Market Inefficiency, Insurance Mandate and Welfare: U.S. Health Care Reform 2010

(Preliminary and Incomplete!)

Juergen Jung
Towson University, Maryland

Chung Tran
Australian National University

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Disclaimer

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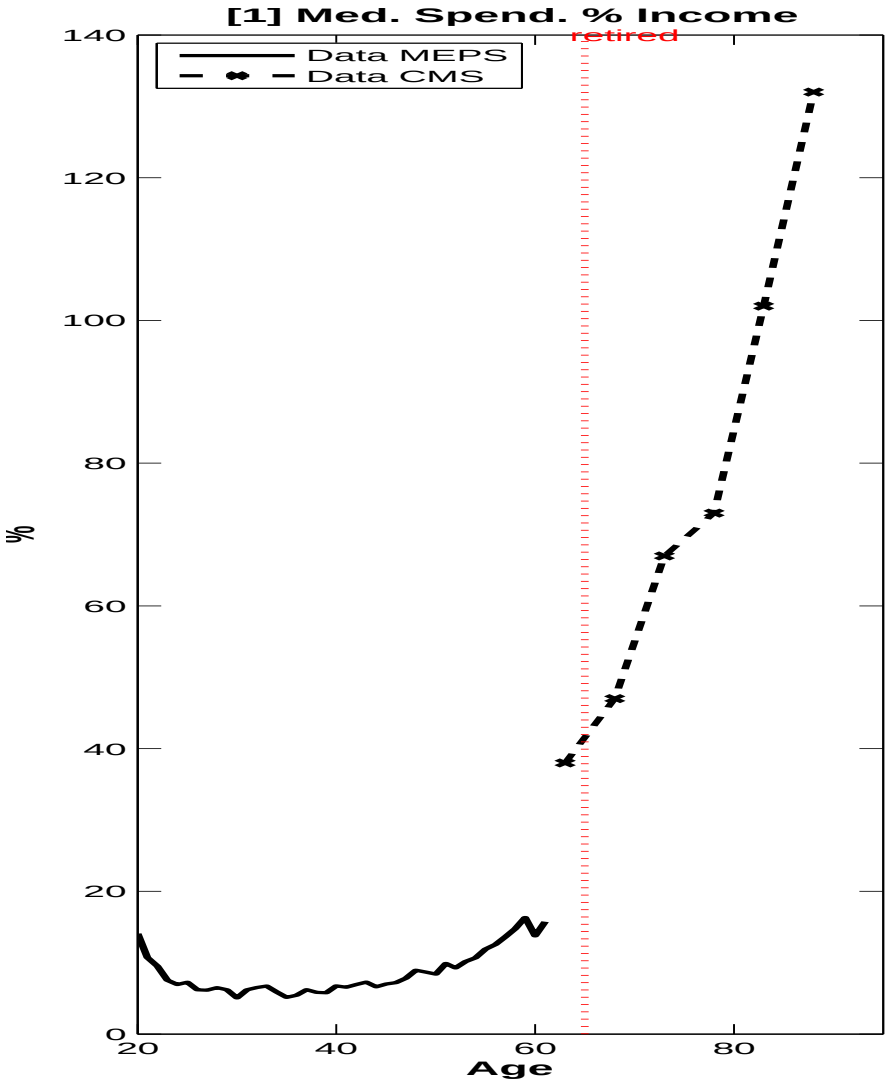
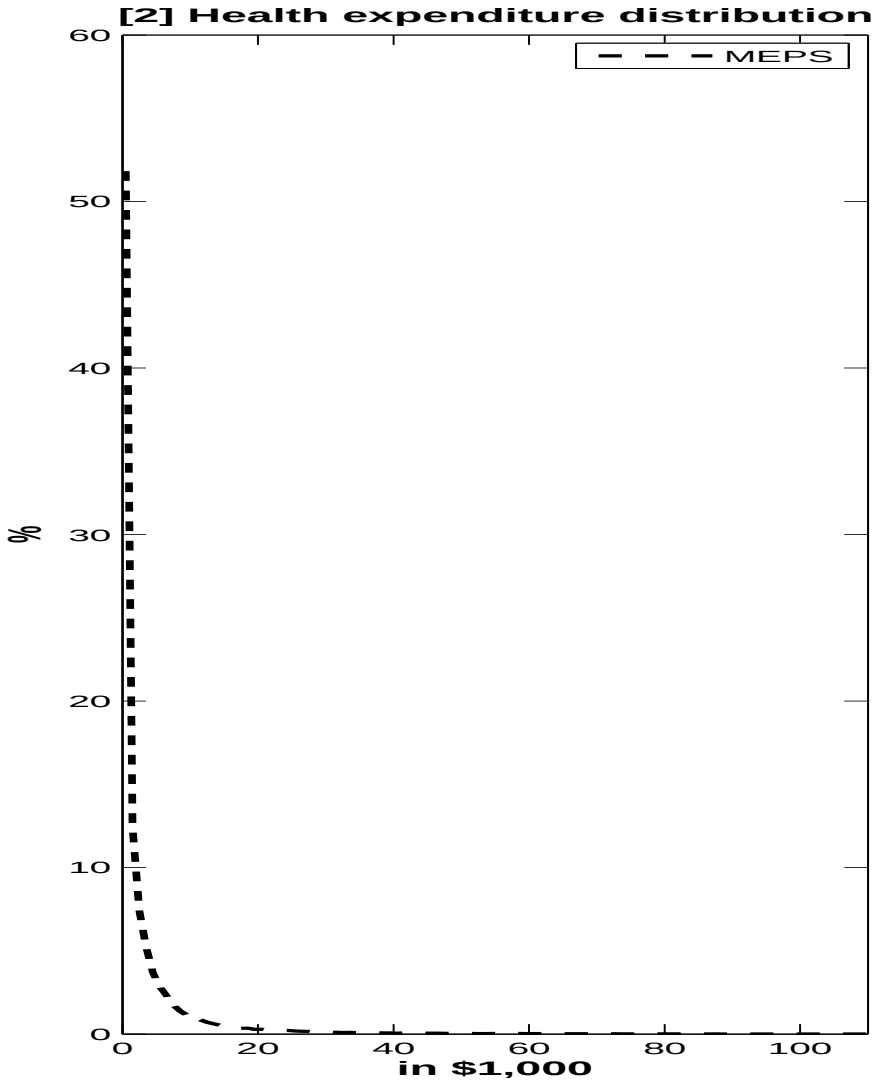
The U.S. health insurance system

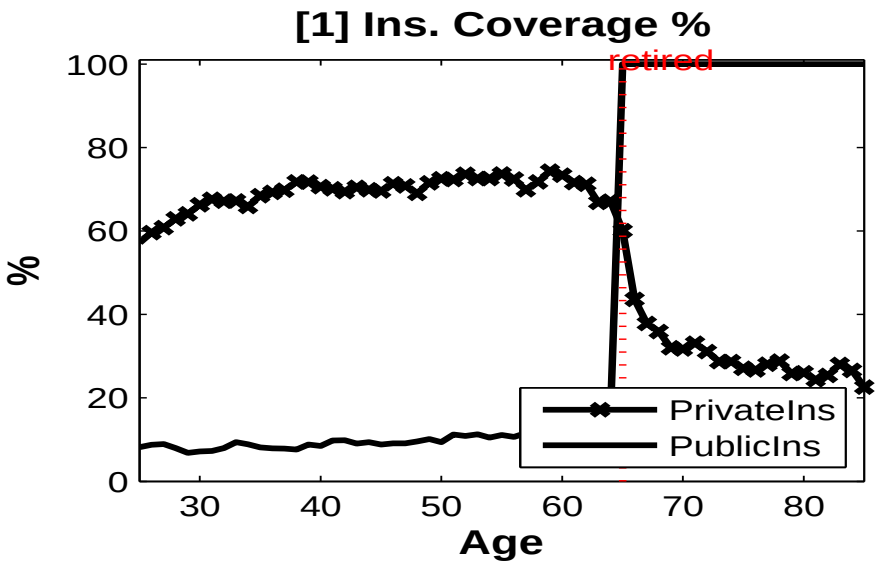
- Mixed system:
  - Private health insurance for working population
  - Public health insurance for poor (Medicaid) and old (Medicare)
- Main issues in the current system:
  - Low coverage: 47 million uninsured in 2010 ($\approx 15\%$)
  - High cost: 16% of GDP on Health in 2010 and close to 20% by 2015
  - Health outcomes: questionable?

