Health Insurance for Redistribution
Harvard Kennedy School: Health Equity Seminar

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January 26, 2023

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Using the Tax Framework to Think About Health Insurance

- We use the tax system to accomplish redistribution
  - Socially valuable transfer: to low-income individual (↑ marginal utility)
  - Cost: distortionary taxation

- Public health insurance is also a large vehicle for redistribution
  - Transfer from rich to poor healthy → sick
  - Value: risk protection
  - Cost: moral hazard
Public Health Insurance in Practice

- Health insurance = proportional subsidy to health care expenditures

- Across the world, subsidy more generous for low income individuals

- Questions about policy design require us to think about subsidized, low-income health insurance both like a tax and like insurance
Policy Trade Offs

- Policy questions: who should receive low-income health insurance subsidies?
  - US context: Medicaid eligibility threshold

- Addressing this means modeling aspects of trade-offs
  - Redistributive benefit of transfer to sick and poor individuals
  - Distortionary effects of funding it with income taxes
  - Labor market effects of public health insurance
  - Moral hazard costs of subsidizing health care
This Paper

1. Build a model that incorporates health into a tax framework

2. Estimate important new parameters that relate health insurance effects to income distribution

3. Estimate optimal policy in US, combining estimates from (2) with the model in (1)
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   - Mirrlees framework with heterogeneous health
   - Allow health to affect choice of labor supply & value of consumption

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   - Revisit RAND Health Insurance Experiment
   - Allow demand elasticity of health care to differ by income group

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2. **Estimate important new parameters that relate health insurance effects to income distribution**
   - Revisit RAND Health Insurance Experiment
   - Allow demand elasticity of health care to differ by income group

3. **Estimate optimal policy in US, combining estimates from (2) with the model in (1)**
   - Restricted policy space: health care safety net based on income
   - Subsidies for rich/poor + endogenous income threshold (fixed point)
Results

1. Model builds intuition: health care spending more informative about the sickest individuals in society
   - More effective tool for redistribution when preferences for health equity
   - Improving health increases labor supply (consistent with Stephens and Toohey, 2022)

2. Estimate elasticity of medical spending for different income groups
   - Find that low income individuals are much less responsive to marginal changes in health care subsidy

3. Optimal policies depend on social preferences
   - Utilitarian: no public insurance/survival of the fittest
   - If weight sick individuals: set Medicaid eligibility at 130% FPL
   - Rawlsian: set Medicaid eligibility at 309% FPL
Related Literature

- **Optimal taxation** (Mirrlees, 1971; Saez, 2001; Saez and Stantcheva, 2016; Piketty, Saez, and Stantcheva, 2014; Laroque, 2005; Gauthier and Laroque, 2009; Le Grand, Ragot, and Rodrigues, 2022)
  - Enrich framework to incorporate health dimension
  - Introduce equity and efficiency reasons (redistribution and tagging) to subsidize health care (Sitglitz, 2018; Cremer, Gahvari, and Lozachmeur, 2010; Henriet and Rochet, 2005)

- **Welfare analysis in health care** (Cutler et. al., 2022; Grossman, 1972; Hendren, 2020; Meltzer and Smith, 2012; Finklestein, Hendren, and Luttmer, 2019; Cardon and Hendel, 2001; Garber and Phelps, 1997)
  - Nest Cost-Effectiveness Analysis into public finance tax framework

- **Empirical literature on heterogeneous moral hazard responses** (Lavetti et. al., 2019; Cockx and Brasseur, 2003; Brot-Goldberg et. al., 2017; Manning et. al., 1988; Feldstein, 1970, 71)
  - Present causal evidence that poor are less responsive to marginal health care subsidies
Overview

1. Introduction

2. A Model for Redistributive Health Insurance

3. Quantifying the Fiscal Costs and Welfare Benefits of Public Health Insurance

4. Simulating the Optimal Policy
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   - Related Literature

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   - Incorporating Health

3. Quantifying the Fiscal Costs and Welfare Benefits of Public Health Insurance
   - Elasticities of Medical Spending by Income
   - Marginal Social Welfare Weights

4. Simulating the Optimal Policy
   - Estimation Algorithm
   - Simulation Results
Model Overview

- Individual utility depends on health state:
  - Mirrlees (1971) framework with heterogeneous ability health
  - Choose medical spending and labor supply

- Policy instruments:
  - Two proportional health care subsidies (i.e. coinsurance) for rich/poor
  - Endogenous income eligibility threshold
  - Linear income tax and lump sum transfer

- Government:
  - Maximizes welfare objective that incorporates social preferences
Individual Utility

- Incorporate idea that marginal utility ↓ as health deteriorates
  (Finkelstein, Luttmer, and Notowidigdo, 2013)

\[ V_i(c_i, m_i, z_i) = H(m_i, \theta_i) \cdot u(c_i) - v(z_i, m_i, \theta_i) \]

- Health state scalar (quality of life)
- Concave consumption utility
- Effort cost of labor supply
Individual Utility

- Incorporate idea that marginal utility ↓ as health deteriorates
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\[ V_i(c_i, m_i, z_i) = H(m_i, \theta_i) \cdot u(c_i) - v(z_i, m_i, \theta_i) \]

- Primitives: health type
Individual Utility

- Incorporate idea that marginal utility ↓ as health deteriorates
  
  \[
  V_i(c_i, m_i, z_i) = H(m_i, \theta_i) \cdot u(c_i) - v(z_i, m_i, \theta_i)
  \]

  - Health state scalar (quality of life)
  - Concave consumption utility
  - Effort cost of labor supply

- Primitives: health type

- Individuals choose: medical spending
Individual Utility

- Incorporate idea that marginal utility ↓ as health deteriorates
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\[ V_i(c_i, m_i, z_i) = H(m_i, \theta_i) \cdot u(c_i) - v(z_i, m_i, \theta_i) \]

- Primitives: health type
- Individuals choose: medical spending, labor supply
Individual Utility

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- Primitives: health type

- Individuals choose: medical spending, labor supply, and consumption

Assumptions and formal utility function specification
Policy Instruments

- Suppose (for reasons outside of the model) the government can only choose policies of the form:

![Graph showing Health Care Subsidy Generosity against Individual Income $z_i$. The graph features two levels of subsidy, $s_L$ and $s_H$, with a "safety net" eligibility threshold $\hat{z}$.](image-url)
Policy Instruments

- Proportional health care subsidies (a.k.a. coinsurance)

\[ s(m_i, z_i) = \begin{cases} 
(1 - s_L) \cdot m_i, & z_i \leq \hat{z} \\
\text{coinsurance for the poor} & \\
(1 - s_H) \cdot m_i, & \text{otherwise} \\
\text{coinsurance for the rest} &
\end{cases} \]

- Income tax to finance

\[ T(z_i) = \tau \cdot z_i + R \]

\( \tau \) linear tax 
\( \hat{z} \) income eligibility threshold 
\( m_i \) income 
\( \tau \) lump-sum transfer/tax
Individual Utility

- Incorporate idea that marginal utility ↓ as health deteriorates
  (Finkelstein, Luttmer, and Notowidigdo, 2013)

\[ V_i(c_i, m_i, z_i) = \underbrace{H(m_i, \theta_i)}_{\text{health state scalar (quality of life)}} \cdot \underbrace{u(c_i)}_{\text{concave consumption utility}} - \underbrace{v(z_i, m_i, \theta_i)}_{\text{effort cost of labor supply}} \]

- Primitives: health type
- Individuals choose: medical spending, labor supply, and consumption
- Subject to budget constraint:

\[ c_i \leq (1 - \tau)z_i + R - (1 - s)m_i \]

\underbrace{\text{after-tax income}}_{\text{medical spending}}
Welfare Objective

- Government chooses policy to maximize social welfare objective

\[ W = \int G_i \cdot V_i(c_i, m_i, z_i) \, di \]

- Key concept: marginal social welfare weight

\[ g_i \equiv G_i \cdot u'(c) \cdot H(m_i, \theta_i) \]

- Familiar cases:
  - Utilitarian: \( G_i = 1 \)
  - Rawlsian: for \( \min \{V_i\} \) \( G_{\min} = 1 \) and \( G_{i>\min} = 0 \)
Incorporating Social Preferences

- Social opinion on health outcomes
  - Survey evidence: “widespread [...] view that present health outcomes are largely unfair” (Stantcheva, 2020)

- Want to account for social preferences in policy design

- Introduce: generalized marginal social welfare weight (Saez and Stantcheva, 2016)

  - Set $G_i = \frac{1}{H_i \cdot u'(c)} \cdot g_i(H_i, z_i)$
  - Where $g_i(H_i, z_i)$ depends on health and income
How does the government set these optimally?

\[ \text{plus tax } \tau \text{ and transfer } R \text{ to finance} \]
Optimal Policy

- Government chooses subsidies and taxes to max social objective:
  - Weighted sum of individuals

- Subject to incentive constraints:
  - Individuals choose medical spending, labor supply, and consumption optimally, given the policy

- And government resource constraint:
  - Health care subsidies must be tax financed
Policy Trade Offs: Health Care Subsidy and Tax

- Welfare benefit determined by social preferences
  - Benefit quantified in average marginal social welfare weight, “$\bar{g}$”
  - Key idea: depends on covariance between what the policy instrument affects (i.e. medical spending) and social welfare weight $g_i$
Policy Trade Offs: Health Care Subsidy and Tax

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- Fiscal costs of health care subsidy are affected by
  1. Moral hazard: effect of subsidy on total medical spending (need estimates of medical spending elasticity for affected group)
  2. Labor market effects: ↑ health ↑ labor supply (Stephens and Toohey, 2022)
Policy Trade Offs: Health Care Subsidy and Tax

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- Fiscal costs of tax are affected by
  1. Labor market distortions (need labor supply elasticity)
  2. Income effects on medical spending (need income elasticity)
Policy Trade Offs: Eligibility Threshold

- Fix subsidies at full coverage for low income ($s_L = 1$) and no coverage for the rest ($s_H = 0$)
Policy Trade Offs: Eligibility Threshold

- Fix subsidies at full coverage for low income \((s_L = 1)\) and no coverage for the rest \((s_H = 0)\)

- Welfare benefit: weighted *utility difference* of individuals above and below the threshold
  - Linear approximation: average marginal social welfare weight for *individuals around the threshold*
Policy Trade Offs: Eligibility Threshold

- Fix subsidies at full coverage for low income \( s_L = 1 \) and no coverage for the rest \( s_H = 0 \)

- Welfare benefit: weighted *utility difference* of individuals above and below the threshold
  - Linear approximation: *average marginal social welfare weight for individuals around the threshold*

- Fiscal costs of raising the threshold depend on
  1. Difference between the subsidies \( s_H, s_L \)
  2. Mechanical effect: $ amount that newly eligible individuals spend on health care (need *average medical spending* for this group)
  3. Behavioral effect: how much more do newly eligible individuals spend when receive full coverage versus no coverage (need *pairwise (non-local) elasticity of medical spending*)
Summary of Optimal Policy

- Health care subsidy for income groups \( j = H, L \)

\[
\begin{align*}
  s_j &= \frac{\bar{g}_m^j - 1}{\bar{g}_m^j - 1 + \eta_m^j} \\
  \text{covariance } &\quad g_i \text{ and } m_i \\
  \text{elasticity of } &\quad \text{medical spndg}
\end{align*}
\]

- Tax

\[
\begin{align*}
  \tau &= \frac{1 - \bar{g}_z}{1 - \bar{g}_z + \xi_z} \\
  \text{covariance } &\quad g_i \text{ and } z_i \\
  \text{elasticity of } &\quad \text{labor supply}
\end{align*}
\]

- Threshold

\[
\begin{align*}
  \bar{g}_m(\hat{z}) &= \frac{S_L}{S_H} \cdot \eta_m(S_H, S_L - S_H|\hat{z}) + 1 \\
  \text{covariance } &\quad g_i \text{ and } m_i \\
  \text{pairwise elasticity } &\quad \text{between } s_L \text{ and } s_H \\
  \text{for } z_i = \hat{z} &\quad \text{for } z_i = \hat{z}
\end{align*}
\]
Sufficient Statistics Wish List

