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ARTICLE

Investigating household choice for health and life insurance

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ABSTRACT

The objective of this article is to investigate the joint determination of household choice for health and life insurance. Using the 2008–2009 Consumer Expenditure Survey data, we model household choice for health and life insurance assuming households consider purchasing them to manage financial risks in their life, after accounting for household characteristics, insurance characteristics, health status, and disability status. The model allows assessing the impact of health insurance choice on the choice of life insurance and the correlation between these two choices. The result suggests that health insurance choice positively affects the choice of life insurance and these two choices are positively correlated indicating complementary nature of these insurances in the basket of households' risk minimising goods.

KEYWORDS

Insurance; financial risk; health insurance; life insurance; bivariate probit

JEL CLASSIFICATION

G22; I13; D15; D12; D81; C35

I. Introduction

Households face financial risks as the volatility of unexpected loss in their earnings (Jorion 2007). Therefore, they choose different insurance policies to manage these risks (Johnson et al. 1993). Based on the evaluation of various risks, they decide to choose multiple insurance policies. Various factors such as financial needs, socio-economic status, and health status affect the risk evaluation. Thus, the objective of choosing insurance policies is to maximise expected utilities in the presence of various risks (Ehrlich and Becker 1972). Therefore, the correlation among losses associated with different risk situations will dictate the joint decision for the choice of various insurance policies.

To avoid financial risks where losses occur in diminished earnings, households choose health and life insurance (Cook and Graham 1977). In 2007, there were 253.5 million people in the United States with health insurance (US Census Bureau 2008), and 30.8 million life insurance policies were sold (American Council of Life Insurers 2007). Many households buy health and life insurance together. Despite the importance of these insurances in the basket of household's risk minimising goods, their choice behaviour is not investigated at the household level, and studies that demonstrate their choices look at them independently. Considering a major amount of the national economy being spent on health care, it is important to understand the households' joint insurance choice. In this study, we empirically estimate the joint model of household choice for health and life insurance.

II. Empirical model

We model household choice for health and life insurance jointly in an empirical setting.[1] Using a bivariate probit, we estimate the simultaneous model at disaggregate level controlling for the covariates associated with households' socio-economic status, insurance characteristics, and health and disability status. Let $(HI_h,\ LI_h)$ are choices of household (h) for health (HI) and life insurance (LI), respectively. The observed variables are dichotomous taking value 1 when the choice is made and 0 otherwise. The latent utilities associated with these insurance choices are as follows.

$$\begin{aligned} HI_h^* &= \alpha_1 + x_h'\beta_1 + z_{HIh}'\gamma_1 + \varepsilon_h^{HI} \\ HI_h &= 1 \text{ if } HI_h{}^* > 0\,,0 \text{ othewise} \end{aligned} \tag{1}$$

$$\begin{aligned} LI_h^* &= \alpha_2 + x_h'\beta_2 + z_{LIh}'\gamma_2 + HI_h\delta_2 + \varepsilon_h^{LI} \\ LI_h &= 1 \text{ if } LI_h^* > 0\,,0 \text{othewise} \end{aligned} \tag{2}$$

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[1]A theoretical model to motivate the joint estimate of health and life insurance choices is in the Web Appendix.

x_h' relates to h's socio-economic, and health and disability status, z_{HIh}' and z_{LIh}' are variables specific to health and life insurance, respectively. ε_h^{HI} and ε_h^{LI} have bivariate normal distribution:

$$\begin{pmatrix} \varepsilon_h^{HI} \\ \varepsilon_h^{LI} \end{pmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \right) \tag{3}$$

The model can be estimated using maximum likelihood method efficiently. The sign of ρ will dictate whether the health and life insurance are perceived as complementary/substitute goods.

III. Data

The study analyses 2008–2009 panel data of the Consumer Expenditure (CE) Survey. The Census Bureau under the contract from the Bureau of Labor Statistics collects the CE data. The CE data contain comprehensive data on buying habits of American consumers. The data also provide detailed household characteristics including demographics, income, and tax. The CE survey programme consists of surveying nationally representative US households on a rotating panel basis.

We select households with *single main decision-making unit*, who make active decisions for health and life insurance, that is, they incur net positive expenditure on their insurance policies. We begin with 34,485 households from which we drop 995, 7148, 5712, and 79 households with multiple decision-making units, Medicare, Medicaid, and missing information. In Table 1, we show cross-tabulation of insurance choices for 20,551 households. Insurance characteristics constitute who pays the premium, self or others. In the Appendix, we provide operationalisation of health status. In Table 2, we provide the summary of the households' socio-economic status.

