Health Insurance and Precautionary Saavings Under Liquidity Constraints

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ABSTRACT

In this study, we analyze the effects of households' private health insurance subscription on their savings behavior in Korea. To do so, we adopt data from the Korea Welfare Panel Study for 2008–2013 and employ a panel Tobit regression model. We present evidence on the existence of a motive for precautionary savings for unexpected medical expenditures. However, this result is in contrasts those of a study on the United Kingdom (Guariglia and Rossi, 2004), which has a mixed healthcare system that combines public and private health insurance and is similar to that in Korea. This contrasting result can be attributed to the significant difference in the insurance coverage rates of the public healthcare sector between the two countries. In addition, the results revealed that a precautionary savings motive is more often found among households who face liquidity constraints than among unconstrained households, even under differing empirical specifications. Finally, our empirical results are robust to the random effects Tobit model for unobserved effect and a control function approach for endogeneity problem.

Keywords: Liquidity constraints, Panel Tobit regression model, Precautionary savings, Private health insurance

INTRODUCTION

Households face various sources of risks; for instance, as labor market risks, they encounter unemployment, the possibility of being disabled, resignation, or temporary leave due to health problems. These risks play a crucial role because households make their consumption–saving decision according to the risks they face. Most studies measuring uncertainties tend to use the conditional variance of consumption or income growth (Dynan 1993; Kimball 2001). while others use proxies for uncertainty, such as health insurance (Starr-McCluer 1996; Guariglia & Rossi 2004). Households are likely to subscribe to private health insurance as a precautionary measure for unexpected spending in the case of an illness. However, despite the use of health insurance as an instrument in the empirical testing of precautionary savings and its various policy implications related to healthcare systems, few studies in the literature examine the topic from this perspective.

In Korea, the proportion of household medical expenditures to total household consumption expenditures was 6.61% in 2012, which is the highest level recorded to date. Such medical expenditures create severe uncertainties in households regarding their future economic situation and thus cause them to save more and consume less. In other words, households tend to formulate a motive for precautionary savings for unexpected medical expenditures. Against this background, the growth rate of private health insurance (PHI) subscription in Korea has gradually gained momentum. The healthcare system in Korea, in particular the coexistence of public and private healthcare, has recently gained researchers' attention. Every individual subscribes to one of the two types of mandatory national health insurance (NHI), that is, for employees and self-employed, and medical aid.[1] However, as frequently pointed out, the coverage rate of NHI in Korea is substantially lower than that in other OECD countries, and this situation is unlikely to improve without an increase in households' contribution to NHI. To explore the implication of this problem, this study aims to present empirical evidence of a precautionary savings motive in Korea with respect to medical expenditures.

Thus, we analyze the effects of PHI subscription on household savings behavior in line with the research direction pioneered by Starr-McCluer (1996). PHI is supplementary to NHI in Korea in terms of medical cost financing. In this case, if a motive for such precautionary savings exists, the purchase of supplementary PHI is likely to negatively affect household savings. In other words, PHI mitigates uncertainties regarding unexpected medical expenditures. Reducing the precautionary savings motive will in turn flatten the optimal consumption path. If households' motive for precautionary savings is significantly strong, a subscription to PHI is likely to yield a positive welfare effect in terms of consumption smoothing, as highlighted in Chou et al. (2003).

[1] Medical aid is similar to Medicaid in the United States.

However, a precautionary saving motive under a liquidity constraint may differ from motive without one.[2] Only a few papers attempt to explain the linkage between precautionary savings and a liquidity constraint. For instance, Lee and Swada (2010). empirically tested this relationship in Pakistan and found substantial precautionary saving motive in this developing country. Using Italian household data, Deidda (2014). provided empirical evidence of a stronger effect on households who face liquidity constraints than unconstrained households.

In this study, we analyze not only the effects of PHI on savings behavior but also the relationship between liquidity constraints and precautionary savings in the form of PHI subscription in Korea. To do so, we conduct empirical tests using various specifications and present interesting findings. The contributions of this paper are two-fold. First, we use PHI as an uncertainty measure in the present model, whose results have implications for health policymakers in Korea. Korea has a unique healthcare insurance system, which comprises mandatory public healthcare as well as the choice of private health insurance, thus rendering it comparable with the healthcare system in the United Kingdom. Second, we provide empirical evidence on precautionary savings motive under liquidity constraints. To the best of our knowledge, few empirical studies discuss the linkage between precautionary savings and a liquidity constraint in developed countries. Further, we conduct a robustness check for our findings using a control function approach.

