Optimal Health Insurance Revenue Structure

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Motivation

- Increasing dependence of health insurance revenue on subsidies from other sectors of government
  - Rapid increase in health insurance (HI) expenditure due to population aging
  - Population aging also reduces revenue base for HI contributions

Table 1. Proportion of Government Subsidy in Public Health Insurance Revenue (%)
(For Countries with Social-Insurance-Based Public Health Insurance System)

	Proportion of Subsidy in Public Health insurance Revenue	Proportion of Public Health Expenditure
Austria	41.4	76.4
Belgium	16.5	75.1
Czech Republic	9.7	85.2
France	6.6	79
Germany	11.7	76.9
Hungary	17.6	70.6
Japan	18.9	81.3
Korea	22.4	54.9
Luxemburg	22.7	90.9
Netherlands	7.1	81.4
Poland	17.4	70.8
Slovakia	10.2	66.8
Switzerland	27.8	59.3

Source: OECD (2010)

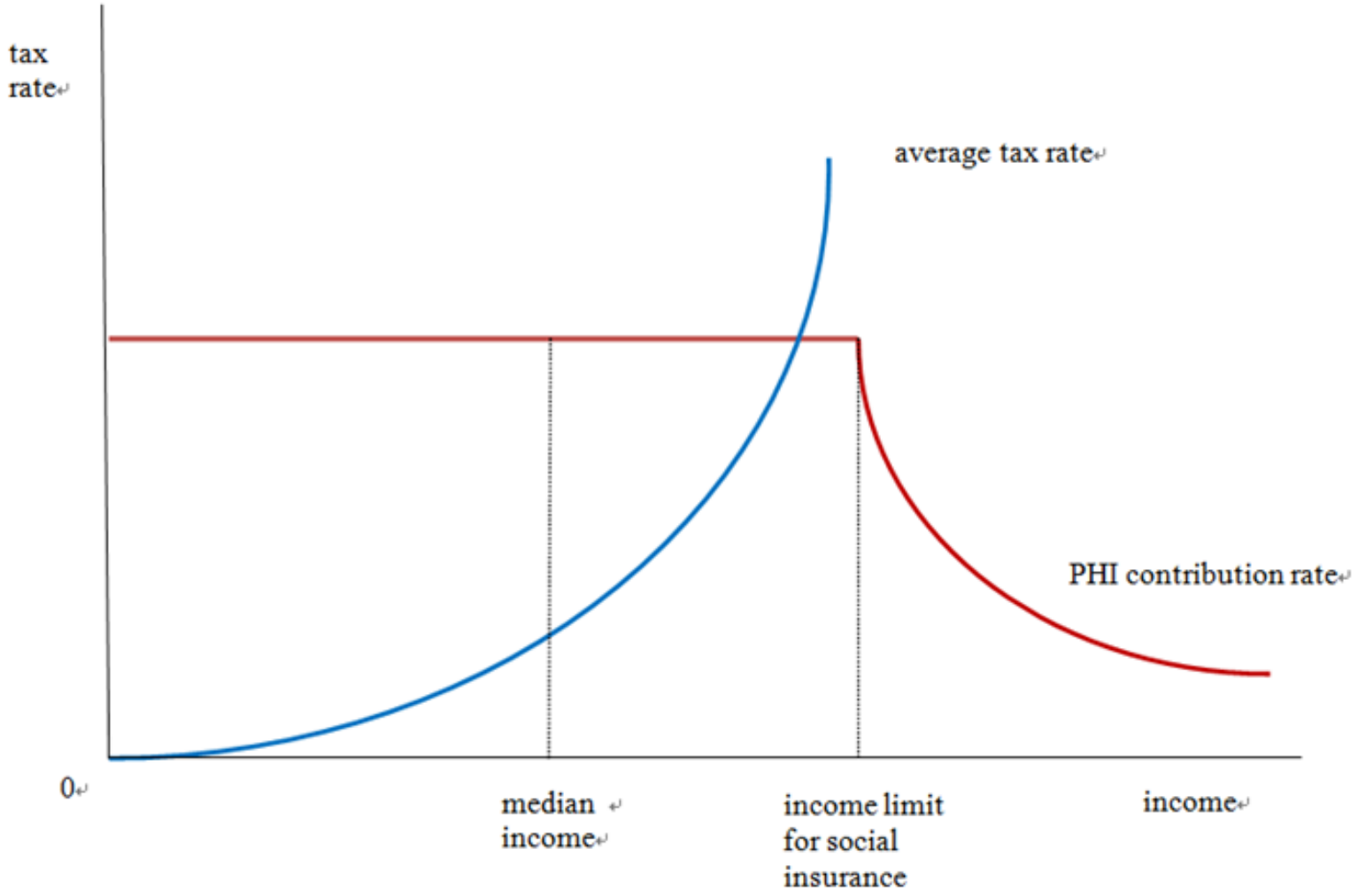
More dependence on the government subsidy means:

- Reducing labor income tax
- Increasing capital income tax and consumption tax
- Because:
  - HI contribution is typically imposed on labor income (or non-capital income)
  - The source of the government subsidy is tax revenue, which consists of labor income tax, capital income tax, and consumption tax

Economic effects of the tax base change

- Any possibility of increasing health expenditure?
- From political economy perspective (Persson and Tabellini, 1999):
  - Tax burden is generally progressive
  - HI contribution is generally regressive, because of the existence of an income ceiling for HI contributions
  - Revenue-neutral increase in tax-financing will reduce the median voter's fiscal burden, which will make her vote for larger HI expenditure

Figure 6. Average tax rate and contribution rate



Related to median voter theorem

- Two Hypotheses:

  (A) Proportion of PHI-contribution-financing has positive relationship to public (or national) health expenditure

  (B) Proportion of PHI-contribution-financing is negatively related to progressivity

Estimation equations

National health expenditure and public health expenditure

- Fixed Effect Model with year dummies
- 2-stage estimation
- IV: PHI contribution proportion (Sov_Gov)
  - Possibility of endogeneity
  - Government may adjust based on projected increase in public health expenditure

$$Tot\_Exp\_GDP_{it} = \alpha_0 + \alpha_1 Soc\_Gov_{it} + \alpha_2 GDP\_pc_{it} + \alpha_3 Sen\_Rate_{it} + \alpha_4 OOP_{it} + \alpha_5 Gov\_Exp_{it} + \alpha_6 Progressivity_{it} + \upsilon_t + \mu_i + \varepsilon_{it}$$

$$Pub\_Exp\_GDP_{it} = \beta_0 + \beta_1 Soc\_Gov_{it} + \beta_2 GDP\_pc_{it} + \beta_3 Sen\_Rate_{it} + \beta_4 OOP_{it} + \beta_5 Progressivity_{it} + \upsilon_t + \mu_i + e_{it}$$

$$Soc\_Gov_{it} = \gamma_0 + \gamma_1 GDP\_pc_{it-1} + \gamma_2 Sen\_Rate_{it-1} + \gamma_3 OOP_{it-1} + \gamma_4 Progressivity_{it-1} + \gamma_5 Progressivity_{it-1} \times Sen\_Rate_{it} + \gamma_6 Soc\_Gov_{it-1} + v_{it}$$

- Dependent variables
  - National health expenditure (Tot_Exp_GDP)
  - Public health expenditure (Pub_Exp_GDP)
- Independent variables
  - GDP_pc: GDP per capita
  - Sen_rate: Proportion aged 65 and above
  - OOP: Proportion of out-of-pocket payment
  - Soc_gov: Share of HI fund in public health expenditure
  - Gov_Exp: Public health expenditure share in national health expenditure

- Independent variables, continued:
  - Year dummy: υ_t
  - Tax progressivity

(1) Difference between before-tax and after-tax Gini (Musgrave and Thin (1948) , [1])

(2) Kakwani (1991) index: ([2])

$$P_2 = \left(G - G^*\right)\frac{1-t}{t}$$

(1) Income elasticity of tax burden ([3])