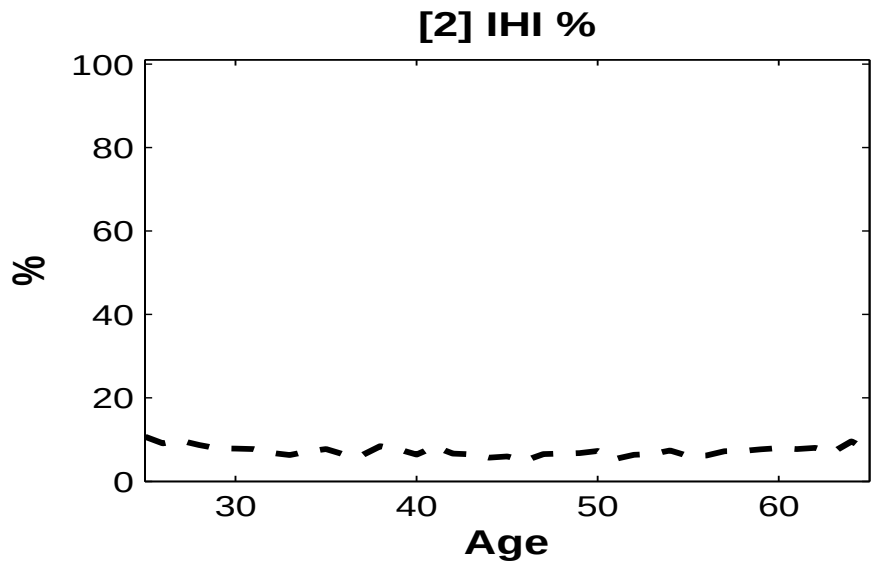
Health expenditures: MEPS 2000-2009

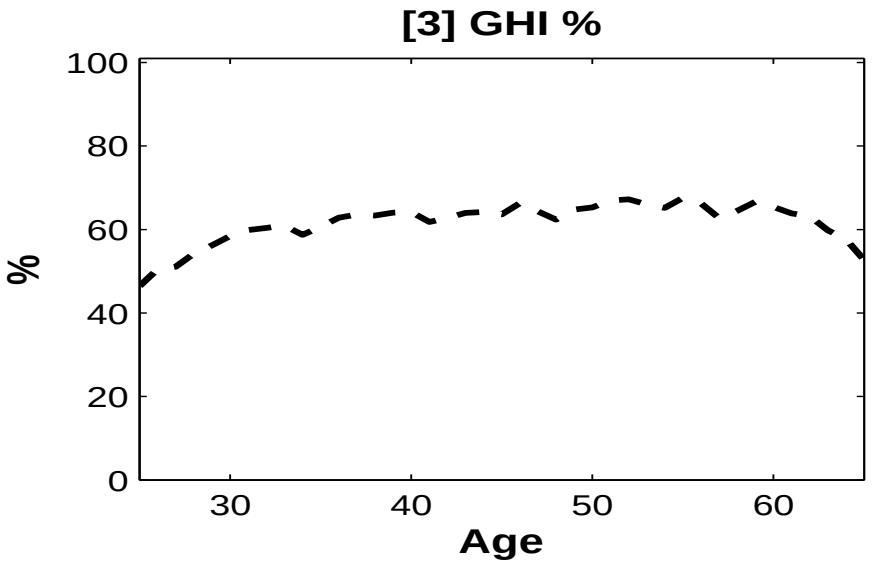


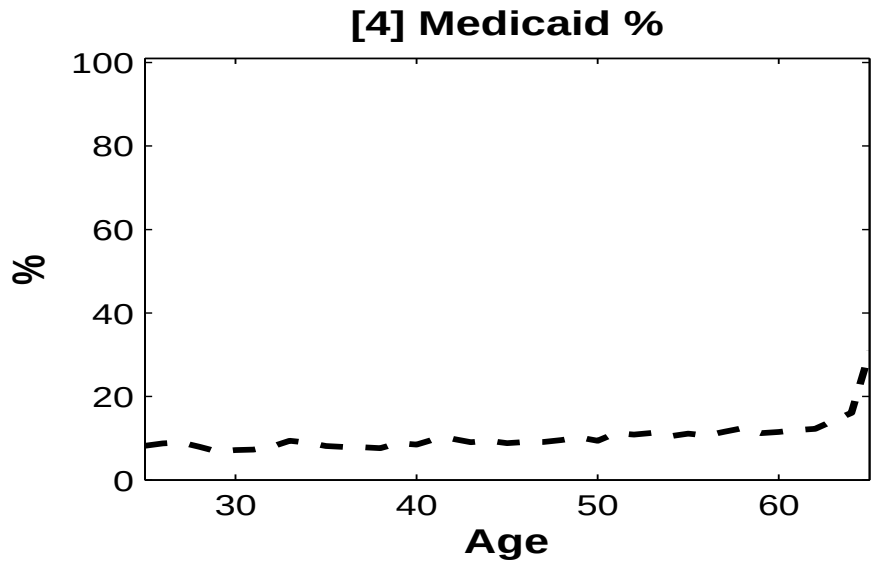


Insurance take-up rates: MEPS 2000-2009









Affordable Care Act (2010)

- Private insurance:
  1. Health insurance mandate enforced by **penalties** and **subsidies**
  2. Health insurance exchanges
  3. Restrictions on insurance companies
- Public insurance
  1. Expansion of **Medicaid**
  2. Cuts in Medicare
  3. New **taxes**
- Focus on reducing the number of uninsured

This paper

1. Develop a stochastic dynamic general equilibrium **OLG model** with
   - endogenous health spending + insurance choice
   - core structure of US health insurance system

   that accounts for
   - life-cycle patterns of health spending + insurance take-up
   - distributions of income and health expenditures
2. to quantify the long-run effects of the ACA (2010) on
   - insurance coverage and health expenditures
   - macroeconomic aggregates and welfare

Results preview

- **Coverage**
  - 76.23% to 90.41% of workers due to ↓ Adverse selection
  - IHI ↑, Medicaid ↑, but GHI ↓
  - Insurance take-up driven by **penalty** and not subsidies
- **Medical Spending**
  - Moral hazard ↑ → medical services M ↑ and health capital ↑
  - but switch from high to low price types → total spending $p_m M$ ↓
- **Aggregates and welfare**
  - Redistribution from high-income-healthy types
  - Capital stock ↓ and labor supply ↓ → GDP ↓ 1.2%
  - Welfare ↓ except low income groups
- **Fiscal costs**
  1. Payroll tax of 0.5% on income $> \$200,000$
  2. Consumption tax ↑ by 1.0%
  3. Lump-sum tax of 0.36% of household income
  4. Government spending ↓ by 0.5% of GDP

Related literature

1. Health microeconomics/econometrics
   - Grossman (1972a,1972b), Grossman (2000)

2. Quantitative macroeconomics/public finance
   - Ayagari (1994), Imrohoroglu et al (1995), Hugget (1996)

3. Macro-health economics:
   - Exogeneous health expenditure shocks: Attanasio, Kitao and Violante (2008), Jeske and Kitao (2009), Pashchenko and Porapakkarm (2010), Janicki (2011)

   - Endogenous health expenditures and insurance: Suen (2006), Feng (2009), Fonseca et al.(2009,2013) and Jung and Tran (2008, 2010, 2013)

MODEL

The Model: "Workhorse" macro model

Dynamic stochastic overlapping generations model with heterogeneous agents:

- Structure: households, government and production sectors for C
- Markets: consumption, labor and capital
- Households live for multiple-periods as workers and retirees
- Exogenous mortality shocks
- Idiosyncratic labor productivity shocks
- Incomplete financial markets

The Model: New features

- Health as a durable good: consumption and investment
- Idiosyncratic health shocks
- Endogenous health spending
- Elements of the US health insurance system
  - Individual health insurance (IHI)
  - Group health insurance (GHI)
  - Medicaid and Medicare
  - Random employer matching
- Endogenous health insurance choice

The Model: Preferences and technology

- Preferences:

$$u\left(c_j, l_j, h_j, m_j\right)$$

- Health capital:

$$h_j = i\left(m_j, h_{j-1}, \delta^h, \epsilon_j^h\right)$$

- Human capital ("labor"):

$$e_j = e\left(\vartheta, h_j, \epsilon_j^l\right)$$

- Shocks:

$$\Pr\left(\epsilon_{j+1}^h | \epsilon_j^h\right) \in \Pi_j^h \text{ and } \Pr\left(\epsilon_{j+1}^l | \epsilon_j^l\right) \in \Pi_j^l$$

The Model: Health insurance

- A private health insurance market for workers
  - Individual and group plans for $\text{prem}^{\text{IHI}}(j,h)$ and prem^{GHI}
  - Group insurance offer ϵ^{GHI} depends on current insurance state and income
  - $\Pr\left(\epsilon_{j+1}^{\text{GHI}}|\epsilon_{j}^{\text{GHI}},\vartheta\right) \in \Pi_{j,\vartheta}^{\text{GHI}}$
  - Health insurance choice:

$$in_j = \begin{cases} 0 & \text{if no insurance} \\ 1 & \text{if Individual health insurance (IHI)} \\ 2 & \text{if Group health insurance (GHI)} \\ 3 & \text{if Medicaid} \end{cases} \quad \text{if } j \leq J_w$$

- Income/asset test for Medicaid
- Medicare for retirees for $\text{prem}^{R} \rightarrow$ no more insurance choice

The Model: Out-of-Pocket health spending

- Worker's out-of-pocket health expenditures depend on insurance state

$$o\left(m_j\right) = \begin{cases} p_m^{in_j} \times m_j, & \text{if } in_j = 0 \\ \rho^{in_j}\left(p_m^{in_j} \times m_j\right), & \text{if } in_j > 0 \end{cases}$$

- Retiree's out-of-pocket health expenditures depend on Medicare generosity

The Model: Technology and firms

- Final goods C production sector for price $p_C = 1$:

$$\max_{\{K,\ L\}} \{F(K, L) - qK - wL\}$$

- Medical services M production sector for price p_m:

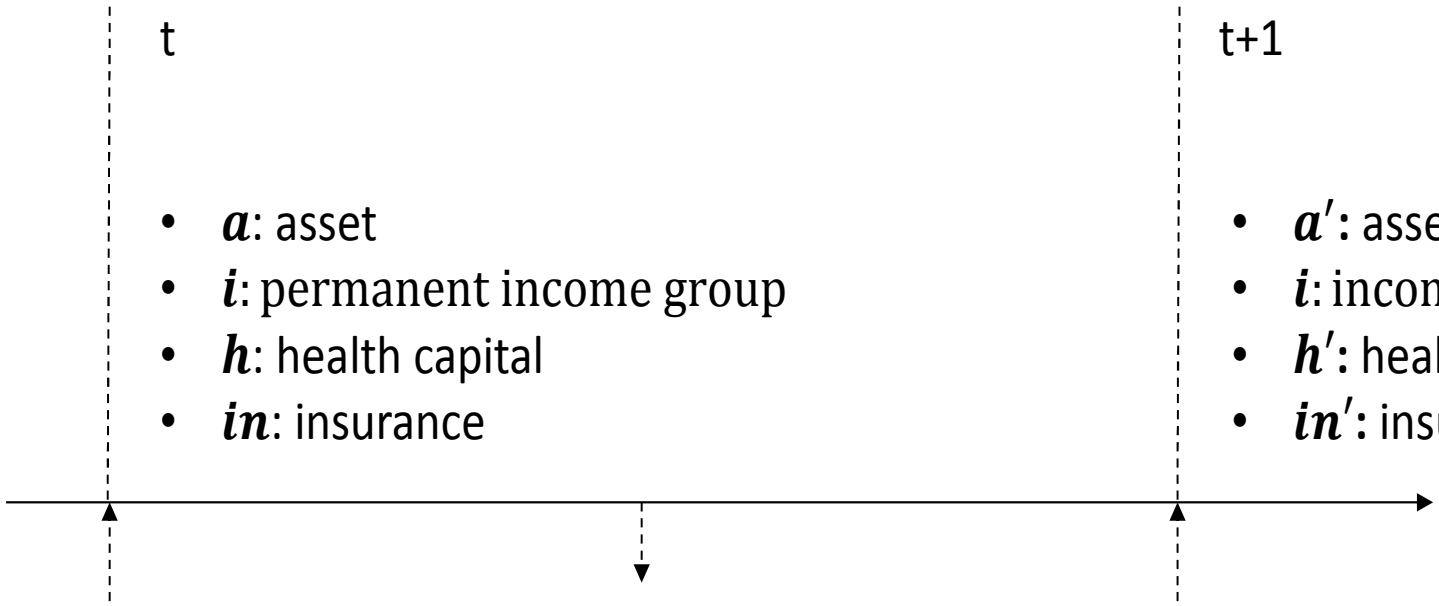
$$\max_{\{K_m,\ L_m\}} \{p_m F_m(K_m, L_m) - qK_m - wL_m\}$$

- p_m is a base price for medical services
- Price paid by households depends on insurance state:

$$p_j^{in_j} = \left(1 + \nu^{in_j}\right) p_m$$

- ν^{in_j} is an insurance state dependent markup factor
- Profits are redistributed to all surviving agents

The Model: Household problem



Shocks:
- ϵ_t^h: health
- ϵ_t^l: productivity
- ϵ_t^{GHI}: group HI

Choices:
- c: consumption
- l: leisure
- m: medical services
- a': savings
- in': insurance

Shocks:
- ϵ_{t+1}^h : health
- ϵ_{t+1}^l: productivity
- ϵ_{t+1}^{GHI}: group HI

State vector:
$x_t = \{j, a, i, h, in, \epsilon^h, \epsilon^l, \epsilon^{GHI}\}$ → Choice $=\{c, l, m, a', in'\}$ → $x_{t+1} = \{j+1, a', i, h', in', \epsilon'^h, \epsilon'^l, \epsilon'^{GHI}_t\}$

Worker's dynamic optimization problem

$$V(x_j) = \max_{\{c_j, l_j, m_j, a_{j+1}, in_{j+1}\}} \left\{ u(c_j, h_j, l_j, m_j) + \beta \pi_j E\left[V(x_{j+1}) \mid \epsilon_j^l, \epsilon_j^h, \epsilon_j^{GHI} \right] \right\}$$

$$s.t.$$

$$\left(1+\tau^C\right) c_j + (1+g)\, a_{j+1} + o(m_j)$$

$$+1_{\{in_{j+1}=1\}} \text{prem}^{\text{IHI}}(j,h) + 1_{\{in_{j+1}=2\}} \text{prem}^{\text{GHI}}$$

$$= y_j^W - tax_j + t_j^{\text{SI}}$$

$$0 \leq a_{j+11}$$

$$0 \leq l_j \leq 1$$

$$h_j = i\left(m_j, h_{j-1}, \delta^h, \epsilon_j^h\right)$$

Worker's dynamic optimization problem

where

$$
\begin{aligned}
y_j^W &= e\left(\vartheta, h_j, \epsilon_j^l\right) \times l_j \times w + R\left(a_j + t^{\text{Beq}}\right) + \text{profits} \\
tax_j &= \tilde{\tau}\left(\tilde{y}_j^W\right) + tax_j^{SS} + tax_j^{\text{Med}} \\
\tilde{y}_j^W &= y_j^W - a_j - t^{\text{Beq}} - 1_{[in_{j+1}=2]}\text{prem}^{\text{GHI}} - 0.5\left(tax_j^{SS} + tax_j^{\text{Med}}\right) \\
tax_j^{SS} &= \tau^{\text{Soc}} \times \min\left(\bar{y}_{ss},\ e\left(\vartheta, h_j, \epsilon_j^L\right) \times l_j \times w - 1_{[in_{j+1}=2]}\text{prem}^{\text{GHI}}\right) \\
tax_j^{\text{Med}} &= \tau^{\text{Med}} \times \left(e\left(\vartheta, h_j, \epsilon_j^l\right) \times l_j \times w - 1_{[in_{j+1}=2]}\text{prem}^{\text{GHI}}\right) \\
t_j^{\text{SI}} &= \max\left[0,\ \underline{c} + o\left(m_j\right) + tax_j - y_j^W\right]
\end{aligned}
$$

Retiree's dynamic optimization problem

$$
\begin{aligned}
V(x_j) &= \max_{\{c_j, m_j, a_{j+1}\}} \left\{ u(c_j, h_j, m_j) + \beta \pi_j E\left[V(x_{j+1}) \mid \epsilon_j^h \right] \right\} \\
&\quad s.t.
\end{aligned}
$$

$$
\begin{aligned}
\left(1+\tau^C\right) c_j + (1+g)\, a_{j+1} + o^R(m_j) + \text{prem}^R &= \\
R\left(a_j + t_j^{\text{Beq}}\right) - tax_j + t_j^{\text{Soc}} + t_j^{\text{SI}}
\end{aligned}
$$

where

$$
\begin{aligned}
a_{j+1} &\geq 0 \\
h_j &= i\left(m_j, h_{j-1}, \delta^h, \epsilon_j^h\right)
\end{aligned}
$$

$$
\begin{aligned}
tax_j &= \tilde{\tau}\left(\tilde{y}_j^R\right) \\
\tilde{y}_j^R &= t_j^{\text{Soc}} + r \times \left(a_j + t_j^{\text{Beq}}\right) + \text{profits} \\
t_j^{\text{SI}} &= \max\left[0, \underline{c} + o^R(m_j) + tax_j - R\left(a_j + t_j^{\text{Beq}}\right) - t_j^{\text{Soc}}\right]
\end{aligned}
$$

Insurance sector

$$\left(1+\omega_{j,h}^{\text{IHI}}\right)\sum_{j=2}^{J_1}\mu_j\int\left[1_{\left[in_j\left(x_j\right)=1\right]}\left(1-\rho^{\text{IHI}}\right)p_m^{\text{IHI}}m_{j,h}\left(x_{j,h}\right)\right]d\Lambda\left(x_{j,h}\right)$$

$$=\quad R\sum_{j=1}^{J_1-1}\mu_j\int\left(1_{\left[in_{j,h}\left(x_{j,h}\right)=1\right]}\text{prem}^{\text{IHI}}\left(j,h\right)\right)d\Lambda\left(x_{j,h}\right)$$

$$\left(1+\omega^{\text{GHI}}\right)\sum_{j=2}^{J_1}\mu_j\int\left[1_{\left[in_j\left(x_j\right)=2\right]}\left(1-\rho^{\text{GHI}}\right)p_m^{\text{GHI}}m_j\left(x_j\right)\right]d\Lambda\left(x_j\right)$$

$$=\quad R\sum_{j=1}^{J_1-1}\mu_j\int\left(1_{\left[in_j\left(x_j\right)=2\right]}\text{prem}^{\text{GHI}}\right)d\Lambda\left(x_j\right),$$

Government budget

$$
\begin{aligned}
& G + \sum_{j=1}^{J} \mu_j \int t_j^{\mathrm{SI}}(x_j)\, d\Lambda(x_j) + \sum_{j=2}^{J_1} \mu_j \int \left(1-\rho^{\mathrm{MAid}}\right) p_m^{\mathrm{MAid}} m_j(x_j)\, d\Lambda(x_j) \\
& + \sum_{j=J_1+1}^{J} \mu_j \int \left(1-\rho^{R}\right) p_m^{R} m_j(x_j)\, d\Lambda(x_j) \\
= \; & \sum_{j=1}^{J} \mu_j \int \left[\tau^{C} c(x_j) + tax_j(x_j)\right] d\Lambda(x_j) + \sum_{j=J_1+1}^{J} \mu_j \int \mathrm{prem}^{R}(x_j)\, d\Lambda(x_j) \\
& + \sum_{j=1}^{J_1} \mu_j \int \tau^{\mathrm{Med}} \left(e_j(x_j) \times l_j(x_j) \times w - 1_{[in_{j+1}(x_j)=2]} \mathrm{prem}^{\mathrm{GHI}}(x_j)\right) d\Lambda(x_j)
\end{aligned}
$$

