Health Care Financing over the Life-Cycle, Universal Medical Vouchers and Welfare

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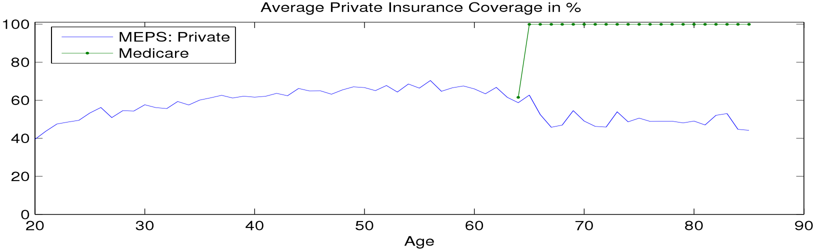
Main problems of the U.S. health insurance system

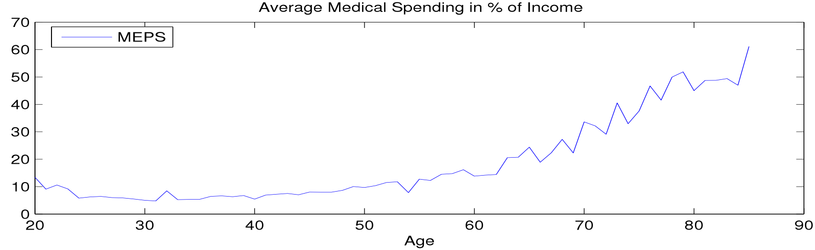
1. Health insurance coverage is low
   - 47 million are uninsured in 2006 (15%)
2. Health expenditure is high
   - 16% of GDP in 2006
   - close to 20% by 2015
3. Questionable health outcomes?

Analyzing comprehensive health care reform

- Medicare Prescription Drug, Improvement, and Modernization Act (2003)
  - Health Savings Accounts
  - Medicare Part D (2006) for prescription drugs
  - Stop imports of generic drugs
  - Restrict Medicare's ability to negotiate drug prices
- Patient Protection and Affordable Care Act (2010)
  - Health insurance exchanges plus mandate
  - Restrictions on insurance companies
  - Expansion of Medicaid
  - Cuts in Medicare

Health insurance and expenditure profiles (2004/05)





Objectives and main contributions

1. Develop a modelling framework to analyze comprehensive health care reform:
    - Stochastic dynamic general equilibrium **life-cycle model** with
        1. endogenous health expenditures and
        2. insurance choice to
    - account for the life-cycle patterns of
        1. health expenditures and
        2. insurance take-up rates observed in the data
2. Demonstrate the usefulness of the model by
    - quantifying the short-run and long-run effects of a comprehensive reform with **universal medical vouchers**
    - incl. transitions and welfare analysis

Related literature

1. Health expenditure over the life cycle
   - Grossman (1972a,1972b), Grossman (2000)
2. Consumption over the life cycle
   - Deaton (1992), Gourinchas and Parker (2002)
   - Fernandez-Villaverde and Krueger(2006,2009)
3. Health expenditure shocks, health insurance and precautionary savings
   - Kotlikoff (1986), Hubbard, Skinner and Zeldes (1995)
   - Palumbo (1999) and DeNardi, French and Jones (2006)
4. Quantitative macromodels with exogeneous health expenditure shocks
   - Attanasio, Kitao and Violante (2008), Jeske and Kitao (2009)
5. Macromodels with endogenous health expenditures and insurance
   - Suen (2006), Jung and Tran (2008) and Feng (2009)

Outline

1. Model
2. Calibration
3. Policy experiments
4. Conclusion

MODEL

The Model: Key Features

1. An overlapping generations model with heterogenous agents
   - Sectors: household, firm and government
   - Markets: consumption, labor and capital
   - Agents live for multiple-periods as workers and retirees, and face period mortality shocks and labor productivity shocks
   - Incomplete financial markets
2. New features from the Grossman literature
   - Health as a durable good: consumption and investment
   - Health depreciation and health shocks
   - Endogenous demand for health care and health insurance
   - Mix of private and public health insurance

