The hidden effects of health insurance*

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Abstract

This paper studies how health insurance inequality affects health inequality. To do this, I first develop a general equilibrium overlapping generations model with incomplete markets, heterogeneous agents, and endogenous health that is consistent with several features of the U.S. health insurance system. I then use the model to study the effects of switching from the current health insurance system to a tax-financed universal health insurance system. I find that health inequality is lower and average health is higher in the economy with universal health insurance. Consequently, I find that switching to universal health insurance would lead to lower medical spending, increased life expectancy, and higher labor productivity.

J.E.L. codes: To be completed.

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1 Introduction

This paper studies how health insurance inequality affects health inequality. The paper is motivated by three observations. First, there exists substantial heterogeneity in health by income. To illustrate, individuals at the top of the income distribution can expect to live 12.3 years longer than individuals at the bottom of the income distribution (Chetty et al., 2016). Second, low-income individuals are less likely to have health insurance. As an example, more than 27 percent of people in the bottom income quintile did not have health insurance in 2010. In contrast, less than 5 percent of people in the top income quintile in 2010 were uninsured. Third, there exists large disparities in health behavior by income. In particular, smoking, drinking, lack of exercising, and unhealthy eating, all of which have been shown to affect mortality and medical spending risk, are more prevalent among low-income individuals.

I start by developing a general equilibrium overlapping generations model with incomplete markets and heterogeneous agents that can account for these facts. Agents in the model differ along the dimensions of age, health, assets, labor productivity, medical spending, and health insurance coverage. While shocks to labor productivity are uninsurable, medical spending shocks are partially insurable in the form of Medicare, Medicaid, and private health insurance. I follow Dalgaard and Strulik (2014) and model health as an accumulation of health deficits. The agent's stock of health deficits affects her survival probability, labor earnings, and medical spending risk. The law of motion for health deficits is endogenous and depends on the agent's health behavior. In particular, agents can slow the rate of accumulation of health deficits through costly (in terms of foregone leisure) investments in health behavior such as exercising.

*Preliminary and incomplete.

Note that health insurance has no direct effect on an individual's health in the model. This follows from the assumption that the law of motion for health deficits only depend on health behavior. That said, health insurance still indirectly affects an individual's health through its effect on health behavior. On the one hand, by providing partial insurance against medical spending risk, health insurance might discourage healthy behavior. On the other hand, health insurance increases future expected consumption. The corresponding rise in the agent's continuation value might encourage healthy behavior since it increases the probability of survival.

I estimate the model using data from the Medical Expenditure Panel Survey (MEPS) and the Health and Retirement Study (HRS). These datasets provide individual-level longitudinal data on various health measures, medical spending, insurance coverage, and demographics. Building on work in gerontology, I approximate an individual's stock of health deficits by her frailty index, which measures how many disabilities and diseases a person has (Searle et al., 2008). This frailty index can then be used to estimate the effect of health deficits on longevity, medical spending risk, and labor earnings directly from the data.

I then study how inequality in insurance coverage affects health inequality by comparing the distribution of health in the benchmark model described above with the distribution of health in an alternative model with tax-financed universal health insurance. Preliminary results show that health inequality is lower under universal health insurance. This follows from the observation that average consumption is higher in the model with universal health insurance, which in turn incentivize low-income individuals to invest more in health behavior to increase the probability of survival. Although high-income individuals respond to the increased tax burden needed to finance the universal health insurance system by investing less in health behavior, the effect is quantitatively small relative to the effect on low-income individuals. As a result, health inequality is lower and average health is higher under universal health insurance. Lastly, I find that the increase in average health leads to lower medical spending, increased life expectancy, and higher labor productivity.

2 Relation to the literature

To be completed.

3 Model

The following subsections present the benchmark model used in the analysis. The model is a discrete time, general equilibrium, overlapping generations model with ex-ante heterogeneous consumers, where consumers differ in age, health deficits, assets, medical expenditures, labor productivity, and health insurance status.

3.1 Technology

Firms hire labor at wage w and rent capital at rate r from the consumers to maximize profits. I assume that the aggregate technology can be represented by a constant returns to scale Cobb-Douglas production function:

$$Y = \theta K^{\alpha} N^{1-\alpha}, \tag{1}$$

where θ denotes total factor productivity, K is the aggregate capital stock, N denotes aggregate labor supply (measured in efficiency units), and α is capital's share of income. Output is used for consumption,

C, investment, $I = K' - (1-\delta)K$, and to cover medical expenses, M:

$$C + M + K' = \theta K^{\alpha} N^{1-\alpha} + (1-\delta)K, \tag{2}$$

where δ is the rate of depreciation.

3.2 Agents

The economy is populated by a continuum of ex-ante heterogeneous agents. Agents are indexed by type $s = (j, a, \xi, \eta, i, h)$, where j denotes age, a is assets, ξ denotes medical expenditures, η is labor productivity, i is the consumer's private health insurance status, and h denotes health deficits. Throughout I let $\Phi(s)$ denote the measure of agents of type s.

