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Effects of Economic and Health Conditions on the Transition to Living Alone: A Longitudinal Study on Older Koreans

Min-Ah Lee | Chung-Ang University

It has been observed that older adults who are better off and healthier are more likely to live alone in Western societies. Little is, however, known about the transition to living alone in older adults in Korea. Using data from the four waves of the Korean Longitudinal Study of Ageing (KLoSA) over a period of six years, discrete time event history analyses were conducted to analyze the determinants of the transition to living alone for older Koreans. The findings show that home ownership and higher household income at a previous wave were negatively associated with the transition to living alone in general whereas prior depressive symptoms were positively associated with the transition to living alone for older Koreans. Physical health conditions, however, did not have significant effects on the transition to living alone. This suggests that older adults who were disadvantaged in terms of economic and mental health conditions have a higher likelihood of having the transition to living alone and also implies that the transition to living alone in disadvantaged older adults may amplify the harmful effects of living alone on their well-being in the long run.

Keywords: *transition to living alone, living arrangements, independent living of older adults, discrete time event history, older Koreans*

Introduction

The percentage of older adults living alone has increased in many countries. In Western societies, such as the United States and several European countries, the number of older adults living alone has increased dramatically in the 20th century (Kramarow 1995; Hays and George 2002; Tomassini et al. 2004) and has also increased in the other parts of the world, including Asia, over the last decades (Martin 1989; Kim 2008; Shah et al. 2011). In particular, the number of older adults living alone has increased markedly in Korea as a rapidly aging country. Among the total population of older adults, aged 65 or over, in Korea, the percentages of older adults living alone were about 8.9 in 1990 and 20.2 in 2010 (Statistics Korea 2010).

The increase of older adults living alone in Western societies has been often explained by the increased independency of older adults who are better off and healthier (Mutchler and Burr 1991; Kramarow 1995). Economic growth and health promotion in Western societies have promoted independence and a preference for privacy (Mutchler and Burr 1991; Burr and Mutchler 2007), leading to the increase of older adults living alone. However, less is known about this transition to living alone in older adults in non-Western countries, such as Korea. Given that there are inconsistent findings on living alone in older adults in non-Western countries (e.g., Shah et al. 2003; Tohme et al. 2011), it is questionable whether better economic and health conditions are, in fact, associated with a higher likelihood of the transition to living alone for older Koreans. Although a recent study has shown that lower education is associated with living alone in Korea (Park and Choi 2015), it has not been examined whether and how economic and health conditions are associated with the transition to living alone of older adults using longitudinal data. In addition, the increased preference for privacy and independent living in older adults may not apply to older adults in Korea, where traditional family value, emphasizing filial piety and supporting co-residence between parents and adult children, is still valued socially, although even this has been weakened over recent decades. Moreover, it has been observed that the increase of older adults living alone is significantly associated with the increased poverty rate of older adults in Korea (Park and Kim 2016), suggesting that older adults living alone might be economically disadvantaged, *not* independent.

The present study examined social determinants of the transition to living alone for older Koreans, focusing on economic resources and health

conditions. To properly investigate the mechanism of living alone in older adults, it is necessary to analyze longitudinal data, minimizing the possibility of reverse causation. Especially for analyzing changes in living arrangements, a cross-sectional design may lead to an endogeneity problem, because living arrangements can affect individual economic standing, health status, and eventually even survival (e.g., Fujino and Matsuda 2009; Sok and Yun 2011). In the study, four waves of the Korean Longitudinal Study of Ageing (KLoSA), a nationally representative sample in Korea, were used to track the transition to living alone in older Koreans, which should help to improve the levels of external validity and causality. Especially, examining the effects of economic and health conditions at a previous wave on the transition to living alone at the following wave would benefit the study in terms of causality by assuring temporal precedence as a condition for causality relative to cross-sectional data analyses. Using discrete time event history techniques, this study examined whether and how economic and health conditions at a wave are associated with the transition to living alone in older Koreans in the next wave.

Literature Review

Economic resources, health conditions, and living alone in older adults

Economic and health conditions, as individual resources, have been considered to be important determinants of living arrangements for older adults (Mutchler and Burr 1991; Davis et al. 1996; Liang et al. 2005; Zimmer 2005; Sarma and Simpson 2007; Martikainen, Nihtilä and Moustgaard 2008). In particular, economic conditions have been examined as one of the most important predictors associated with living alone in older adults because it shows the affordability of satisfying the basic needs of daily living and maintaining an individual life and household (Liang et al. 2005; Burr and Mutchler 2007). Home ownership and higher income, as indicators of economic conditions, are significantly associated with a higher likelihood of living alone in older adults (Mutchler and Burr 1991). Given that the spread of separate living is associated with an increased preference for privacy and independence in Western societies (Mutchler and Burr 1991; Hays and George 2002), economic capability has been a basic condition for the privacy and independence that many older adults want.

