Does the Social Safety Net Improve Welfare? A Dynamic General Equilibrium Analysis

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Main Question: what is the welfare cost/gain of US social safety net?

- Social safety net (or means-tested social insurance): Medicaid, in-kind/cash transfer programs (e.g. AFDC, food stamp).
- Provide a “safety net” by guaranteeing a minimum consumption floor.
Motivation

Total spending on US means-tested social insurance is

- large: 5.0% of GDP in 2004, and half of that is for health care.
- fastest growing component of the US government spending
  - only 1.2% of GDP in 1964,
  - projected to rise further. (population aging, rising health care cost)

Many policy proposals to reform means-tested social insurance.

- Example: the recent US health care reform.

Despite the facts above, relatively little academic work to quantify the welfare consequence of means-tested social insurance.

This paper attempts to fill this gap in the literature.
Conventional wisdom:
- Means-tested Social insurance improves welfare as it provides insurance against negative shocks, such as income and health shocks.
  - by guaranteeing a minimum consumption floor. (Insurance channel)

But some argued that: it may reduce welfare because
- it discourages work and thus reduce labor supply (e.g. Moffitt (2002)).
- it reduces precautionary saving (Hubbard, Skinner, and Zeldes (1995)).

Recent empirical research: it crowds out private insurance, implying the insurance effect may be small.
What I Do

- Develop a quantitative dynamic general equilibrium model with incomplete markets and heterogeneous agents.
- Evaluate the tradeoff between these mechanisms, and quantify the net welfare consequence.
- **Different** from standard incomplete markets models, I endogenize health insurance decisions.
  - captures the crowding-out effects on private health insurance.
A model of endogenous health insurance: can it account for the main features of the US health insurance market?

<table>
<thead>
<tr>
<th>US Health Insurance Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of working-age population with</td>
</tr>
<tr>
<td>Employer-sponsored health insurance</td>
</tr>
<tr>
<td>Individual health insurance</td>
</tr>
<tr>
<td>Medicaid</td>
</tr>
<tr>
<td>No health insurance</td>
</tr>
<tr>
<td>Employer-sponsored HI take-up rate</td>
</tr>
</tbody>
</table>

Data source: MEPS

Special attention to the uninsured puzzle: 47 millions Americans uninsured. (Gruber (2008))

- Is the existence of means-tested social insurance a solution?
Preview of Main Results

- Means-tested social insurance generates a significant *welfare loss*.
  - (CEV: -1.6% of consumption each period)

- Why welfare loss?
  - Large crowding out effect on private health insurance,
    - offsetting the welfare gain from insurance provided by social insurance.
      - (CEV: 1.4% with fixed private health insurance)
  - Large negative effect on labor supply.
    - (CEV: 4.4% with fixed labor supply)

- The model matches the US health insurance structure.

- Provide an explanation for the puzzle: many Americans don’t buy health insurance.
  - Means-tested social insurance accounts for approximately half of the uninsured Americans.
  - Intuition: since they (currently not qualified) would become qualified for social insurance after being hit by large health shocks.
A 65-period OLG model with one period is one year.
- Born in 21, retire in 65 and die in 85.
- One unit of time endowed each period: work or not work $l \in \{0, 1\}$.
- Preference: CRRA, $u = \frac{c^{1-\sigma}}{1-\sigma} - \zeta l$ with $\sigma = 2.0$
- Endogenous private health insurance choices $h'$
  - $h' = 1$: no health insurance
  - $h' = 2$: individual health insurance from the market.
  - $h' = 3$: employer-sponsored health insurance (if offered $e_h = 1$).
- Means-tested social insurance: a consumption floor ($c$) financed by payroll tax $\tau_w$. (following Hubbard, Skinner, Zeldes (1995))
- Health expense ($m$): an exogenous expense shock.
The Individual’s Problem

- The individual’s state in each period: \( s = \{j, a, m, e_h, h, \epsilon, \eta\} \)
  - Age: \( j \). Asset: \( a \). Health expense: \( m \). Productivity: \( \epsilon \).
  - ESHI offer \( e_h \): 0 (not offered), 1 (offered).
  - Health insurance status \( h \): 1 (uninsured), 2 (individual HI), 3 (ESHI).
- Optimization problem \((P1)\) for an individual with state \( s \).

\[
V(s) = \max_{c, l, h'} u(c, l) + \beta P_j E[V(s')] \\
\text{subject to} \\
\left\{ \begin{array}{l}
\frac{a'}{1+r} + c + (1 - \kappa_h)m + p_{h'} - \tau p_3 I_{h' = 3} = \tilde{w} e(l(1 - \tau) + a + Tr) & \text{if } j \leq R \\
\frac{a'}{1+r} + c + (1 - \kappa_h)(1 - \kappa_m)m + p_{h'} = SS(\eta) + a + Tr, & \text{if } j > R
\end{array} \right.
\]

\( l \in \{0, 1\} \)
\( h' \in \{1, 2, 3\} \) if \( e_h = l = 1 \),
\( h' \in \{1, 2\} \) otherwise.

\[
\tilde{w} = w - c_e \text{ if } e_h = 1, \tilde{w} = w \text{ otherwise.}
\]
Social Insurance and Private Health Insurance

- **Social Insurance**: guaranteeing a minimum consumption floor $c$.