Preferences and technology

- Preferences:

$$u\left(c_j, s_j\right)$$

- Health capital:
  - service flow from health capital

$$s_j = s\left(h_j\right) \tag{1}$$

  - health production

$$h_j = h\left(m_j, h_{j-1}, \varepsilon_j\right) \tag{2}$$

  - health shocks

$$p_j\left(\varepsilon_j, \varepsilon_{j-1}\right) \quad = \quad \Pr\left(\varepsilon_j | \varepsilon_{j-1}, j\right)$$

- Human capital:
  - accumulation

$$e_j = e\left(h_{j-1}, \epsilon_j\right) \text{ for } \; j = \{1, ..., J_1\}$$

  - productivity shocks

$$\pi_j\left(\epsilon_j, \epsilon_{j-1}\right) \quad = \quad \Pr\left(\epsilon_j | \epsilon_{j-1}, j\right)$$

Health insurance arrangements

- A private health insurance market for workers
  - Two insurance plans: individual and group
  - Group insurance offers provided by employers with a probability

$$\omega_{GI}\left(i_{GI,j}, i_{GI,j-1}\right) = \Pr\left(i_{GI,j} | i_{GI,j-1}, income\right)$$

  - Health insurance choice: endogenous
    - $in_j = 0$: no insurance
    - $in_j = 1$: individual based insurance
    - $in_j = 2$: group based insurance (if offered via employer)

- A public insurance program for retirees (Medicare): no insurance choice

Health expenditures and financing

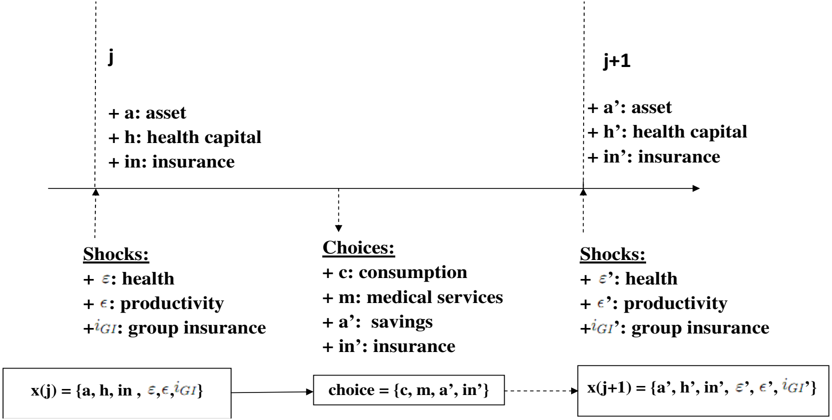
- The total health expenditure: $p_m m$
- Worker's out of pocket health expenditures:

$$o^W(m_j) = \begin{cases} p_{m,noIns} m & \text{if } in_j = 0, \\ \min\left[p_{m,Ins} m_j, \gamma + \rho\left(p_{m,Ins} m_j - \gamma\right)\right] & \text{if } in_j = 1, 2 \end{cases}$$

- Retiree's out of pocket health expenditures:

$$o^R(m_j) = \min\left[p_{m,Med} m_j, \gamma^{Med} + \rho^{Med}\left(p_{m,Med} m_j - \gamma^{Med}\right)\right]$$

Household problem: Timing of events



Worker's dynamic optimization problem

$$V_j(x_j) = \max_{\{c_j, m_j, a_{j+1}, in_{j+1}\}} \left\{ u(c_j, s_j) + \beta \pi_j E_{\varepsilon_{j+1}, \epsilon_{j+1}, i_{GI,j+1} | \varepsilon_j, \epsilon_j, i_{GI,j}} [V(x_{j+1})] \right\}$$

s.t.

$$(1), (2), 0 \leq a_{j+1}, and$$

$$\begin{aligned} & \left(1+\tau^C\right) c_j + (1+g) a_{j+1} + o^W(m_j) + 1_{\{in_{j+1}=1\}} p(j,h) + 1_{\{in_{j+1}=2\}} p \\ = \quad & we(h_{j-1}, \epsilon_j) + R\left(a_j + T^{Beq}\right) + Insprofit_1 + Insprofit_2 - Tax_j + T_j^{SI} \end{aligned}$$

