Health Insurance for Redistribution

Harvard Kennedy School: Health Equity Seminar

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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 ($\uparrow$ marginal utility)
  - Cost: distortionary taxation
- Public health insurance is also a large vehicle for redistribution
  - Transfer from ~~rich to poor~~ healthy $\rightarrow$ 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
  ▸ Across the globe ▸ Across states in the USA
- 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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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

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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 $\downarrow$ as health deteriorates
  (Finkelstein, Luttmer, and Notowidigdo, 2013)

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

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- Primitives: health type

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- Primitives: health type
- Individuals choose: medical spending

Individual Utility

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

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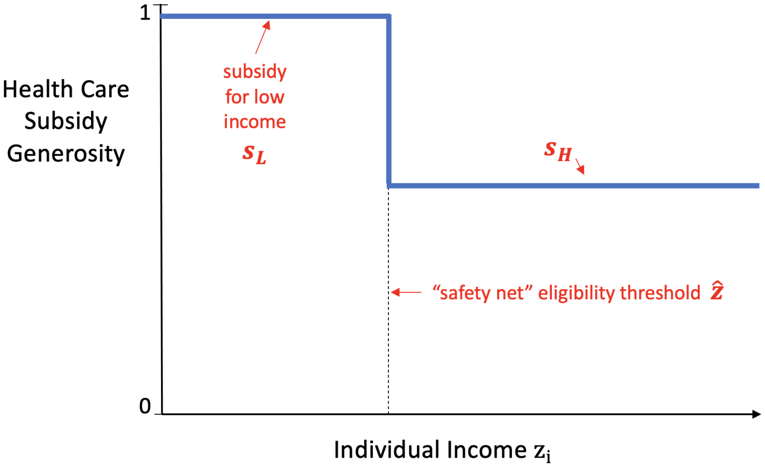
- Primitives: health type
- Individuals choose: medical spending, labor supply, and consumption

  ‣ Assumptions and formal utility function specification

Policy Instruments

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



▸ Across the globe ▸ Across states in the USA

Policy Instruments

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

$$s(m_i, z_i) = \begin{cases} \underbrace{(1 - s_L)}_{\substack{\text{coinsurance} \\ \text{for the poor}}} \cdot m_i & , z_i \leq \underbrace{\hat{z}}_{\substack{\text{income} \\ \text{eligibility} \\ \text{threshold}}} \\ \underbrace{(1 - s_H)}_{\substack{\text{coinsurance} \\ \text{for the rest}}} \cdot m_i & , \textit{otherwise} \end{cases}$$

- Income tax to finance

$$T(z_i) = \underbrace{\tau}_{\substack{\text{linear} \\ \text{tax}}} \cdot z_i + \underbrace{R}_{\substack{\text{lump-sum} \\ \text{transfer/tax}}}$$

Individual Utility

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

$$c_i \leq \underbrace{(1-\tau)z_i + R}_{\text{after-tax income}} - \underbrace{(1-s)m_i}_{\substack{\text{out-of-pocket} \\ \text{medical spending}}}$$

Welfare Objective

- Government chooses policy to maximize social welfare objective

$$W = \int_i G_i \cdot V_i(c_i, m_i, z_i)\ di$$

- Key concept: marginal social welfare weight

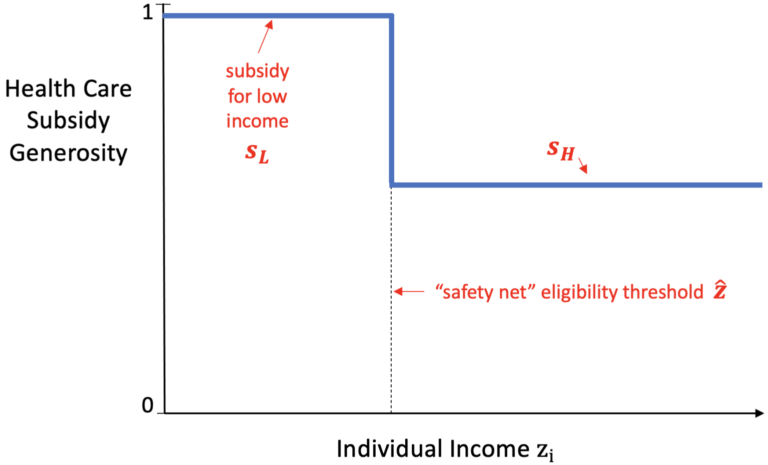
$$g_i \equiv \underbrace{G_i}_{\substack{\text{social weight} \\ \text{on individual } i}} \cdot \underbrace{u'(c) \cdot H(m_i, \theta_i)}_{\substack{\text{marginal utility} \\ \text{of consumption}}}$$

- Familiar cases:
  - Utilitarian: $G_i = 1$
  - Rawlsian: for $\min_i\{V_i\}$ $G_{\min} = 1$ 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?



