

**Revenue Structure of Public Health  
Insurance and Health Expenditure:  
An Inter-Country Panel Study**

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# Motivation

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

**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 (1)
  - Reduces the net tax burden of future generation.
  - Increases that of current generation.
  - This will improve the social welfare, because:
    - Under the current fiscal policy in Korea, the net tax burden is shifted to the future generation.
    - Redistribution of the tax burden from future generation to current generation will equalize the net tax burden across generations, which will improve social welfare.

Figure 3. Net Tax Burden for HI (Korea)

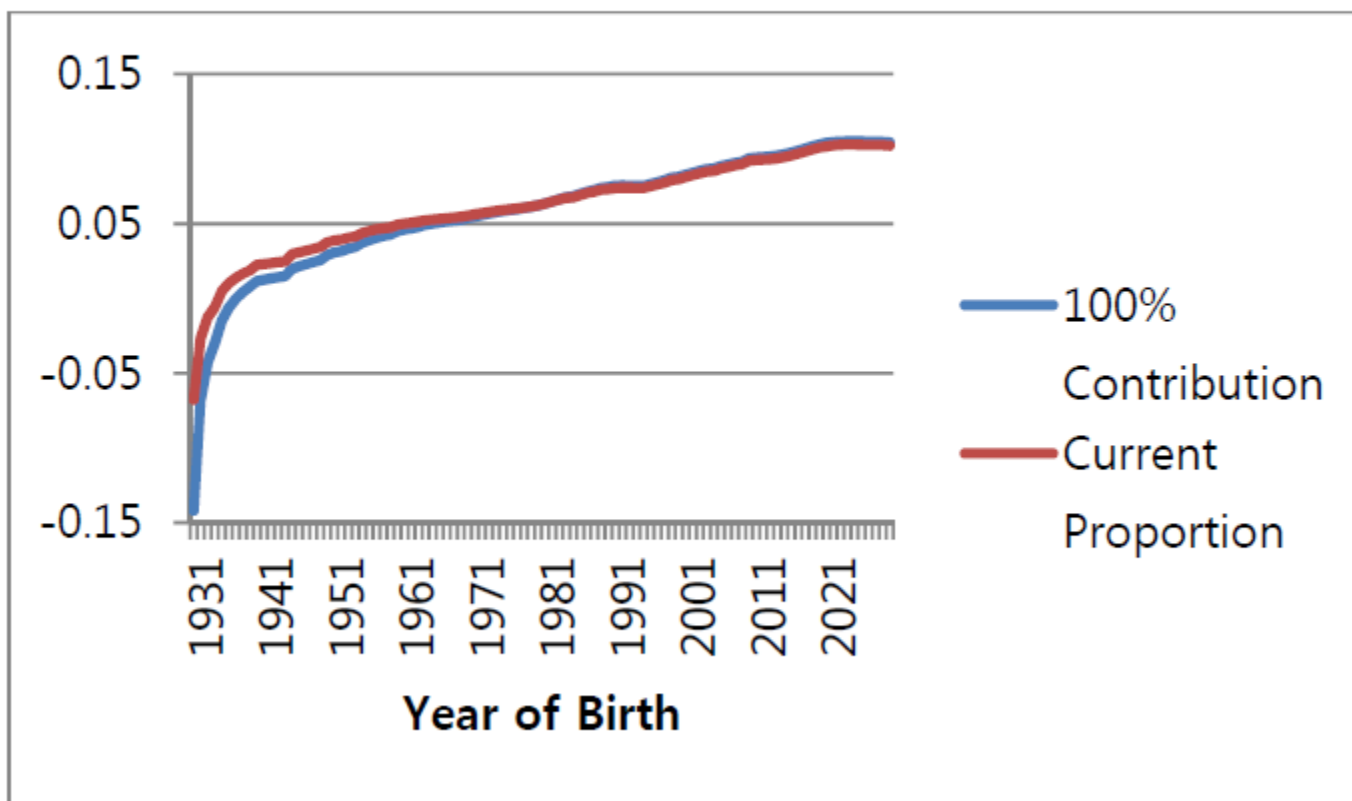
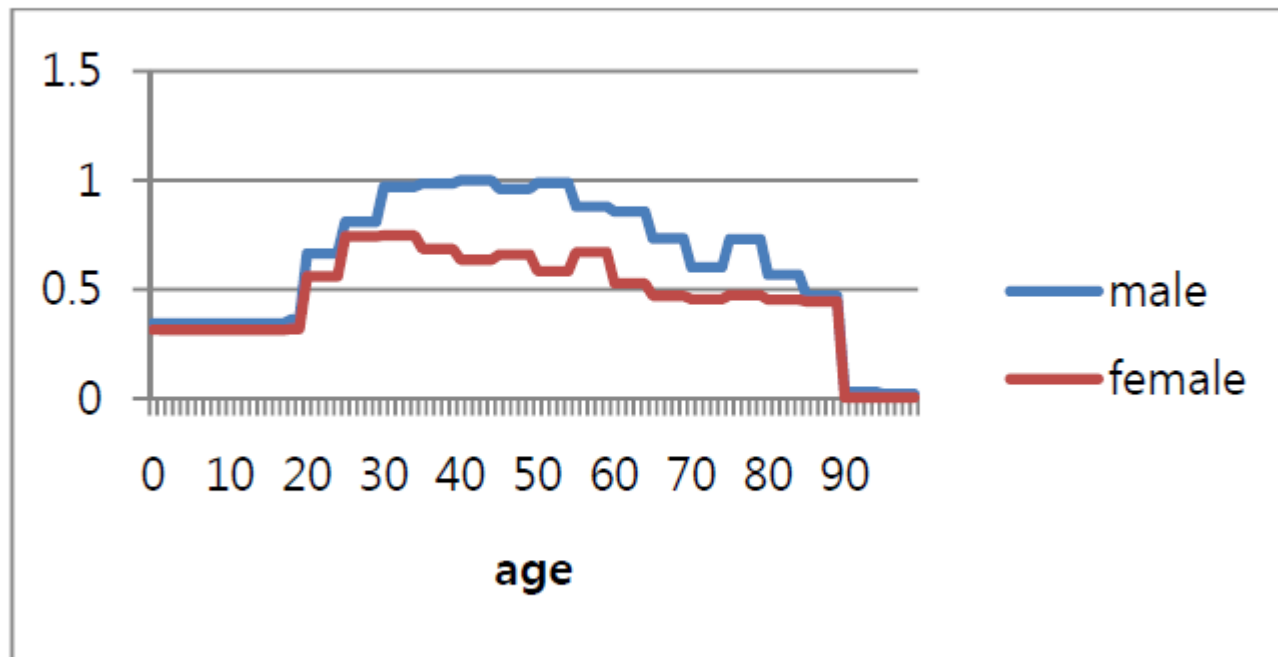