To explore the implications of our theoretical predictions, we reference the Korea Welfare Panel Study (KOWEPS), constructed to develop welfare policies in Korea. Following Guariglia and Rossi (2004) and Hsu et al. (2011). we adopt the panel Tobit regression analysis, invented to address the censored data problem and unobserved heterogeneity across individuals. It is essential to control for unobserved heterogeneity to deal with endogeneity inherent in the purchase of private health insurance. Further, to perform a robustness check of our key empirical results, we use a control function approach and present a two-step estimation. First, we treat the residuals from the probit model with the main explanatory variable as the dependent variable, and then include the residual as an explanatory variable to check whether the main variable is still significant. The empirical results from the control function approach confirm that our main results are still valid.

When examining precautionary savings and liquidity constraints in the case of uncertainties resulting from capital market imperfections, it is important to adopt a model that accounts for these features. However, as Carroll and Kimball (2001). point out, there is no analytical closed-form solution, and the simulation results from existing theoretical models present mixed conclusions. Liquidity constraints may induce precautionary savings and both share a complementary or substitutive relationship. In the case of a complementary relationship, uncertainty has a larger effect on constrained households than on unconstrained households. Our empirical findings reveal a complementary relationship between precautionary savings and liquidity constraints for Korean households. This is consistent with Deidda's (2014). result for Italian households. Furthermore, the empirical findings suggest that the precautionary savings motive is significantly stronger for households who have limited access to the credit market.

The remainder of this paper is organized as follows: Section II presents a brief explanation of the health insurance systems in Korea. Section III discusses the empirical models. Section IV describes the data and main empirical results. Section V concludes.

Health insurance system in korea

In Korea, there are three types of health insurance systems: NHI system, medical aid program (MAP), and private health insurance (PHI). NHI provides universal coverage for outpatient care, in-patient service, preventive care, and prescription drugs to all citizens in Korea, except lower-income groups, which are supported by MAP.[3] In 2013, 50 million people, or approximately 97.2% of the total population, were covered. The insured are classified into two groups: insured employees and self-employed. The insured employee category includes the insured's spouse, direct lineal ascendants and descendants, unmarried brothers and sisters, as well as the employees themselves in the private and public sector. In 2013, insured employees in Korea paid 5.89%[4] of their average monthly salary as a monthly payment toward the insurance system. The self-employed insured category includes all persons who do not fall under the insured employee category. The contribution of the insured self-

[2] According to Modigliani and Sterling (1983) and Kimball (1990), individuals should have prudence preference for precautionary saving motive. By contrast, Besley (1995) and Caroll and Kimball (2005) suggest that precautionary savings stem from individuals facing a binding constraint with non-prudent preference.

[3] Koreans who are overseas and foreigners residing in Korea may also opt for the NHI program by completing a registration procedure.

[4] The contribution rates tend to vary by year.

employed is calculated on the basis of the annual average income, properties, vehicles, age, and gender.[5] The remaining 2.8% were covered by MAP, is a tax-financed public assistance scheme to secure the minimum livelihood of low-income households and assist them with medical services that provide self-help. Under MAP, the government incurs all medical expenses for patients who are unable to pay for medical services.[6] Since 2004, MAP has been expanded to cover patients with rare, intractable, and chronic diseases as well as children below 18 years of age. This program is jointly funded by the central and local governments.

Table 1
Population Coverage (2013)

(Unit: 1,000 persons)

Classification		Coverage	%
Total		51,448	100
NHI	Subtotal	49,990	97.2
	Insured Employees	35,006	68.1
	Self-employed insured	14,984	29.1
MAP		1,458	2.8

Source: NHIS Statistical Yearbook (2013)

The last pillar of the Korean health insurance system is private health insurance, which broadly covers medical expenses for chronic illnesses and accidents. PHI plans play both a supplementary and complementary roles in the NHI plan by paying a lump-sum disbursement on the diagnosis of a critical illness, irrespective of actual medical expenditures and medical care receipts (critical illness plan), or providing itemized medical expense compensation upon service use (medical expenses plan). The demand for PHI plans among public insurance members further increased because of the limited coverage[7] and weak financial protection from public insurance packages. Unlike NHI, private plans pay the claimed benefit directly to the policyholders and not the healthcare service providers. According to Shin (2012). PHI's financing out-of-pocket payment for NHI-excluded services and cost sharing make it worthwhile for NHI members.