- plus tax τ and transfer R to finance

Optimal Policy

- Government chooses subsidies and taxes to max social objective:
  - Weighted sum of individuals ▸ Formal statement
- Subject to incentive constraints:
  - Individuals choose medical spending, labor supply, and consumption optimally, given the policy ▸ Policy and labor supply ▸ Policy and medical spending
- 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

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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)

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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 ($s_H = 0$)

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  - Linear approximation: average marginal social welfare weight *for individuals around the threshold*

Policy Trade Offs: Eligibility Threshold

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- 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 $j = H, L$ ▸ Detail

$$s_j = \frac{\bar{g}_m^j - 1}{\underbrace{\bar{g}_m^j}_{\substack{\text{covariance} \\ g_i \text{ and } m_i}} - 1 + \underbrace{\eta_m^j}_{\substack{\text{elasticity of} \\ \text{medical spndg}}}}$$

- Tax ▸ Detail

$$\tau = \frac{1 - \bar{g}_z}{1 - \underbrace{\bar{g}_z}_{\substack{\text{covariance} \\ g_i \text{ and } z_i}} + \underbrace{\xi_z}_{\substack{\text{elasticity of} \\ \text{labor supply}}}}$$

- Threshold ▸ Detail

$$\underbrace{\bar{g}_m(\hat{z})}_{\substack{\text{covariance} \\ g_i \text{ and } m_i \\ \text{for } z_i = \hat{z}}} = \frac{s_L}{s_H} \cdot \underbrace{\eta_m(s_H, s_L - s_H | \hat{z})}_{\substack{\text{pairwise elasticity} \\ \text{between } s_L \text{ and } s_H \\ \text{for } z_i = \hat{z}}} + 1$$

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

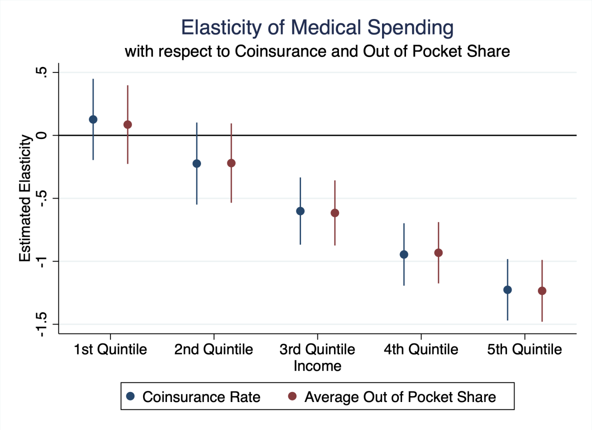
- RAND Health Insurance Experiment: large-scale field experiment conducted in the 1970's
  - random assignment of health insurance plan generosity (95%, 50%, 25%, or 0%)
- Empirical Framework:

$$\log(m_{i,y}) = \eta_q(\log(s_p) \times \mathbb{1}[z_i \in q]) \; + \beta_y + \beta_{l,t} + \epsilon_{i,y}$$

  - 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

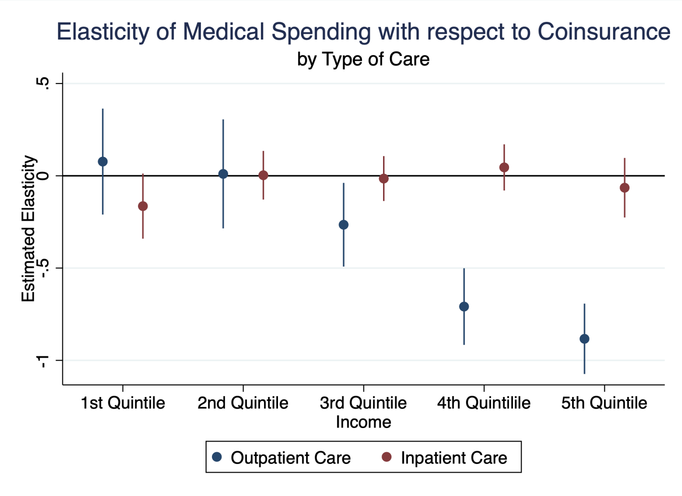
- Low-income individuals unlikely to over-consume care if it is free



▸ Table ▸ T-Tests for Equality in Elasticities

Elasticities by Inpatient (Hospital) and Outpatient (Office)

- Driven by outpatient care



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

	Income Quintile				
	Bottom	Second	Third	Fourth	Top
Health Status (percentage points relative to the mean)					
Self-reported, Overall	-1.81	-3.81	0.36	2.90	7.20
Mental Health	-2.31	-1.21	0.89	1.80	2.81
Physical Health	-1.97	-3.25	0.42	2.65	4.13
Components of Quality of Life (average share)					
Hearing Impairment	0.06	0.09	0.07	0.06	0.06
Writing Impairment	0.09	0.11	0.06	0.04	0.02
Health Limits Social Activity	0.12	0.13	0.07	0.05	0.04
Difficulty Lifting 10 lbs	0.15	0.17	0.09	0.06	0.04
Difficulty Crouching	0.17	0.21	0.15	0.09	0.02
Difficulty Reaching	0.13	0.16	0.09	0.06	0.04
N	41,409	38,654	31,425	27,030	22,747

Table: Summary Statistics by Income Quintile

More Summary Stats

Measuring H: Quality of Life

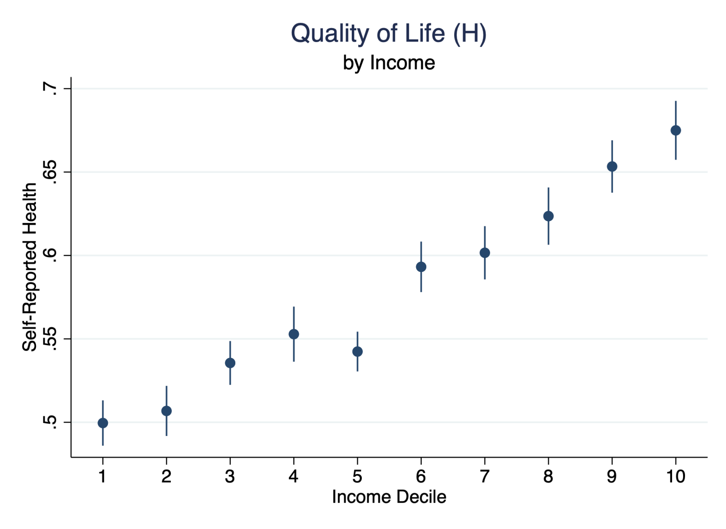
- QALYs literature
  - No universally accepted metric of health-related Quality of Life (Cutler et. al. 2022)
  - Usually measured in a series of "domains," including physical and mental functioning, role limitations, pain, and cognition
- Empirical framework used in health cost benefit analysis
  - Individuals i, year t, age, sex, race, blood pressure, education, smoking history, etc