Similarly, health status is critical for deciding to live alone because older

adults in poor health would have difficulty with living independently, even if they could afford it economically. Health matters because older adults may need more support from adult children or others as health declines (Liang et al. 2005), meaning that health status influences the level of independence and autonomy of older adults (Mutchler and Burr 1991). In many studies, better health status is associated with living alone, compared with coresidence with adult child/others and institutionalization (Mutchler and Burr 1991; Spitze, Logan and Robinson 1992; Wilmoth 2000; Liang et al. 2005; Burr and Mutchler 2007; Martikainen et al. 2008). Older adults who have lower functional ability or experience health declines are less likely to live alone (Mutchler and Burr 1991; Burr and Mutchler 2007; Sarma, Hawley and Basu 2009). Also, older adults who evaluate self-rated health fairly are more likely to live independently and less likely to live with others than those who have poor self-rated health (Sarma and Simpson 2007).

Although poor health associated with living arrangements has been commonly defined in terms of physical and functional status, mental health as well as physical health should be examined to assess the underlying mechanism of the transition to living alone associated with health conditions more clearly (Brown et al. 2002). Both physical and mental health conditions reflect the capability of older adults to sustain independent living and the degree of support required from others. Moreover, mental health, versus physical health, may have a different effect on the living arrangements of older adults because poor mental health status, such as increased depressive symptoms, may inhibit coresidence with an adult child by negatively influencing the well-being of the care giver(s) (Ostwald et al. 1999), which may increase the likelihood of living alone for older adults even in those who are not physically healthy enough.

Despite the importance of mental health, most studies examining associations between health and living arrangements of older adults have focused on physical health (e.g., Takagi, Silverstein and Crimmins 2007; Martikainen et al. 2008), with a few exceptions (e.g., Brown et al. 2002; Liang et al. 2005). Moreover, the effects of mental health on living alone are not consistent across studies examining mental health. Depressive symptoms do not have a significant effect on the transition to living alone in older Japanese adults, but are inversely significant for living with a single child versus living with a married child (Brown et al. 2002). Other studies have shown non-significant effect of depressive symptoms on living alone (Liang et al. 2005) and household expansion in the United States (Hays, Pieper and Purser 2003). In contrast to Western societies, mental health condition as a predictor

of the transition to living alone may be more critical in Asian countries in which strong and intimate relationships between older parents and adult children are culturally valued, because the poor mental health condition of older parents can be hazardous to the relationship.

Compared with Western societies, less is known about the transition to living alone in older adults in non-Western societies. A few studies have provided inconsistent results on whether and how economic and health conditions are associated with the transition to living alone in older adults in non-Western societies. Some studies have supported the Western results, showing associations between better economic and health conditions and a higher likelihood of living alone. Older adults who are economically better off are more likely to live alone in Lebanon (Tohme et al. 2011) and are also less likely to live with an adult child in Kuwait (Shah et al. 2003; Shah et al. 2011) and Turkey (Aytaç 1998). In contrast, home ownership is negatively associated with the transition to living alone for unmarried older adults (Brown et al. 2002) and positively with co-residence with adult children in Japan (Takagi et al. 2007).

In terms of health effects, a few studies have shown negative associations between poor physical health and living alone in older adults while others have provided non-significant associations between the two. Poor health conditions, measured by functional limitations and/or chronic conditions, decrease the probability of the transition to living alone in Japan significantly (Brown et al. 2002) and increase the likelihood of living with children or others in China (Zimmer 2005). Self-rated health and chronic diseases are, however, not significant for the transition to living alone in Japan (Brown et al. 2002). Physical conditions, measured by chronic diseases and functional limitations, are also not significant in Lebanon (Tohme et al. 2011).

Other covariates associated with living alone

To examine the effects of economic and health conditions on the transition to living alone clearly, other covariates associated with living alone need to be considered too. In particular, it has been observed that gender and prior living arrangements are associated with the transition in living arrangements. Among socio-demographic factors, gender is a well-known factor associated with living alone in older adults, given that life experiences, economic status, and sociocultural expectations associated with the transition to living alone vary by gender (Davis et al. 1996). Females are more likely to live alone than males in the developing countries of Asia, Latin America, and Africa

(Bongaarts and Zimmer 2002) as well as in Western industrialized countries (Davis et al. 1996; Prioux, 2002; Pizzetti, Manfredini and Lucchetti 2005; Jacobsen et al. 2011). Similarly, older men are more likely to live with spouses than older women, in general. For example, in the United States "only 42% of women aged 65 and older were living with a spouse, compared with 72% of men in 2008 (Jacobsen et al. 2011, p.4)." This reflects gender differences in the average lifespan, leading to feminization of the older adult population. Older women are simply more likely to be widowed, which leads to a higher likelihood of living alone for older women.

Prior living arrangements should be also considered as an important covariate of the transition to living alone because they affect possible transition options ahead (Martikainen et al. 2008). Certain types of prior living arrangements may be previous stages of living alone. For example, it is probable that unmarried older adults living with an adult child are more likely to have a transition to living alone than married older adults living with an adult child. Living arrangements are also intertwined with marital status of older adults because marital status is critical for the possible options for living arrangements (Liang et al. 2005; Strohschein 2011). Moreover, because prior living arrangements may mediate between economic and health conditions and the transitions in living arrangements (Liang et al. 2005), it is necessary to examine whether and how economic and health conditions are associated with the transition to living alone even after controlling for prior living arrangements.