Pensions and bequests

- Pensions:

$$\sum_{j=J_1+1}^{J} \mu_j \int t_j^{\text{Soc}}(x_j)\, d\Lambda(x_j)$$

$$= \sum_{j=1}^{J_1} \mu_j \int \tau^{\text{Soc}} \times \left(e_j(x_j) \times l_j(x_j) \times w - 1_{[in_{j+1}(x_j)=2]} \text{prem}^{\text{GHI}} \right) d\Lambda(x_j)$$

- Bequests:

$$\sum_{j=1}^{J_1} \mu_j \int t_j^{\text{Beq}}(x_j)\, d\Lambda(x_j) = \sum_{j=1}^{J} \int \tilde{\mu}_j a_j(x_j)\, d\Lambda(x_j)$$

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 government programs and the general budget clear
- The distribution is stationary

A competitive equilibrium

- Given $\left\{\Pi_j^l, \Pi_j^h, \Pi_{j,\vartheta}^{\text{GHI}}\right\}_{j=1}^J$, $\{\pi_j\}_{j=1}^J$ and
- $\left\{tax\left(x_j\right), \tau^C, \text{prem}^R, \tau^{SS}, \tau^{\text{Med}}\right\}_{j=1}^J$,

a competitive equilibrium is a collection of sequences of:

- distributions $\{\mu_j, \Lambda_j\left(x_j\right)\}_{j=1}^J$
- individual household decisions $\{c_j\left(x_j\right), l_j\left(x_j\right), a_{j+1}\left(x_j\right), m_j\left(x_j\right), in_{j+1}\left(x_j\right)\}_{j=1}^J$
- aggregate stocks of capital and labor $\{K, L, K_m, L_m\}$
- factor prices $\{w, q, R, p_m\}$
- markups $\left\{\omega^{\text{IHI}}, \omega^{\text{GHI}}, \nu^{in}\right\}$ and
- insurance premiums $\left\{\text{prem}^{\text{GHI}}, \text{prem}^{\text{IHI}}\left(j, h\right)\right\}_{j=1}^J$

such that:

A competitive equilibrium

(a) $\{c_j(x_j), l_l(x_j), a_{j+1}(x_j), m_j(x_j), in_{j+1}(x_j)\}_{j=1}^{J}$ solves the consumer problem

(b) the firm first order conditions hold:

$$w = F_L(K, L) = p_m F_{m,L}(K_m, L_m)$$

$$q = F_K(K, L) = p_m F_{m,K}(K_m, L_m)$$

$$R = q + 1 - \delta$$

A competitive equilibrium

(c) markets clear

$$
\begin{aligned}
K + K_m &= \sum_{j=1}^{J} \mu_j \int \left(a\left(x_j\right)\right) d\Lambda\left(x_j\right) + \sum_{j=1j}^{J} \int \tilde{\mu}_j a_j\left(x_j\right) d\Lambda\left(x_j\right) \\
&\quad + \sum_{j=1}^{J_1-1} \mu_j \int \left(1_{\left[in_{j+1}=2\right]}\left(x_j\right) \times \text{prem}^{\text{IHI}}\left(j,h\right)\right) d\Lambda\left(x_j\right) \\
&\quad + \sum_{j=1}^{J_1-1} \mu_j \int \left(1_{\left[in_{j+1}=3\right]}\left(x_j\right) \times \text{prem}^{\text{GHI}}\right) d\Lambda\left(x_j\right)
\end{aligned}
$$

$$
T^{\text{Beq}} = \sum_{j=1j}^{J} \int \tilde{\mu}_j a_j\left(x_j\right) d\Lambda\left(x_j\right)
$$

$$
L + L_m = \sum_{j=1}^{J_1} \mu_j \int e_j(x_j) l_j\left(x_j\right) d\Lambda\left(x_j\right)
$$

A competitive equilibrium

(*d*) the aggregate resource constraint holds

$$G+(1+g)\,S+\sum_{j=1}^{J}\mu_j\int\left(c\left(x_j\right)+p_m^{in_j\left(x_j\right)}m\left(x_j\right)\right)d\Lambda\left(x_j\right)+\text{Profit}^M=Y+(1-\delta)\,K$$

(*e*) the government programs clear

(*f*) the budget conditions of the insurance companies hold, and

(*g*) the distribution is stationary

$$\left(\mu_{j+1},\Lambda\left(x_{j+1}\right)\right)=T_{\mu,\Lambda}\left(\mu_j,\Lambda\left(x_j\right)\right),$$

where $T_{\mu,\Lambda}$ is a one period transition operator

CALIBRATION

Parameterization and calibration

- Goal: to match U.S. data pre ACA
- Data sources:
  - MEPS: labor supply, health shocks, health expenditures, coinsurance rates
  - PSID: initial asset distribution
  - CENSUS: demographic profiles
  - Previous studies: income process, labor shocks, aggregates

Parameterization

- Preferences:

$$u(c, l, h, m) = \frac{\left(\left(c^{\eta} \times \left(\frac{1-l-1_{[l>0]}\bar{l}_j}{(1+m)^{\eta_m}}\right)^{1-\eta}\right)^{\kappa} \times h^{1-\kappa}\right)^{1-\sigma}}{1-\sigma}$$

- Human capital:

$$e = e_j\left(\vartheta, h_j, \epsilon^l\right) = \left(\overline{wage}_{j,\vartheta}\right)^{\chi} \times \left(\exp\left(\frac{h_j - \bar{h}_{j,\vartheta}}{\bar{h}_{j,\vartheta}}\right)\right)^{1-\chi} \times \epsilon^l$$

- $\overline{wage}_{j,\vartheta}$ from MEPS
- ϵ^l and Π^l from prior studies using Tauchen (1986) procedure

Parameterization

- Health capital accumulation:

$$h_j = i\left(m_j, h_{j-1}, \delta_j^h, \epsilon_j^h\right) = \overbrace{\phi_j m_j^{\xi}}^{\text{Investment}} + \overbrace{\left(1-\delta_j^h\right) h_{j-1}}^{\text{Trend}} + \overbrace{\epsilon_j^h}^{\text{Disturbance}}$$

- ϕ and ξ calibrated to match health spending
- δ^h from MEPS using zero medical spenders and $\bar{h}_j = \overbrace{\left(1-\delta_j^H\right)\bar{h}_{j-1}}^{\text{Trend}}$
- ϵ^h and Π^h from MEPS

Calibration: Health shocks

- Split each cohort j into 4 risk groups
- Average health capital per risk group: $\left\{\bar{h}_{j,d}^{\max} > \bar{h}_{j,d}^{3} > \bar{h}_{j,d}^{2} > \bar{h}_{j,d}^{1}\right\}$
- Shock magnitude:

$$\epsilon_j^h = \left\{0, \frac{\bar{h}_{j,d}^{3} - \bar{h}_{j,d}^{\max}}{\bar{h}_{j,d}^{\max}}, \frac{\bar{h}_{j,d}^{2} - \bar{h}_{j,d}^{\max}}{\bar{h}_{j,d}^{\max}}, \frac{\bar{h}_{j,d}^{1} - \bar{h}_{j,d}^{\max}}{\bar{h}_{j,d}^{\max}}\right\} \times h_m^{max}$$

Parameterization: Production function

- Final goods production:

$$F(K, L) = AK^{\alpha}L^{1-\alpha}$$

- Medical services production:

$$F_m(K_m, L_m) = A_m K_m^{\alpha_m} L_m^{1-\alpha_m}$$

- Parameters from other studies
- $A = 1$ and A_m calibrated to match aggregate health spending

Calibration: Group insurance offers

- Offer shock: $\epsilon^{GHI} = \{0, 1\}$ where
  - 0 indicates no offer and
  - 1 indicates a group insurance offer
- MEPS variables OFFER31X, OFFER42X, and OFFER53X
- Probability of a GHI offer is highly correlated with income
- $\Pi^{h}_{j,\vartheta}$ with elements $\Pr\left(\epsilon^{\text{GHI}}_{j+1} | \epsilon^{\text{GHI}}_{j}, \vartheta\right)$
- ϑ indicates permanent income group

Calibration: Coinsurance rates

- Coinsurance rates from MEPS
- Premiums clear insurance constraints
- Markup profits of GHI are zero
- Markup profits of IHI are calibrated to match IHI take up rate
- IHI profits used to cross-subsidize GHI

Calibration: Price of medical services

- Reimbursement rates of Medicare/Medicaid are close to 70% of private health insurance (CMS)
- The national average is a markup of around 60% for the uninsured (Brown (2006))
- Large GHI can negotiate favorable prices (Phelps (2003))
- Price vector:

$$\left[p_m^{\text{noIns}}, p_m^{\text{IHI}}, p_m^{\text{GHI}}, p_m^{\text{Maid}}, p_m^{\text{Mcare}}\right] = (1 + [0.70, 0.25, 0.10, 0.0, -0.10]) \times p_m$$

Calibration: Pension payments

- L is average/aggregate effective human capital and
- $w \times L$ average wage income
- Pension payments: $t^{\text{Soc}}(\vartheta) = \Psi(\vartheta) \times w \times L$
- where $\Psi(\vartheta)$ is replacement rate that determines the size of pension payments
- Total pension amount to 4.1 percent of GDP

Calibration: Public health insurance

- Premium for medicare at 2.11% of GDP (Jeske and Kitao (2009))
- Coinsurance rates for Medicare and Medicaid from MEPS
- Calibrated: Medicaid eligibility FPL_{Maid} at 60% of FPL to match % on Medicaid
- Calibrated: Asset test for Medicaid to match Medicaid take-up profile

Calibration: Taxes

- Gouveia and Strauss (1994) for federal progressive income tax

$$\tilde{\tau}(\tilde{y}) = a_0 \left[\tilde{y} - \left(\tilde{y}^{-a_1} + a_2 \right)^{-1/a_1} \right]$$