where

$$\begin{aligned} Tax_j &= \tilde{\tau}\left(\tilde{y}_j^W\right) + \left(\tau^{Soc} + \tau^{Med}\right)\left(we(h_{j-1}, \epsilon_j) - 1_{\{in_{j+1}=2\}} p\right) \\ \tilde{y}_j^W &= \left\{ \begin{array}{c} we(h_{j-1}, \epsilon_j) + ra_j + rT^{Beq} + Insprofit_1 + Insprofit_2 \\ -\left(\tau^{Soc} + \tau^{Med}\right)\left(we(h_{j-1}, \epsilon_j) - 1_{\{in_{j+1}=2\}} p\right) - 1_{\{in_{j+1}=2\}} p \end{array} \right. \\ T_j^{SI} &= \max\left[0, \underline{c} + Tax_j - we(h_{j-1}, \epsilon_j) - R\left(a_j + T^{Beq}\right) - InsP_1 - InsP_2\right] \end{aligned}$$

Retiree's dynamic optimization problem

$$V_j\left(x_j\right) = \max_{\left\{c_j, m_j, a_{j+1}\right\}} \left\{u\left(c_j, s_j\right) + \beta \pi_j E_{\varepsilon_{j+1}|\varepsilon_j}\left[V_{j+1}\left(x_{j+1}\right)\right]\right\}$$

s.t.

$$(1), (2), 0 \leq a_{j+1}, and$$

$$c_j + (1+g)\, a_{j+1} + o^R\left(m_j\right) + p_j^{Med} = R\left(a_j + T^{Beq}\right) + T_j^{Soc} + T_j^{SI} - Tax_j$$

Firms and insurance companies

- Firms:

$$\max_{\{K,L\}} \{F(K,L) - qK - wL\}, \text{ given } (q,w)$$

- Insurance companies:

$$\begin{aligned}
& (1+\omega_{ins}) \sum_{j=2}^{J_1} \mu_j \int \left[1_{\{in_j(x_j)=1,2\}} (1-\rho) \max\left(0, p_{m,Ins} m_j(x_j) - \gamma\right) \right] d\Lambda(x_j) \\
= \quad & (1+r) \sum_{j=1}^{J_1} \mu_j \int \left(1_{\{in_j(x_j)=1,2\}} p(j,h) \right) d\Lambda(x_j)
\end{aligned}$$

Government I

- Bequests:

$$\sum_{j=1}^{J} \mu_j \int T_j^{Beq}(x)\, d\Lambda_j(x) = \sum_{j=1}^{J} \tilde{\mu}_j \int a_j(x)\, d\Lambda_j(x)$$

- Social Security:

$$\begin{aligned} & \sum_{j=J_1+1}^{J} \mu_j \int T_j^{Soc}(x)\, d\Lambda_j(x) \\ = \quad & \sum_{j=1}^{J_1} \mu_j \int \tau^{Soc} \left(we\left(j, h_j, \epsilon\right) - 1_{\{in_{j+1}=2\}} p \right) d\Lambda_j(x) \end{aligned}$$

Government II

- Medicare:

$$\sum_{j=J_1+1}^{J} \mu_j \int \left(1-\rho^{Med}\right) \max\left(0, m_j\left(x\right)-\gamma^{Med}\right) d\Lambda_j\left(x\right)$$

$$= \sum_{j=1}^{J_1} \mu_j \int \tau^{Med} \left(we\left(j, h_j, \epsilon\right) - 1_{\{in_{j+1}=2\}} p\right) d\Lambda_j\left(x\right)$$

$$+\sum_{j=J_1+1}^{J} \mu_j \int p_j^{Med} d\Lambda_j\left(x\right)$$

- General government budget:

$$G + \sum_{j=1}^{J} \mu_j \int T_j^{SI}\left(x_j\right) d\Lambda\left(x_j\right)$$

$$= \sum_{j=1}^{J} \mu_j \int Tax_j\left(x_j\right) d\Lambda\left(x_j\right) + \sum_{j=1}^{J} \mu_j \int \tau^C c\left(x_j\right) d\Lambda\left(x_j\right).$$

A competitive equilibrium

Given the transition probability matrices and the exogeneous government policies, a competitive equilibrium is a collection of sequences of distributions of household decisions, aggregate capital stocks of physical and human capital, and market prices such that

- Agents solve the consumer problem
- The F.O.Cs of firms hold
- The budget constraints of insurances companies hold
- All markets clear
- All the government programs and the general budget clear
- The distribution is stationary