Social and cultural contexts in Korean society

Traditional family culture, emphasizing filial piety and supporting the extended family form, has been valued in Korea, leading to a higher percentage of coresidence of older adults with adult children, compared with Western societies. Over the past several decades, however, Korean society has experienced rapid changes in family culture and population structure (Park 2013). Due to increased longevity and decreased fertility, the percentage of older adults in the Korean population has increased rapidly. The percentages of older adults, aged 65 or over, were 4.97, 7.3, and 11.3 in 1990, 2000, and 2010 respectively (Statistics Korea 2010). Given this rapid aging and lack of a welfare system for families and older adults, Korean society has relied on traditional family values, emphasizing co-residence with adult children and family support for older adults, based on filial piety and responsibility.

These traditional family values, however, have become less powerful

over recent decades, which is reflected in changes in living arrangements of older adults in Korea. With the change in the social and cultural atmosphere, the number of older adults living alone has increased whereas the number of older adults living with adult children has decreased. According to one study (Kim 2008), the percentages of older adults living with their children were about 80 in 1980 and 40 in 2000. Among total households in which older adults, aged 60 or over, resided, the percentages of intergenerational households were 57.8 and 47.8 while the percentages of one-person households were 18.55 and 24.36 in 2000 and 2010 respectively, in Korea (Statistics Korea 2010). Given the rapid aging and weakening traditional family values, coresidence with an adult child has become less common in Korea. A comparative study of four East Asian countries showed that Korea was the lowest in terms of traditional family values and the percentage of coresidence with an adult child of older adults, compared with China, Japan, and Taiwan (Yasuda et al. 2011). It seems that the willingness and affordability of adult children to support their parents may have decreased in Korea (Kim 2008).

Additionally, some statistics on older Koreans may raise questions as to whether older adults who are capable of independent living are, in fact, more likely to live alone. It has reported that Korea had the highest poverty rate of older adults, aged 65 or over among OECD countries in the 2000s (OECD 2008, 2013). Surprisingly, the poverty rate of older adults living alone was 77% in the mid-2000s (OECD 2008). It has also been observed that the increase of older adults living alone is significantly associated with the increased poverty rate of older adults in Korea (Park and Kim 2016) and older adults living alone are likely to have economic hardships (e.g., Lee and Kim 2013), suggesting that older adults living alone are economically disadvantaged, *not* independent.

In this context, it should be examined empirically whether and how economic and health conditions are associated with the transition to living alone in older Koreans. Although a couple of studies have shown that older Koreans who depend on their children's economic support or government subsidies are more likely to live with their children than those with independent economic resource (Won and Lee 1999) and better economic situation and health condition are positively associated with living alone of older Koreans after spousal loss (Song 2007), less clear if and how economic and health conditions are associated with the transition to living alone. There is, to the author's knowledge, no previous empirical study analyzing the mechanism of the transition to living alone for older Koreans with

longitudinal data.

Methods

Data

Data were drawn from the four waves of the Korean Longitudinal Study of Ageing (KLoSA) from 2006 (wave 1) to 2012 (wave 4). The first wave was conducted in 2006, and each successive wave was collected 2 years later. The KLoSA is a nationally representative panel survey for Koreans aged 45 or over, as of 2006 (wave 1), collected by multistage stratified probability sampling based on geographical area, conducted by the Korea Labor Institute (Korea Labor Institute 2010). For the present study, the three waves of KLoSA data collected in 2008 (wave 2), 2010 (wave 3), and 2012 (wave 4) were used for measuring whether a transition to living alone had occurred between each wave and the previous wave. In the sample, only respondents who were aged 60 or over at each wave and who lived with someone, such as a spouse, child, and/or others at wave 1, were included. For example, in the sample for measuring the transition to living alone as of wave 2 (in 2008), only respondents who did not live alone at wave 1 and were aged 60 or over as of wave 2 were included. Respondents who attained 60 years of age after wave 2 were added to the sample at the time of a corresponding wave. After measuring whether a transition to living alone occurred between each wave and the previous wave, each data set was matched with the data set of the previous wave that had information on the characteristics of the respondents, including economic and health conditions at the previous wave. Finally, three separate data sets that held information on the respondents' characteristics and whether they had a transition to living alone between two waves (between waves 1 and 2, waves 2 and 3, and waves 3 and 4) were constructed and pooled for the analysis.

In terms of sample sizes and matching rates, 5202 of 6113 respondents aged 60 or over at wave 2 (i.e., 2008) were matched with information at wave 1 (i.e., 85.1%). Among them, 592 respondents who already lived alone at wave 1 were excluded from the sample of matched data between waves 1 and 2. Then, 5092 of 5194 respondents aged 60 or over at wave 3 were matched with information at wave 2 (i.e., 98.03%). Finally, 5142 of 5289 respondents who were aged 60 or over at wave 4 were matched with information at wave 3 (i.e., 97.22%). For the matched data sets between waves 2 and 3 and between

waves 3 and 4, respondents who already lived alone at wave 1 or made the first transition to living alone at waves 2 or 3 were excluded. Additionally, for all matched data sets, respondents who had unclear information on living arrangements and those who were married but did not live with spouses were also excluded to minimize confounding issues. Consequently, the numbers of observations for matched data sets between waves were 4236 (i.e., waves 1 and 2), 4193 (i.e., waves 2 and 3), and 4081 (i.e., waves 3 and 4).