- Elasticities of medical spending for individuals in different income groups
  - Obtain from RAND health insurance experiment

- Average marginal social welfare weights/covariances with $m_i$ and $z_i$
  - Obtain from the Medical Expenditure Panel Survey (MEPS)

- Medical spending levels across income groups
  - Obtain MEPS

- Elasticity of labor supply
  - Calibrate from literature at upper range estimate $\xi_z = 0.5$ (Saez, Slemrod, and Giertz 2012)
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Estimating Elasticities

- RAND Health Insurance Experiment: large-scale field experiment conducted in the 1970’s
  - random assignment of health insurance plan generosity (95%, 50%, 25%, or 0%)

- Empirical Framework:
  \[
  \log(m_{i,y}) = \eta_q(\log(s_p) \times 1[z_i \in q]) + \beta_y + \beta_{l,t} + \epsilon_{i,y}
  \]

  - individuals \( i \)
  - year \( y \), month \( t \), and location \( l \)
  - medical spending \( m \)
  - generosity \( s \), plan \( p \)
  - income \( z \) in quintile \( q \)
Elasticities of Medical Spending by Income

- Low-income individuals unlikely to over-consume care if it is free
Elasticities by Inpatient (Hospital) and Outpatient (Office)

- Driven by outpatient care

![Elasticity of Medical Spending with respect to Coinsurance by Type of Care](image)
Why might elasticities differ by income?

- Income and substitution effects
  - Low income: income and substitution effects cancel out
  - High income: substitution effect dominates

- Result is consistent with other literature
  - Brot-Goldberg et al 2017 QJE have appendix table with similar result
  - Lavetti et al 2019 NBER WP find small (-.1) elasticity for low income individuals

- Caveat: it’s an intensive margin elasticity
Implications from RAND Experiment Data

- Fiscal costs of subsidizing health care likely differ for rich and poor
  - Standard literature estimate from RAND = .2
  - But average misleading for costs of safety net expansion (e.g. Medicaid)

- Main Implication:
  - Health care subsidies for the poor may be subject to smaller moral hazard concerns (and potentially increase labor supply)
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Obtaining the Average Marginal Social Welfare Weights

- Need to know the covariance between:
  - Social welfare weights $g_i$
  - And objects affected by policy instruments (medical spending $m_i$ and labor supply $z_i$)
  - Use the empirical joint distribution of $H_i$, $m_i$, and $z_i$ (Saez, 2001)

Data: Medical Expenditure Panel Survey (MEPS) Data

- Publicly available from Agency for Healthcare Research and Quality
- Contain person-level data on: income, health status, aggregate medical expenditures
- Data years: 2009 - 2016 (for data quality reasons)
### MEPS Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>Bottom</th>
<th>Second</th>
<th>Third</th>
<th>Fourth</th>
<th>Top</th>
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</thead>
<tbody>
<tr>
<td><strong>Health Status</strong> (percentage points relative to the mean)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Self-reported, Overall</td>
<td>-1.81</td>
<td>-3.81</td>
<td>0.36</td>
<td>2.90</td>
<td>7.20</td>
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<td>Mental Health</td>
<td>-2.31</td>
<td>-1.21</td>
<td>0.89</td>
<td>1.80</td>
<td>2.81</td>
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<td>Physical Health</td>
<td>-1.97</td>
<td>-3.25</td>
<td>0.42</td>
<td>2.65</td>
<td>4.13</td>
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<tr>
<td><strong>Components of Quality of Life</strong> (average share)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hearing Impairment</td>
<td>0.06</td>
<td>0.09</td>
<td>0.07</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Writing Impairment</td>
<td>0.09</td>
<td>0.11</td>
<td>0.06</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td>Health Limits Social Activity</td>
<td>0.12</td>
<td>0.13</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>Difficulty Lifting 10 lbs</td>
<td>0.15</td>
<td>0.17</td>
<td>0.09</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Difficulty Crouching</td>
<td>0.17</td>
<td>0.21</td>
<td>0.15</td>
<td>0.09</td>
<td>0.02</td>
</tr>
<tr>
<td>Difficulty Reaching</td>
<td>0.13</td>
<td>0.16</td>
<td>0.09</td>
<td>0.06</td>
<td>0.04</td>
</tr>
</tbody>
</table>

| N                                     | 41,409 | 38,654 | 31,425 | 27,030 | 22,747 |

**Table**: Summary Statistics by Income Quintile
Measuring $H$: Quality of Life

- **QALYs literature**
  - No universally accepted metric of health-related Quality of Life (Cutler et. al. 2022)
  - Usually measured in a series of “domains,” including physical and mental functioning, role limitations, pain, and cognition

- **Empirical framework used in health cost benefit analysis**
  - Individuals $i$, year $t$, age, sex, race, blood pressure, education, smoking history, etc

$$H_{it}^{\text{self-reported}} = \beta_{cc}[1[\text{chrnc cndtn} = \text{cc}]] + \text{bmi}_{it} + \alpha \cdot X_{it} + \beta_t + \epsilon_{it}$$

- **Idea:** use $H_{it}^{\text{self-reported}}$ directly as measure of health in calculating welfare weights
Health, Income, and Medical Spending

- Health disparities by income are evident in the raw data

![Graph showing Quality of Life (H) by Income]
Health, Income, and Medical Spending

- Medical spending quite informative about an individual’s health state
Implications for Redistribution

- Redistribution goals: advance equity, accounting for health disparities along the socioeconomic gradient
- Transfer to low-income individual
  - is also a transfer to an individual with higher underlying risk factors
- Targeting transfer to a low-income, high medical spending individual
  - Effectively targets the poorest and sickest individuals
- Relevant statistic for the optimal subsidy: covariance of health and medical spending
Average Welfare Weights by Income Percentile

- Specify welfare weights: inversely proportional to income
Average Welfare Weights by Income Percentile

- Specify welfare weights: inversely proportional to income, weighted by health
Redistribution in Utilitarian Case: Survival of the Fittest