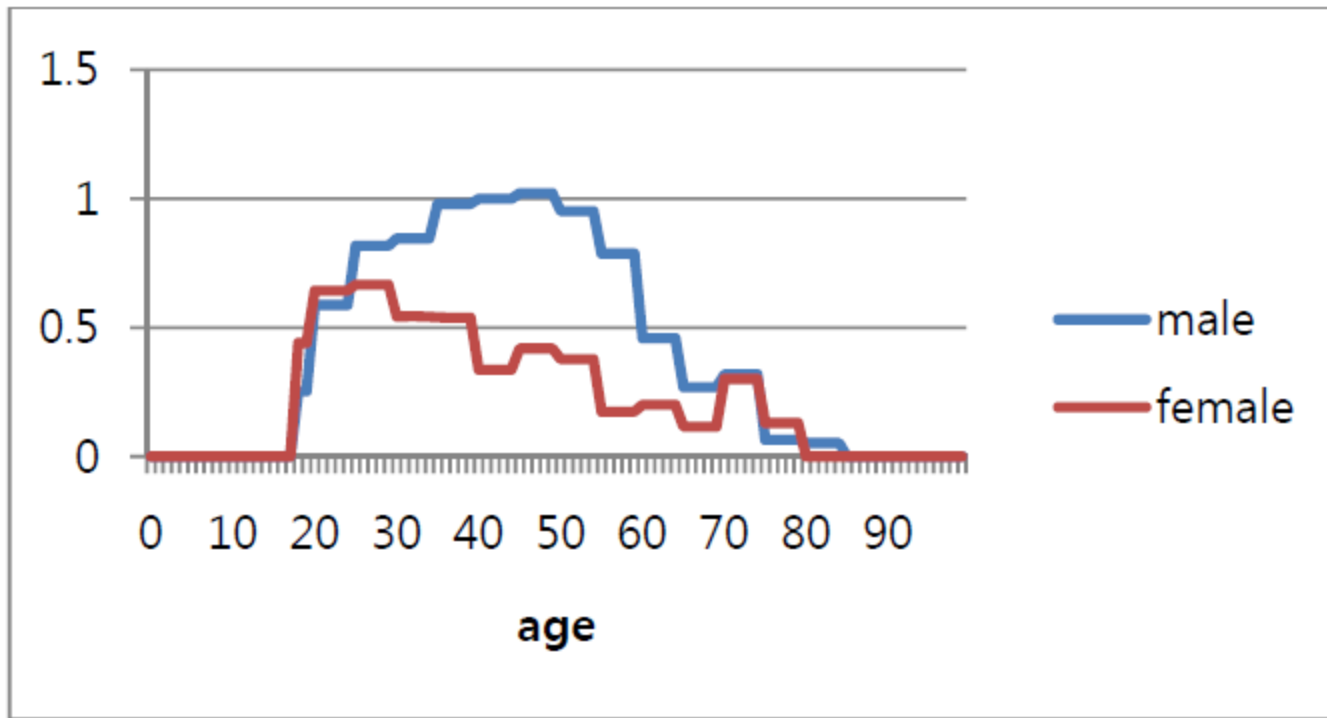
Figure 1. Age Profile of Tax Revenue<sup>1)</sup> (Korea)