Measurements

Transition to Living Alone. A transition to living alone, the dependent variable, is a categorical variable to identify whether respondents experienced a transition to living alone between successive waves. It was coded as a dummy variable, as 0 (respondents who still live with someone) or 1 (respondents who had made the transition to living alone between two consecutive waves). For conducting event history analysis, respondents who had the first transition to living alone at a certain wave were dropped in the analytical models.

Economic and health conditions. Annual household income per a household member in the last year and home ownership were measured as indicators of the economic resources of the respondents. Both were measured at waves 1, 2, and 3 to examine whether and how economic conditions could be associated with the transition to living alone at waves 2, 3, and 4 respectively. Annual household income per a household member, which was measured by dividing annual household income by the number of household members, was classified into five categorical variables, based on the income distribution of each wave: second, third, fourth quartiles, and missing income, with the first quartile as the reference. Home ownership was measured as binary variables with three categories: "home ownership by respondents," "home ownership by other family member(s)," and "no home ownership." The reference group for home ownership is "no home ownership."

As indicators of physical and mental health conditions, three variables were used: self-rated health, perceived functional limitation, and depressive symptoms. Self-rated health ranged from 1 (very poor) to 5 (excellent), while perceived functional limitation ranged from 1 (not at all) to 4 (very much). Depressive symptoms were measured using the ten item short-form Center for Epidemiological Studies Depression (CES-D10) scale, assessing major depressive symptoms in the most recent week. The respondents rated each

symptom on a four-point scale from 1 (not at all or less than 1 day) to 4 (nearly every day). The symptoms included: (1) loss of interest, (2) trouble concentrating, (3) feeling depressed, (4) feeling tired or low in energy, (5) feel pretty good, (6) feel afraid, (7) trouble falling asleep, (8) feel generally satisfied, (9) feel alone, and (10) feel it is hard to get going. The two positive questions (i.e., feel pretty good and generally satisfied) were reversed for consistency. The reliability scores for depressive symptoms (Cronbach's α) were 0.78, 0.86, and 0.86 at waves 1, 2, and 3 respectively.

Covariates. Gender (female = 1) and age, measured in years, were included in the analytical models. Educational attainment was measured as binary variables, with four categories: "elementary school or less," "middle school graduates," "high school graduates," and "college or over." The reference group for educational attainment is "elementary school or less." Number of child was also measured as a control variable.

Prior living arrangements consisted of three categories to classify the household structure of respondents by the people who lived with them: "living with spouse only," "unmarried living with someone (i.e. children and/or others)," and "married living with someone (i.e. children and/or others)." The reference group in the analytical models is those who lived with spouses only.

Gender and educational attainment were independent variables measured at the baseline of 2006 because they did not change in later life. Educational attainment is usually determined in early stage of adulthood and rarely changes in later life. Other independent variables, including economic and health conditions, were time-varying covariates measured at the previous wave of the dependent variable measured, given that their values could change over the period of the observation (Allison 2010). By measuring time-varying conditions, it would examine the effects of economic and health conditions prior to the occurrence of the transition to living alone more clearly.

Analytical Strategy

Given that the data used were characterized by repeated observations (i.e., person-year data) and did not provide information on exact time points of when respondents transitioned to living alone, discrete time event history analyses of logistic regression with robust standard errors were used. The use of a discrete time event history analysis is more appropriate than a continuous time approach when the occurrences of events are considered as

being present at the same recorded time (Allison 1982, 2010). In the data used for the study, the moment respondents were transitioning to living alone could occur at any point in time between two consecutive waves, but it was recoded as being occurred at a following wave, which is a condition appropriate for a discrete time event approach (Allison 1982). Respondents who had the first transition to living alone at a certain wave were excluded in the sample for the analyses as mentioned above.

The first set of event history analysis models was to examine the effects of economic and health conditions on the transition to living alone. After analyzing the first model, which examined socio-demographic factors such as gender, age, educational attainment, and number of child, the second and third models added economic and health conditions hierarchically. One additional model was conducted to examine the effects of economic and health conditions on the transition to living alone after controlling for prior living arrangements. This could help identify more clearly if the unique effects of economic and health conditions exist.

The second set of event history analysis models, in which respondents who experienced spousal loss between the two consecutive waves were excluded, was to examine whether and how economic and health conditions were associated with the transition to living alone of those who did not have the event of widowhood. The estimates of all analytical models were weighted to adjust the estimates to the older Korean population.

Results

Descriptive Statistics

Table 1 presents the means/proportions and standard deviations of all the variables for each matched data set. About 4% of respondents matched between 2006 and 2008 made the transition to living alone as of 2008. The rate of experiencing the transition to living alone decreased as of 2010, but increased in 2012. Only 2% of respondents made the first transition to living alone between 2008 and 2010 while 4% of respondents made the transition between 2010 and 2012.