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

- Idea: use $H_{it}^{self-reported}$ directly as measure of health in calculating welfare weights

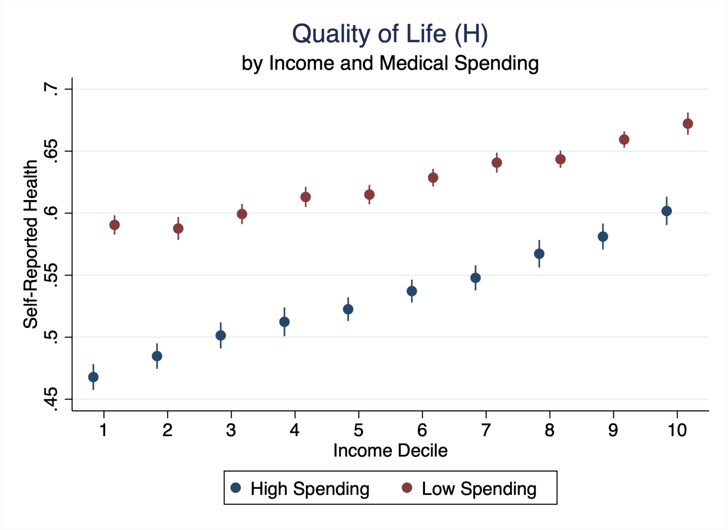
Health, Income, and Medical Spending

- Health disparities by income are evident in the raw data



Health, Income, and Medical Spending

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



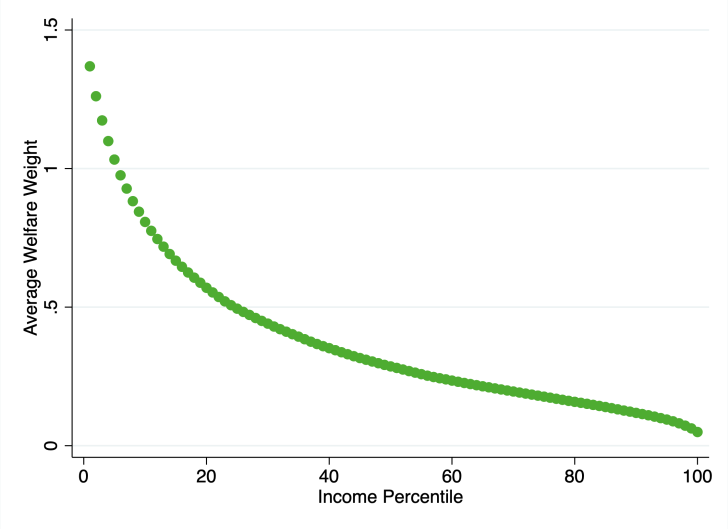
▸ Decomposed for Physical and Mental Health ▸ Residualized

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

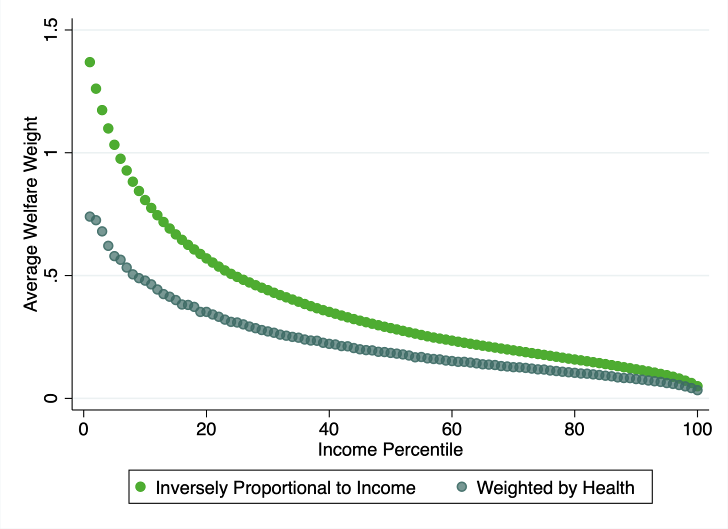
Average Welfare Weights by Income Percentile

- 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 $\implies g_i = H_i \cdot u'(c)$
  - 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