Source: Chun and Jung (2012)

Note: 1) Central government Tax revenue

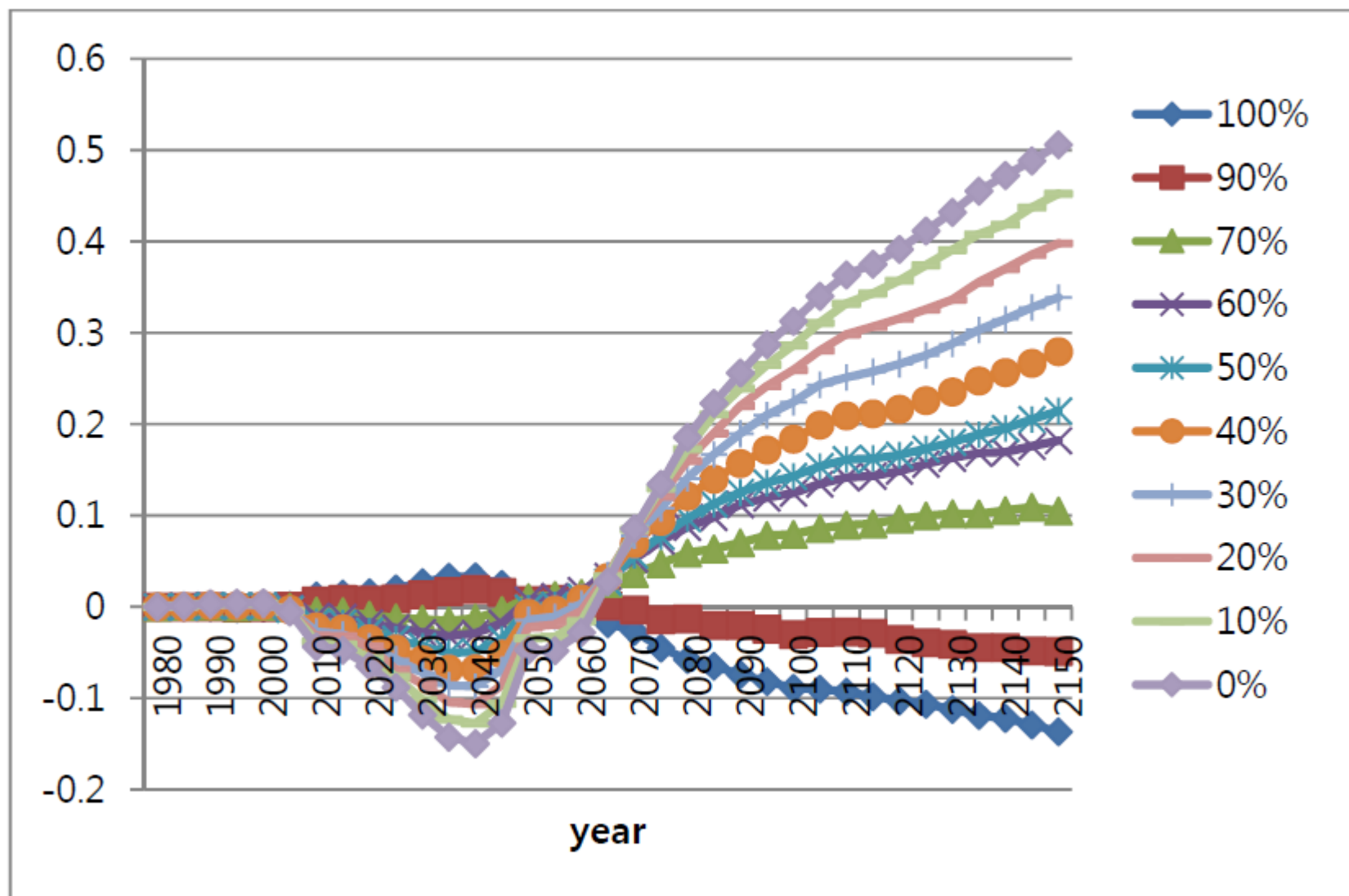
Figure 2. Age Profile of HI Contribution (Korea)