Medical expenditures are stochastic and depend on the agent's current medical expenses, age, and health deficits. It follows a finite-state Markov process with stationary transitions over time:

$$Q_{j,h}(\xi, X) = Prob\left(\xi' \in X \,:\, (\xi,\, j,\, h)\right). \tag{3}$$

Similarly, labor productivity is given by a stationary finite-state Markov process:

$$Q(\eta, E) = Prob\left(\eta' \in E \,:\, \eta\right). \tag{4}$$

Next, the agent's insurance status specifies whether or not she purchased private health insurance in the preceding period. Lastly, h denotes the agent's stock of health deficits. The evolution of deficits is endogenous and depends on the individual's health behavior. In particular, agents can slow the rate of accumulation of deficits through investments in health behavior, e :

$$h' = F(h, j, e). \tag{5}$$

Agents are endowed with one unit of time that can be allocated to work, leisure, and health behavior. The period-by-period return function is denoted by $U(c, e, \ell)$, where c denotes consumption and ℓ denotes labor supply. Starting at age j_r, all agents receive Social Security benefits, SS, and health insurance from the government in the form of Medicare. All agents face a survival probability ψ_{jh} that depends on their age and health deficits. Agents that survive until age J die with probability one. In the event of death, the agent's assets are uniformly distributed across the population by means of lump-sum transfers, B.

3.3 Health insurance and government welfare programs

This section presents the different types of health insurance that are available in the economy. Health insurance is available in the form of private health insurance, Medicare, and Medicaid. The government also run a welfare program that combines institutional features of food stamps, disability insurance, and basic medical relief (for brevity, referred to as food stamps below). The agent's insurance status determines what fraction of her medical expenses must be paid out-of-pocket. Throughout, I let χ_P, χ_{CARE}, and χ_{CAID} denote the copayment parameter for private health insurance, Medicare, and Medicaid, respectively.

Medicare provides health insurance to all agents aged jr and older. Medicaid, on the other hand, is a means-tested program that provides health insurance to the poor. Consistent with program rules, I model two ways to qualify for Medicaid. First, agents are eligible for Medicaid if the sum of their gross income and interest earnings is below a threshold y^{cat}. Second, agents also qualify for Medicaid if the sum of their gross income and interest earnings net of out-of-pocket medical expenses is below a threshold y^{mn} and their assets are less than a^{mn}. I refer to the two eligibility criteria as "categorical eligibility" and "eligibility based on medical need," respectively.

Agents can purchase private health insurance for the following period. I let private insurance companies price-discriminate based on age, health deficits, and current medical expenditures. I assume the price is actuarially fair for each insurance pool (j, h, ξ). This gives the following insurance premium:

$$\pi_{jh\xi} = \begin{cases} \frac{\psi(j,h)(1-\chi_P)\int \xi' Q_{j,h}\left(\xi, d\xi'\right)}{(1+r')} & \text{if } j < j_r - 1 \\ \\ \frac{\psi(j,h)(1-\chi_P)\chi_{CARE}\int \xi' Q_{j,h}\left(\xi, d\xi'\right)}{(1+r')} & \text{if } j \geq j_r - 1. \end{cases} \tag{6}$$

Finally, the government provides health insurance in the form of a combined food stamps and basic medical relief program. To qualify for this program in the model, consumers have to forfeit all assets. In return, the government pays for all out-of-pocket medical expenses and guarantees a minimum consumption level, $\underline{c}$.

3.4 Agent problem

The agent's choice set depends on her age. Throughout, I use the word *young* to denote agents less than age j_r and *old* to denote agents that are at least j_r years old.

3.4.1 Young agents

Recall that a consumer's type is given by $s = (j, a, \xi, \eta, i, h)$, where j denotes age, a is assets, ξ denotes medical expenditures, η is labor productivity, i is the consumer's private health insurance status, and h denotes health deficits. Let $V^y(s)$ denote the value of young agents that do not choose to go on food stamps. Similarly, let $V^F(s)$ denote the value of food stamps. Agents then solve the following problem:

$$V(s) = \max \ \left\{V^y(s), V^F(s)\right\}, \tag{7}$$

where $V^y(s)$ is given by

$$\begin{aligned}
V^y(s) \quad = & \quad \max_{c,e,a',\ell,i'} U(c,e,\ell) + \beta\psi_{jh} \iint V(s')Q(\eta, d\eta')\, Q_{j,h}(\xi, d\xi') \\
\text{s.t.} \quad & c + a' + m_{op}(\xi, i) + \mathbb{I}_{i'=i_P}\pi_{jh\xi} = w\epsilon_{jh}\eta\ell(1-\tau) \\
& \qquad + (1+r)(a+B) + \mathbb{I}_{Med}(s,\ell)(1-\chi_{CAID})\, m_{op}(\xi, i) \\
& h' = F(h, j, e) \\
& m_{op}(\xi, i) = \mathbb{I}_{i=i_P}\chi_P\xi + (1 - \mathbb{I}_{i=i_P})\xi \\
& 0 \le e + \ell \le 1 \\
& i' \in \{i_S, i_P\} \\
& c, a' \ge 0
\end{aligned} \tag{8}$$