CALIBRATION

Calibration

- Preferences:

$$u\left(c_j, s_j\right) = \frac{\left(c_j^{\eta} s_j^{1-\eta}\right)^{1-\sigma}}{1-\sigma}$$

- Health services:

$$s_j = h_j$$

- Health production:

$$h_j = \phi m_j^{\xi} + \left(1 - \delta_{h,j}\right) h_{j-1} + \varepsilon_j$$

- Human capital:

$$e_j = e\left(\epsilon_j\right)^{\chi} \left(h_{j-1}^{\theta}\right)^{1-\chi} \text{ for } \; j = \{1, ..., J_1\}$$

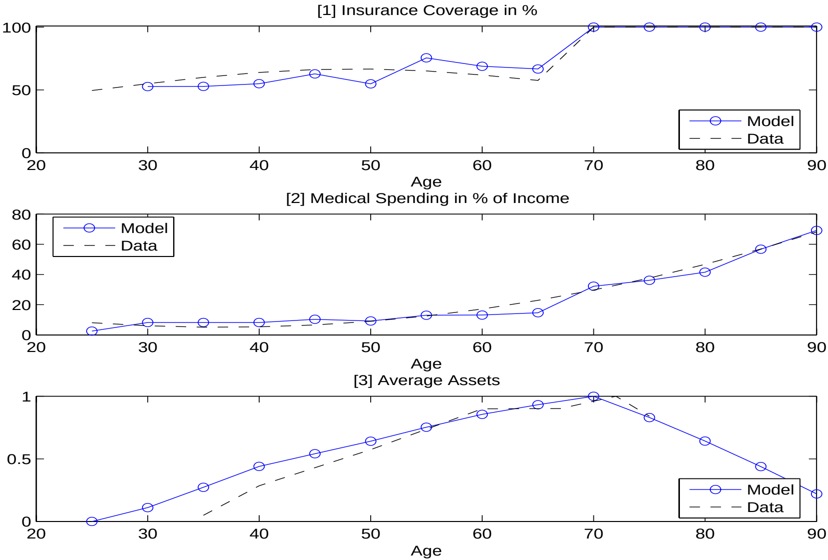
- Markov switching probabilities of the productivity shocks and group insurance offer states are estimated from MEPS 2004-2005 data.

Calibration

Baseline Parameters		
Demographics:	Health Production:	Insurance:
$J_1 = 9$	$\phi = 1$	$\gamma = 1.7\%$ of median income
$J_2 = 5$	$\xi = 0.32$	$\rho = 34\%$
$n = 1.2\%$		$\gamma^{Med} = 6\%$ of elderly's aver health spending
		$\rho^{Med} = 30\%$
Preferences:	Health Productivity:	Exogenous premium growth
$\sigma = 2.5$	$\theta = 0$, $\chi = 0.9$	depending on age and health
$\beta =?$		
Technology:		
$\alpha = 0.36$		
$\delta = 15\%$		
$g = 1.5\%$		

- Depreciation rates of health capital $\delta_{h,j} =?$
- Magnitudes and transition probabilities of health shocks $\varepsilon_j =?$

The model and the data



POLICY EXPERIMENTS

A counterfactual health care reform: Universal Medical Vouchers

Motivated by Kotlikoff (2007) and Emanuel and Fuchs (2007)

1. Government
    - issues medical vouchers to all individuals
    - Vouchers are calculated individually based on the amount of the expected health expenditures for next year (experience rating system)
    - Vouchers are financed by a consumption, payroll, or lump sum tax
2. Individuals purchase private health insurance contracts from insurance companies using the voucher
3. Participating insurance companies have to accept vouchers and offer basic insurance contracts

Aggregate effects of the voucher program fnanced by a payroll tax

	Benchmark	Regime 1 - Payroll tax
Capital: K	100.00	89.823
Human capital: L	100.00	100.000
Output: Y	100.00	96.210
Med spending: $p_m * M$	100.00	101.538
Consumption: C	100.00	97.602
Consumption tax: τ_C	5.155	5.676
Payroll voucher tax: τ_V	0.000	8.227
Interest rate: R in %	3.981	4.704
Wages: w	100.000	96.210
Voucher Payments % of GDP	0.0	5.208

Table: Steady state result with health as consumption good only $\theta = 0$.