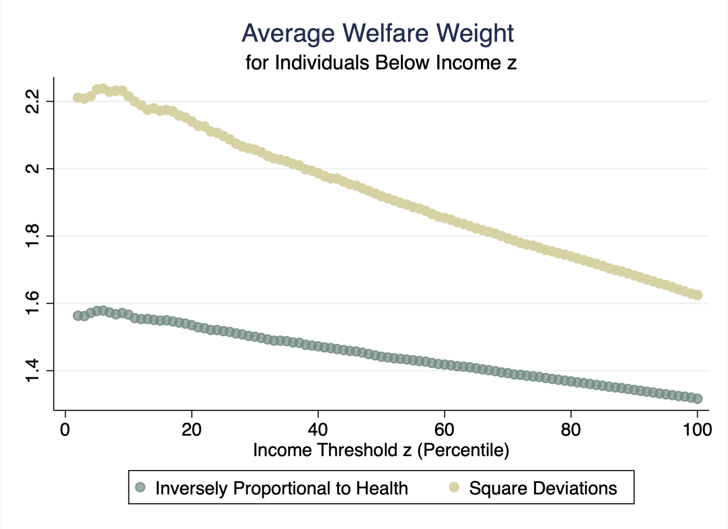
Alternative Welfare Objectives

- 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

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

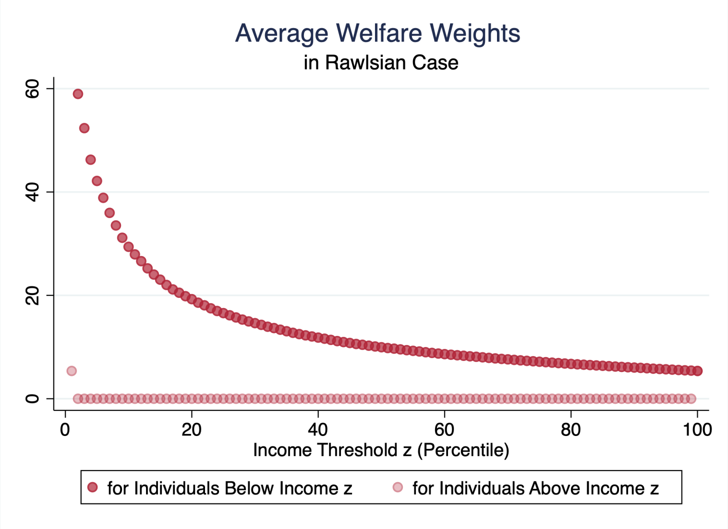
Covariance of health and medical spending

- 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 η_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 $j = H, L$

$$s_j = \frac{\bar{g}_m^j - 1}{\underbrace{\bar{g}_m^j}_{\substack{\text{covariance} \\ g_i \text{ and } m_i}} - 1 + \underbrace{\eta_m^j}_{\substack{\text{elasticity of} \\ \text{medical spndg}}}}$$

- Tax

$$\tau = \frac{1 - \bar{g}_z}{1 - \underbrace{\bar{g}_z}_{\substack{\text{covariance} \\ g_i \text{ and } z_i}} + \underbrace{\xi_z}_{\substack{\text{elasticity of} \\ \text{labor supply}}}}$$

- Threshold

$$\underbrace{\bar{g}_m(\hat{z})}_{\substack{\text{covariance} \\ g_i \text{ and } m_i \\ \text{for } z_i = \hat{z}}} = \frac{s_L}{s_H} \underbrace{\eta_m(s_H, s_L - s_H | \hat{z})}_{\substack{\text{pairwise elasticity} \\ \text{between } s_L \text{ and } s_H \\ \text{for } z_i = \hat{z}}} + 1$$

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
  - Detailed description

Optimal Policy Simulation

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

Table: Simulated Optimal Policy

Comparison to What Countries Use In Practice

	Income Eligibility Threshold for Health Care Safety Net		
	% FPL	Benefit	Universal Care
Australia	139%	Cap on drugs	✓
Canada	166%	Cap on drugs	✓
England	236%	Cap on drugs	✓
France	57.5%	All Care	✓
Israel	71%	Specialist Care	✓
Italy	105%	All Care	✓
Japan	190%	Reduced Coinsurance	✓
New Zealand	231%	Reduced Copays	✓
Taiwan	100%	All Care	.
Unites States	138%	All Care	X

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 $\downarrow$ earnings $\uparrow$ bankruptcies among working-age adults (Dobkin et. al. 2018)

Health Insurance Policy Across the Globe

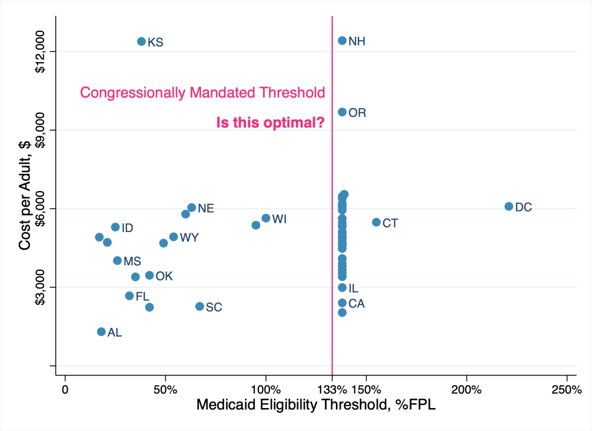
Country	*Health Insurance Safety Nets* For Low Income Individuals	For Sicker Individuals	For Children, Elderly, or Mothers	*Universal Care* For All Citizens
Australia	✓			✓
Canada	✓			✓
Denmark		T	C	✓
France	✓			✓
Germany			C	✓
Italy	✓	D & CC		✓
Japan	✓	CC		✓
Netherlands		D & CC	C	✓
New Zealand	✓			✓
Norway			C	✓
Singapore	✓			✓
Sweden			C & E	✓
Switzerland			C & M	✓
Taiwan	✓			✓
Unites States	✓	D & CC	C, M, & E	x

D=disabled, CC=chronic condition, T=terminally ill, C=children, E=elderly, M=mothers.