- Economic effects of the tax base change (2)
  - Does it improve the growth?
  - Coexistence of growth-improving effects and growth-delaying effects
    - Reducing labor income tax and increasing consumption tax raise the savings rate
    - Increasing capital income tax reduces the savings.
    - Reducing labor income tax increase labor supply
    - Technological improvement is expected if the production increases due to the tax base change (Chun (2013)).
  - The simulation of Korean case shows that the tax base change improves the growth and the welfare of the future generations.

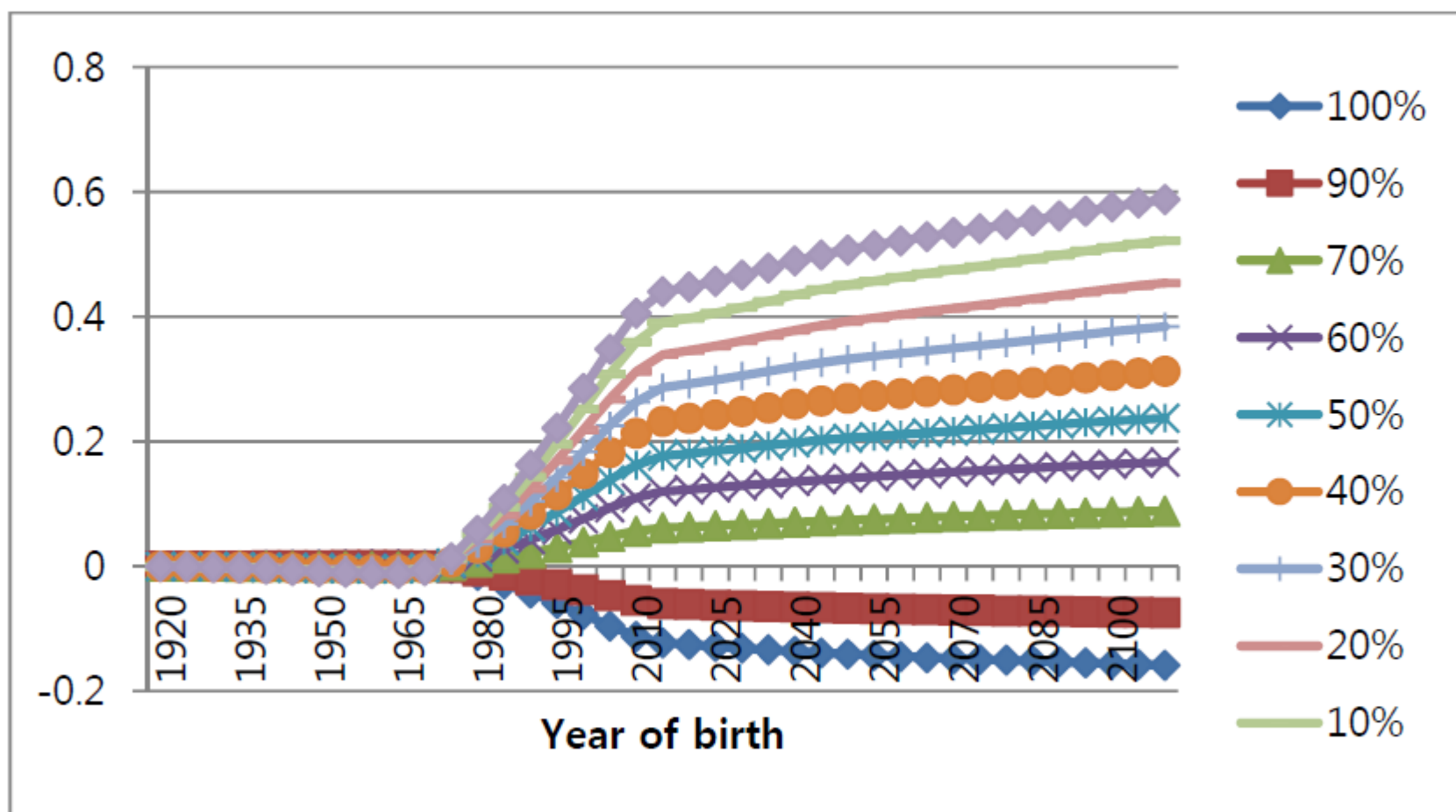
Figure 4. HI Contribution Proportion and GDP Per Capita  
 (Korea, % increase in the welfare compared with under current proportion<sup>1)</sup>)