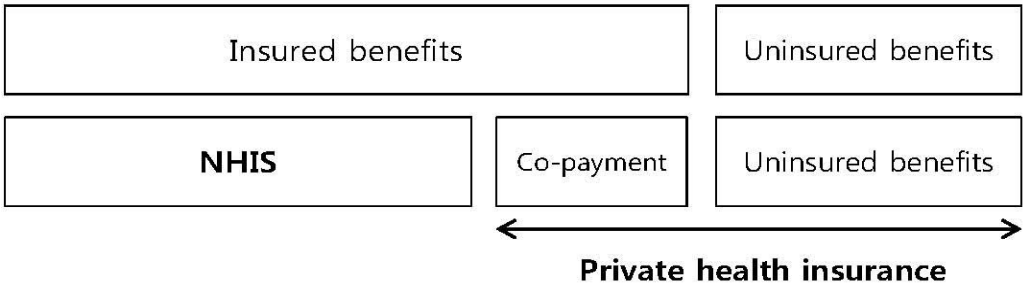

Figure 1 PHI Coverage

Empirical models

Our main analysis is based on a panel Tobit regression model with individual-specific effects. The model is used to analyze the determinant of individuals' savings decisions and applied to a situation where savings take a positive value or the value of zero to represent negative savings. In particular, we estimate a random effects model because there is no simple consistent estimator for fixed-effect models in a general micro-econometric setting of a short panel.[8] Similar to Guariglia and Rossi's (2004) model, the Tobit regression model with random effects in this study is estimated as follows:

$$S_{i,t}^{*} = \gamma PHI_{i,t} + \beta' X_{i,t} + \mu_i + \varepsilon_{i,t}, \quad \begin{cases} S_{i,t} = S_{i,t}^{*} \text{ if } S_{i,t}^{*} > 0 \\ S_{i,t} = 0 \quad \text{if } S_{i,t}^{*} \leq 0 \end{cases} \qquad (1)$$

where $\varepsilon_{i,t} \sim N(0, \sigma_{\varepsilon}^2)$. $S_{i,t}^{*}$ is an unobservable savings variable for household i at time t and the observed

[5] For details on the calculation of the contribution score for the low-income group, see National Health Insurance Service (2014).
[6] However, the deductible for outpatient services was introduced for those who qualified for MAP.
[7] NHI offers uninsured benefits as well as co-payments.
[8] More complicated semi-parametric estimators that permit fixed effects in Tobit and generalized Tobit models are discussed in Cameron and Trivedi (2005).

savings variable $S_{i,t}$ holds the relationship described in eq. (1). $PHI_{i,t}$ is a dummy for PHI enrolment and takes the value of 1 if the household head has at least one PHI at time t, and 0 otherwise. β' is the transpose of a finite dimensional vector of unknown parameters, β, with control variables X. These control variables include those for taste-shifters, health status such as the household head's age, number of household members, dummies for non-residency within Seoul, self-rated health status, and other variables described in Table 2. In addition, as Carroll and Samwick (1998). suggested, because savings may vary across levels of permanent income, we include a proxy for permanent income for each individual.[9] The joint density for the ith observation $\mathbf{S}_i = (S_{i1}, \dots, S_{iT})$ can be written as

$$f(\mathbf{S}_i|\mathbf{X}_i, \mu_i, \gamma, \beta, \sigma_\varepsilon^2) = \prod_{t=1}^{T}[\frac{1}{\sigma_\varepsilon}\phi_{i,t}]^{d_{i,t}}\,[1-\Phi_{i,t}]^{1-d_{i,t}},$$

where $\phi_{i,t} = \phi\left(\frac{S_{i,t}-\mu_i-\gamma PHI_{i,t}-\beta' X_{i,t}}{\sigma_\varepsilon}\right)$ and $\Phi_{i,t} = \Phi(\frac{\mu_i+\gamma PHI_{i,t}+\beta' X_{i,t}}{\sigma_\varepsilon})$. $\phi(\cdot)$ and $\Phi(\cdot)$ denote the standard normal probability density function (pdf) and cumulative density function (cdf), respectively. Under the assumption that $\mu_i \sim N(0, \sigma_\mu^2)$, the random effects maximum likelihood estimator of $\beta, \sigma_\varepsilon^2$ and σ_μ^2 maximize the log-likelihood $\sum_{i=1}^{N} \ln f(\mathbf{S}_i|\mathbf{X}_i, \gamma, \beta, \sigma_\varepsilon^2, \sigma_\mu^2)$,