- Medicare tax is 2.9%
- Social security tax is 9%
- Consumption tax is 5%

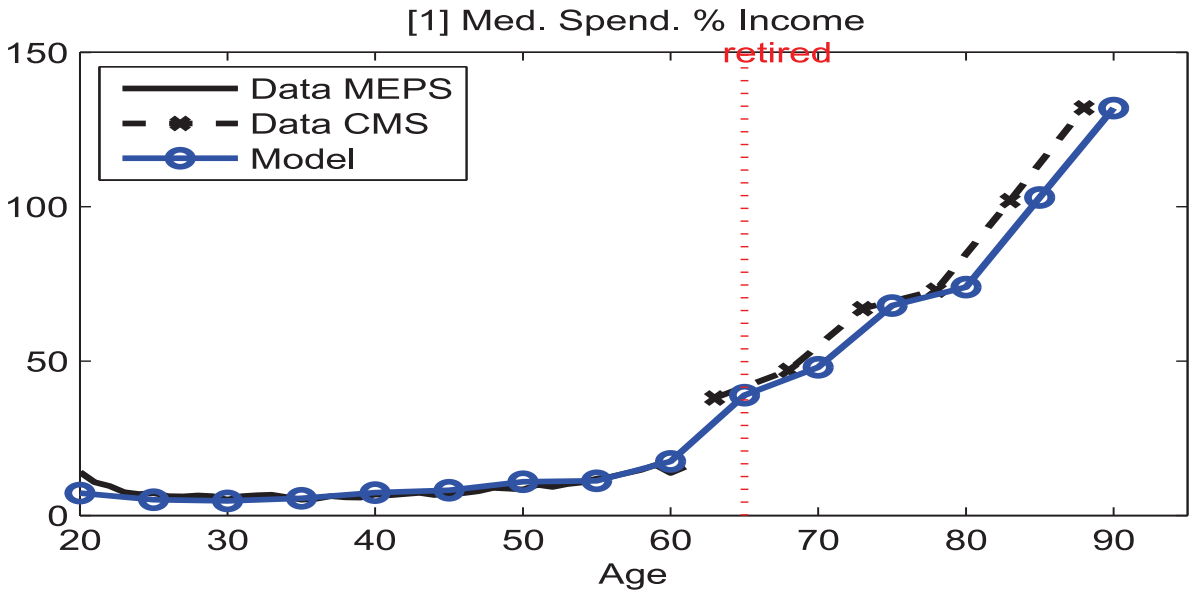
Calibration: External parameters

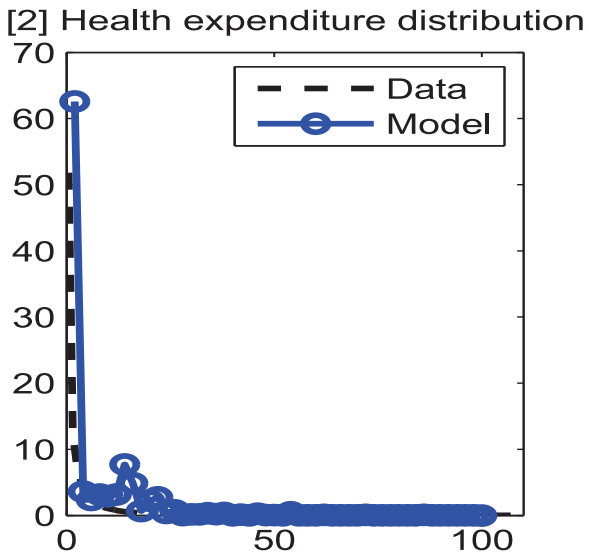
Parameters:		**Explanation/Source:**
- Periods working	$J_1 = 9$	
- Periods retired	$J_2 = 6$	
- Population growth rate	$n = 1.2\%$	CMS 2010
- Years modeled	$years = 75$	from age 20 to 95
- Total factor productivity	$A = 1$	Normalization
- Capital share in production	$\alpha = 0.33$	KydlandPescott1982
- Capital in medical services production	$\alpha_m = 0.26$	Donahoe (2000)
- Capital depreciation	$\delta = 10\%$	KydlandPescott1982
- Health depreciation	$\delta_{h,j} = [0.6\% - 2.13\%]$	MEPS 1999/2009
- Survival probabilities	π_j	CMS 2010
- Health Shocks	see appendix	MEPS 1999/2009
- Health transition prob.	see appendix	MEPS 1999/2009
- Productivity shocks	see appendix	MEPS 1999/2009
- Productivity transition prob.	see appendix	MEPS 1999/2009
- Group insurance transition prob.	see appendix	MEPS 1999/2009

Calibration: Calibrated parameters

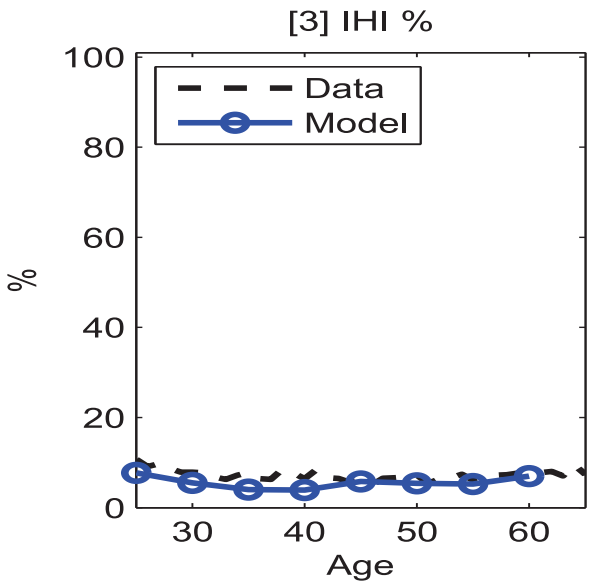
Parameters:		**Explanation/Source:**
- Relative risk aversion	$\sigma = 3.0$	to match $\frac{K}{Y}$ and R
- Preference on consumption vs. leisure:	$\eta = 0.43$	to match labor supply and $\frac{p \times M}{Y}$
- Disutility of health spending:	$\eta_m = 1.5$	to match health capital profile
- Preference on c and l vs. health	$\kappa = 0.89$	to match labor supply and $\frac{p \times M}{Y}$
- Discount factor	$\beta = 1.0$	to match $\frac{K}{Y}$ and R
- Health production productivity	$\phi_j \in [0.7 - 0.99]$	to match spending profile
- TFP in medical production	$A_m = 0.4$	to match $\frac{p \times M}{Y}$
- Production parameter of health	$\xi = 0.175$	to match $\frac{p \times M}{Y}$
- effective labor services production	$\chi = 0.26$	to match labor supply
- Health productivity	$\theta = 1$	used for sensitivity analysis
- Pension replacement rate	$\Psi = 40\%$	to match τ^{soc}
- Residual Government spending	$\Delta_C = 12.0\%$	to match size of tax revenue
- Minimum health state	$h_{\min} = 0.01$	to match health spending