(2) Difference in effective average income tax rate between 67%-of-average-income earner and 167%-of-average-income earner ([4])

(3) Difference in effective average income tax rate between 67%-of-average-income earner and 100%-of-average-income earner ([5])

Estimated PHI Contribution Proportion Determination Equation

	[1]		[2]		[3]		[4]		[5]	
GDP pc /1000 (-1)	-0.0007	***	-0.0005	**	-0.0014	***	-0.0013	**	-0.0014	***
	<0.0002>		<0.0002>		<0.0005>		<0.0005>		<0.0005>	
sen_rate (-1)	-0.0107	**	0.0077		0.0009		0.0026		-0.0013	
	<0.0049>		<0.0049>		<0.0032>		<0.0035>		<0.0036>	
OOP (-1)	0.0019	***	0.0021	***	-0.0005		-0.0004		-0.0003	
	<0.0007>		<0.0007>		<0.0007>		<0.0007>		<0.0006>	
progressivity (-1)	-0.8609	**	0.2048		-0.1058	**	0.0007		-0.0250	**
	<0.3446>		<0.1572>		<0.0470>		<0.0033>		<0.0108>	
progressivity (-1) X sen_rate (-1)	0.0695	***	-0.0153		0.0083	***	0.0000		0.0017	**
	<0.0267>		<0.0123>		<0.0036>		<0.0003>		<0.0007>	
SocGov (-1)	0.6182	***	0.6621	***	0.3359	***	0.3412	***	0.2973	***
	<0.0625>		<0.0610>		<0.0853>		<0.0873>		<0.0877>	
constant	0.3446	***	0.0785	***	0.4764	***	0.4462	***	0.5367	***
	<0.0828>		<0.0613>		<0.0748>		<0.0764>		<0.0836>	
# of Obs	164		164		154		154		154	
Adjusted R-Square	0.9929		0.9951		0.9714		0.9851		0.9570	

Note: number in the parenthsis is standard error

Estimated Public Health Expediture determination Equation

	[1]		[2]		[3]		[3-1]		[4]		[5]	
SocGov	-5.9556	**	-7.4815	***	-3.2000		-11.2423	**	-8.0653	**	-9.1681	**
	<2.8478>		<2.8914>		<3.2938>		<5.4025>		<3.4959>		<3.6048>	
GDP pc / 1000	0.0094		0.0000		0.0000		0.0114		0.0000	*	0.0000	**
	<0.0103>		<0.0103>		<0.0181>		<0.0139>		<0.0186>		<0.0194>	
Sen_rate	0.1667	***	0.1793	***	0.0765		0.2430	**	0.0725		0.0865	
	<0.0457>		<0.0459>		<0.0670>		<0.1177>		<0.0683>		<0.0712>	
OOP	-0.1431	***	-0.1313	***	-0.0317	**	-0.1074	***	-0.0489	***	-0.0498	***
	<0.0277>		<0.0279>		<0.0139>		<0.0378>		<0.0139>		<0.0144>	
Progressivity	0.7304		-0.0127		0.3698	**	1.9810		0.0505	**	0.0208	
	<0.7934>		<0.3045>		<0.1901>		<2.3890>		<0.0209>		<0.0448>	
constant	9.4266	***	10.0768	***	8.4028	***	10.3436	***	12.2403	***	13.2712	***
	<1.2998>		<1.3181>		<2.8265>		<2.1006>		<2.9618>		<3.0667>	
# of Obs	164		164		154		164		154		154	
Adjuste R-Square	0.1767		0.0995		0.2322		0.0392		0.1426		0.1236	

Note: number in the parenthsis is standard error

[3-1] the IV estimated with instantenous independent variables except for SocGov.