where $f(\mathbf{S}_i|\mathbf{X}_i, \gamma, \beta, \sigma_\varepsilon^2, \sigma_\mu^2) = \int f(\mathbf{S}_i|\mathbf{X}_i,\ \mu_i\ \gamma, \beta,\ \sigma_\varepsilon^2)\frac{1}{\sqrt{2\pi\sigma_\mu^2}}\exp\,(\frac{-\mu_i}{2\sigma_\mu^2})^2 d\mu_i$.

This one-dimensional integral can be computed using a Gaussian quadrature rule.

Data and empirical results

4.1. Data

The data used in the empirical investigation are from the KOWEPS, administered by the Korea Institute for Social and Health Affairs and Seoul National University to elaborate on a more flexible social welfare policy. The first such study in 2006 covered 7,072 households. Over the years, KOWEPS has surveyed families and individuals, collecting information on various aspects, for example, social service needs, utilization patterns, economic and demographic characteristics, income sources, and emotional and behavioral health status. The survey comprises three questionnaire types: households, household members aged 15 years and above, and special topics (supplements). The most recent wave of surveys (eighth wave) was conducted in 2013, and the attrition rate of original households (compared to the first wave) was 25.47%.[10] We ignore data from the first and second waves in this empirical study because they do not contain information on households' PHI status.

4.2. Samples and Descriptive Statistics

Table 2 presents the descriptive statistics for the explanatory variables used in this study. Our unbalanced panel data comprise 15,155 observations, which include household heads from 4,433 households for 2008–2013. The table presents a comparison between households that own PHI (67.2%) and those that do not (32.8%). In addition, it shows the distinctive features between the two groups. We observe that households with PHI are those with higher permanent income and a greater number of younger household heads. Further, household heads with PHI are more likely to have a college (or higher)[11] education, be healthier in terms of self-assessed health, and enroll for the NHI employee insured scheme. The proportion of those who do not have a partner is higher in households with no PHI than in households with PHI. Finally, households with PHI are more likely to own a house and have more housing-related debt.

[9] To obtain fitted values, we estimate a panel regression model for log disposable income by age, age squared, education dummies, certain occupational dummies, and other dummies. The results for the earnings equation are not reported, but can be made available by the authors upon request.

[10] The recorded retention rate was an approximate 75%, which is similar to that of other panel surveys or relatively higher levels. Nevertheless, to address the problems of the declining original sample size owing to survey rejection and natural loss and the distribution of the sample and representativeness, a new panel sample was constructed in 2012 with 1,800 households.

[11] This group comprises those who have a two-year college degree, four-year university degree, a master's degree, or a doctorate.

Table 2
Descriptive statistics of explanatory variables

	PHI (n = 10,178)		No PHI (n = 4,077)		
Share of total sample	0.672		0.328		
	Mean	S. D.	Mean	S. D.	Description
log permanent income	8.218	0.387	7.936	0.486	
Age	44.73	10.14	50.93	14.54	
nhh	3.218	1.218	2.758	1.336	number of household members
non-Seoul metropolitan area	0.545	0.498	0.531	0.499	dummy; those who reside outside Seoul metropolitan area
female	0.156	0.363	0.191	0.393	dummy
without partner	0.225	0.418	0.372	0.483	dummy; unmarried, widowed, divorced or separated
single household	0.108	0.310	0.206	0.404	dummy
single parent	0.026	0.159	0.029	0.168	dummy
college	0.425	0.494	0.269	0.443	dummy; those who have than a college degree
good health	0.808	0.394	0.648	0.478	dummy; self-rated health
poor health	0.054	0.225	0.144	0.352	dummy; self-rated health
rented housing	0.490	0.500	0.551	0.497	dummy
housing-related debt	0.392	0.488	0.306	0.461	dummy

4.3. Estimation Results

In this study, we are primarily interested in eq. (1), which describes the relationship between PHI and savings behavior. By doing so, we reveal that the purchase of a supplementary PHI can reduce uncertainty regarding unexpected health expenditures and thus, reduces households' precautionary savings motive. To control for other factors influencing savings behavior, we include age, income, health status, and wealth control variables, as described in the earlier section.

