Dysfunctional U.S. Health Care System

**Issues:**
1. Low Coverage: 47 million in 2006 (15%)
2. High Cost: 16% of GDP in 2006 and close to 20% by 2015

**Causes:**
1. Market failure
2. Wrong government intervention

**Market Based Reform: Universal Health Insurance Vouchers (UHIV)**
1. increase the number of insured individuals
2. control total health expenditure
What are Health Insurance Vouchers?

Emanuel and Fuchs (2007) as well as Kotlikoff (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
   - keeps individual health records (like in Medicare)
   - fixes annual budget for vouchers as percentage of GDP

2 Individuals
   - purchase health insurance from private insurance companies using the voucher

3 Participating insurance companies
   - have to accept vouchers
   - contracts must provide a ‘base insurance’
   - can offer additional insurance
   - compete and monitor to keep premiums and prices for health care services low
Objectives of the Paper

- Develop an analytical framework to study the implications of a health insurance voucher program

Our key contributions

1. A macro model with endogenous health production and health insurance choice

2. Quantify the short-run and long-run effects of introducing the voucher program
The Model: Key Features

- Standard stochastic overlapping generations model
  1. Sectors: household, firm and government
  2. Endowments: random lifetime and ability to work
  3. Markets: consumption, labor and capital

- New features
  1. Health: a consumption and investment good
  2. Health: fixable, risky, and insurable
  3. Private health insurance market
The Model: Preferences and Capital Accumulation

- Preferences:
  \[ u(c_j, s_j) \]

- Health capital:
  1. Service flow from health capital
  \[ s_j = s(h_j) \]
  2. Health production
  \[ h_j = h(m_j, h_{j-1}, \varepsilon_j) \]
  3. Health shocks
  \[ P_j(\varepsilon_j, \varepsilon_{j-1}) = \Pr(\varepsilon_j|\varepsilon_{j-1}, j) \]

- Human capital:
  1. Accumulation
  \[ e_j = e(j, h, \varepsilon_j) \text{ for } j = \{1, \ldots, J_1\} \]
  2. Productivity shocks
  \[ \Pi_j(\varepsilon_j, \varepsilon_{j-1}) = \Pr(\varepsilon_j|\varepsilon_{j-1}, j) \]
The Model: Health Insurance and Expenditures

- Insurance plans: individual and group insurance
- Group insurance offers provided by employers: no rating and lower price

\[ \Omega_{\text{income}}(i_{GI,j}, i_{GI,j-1}) = \Pr(i_{GI,j}|i_{GI,j-1}, \text{income}) \]

- Health insurance choice: endogenous
- Health insurance states:
  - \( in_j = 1 \): no insurance
  - \( in_j = 2 \): individual health insurance
  - \( in_j = 3 \): group health insurance
- Health expenditures depend on individuals’ health insurance state
Agent state vector $x_j = \{a_j, h_{j-1}, \text{in}_j, \epsilon_j, \epsilon_j, i_{GI,j}\}$

Agents receive income (wage, interest income, accidental bequests, and social insurance)

Pay taxes (payroll and progressive income tax)

Agents simultaneously choose:

1. Consumption $c_j$ and asset holdings $a_j$
2. Health expenditures $m_j$
3. Insurance state for next period $\text{in}_j = \{1, 2, 3\}$
4. If $i_{GI,j} = 1$ then agents can either buy individual insurance $\text{in}_j = 2$ or group insurance $\text{in}_j = 3$
5. If $i_{GI,j} = 0$ then agents can only buy individual insurance $\text{in}_j = 2$
The Model: Worker’s Dynamic Programming Formulation

\[ V_j(x_j) = \max \left\{ c_j, m_j, a_{j+1}, i_{n+1} \right\} \left\{ u(c_j, h_j) + \beta \pi_j E_{\varepsilon_{j+1}, \varepsilon_{j+1}, i_{G_l,j+1}|\varepsilon_j, i_j, i_{G_l,j}} [V(x_{j+1})] \right\} \]

s.t.