- Under this specification of utility:

\[ V_i = H_i(m_i, \theta_i) \cdot u(c_i) - v(z_i, m_i, \theta_i) \]

- Sick people work less
- Spend more on health care

- Utilitarian welfare objective \( \Rightarrow g_i = H_i \cdot u'(c) \)
  - Value of transfer to low income individual is reduced because they are in poor health to enjoy it

- Survival of the fittest result: no taxation and no redistribution
Alternative Welfare Objectives

- Capturing concerns for health equity:
  - Weights that are inversely proportional to health
  - Or square differences from perfect health $g_i = (1 - H_i)^2$

- Weighting scheme determines the generosity of the policy

- Relevant statistic is average “covariance” between health and medical spending/income for relevant income group

$$\overline{g_m^L} = \frac{\int_{\text{low inc } i} g_i(H_i, z_i) \cdot m_i \, di}{\int_{\text{low inc } i} g_i(H_i, z_i) \, di \cdot \int_{\text{low inc } i} m_i \, di}$$
Covariance of health and medical spending

- For individuals below income percentile $\hat{z}$
Covariance of health and medical spending

- For both groups, Rawlsian case
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Simulating the Optimal Policy

- Data informs us about the trade-offs in the optimal policy

- Elasticities $\eta_m$ informative about
  - how changes to policy affect fiscals costs and equilibrium spending

- Joint distribution of medical spending and income informative about
  - Average social welfare weights, $\bar{g}$
Simulating the Optimal Policy

- Health care subsidy for income groups $j = H, L$

$$s_j = \frac{\bar{g}_m^j - 1}{\bar{g}_m^j - 1 + \eta_j^m}$$

- Covariance $g_i$ and $m_i$
- Elasticity of medical spending

- Tax

$$\tau = \frac{1 - \bar{g}_z}{1 - \bar{g}_z + \xi_z}$$

- Covariance $g_i$ and $z_i$
- Elasticity of labor supply

- Threshold

$$\bar{g}_m(\hat{z}) = \frac{S_L}{S_H} \eta_m(s_H, S_L - s_H|\hat{z}) + 1$$

- Covariance $g_i$ and $m_i$ for $z_i = \hat{z}$
- Pairwise elasticity between $s_L$ and $s_H$ for $z_i = \hat{z}$
**Estimation Algorithm**

- **Subsidy and tax: sufficient statistics approach**
  - Leverage richness of experiment data and use different elasticity point estimates at different subsidy rates
  - **Pairwise Elasticity Estimates**
  - Fixed point: Plug in (all three) elasticity estimates and check internal consistency

- **Endogenous threshold: compute gradient and find minimum**
  - Depends on the subsidies above and below (also chosen optimally)
  - Approach: conjecture threshold at every possible value, calculate optimal subsidies/tax, compute gradient, then search over the minimum gradient
Optimal Policy Simulation

### Social Welfare Objective

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(1 - H_i)^2$</td>
<td></td>
<td>Rawlsian min{z, H}</td>
<td>Inversely proportional to H</td>
</tr>
<tr>
<td>Care Subsidy: High Inc</td>
<td>0.657</td>
<td>0.378</td>
<td>0.704</td>
</tr>
<tr>
<td>Care Subsidy: Low Inc</td>
<td>0.657</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Eligibility as % FPL (Inc Percentile)</td>
<td>.</td>
<td>309.7%</td>
<td>129% (45th pctile) (11th pctile)</td>
</tr>
<tr>
<td>Payroll tax</td>
<td>0.151</td>
<td>0.452</td>
<td>0.198</td>
</tr>
<tr>
<td>Transfer</td>
<td>$2,094.50</td>
<td>$9,054.60</td>
<td>-$1,959.4</td>
</tr>
</tbody>
</table>

Table: Simulated Optimal Policy
## Comparison to What Countries Use In Practice

<table>
<thead>
<tr>
<th>Country</th>
<th>% FPL</th>
<th>Benefit</th>
<th>Universal Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>139%</td>
<td>Cap on drugs</td>
<td>✔️</td>
</tr>
<tr>
<td>Canada</td>
<td>166%</td>
<td>Cap on drugs</td>
<td>✔️</td>
</tr>
<tr>
<td>England</td>
<td>236%</td>
<td>Cap on drugs</td>
<td>✔️</td>
</tr>
<tr>
<td>France</td>
<td>57.5%</td>
<td>All Care</td>
<td>✔️</td>
</tr>
<tr>
<td>Israel</td>
<td>71%</td>
<td>Specialist Care</td>
<td>✔️</td>
</tr>
<tr>
<td>Italy</td>
<td>105%</td>
<td>All Care</td>
<td>✔️</td>
</tr>
<tr>
<td>Japan</td>
<td>190%</td>
<td>Reduced Coinsurance</td>
<td>✔️</td>
</tr>
<tr>
<td>New Zealand</td>
<td>231%</td>
<td>Reduced Copays</td>
<td>✔️</td>
</tr>
<tr>
<td>Unites States</td>
<td>138%</td>
<td>All Care</td>
<td>X</td>
</tr>
</tbody>
</table>

*Income Eligibility Threshold for Health Care Safety Net*
Optimal Policy Remarks

- Policy with weights inversely proportional to health looks like Medicaid

- Note that solution does not involve ONLY taxes
  - (Not today) Not only a feature of linear tax schedule
  - Can show that planner prefers to use insurance when there are direct concerns for health equity

- Limitations
  - Labor market effects
  - May be particularly important when low income subsidy is far from rest
Takeaways

1. Health care spending more informative about the sickest individuals in society
   - More effective tool for redistribution when preferences for health equity
   - Improving health increases labor supply (consistent with Stephens and Toohey, 2022)

2. Low income individuals are much less responsive to marginal changes in health care subsidy

3. Optimal policies depend on social preferences
   - Utilitarian: no public insurance/survival of the fittest
   - If weight sick individuals: set Medicaid eligibility at 130% FPL
   - Rawlsian: set Medicaid eligibility at 309% FPL
Descriptive evidence

- **Social preferences for health equity**
  - Survey evidence: “widespread belief in the positive efficiency and equity effects of better health insurance, and a view that present health outcomes are largely unfair” (Stantcheva, 2020)