Table 3 presents the main empirical results of the panel Tobit regression analysis. These estimation results are compared to different specifications. First, the coefficient for PHI in the pooled Tobit model is −0.254, which is negative and statistically significant at the 1% significance level.[12] Second, in our benchmark model, which is a random effect Tobit, the coefficient for PHI is negative. Although we use the panel Tobit regression with random effects for unobserved heterogeneity, an endogeneity problem can still be found, a phenomenon also highlighted in other studies. Therefore, we employ a control function approach to provide additional evidence. We detail the control function approach later in this chapter. Column (3) in Table 3 presents the result for the control function approach. Here as well, the effect of PHI on savings behavior is significantly negative, which is consistent with our main findings. Thus, our empirical results provide evidence in support of the existence of a precautionary savings motive for PHI in Korea.

Table 3
Results of panel Tobit regression for household savings

	Pooled Tobit	Random Effect Tobit	Control Function Approach
private health insurance	-0.254***	-0.355***	-200.2***
	[0.098]	[0.103]	[39.55]
log permanent income	2.228***	2.413***	-0.291***
	[0.228]	[0.278]	[0.027]
age	-0.273***	-0.295***	-633.7***
	[0.033]	[0.039]	[20.27]
age*age/100	0.283***	0.302***	757.4***
	[0.033]	[0.040]	[22.99]
ln (hhs)	-1.766***	-1.677***	68.46
	[0.162]	[0.190]	[67.09]
non Seoul	-0.079	-0.072	-166.5***
	[0.088]	[0.111]	[35.01]
female	-0.114	-0.201	-2,565***
	[0.153]	[0.186]	[91.80]
without partner	0.260	0.380**	2,058***
	[0.159]	[0.186]	[85.47]
single household	-0.812***	-0.730**	-719.0***
	[0.248]	[0.291]	[93.84]
single parent	-1.138***	-1.208***	-58.51
	[0.303]	[0.344]	[116.5]
college	0.049	-0.166	294.5***
	[0.136]	[0.171]	[59.20]
good health	-0.324***	-0.257**	-330.0***
	[0.122]	[0.120]	[50.58]

[12] The results are found to be robust using the private health insurance premium amount and are available upon request.

	Pooled Tobit	Random Effect Tobit	Control Function Approach
poor health	-0.299	−0.277	1,097***
	[0.184]	[0.180]	[78.88]
rented housing	-0.239**	-0.189	762.7***
	[0.101]	[0.117]	[44.56]
mortgage debt	0.167*	0.170*	-121.0***
	[0.098]	[0.103]	[39.48]
constant	−7.655***	−8.634***	17,098***
	[1.574]	[1.918]	[509.2]

Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are given in parentheses.

This implies that households are less likely to save after they purchase private health insurance. This finding supports our precautionary saving hypothesis and is similar those in Lee and Sawada (2010) and Deidda (2014), who use different models and specifications for testing. In addition, they use a classical linear regression model with variations in consumption and income growth and subjective measurements. However, in comparison to existing studies, our specification with a PHI subscription is a more direct measurement of uncertainty when testing for a precautionary savings motive.

Thus, our analysis revealed the existence of a precautionary savings motive. However, under the possibility of a liquidity constraint, households may change their risk attitude because of limited access to credit borrowing. Lee and Sawada (2007) and Deidda (2014) find the coefficient of precautionary motive to be larger for liquidity-constrained households. Our specification is a sample-splitting analysis to assess the degree of liquidity and conduct our benchmark analysis. The sample-splitting approach is commonly used when empirically analyzing broad macroeconomics concepts, for example, permanent income or a lifecycle hypothesis (Hayashi (1985); Zeldes (1989); Shea (1995); Parker (1999); Ni &Seol (2014)).

Thus, we split the samples into subsamples on the basis of liquidity, income level, and age of household head. We further divide them into two groups: low- and high-liquidity households, which hold the top and bottom 20% of liquid assets relative to household disposable income respectively. Low-liquidity households are found to face more uncertainty if households have a binding constraint in borrowing money; therefore, they are likely to have an incentive to save more. However, high-liquidity households have less incentive to save because they possess sufficient liquidity for future uncertainties. Our Tobit regression results show that the estimate for the low-liquidity group is stronger than that for the high-liquidity households. The coefficient of PHI is −0.905 (significant at the 1% level) for low-liquidity households and negative, but not significant, for high-liquidity households.