Estimated National Health Expenditure Determination Equation

	[1]		[2]		[3]		[4]		[5]	
SocGov	-9.6672	**	-11.4695	***	-8.0903	*	-11.6467	***	-14.7046	***
	<4.0624>		<4.0927>		<4.3114>		<4.3899>		<4.7505>	
GDP pc / 1000	0.0490	***	0.0504	***	-0.0529	**	-0.0667	**	-0.0810	***
	<0.0146>		<0.0145>		<0.0265>		<0.0267>		<0.0285>	
Sen_rate	0.2068	***	0.2210	***	0.1048		0.0855		0.0966	
	<0.0641>		<0.0640>		<0.0843>		<0.0854>		<0.0905>	
OOP	-0.1481	***	-0.1361	***	0.0356		0.0489		0.0617	
	<0.0502>		<0.0503>		<0.0438>		<0.0443>		<0.0476>	
GoVExp	-0.0175		-0.0187		-0.0066		0.0205		0.0368	
	<0.0390>		<0.0391>		<0.0384>		<0.0391>		<0.0423>	
Progressivity	0.3985		-0.2657		0.5738	***	0.0729	***	0.0783	
	<1.1127>		<0.4244>		<0.2396>		<0.0263>		<0.0585>	
constant	14.2287	***	15.1211	***	13.9599	***	14.5965	***	15.7966	***
	<4.2107>		<4.2242>		<3.6909>		<3.7285>		<4.0598>	
# of Obs	164		164		154		154		154	
Adjsted R-Square	0.2287		0.2037		0.0582		0.0517		0.0417	

Note: number in the parenthsis is standard error

Estimation results

- An increase in tax financing or in subsidies from other sectors of the general government is likely to increase health care expenditure
  - Median Voter Theorem underlies the result
- Then, what is the effect on welfare?

Identification of optimal HI revenue structure (General Equilibrium Model approach)

- Increase in tax financing increases health expenditure, which increases the tax burden
- The resulting health expenditure increase improves health (McGuire, 2000)
- Growth effect of revenue-neutral increase in tax financing improves social welfare (Chun, 2012)

General Equilibrium Model

- Overlapping generations model
  - Life expectancy: 80 years
  - 12 5-year periods
- Household sector
  - 10 lifetime income classes
  - Decision-making:
    - Consumption
    - Health care service

Risks in health

- With Prob=$prL_{a,}$ a person becomes ill
- With Prob=$prR_{a,}$ a person who is ill recovers
- Lose utility SH in monetary terms
- Health service purchase partially compensates for the loss of utility due to illness

$-SH + FH(H, \varepsilon)$ ε : Physician's effort

Utility

- When healthy : $u(c) + N(1-l)$
- When sick: $u(c - SH + FH(H, \varepsilon)) + N(1-l)$

$FH_H(H, \varepsilon) = oop = C_H \cdot Coinrate$

oop : Out of pocket money, C_H : treatment cost, $Coinrate$: coinsurance rate

Physicians

- Maximize financial profit – disutility from effort

$$V = pop_{sick}\left(R + C_H(1-\delta_H)H - C_H H - G(\varepsilon)\right)$$

Subject to $FH_H(H,\varepsilon) = oop$

R : Lump-sum payment to physician

δ_H : Part of cost-sharing of physician, i.e. $1-\delta_H$: Fee for service treatment

$G(\cdot)$: Disutility of physician effort

$$\frac{dV}{d\varepsilon} = -\delta_H \frac{\partial H}{\partial \varepsilon} - G'(\varepsilon) = -\delta_H \frac{FH_{H\varepsilon}(H,\varepsilon)}{FH_{HH}(H,\varepsilon)} - G'(\varepsilon) = 0$$

H, ε are jointly decided by the ill person and the physician (Nash equilibrium)

- Public health insurance parameters affect this joint decision
  - Coinsurance rate
  - Lump-sum payment to physician
  - Part of cost-sharing to physician