  
  $\begin{align*}
  Tr &= \max\{0, c + (1 - \kappa_h)m - a - \bar{w}el(1 - \tau)\}, & \text{if } j \leq R \\
  Tr &= \max\{0, c + (1 - \kappa_h)(1 - \kappa_m)m - a - SS(\eta)\}, & \text{if } j > R
  \end{align*}$

- Financed by payroll taxes.

- **Private health insurance markets**
  - **Employer-sponsored health insurance**
    - community rated: no pre-existing conditions, same price for everyone ($p_3$).
    - premiums are exempted from taxation.
  - **Individual health insurance**
    - not community rated: price conditional on age and health status ($p_2(j, m)$)
  - Insurance companies are competitive: prices are actuarially-fair values with a markup $\lambda$. 

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Kai Jackie Zhao  | Welfare Effect of the Social Safety Net
SS, Medicare, and Accidental Bequests

- **Medicare**
  - covers a $\kappa_m$ fraction of health expense for the elderly.
  - financed by payroll taxes.

- **Pay-as-you-go Social Security**
  - SS payment to the elderly: $SS(\eta)$
  - financed by payroll taxes.

- **Accidental Bequests**: collected by the government, and redistributed back equally to the new-born.
The Representative Firm

The firm’s profit maximization problem:

$$\max_{L,K} Y - wL - (r + \delta)K,$$

with

$$Y = K^\alpha (AL)^{1-\alpha}.$$ 

- **K**: capital; **L**: labor; **Y**: output; **\delta**: capital depreciation rate.
- **A**: Labor-augmented technology.

Firm’s FOCs imply,

$$w = (1 - \alpha)A\left(\frac{K}{AL}\right)\alpha$$

$$r = \alpha\left(\frac{K}{AL}\right)^{\alpha-1} - \delta$$
**Definition:** A stationary equilibrium is given by a collection of value functions \( V(s) \), individual policy rules \( \{a', l, h'\} \), the distribution of individuals \( \Phi(s) \); aggregate factors \( \{K, L\} \); prices \( \{r, w, \tilde{w}\} \); Social Security, Medicare, the social safety net; private health insurance contracts defined by pairs of price and coinsurance rate \( \{p_h, \kappa_h\} \), such that,

1. Given prices, government programs, and private health insurance contracts, the value function \( V(s) \) and individual policy rules \( \{a', l, h'\} \) solve the individual’s dynamic programming problem (P1).
2. Given prices, \( K \) and \( L \) solve the firm’s profit maximization problem.
3. The capital and labor markets clear.
4. The government programs, the social safety net, Social Security, and Medicare are self-financing.
5. The health insurance companies are competitive.
6. The distribution \( \Phi(s) \), evolves over time according to the equation \( \Phi' = R_\Phi(\Phi) \), and satisfies the stationary equilibrium condition: \( \Phi' = \Phi \).
7. The amount of initial assets of the new born cohort is equal to the amount of accidental bequests from the last period.
Quantitative Question and Strategy

- **Quantitative question:** what is the impact of means-tested social insurance on
  - individual welfare,
  - individual decisions: private health insurance, labor supply, saving.

- **Quantitative strategy:** (steady-state comparison)
  - Calibrate the benchmark model to the current US economy (in 2004).
  - Construct counterfactual economies with different $c$ and $\tau_w$.
  - Compare them to the benchmark economy.
Labor productivity $\epsilon: \ln \epsilon = a + y$.
- $a$: age-specific deterministic component.
- $y$: a persistent shock, has 5 states, follows a joint process with the probability of being offered ESHI.

Health expense shock $m$.
- Governed by a 6-state markov chain.
- Categorize the distribution of total health expenditure into 6 bins (25%, 50%, 75%, 90%, 95%).

Calibrated using Medical Expenditure Panel Survey (MEPS) dataset.
Social Insurance.