Negative efficiency effects driven by:

1. Savings effect
2. Moral hazard effect
3. Tax effect
4. General equilibrium effect

$$
\begin{aligned}
& \left(1+\tau^{C}\right) c_j + (1+g)\, a_{j+1} + o^{W}\left(m_j\right) + p\left(x_j\right) \\
= \; & \left(1-\tau^{V}\right) we\left(h_{j-1}, \epsilon_j\right) + R\left(a_j + T^{Beq}\right) - Tax_j + T_j^{SI} + v_j - \tau^{LS}
\end{aligned}
$$

Aggregate efficiency effects: four key channels

	Benchmark	Regime 1 - Payroll tax
1. Capital: K	100.00	89.823
(The saving effect)		
2. Med spending: $p_m * M$	100.00	101.538
(The moral hazard effect)		
3. Payroll voucher tax: τ_V	0.000	8.227
(The tax effect)		
4a. Interest rate: R in %	3.981	4.704
4b. Wages: w	100.000	96.210
(The general equilibrium price effect)		

Table: Steady state result with health as consumption good only $\theta = 0$.

Aggregate effects with consumption tax

	Benchmark	Regime 2 - Cons Tax
1. Capital: K	100.00	98.293
(The savings effect)		
2. Med spending: $p_m * M$	100.00	107.858
(The moral hazard effect)		
3a. Consumption tax: τ_C	5.155	18.049
(The tax effect)		
3b. Payroll voucher tax: τ_V	0.000	0.000
4a. Interest rate: R in %	3.981	3.988
4b. Wages: w	100.000	99.382
(The general equilibrium price effect)		

Table: Steady state results with health as consumption good only $\theta = 0$.

Health as Consumption and Investment Goods

- Additional channel: the human capital effect

- Similar results as in the case without human capital effect
- Higher health spending produces higher health
- Higher health capital alleviates some of the negative tax distortions
- Negative savings effect is now smaller
- Price (G.E.) effects are smaller

Health as consumption and investment good

	Benchmark $\theta = 0$	Payroll tax $\theta = 0$	Benchmark $\theta = 1$	Payroll tax $\theta = 1$
1. Capital: K	100.00	89.823	100.00	90.902
(The saving effect)				
2. Med spending: $p_m * M$	100.00	101.538	100.00	101.077
(The moral hazard effect)				
3. Payroll voucher tax: τ_V	0.000	8.227	0.000	8.224
(The tax effect)				
4a. Interest rate: R in %	3.981	4.704	4.251	4.919
4b. Wages: w	100.000	96.210	100.000	96.555
(The G.E price effect)				
5. Human capital L	100.000	100.000	100.000	100.199
(The human capital effect)				

Table: Steady state results with health productivity $\theta = 1$.

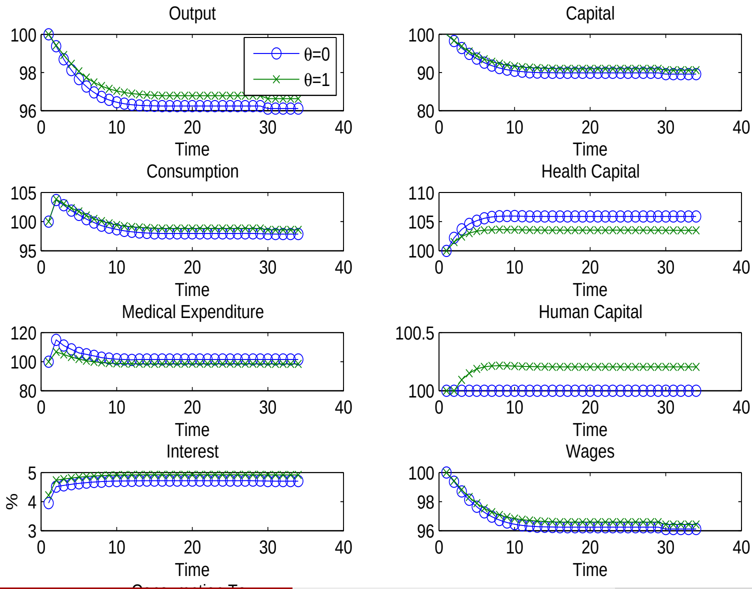
Health as consumption and investment good

