronic illness	0.029	0.169	0.036	0.187
Accident	0.016	0.123	0.026	0.161
Existing acute condition (1=yes)	0.058	0.231	0.046	0.209
Existing chronic condition (1=yes)	0.170	0.376	0.212	0.409
Self-rated health status (SRHS)[1]	3.182	0.692	3.078	0.721
Change in SRHS	-0.095	0.791	-0.053	0.786
Age	58.88	5.681	56.53	5.874
Education (1=high school or more)	0.597	0.491	0.413	0.492
Self-employed at t-1 (1=self-employed)	0.610	0.485	0.577	0.494
Rural residence (1=rural)	0.314	0.465	0.345	0.476
Household assets (median, 2008 USD) [2]	149,990		147,010	
N	2,257		2,454	

Notes: Calculated by the authors using the KLoSA.
[1] SRHS is a categorical variable between one and four. One corresponds to bad and four corresponds to good.
[2] 1,000 Korean Won is approximately equal to 1 US dollar.

Table 1b Summary Statistics: Labor Force Entry Sample

	Males		Females	
	Mean	S.D.	Mean	S.D.
Enter labor force?	0.172	0.377	0.120	0.326
New health shock	0.107	0.309	0.105	0.306
Acute health event	0.044	0.199	0.028	0.165
Chronic illness	0.041	0.202	0.057	0.232
Accident	0.027	0.161	0.027	0.163
Existing acute condition (1=yes)	0.202	0.401	0.116	0.320
Existing chronic condition (1=yes)	0.298	0.457	0.299	0.458
Self-rated health status (SRHS)	2.657	0.893	2.830	0.783
Change in SRHS	-0.002	0.819	-0.020	0.780
Age	64.43	4.610	60.07	6.335
Education (1=high school or more)	0.276	0.447	0.381	0.486
Spouse's working status (t, 1=working)	0.265	0.442	0.451	0.497
Spouse's working status (t-1, 1=working)	0.323	0.468	0.547	0.498
Rural residence (1=rural)	0.209	0.407	0.182	0.385
Household assets (median, 2008 USD)	151,181		162,000	
N	1,687		4,906	

Notes: Per Table 1a.

Table 2 Statistics on Labor Supply, ADLs, and Income by Health Shock

	Acute health event	Chronic illness	Accident	No health shock
Share of individuals who exit the labor force	35.8	18.7	21.0	10.9
Share of ones with a limitation in daily activities	48.6	31.0	41.0	NA
Change in annual earned income (USD)	-5,318	-3,226	-2,775	-2,497

Notes: Unpaid family workers are excluded from the calculation. All other notes per Table 1a.

Table 3 Effect of Health Shocks on Labor Force Exit (0=Working, 1=Exit)

	Males		Females	
	(1)	(2)	(3)	(4)
Any health shocks (spouse)	0.015		-0.030	
	(0.025)		(0.026)	
Acute health event		0.045		0.006
		(0.053)		(0.044)
Onset of chronic illness		-0.032		-0.092***
		(0.028)		(0.031)
Accident		0.052		0.030
		(0.044)		(0.061)
Any health shocks (own)	0.138***		0.056*	
	(0.032)		(0.030)	
Acute health event		0.275***		0.097†
		(0.061)		(0.062)
Onset of chronic illness		0.038		0.039
		(0.039)		(0.044)
Accident		0.128*		-0.003
		(0.067)		(0.047)
Existing acute condition	0.042†	0.043†	-0.001	0.001
	(0.026)	(0.026)	(0.038)	(0.038)
Existing chronic condition	0.034*	0.029†	-0.017	-0.017
	(0.018)	(0.018)	(0.022)	(0.021)
SRHS	-0.065***	-0.060***	-0.056***	-0.057***
	(0.012)	(0.011)	(0.016)	(0.015)
Change in SRHS	-0.065***	-0.058***	-0.053***	-0.053***
	(0.011)	(0.012)	(0.013)	(0.013)
Age	0.008***	0.008***	0.005*	0.004†
	(0.002)	(0.002)	(0.003)	(0.003)
High school education	0.046***	0.042***	-0.009	-0.009
	(0.016)	(0.015)	(0.023)	(0.023)
Self-employed	-0.062***	-0.061***	-0.046**	-0.047**
	(0.014)	(0.013)	(0.019)	(0.019)
Rural residence	-0.031**	-0.032**	-0.074***	-0.074***
	(0.013)	(0.013)	(0.018)	(0.018)
Spousal controls[1]	Yes	Yes	Yes	Yes
Adj. R-sq.	0.106	0.122	0.044	0.046
N	2,257	2,257	2,454	2,454

Notes: Robust standard errors in parentheses. †, *, **, and *** indicate statistical significance at the 15, 10, 5, and 1 percent level, respectively. All models include the log of household net assets and dummies for the KLoSA wave. Standard errors are clustered by individual.