- **Equity: low income individuals**
  - Have lower life expectancy (Chetty et. al. 2016)
  - More likely to suffer from obesity or respiratory conditions (Chetty et. al. 2016) and get hospitalized (Wadhera et. al. 2020)

- **Efficiency: Poor health**
  - Has consequences for labor market aspirations (Stephens and Toohey, 2022; O’Donnell et. al. 2015; Currie and Madrian, 1999)
  - Hospitalizations ↓ earnings ↑ bankruptcies among working-age adults (Dobkin et. al. 2018)
# Health Insurance Policy Across the Globe

## Health Insurance Safety Nets

<table>
<thead>
<tr>
<th>Country</th>
<th>For Low Income Individuals</th>
<th>For Sicker Individuals</th>
<th>For Children, Elderly, or Mothers</th>
<th>Universal Care For All Citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
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<td></td>
<td>C</td>
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<tr>
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<tr>
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<td></td>
<td>T</td>
<td>C</td>
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<tr>
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<tr>
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<td>✓</td>
<td>D &amp; CC</td>
<td></td>
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<td>C</td>
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<td>C &amp; E</td>
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<td>C &amp; M</td>
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<tr>
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<td>✓</td>
<td>D &amp; CC</td>
<td>C, M, &amp; E</td>
<td>x</td>
</tr>
</tbody>
</table>

D=disabled, CC=chronic condition, T=terminally ill, C=children, E=elderly, M=mothers.
Public Health Insurance Across US States

- US public health insurance program: Medicaid
  - Administered by states
  - Substantial variation in where to draw the line
Mental versus Physical Health Disparities

Quality of Life Disparities
Across High and Low Medical Spending

Note: Figure reports coefficients from regressions in which the dependent variable is either physical or mental health, and the independent variables are categorical indicators for individuals within each income decile, interacted with whether they had above the median medical spending. Top decile omitted, which means coefficients report relative differences, relative to top income decile.
Mental versus Physical Health Disparities

Quality of Life Disparities
For Low Medical Spending Individuals

Note: Figure reports coefficients from regressions in which the dependent variable is either physical or mental health, and the independent variables are categorical indicators for individuals within each income decile, conditional on having below the median medical spending.
Mental versus Physical Health Disparities

Quality of Life Disparities
For High Medical Spending Individuals

Note: Figure reports coefficients from regressions in which the dependent variable is either physical or mental health, and the independent variables are categorical indicators for individuals within each income decile, conditional on having above the median medical spending.
Consumption, Medical Spending, and Labor Supply

- Individuals $i$ differ in underlying health type $\theta_i$
- Individuals $i$ derive utility

$$V_i = H(m_i, \theta_i) \cdot u(c_i) - v(z_i, m_i, \theta_i)$$

where

- $c_i$: consumption
- $v(z_i, m, \theta_i) \geq 0$: disutility from labor supply
- $H_i \in (0, 1]$: health state that scales utility

Assumptions:

- $u(c_i)$ is increasing, concave; common function
- $v(z_i, m_i, \theta_i)$ increasing and convex in $z_i$, increasing and concave in $m_i$
- $H(m_i, \theta_i)$ increasing in $m_i$
Welfare Objective

- Planner sets policy \( P \)
  - Welfare objective: generalized marginal social welfare weights (Saez and Stantcheva, 2016)

- Government chooses a policy \( P \) optimally to maximize

\[
W(\tilde{P} | P) = \int_i g_i(H_i, z_i | P) U_i(\tilde{P}) \, di,
\]

- S.t. resource constraint:
  \[
  \int_i (R + \tau z_i) \, di \geq s_L \int m_i \, di + s_H \int_{z_i > \hat{z}} m_i \, di
  \]

Back
Consumption and Labor Supply

Consumption determined by the budget constraint:

\[ c_i = (1 - \tau)z_i + R - (1 - s(z_i))m_i \]

- after tax income
- out-of-pocket medical expenditures

Labor \( z_i \) chosen optimally \( \implies \)

\[ (1 - \tau) \cdot u'(c_i) \cdot H(m_i, \theta_i) = v_z(z_i, m_i, \theta_i) \]

- marginal returns to working
- marginal cost of effort

Returns to labor supply are:

- ↑ in level of health and in medical expenditures
- ↓ in the tax rate
Labor Supply

\[(1 - \tau)u_c(c_i) \cdot H(m_i, \theta_i) - v_z(z_i, m_i, \theta_i) = 0\]

- **Marginal returns to working**
- **Marginal cost of effort**
Medical Spending Decision

- Medical spending $m_i$ chosen optimally $\Rightarrow$
  \[
  u(c_i) \cdot H_m(m_i, \theta_i) - v_m(z, m, \theta) = u_c(c_i) \cdot H(m_i, \theta_i) \cdot (1 - s(z_i))
  \]
  
  - Marginal improvements in health:
    ▶ $\uparrow$ in level of utility and medical technology
  
  - Marginal costs of forgone consumption:
    ▶ $\uparrow$ with level of health
    ▶ $\downarrow$ with levels of consumption

Back
Medical Spending Decision

\[ u(c_i) \cdot H_m(m_i, \theta_i) - v_m(z, m, \theta) = u'(c_i) \cdot H(m_i, \theta_i) \cdot (1 - s(z_i)) \]

- Marginal benefit of health care
- Marginal cost of forgone consumption

Marginal benefit of medical spending
\[ u(c_i) \cdot H_m(m_i, \theta_i) - v_m(z_i, m_i, \theta_i) \]

Marginal cost of forgone consumption
\[ u'(c_i) \cdot H(m_i, \theta_i) \cdot (1 - s(z_i)) \]
Deriving the Optimal Policy: Key Concepts

- **Local welfare losses** of less generous health insurance policy:
  \[
  \frac{dW}{d(1 - s)} = - \bar{g}_m(Z')
  \]
  marginal social welfare weight of individuals in income group \(Z\)

