Health insurance, income protection insurance, benefit limits, and economic growth

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Abstract

In a small open economy where human capital can yield higher expected profit than physical capital, we build an overlapping generation framework. We compared the cases with health insurance (HI) and income protection insurance (IPI). HI provides individuals with a fixed amount of benefit, while IPI protects a certain proportion of individual income. First, we find that when individuals can choose insurance coverage freely, HI and IPI are mostly the same, and individuals will choose to cover a fixed proportion of their risks. Freely chosen insurance can either enhance or deter human capital accumulation. Second, with proper benefit limit, HI can benefit human capital accumulation and economic growth and that the insurance should be just enough to eliminate private saving. Also, limited IPI can be better in boosting human capital than limited HI. Finally, HI, IPI and limits will be more important for economic growth when the return to human capital is moderate.

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1. Our purpose
   (1) To find the function of insurance in the initial development of a small open developing economy.
   (2) To compare the case when individuals can choose their insurance coverage freely and the case when they can't.
   (3) To compare two kinds of benefit limits: limit on insurance amount (health insurance) and limit on income coverage proportion (income protection insurance).
2. Previous research

   Lu, C. and Yanagihara, M. 2013, Life Insurance, Human Capital Accumulation and Economic Growth. *Australian Economic Papers*, 52.1: 52-60.
3. Our model made 3 improvements:
   (1) We bring saving into their model, so that individuals can choose between different tools to defend against risks.
   (2) We allow individuals to choose their insurance coverage freely and find the results.
   (3) We investigate the case where government can set benefit limits on insurance payment amount (Health insurance) and coverage proportion (Income protection insurance).
4. Settings of the model
   (1) Small open economy, so the interest rate is constant.
   (2) Backward from the world level in knowledge and technical level, so no diminishing return of investment in human capital.
   (3) The expected return from human capital is higher than that of physical capital, but the former is risker.
5. The overlapping-generation model
   (1) We build a discrete-time overlapping-generation model. All individuals live for two periods: young and old, which are denoted by 1 and 2, respectively. Those who spend their young period in period t are called generation t.

(2) There is no public education system; children learn all their skills by watching parents do their work. Following Yakita (2003) Lu and Yanagihara (2013), we assume that the human capital of the parents proportionately determines the human capital of their children.

$$h_{1,t} = \chi h_{2,t},\ \chi > 0 \tag{1}$$

(3) Base on this level of human capital, they get an income, $i_{1,t}$,

$$i_{1,t} = h_{1,t} \tag{2}$$

(4) They can allocate their income to three parts: consumption in the young period, investment in education, saving, and payments for insurance. Therefore, the budget constraint in the young becomes:

$$c_{1,t} + e_{1,t} + s_{1,t} = i_{1,t} = h_{1,t} \tag{3}$$

(5) As the same with Krebs (2003) and Grossmann (2008), the human capital of generation t in their old period, $h_{2,t+1}$, is proportionally determined by the amount of education investment as:

$$h_{2,t+1} = \theta e_{1,t} \tag{4}$$

where $\theta > 1$ is a parameter measuring education efficiency.

6. Health risks

(1) Consider that individuals face uncertainty in their old period. If they are healthy, they can fully realize their human capital. On the contrast, if they are unhealthy, we assume the illness will cause the total loss of the ability to work.

(2) So, his consumption in the second period will be

$$c_{2,t+1} = \begin{cases} (1+\mathrm{r})s_{1,t} + h_{2,t+1},\ if\ healthy \\ (1+\mathrm{r})s_{1,t},\ if\ unhealthy \end{cases} \tag{5}$$

(3) Denoting the probability of being unhealthy as π, we can rewrite the expected utility function into the following:

$$E\left[u\left(c_{1t}, h_{2,t+1}, s_{1,t}\right)\right] = \frac{1}{\sigma}{c_{1,t}}^{\sigma} + \frac{1}{1+\beta}\frac{1}{\sigma}\left[(1-\pi)\left((1+\mathrm{r})s_{1,t} + h_{2,t+1}\right)^{\sigma}\right] + \frac{1}{1+\beta}\frac{1}{\sigma}\left[\pi\left((1+\mathrm{r})s_{1,t}\right)^{\sigma}\right] \tag{6}$$

7. Health insurance and income protection insurance

   (1) According to the Health Insurance Association of America, health insurance is defined as "coverage that provides for the payments of benefits as a result of sickness or injury. " (p. 225). In our analysis, HI provides individuals a specific amount of money when they fall ill regardless of their income.