Back   Policy Instruments

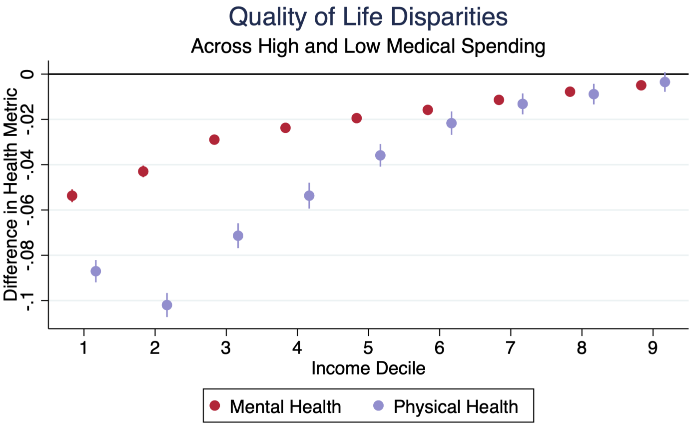
Public Health Insurance Across US States

- US public health insurance program: Medicaid
  - Administered by states
  - Substantial variation in where to draw the line



Back
Policy Instruments

Mental versus Physical Health Disparities



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.

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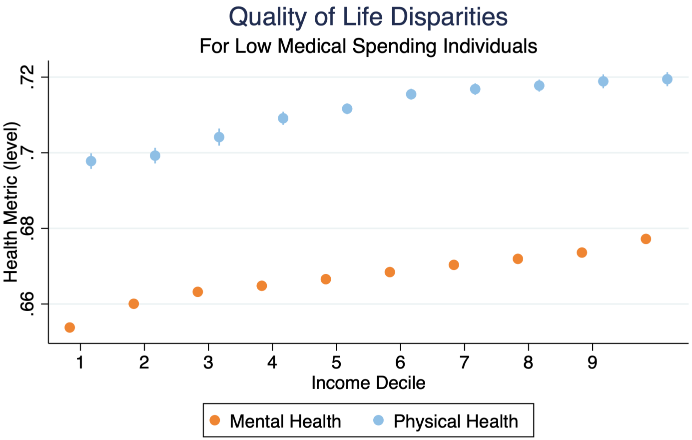
Mental versus Physical Health Disparities



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.

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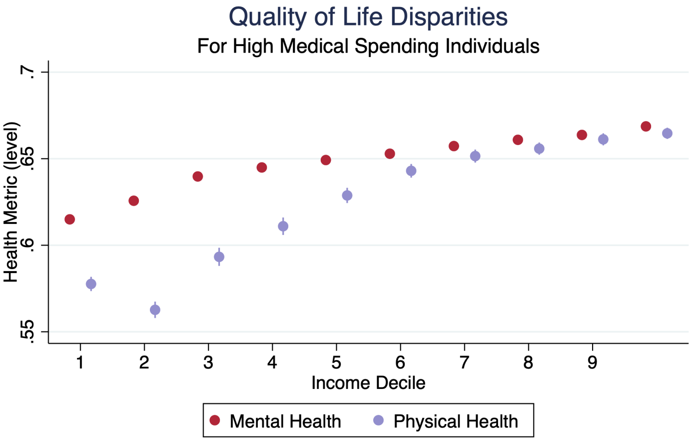
Mental versus Physical Health Disparities



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.

▸ Back

Consumption, Medical Spending, and Labor Supply

- Individuals i differ in underlying health type θ_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
  - $H(mi, \theta_i)$ increasing in m_i

Back

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

$$W(\overbrace{\tilde{P}}^{\text{arbitrary policy}} \mid \overbrace{P}^{\text{optimal policy}}) = \int_i \underbrace{g_i(H_i, z_i|P)}_{\text{generalized marginal social welfare weight}} \quad \underbrace{U_i(\tilde{P})}_{\text{money-metric utility at arbitrary policy } \tilde{P}} \quad di,$$

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

Back

Consumption and Labor Supply

- Consumption determined by the budget constraint:

$$c_i = \underbrace{(1-\tau)z_i + R}_{\substack{\text{after tax} \\ \text{income}}} - \underbrace{(1 - s(z_i))m_i}_{\substack{\text{out-of-pocket} \\ \text{medical expenditures}}}$$

- Labor z_i chosen optimally $\implies$

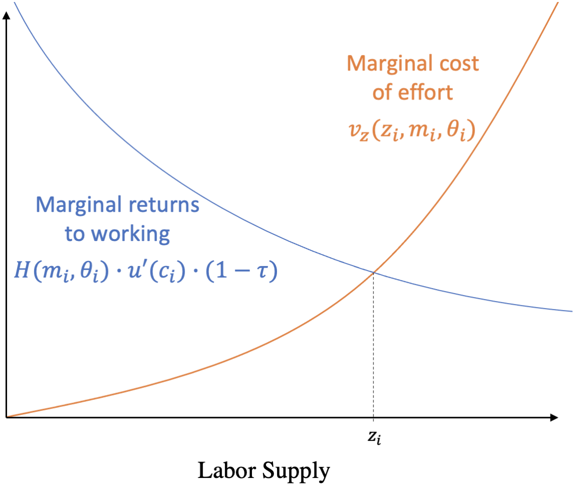
$$\underbrace{(1-\tau) \cdot u'(c_i) \cdot H(m_i, \theta_i)}_{\text{marginal returns to working}} = \underbrace{v_z(z_i, m_i, \theta_i)}_{\text{marginal cost of effort}}$$

- Returns to labor supply are:
  - $\uparrow$ in level of health and in medical expenditures
  - $\downarrow$ in the tax rate

Back

Labor Supply

$$\underbrace{(1-\tau)u_c(c_i)\cdot H(m_i,\theta_i)}_{\text{marginal returns to working}} - \underbrace{v_z(z_i,m_i,\theta_i)}_{\text{marginal cost of effort}} = 0$$