Table 2. Overall data descriptive.

	Mean	SD	Median	Max	Min
Family information					
Age (in years)	43.2164	11.6258	44.0000	64.0000	16.0000
Infants (below 2)	0.0694	0.2672	0.0000	3.0000	0.0000
Juvenile (between 2 and 16)	0.6069	0.9682	0.0000	7.0000	0.0000
Adults (above 16)	2.0145	0.9057	2.0000	9.0000	1.0000
Old (above 64)	0.0140	0.1298	0.0000	3.0000	0.0000
Financial information (in terms of thousands of $)					
Income after tax	77.1930	65.8210	61.0000	1174.0205	−77.0563
Income from asset	5.7008	25.5278	0.0000	943.1294	−72.2926
Pension and retirement deductions	6.6735	6.0687	5.2020	70.4010	0.0000
Sex					
Female					50.54%
Male					49.46%
Earner type					
Reference person only					33.73%
Reference person plus spouse					34.05%
Spouse only					5.90%
Others					22.34%
No earner					3.98%
Family type					
Single person					23.54%
Husband/Wife with children					34.45%
Single parent					6.14%
Other type					16.07%
Husband/Wife only					19.80%
Education					
Non-high school graduate					8.93%
College graduate					46.63%
High school graduate					44.44%
Occupation					
Technical and sales					20.21%
Service					11.70%
Blue collar and other					12.33%
Self employed					8.89%
Retired					2.84%
Out of labour force					2.01%
Manager/Professional/Supervisor					42.02%
Race					
Black					10.73%
White					89.27%
House ownership					
House not owned					30.70%
House owned					69.30%
Residence					
Rural					4.92%
Urban					95.08%
Region					
Northeast					18.11%
Midwest					24.51%
West					23.04%
South					34.34%

IV. Results

We present our results in Table 3. The correlation coefficient between health and life insurance choice is positive and significant. Therefore, health and life insurance, two financial risk-managing goods, are complements. Furthermore, households with health

Table 1. Cross tabulation of health and life insurance choice.

		Life insurance		
Insurance policy		Not have (0)	Have (1)	Total
Health insurance	Not have (0)	3357 (16.34%)	781 (3.80%)	4138 (20.14%)
	Have (1)	7498 (36.48%)	8915 (43.38%)	16,413 (79.86%)
	Total	1085 (52.82%)	9696 (47.18%)	20,551

Table 3. Parameter estimates of the proposed model.

		Health insurance		Life insurance	
		Param	SE	Param	SE
	Intercept	0.1416	0.0016	−2.5675	0.0020
	Age	−0.0606	0.0001	0.0280	0.0001
	Square of age	0.0709	0.0001	−0.0215	0.0001
Sex (base male)	Female	0.0891	0.0003	−0.0627	0.0003
	Members below 2 years	0.1714	0.0005	0.1191	0.0005
	Members between 2 and 16 years	−0.0491	0.0002	−0.0336	0.0002
	Members above 16	0.0123	0.0002	−0.1777	0.0003
	Members above 64	−0.4161	0.0010	0.0616	0.0011
Earner type (base No earner)	Reference person earn only	0.1807	0.0007	0.3889	0.0010
	Reference person + spouse earn only	0.2102	0.0008	0.4273	0.0011
	Spouse earn only	−0.0190	0.0008	0.4423	0.0011
	Other type	0.0776	0.0008	0.5912	0.0011
Family type (base Husband/Wife only)	Single person	0.0574	0.0006	−0.0858	0.0006
	Husband/Wife with child	0.0119	0.0005	−0.0064	0.0005
	Single parent	0.2645	0.0007	−0.0632	0.0008
	Other family type	−0.1221	0.0006	−0.0726	0.0006
Region (base South)	Northeast	0.6474	0.0004	−0.1301	0.0004
	Midwest	0.6230	0.0003	0.0799	0.0003
	West	0.3752	0.0003	−0.2353	0.0003
Education (base High School)	Non-high school graduate	−0.4484	0.0004	−0.2091	0.0005
	College graduate	0.1827	0.0003	−0.0500	0.0003
Race (base White)	Black	−0.0770	0.0004	0.1334	0.0004
Occupation (base Manager/ Professional/ Supervisor)	Technical and sales	0.0244	0.0004	−0.0940	0.0003
	Service	−0.1961	0.0004	−0.3960	0.0005
	Blue collar and other	−0.1337	0.0004	−0.0481	0.0004
	Self employed	−0.3727	0.0005	−0.5442	0.0006
	Retired	0.2475	0.0009	−0.0071	0.0010
	Out of labour force	−0.4882	0.0011	−0.7748	0.0017
Residence (base Urban)	Rural	−0.1538	0.0005	−0.0421	0.0005
House ownership(base owned)	House not owned	−0.1788	0.0003	−0.0569	0.0003
	Income after tax	0.0041	0.0000	0.0004	0.0000
	Income from asset	−0.0061	0.0000	−0.0033	0.0000
	Retirement and pension deduction	0.0190	0.0000	0.0235	0.0000
Health status (base Healthy)	Mildly unhealthy	0.3548	0.0004	0.2863	0.0003
	Average unhealthy	0.1999	0.0003	0.2989	0.0003
	Severe unhealthy	0.2802	0.0005	0.2708	0.0005
Premium paid (base Others)	Premium paid by Self	5.6265	0.0244	6.7620	0.0315
Disability (base No Disability)	With disability	0.4518	0.0011	0.3400	0.0014
	Health insurance			0.5142	0.0006
		Param		SE	
	Correlation coefficient	0.2372		0.0004	
	Log likelihood	−138,365,228			