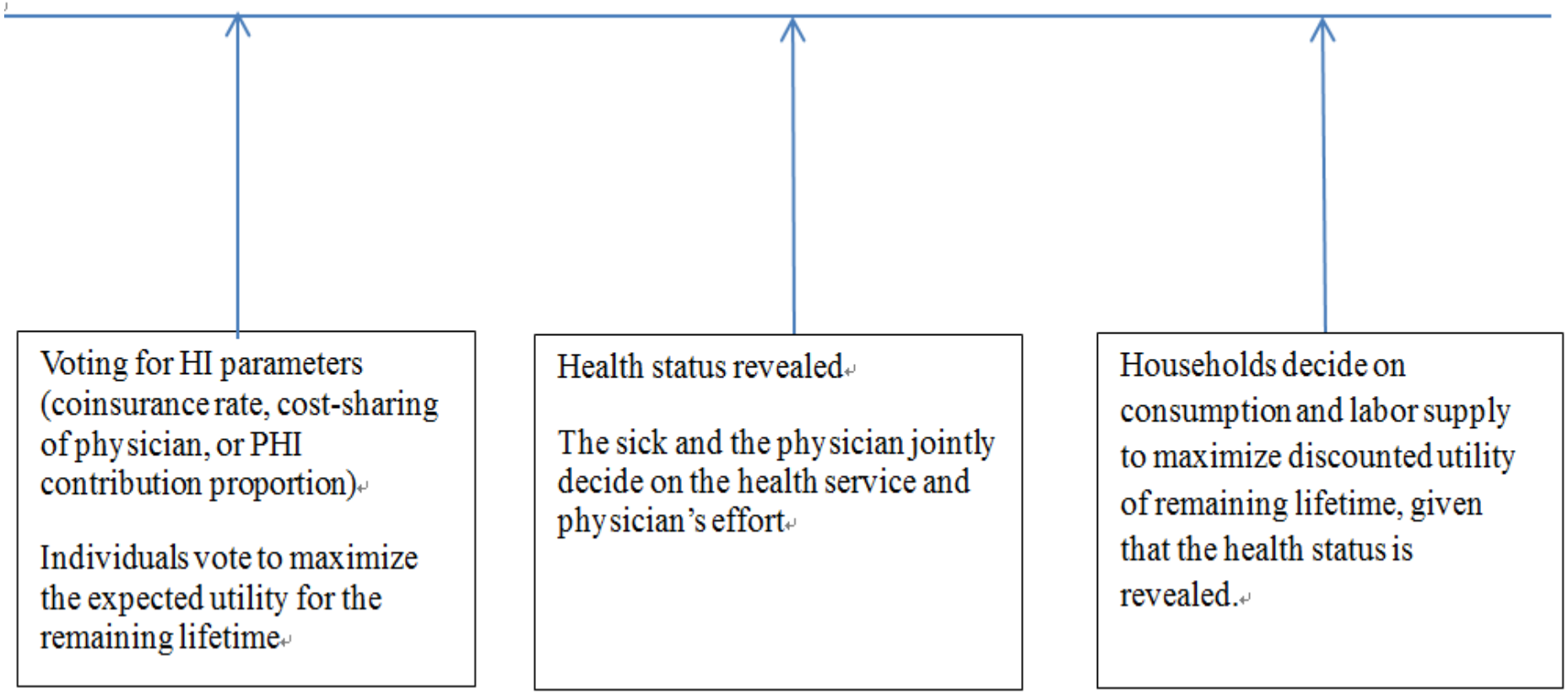
Firms

- Constant returns to scale of production technology
- Production factor: Labor supply
- Perfect competition

Government

- Provides public health insurance (PHI) system
- Maintains balanced budget
  - Lump-sum payment to physician + Fee for service
    = PHI contribution + Tax revenue
- Taxes
  - Progressive income tax
  - Proportional consumption tax
  - Proportional PHI contribution

Flow of decisions



Issues

- Identification of optimal PHI contribution proportion
  - The existence of progressive income taxation induces a heterogeneous effect of PHI contribution proportion across income classes and age groups
- Effect of tax revenue proportion
  - The proportion affects the progressivity of the tax burden across classes and age groups

Effect of population aging

- As the population ages, the median voter is getting older
- PHI contribution is typically not imposed on the older age groups
- In an extremely old society, an increase in tax financing may reduce PHI expenditure