   (2) Income Protection Insurance (IPI) is an insurance policy, available principally in Australia, Ireland, New Zealand, South Africa, and the United Kingdom, paying benefits to policyholders who are incapacitated and hence unable to work due to illness or accident. IPI provides individuals with a proportion of their full income when they lose the ability to work.

8. When individuals can choose their insurance freely

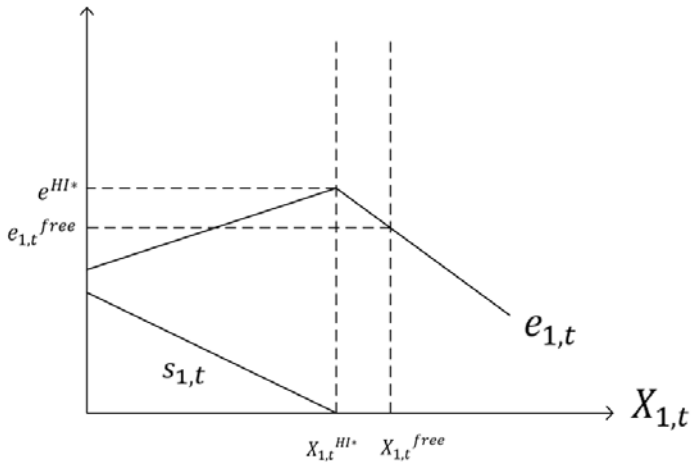
   (1) **Proposition 1**: Without limit, an individual will choose the optimal IPI coverage $\delta^* \equiv \left(\frac{1+r}{(1-\pi)\theta}\right)^{\frac{1}{1-\sigma}} \in (0,1)$. And IPI and HI will yield the same result.

   (2) **Proposition 2**: When $\Omega < 1$, the freely chosen IPI or HI will increase the human capital accumulation and economic growth rate, where $\Omega \equiv \left[\frac{(1-\pi)(\theta-(1+\mathrm{r}))}{\pi(1+\mathrm{r})}\right]^{\frac{1}{1-\sigma}} - \left[\left[\frac{(1-\pi)\theta}{1+r}\right]^{\frac{1}{1-\sigma}} + (1+\mathrm{r})\left(\frac{1+\beta}{1+r}\right)^{\frac{1}{1-\sigma}}\right]\frac{1}{\pi}$, vice versus. The lower the expected return of education relative to the interest rate is, the more likely freely chosen IPI or HI will increase human capital accumulation and economic growth, vice versus.

9. When the government limits the insurance payment amount (limited HI)

   (1) Proposition 3: With proper limit, HI will boost human capital accumulation and economic growth. The growth optimal HI is ${X_{1,t}}^{HI*} = \frac{h_{1,t}}{A+1}$, $where\ A = \frac{\left(\left(\frac{(1+\beta)}{(1-\pi)*\theta}\right)^{\frac{1}{1-\sigma}}\theta+1\right)}{(\pi*(1+r))^{\frac{1}{1-\sigma}}\theta}\left((1-\pi)\left(\theta-(1+r)\right)\right)^{\frac{1}{1-\sigma}}\frac{1+r}{\pi}$. When $X_{1,t} < {X_{1,t}}^{HI*}$, $s_{1,t} > 0$, as $X_{1,t}$ increases, $s_{1,t}$ will decrease; when $X_{1,t} > {X_{1,t}}^{HI*}$, $s_{1,t} = 0$.The growth-optimal HI is lower than the freely chosen HI, ${X_{1,t}}^{HI*} < {X_{1,t}}^{free}$, and the education investment at the freely-chosen point will also be lower, ${e_{1,t}}^{free} < {e_{1,t}}^{HI*}$.