Medical Spending Decision

- Medical spending m_i chosen optimally $\implies$

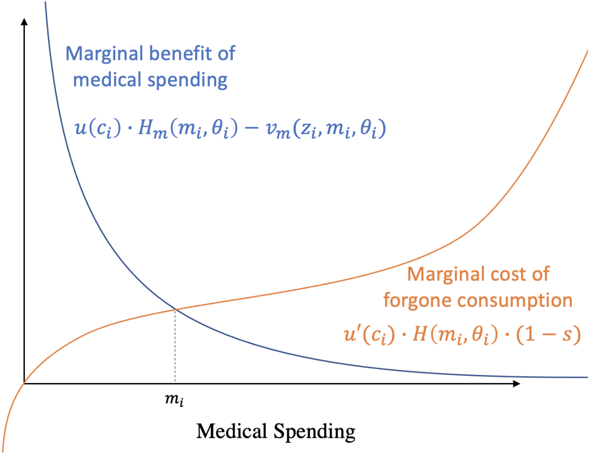
$$\underbrace{u(c_i) \cdot H_m(m_i, \theta_i) - v_m(z, m, \theta)}_{\text{marginal benefit of health care}} = \underbrace{u_c(c_i) \cdot H(m_i, \theta_i) \cdot (1 - s(z_i))}_{\text{marginal cost of forgone consumption}}$$

- 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

$$\underbrace{u(c_i)\cdot H_m(m_i,\theta_i) - v_m(z,m,\theta)}_{\text{marginal benefit of health care}} = \underbrace{u'(c_i)\cdot H(m_i,\theta_i)\cdot(1-s(z_i))}_{\text{marginal cost of forgone consumption}}$$



Back

Deriving the Optimal Policy: Key Concepts

- Local **welfare losses** of less generous health insurance policy:

$$\frac{dW}{d(1-s)} = - \underbrace{\bar{g}_m(\mathcal{Z}')}_{\substack{\text{marginal social welfare} \\ \text{weight of individuals in} \\ \text{income group } \mathcal{Z}}}$$

- **Reduction in fiscal costs** of less generous insurance

$$\frac{dB}{d(1-s)} = \left(\frac{s}{(1-s)} \underbrace{\eta_m(s|\mathcal{Z}')}_{\substack{\text{elasticity of medical} \\ \text{spending among group } \mathcal{Z}'}} +1 \right) \underbrace{\bar{m}(\mathcal{Z}')}_{\text{avg medical spending among } \mathcal{Z}'}$$

- Full Lagrangian Formulation

Optimal Policy: Coinsurance

- 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 $\bar{g}_m(\mathcal{Z}') = \underbrace{\frac{\int_{\mathcal{Z}'} g_i \cdot H_i \cdot m_i \; di}{\int_{\mathcal{Z}'} H_i di \int_{\mathcal{Z}'} m_i \; di}}_{\substack{\text{avg social welfare weight} \\ \text{for low (or high) income group} \\ \text{weighted by spending and health}}}$ and $\eta(s'|\mathcal{Z}') = \underbrace{\frac{s \cdot \frac{d \int_{\mathcal{Z}'} m_i di}{ds}}{\int_{\mathcal{Z}'} m_i di}}_{\substack{\text{elasticity of medical} \\ \text{spending wrt coinsurance} \\ \text{for low (or high) income group}}}$

Full Optimality Condition Back

Optimal Policy: Tax

- Optimal linear tax:

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

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

- and the lump sum transfer is pinned town by the government budget constraint

Full Optimality Condition Back

Optimal Policy: Medicaid Eligibility Threshold

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

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

with

$$\bar{g}_m(\hat{z}) = \underbrace{\frac{\int\limits_{\mathcal{M}} g_i H_i \cdot m_i \; dF_{m,z}(m_i|\hat{z})}{\int_i g_i \cdot H_i di \int\limits_{\mathcal{M}} m_i dF_{z,m}(m_i|\hat{z})}}_{\substack{\text{avg social welfare weight} \\ \text{of individuals at the threshold}}}$$

$$\eta_m(s_H, s_L - s_H|\Delta\hat{z}) = \underbrace{\frac{\int\limits_{\hat{z}}^{\hat{z}+\epsilon} \int\limits_{\mathcal{M}} m_i(s_L) dF_{z,m}(m_i|z_i) - \int\limits_{\mathcal{M}} m_i(s_H) dF_{z,m}(m_i|z_i) dF_z(z_i)}{\int\limits_{\hat{z}}^{\hat{z}+\epsilon} \int\limits_{\mathcal{M}} m_i(s_H) dF_{z,m}(m_i|z_i) dF_z(z_i) \cdot (s_L - s_H)/s_L}}_{\substack{\text{pairwise elasticity between } s_L \text{ and } s_H \text{ for individuals} \\ \text{near the threshold}}}$$

▸ Full Optimality Condition ▸ Back

Lagrangian formulation to the planner's problem

$$\mathcal{L} = \int_i \frac{g_i}{u'} (u(\underbrace{R + (1-\tau)z_i - (1-s(z))m_i}_{=c_i}) H_i(m_i, \theta_{it}, a_t) - v_i(z_i)) \; di$$

$$+ \lambda \left(\tau \int_i z_i di - R - \int_0^{\hat{z}} \int_{\mathcal{M}} s_L m_i \; dF_{zm}(m_i|z_i) dF_z(z_i) - \int_{\hat{z}}^{Z} \int_{\mathcal{M}} s_H m_i \; dF_{zm}(m_i|z_i) dF_z(z_i) \right)$$