[1] Includes age, education, employment status, existing acute and chronic conditions, SRHS, and change in SRHS.

Table 4 Earned Income and Share of Individuals Receiving Care-giving from their Spouse, Exit Sample

	(1) Males	(2) Females
Average annual earned income at t-1	22,932	9,824
Share of individuals receiving care from the spouse (%)	18.1	1.6
Acute health event (%)[b]	30.6	0
Chronic illness (%)[b]	4.4	0
Accident (%)[b]	13.3	4.0

Notes: Per Table 1a.

Table 5 Effect of Health Shocks on Labor Force Exit by Severity (0=Working, 1=Exit)

	Males		Females	
	(1)	(2)	(3)	(4)
Health shocks (spouse)				
Any & Not severe	0.030		-0.060*	
	(0.029)		(0.032)	
Any & Severe	-0.017		-0.001	
	(0.039)		(0.041)	
Acute & Not severe		0.019		-0.029
		(0.064)		(0.068)
Acute & Severe		0.081		0.027
		(0.097)		(0.057)
Chronic & Not severe		-0.011		-0.062†
		(0.034)		(0.041)
Chronic & Severe		-0.085***		-0.154***
		(0.021)		(0.043)
Accident & Not severe		0.094†		-0.040
		(0.059)		(0.069)
Accident & Severe		-0.013		0.114
		(0.053)		(0.096)
Health shocks (own)				
Any & Not severe	0.054†		0.019	
	(0.037)		(0.035)	
Any & Severe	0.246***		0.130**	
	(0.053)		(0.057)	
Acute & Not severe		0.178**		0.025
		(0.086)		(0.066)
Acute & Severe		0.334***		0.265**
		(0.080)		(0.122)
Chronic & Not severe		0.006		0.034
		(0.042)		(0.051)
Chronic & Severe		0.098		0.071
		(0.075)		(0.085)
Accident & Not severe		0.057		-0.062
		(0.076)		(0.054)
Accident & Severe		0.228**		0.092
		(0.113)		(0.082)
Adj. R-sq.	0.115	0.128	0.046	0.050
N	2,257	2,257	2,454	2,454

Notes: All models include dummies for education, self-employment status, rural residence, existing chronic and acute conditions and KLoSA wave, as well as age, logged household net assets, and spousal characteristics. All other notes per Table 3.

Table 6 Effect of Health Shocks on Labor Force Exit by Co-residence with Adult Children (0=Working, 1=Exit)

	Males		Females	
	(1)	(2)	(3)	(4)
Any health shocks (spouse)	0.040		-0.086*	
× Co-residence with adult children	(0.048)		(0.049)	
Acute × Co-residence with adult children		0.051		-0.095
		(0.106)		(0.084)
Chronic × Co-residence with adult children		0.016		0.007
		(0.057)		(0.058)
Accident × Co-residence with adult children		0.065		-0.205**
		(0.086)		(0.101)
Any health shocks (spouse)	-0.002		0.007	
	(0.033)		(0.038)	
Acute health event		0.023		0.053
		(0.071)		(0.067)
Onset of chronic illness		-0.040		-0.092**
		(0.037)		(0.042)
Accident		0.016		0.092
		(0.059)		(0.084)
Any health shocks (own)	0.070		0.032	
× Co-residence with adult children	(0.065)		(0.060)	
Acute × Co-residence with adult children		0.053		-0.213*
		(0.120)		(0.117)
Chronic × Co-residence with adult children		0.015		0.104
		(0.076)		(0.088)
Accident × Co-residence with adult children		0.000		0.103
		(0.132)		(0.093)
Any health shocks (own)	0.106**		0.041	
	(0.043)		(0.041)	
Acute health event		0.242***		0.176*
		(0.093)		(0.086)
Chronic illness		0.032		-0.009
		(0.052)		(0.055)
Accident		0.133		-0.052
		(0.095)		(0.060)
Co-residence with adult children	-0.105	-0.011	-0.017	-0.018
	(0.012)	(0.012)	(0.017)	(0.017)
Adj. R-sq.	0.107	0.123	0.045	0.051
N	2,257	2,257	2,454	2,454

Notes: Per Table 5.

Table 7 Effect of Health Shocks on Labor Force Exit by Household Assets (0=Working, 1=Exit)