- Previous 4 channels
- Additional channel: the human capital effect

	Benchmark	Payroll tax	Consumption tax
Capital: K	100.000	90.902	100.078
Human capital: L	100.000	100.199	100.382
Output: Y	100.000	96.747	100.273
Medical spending: $p_m * M$	100.000	101.077	107.454
Consumption: C	100.000	98.346	96.548
Interest rate: R in %	4.251	4.919	4.121
Wages: w	100.000	96.555	99.891
Voucher Payments in % of GDP	0.000	5.227	5.673

Table: Steady state results with health productivity $\theta = 1$.

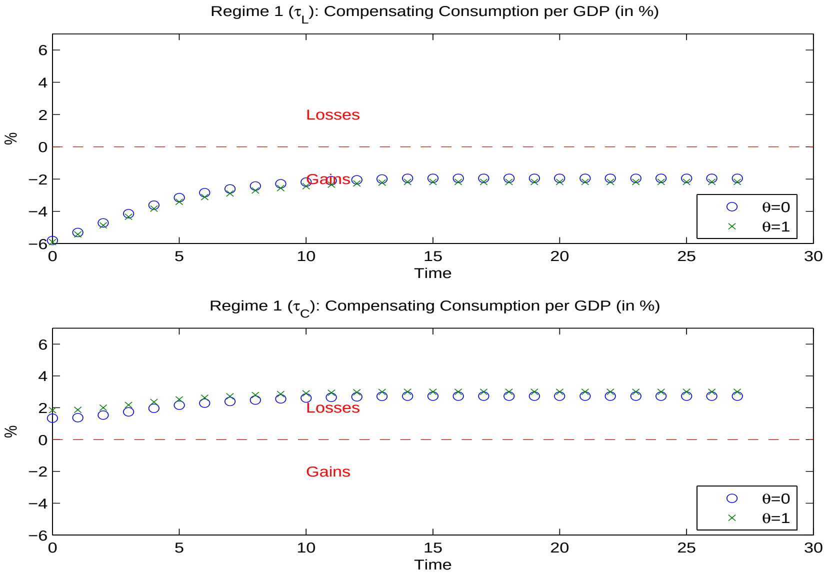
Transitions from benchmark to regime 1: payroll tax



Welfare effects: Payroll vs. consumption tax

- Negative efficiency effects
  - Capital drops
  - Output drops
  - Household income drops (w decrease)
  - Consumption of C drops
- Positive insurance effects
  - More insured, improved risk sharing
  - Increases in medical spending
  - Increases in health capital H
  - If H is productive, it has a positive effect on output

Welfare effects: Payroll vs. consumption tax



Aggregate effects: Payroll vs. consumption tax

	Benchmark	Regime 1 Payroll tax	Regime 2 Consumption Tax
Capital: K	100.00	89.823	98.293
Human capital: L	100.00	100.000	100.000
Output: Y	100.00	96.210	99.382
Med spending: $p_m * M$	100.00	101.538	107.858
Consumption: C	**100.000**	**97.602**	**96.227**
Consumption tax: τ_C	5.155	5.676	18.049
Payroll voucher tax: τ_V	0.000	8.227	0.000
Interest rate: R in %	3.981	4.704	3.988
Wages: w	100.000	96.210	99.382
Voucher Payments % of GDP	0.0	5.208	5.583

Table: Steady state result with health as consumption good only $\theta = 0$.

Key Lessons

- General equilibrium channels
- Tax financing instruments: Payroll vs. consumption tax
- Role of health: Productive vs. non-productive health
- Policy outcomes: Aggregate vs. welfare effects

Conclusion

1. Construct a heterogeneous agents macro-model with health as a durable good
2. Account for life-cycle patterns of health expenditures and private insurance take up rates
3. Assess the macroeconomic effects of introducing a universal health insurance system

Future work on macro-health economics

1. Model:
    - Elastic labor and Medicaid
    - The life cycle profiles with a pure age effect
    - A structural estimation of the health production function

2. Research Questions:
    - Life cycle consumption puzzle
    - The tax deductible policy and health insurance markets
    - The macroeconomic effects of Obama's health care reform 2010
    - Optimal public health insurance policy
    - Financing health costs in an aging economy