The descriptive statistics of independent variables by whether the respondents had made the transition to living alone are presented in Table 2 with the results of *t* or chi-squared tests comparing the variables by the living arrangement. The bivariate statistics showed that the two groups had

TABLE 1
Descriptive Statistics for Variables Across Waves (Years) Including Means/Proportions and Standard Deviations of the Variables

	2008, wave 2 (N=4236)		2010, wave 3 (N=4193)		2012, wave 4 (N=4081)	
Transition to living alone between waves	0.04		0.02		0.04	
Gender (female=1)	0.53		0.53		0.52	
Age	68.71	(7.56)	68.93	(7.68)	69.22	(7.77)
Educational attainment						
Elementary school or less	0.62		0.60		0.56	
Middle school	0.15		0.16		0.17	
High School or more	0.23		0.25		0.27	
Number of child	3.62	(1.57)	3.51	(1.53)	3.36	(1.49)
Home ownership						
Home ownership by respondents	0.37		0.40		0.43	
Home ownership by other family members	0.43		0.46		0.43	
No home ownership	0.20		0.14		0.14	
Annual household income per a household member in the last year						
1st quartile	0.25		0.25		0.26	
2nd quartile	0.21		0.29		0.26	
3rd quartile	0.25		0.24		0.26	
4th quartile	0.19		0.20		0.21	
Missing cases	0.10		0.02		0.01	
Self-rated health	2.80	(0.97)	2.86	(0.89)	2.88	(0.90)
Perceived functional limitation	2.43	(0.90)	2.37	(0.84)	2.31	(0.77)
Depressive symptoms	17.07	(5.16)	17.78	(5.65)	17.61	(5.62)
Prior living arrangement						
Living with spouses only	0.49		0.51		0.50	
Unmarried with children and/or others	0.20		0.17		0.15	
Married with children and/or others	0.31		0.32		0.35	

Notes: Standard deviations in parentheses are presented for continuous variables only.
Because of missing cases, the number of observations may vary across variables.

TABLE 2
Descriptive Statistics for Variables and *t*-Test or Chi-Squared Test Results for Comparing the Variables by Living Arrangements, for the Pooled Sample

	Total (N=12510)		No transition to living alone (N=12106)		Transition to living alone (N=404)		t-test/ Chi-squared test
Transition to living alone between waves	0.03						
Gender(female=1)	0.53		0.52		0.77		***
Age	68.95	(7.67)	68.89	(7.68)	70.84	(7.09)	***
Educational attainment							***
Elementary school or less	0.59		0.59		0.73		
Middle school	0.16		0.16		0.11		
High School or more	0.25		0.25		0.16		
Number of child	3.50	(1.54)	3.49	(1.53)	3.69	(1.70)	
Home ownership							***
Home ownership by respondents	0.40		0.40		0.35		
Home ownership by other family members	0.44		0.44		0.37		
No home ownership	0.16		0.16		0.28		
Annual household income per a household member in the last year							***
1st quartile	0.25		0.25		0.39		
2nd quartile	0.26		0.26		0.24		
3rd quartile	0.25		0.25		0.17		
4th quartile	0.20		0.20		0.13		
Missing cases	0.04		0.04		0.07		
Self-rated health	2.84	(0.92)	2.85	(0.92)	2.64	(0.88)	***
Perceived functional limitation	2.37	(0.84)	2.36	(0.84)	2.55	(0.83)	***
Depressive symptoms	17.48	(5.49)	17.42	(5.46)	19.41	(5.95)	***
Prior living arrangement							***
Living with spouses only	0.50		0.50		0.52		
Unmarried with children and/or others	0.17		0.16		0.40		
Married with children and/or others	0.33		0.34		0.08		

Significance levels: +p<0.10, *p<0.05, **p<0.01, ***p<0.001

Notes: Standard deviations in parentheses are presented for continuous variables only.
Because of missing cases, the number of observations may vary across variables.

significantly different characteristics. About 77% of older adults living alone in the pooled data were females whereas 52% of older adults living with someone were females, reflecting that females are much more likely to live alone than men. The average age of respondents living alone was higher than that of those living with someone. For educational attainment, the chi-squared test results suggest that there were significant differences in the two groups according to educational levels.

It was also shown that there were significant differences in whether or not having the transition to living alone according to home ownerships and household income per a household member. In terms of health conditions, according to the t-test results, respondents transited to living alone had a lower level of physical and mental health conditions than their counterparts. The average score of self-rated health was lower, while perceived functional limitation and depressive symptoms were higher for respondents who experienced the transition to living alone than other who did not. These bivariate comparisons indicate that older adults who had poorer health might have a higher likelihood of having the transition to living alone.

Event history analyses: Effects of economic and health conditions

Table 3 summarizes the results of discrete time event history analyses examining the effects of economic and health conditions prior to the transition to living alone. From models 2 to 4, economic resources at the previous wave were consistently significant for the first transition to living alone. Home ownership by other family members was significant for the transition to living alone. Compared with older adults who rented houses, without home ownership, those whose co-resident family members owned houses were less likely to have the transition to living alone. However, there was no significant difference in the transition to living alone between those living in rented houses and in houses owned by respondents. Annual household income per a household member was also significant for the transition to living alone. All three categories of annual household income were significant, suggesting that older adults whose household incomes are higher are *less* likely to make the transition to living alone.