- 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

$$m_i(P) \in \arg\max_m \; u(R + (1-\tau)z_i - (1-s)m_i)H(m_i, \theta_i) - v(z_i, \theta_i)$$

$$m_{it} : - u'(c_i) \cdot (1-s)H(m_i, \theta_i) + u(c_i) \frac{dH(m_i, \theta_i)}{dm_i} = 0$$

Back

Optimality Conditions: health care subsidy

- The optimality condition for the two coinsurance rates is given by

$$\left.\frac{d\mathcal{L}}{d(1-s)}\right|_{z_i\in\mathcal{Z}'} = \int_{\mathcal{Z}'}\int_{\mathcal{M}} \frac{g_i}{u'}\underbrace{\left(\left(-u'\cdot(1-s)H_i + u\frac{dH_i}{dm_i}\right)\frac{dm_i}{d(1-s)}\right.}_{=0 \text{ by the envelope theorem}} - u'\cdot m_i H_i dF_{m,z}(m_i|z_i)dF_z(z_i)$$

$$+\lambda\left(\frac{s}{(1-s)}\underbrace{\frac{-(1-s)\int_{\mathcal{Z}'}\int_{\mathcal{M}} m_i\frac{dm_i}{d(1-s)}di}{\int_i m_i dF_{m,z}(m_i|z_i)dF_z(z_i)}}_{\substack{\eta_m(s|\mathcal{Z}') \text{ the elasticity of medical} \\ \text{spending among group } \mathcal{Z}'}}+1\right)\underbrace{\int_{\mathcal{Z}'}\int_{\mathcal{M}} m_i dF_{m,z}(m_i|z_i)dF_z(z_i)}_{\bar{m}(\mathcal{Z}') \text{ avg medical spending among } \mathcal{Z}'}$$

$$+\lambda\tau \underbrace{\int_i \frac{dz_i}{d(1-s)}}_{\approx 0 \text{ labor market effects (local reform)}}$$

- Setting it equal to zero implies that

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

▸ Back

Optimality Conditions: payroll tax

- The optimality condition for the payroll tax is

$$\frac{d\mathcal{L}}{d(1-\tau)} = \int_i \frac{g_i}{u'} \left(\underbrace{H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it})(1-\tau) - v_i'(z_{it}, \theta_{it})}_{=0 \text{ by enveope theorem}} \right) \frac{dz_i}{d(1-\tau)} \; di$$

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

$$+ \lambda \underbrace{\left(\tau \int_i \frac{dz_i}{d(1-\tau)} \; di - \int_i z_i \; di \right)}_{=\bar{z}(\frac{\tau}{1-\tau}\xi_z - 1)}$$

- Setting it equal to zero implies that $\left(\frac{\tau}{1-\tau}\xi_z - 1\right) = \frac{\int_i g_i H_{it}(m_{it}, \theta_{it}, a_t) \cdot z_i \; di}{\lambda \cdot \int_i z_i di} = \bar{g}_z$ at the optimum

Back Income effects?

Optimality Conditions: payroll tax

- The optimality condition for the payroll tax is

$$\frac{d\mathcal{L}}{d(1-\tau)} = \int_i \frac{g_i}{u'} \left(\underbrace{H_{it}(m_{it},\theta_{it},a_t)\cdot u'(c_{it})(1-\tau) - v_i'(z_{it},\theta_{it})}_{=0 \text{ by enveope theorem}} \right) \frac{dz_i}{d(1-\tau)}\ di$$

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

$$+ \underbrace{\lambda\left(\tau \int_i \frac{dz_i}{d(1-\tau)}\ di - \int_i z_i\ di\right)}_{=\bar{z}(\frac{\tau}{1-\tau}\xi_z - 1)} - \underbrace{\lambda \int_i s(z_i)\frac{dm_i}{d(1-\tau)} di}_{\text{income effects?}}$$

- If think ↑ marginal tax rate ↑ medical spending, could calibrate with income elasticity of medical spending ≈.7 (Acemoglu, Finklestein, Notowididgo, 2009)

Optimality Conditions: payroll tax

- Defining ε_m^I aggregate income elasticity of medical spending

$$\frac{d\mathcal{L}}{d(1-\tau)} = \int_i \frac{g_i}{u'} H_{it}(m_{it}, \theta_{it}, a_t) \cdot u'(c_{it} - v_i(z_{it})) \cdot z_i \; di$$
$$+ \lambda \underbrace{\left(\tau \int_i \frac{dz_i}{d(1-\tau)} \; di - \int_i z_i \; di \right)}_{=\bar{z}(\frac{\tau}{1-\tau}\xi_z - 1)} - \lambda \underbrace{\int_i s(z_i) \frac{dm_i}{d(1-\tau)} di}_{=\varepsilon_m^I \cdot \bar{m}}$$

- Setting it equal to zero implies that
$\left(1 - \frac{\tau}{1-\tau}\xi_z\right) + \underbrace{\varepsilon_m^I \cdot \bar{m}/\bar{z}}_{\approx .7x.17=.12} = \frac{\int_i g_i H_{it}(m_{it}, \theta_{it}, a_t) \cdot z_i \; di}{\lambda \cdot \int_i z_i di} = \bar{g}_z$ at the optimum

- Implies a slightly higher optimal tax rate (add income elasticity weighted by medical spending share)