insurance are more likely to hold life insurance *ceteris paribus*. Thus, if there were an adverse shock to health, then the shock would raise the likelihood of purchasing health as well as life insurance.

The impact of age on household choice for insurance is non-linear with U-shape for health insurance choice, and inverted U-shape for life insurance choice. The initial stock of health is high for young households; therefore, their concern for health/life insurance choice would be low when they are young. However, the depletion of health stock with older age is hedged with investment in health/life insurance. Concerning gender, females prefer life insurance to health insurance *ceteris paribus*. The differences in gender can be attributed to differential risks acquired from roles, stress, lifestyles, and preventive healthcare practices (Verbrugge 1985). Less-educated households are less likely to buy insurance. College graduates prefer health insurance to life insurance. Celik and Mesut (2009) report such behaviour where education level negatively affects the choice of life insurance. Consistent with prior literature (Shower and Shotick 1994), regular income has a positive impact on the choice of both health and life insurance. Households with health and disability issues are more likely to choose health as well as life insurance. Households paying premium themselves (that could serve as a

proxy for risk averseness) tend to buy both health and life insurance.

V. Discussion and conclusion

The health care reform in the United States is an ongoing puzzling question that is subject to extensive political as well as public debate. Understanding health requires knowledge about uncertainties associated with household health status that accounts for resource scarcity, substitutability, and heterogeneity (Fuchs 1996). Providing each American health insurance is one of the primary objectives of the health policy in the United States. However, the households' decision to choose health insurance is dependent on their choice for other types of insurance such as life insurance, car, and home insurance. For the policy effectiveness, it is important to know the correlation among various insurance types that households choose. For example, as the government in most cases do not share the premium associated with life insurance, it is important to know how households' choice for health and life insurance are correlated to determine the effectiveness of the health reform policy that might be affected by the shocks in life insurance market. In this study, we empirically investigate the joint determination of health and life insurance choice at disaggregate household level considering households buy them to manage financial risks in their life. Our empirical results indicate that health and life insurance are complements in the basket of household's financial risk minimising goods, and choice of health insurance increases the choice of life insurance.

Disclosure statement

No potential conflict of interest was reported by the author.

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Appendix

A Theoretical Model

Insurance protects risk-averse households suffering from the full consequences of those actions that affect them unfavourably (Spence and Zeckhauser 1971). Most of the households consider purchasing either health or life insurance or both to mitigate potential health and safety risks in their life. Health insurance protects from unfavourable consequences arising out of adverse health such as financial burden related to hospitalisation, medical supplies, prescription drugs, doctor visits, etc. Life insurance ensures the economic well-being of the household against the untimely demise of family member, especially the breadwinners. Becker (1964) recognises health as a form of human capital and distinguishes it from another form of human capital such as education. Grossman (1972) further proposes a model that views health as a durable capital of stock that produces an output of healthy time. We emulate our analytical model of household choice for health and life insurance from Grossman model.