\[
\left(1 + \tau^C \right) c_j + (1 + g) a_{j+1} + o^W (m_j) + \tilde{p} = \tilde{\omega}_j + R \left( a_j + T^{Beq} \right) - Tax_j + T_{j}^{Si} + v_j
\]

\[ \tilde{p}_j < \tilde{\omega}_j + R \left( a_j + T_{j}^{Beq} \right) - o^W (m_j) - Tax_j \]

\[ 0 \leq a_j \]
The Model: Retiree’s Program

- Agent state vector $x_j = \{a_j, h_{j-1}, \varepsilon_j\}$
- Agents receive income (pension, interest income, accidental bequests, and social insurance)
- Pay taxes (progressive income tax)
- Forced into Medicare $\rightarrow$ pay $p_j^{Med}$

Agents simultaneously choose:

1. Consumption $c_j$ and asset holdings $a_j$
2. Health expenditures $m_j$
The Model: Retiree’s Dynamic Programming Formulation

\[
V_j(x_j) = \max_{\{c_j,m_j,a_j+1\}} \left\{ u(c_j, h_j) + \beta \pi_j E_{\epsilon_{j+1}|\epsilon_j} \left[ V_{j+1}(x_{j+1}) \right] \right\}
\]

s.t.

\[
c_j + a_j + o^R(m_j) + p_j^{Med}
= R \left( a_{j-1} + T^{Beq} \right) + R^m a_{j-1}^m + T_j^{Soc} + T_j^{Sl} - Tax_j
\]

\[
0 \leq a_j
\]
The Model: Firms and Insurance Companies

- **Firms:**
  \[
  \max_{\{K,L\}} \{ F(K, L) - qK - wL \}, \text{ given } (q, w)
  \]

- **Insurance Companies:**
  \[
  (1 + \omega) \sum_{j=2}^{J_1+1} \mu_j \int \left[ 1_{\{\text{in}_j(x_j) = 2\}} (1 - \rho) \max(0, p_{m,\text{Ins}m_j(x_j)} - \gamma) \right] d\Lambda(x_j)
  \]
  \[
  = (1 + r) \sum_{j=1}^{J_1} \mu \int \left( 1_{\{\text{in}_j(x_j) = 2\}} p(j, h) \right) d\Lambda(x_j)
  \]
  \[
  (1 + \omega) \sum_{j=2}^{J_1+1} \mu_j \int \left[ 1_{\{\text{in}_j(x_j) = 3\}} (1 - \rho) \max(0, p_{m,\text{Ins}m_j(x_j)} - \gamma) \right] d\Lambda(x_j)
  \]
  \[
  = (1 + r) \sum_{j=1}^{J_1} \mu \int \left( 1_{\{\text{in}_j(x_j) = 3\}} p \right) d\Lambda(x_j)
  \]
The Model: 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:**

\[
\sum_{j=J_1+1}^{J} \mu_j \int T_{j}^{Soc}(x) \, d\Lambda_j(x)
= \sum_{j=1}^{J_1} \mu_j \int \tau^{Soc} \left( we(j, h_j, \epsilon) - 1_{\{in_{j+1}=3\}} p \right) \, d\Lambda_j(x)
\]
The Model: Government II

- Medicare:

\[
\sum_{j=J_1+1}^{J} \mu_j \int (1 - \rho_j^{\text{Med}}) \max (0, m_j(x) - \gamma_j^{\text{Med}}) \, d\Lambda_j(x)
\]

\[
= \sum_{j=1}^{J_1} \mu_j \int \tau_j^{\text{Med}} \left( w(e(j, h_j, \epsilon)) - 1 \{\in \in_{j+1=3}\} p \right) \, d\Lambda_j(x)
\]

\[
+ \sum_{j=J_1+1}^{J} \mu_j \int p_j^{\text{Med}} \, d\Lambda_j(x)
\]

- Government budget is balanced:

\[
G + \sum_{j=1}^{J} \mu_j \int T_j^{\text{SI}}(x_j) \, d\Lambda(x_j) + \sum_{j=1}^{J} \mu_j \int \nu(h_j(x_j)) \, d\Lambda(x_j)
\]

\[
= \sum_{j=1}^{J} \mu_j \int T\alpha_j(x_j) \, d\Lambda(x_j) + \sum_{j=1}^{J} \mu_j \int \tau_j^{\text{C}} c(x_j) \, d\Lambda(x_j).
\]
Calibration

- Preferences:
  \[ u(c_j, h_j) = \left( \frac{c_j^\eta s_j^{1-\eta}}{1 - \sigma} \right)^{1-\sigma} \]

- Health services:
  \[ s_j = h_j \]

- Health Production:
  \[ h_j = \phi m_j^\xi + (1 - \delta(h_j)) h_{j-1} + \varepsilon_j \]

- Markov switching probabilities between income shocks and group insurance offer states are estimated from MEPS 2004-2005 data.