We extend our analysis to the samples split by income level and age. In addition to a liquidity constraint, low-income households or young households have more binding constraints than high-income households or older households. For income level, we split the sample as per the top and bottom 20% of household disposable income for low- and high-income households. Our estimation results are consistent with the theory's prediction. The effect of PHI on savings behavior is −1.182 (significant at the 1% level) for low-income households and −0.202 but not significant for high-income households. Our criterion for age group is an average age of 47 years.[13] For young households, the coefficient of PHI is estimated at −0.498 and statistically significant; however, for older households, the estimated coefficient is −0.224 but not significant. Our empirical findings confirm that the precautionary saving motive can stem from liquidity constraints, which we test under various specifications. Households with low liquidity or low-income level are more likely to have a binding constraint than those with

[13] This is the mean age in the pooled samples. Our sample is split into older households whose heads are older than 48 years and young households whose heads are 47 years of age or younger. The average value is marginally higher than that in other studies that conduct a representative household survey in different countries. In Parker (1999), the age group comprised those who were older than 44 years, which is based on the notion that behavioral change in typical households in the United States—that is, from a buffer stock-type behavior to permanent income or a lifecycle hypothesis type—occurs around the age of 43 years. Similarly, Ni and Seol (2014) split the sample for Korean households on the basis of those who are 43 years or younger.

high liquidity or high income, as also younger households in comparison to older ones. This finding is in line with the permanent income and lifecycle hypothesis, in which households are cautious when making saving–consumption decisions in the case of unexpected future shock. The magnitude of an uncertainty effect is larger for constrained households than unconstrained households. Thus, our empirical findings suggest a complementary relationship between precautionary saving motive and liquidity constraints for Korean households, which is consistent with Deidda's (2014). results for Italian households.

Table 4
Results for liquidity constraint test

	Liquidity		Income		Age of household head	
	low	high	low	high	young	old
private health insurance	−0.905***	−0.254	−1.182***	−0.202	−0.498***	−0.224
	[0.283]	[0.224]	[0.230]	[0.207]	[0.134]	[0.158]
log permanent income	2.004***	1.606***	−0.164	−2.765***	4.073***	1.497***
	[0.740]	[0.553]	[0.626]	[0.553]	[0.411]	[0.382]
age	−0.271***	−0.287***	−0.133**	−0.224**	−0.247*	0.438***
	[0.096]	[0.085]	[0.064]	[0.101]	[0.136]	[0.129]
age*age/100	0.264***	0.268***	0.139**	0.218**	0.198	−0.287***
	[0.096]	[0.084]	[0.063]	[0.103]	[0.179]	[0.106]
ln (hhs)	−1.575***	−1.151***	−4.126***	−2.372***	−2.273***	−0.296
	[0.510]	[0.390]	[0.557]	[0.329]	[0.270]	[0.284]
non Seoul	0.400	−0.097	0.557**	−0.355**	0.203	−0.282*
	[0.286]	[0.214]	[0.234]	[0.182]	[0.143]	[0.167]
female	−0.203	−0.325	0.688**	0.184	−0.113	−0.127
	[0.414]	[0.428]	[0.272]	[0.631]	[0.265]	[0.269]
without partner	0.500	0.169	0.756**	−0.034	0.658***	0.199
	[0.442]	[0.422]	[0.345]	[0.485]	[0.246]	[0.285]
single household	−0.228	−0.387	−2.597***	−3.941***	−0.470	−0.151
	[0.759]	[0.616]	[0.645]	[0.970]	[0.410]	[0.420]
single parent	−0.245	−1.324	−0.718	−2.730	−0.656	−1.746***
	[0.668]	[0.993]	[0.512]	[1.519]*	[0.431]	[0.631]
college	0.104	−0.182	−0.298	0.406	−0.428**	−0.561
	[0.462]	[0.336]	[0.435]	[0.293]	[0.210]	[0.303]*
good health	−0.295	0.379	−0.242	0.176	0.351*	0.209
	[0.330]	[0.260]	[0.234]	[0.242]	[0.183]	[0.159]
poor health	0.275	−0.631	−0.340	−1.301***	0.072	−0.387
	[0.445]	[0.430]	[0.272]	[0.449]	[0.348]	[0.213]*
rented housing	0.126	−0.209	−0.053	0.124	0.054	−0.431**
	[0.338]	[0.242]	[0.258]	[0.204]	[0.154]	[0.179]
mortgage debt	1.261***	−0.261	0.135	−0.048	0.173	0.153
	[0.310]	[0.214]	[0.257]	[0.173]	[0.137]	[0.156]