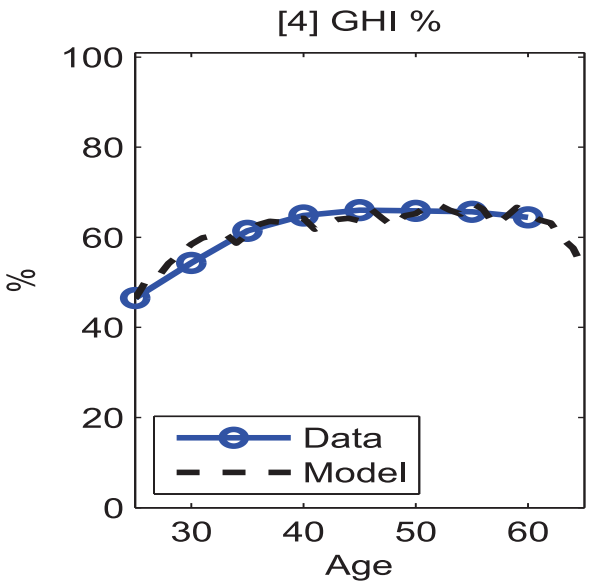
Health Expenditures: Model vs. Data

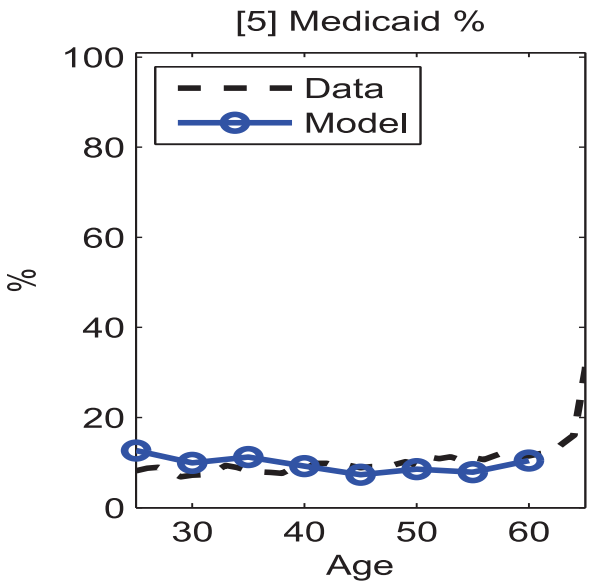


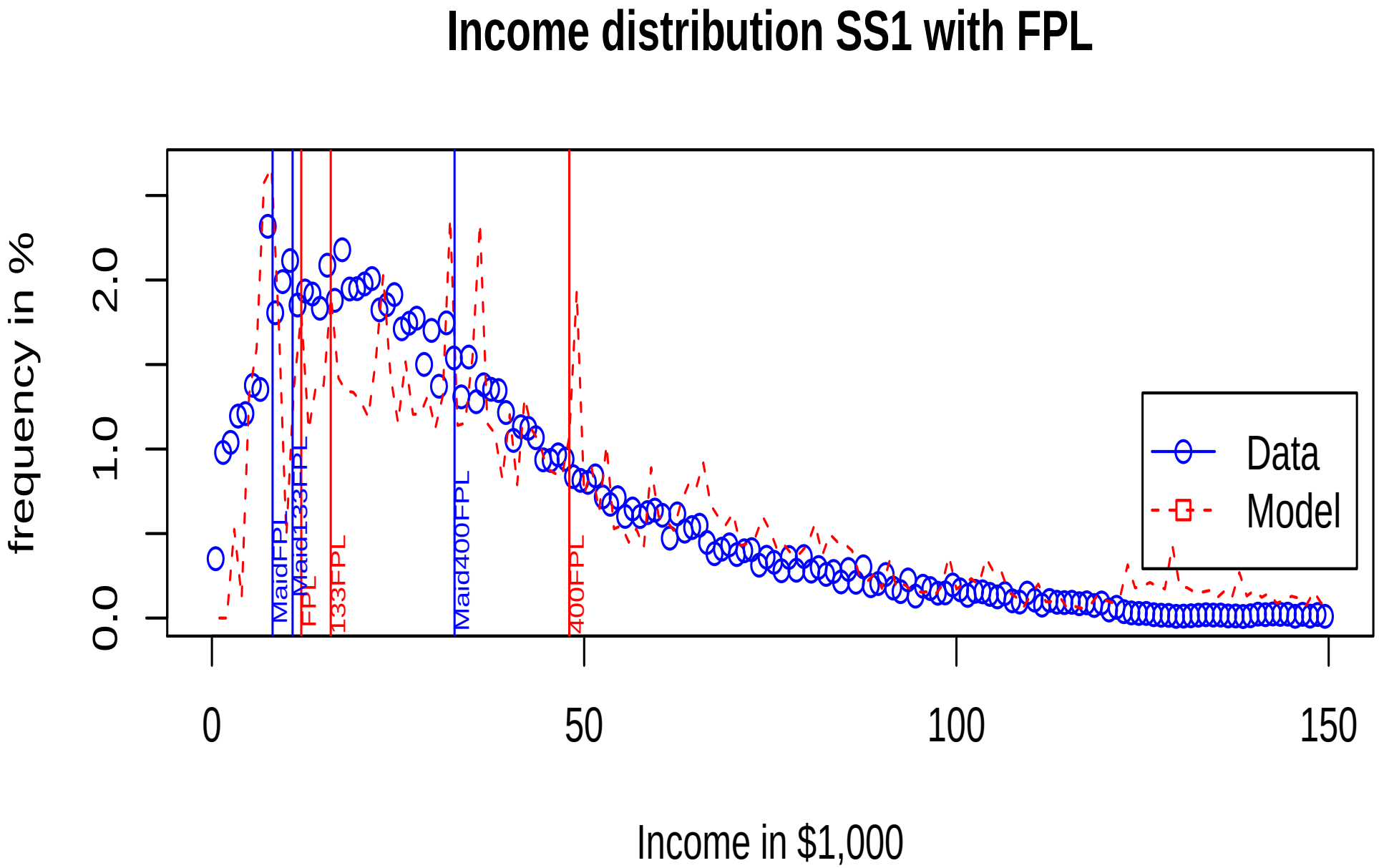


Insurance Take Up Rate: Model vs. Data








Income distribution SS1 with FPL
frequency in %
0.0
1.0
2.0
0
50
100
150
Income in $1,000
MaidFPL
Maid133FPL
FPL
133FPL
Maid400FPL
400FPL
Data
Model

Income Distribution: Model vs. Data

Quantiles	**MEPS data** (in $1,000)	**Model** (in $1,000)
10%	11.02	8.12
20%	18.17	15.86
30%	24.88	23.39
40%	31.14	31.05
50%	37.98	38.00
60%	45.75	48.05
80%	68.82	78.21
100%	391.18	323.52

Calibration: Matched moments

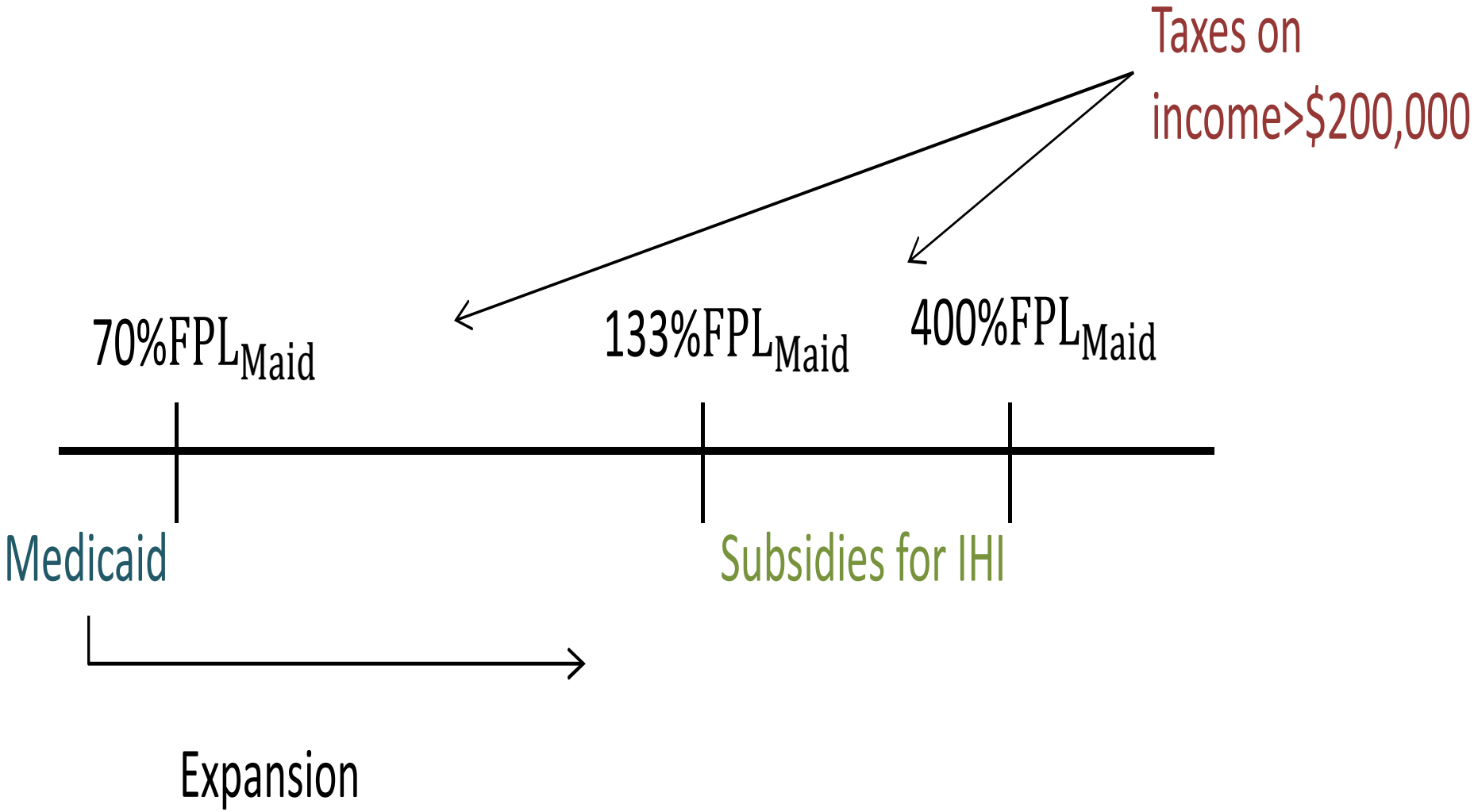
Moments	**Model**	**Data**	**Source**
- Medical expenses HH income	17.6%	17.07%	CMS communication
- Workers IHI	6.7%	7.6%	MEPS 1999/2009
- Workers IHI	62.2%	63.6%	MEPS 1999/2009
- Workers Medicaid	9.0%	9.2%	MEPS 1999/2009
- Capital output ratio: K/Y	2.9	$2.6-3$	NIPA
- Interest rate: R	4.2%	4%	NIPA
- Size of Social Security: $SocSec/Y$	5.9%	5%	*OMB* 2008
- Size of Medicare: $Medicare/Y$	3.1%	$2.5-3.1\%$	U.S. Department of Health 2007
- Payroll tax Social Security: τ^{Soc}	9.4%	$10-12\%$	IRS
- Consumption tax: τ^{C}	5.0%	5.7%	Mendoza et al. (1994)
- Payroll tax Medicare: τ^{Med}	2.9%	$1.5-2.9\%$	Social Security Update 2007
-Total tax revenue/Y	21.8%	28.3%	Stephenson (1998) and Barro and Sahasakul (1986)
- Medical spending profile		see figure	
- Medical spending distribution		see figure	
- Insurance take-up ratios		see figure	

ACA IMPLEMENTATION

Elements of the "Obama reform" in the model

1. **Penalty:** Uninsured pay penalty of 2.5% of income
2. **Subsidy and insurance exchanges:** Subsidy to buy IHI if $133\% FPL < income < 400\% FPL$
3. **Expansion of Medicaid:**
   - Income $<$ 133% FPL
   - No more asset tests
4. **No screening:** No price discrimination in IHI markets
5. **Financing:**
   1. Payroll tax on the rich (income $>$ 200k)
   2. Consumption tax, or
   3. Fixed tax (let exogenous gov't consumption adjust)