	Male		Female	
	(1)	(2)	(3)	(4)
Any health shocks (spouse) × B_25[1]	-0.137***		-0.046	
	(0.038)		(0.063)	
Acute × B_25		-0.130†		-0.064
		(0.079)		(0.103)
Chronic × B_25		-0.054		0.030
		(0.047)		(0.074)
Accident × B_25		-0.206***		0.066
		(0.070)		(0.128)
Any health shocks (spouse)	0.059*		-0.042	
	(0.034)		(0.029)	
Acute health event		0.075		0.018
		(0.070)		(0.050)
Onset of chronic illness		-0.016		-0.105***
		(0.041)		(0.032)
Accident		0.123*		0.010
		(0.064)		(0.073)
Any health shocks (own) × B_25	0.033		-0.021	
	(0.072)		(0.065)	
Acute × B_25		-0.156		0.177
		(0.139)		(0.144)
Chronic × B_25		0.117		-0.049
		(0.096)		(0.095)
Accident × B_25		0.165		-0.082
		(0.131)		(0.093)
Own any health shocks	0.130***		0.061	
	(0.038)		(0.037)	
Acute health event		0.303***		0.048
		(0.069)		(0.070)
Chronic illness		0.003		0.050
		(0.039)		(0.053)
Accident		0.076		0.028
		(0.084)		(0.063)
B_25	-0.011	-0.011	-0.003	0.000
	(0.014)	(0.014)	(0.022)	(0.017)
Adj. R-sq.	0.110	0.130	0.044	0.047
N	2,257	2,257	2,454	2,454

Notes: Per Table 5.
[1]Denotes a dummy variable for being in the bottom 25% of household net assets.

Table 8 Share of Individuals Receiving Care-giving from their Spouse, Entry Sample

	Males	Females
Any health shocks (%)	30.6	14.1
Acute health event (%)	28.3	10.0
Chronic illness (%)	34.3	15.6
Accident (%)	30.0	13.9

Notes: Per Table 1a.

Table 9 Effect of Health Shocks on Labor Force Entry (0=No Entry, 1=Entry)

	Males		Females	
	(1)	(2)	(3)	(4)
Any health shocks (spouse)	0.009		0.026†	
	(0.028)		(0.017)	
Acute health event		0.009		0.014
		(0.051)		(0.023)
Chronic illness		0.019		0.025
		(0.038)		(0.024)
Accident		-0.022		0.052
		(0.049)		(0.038)
Any health shocks (own)	-0.000		-0.009	
	(0.027)		(0.014)	
Acute health event		-0.055		-0.066***
		(0.035)		(0.017)
Chronic illness		0.032		0.006
		(0.044)		(0.018)
Accident		0.004		0.026
		(0.047)		(0.028)
Existing acute condition	-0.037*	-0.039*	-0.017	-0.018
	(0.022)	(0.022)	(0.012)	(0.012)
Existing chronic condition	-0.020	-0.019	0.002	0.003
	(0.022)	(0.022)	(0.011)	(0.011)
SRHS	0.080***	0.079***	0.048***	0.048***
	(0.013)	(0.013)	(0.009)	(0.009)
Change in SRHS	0.061***	0.060***	0.035***	0.034***
	(0.013)	(0.013)	(0.007)	(0.007)
Age	-0.019***	-0.019***	-0.005***	-0.005***
	(0.004)	(0.004)	(0.002)	(0.002)
High school education	-0.024	-0.020	-0.030**	-0.029**
	(0.027)	(0.024)	(0.013)	(0.014)
Rural residence	0.019	0.020	0.111***	0.111***
	(0.024)	(0.024)	(0.015)	(0.015)
Spousal controls	Yes	Yes	Yes	Yes
Adj. R-sq.	0.098	0.099	0.073	0.074
N	1,687	1,687	4,906	4,906

Notes: Per Table 3.

Table 10 Effect of Health Shocks on Labor Force Entry by Household Assets (0=No Entry, 1=Entry)

	Males		Females	
	(1)	(2)	(3)	(4)
Any health shocks (spouse) × B_25[1]	0.008		0.118***	
	(0.059)		(0.042)	
Acute × B_25		0.069		0.194***
		(0.113)		(0.061)
Chronic × B_25		-0.020		0.072
		(0.077)		(0.063)
Accident × B_25		0.013		0.068
		(0.099)		(0.078)
Any health shocks (spouse)	0.007		-0.008	
	(0.034)		(0.017)	
Acute health event		-0.012		-0.042**
		(0.059)		(0.020)
Chronic illness		0.026		0.006
		(0.045)		(0.026)
Accident		-0.027		0.024
		(0.062)		(0.042)
Any health shocks (own) × B_25	-0.004		-0.022	
	(0.055)		(0.031)	
Acute × B_25		-0.007		-0.055†
		(0.077)		(0.034)
Chronic × B_25		-0.072		-0.036
		(0.086)		(0.040)
Accident × B_25		0.084		0.005
		(0.093)		(0.060)
Any health shocks (own)	-0.001		-0.002	
	(0.032)		(0.016)	
Acute health event		-0.055		-0.050**
		(0.041)		(0.021)
Chronic illness		0.046		0.018
		(0.052)		(0.022)
Accident		-0.026		0.022
		(0.060)		(0.031)
B_25	-0.035	-0.036	0.016	0.015
	(0.027)	(0.027)	(0.015)	(0.015)
Adj. R-sq.	0.099	0.101	0.076	0.078
N	1,687	1,687	4,906	4,906

Notes: Per Table 3.

[1]Denotes a dummy variable for being in the bottom 25% of household net assets.