- **Reduction in fiscal costs** of less generous insurance:
  \[
  \frac{dB}{d(1 - s)} = \left( \frac{s}{(1 - s)} \right) \left( \eta_m(s|Z') \right) + 1 \left( \bar{m}(Z') \right)
  \]
  elasticity of medical spending among group \(Z'\)
  avg medical spending among \(Z'\)

- Full Lagrangian Formulation
Optimal health care subsidy for income subgroup $z_i \in \mathcal{Z}'$:

$$s' = \frac{\bar{g}_m(\mathcal{Z}') - 1}{\bar{g}_m(\mathcal{Z}') - 1 + \eta(s'|\mathcal{Z}')}
$$

with $\bar{g}_m(\mathcal{Z}') = \frac{\int_{\mathcal{Z}'} g_i \cdot H_i \cdot m_i \, di}{\int_{\mathcal{Z}'} H_i \, di \int_{\mathcal{Z}'} m_i \, di}$

and $\eta(s'|\mathcal{Z}') = \frac{s \cdot \frac{d}{ds} \int_{\mathcal{Z}'} m_i \, di}{\int_{\mathcal{Z}'} m_i \, di}$

avg social welfare weight for low (or high) income group weighted by spending and health

elasticity of medical spending wrt coinsurance for low (or high) income group
Optimal Policy: Tax

- Optimal linear tax:

\[ \tau = \frac{1 - \bar{g}_z}{1 - \bar{g}_z + \xi_z} \]

with \( \bar{g}_z = \frac{\int_i g_i \cdot H_i \cdot z_i \, di}{\int_i H_i \, di \int_i z_i \, di} \) avg social welfare weight weighted by income and health and \( \xi_z = \frac{(1 - \tau) \int_i z_i \, di}{\int_i z_i \, di \cdot d(1 - \tau)} \) aggregate labor supply elasticity

- and the lump sum transfer is pinned town by the government budget constraint
Optimal Policy: Medicaid Eligibility Threshold

- Optimal “low-income eligibility” threshold $\hat{z}$ is

$$\tilde{g}_m(\hat{z}) = (\eta_m(s_H, s_L - s_H|\hat{z}) + 1)$$

with

$$\tilde{g}_m(\hat{z}) = \frac{\int_{\mathcal{M}} g_i H_i \cdot m_i \, dF_{m,z}(m_i|\hat{z})}{\int_{\mathcal{H}} g_i \cdot H_i \, di \int_{\mathcal{M}} m_i dF_{z,m}(m_i|\hat{z})}$$

avg social welfare weight
of individuals at the threshold

$$\eta_m(s_H, s_L - s_H|\Delta\hat{z}) = \frac{\int_{\mathcal{M}} \int_{\hat{z}}^{\hat{z}+\epsilon} m_i(s_L) \, dF_{z,m}(m_i|z_i) - \int_{\mathcal{M}} \int_{\hat{z}}^{\hat{z}+\epsilon} m_i(s_H) \, dF_{z,m}(m_i|z_i) \, dF_z(z_i)}{\int_{\mathcal{M}} \int_{\hat{z}}^{\hat{z}+\epsilon} m_i(s_H) \, dF_{z,m}(m_i|z_i) \, dF_z(z_i) \cdot (s_L - s_H)/s_L}$$

pairwise elasticity between $s_L$ and $s_H$ for individuals
near the threshold
Lagrangian formulation to the planner’s problem

\[
\mathcal{L} = \int_i \frac{g_i}{u'} \left( u(R + (1 - \tau)z_i - (1 - s(z))m_i)H_i(m_i, \theta_{it}, a_t) - v_i(z_i) \right) \, di
\]

\[
+ \lambda \left( \tau \int_i z_i \, di - R - \int_0 \hat{z} \int_0 \mathcal{M} s_L m_i \, dF_{zm}(m_i | z_i) dF_z(z_i) - \int_0 \hat{z} \int_0 \mathcal{M} s_H m_i \, dF_{zm}(m_i | z_i) dF_z(z_i) \right)
\]

subject to \( s, \tau \in [0, 1] \), and

- Labor supply as function of \( P \)

\[
z_i(P) \in \arg \max_z u(R + (1 - \tau)z_i - (1 - s)m_i)H(m_i, \theta_{i}) - v(z_i; \theta_{i})
\]

\[
z_{it} : H_i \cdot u'(c_i - v(z_i, \theta_{i})) \cdot (1 - \tau) - v'(z_i, \theta_{i}) = 0
\]

- Medical spending as function of \( P \)

\[
m_i(P) \in \arg \max_m u(R + (1 - \tau)z_i - (1 - s)m_i)H(m_i, \theta_{i}) - v(z_i, \theta_{i})
\]

\[
m_{it} : - u'(c_i) \cdot (1 - s)H(m_i, \theta_{i}) + u(c_i) \frac{dH(m_i, \theta_{i})}{dm_i} = 0
\]
Optimality Conditions: health care subsidy

The optimality condition for the two coinsurance rates is given by

\[
\left.\frac{d\mathcal{L}}{d(1-s)}\right|_{z_i \in \mathcal{Z}'} = \int_{\mathcal{Z}'} \int_{\mathcal{M}} \frac{g_i}{u'} \left( -u' \cdot (1-s)H_i + u \frac{dH_i}{dm_i} \right) - u' \cdot m_i H_i dF_{m,z} (m_i | z_i) dF_z (z_i)
\]

\[
\mathbf{= 0 \ by \ the \ envelope \ theorem}
\]

\[
\left( \frac{s}{(1-s)} \right) \eta_m (s | \mathcal{Z}') + 1 \right) = \frac{\int_{\mathcal{Z}'} \int_{\mathcal{M}} g_i \cdot m_{it} \cdot H_{it} dF_{m,z} (m_i | z_i) dF_z (z_i)}{\int_{\mathcal{Z}'} \int_{\mathcal{M}} m_{it} \cdot dF_{m,z} (m_i | z_i) dF_z (z_i)}
\]

Setting it equal to zero implies that

\[
\mathbf{\approx 0 \ labor \ market \ effects \ (local \ reform)}
\]
Optimality Conditions: payroll tax