The effects of economic conditions were still significant after controlling for health conditions and prior living arrangements in models 3 and 4 respectively. In model 4 including prior living arrangements, older adults with homes owned by other family members were approximately 0.49 times less likely to make the transition to living alone than those who rented

TABLE 3
Discrete Time Event Analyses of the Transition to Living Alone, Analyzing Economic and Health Conditions Prior to the Transition (Odds Ratios)

	Model 1	Model 2	Model 3	Model 4
Gender (Female=1)	2.70***	3.84***	3.73***	2.41***
Age	1.03***	1.03***	1.02**	0.99
Educational attainment (Elementary or less=referent)				
Middle school	0.81	0.15	0.92	1.01
High School or more	0.87	0.16	0.98	1.14
Number of child	1.00	1.01	1.02	1.05
Home ownership (No home ownership=referent)				
Home ownership by respondents		0.89	0.91	0.88
Home ownership by other family members		0.38***	0.39***	0.49***
Annual household income per a household member in the last year (1st quartile=referent)				
2nd quartile		0.65**	0.65**	0.66**
3rd quartile		0.49***	0.50***	0.48***
4th quartile		0.51***	0.50***	0.44***
Missing cases		0.81	0.77	0.68
Self-rated health			1.06	1.05
Perceived functional limitation			1.04	1.03
Depressive symptoms			1.03**	1.02*
Prior living arrangement (Living with spouses only=referent)				
Unmarried with children and/or others				2.10***
Married with children and/or others				0.27***
Year (2008=referent)				
2010	0.51***	0.54***	0.51***	0.52***
2012	1.16	1.20	1.18	1.31*
Wald Chi^2	125.94***	253.86***	275.84***	382.14***
Pseudo R^2	0.04	0.07	0.08	0.11
Person-years	12501	12499	12419	12419

Significance levels: +p<0.10, *p<0.05, **p<0.01, ***p<0.001

houses. The second, third, and fourth quartiles of annual household income have 0.66, 0.48, and 0.44 times the likelihood of the transition to living alone versus the first quartile of annual household income in model 4. Thus, the higher the household income, the lower the likelihood of making the transition to living alone in general.

In terms of health conditions, physical health variables were not significant for the transition to living alone. Only depressive symptoms had a significant effect on the transition to living alone. The likelihood of making the transition increased 1.02 times as depressive symptoms increased by one unit in model 4. The greater depressive symptoms, the higher the likelihood of making the transition to living alone.

Among socio-demographic factors, only gender was significant in all the models. Specifically, older female adults were more likely to make the transition to living alone than older male adults. Age became non-significant after controlling for prior living arrangements in model 4, suggesting that age is also associated with prior living arrangements. For prior living arrangements, unmarried who lived with children and/or others were 2.1 times more likely to experience the transition to living alone than those who lived with spouses only whereas married who lived with children and/or others were about 0.27 times less likely to make the transition to living alone than those who lived with spouses only. Married who lived with children and/or others were least likely to experience the transition to living alone, while unmarried who lived with children and/or others were more likely to experience the transition to living alone.

Table 4 summarizes the results of discrete time event history analyses in which respondents who experienced spousal loss between the waves were excluded (N=309). The effects of economic and health conditions were quite consistent with those in Table 3. Older adults with houses owned by other family members were less likely to make the transition to living alone than those who rented houses. In contrast to results summarized in Table 3, only third quartile of annual household income per a member was marginally associated with the transition to living alone versus the first quartile of annual household income in model 3. In terms of health conditions, physical health variables were not significant for the transition to living alone. Only depressive symptoms had a significant and positive effect on the transition to living alone as shown in Table 3.[1]

[1] We should be cautious to interpret the analytic results of model 4 in which prior living arrangements were included because the likelihood of making the transition to living alone would be

TABLE 4
Discrete Time Event History Analyses of the Transition to Living Alone, Excluding Older Adults Who Experienced Spousal Loss Between Waves (Odds Ratios)

	Model 1	Model 2	Model 3	Model 4
Gender (Female=1)	2.32***	4.18***	3.96***	0.98
Age	1.02+	1.02+	1.02	0.96***
Educational attainment (Elementary or less=referent)				
Middle school	0.83	0.86	0.91	1.15
High School or more	0.96	0.98	1.02	1.45
Number of child	0.95	0.97	0.98	1.06
Home ownership (No home ownership=referent)				
Home ownership by respondents		1.12	1.17	1.14
Home ownership by other family members		0.23***	0.24***	0.42***
Annual household income per a household member in the last year (1st quartile=referent)				
2nd quartile		0.84	0.85	0.83
3rd quartile		0.62*	0.66+	0.55**
4th quartile		0.75	0.77	0.57*
Missing cases		1.25	1.26	0.82
Self-rated health			1.12	1.12
Perceived functional limitation			1.14	1.16
Depressive symptoms			1.04**	1.03**
Prior living arrangement (Living with spouses only=referent)				
Unmarried with children and/or others				19.06***
Married with children and/or others				0.54***
Year (2008=referent)				
2010	0.19***	0.20***	0.18***	0.18***
2012	1.07	1.12	1.11	1.37**
Wald Chi^2	80.61***	178.17***	217.12***	390.85***
Pseudo R^2	0.052	0.100	0.110	0.258
Person-years	12193	12191	12114	12114