- Human Capital:
  \[ e_j = e(\varepsilon_j)^\chi (h_{j-1}^{\theta})^{1-\chi} \text{ for } j = \{1, \ldots, J_1\}, \]

where \( e(\varepsilon_j) \) are estimated efficiency profiles from MEPS 2004-2005 for 3 separate income quantiles

- \( \beta_0, \beta_2 < 0, \beta_1 > 0, \chi \in (0, 1) \) and \( \theta = 0 \) in benchmark version.
## Baseline Parameters

<table>
<thead>
<tr>
<th>Demographics:</th>
<th>Health Production:</th>
<th>Insurance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>$J_1 = 9$</td>
<td>$\phi = 1$</td>
<td>$\gamma = $26%$ of spending</td>
</tr>
<tr>
<td>$J_2 = 5$</td>
<td>$\xi = 0.35$</td>
<td>$\rho = 33%$</td>
</tr>
<tr>
<td>$n = 1.2%$</td>
<td>$\delta_h = [3%, \ldots, 90%]$</td>
<td>$\gamma^{Med} = $90%$ of private deductible</td>
</tr>
<tr>
<td>Preferences:</td>
<td>Health Productivity:</td>
<td>$\rho^{Med} = 0.25$</td>
</tr>
<tr>
<td>$\sigma = 2.5$</td>
<td>$\theta = ?$</td>
<td>Exogenous premium growth depending on age and health</td>
</tr>
<tr>
<td>$\beta = 0.99$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\alpha = 0.33$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta = 10%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$g = 1.5%$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Steady States vs. Data (NO Human Capital Effect)

Insurance Coverage in %

% Insured Spending Below Deductible

Average Savings

Average Consumption

Average Health

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Health Vouchers

2009
## Experiment 1: NO Human Capital Effect

<table>
<thead>
<tr>
<th></th>
<th>No Human Capital Effect</th>
<th>Benchmark 1</th>
<th>Vouchers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output: ( Y )</strong></td>
<td>100.000</td>
<td>101.578</td>
<td></td>
</tr>
<tr>
<td><strong>Capital: ( K )</strong></td>
<td>100.000</td>
<td>104.445</td>
<td></td>
</tr>
<tr>
<td><strong>Human capital: ( H )</strong></td>
<td>100.000</td>
<td>100.000</td>
<td></td>
</tr>
<tr>
<td><strong>Med. spending: ( pm \times M/Y )</strong></td>
<td>12.9%</td>
<td>12.6%</td>
<td></td>
</tr>
<tr>
<td><strong>Vouchers in % of GDP</strong></td>
<td>0.0%</td>
<td>3.5%</td>
<td></td>
</tr>
<tr>
<td><strong>Interest rate: ( R )</strong></td>
<td>6.0%</td>
<td>5.4%</td>
<td></td>
</tr>
<tr>
<td><strong>Wages: ( w )</strong></td>
<td>100.000</td>
<td>101.578</td>
<td></td>
</tr>
<tr>
<td><strong>Consumption tax: ( \tau_C )</strong></td>
<td>0.050</td>
<td>0.085</td>
<td></td>
</tr>
<tr>
<td><strong>Soc. sec. tax: ( \tau_{SS} )</strong></td>
<td>0.109</td>
<td>0.103</td>
<td></td>
</tr>
<tr>
<td><strong>Medicare tax: ( \tau_{Med} )</strong></td>
<td>0.039</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td><strong>Income tax in % of GDP:</strong></td>
<td>0.179</td>
<td>0.194</td>
<td></td>
</tr>
<tr>
<td><strong>( K/Y )</strong></td>
<td>2.656</td>
<td>2.731</td>
<td></td>
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<td><strong>( C/Y )</strong></td>
<td>0.408</td>
<td>0.453</td>
<td></td>
</tr>
</tbody>
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### Key Mechanism: Savings Effect