Source: Chun and Jung (2012)

Note: 1) Current Proportion of PHI Contribution is 80%.

Figure 5. HI Contribution Proportion and Welfare Across Generations (Korea, % increase in the welfare compared with current proportion<sup>1)</sup>)



Source: Chun (2012)

Note: 1) Current Proportion of PHI Contribution is 80%.

- Economic effects of the tax base change (3)
  - Any possibility of increase in the 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 income ceiling for HI contribution imposition.
    - Revenue-neutral increase in tax-financing will reduce the median voter's fiscal burden, which will make her vote for larger HI expenditure.

– Bureaucrats' behavior (Niskanen (1968))

- HI policy makers and administrators, who want to increase budget and power (influence), will try to increase the HI expenditure, because they do not have to make much effort to increase the contribution revenue, if the problem of the health insurance budget deficit is relieved by the subsidy.
- They will make less effort to control the HI expenditure increase, by implementing cost-saving benefit formulae and treatment fee payment system and reinforcing its administration to reduce frauds of benefit recipients and healthcare providers

# This paper addresses

- Effects of the revenue-neutral increase in tax-financing on (public) health expenditure.
  - Using 2010 OECD Health Data

# Estimation

$$\begin{aligned} \text{Tot\_Exp\_GDP} = & \alpha_0 + \alpha_1 \text{Soc\_Gov} + \alpha_2 \text{Sen\_rate} + \alpha_3 \text{GDP\_pc} + \alpha_4 \text{OOP} + \alpha_5 \text{Gov\_Exp} \\ & + \alpha_6 \text{Nm\_Physician\_1000} + \alpha_7 \text{Share\_Hospital\_Exp} + \alpha_8 \text{Unit\_MRI\_1million} \end{aligned} \quad (1)$$

↵

$$\begin{aligned} \text{Pub\_Exp\_GDP} = & \beta_0 + \beta_1 \text{Soc\_Gov} + \beta_2 \text{Sen\_rate} + \beta_3 \text{GDP\_pc} + \beta_4 \text{OOP} \\ & + \beta_6 \text{Nm\_Physician\_1000} + \beta_7 \text{Share\_Hospital\_Exp} + \beta_8 \text{Unit\_MRI\_1million} \end{aligned} \quad (2)$$

- Dependent variables:
  - National health expenditure (Tot\_Exp\_GDP)
  - Public health expenditure (Pub\_Exp\_GDP)
- Independent variables:
  - Demand side:
    - GDP\_pc: GDP per capita
    - Sen\_rate: proportion of the aged 65 and older
    - OOP: proportion of out-of-pocket money
  - Supply side
    - Nm\_Physician\_1000: number of physician per 1000 people
      - Physician-induced supply (McGuire (2000)) vs. reducing physician's income (depending on demand elasticity of physician)
    - Share\_Hospital\_Exp: share of hospital care
    - Unit\_MRI\_1million: number of unit of MRI per 1 million people



- Independent variables – continued-
  - Policy side:
    - Soc\_gov: share of HI fund share in public health expenditure
    - Gov\_Exp: public health expenditure share in national health expenditure

- Samples
  - OECD countries
  - OECD countries as of 1961
  - European OECD countries
  - European OECD countries as of 1961
  - European OECD countries as of 1961, with Soc\_Gov larger than 10%.