Significance levels: +p<0.10, *p<0.05, **p<0.01, ***p<0.001

It should be noted that the effect of year 2010 is opposite to that of year 2012 in Tables 3 and 4. It seems that this difference reflects changes in social environments and living arrangements for older adults in the mid to late 2000s in Korea. In Korea, the percentage of those living alone among older adults increased between 2006 and 2008, more than between 2008 and 2010. According to the Seoul Metropolitan government, the percentages of those living alone among older adults aged 65 or over in Seoul were approximately 18.8 and 20.5 in 2006 and 2008 respectively; the rate increased between 2006 and 2008 by 8.6% (Seoul Metropolitan Government 2012). However, the percentage of those living alone among older adults aged 65 or over was approximately 20.15 and 21.45 in 2010 and 2012 respectively (Seoul Metropolitan Government 2012), which means that the percentage of older adults living alone slightly decreased between 2008 and 2010, but it increased between 2010 and 2012 again. The results of the study reflect these changing patterns in Korea. It seems that the financial crisis of 2008, which originated from the United States, led to a relatively rapid increase of older adults living alone as of 2008; its increasing rate slightly decreased after the financial crisis in the next couple of years.

Discussion

The findings showed that economic and health conditions were significantly associated with the first transition to living alone in older Koreans. In terms of the effects of economic conditions, older adults whose co-resident family members owned a house were less likely to make the transition to living alone two years later. Also, annual household income per a household member was negatively and significantly associated with the transition to living alone. These findings suggest that older adults who were economically disadvantaged were more likely to live alone in Korea, which differs from previous studies in other countries (e.g., Mutchler and Burr 1991; Tohme et al. 2011). Indeed, these previous studies argued that living alone in older adults reflected their increased independence, based on better economic standing. However, it seems that older adults who rented houses and were in the lowest income quartile have a higher likelihood of the transition to living

rare for those who lived with spouses only without spousal loss in Korea. It should be noted that only 0.63% of older adults who lived with spouse only and did not experience spousal loss between the two waves had the transition to living alone. This might be why the odds ratio of those who were unmarried with children and/or others in Table 4 was much greater than that in Table 3.

alone in Korea.

Moreover, the findings did not support that better physical health conditions would increase independent living in older adults. The two physical health measures were not significant for the transition to living alone. This, at least, suggests that better physical health for independent living is not a required condition for the first transition to living alone in older Koreans. In contrast, depressive symptoms were positively and significantly associated with the transition to living alone. As the level of depressive symptoms at a previous wave increased, the likelihood of having the transition to living alone increased. Poor mental health may inhibit coresidence with adult children/others by reducing the well-being of the caregivers (Ostwald et al. 1999). Another possibility is that depressive symptoms prior to the transition to living alone may reflect the emotional distress of older adults while they lived with family members such as an adult child. Older adults who were not satisfied with coresidence or had lower quality relationships with family members may prefer to live alone when they need to decide.

The present study showed that economically and psychologically disadvantaged older adults are *more* likely to make the transition to living alone in Korea. This suggests that older adults with better resources might sustain co-residence with an adult child and/or other family members, which differs from the Western context, where better economic and physical conditions *facilitate* the independent living of older adults. Under the influence of weakening traditional family values and rapid aging in Korea, older adults with limited economic resources and poorer mental health conditions are more likely to have the transition to living alone.

Some observations and empirical evidences in Asian countries, including Korea may provide meaningful theoretical grounds for the interpretation of the transition to living alone in older Koreans. In Asian countries, coresidence with an adult child may be based on the reciprocal exchange of resources between older parent(s) and the adult child (Tai and Treas 2009; Takagi and Silverstein 2011). This reciprocal exchange is possible in two contrasting ways depending on who have or provide resources between the older parent(s) and adult children. First, older adults who have more economic resources (i.e., home ownership and higher household income) are more likely to live with an adult child in Japan, which has been referred to as "purchasing piety" (Takagi and Silverstein 2011). For adult children, co-residence with parents might be a rational strategy, especially when they have limited economic and financial resources for separate living.

In contrast, it is also possible that older parents provide family and grandchild care to an adult child who has better economic resources. Because of the limited childcare system and increased number of working women in Korea, many older parents assist in housework and grandchild care for their adult children. According to Statistics Korea (2013a), among older adults aged 60 or over and who co-reside with adult children, 10.2% of respondents answered that they are living with an adult child to provide grandchild care and housework. In addition, 36% of older adults answered that they are living with an adult child because they are not able to afford independent living while 29.3% answered that their adult children are not able to afford independent living (Statistics Korea 2013a). These statistics suggest that older Koreans are likely to live with their adult children if either an older parent or adult child has moderate or sufficient economic resources, which is a condition for reciprocal exchange between them.

At the same time, adult children who have better economic resources might be more willing to live with their parents as well. With changes in family values, the spread of economic hardship, and demographic trends of fewer children and longer life spans over recent decades, younger generations have become less willing and/or less able to live with their parents in Korea (Kim 2008). An adult child who has sufficient economic resources might, ironically, decide to coreside with their parent(s) without economic burden and stress. That is, greater economic resources in households may *inhibit* separate living between an older parent and adult child. In contrast, limited economic resources in households may *precipitate* separate living between an older parent and adult child by decreasing the possibility of reciprocal exchange and willingness of co-residence.