Elements of the "Obama reform" in the model



ACA in the model: Subsidies and penalities

- *subsidy* (x_j) is a function of income and insurance choice:

Income in percent of FPL_{Maid}	**Premium subsidy rate**
$100 - 150\%$	94%
$150 - 200\%$	77%
$200 - 250\%$	62%
$250 - 300\%$	42%
$300 - 350\%$	25%
$350 - 400\%$	13%

- Penalties are a function of income:

$$penalty\left(x_j\right) = 0.025 \times \tilde{y}_j^W\left(x_j\right)$$

- The new tax on higher income households is:

$$tax_j^{\text{ACA}}\left(x_j\right) = \tau^V \times \tilde{y}_j^W\left(x_j\right) \text{ if } \tilde{y}_j^W\left(x_j\right) \geq \$200,000$$

ACA in the model

The household budget constraint:

$$\left(1+\tau^{C}\right)c_j+\left(1+g\right)a_{j+1}+o^{W}\left(m_j\right)+1_{\{in_{j+1}=1\}}\text{prem}^{\text{IHI}}+1_{\{in_{j+1}=2\}}\text{prem}^{\text{GHI}}$$

$$= \quad y_j^{W}-Tax_j+T_j^{\text{SI}}-1_{\{in_{j+1}=0\}}penalty_j+1_{\{in_{j+1}=1\}}subsidy_j$$

The new zero profit condition for individual insurance becomes:

$$\left(1+\omega\right)\times\sum_{j=2}^{J_1}\mu_j\int\left[1_{\{in_j(x_j)=1\}}\left(1-\rho^{\text{IHI}}\right)p_m^{\text{IHI}}m_j\left(x_j\right)\right]d\Lambda\left(x_j\right)$$

$$= \quad R\sum_{j=1}^{J_1-1}\mu_j\int\left(1_{\{in_j(x_j)=1\}}\text{prem}^{\text{IHI}}\right)d\Lambda\left(x_j\right)$$

Government budget:

$$G + \sum_{j=1}^{J} \mu_j \int t_j^{\mathrm{SI}}(x_j)\, d\Lambda(x_j) + \sum_{j=2}^{J_1} \mu_j \int \left(1 - \rho^{\mathrm{MAid}}\right) \left(p_m^{\mathrm{MAid}} m_j(x_j)\right) d\Lambda(x_j)$$

$$+ \sum_{j=J_1+1}^{J} \mu_j \int \left(1 - \rho^{R}\right) \left(p_m^{R} m_j(x_j)\right) d\Lambda(x_j)$$

$$+ \sum_{j=1}^{J_1-1} \mu_j \int 1_{\{in_{j+1}(x_j)=1\}} subsidy(x_j)\, d\Lambda(x_j)$$

$$= \sum_{j=1}^{J} \mu_j \int \left[\tau^{C} c(x_j) + tax_j(x_j)\right] d\Lambda(x_j) + \sum_{j=J_1+1}^{J} \mu_j \int \mathrm{prem}^{R} d\Lambda(x_j)$$

$$+ \sum_{j=1}^{J_1} \mu_j \int \tau^{\mathrm{Med}} \left(e\left(h_{j-1}(x_j), \epsilon_j^{l}\right) l_j(x_j)\, w - 1_{\{in_{j+1}(x_j)=2\}} \mathrm{prem}^{\mathrm{GHI}}\right) d\Lambda(x_j)$$

$$+ \sum_{j=1}^{J_1} \mu_j \int tax_j^{\mathrm{ACA}}(x_j)\, d\Lambda(x_j) + \sum_{j=1}^{J_1-1} \mu_j \int 1_{\{in_{j+1}(x_j)=0\}} penalty(x_j)\, d\Lambda(x_j)$$

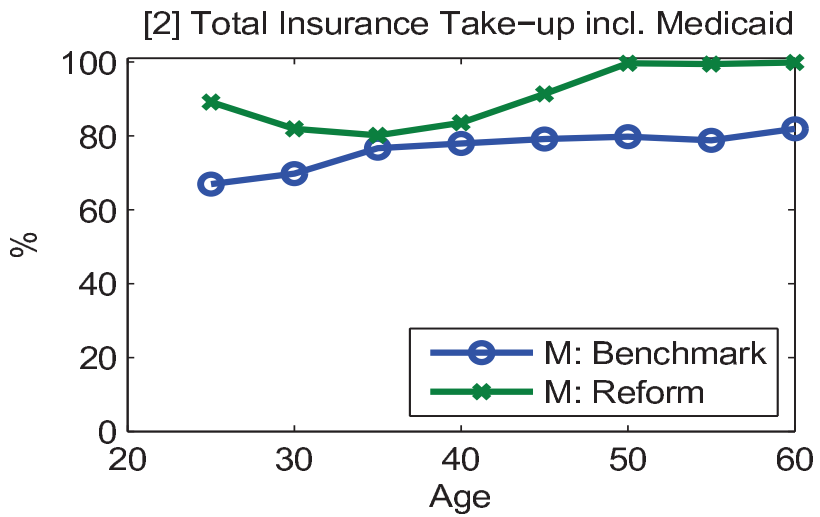
RESULTS

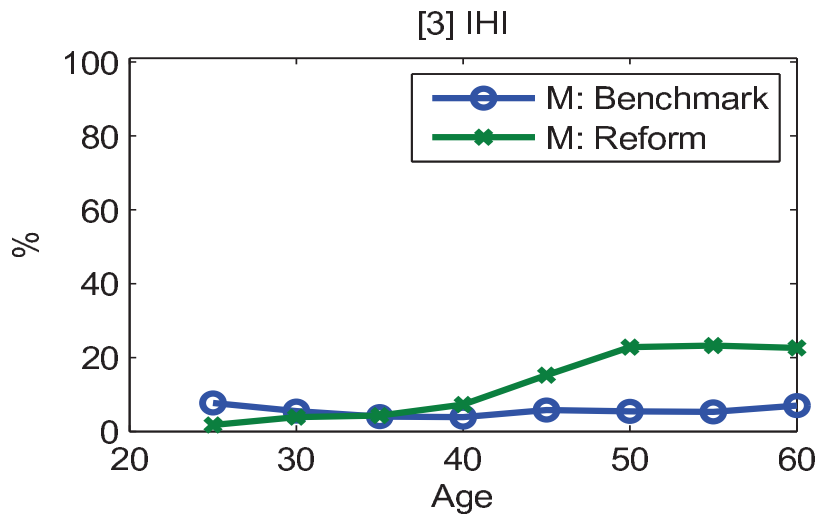
Policy experiments

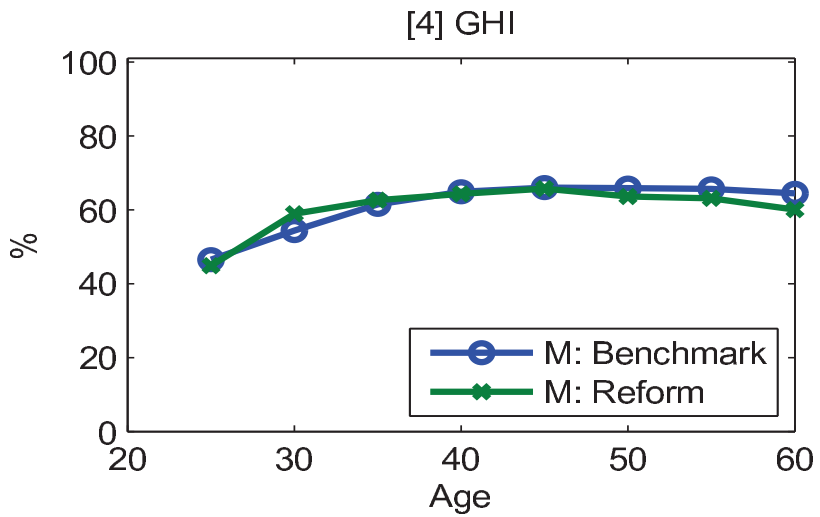
- Goal
  - Evaluation of main features of the Affordable Care Act
- Evaluation criteria
  - Stated goals, efficiency and welfare measures
- Analyze elements of reform separately (mandate vs. subsidy)
- Alternative taxes
  - Payroll tax vs. consumption tax vs. gov't spending cuts
- Pending: Partial vs. general equilibrium analysis

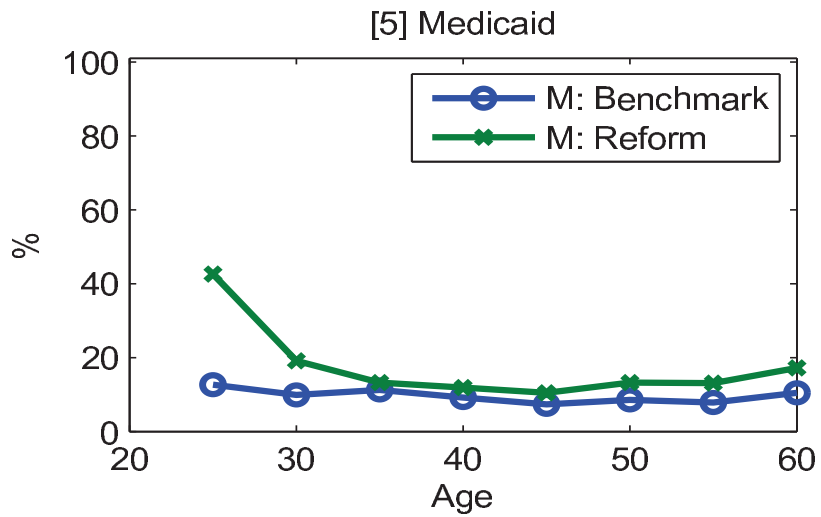
OVERALL EFFECTS OF ACA

Benchmark vs. Reform: Insurance take-up rates









Benchmark vs. Reform: Health insurance and expenditures

	Benchmark	**The ACA Reform**	
		(a) Partial eqm.	(b) General eqm.
Workers insured (%):	76.23	99.00	90.41
+ IHI (%)	5.55	23.85	12.38
+ GHI (%)	61.05	57.64	60.38
+ Medicaid (%)	9.62	17.51	17.64
IHI average premium	100	100	140.20
GHI premium	100	100	80.48
Medical services (M)	100	100.06	100.04
Med. spending ($p_m \times M$)	100	95.04	96.31
Med. spending/GDP(%)	17.66	–	17.61