- Floor $c$: calibrated to match % of working popu. on Medicaid.
- Payroll tax $\tau_w$: endogenously determined, $\tau_w = 5.3\%$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma$</td>
<td>2</td>
<td>Macro literature</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.33</td>
<td>Macro literature</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.06</td>
<td>Macro literature</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.97</td>
<td>Macro literature</td>
</tr>
<tr>
<td>$\tau_s$</td>
<td>12.4%</td>
<td>US Social Security tax rate</td>
</tr>
<tr>
<td>$\kappa_m$</td>
<td>0.5</td>
<td>Attanasio, et al (2008)</td>
</tr>
<tr>
<td>$\tau_m$</td>
<td>4.7%</td>
<td></td>
</tr>
<tr>
<td>$c$</td>
<td>$$9,700$</td>
<td>% of working pop. on Medicaid</td>
</tr>
<tr>
<td>$\tau_w$</td>
<td>5.3%</td>
<td></td>
</tr>
<tr>
<td>$A$</td>
<td>24500</td>
<td>Output per person: $$40293$</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>0.11</td>
<td>Kahn et al. (2005)</td>
</tr>
<tr>
<td>$\pi$</td>
<td>0.2</td>
<td>Sommers(2002)</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>0.2E-4</td>
<td>Employment rate: 73%</td>
</tr>
</tbody>
</table>
Key Statistics of the Benchmark Economy

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Model</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>3.2%</td>
<td></td>
</tr>
<tr>
<td>Employment rate</td>
<td>72%</td>
<td>73%</td>
</tr>
<tr>
<td>Output per person</td>
<td>$41007</td>
<td>$40293</td>
</tr>
<tr>
<td>ESHI take-up rate</td>
<td>92.9%</td>
<td>90.7%</td>
</tr>
<tr>
<td>% of working popu. with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual HI</td>
<td>3.7%</td>
<td>4.4%</td>
</tr>
<tr>
<td>ESHI</td>
<td>52.7%</td>
<td>59.4%</td>
</tr>
<tr>
<td>Medicaid</td>
<td>9.5%</td>
<td>9.6%</td>
</tr>
<tr>
<td>No HI</td>
<td>34.1%</td>
<td>26.7%</td>
</tr>
</tbody>
</table>

Data source: MEPS

Fraction of Individuals on Medicaid by Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Model</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-35</td>
<td>10.5%</td>
<td>10.4%</td>
</tr>
<tr>
<td>36-45</td>
<td>11.5%</td>
<td>8.8%</td>
</tr>
<tr>
<td>46-55</td>
<td>8.2%</td>
<td>7.0%</td>
</tr>
<tr>
<td>56-65</td>
<td>7.2%</td>
<td>6.4%</td>
</tr>
<tr>
<td>66-75</td>
<td>10.3%</td>
<td>12.9%</td>
</tr>
<tr>
<td>76-</td>
<td>23.2%</td>
<td>12.3%</td>
</tr>
</tbody>
</table>

Data source: MEPS
Construct and compare a counterfactual economy with a floor $100.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Benchmark (with $9700 floor)</th>
<th>Counterfactual (with $100 floor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected ave. lifetime utility</td>
<td>-1.59E-3</td>
<td>-1.57E-3</td>
</tr>
<tr>
<td>Welfare Consequence</td>
<td>n.a.</td>
<td>1.6%</td>
</tr>
<tr>
<td>% of working popu. with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual HI</td>
<td>3.7%</td>
<td>18.2%</td>
</tr>
<tr>
<td>ESHI</td>
<td>52.7%</td>
<td>63.6%</td>
</tr>
<tr>
<td>Public HI</td>
<td>9.5%</td>
<td>≤0.01%</td>
</tr>
<tr>
<td>No HI</td>
<td>34.1%</td>
<td>18.2%</td>
</tr>
<tr>
<td>ESHI take-up rate</td>
<td>92.9%</td>
<td>97.1%</td>
</tr>
<tr>
<td>ESHI premium</td>
<td>$3323</td>
<td>$3225</td>
</tr>
<tr>
<td>Social safety net tax rate $\tau_w$</td>
<td>5.3%</td>
<td>≤0.01%</td>
</tr>
<tr>
<td>Employment rate</td>
<td>72%</td>
<td>87%</td>
</tr>
<tr>
<td>Aggregate labor</td>
<td>0.89</td>
<td>0.95</td>
</tr>
<tr>
<td>Aggregate capital(in $1000)</td>
<td>147</td>
<td>193</td>
</tr>
<tr>
<td>Output per person</td>
<td>$41007</td>
<td>$46755</td>
</tr>
<tr>
<td>Interest rate</td>
<td>3.2%</td>
<td>2.0%</td>
</tr>
</tbody>
</table>
Using consumption equivalent variation (CEV) as the welfare criteria.
- CEV: the change in consumption each period required for a new born to achieve the same expected lifetime utility.

Reducing the floor $c$ from $9700 to $100,
- generates a welfare loss of 1.6% of consumption each period.

Welfare result of social insurance by labor productivity.