- The optimality condition for the payroll tax is

\[
\frac{dL}{d(1-\tau)} = \int_i \frac{g_i}{u'} \left( H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it})(1-\tau) - v'_i(z_{it}, \theta_{it}) \right) \frac{dz_i}{d(1-\tau)} \, di \\
+ \int_i \frac{g_i}{u'} H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it} - v_i(z_{it})) \cdot z_i \, di \\
+ \lambda \left( \tau \int_i \frac{dz_i}{d(1-\tau)} \, di - \int_i z_i \, di \right) \right) \\
= \bar{z}(\frac{\tau}{1-\tau} \xi z - 1)
\]

- Setting it equal to zero implies that

\[
\left( \frac{\tau}{1-\tau} \xi z - 1 \right) = \frac{\int_i g_i H_{it}(m_{it}, \theta_{it}, a_t) \cdot z_i \, di}{\lambda \cdot \int_i z_i \, di} = \bar{g}_z \text{ at the optimum}
\]
Optimality Conditions: payroll tax

- The optimality condition for the payroll tax is

\[
\frac{dL}{d(1 - \tau)} = \int_i \frac{g_i}{u'} \left( H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it})(1 - \tau) - v'_i(z_{it}, \theta_{it}) \right) \frac{dz_i}{d(1 - \tau)} 
\]

\[= 0 \text{ by envelope theorem} \]

\[+ \int_i \frac{g_i}{u'} H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it} - v_i(z_{it})) \cdot z_i \, di \]

\[+ \lambda \left( \tau \int_i \frac{dz_i}{d(1 - \tau)} \, di - \int_i z_i \, di \right) - \lambda \int_i s(z_i) \frac{dm_i}{d(1 - \tau)} \, di \]

\[= \bar{z}(\frac{\tau}{1 - \tau} \xi_z - 1) \]

- If think ↑ marginal tax rate ↑ medical spending, could calibrate with income elasticity of medical spending \( \approx .7 \) (Acemoglu, Finklestein, Notowididgo, 2009)
Optimality Conditions: payroll tax

- Defining $\varepsilon_m$ aggregate income elasticity of medical spending

$$\frac{dL}{d(1-\tau)} = \int_i \frac{g_i}{u'} H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it} - v_i(z_{it})) \cdot z_i \, di$$

$$+ \lambda \left( \frac{d}{d(1-\tau)} \int_i dz_i \, di - \int_i z_i \, di \right) - \lambda \int_i s(z_i) \frac{dm_i}{d(1-\tau)} \, di$$

$$= \bar{z} (\frac{\tau}{1-\tau} \xi_z - 1) = \varepsilon_m \cdot \bar{m}$$

- Setting it equal to zero implies that

$$\left(1 - \frac{\tau}{1-\tau} \xi_z\right) + \underbrace{\varepsilon_m \cdot \bar{m}}_{\approx .7 \times .17 = .12} / \bar{z} = \frac{\int_i g_i H_{it}(m_{it}, \theta_{it}, a_t) \cdot z_i \, di}{\lambda \cdot \int_i z_i \, di} = \bar{g}_z$$

- Implies a slightly higher optimal tax rate (add income elasticity weighted by medical spending share)
The optimality condition for the transfer, $R$, pins down the multiplier, $\lambda$

$$\frac{d\mathcal{L}}{dR} = \int_i g_i H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it}) \, di - \lambda$$

$$\implies \lambda = \int_i g_i H_{it}(m_{it}, \theta_{it}, a_t) \, di$$
Optimality Conditions: Medicaid eligibility income threshold

Finally, the optimality condition for the safety net eligibility threshold, $\hat{z}$, is given by:

$$
\frac{dL}{d\hat{z}} = f(\hat{z}) \int_{\mathcal{M}|\hat{z}} g_i(u(R + (1 - \tau)z_i - (1 - s_H)m_i)H_i(m_i, \theta_{it}, a_t) - v_i(z_i)) dF_{zm}(m_i|\hat{z})
$$

$$
- f(\hat{z}) \int_{\mathcal{M}|\hat{z}} g_i(u(R + (1 - \tau)z_i - (1 - s_H)m_i)H_i(m_i, \theta_{it}, a_t) - v_i(z_i)) dF_{zm}(m_i|\hat{z})
$$

$$
+ \lambda \left( - \int_{\mathcal{M}} s_L m_i \ dF_{zm}(m_i|\hat{z}) + \int_{\mathcal{M}} s_H m_i \ dF_{zm}(m_i|\hat{z}) \right) f(\hat{z})
$$
### Elasticities of Medical Spending by Income Quintile

<table>
<thead>
<tr>
<th>Income Quintile</th>
<th>Coinsurance Rate</th>
<th>Average Out-of-Pocket Share</th>
<th>Avg Spending</th>
</tr>
</thead>
<tbody>
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<td>0.127</td>
<td>0.0857</td>
<td>$1,583.4</td>
</tr>
<tr>
<td></td>
<td>(0.164)</td>
<td>(0.159)</td>
<td>(182.3)</td>
</tr>
<tr>
<td>2nd</td>
<td>-0.224</td>
<td>-0.220</td>
<td>$1,471.3</td>
</tr>
<tr>
<td></td>
<td>(0.166)</td>
<td>(0.161)</td>
<td>(131.4)</td>
</tr>
<tr>
<td>3rd</td>
<td>-0.601***</td>
<td>-0.616***</td>
<td>$1,599.3</td>
</tr>
<tr>
<td></td>
<td>(0.136)</td>
<td>(0.132)</td>
<td>(113.7)</td>
</tr>
<tr>
<td>4th</td>
<td>-0.946***</td>
<td>-0.932***</td>
<td>$1,532.3</td>
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<tr>
<td></td>
<td>(0.126)</td>
<td>(0.124)</td>
<td>(98.57)</td>
</tr>
<tr>
<td>5th</td>
<td>-1.226***</td>
<td>-1.234***</td>
<td>$1,744.1</td>
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<tr>
<td></td>
<td>(0.124)</td>
<td>(0.125)</td>
<td>(132.4)</td>
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Note: Dependent variable in two regressions is log medical spending. Independent variables in logs. Regressions include location and month fixed effects.
### Tests for Equality in the Elasticities