#### Income effect

<table>
<thead>
<tr>
<th></th>
<th>Young generation</th>
<th>Old generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>no premium payments:</td>
<td>(\uparrow)</td>
<td>(\uparrow)</td>
</tr>
<tr>
<td>no payroll tax:</td>
<td>(\uparrow)</td>
<td></td>
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</table>

#### Substitution effect

<table>
<thead>
<tr>
<th></th>
<th>Price of (c)</th>
<th>Price of (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>increase in (\tau_c):</td>
<td>(\uparrow)</td>
<td></td>
</tr>
<tr>
<td>100% coverage:</td>
<td></td>
<td>(\downarrow)</td>
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</table>
Key Mechanism: Savings Effect

- Replacing Medicare by Vouchers results in income and substitution effects.
  - Removing insurance premium increases income (income effect)
  - \( \downarrow \) payroll tax increases income (income effect) while \( \uparrow \) consumption tax increases price of consumption (substitution effect).

- \( \uparrow \) savings and \( \uparrow \) physical capital \( K \)
  - affects wage and interest rates
  - increases household income (G.E. income effect)

- These increase the demand for health care services

- Net result: \( \uparrow \) total health care expenditure increases, but as fraction of GDP health expenditure decreases
Steady States vs. Data (WITH Human Capital Effect)

- **Insurance Coverage in %**
  - Model
  - Voucher
  - Data

- **Medical Spending in % of Income**

- **% Insured Spending Below Deductible**

- **Average Savings**

- **Average Consumption**

- **Average Health**

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## Experiment 2: WITH Human Capital Effect

<table>
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<tr>
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<th>No Human Capital Effect</th>
<th>Human Capital Effect</th>
</tr>
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<tr>
<td>Income tax in % of GDP:</td>
<td>0.179 0.194</td>
<td>0.175 0.195</td>
</tr>
<tr>
<td>( K/Y )</td>
<td>2.656 2.731</td>
<td>2.783 2.893</td>
</tr>
<tr>
<td>( C/Y )</td>
<td>0.408 0.453</td>
<td>0.377 0.431</td>
</tr>
</tbody>
</table>
Key Mechanism: Human Capital Effects

- **Savings effect**

- **Human capital effect**
  - Vouchers induce households to spend more on health (moral hazard).
  - \( \uparrow \text{health} \) and therefore \( \uparrow \) human capital depending on whether health is productive
  - increases wage and interest rates, household income and again the demand for health care services

- Result: \( \uparrow \) the demand for health care, but as fraction of GDP health expenditure decreases
Transitions: NO Human Capital Effect

Output

Time

Capital

Time

Consumption

Time

Medical Expenditure

Time

Human Capital

Time

Wages

Time

Human Capital

Time

Interest

Time

Wages

Time

Consumption Tax

Time

Wages

Time

Consumption Tax

Time

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Welfare Analysis: NO Human Capital Effect

![Chart 1: Compensating Consumption per Lifetime Consumption (in %)]

- **Losers**
- **Winners**

![Chart 2: Compensating Consumption per GDP (in %)]

- **Losses**
- **Gains**

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Transitions WITH human capital effect

Output

Capital

Consumption

Medical Expenditure

Human Capital

Interest

Wages

Consumption Tax

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Health Vouchers

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Welfare Analysis: WITH Human Capital Effect

Compensating Consumption per Lifetime Consumption (in %)

- Winners
- Losers

Generation

Old Regime Agents
New Regime Agents

Compensating Consumption per GDP (in %)

- Gains
- Losses

Time

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Conclusion

- Health vouchers seem promising in being able to sustainably finance health care expenditures while providing full health insurance coverage to the entire U.S. population.

- The decrease in health care expenditure as fraction of GDP is primarily due to a general equilibrium savings effect.

- The human capital effect is potentially important.

- Welfare gain.
Extensions

- **Empirical**
  - structurally estimate health production parameters $\phi, \xi, \delta(h)$ and health shock process

- **Modelling**
  - the supply of health care services $m$ and prices $p_m$
  - insurance firm competition and its effect on price of health care services and insurance premiums

- **Issues**
  - privatization of public health insurance programs
  - financing health costs in an aging economy