	Liquidity		Income		Age of household head	
	low	high	low	high	young	old
constant	−9.465*	−1.198	6.957	36.92***	−22.16***	−24.70***
	[5.112]	[3.777]	[4.405]	[3.753]	[3.457]	[4.801]

Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are given in parentheses.

4.4. Control Function Approach

To more explicitly reflect the existence of negative savings in the dataset and capture the endogeneity in PHI enrolment, we further investigate the saving decisions using the control function approach.[14] Thus, saving is modeled as

$$S_i = \gamma PHI_i + \beta_1' X_i + \varepsilon_i. \quad (3)$$

The endogenous decision for PHI enrolment is

$$PHI_i = 1[\beta_2 Z_i + u_i \geq 0]. \quad (4)$$

In this case, a simple two-step estimator is obtained as follows. First, we obtain the probit estimate, $\hat{\beta}_{2,}$[15] and calculate the generalized residual, $\widehat{gr}_i \equiv PHI_i\lambda(\hat{\beta}_i Z_i) - (1 - PHI_i)\lambda(-\hat{\beta}_i Z_i)$, where $\lambda(\cdot) = \phi(\cdot)/\Phi(\cdot)$ is the inverse Mills ratio. Second, we estimate the saving equation and include a generalized residual as a regressor:

$$S_i = \gamma PHI_i + \beta_1' X_i + \delta\widehat{gr}_i + \varepsilon_i. \quad (5)$$

In addition to the Tobit regression (Table 3), the control function approach allows us to confirm that the effect of PHI on savings behavior is significantly negative. In this section, as a robustness check, we test whether liquidity constraints persist under various specifications using the control function approach

To do so, we conduct a split-sample analysis, which is similar to the main regression. Columns (1) and (2) in Table 5 show the results for low- and high-liquidity households. The effect of PHI on saving in a low-liquidity household is significantly negative and that for a high-liquidity household is negative but not significant. Columns (3) and (4) are a comparison of the results by income group. The results show that the effect of PHI on low-income households is still significantly negative and that of high-income households is negative and significant at the 5% level. Columns (5) and (6) show the estimation results by age of household head. As expected, our results confirm that the effect of PHI on younger households is negative and significant, but that on older households is not significant. The magnitude of the effect on younger household heads is larger than that on older ones. Thus, the empirical results obtained from the control function approach show a clear pattern in supporting liquidity constraint.

[14] When the model is nonlinear, such as a Tobit regression, and the endogenous variable is not continuous, the control function approach does not work, as documented in Imbens and Wooldridge (2009). This is called a "forbidden regression." In other words, the control function approach applies when the model is linear in parameters, with the endogenous variable being either continuous or discrete, or when the model is nonlinear and the endogenous variable is continuous. Therefore, we report the results of only the linear regression of savings for endogenous PHI decisions.

[15] For parsimoniousness, we do not report the results for the probit regression here. The regressors are treated as explanatory variables in the savings equation and dummy variables denote workplace size.