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**Joint F-Test**

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<td><strong>4.83</strong></td>
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**p-value**

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<tr>
<td><strong>0.000</strong></td>
<td><strong>0.000</strong></td>
<td><strong>0.0001</strong></td>
<td><strong>0.0281</strong></td>
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</tr>
</tbody>
</table>

**Table:** Pairwise Parameter Tests for Equality in the Elasticity Estimates
Elasticities at different points of the price schedule

Pairwise Elasticity Estimates by Income Quintile

Health Care Subsidy Comparisons

- 100% vs 75%
- 100% vs 50%
- 100% vs 5%
- 75% vs 5%

1st Quintile
2nd Quintile
3rd Quintile
4th Quintile
5th Quintile
Health, Income, and Medical Spending

- Medical spending quite informative about an individual’s health state

![Graph showing the relationship between income decile and quality of life (QoL), with different markers for inpatient, outpatient, office, and zero spending.]
## MEPS Summary Statistics

<table>
<thead>
<tr>
<th>Income Quintile</th>
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<th>Second</th>
<th>Third</th>
<th>Fourth</th>
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<td>48.96</td>
<td>47.86</td>
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<tr>
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<td>0.374</td>
<td>0.439</td>
<td>0.477</td>
<td>0.524</td>
<td>0.599</td>
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<td>White</td>
<td>0.738</td>
<td>0.785</td>
<td>0.814</td>
<td>0.831</td>
<td>0.838</td>
</tr>
<tr>
<td>Black</td>
<td>0.160</td>
<td>0.141</td>
<td>0.117</td>
<td>0.0996</td>
<td>0.0711</td>
</tr>
<tr>
<td>Married</td>
<td>0.451</td>
<td>0.425</td>
<td>0.532</td>
<td>0.614</td>
<td>0.679</td>
</tr>
<tr>
<td>Education (years)</td>
<td>8.387</td>
<td>8.521</td>
<td>9.267</td>
<td>10.01</td>
<td>11.02</td>
</tr>
</tbody>
</table>

| Behavioral Risk Factors (shares) |          |          |          |          |          |
| Smoker                        | 0.198    | 0.194    | 0.173    | 0.138    | 0.0855   |
| BMI Obese                     | 0.278    | 0.287    | 0.301    | 0.304    | 0.265    |

| Comorbidity Factors |          |          |          |          |          |
| Asthma              | 0.136    | 0.118    | 0.0969   | 0.0925   | 0.0888   |
| Cancer              | 0.0979   | 0.148    | 0.126    | 0.118    | 0.127    |
| Diabetes            | 0.125    | 0.144    | 0.116    | 0.0975   | 0.0745   |
| Heart Attack        | 0.0488   | 0.0678   | 0.0488   | 0.0332   | 0.0268   |
| Charlson Score      | 0.326    | 0.391    | 0.287    | 0.237    | 0.226    |

N | 41,409 | 38,654 | 31,425 | 27,030 | 22,747
Estimation Algorithm 1/3

1. Specify the welfare weights

\[ g_i = (1 - H_i)^2 \quad \text{or} \quad g_i = \min \{ H_i z_i \} \]

2. Using appropriate survey estimation methods, estimate \( \bar{g}_z \)

\[ \bar{g}_z = \frac{\mathbb{E}[g_i \cdot \hat{H}_i \cdot z_i]}{\mathbb{E}[z_i] \cdot \mathbb{E}[g_i \cdot \hat{H}_i]} \]

3. Discretize income space into 100 bins (normalized to % Federal Poverty Line) and fix income threshold \( \hat{z} \) at each bin

4. Estimate \( \bar{g}_m^H, \bar{g}_m^L, \bar{g}_m(\hat{z}) \) for each bin, e.g.

\[ \bar{g}_m^L = \frac{\mathbb{E}[g_i \cdot \hat{H}_{it} \cdot m_i | z_i \leq \hat{z}]}{\mathbb{E}[m_i | z_i \leq \hat{z}] \cdot \mathbb{E}[g_i \cdot \hat{H}_{it}]} \]
Estimation Algorithm 2/3

5. Compute the optimal $s_L$ and $s_H$ for all possible $\hat{z}$

- $s_L$ and $s_H$ depend on the elasticities, $\eta_m(s|z_i \leq \hat{z})$ and $\eta_m(s|z_i > \hat{z})$
- Empirical elasticity estimate for quintile of that particular $\hat{z}$
  - (e.g. given a $\hat{z}$ in 15th pctile, use aggregate $\hat{\eta}$ from bottom RAND income quintile)
- Compute gradient at corners to determine existence of interior solution
  - Using RAND elasticity estimates at free care and 95%

- If gradient is positive at the upper bound: $s^* = 1$ (and if negative at lower bound $s^* = 0$)

- If interior solution exists: compute $s_L$ and $s_H$ for the three local pairwise elasticities (i.e. 100%, versus 75%, 75% versus 50%, and 50% versus 5%)

- Check that solution internally consistent
  - (e.g. if the $s_L$ estimated using the pairwise elasticity between 100% and 75% health care subsidy is equal to 60%, we reject that estimate of $s_L$)
6. Search over the space of $\hat{z}$ to recover optimal policy
   ▶ Estimate for each bin
   $$\bar{g}_m(\hat{z}) = \mathbb{E}[g_i \cdot m_i | z_i \in \text{pctl}(\hat{z})] / (\mathbb{E}[m_i | z_i \in \text{pctl}(\hat{z})] \cdot \mathbb{E}[g_i])$$
   ▶ For the elasticity, estimate all possible pairwise elasticities in the RAND data for each income quintile
     - Construct a four by four matrix, where the rows and columns index subsidies of 100%, 75%, 50%, or 25%
     - Find pairwise comparison in RAND experiment closest to the 'optimal' $s_L$ and $s_H$
     - Using estimates from the income quintile where the conjectured $\hat{z}$ lies

7. Calculate the optimal tax, $\tau$, using $\bar{g}_z$ and calibrating $\xi_z = .5$

8. Finally, obtain transfer $R$ from binding budget constraint