   (2) Figure 01 Freely-chosen HI and growth-optimal HI

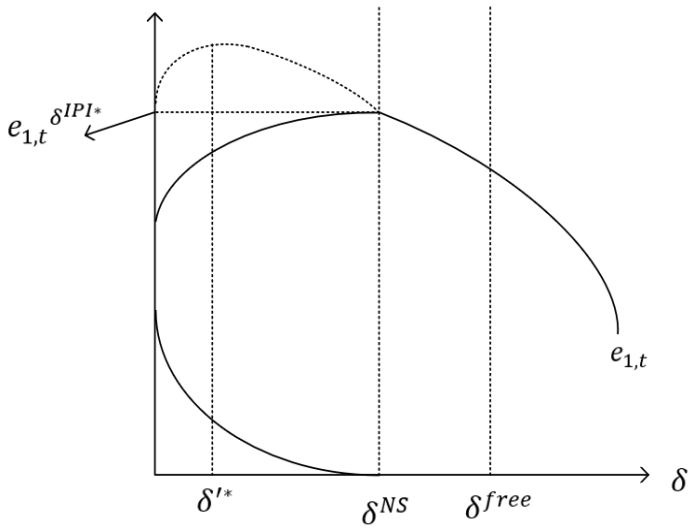


10. When the government limits the insurance coverage proportion

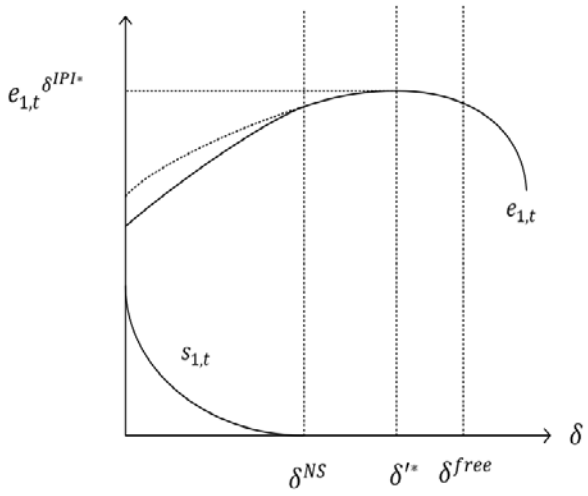
(1) **Proposition 4**: With proper benefit limit, IPI can be better in enhancing the human capital accumulation and economic growth than HI.

(2) **Proposition 5**: As the coverage proportion δ increase from 0, the amount of saving decreases, and the investment in education increases. When $\delta = \delta^{NS}$, the saving will become 0. The growth-optimal IPI coverage is $\delta^{IPI*} = \max\{\delta^{NS}, \delta'^{*}\}$. δ^{NS} *and* δ'^{*} are defined in the proof.

(3) **Figure 02 Saving and education investment under different IPI coverage**



(a)



(b)

11. Numerical example

Table 1 The results of the numerical example

$(\pi = 0.2, \beta = 0.25, \sigma = \frac{1}{2}, r = 0.05, h_{2,t+1} = 100, \chi = 2)$

		$c_{1,t}$	$e_{1,t}$	$s_{1,t}$	$X_{1,t}$	δ	$h_{2,t+1}$	g_t
$\theta = 1.5$	NI	58.69	23.79	17.53	0	0	35.69	-28.63%
	Free HI	57.18	35.10	0	7.72	77%	52.65	5.29%
	GO HI	59.73	36.70	0	3.57	34%	55.05	10.1%
	Free IPI	57.18	35.10	0	7.72	77%	52.65	5.29%
	GO IPI	57.95	39.25	0	2.80	25%	58.88	17.75%
$\theta = 5$	NI	32.45	66.16	1.40	0	0	330.78	561.56%
	Free HI	31.42	64.35	0	4.22	6.89%	321.77	543.54%
	GO HI	32.72	67.00	0	0.28	0.44%	335.01	570.02%
	Free IPI	31.42	64.35	0	4.22	6.89%	321.77	543.54%
	GO IPI	32.19	67.54	0	0.276	0.4282%	337.69	575.39%

12. Conclusions

(1) First, Individuals prefer insurance instead of saving to defense against risks, the freely chosen HI and IPI will yield the same result. Free insurance can either enhance or deter human capital accumulation.

(2) With proper benefit limits, both HI and IPI can enhance human capital accumulation.

And the growth-optimal IPI can be better in enhancing the human capital accumulation and economic growth than HI.

(3) Finally, when the return to education is moderate, HI and IPI can be critical for a small open economy, proper benefit limitations are also very important in that situation.