Table 5
Results for control function approach

	Liquidity		Income		Age of household head	
	low	high	low	high	young	old
private health insurance	−344.8***	−49.25	−220.6***	−416.3***	−329.0***	−88.46
	[113.8]	[120.8]	[29.89]	[189.7]	[52.03]	[58.69]
log permanent income	−0.479***	−0.250***	−0.118	−1.348	−0.683***	−0.247***
	[0.083]	[0.078]	[0.023]***	[0.124]	[0.040]	[0.040]
age	−1,239***	−746.1***	−85.51	−1,748***	−668.5***	−752.0***
	[62.91]	[63.03]	[17.26]***	[103.0]	[50.11]	[64.91]
age*age/100	1,469***	858.3***	104.6	2,054***	830.0***	814.9***
	[72.10]	[69.74]	[20.01]***	[112.5]	[65.86]	[60.62]
ln (hhs)	559.2***	−154.2	−515.7	16.83	9.345	44.41
	[205.4]	[197.0]	[69.87]***	[286.2]	[95.48]	[96.36]
non Seoul	−88.82	−184.1*	89.17	−551.7***	−264.3***	−165.9***
	[106.1]	[102.3]	[27.83]***	[147.4]	[45.94]	[52.63]
female	−4,839***	−2,424***	−328.9	−6,781***	−4,161***	−2,254***
	[267.1]	[279.7]	[75.74]***	[626.7]	[136.8]	[145.1]
without partner	3,765***	2,024***	386.7	5,252***	3,438***	1,827***
	[249.3]	[258.7]	[69.50]***	[482.8]	[124.9]	[131.6]
single household	−588.0**	−996.1***	−539.2	427.9	−1,455***	−562.3***
	[276.7]	[287.8]	[72.94]***	[855.8]	[133.3]	[136.2]
single parent	190.2	−431.1	−14.06	595.3	−319.9**	−357.8*
	[250.8]	[487.4]	[61.86]	[1,295]	[145.8]	[213.9]
college	572.9***	246.9	40.03	1,133***	580.0***	25.77
	[190.3]	[173.7]	[55.74]	[261.9]	[72.99]	[105.7]
good health	−893.4***	−92.36	−71.62	−811.2***	−703.8***	−268.2***
	[145.7]	[149.1]	[36.14]**	[234.2]	[77.82]	[66.57]
poor health	2,058***	1,043***	132.2	2,574***	1,712***	889.2***
	[208.9]	[248.3]	[47.36]***	[427.6]	[144.3]	[98.55]
rented housing	1,488***	729.7***	194.3	1,779***	1,056***	640.0***
	[141.8]	[133.2]	[37.35]***	[184.4]	[58.46]	[69.04]
mortgage debt	−209.2	−188.7	−61.50	−358.6**	−254.7***	−186.8***
	[127.6]	[114.7]	[34.86]*	[154.0]	[52.82]	[58.39]
constant	32,576***	19,794***	2,583	51,262***	21,858***	20,800***
	[1,563]	[1,600]	[425.4]***	[2,403]	[1,013]	[1,938]

Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are given in parenthes

CONCLUSIONS

This study provides empirical evidence in support of the existence of a precautionary savings motive for PHI in Korea. In other words, the purchase of supplementary PHI significantly reduces uncertainty regarding unexpected health expenditures, thus reducing households' precautionary savings motive. Further, the results reveal that PHI has a significantly negative effect on savings behavior in our benchmark model and the random effect Tobit model, which accounts for unobserved heterogeneity.

To explain the precautionary saving motive, we empirically test for the possibility of a liquidity constraint. We adopt a split-sample approach for liquidity, income, and age group and find that a precautionary saving motive may stem from liquidity constraints. These empirical results are robust for various estimation specifications. In addition, we confirm our empirical findings using a control function approach, which also provides a solution for the endogeneity problem regarding a PHI choice.

The linkage between precautionary savings and liquidity constraints is interpreted as complementary. Under the assumption of liquidity constraints, households facing uncertainty under the liquidity constraint have a stronger incentive to save compared to unconstrained households. In other words, if households have limited access to a credit market, these households have an incentive to subscribe to PHI, thus preparing for unprecedented health shocks.

Although the NHI functions as a mandatory and preventive safety net for almost the entire population in Korea, in 2013, the country's PHI service covered only 55% of all household medical expenses (OECD, 2013). In this case, additional PHI seems to work as an efficient buffer against uncertainty. This is in stark contrast to the United Kingdom, where 93% of medical expenditures are covered by the public sector, and PHI is a substitute for national health system (NHS) in terms of medical care. Moreover, in the United Kingdom, because co-payments in NHS are zero, except in the case of prescriptions and dental care, there is little scope for PHI to financially supplement public coverage. In fact, an individual can only substitute medical treatment funded by NHS with private insurance-funded treatment, as explained in Olivella and Vera Hernandez (2008). We presume that these differences produce contrasting results between Guariglia and Rossi's (2004) study and the present one, despite both countries having a similar mixed health system. In conclusion, we argue that PHI in Korea enhances household welfare through consumption smoothing, particularly under the current government fiscal pressure.

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