Here, $i = i_P$ means the consumer has private health insurance, and $i = i_S$ means the consumer is self-insured. The indicator function, $\mathbb{I}_{Med}(s,\ell)$, equals one if the consumer qualifies for Medicaid. Medicaid covers a share $1 - \chi_{CAID}$ of out-of-pocket medical expenses, $m_{op}(\xi, i)$, which are given by ξ for self-insured agents and $\chi_P\xi$ for agents with that purchased private health insurance in the preceeding period. Lastly, labor earnings depend on the agent's stochastic labor productivity, η, and deterministic life cycle productivity, ϵ_{jh}, the last of which varies with age and health deficits.

Alternatively, the agent can go on food stamps. To qualify for food stamps in the model, agents have to forfeit all assets and work zero hours. In return, the government covers all medical expenses and provides the agent with consumption $\underline{c}$. The value of food stamps is thus given by

$$\begin{aligned}
V^F(s) \quad = & \quad \max_{e} U(\underline{c}, e, 0) + \beta\psi_{jh} \iint V(s')Q(\eta, d\eta')\, Q_{j,h}(\xi, d\xi') \\
\text{s.t.} \quad & h' = F(h, e) \\
& i' = i_S \\
& a' = 0
\end{aligned} \tag{9}$$

3.4.2 Old agents

Let $V^o(s)$ denote the value of old agents. They solve the following problem:

$$V(s) = \max \left\{V^o(s), V^F(s)\right\}, \tag{10}$$

where $V^o(s)$ is given by

$$\begin{aligned} V^o(s) \quad = \quad & \max_{c,e,a',\ell,i'} \; U(c,e,\ell) + \beta\psi_{jh} \iint V(s')Q(\eta,d\eta')\,Q_{j,h}(\xi,d\xi') \\ \text{s.t.} \quad & c + a' + m_{op}(\xi,i) + \mathbb{I}_{i'=i_P}\pi_{jh\xi} = SS + w\epsilon_{jh}\eta\ell(1-\tau) \\ & \qquad\qquad + (1+r)(a+B) + \mathbb{I}_{Med}(s,\ell)(1-\chi_{CAID})\,m_{op}(\xi,i) \\ & h' = F(h,j,e) \\ & m_{op}(\xi,i) = \mathbb{I}_{i=i_P}\chi_{CARE}\chi_P\xi + (1-\mathbb{I}_{i=i_P})\chi_{CARE}\xi \\ & 0 \le e+\ell \le 1 \\ & i' \in \{i_S, i_P\} \\ & c, a' \ge 0 \end{aligned} \tag{11}$$

All consumers start receiving Medicare and Social Security benefits at age jr. Neither program is tied to retirement, and hence agents continue to receive both Medicare and Social Security benefits even if they choose to work in old age. Out-of-pocket medical expenses are given by $\chi_{CARE}\xi$ for agents that did not purchase private health insurance in the preceeding period and $\chi_{CARE}\chi_P\xi$ for agents with private health insurance. Note that the elderly are allowed to work. Lastly, the value of going on food stamps is as described earlier.

3.5 Government

Let b denote the Social Security replacement rate. Social Security benefits SS then satisfy

$$SS = \frac{bwN}{\int \Phi\left(\{1,\ldots,j_r-1\} \times dh \times da \times d\xi \times d\eta \times di\right)}. \tag{12}$$

The government finances its costs of providing health insurance, food stamps, and Social Security by means of proportional labor taxes. For simplicity, I assume that the government balances its budget period-by-period. Let *gov* denote the total government expenditure on health insurance and food stamps (what about government expenditure?). Labor taxes then have to satisfy

$$\tau wN = SS \int \Phi\left(\{j_r,\ldots,J\} \times da \times d\eta \times d\xi \times di \times dh\right) + gov. \tag{13}$$

3.6 Definition of equilibrium

Given a replacement rate b, copayment parameters χ_P, χ_{CARE}, and χ_{CAID}, and initial conditions for capital K_1 and the measure of types Φ_1, an *equilibrium* in this model is a sequence of model variables such that:

1. Given prices, insurance premia, government policies, and accidental bequests, agents maximize utility subject to their constraints.

2. Factor prices satisfy marginal product pricing conditions.

3. Government policies satisfy the government budget constraint.
4. Goods, factor, and insurance market clearing conditions are met.
5. Aggregate law of motion for Φ is induced by the policy functions and the exogenous stochastic processes for idiosyncratic risk.

4 Data and calibration

To be completed.

5 Model validation

To be completed.

6 Results

To be completed.

7 Conclusion

To be completed.