<table>
<thead>
<tr>
<th>Labor Productivity (from low to high)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare gain/loss</td>
<td>-0.6%</td>
<td>0.9%</td>
<td>2.0%</td>
<td>2.8%</td>
<td>3.8%</td>
</tr>
</tbody>
</table>
**Private Health Insurance and Social Insurance**

- Large crowding out effect: as $c$ is reduced from $9700$ to $100$,
  - % of working popu. with individual health insurance: $3.7\% \rightarrow 18.2\%$.
  - % of working popu. with ESHI: $52.7\% \rightarrow 63.6\%$.

- Crowding Out Effects by Labor Productivity

<table>
<thead>
<tr>
<th>Labor Productivity Shock (from low to high)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual HI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benchmark</td>
<td>5.4%</td>
<td>4.6%</td>
<td>2.1</td>
<td>1.7%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Counterfactual</td>
<td>33.8%</td>
<td>23.9%</td>
<td>10.9%</td>
<td>5.0%</td>
<td>2.6%</td>
</tr>
<tr>
<td><strong>Employer-sponsored HI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benchmark</td>
<td>11.7%</td>
<td>46.8%</td>
<td>72.1</td>
<td>82.6%</td>
<td>87.5%</td>
</tr>
<tr>
<td>Counterfactual</td>
<td>38.2%</td>
<td>56.1%</td>
<td>73.9</td>
<td>84.1%</td>
<td>88.9%</td>
</tr>
</tbody>
</table>
Important welfare implication: offsets the welfare gain from public insurance provided by Social Insurance.

Experiment: fix the private health insurance choices, and then replicate the welfare analysis.

Reducing the floor $c$ from $9700$ to $100$ generates a welfare loss of $1.4\%$ of consumption each period.
Large labor supply effect: as \( c \) increases from $9700 to $100,
- Employment rate: 72% → 87%. (Aggregate labor: 0.89 → 0.95.)

Two sources of labor supply effect: (1) means-testing, (2) payroll tax.
- Experiment: reduces \( c \) from $9700 to $100 while keeping payroll tax \( \tau_w \) constant.
- Labor supply effect: slightly smaller, employment rate: 72% → 85%.

Important welfare implication

Experiment: replicate the welfare analysis while keep labor supply decisions constant.

Reducing the floor \( c \) from $9700 to $100 generates a welfare loss of 4.4% of consumption each period.
A large number of Americans do not purchase any health insurance, i.e. 47 million.

It has motivated many policy proposals.

Should understand why, before designing any sensible policy.

Gruber (2008): it is puzzling (at least quantitatively) after reviewing existing potential explanations
  - uncompensated care,
  - market frictions, etc.
This paper provides a promising explanation: the existence of means-tested social insurance.

- Means-testing: implicit insurance to people who are not currently qualified.
  - They would become qualified after being hit by large health shocks.
- The implicit insurance from means-tested social insurance crowds out private health insurance.

Quantitatively:

- When reducing the floor $c$ from $9700$ to $100$, % of working population without health insurance: $34.1\% \rightarrow 18.2\%$.
- Approximately half of uninsured Americans are due to social insurance.
The seminal work by Hubbard, Skinner and Zeldes (1995):

- Social insurance reduces precautionary saving.
- The reason why many individuals do not save over the life cycle.

My model differs along several dimensions: 1) general equilibrium, 2) endogenous health insurance, and 3) endogenous labor supply.

Comparing to them. Do these results hold true here?
Comparing to Hubbard, Skinner and Zeldes (1995), the saving effect here is
- is qualitatively similar,
- but quantitatively much smaller.

This is because of
- general equilibrium effects
- endogenous health insurance

When the consumption floor is reduced from $9700 to $100,

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Aggregate capital (in $1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark (GE and endo. HI)</td>
<td>147→193</td>
</tr>
<tr>
<td>PE model</td>
<td>147→213</td>
</tr>
<tr>
<td>Model (exog. HI)</td>
<td>147→210</td>
</tr>
<tr>
<td>Model (exog. labor)</td>
<td>147→193</td>
</tr>
</tbody>
</table>
Conclusion

- Means-tested social insurance generates a significant *welfare loss*.
  - Large crowding out effect on private health insurance.
  - Large negative labor supply effect.
  - Both are important for obtaining the welfare loss result.

- The model provides an quantitative explanation for a puzzling fact: a large number of Americans are uninsured.
  - Means-tested social insurance accounts for approximately half of the uninsured population.

- Future research: Europe has a higher consumption floor. Can the difference in means-tested social insurance account for the cross-country difference in labor supply. (e.g. Prescott (2004))

- This paper extends their model to a general equilibrium setting, and
- endogenizes health insurance decision and labor supply decision.

Life-cycle models with incomplete markets and heterogenous agents.


Public finance literature on the crowding out effect.

- Cutler and Gruber (1996a, 1996b), Brown and Finkelstein (2008), etc.