Although physical health did not show a significant effect on the transition to living alone, better health in older adults might facilitate living with an adult child because older adults have the capability to provide house work and grandchildren care (Won and Lee 1999), suggesting that older parents not only *receive* support from, but may also *provide* support *to* their children. Indeed, older adults, especially females, are often the primary caregivers for their grandchildren and are requested to do housework for their adult children in Korea (Do and Malhotra 2012; Jeon et al. 2013). Co-residence between parents and adult children might be a reciprocal exchange process, based on their resources.

The significant associations between prior living arrangements and transition to living alone support that prior living arrangements affect possible transition options ahead (Martikainen et al. 2008). It seems that

those who are married living with children might have more options in terms of living arrangements than unmarried living with children when they are in need of changing living arrangements. Moreover, remarriage of older adults is not common in Korea relative to Western societies. As of 2012, the remarriage rates of older adults aged 65 or over after spousal loss were only 2.4 per 10, 000 for men and 0.5 per 10, 000 for women (Statistics Korea 2013b). Given the low rate of remarriage of older adults, an unmarried parent living with their adult child could be more likely to make a transition to living alone rather than extending their household through remarriage.

The findings of the study provide important implications for older adult health. Living alone has been considered to be a critical determinant of older adults' well-being. Many studies have shown that living alone negatively affects the physical and psychological well-being of older adults in non-Western and Western nations. Older adults who live alone are likely to have a lower level of psychological well-being (Mullins, Sheppard, and Anderson 1991; Silverstein, Cong, and Li 2006; Do and Malhotra 2012) and higher mortality (Sorlie, Backlund, and Keller 1995), which has been explained by living alone decreasing social integration and resources. When disadvantaged older adults are more likely to live alone, it is possible that for such older adults, the negative effects of living alone on their psychological well-being and physical health occurring after a certain period of time would be amplified in the long run, given their initial disadvantages.

This study has limitations that should be considered. First, although the analyses of the present study were weighted and matching rates between waves were quite high, caution is needed because more disadvantaged respondents, especially in terms of health, might have been excluded from the sample, raising an attrition issue. Also, because of the limitations of the data, the study did not investigate institutionalization, another living arrangement for some older adults. In Western countries, poor health conditions, such as higher levels of functional limitation and disability, are important determinants of the transition to becoming institutionalized (e.g., Martikainen et al. 2008). Although it is unfortunate that institutionalized older adults could not be included in the study, the selection bias due to the omission might have a lesser impact when referring to the context of Korea than in Western countries given that only a limited number of older adults have been institutionalized in Korea. Only 1.22% (i.e., 112,650 of 5,980,060) and 2.1% (i.e., 52,806 of 4,324,780) of the older adult population aged 65 or over were institutionalized as of 2005 (Ministry of Health and Welfare 2006) and 2012 respectively (Ministry of Health and Welfare 2013). Although a

limited number of older adults are institutionalized in Korea, it should be noted that institutionalization might have different mechanism(s) from the transition to living alone.

It is also important for further studies to investigate the effects of health conditions on returning to living with an adult child or house expansion after the transition to living alone. Considerable decline in physical health in older adults living alone may lead to going back to adult children or others. As physical health conditions, measured by functional limitation and medical problems, became poorer, the oldest old Chinese were more likely to live with an adult child or others, especially those who were not married (Zimmer 2005). Consequently, older adults may tend to live with their children more commonly when they have serious declines in health in Korea too.

Although this study did not examine gender differences because of the limited number of the transition to living alone, further studies on gender differences are needed. Given that older women are more likely to have the transition to living alone and to provide family and grandchild care than men, it is required to examine whether and how economic and health conditions differently affect the transition to living alone across men and women. Finally, in terms of measurements, although the data set used has advantages for measuring home ownership, by distinguishing homes owned by respondents and by other family members, it was not possible to obtain detailed information on the relationship between respondents and other family members. Home ownership might have different effects, depending on who was the owner, such as a spouse or an adult child among family members.

Despite its limitations, this study showed that, for older Koreans, the transition to living alone is based on different dynamics from those in Western countries. More disadvantaged older adults, in terms of economic and mental health conditions, are more likely to make the transition to living alone, indicating that older adults living alone might not be due to the increased preference for privacy and independence in Korea. It appears that older Koreans are likely to live with their adult children if either an older parent or adult child has moderate or sufficient economic resources, suggesting interdependent relationships between them. Unfortunately, older Koreans in more disadvantaged economic and health conditions are more likely to live alone. These initial disadvantages can be amplified as the period of living alone increases. Policy makers and practitioners working with older adults living alone should recognize the possibility of amplified hazards of living alone and provide specific interventions to older Koreans living alone.

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MIN-AH LEE is Associate Professor of Sociology at Chung-Ang University. Her major research areas are health inequality and aging. Her recent research interests include depressive symptoms and suicidality of Koreans in relation to early adversities and social capital as well as the psychological well-being of Korean older adults living alone. Recent publications have also appeared in *Child Abuse & Neglect* and *Social Science & Medicine*. *Address*: Department of Sociology, Chung-Ang University, 84 Heukseok-ro, Dongjak-Gu, Seoul, Korea 06916. *Tel*: 82-2-820-5786 [*E-mail*: malee@cau.ac.kr].