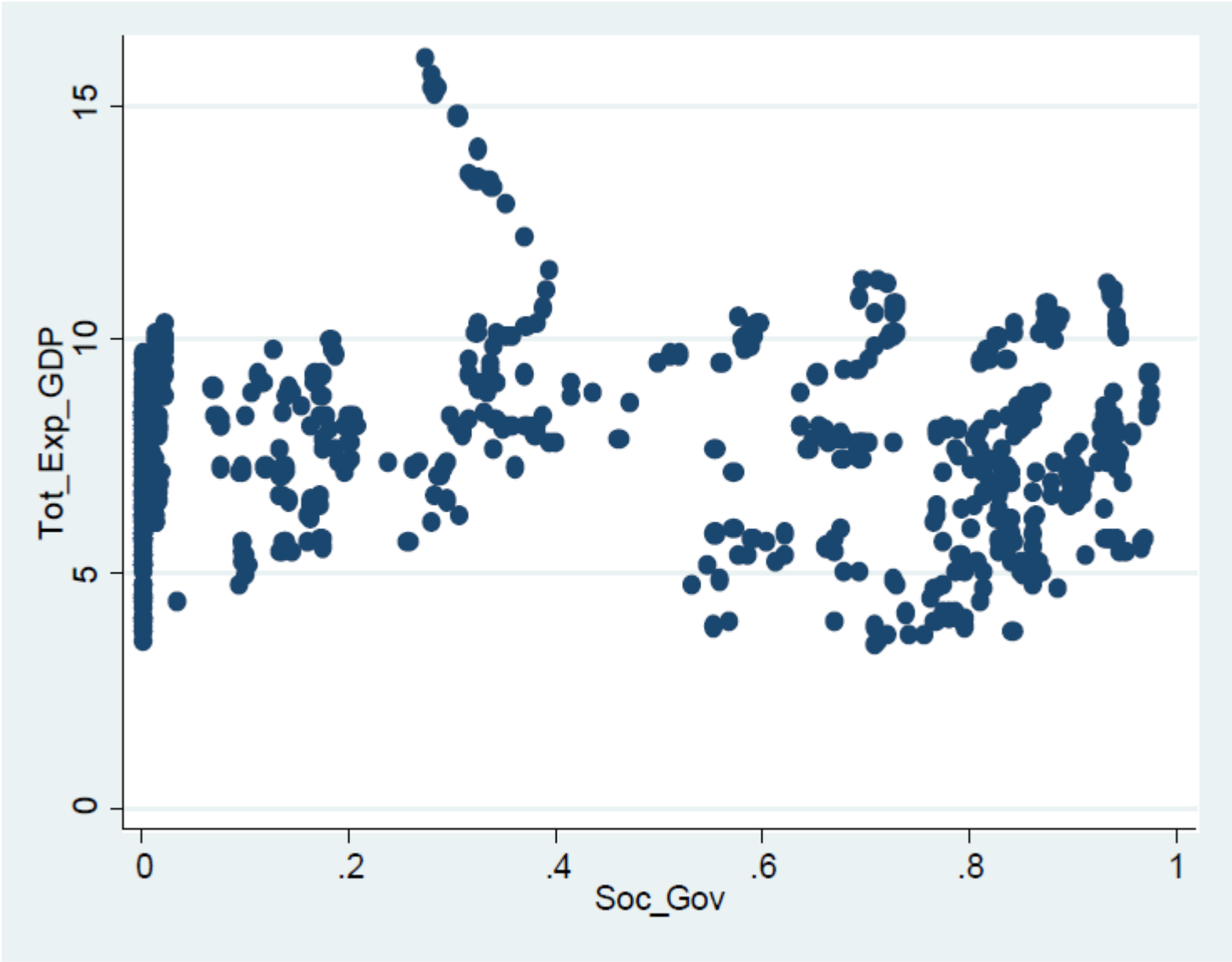
**Table 2. Descriptive statistics**

	Country group	# of obs	Mean	Standard Deviation	Min	Max
Tot_Exp_GDP (%)	OECD	849	7.6	2.0	1.6	16.0
	OECD(1961)	552	8.1	2.1	1.6	16.0
	European OECD	587	7.8	1.5	4.7	11.3
	European OECD(1961)	466	8.1	1.5	5.0	11.3
Pub_Exp_GDP (%)	OECD	813	5.5	1.6	0.7	8.8
	OECD(1961)	531	6.0	1.5	0.7	8.8
	European OECD	569	6.0	1.3	2.7	8.8
	European OECD(1961)	448	6.2	1.3	2.7	8.8
Soc_Gov	OECD	591	0.442	0.371	0.000	0.973
	OECD(1961)	360	0.387	0.364	0.000	0.973
	European OECD	393	0.487	0.383	0.000	0.973
	European OECD(1961)	292	0.425	0.383	0.000	0.973
GDP_pc(USD, PPP)	OECD	892	21,089	7,932	5,104	51,309
	OECD(1961)	581	23,486	7,646	5,343	51,309
	European OECD	629	22,064	7,496	6,819	53,109
	European OECD(1961)	493	23,920	6,916	9,669	51,309