To see a potential correlation between health and life insurance choices, let us consider a following simple one-period model. Assuming a household's probability of being in healthy state is p_h and that in the unhealthy state is $1 - p_h$; the household's money income is $Y$and $Y - Y_m$, respectively, in these two states, where Y_m represents medical expenses. The household can minimise the financial risk incurred in the unhealthy state by paying a premium Y_r for the health insurance. The household will be indifferent between buying and not buying health insurance if the expected utility from these two health states namely, healthy and unhealthy, is the same as the utility derived from paying the premium for health insurance, that is,

$$U(Y - Y_r) = p_h U(Y) + (1 - p_h)U(Y - Y_m) \tag{A1}$$

The probability p_h of being in healthy state is household specific, and it is affected by the household's socio-economic status. Therefore, the emphasis should be given on disaggregate level model that could account for these individual-level differences.

Second, household buys life insurance to protect their dependents in case the insured person dies untimely. Assuming probability of a household being in an alive state is p_a and that in the dead state is $1 - p_a$, the household facing the budget constraint of $Y = C + LI$ where C is consumption and LI is life insurance premium, which has a payoff of B in case of catastrophe. The household would purchase a life insurance if

$$p_a U_a(Y - LI) + (1 - p_a)U_d(B) > p_a U_a(Y) \tag{A2}$$

The probability p_a depends on household's investment in health stock, and it is individual specific, which is affected by the household's socio-economic status.

Analyzing these two models together but considering choices are independent leads to following situations. Situation 1 when neither of the insurances are chosen and probability of this happening is $p_h \times p_a$, situation 2 when health insurance is chosen but not life insurance and the corresponding probability is $(1 - p_h) \times p_a$, situation 3 when life insurance is chosen but not health insurance and the corresponding probability is $(1 - p_a) \times p_h$, and finally situation 4 when both insurances are chosen and the corresponding probability is $(1 - p_h) \times (1 - p_a)$. Note that the corresponding probabilities in each situation are written considering the statistical independence of the two risky outcomes. In reality when risk (i.e. financial risks) being managed is common across insurance choices the assumption of statistical independence may be unrealistic.

However, when we put these two models into a single framework, it is clear that demand for these two insurances is related owing to the resource constraint. In this sense, they would act like substitutes. However, as p_h and p_a are correlated (e.g. better health would reduce both p_h and p_a), they can be complementary goods as well. Studying the relationship between these two choices using this theoretical framework is not part of this study. Instead, the study illustrates the potential interaction between these two insurance choices, which motivate the pursuit to use a simultaneous modelling approach in an empirical study.

A Conceptual Framework

We present the conceptual framework of the joint choice process for health and life insurance in Figure A1. The first part of the conceptual model states that household choice for health and life

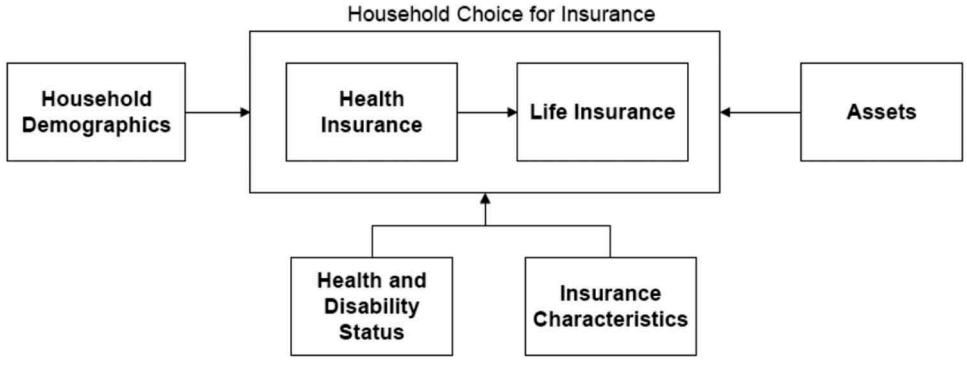

Figure A1. Conceptual framework.

insurance is not independent, that is, it is joint. However, there is an underlying structure of this choice process motivated by the Grossman model (Wagstaff 1993; Muurinen 1983) where we postulate that joint decision for health and life insurance is sequential in nature where households first decide on their health insurance and the subsequent life insurance choice is influenced by their choice for health insurance. Note that also the probability of being in healthy state, p_h, will greatly influence the household's probability of being in alive state, p_a. Hence, the sequential joint structure for the choice process. However, the empirical model allows for the investigation of alternate structures of choice process. The second part of the conceptual model states that household demographics, assets, health and disability status, and insurance characteristics are exogenous factors that will influence the household choice for these insurance policies.

We begin by examining the structure of the household choice process for health and life insurance followed by the effects of several covariates on this choice process. The various covariates of the model come from our conceptual framework.