Back

Optimality Conditions: lump-sum transfer/premium

- The optimality condition for the transfer, R, pins down the multiplier, λ

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

$$\implies \lambda = \int_i g_i H_{it}(m_{it}, \theta_{it}, a_t)\ di$$

Back

Optimality Conditions: Medicaid eligibility income threshold

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

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

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

$$+ \lambda \left(- \int\limits_{\mathcal{M}} s_L m_i \; dF_{zm}(m_i|\hat{z}) + \int\limits_{\mathcal{M}} s_H m_i \; dF_{zm}(m_i|\hat{z}) \right) f(\hat{z})$$

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Elasticities of Medical Spending by Income Quintile

	Elasticities		Avg Spending
Income Quintile	*Coinsurance Rate*	*Average Out-of-Pocket Share*	
1st	0.127	0.0857	$1,583.4
	(0.164)	(0.159)	(182.3)
2nd	-0.224	-0.220	$1,471.3
	(0.166)	(0.161)	(131.4)
3rd	-0.601***	-0.616***	$1,599.3
	(0.136)	(0.132)	(113.7)
4th	-0.946***	-0.932***	$1,532.3
	(0.126)	(0.124)	(98.57)
5th	-1.226***	-1.234***	$1,744.1
	(0.124)	(0.125)	(132.4)

Note: Dependent variable in two regressions is log medical spending. Independent variables in logs. Regressions include location and month fixed effects.

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Tests for Equality in the Elasticities

	Income Quintile			
	Bottom	Second	Third	Fourth
		p-values		
Second	0.103			
Third	0.000	0.041		
Fourth	0.000	0.000	0.0213	
Top	0.000	0.000	0.000	0.0281
Joint F-Test	18.89	13.52	9.56	4.83
p-value	0.000	0.000	0.0001	0.0281

Table: Pairwise Parameter Tests for Equality in the Elasticity Estimates

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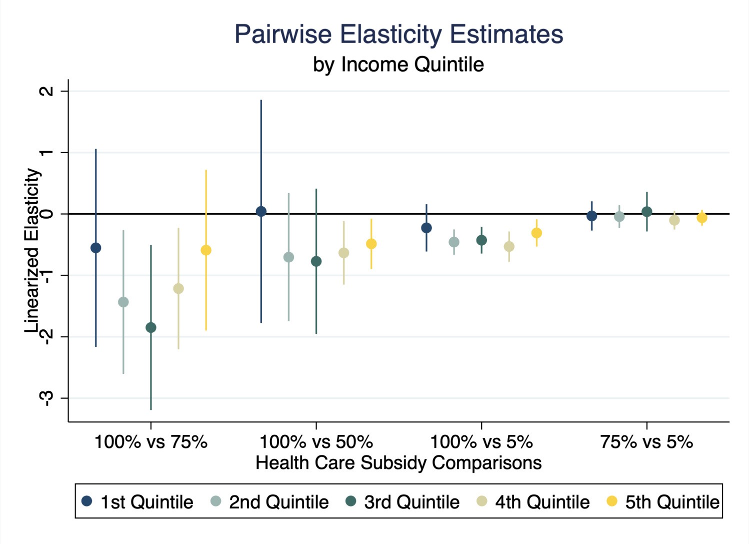
Elasticities at different points of the price schedule



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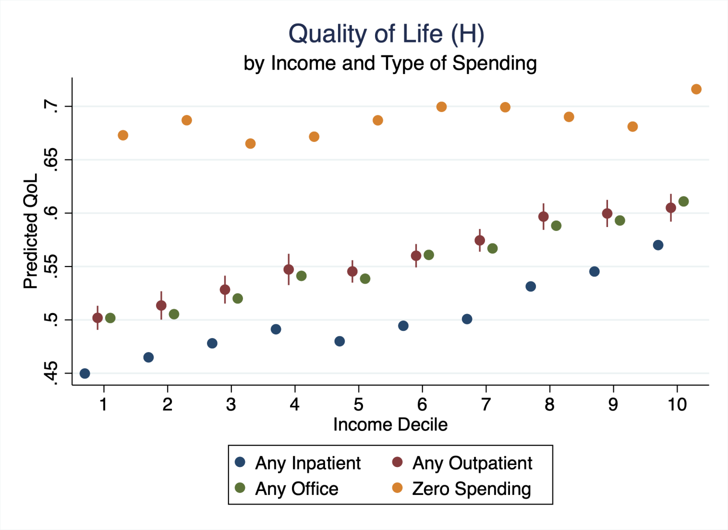
Health, Income, and Medical Spending

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



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MEPS Summary Statistics

	Income Quintile				
	Bottom	Second	Third	Fourth	Top
Sociodemographics					
Age	41.53	48.96	47.86	48.11	49.93
Male	0.374	0.439	0.477	0.524	0.599
White	0.738	0.785	0.814	0.831	0.838
Black	0.160	0.141	0.117	0.0996	0.0711
Married	0.451	0.425	0.532	0.614	0.679
Education (years)	8.387	8.521	9.267	10.01	11.02
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

Back

Estimation Algorithm 1/3

1. Specify the welfare weights

$$g_i = (1 - H_i)^2 \qquad \text{or} \qquad g_i = \min\{H_i z_i\}$$

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 pariwise elasticity between 100% and 75% health care subsidy is equal to 60%, we reject that estimate of s_L)

Estimation Algorithm 3/3

6. Search over the space of $\hat{z}$ to recover optimal policy
   - Estimate for each bin $\bar{g}_m(\hat{z}) = \mathbb{E}[g_i \cdot m_i | z_i \in pctile(\hat{z})] / (\mathbb{E}[m_i | z_i \in pctile(\hat{z})] \cdot \mathbb{E}[g_i])$
   - 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, τ, using $\bar{g}_z$ and calibrating $\xi_z = .5$
8. Finally, obtain transfer R from binding budget constraint

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