OOP(%)	OECD	612	19.8	12.1	2.6	75.9
	OECD(1961)	370	16.3	6.9	5.5	38.5
	European OECD	418	16.5	7.1	2.6	38.5
	European OECD(1961)	305	15.9	7.1	5.5	38.5
num_Physician_1000	OECD	406	2.81	0.89	0.61	6.02
	OECD(1961)	264	2.91	0.96	0.61	6.02
	European OECD	246	3.20	0.67	1.83	6.02
	European OECD(1961)	190	3.37	0.63	1.99	6.02
share_hospital_exp	OECD	382	38.9	6.5	15.8	60.0
	OECD(1961)	217	38.7	6.2	28.7	60.0
	European OECD	217	38.7	6.6	26.1	60.0
	European OECD(1961)	149	39.5	6.6	29.4	60.0
Unit_MRI_1million	OECD	304	6.3	6.8	0.0	43.1
	OECD(1961)	137	8.4	6.6	0.0	26.6
	European OECD	189	6.5	5.8	0.1	21.9
	European OECD(1961)	99	9.2	5.9	0.1	21.9

Source: Author's calculation using 2010 OECD Health Data

Figure 6. Health Expenditure and Revenue Structure (OECD)



Source: Author's calculation using 2010 OECD Health Data

Table 3. Estimated Health Expenditure Equation (National Health Expenditure / GDP, period: 1980-2009)

	[1] <sup>2)</sup>	[2] <sup>3)</sup>	[3] <sup>4)</sup>	[4] <sup>5)</sup>	[4-1] <sup>6)</sup>	[5] <sup>7)</sup>	[6] <sup>8)</sup>	[7] <sup>9)</sup>
model <sup>1)</sup>	Fixed	Random	Random	Fixed	Random	Fixed	Fixed	Random
# of Obs	525	305	344	247	149	190	135	96
Soc_Gov	-2.379*** (0.790) <sup>10)</sup>	-2.228*** (0.692)	-1.433 (0.916)	-1.943* (1.07)	-2.443** (1.15)	-4.857*** (1.23)	-10.419*** (2.407)	-3.215** (1.372)
Sen_rate	0.239*** (0.035)	0.360*** (0.039)	0.333*** (0.038)	0.386*** (0.039)	0.479*** (0.059)	0.317*** (0.049)	0.369*** (0.058)	-0.022 (0.076)
GDP_pc	0.010*** (0.001)	0.088*** (0.01)	0.068*** (0.01)	0.070*** (0.01)	0.101*** (0.019)	0.048* (0.026)	0.048 (0.03)	0.040* (0.023)
OOP	-0.053*** (0.02)	-0.269*** (0.025)	-0.077** (0.033)	-0.124*** (0.038)	-0.106** (0.049)	-0.096** (0.046)	-0.288*** (0.065)	0.0720* (0.043)
Gov_Exp	-0.038*** (0.018)	-0.081*** (0.022)	-0.021 (0.026)	0.018 (0.034)	0.029 (0.038)	0.092** (0.041)	-0.059 (0.057)	-0.0716** (0.033)
Num_Physician_1000						0.823*** (0.205)	0.502* (0.270)	
Share_Hospital_Exp							0.037* (0.021)	
Unit_MRI_1million								0.096*** (0.013)
constant	7.175*** (1.827)	12.465*** (2.133)	5.230* (2.656)	0.018 (0.034)	-0.212 (3.736)	-2.057 (3.878)	13.386*** (4.956)	14.365 (3.477)
Adj R-square	0.442	0.216	0.188	0.005	0.012	0.003	0.046	0.7

Note: 1) Model selected based on Hausman test

2) Sample covers all the OECD countries.

3) Sample covers the OECD countries as of 1961.

4) Sample covers the OECD countries in Europe.

5) Sample covers the OECD countries in Europe as of 1961

6) Sample covers the OECD countries in Europe as of 1961, of which Soc\_Gov is larger than 10%

7) Sample covers Canada, Denmark, France, Germany, Greece, Iceland, Italy, Spain, Switzerland, Turkey, US.

8) Sample covers Canada, Denmark, France, Germany, Greece, Iceland, Spain, Switzerland, Turkey, US.

9) Sample covers: Austria, Canada, Denmark, Greece, Iceland, Italy, Luxemburg, Netherlands, Turkey, Turkey, UK, US.

10) Standard Error

\*\* (\*\*\*) indicates that the coefficient is statistically different from 0 with 90% (95%, 99%) confidence level.