Benchmark vs. Reform: Market aggregates

	Benchmark	**The ACA Reform**	
		(a) Partial eqm.	(b) General eqm.
⋮	⋮	⋮	⋮
Med. spending/GDP(%)	17.66	–	17.61
ACA payroll tax (%)	0	0.60	0.50
GDP	100	–	98.51
Capital (K_c)	100	99.12	98.61
Capital (K_m)	100	101.22	100.24
Weekly hours worked	100	94.79	96.26
Health (H)	100	100.10	100.01
Consumption (C)	100	98.33	97.85
Welfare change		⊕	⊖

The key channels of effects

1. **Negative savings effect:** self-insurance vs. market insurance
2. **Moral hazard effect:** lower effective price of health services
3. **Tax effect:** higher tax rates for high income earners
4. **General equilibrium effect:** wage and interest rates $\rightarrow$
5. Lower income for most
6. Lower consumption levels for most

Welfare effects

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

Welfare effects by health and skill group

Health capital	Skill 1 (low)	Skill 2	Skill 3	Skill 4 (high)
h = 15 (healthy)	1.40	-1.03	-2.60	-2.30
h = 14	1.16	-1.33	-2.68	-2.35
h = 13	0.37	-1.44	-2.77	-2.40
h = 12	0.12	-1.56	-2.83	-2.45
h = 11	0.07	-1.54	-2.89	-2.48
h = 10	0.14	-1.26	-2.65	-2.36
h = 9	0.38	-0.55	-2.14	-2.29
h = 8	0.77	0.55	-1.72	-2.09
h = 7	1.06	1.46	-1.42	-1.70
h = 6	2.22	2.40	-0.92	-1.31
h = 5	3.96	3.69	-0.20	-0.98
h = 4	5.71	5.28	0.68	-0.58
h = 3	7.58	7.31	1.73	0.01
h = 2	10.37	9.11	2.38	0.38
h = 1 (sick)	14.14	12.89	4.86	1.06

Table: Compensating consumption in percent of lifetime income.

ISOLATING THE EFFECTS OF PENALTIES, SUBSIDIES, AND MEDICAID EXPANSION

Only penalties

	Bench	**Penalty in % of individual income**			
		(a) 2.5%	(b) 5%	(c) 10%	(d) 15%
Workers insured (%):	76.23	98.72	99.33	99.73	99.84
+ IHI (%)	5.55	23.78	24.43	25.19	25.69
+ GHI (%)	61.05	66.92	67.41	68.10	68.85
+ Medicaid (%)	9.62	8.03	7.49	6.44	5.31
IHI average premium	100	102.22	101.64	101.16	101.20
GHI premium	100	66.30	65.58	64.90	64.35
Med. spending	100	95.53	95.47	95.46	95.50
Med. spending/GDP(%)	17.66	17.24	17.21	17.17	17.14
GDP	100	100.55	100.74	101.04	101.33
Welfare change (%Δ)		⊖	⊖	⊖	⊖

Only subsidies

	Bench	IHI Subsidies relative to ACA (%)			
		(a) 100%	(b) 120%	(c) 135%	(d) 150%
Workers insured (%):	76.23	85.13	86.36	86.76	87.02
+ IHI (%)	5.55	14.40	15.79	16.41	16.67
+ GHI (%)	61.05	63.99	65.02	65.25	65.36
+ Medicaid (%)	9.62	6.74	5.56	5.10	4.98
IHI average premium	100	99.14	101.30	102.40	102.81
GHI premium	100	88.07	83.16	81.64	80.93
Med. spending	100	98.57	98.46	98.41	98.36
Med. spending/GDP (%)	17.66	17.64	17.69	17.72	17.73
ACA payroll tax (%)	0.0	0.32	0.53	0.67	0.73
GDP	100	99.78	99.59	99.44	99.37
Welfare change (%Δ)		⊕	⊕	⊕	⊕

Only Medicaid

	Bench	**Medicaid extension (% of FPL_{Maid})**			
		(a) 133	(b) 150	(c) 200	(d) 300
Workers insured (%):	76.23	79.81	81.36	84.75	87.16
+ IHI (%)	5.55	6.21	6.61	6.43	5.72
+ GHI (%)	61.05	58.51	56.89	54.05	49.90
+ Medicaid (%)	9.62	15.09	17.86	24.26	31.54
IHI average premium	100	98.38	96.71	92.33	88.07
GHI premium	100	98.87	98.08	97.64	98.38
Med. spending	100	99.17	98.74	97.71	96.71
Med. spending/GDP(%)	17.66	17.74	17.77	17.91	18.07
ACA payroll tax (%)	0.0	0.25	0.40	0.83	1.35
GDP	100	98.93	98.39	96.77	94.94
Welfare change (%Δ)		⊕	⊕	⊕	⊖

IHI screening off or Medicaid asset test off

	[1] Bench	[2] IHI screen off	[3] Asset test off
Workers insured (%):	76.23	65.22	77.36
+ IHI (%)	5.55	0	5.87
+ GHI (%)	61.05	56.12	59.80
+ Medicaid (%)	9.62	9.10	11.70
Med. spend.	100	101.93	99.69
Med. spend./GDP(%)	17.66	17.84	17.67
GDP	100	99.96	99.80
Welfare (%Δ)		$\ominus$	$\oplus$

Summary of separate effects

- **Penalty**
  - force young and healthy agents to buy insurance
  - expand coverage and improve risk sharing
  - but distort savings and work incentives and cause of welfare loss
- **Subsidy**
  - Induce low income agents to buy insurance
  - Prevent collapse of IHI caused by NO screening policy and Medicaid expansion
  - Redistribute income toward the poor
  - Mitigate welfare loss caused by penalty
  - Source of tax distortion
- **Medicaid expansion**
  - Extend coverage of low income agents
  - Improve risk pooling and income redistribution
  - Cause income loss due to fiscal distortions
  - Cost containment (lowest re-imbursement levels)

FINANCING THE REFORM

Financing the reform

How to finance the subsidies and the Medicaid expansion:

1. Consumption tax: τ^C
2. Benchmark payroll tax on rich (income $>$ 200k): τ^V:
3. Interest and profits tax on rich (income $>$ 200k): τ^R
4. Lump-sum tax on all households: τ^{Lump}
5. Adjust government consumption (net of tax effect): G

Financing the ACA

	[1] Benchmark	[2] ACA	[3] ACA financed by		
		τ^V	(a) G	(b) τ^C	(c) τ^{Lump}
Workers:	76.23	90.41	90.68	90.35	90.53
+ IHI (%)	5.55	12.38	12.74	12.39	13.01
+ GHI (%)	61.05	60.38	60.55	60.42	61.55
+ Medicaid (%)	9.62	17.64	17.39	17.54	15.97
Med. Spending	100	96.31	96.29	96.35	96.34
Output (GDP)	100	98.51	98.74	98.70	99.15
Welfare change (%Δ)	0	-0.23	0.41	-0.21	-0.36
Taxes financing the ACA:					
Payroll tax τ^V (%)	0	0.50	–	–	–
Gov't consumption C^G (%)	11.51	–	11.03	–	–
Consumption tax τ^C (%)	5.00	–	–	5.94	–
Lump-sum tax τ^{Lump} (%)	0	–	–	–	0.36

ALTERNATIVE DESIGNS OF THE ACA

Alternative designs of the ACA

1. Higher penalties
2. More progressive subsidies
3. Further Medicaid expansion

Alternative designs of the ACA

	Bench	ACA	[1] Penalty		[2] Subsidy		[3] Medicaid	
			5%	15%	120%	150%	150%	300%
Workers ins.(%):	76.23	90.41	95.81	100.0	92.68	93.72	89.85	87.58
+ IHI (%)	5.55	12.38	18.07	24.99	16.16	18.03	9.92	0.00
+ GHI (%)	61.05	60.38	62.35	65.47	61.13	61.52	58.21	44.29
+ Medicaid (%)	9.62	17.64	15.39	9.55	15.39	14.17	21.72	43.29
Med. spend.	100	96.31	95.43	95.36	96.09	96.04	96.17	95.90
Med.sp./GDP(%)	17.66	17.61	17.47	17.32	17.62	17.67	17.65	18.17
Payroll tax τ^V(%)	–	0.5	0.43	0.31	0.75	0.99	0.58	1.4
GDP	100	98.51	98.83	99.87	98.48	98.29	98.02	94.79
Welfare change	0	−0.23	−0.23	−0.16	−0.11	−0.09	−0.30	−0.53

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 the Obama health care reform 2010

Future work on macro-health economics

- More sensitivity analysis
- Health capital and endogenous survival probabilities
- Optimal public health insurance with endogenous health capital
- Life-cycle consumption puzzle: the role of health
- Structural estimation of the health production function