Structure of the choice process: The objective of joint decision for health and life insurance choice is to manage the financial risks in life. Even though the risks being managed is commons across health and life insurance, we propose the joint decision has an underlying choice structure. Faced with adverse conditions in life, households first decide on whether they should choose health insurance or not. However, their subsequent choice for life insurance is influenced by their decision for health insurance as their bequest motive is affected by investment in their health (Grossman 1972). Note that the proposed structure of joint choice process is based on the existing literature on insurance choice. However, the proposed structure could be subjected to scrutiny. Therefore, we justify our proposed model by estimating various other alternative structures.

Table A1. Household health groups.

Household health group	Health expense	Percentage
Healthy households	$HE_h = 0$	40.98
Mildly unhealthy household	$HE_h<102$	16.55
Average unhealthy household	$102 \leq HE_h<702$	31.30
Severe unhealthy household	$HE_h \geq 702$	11.17
MLE estimates of Log normal distribution (N = 12,129)		
Mean (μ)		1.6337
Standard deviation (σ)		0.3917

Household demographics: Demand for insurance goods such as health and life insurance very much depends on household characteristics (Costa-Font and Garcia-Villar 2009, Gruber and Levy 2009). Therefore, aggregate level model may not be able to capture the variations in their demands. The emphasis is given on disaggregate level demand model for insurance goods so that individual differences can be accounted for in the model. We include age, gender (or sex), household size and composition, earner type, race, education, occupation, and residence as demographic factors. The model accounts for non-linear effect of age.

Assets and income: Households' assets and income will also determine their demand for health and life insurance (Shower and Shotick 1994). Furthermore, we include retirement and pension deductions and house ownership as determinants of these insurance choices.

Health and disability status: Demand for insurance will be affected by household's health and disability status. For example, unhealthy household should have higher preference for both health and life insurance. Similarly, households with disability should have higher preference for both health and life insurance.

Insurance characteristics: Premium for the insurances can be either paid by the households or they can be paid

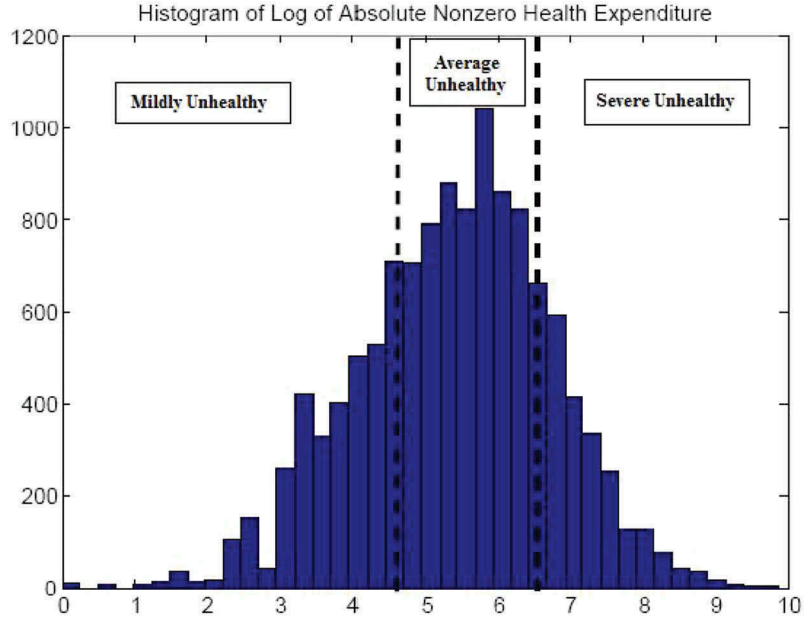

Figure A2. Histogram of nonzero health expense.

by somebody else such as employer. Therefore, insurance characteristics such as how much premium to pay and who pays the premium will have an impact on household choice for health and life insurance (Rubin and Koelln 1993).

Operationalisationof Health Status

We assume, $HE_i \sim \log N(\mu, \sigma^2)$, where HE_i is absolute value of nonzero health expense for household i, and HE_i is distributed log normally with parameters μ and σ^2. We estimate the parameters of this distribution using maximum likelihood. The estimated parameters are significant at 5% level. The parameter estimates and range of expense for different health groups are given in Table A1.

Based on the parameter estimates, we divide the health expense distribution into three regions, lower tail that is 'Mildly Unhealthy', middle region that is 'Average Unhealthy' and upper tail that is 'Severely Unhealthy'. In Figure A2, we show the distribution across the three health groups.

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