Table 4. Estimated Public Health Expenditure Equation (Public Health Expenditure / GDP, period: 1980-2009)

	[1] <sup>2)</sup>	[2] <sup>3)</sup>	[3] <sup>4)</sup>	[4] <sup>5)</sup>	[4-1] <sup>6)</sup>	[5] <sup>7)</sup>	[6] <sup>8)</sup>	[7] <sup>9)</sup>
model <sup>1)</sup>	Random	Fixed	Random	Random	Random	Fixed	Fixed	Random
# of Obs	524	304	343	246	148	189	135	96
Soc_Gov	-0.644* (0.345) <sup>10)</sup>	-1.832** (0.747)	-0.839* (0.457)	-0.735 (0.577)	-2.467*** (0.922)	-3.832*** (1.000)	-7.236*** (1.905)	-2.150** (1.052)
Sen_rate	0.158*** (0.023)	0.253*** (0.031)	0.212*** (0.031)	0.268*** (0.032)	0.358*** (0.048)	0.273*** (0.040)	0.275*** (0.046)	0.005 (0.062)
GDP_pc	0.057*** (0.007)	0.023*** (0.001)	0.048*** (0.008)	0.056*** (0.008)	0.077*** (0.015)	-0.027 (0.019)	-0.008 (0.021)	0.019 (0.017)
OOP	-0.048*** (0.005)	-0.168*** (0.012)	-0.102*** (0.010)	-0.146*** (0.016)	-0.153*** (0.024)	-0.188*** (0.016)	-0.221*** (0.018)	-0.052** (0.026)
Num_Physician_1000						0.075*** (0.160)	0.591*** (0.188)	
Share_Hospital_Exp							0.021 (0.014)	
Unit_MRI_1million								0.072*** (0.011)
Constant	3.481*** (0.398)	4.824*** (0.597)	4.010*** (0.530)	3.589*** (0.690)	3.059*** (1.102)	5.801*** (0.762)	7.051*** (1.140)	6.460*** (1.098)
Adj R-square	0.672	0.3137	0.343	0.240	0.319	0.368	0.168	0.229

Note: 1) Model selected based on Hausman test

2) Sample covers all the OECD countries.

3) Sample covers the OECD countries as of 1961.

4) Sample covers the OECD countries in Europe.

5) Sample covers the OECD countries in Europe as of 1961

6) Sample covers the OECD countries in Europe as of 1961, of which Soc\_Gov is larger than 10%

7) Sample covers Canada, Denmark, France, Germany, Greece, Iceland, Italy, Spain, Switzerland, Turkey, US.

8) Sample covers Canada, Denmark, France, Germany, Greece, Iceland, Spain, Switzerland, Turkey, US.

9) Sample covers: Austria, Canada, Denmark, Greece, Iceland, Italy, Luxemburg, Netherlands, Turkey, Turkey, UK, US.

10) Standard Error

(\* \*\*, \*\*\*) indicates that the coefficient is statistically different from 0 with 90% (95%, 99%) confidence level.

# Summary

- The increase in the tax-financing or more dependence on the subsidy from other sectors of the general government is likely to increase the health care expenditure.
- Then, what is its effect on the welfare?



# Further Research

- Identification of optimal HI revenue structure (General Equilibrium Model Approach)
  - Increase in tax-financing increases the health expenditure, which increases the tax burden.
  - The resulting Health expenditure increase improves the health (McGuire (2000))
  - Growth effect of revenue neutral increase in tax-financing improves social welfare (Chun (2012))

- Identification of process of health expenditure change due to the increase in the tax-financing.
  - higher progressivity of the tax burden makes the median voter prefer higher public Health expenditure under the tax-financed system.
    - Investigate the relationship between the progressivity of the tax burden and the health care expenditure (Data problem?).
  - Identification of the median voter
    - How does population aging affect the median voter's decision?
      - As population ages, the median voter is getting older.
      - PHI contribution is typically not imposed on the older age groups.
      - In extremely old society, the increase in the tax-financing may reduce PHI expenditure.

- Bureaucrats' behavior (General Equilibrium Model)
  - Bureaucrats try to maximize the health expenditure.
  - Possibility of implicit collusion with physicians
    - Physicians want to increase the quantity of health care service and to reduce the effort, to increase the pecuniary revenue and to reduce disutility from the health care service efforts.
    - The physician's effort and the quantity of the physician's service are the substitutes in the production of the good health, if the quantity is large enough (Ma and McGuire (1997)).