

Implications of Health Care Reform for Inequality and Welfare*

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Abstract

Among those who are neither eligible for public health insurance nor offered employer-provided insurance in the United States, more than three-fourths are uninsured. This paper examines how upcoming health care reform aiming to increase insurance coverage affects savings and welfare. I develop a heterogeneous-agent life-cycle model of insurance choice in which households face medical expenditure risk in addition to uninsurable income risk. The existence of an uninsured population reflects limited liability in the medical services market and actuarially unfair premiums in the health insurance market. I estimate key structural parameters so that the model broadly replicates the joint distribution of insurance coverage by age, health, earnings and wealth across active participants in the individual insurance market. I then use the model to explore the implications of the Affordable Care Act which prohibits insurers from price-discriminating based on health risk and mandates the purchase of insurance. I find that the health care reform induces wealth accumulation among the uninsured poor who no longer take advantage of limited liability, leading to lower wealth inequality. The reform also generates welfare gains for the rich who are less exposed to risk, but welfare losses for the poor who lose the benefit of access to free emergency care.

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1 Introduction

This paper examines how health care reform affects health insurance coverage, savings and welfare. Medical expenditure is a major source of risk. However, in the United States among those who are neither eligible for public health insurance nor offered employer-provided insurance, more than three-fourths are uninsured. In order to expand insurance coverage in the private health insurance market, the Affordable Care Act (ACA) introduces guaranteed issue and community rating regulations that prevent insurers from rejecting or price-discriminating against applicants on the basis of health status. The Act also mandates holding insurance and provides means-tested price subsidies. This study explores the implications of these reforms for participation in private health insurance markets, individual saving behavior, and distribution of welfare gains and losses.

To understand the implications of health insurance reform, I first develop a heterogeneous-agent life-cycle model that incorporates idiosyncratic income and health risk, as well as key features of the current U.S. insurance system. I then estimate structural parameters so that the model replicates the current insurance coverage pattern in the data. Finally, using the calibrated model as a laboratory, I conduct an experiment of implementing the ACA to investigate the effects of the health insurance reform.

Households in the model face a combination of idiosyncratic income and health risk. They are also subject to medical expenditure shocks. Poor health translates into higher expected medical expenses, and lower expected future income. The model also captures the following key features of the current U.S. insurance system. A small fraction of individuals of working age are covered by Medicaid. The rest can buy private health insurance either from their employer, if employer-sponsored insurance is offered, or directly from an insurance company. Employer-sponsored group insurance is not risk-rated and a large fraction of the premium is paid by the employer. In contrast, in the individual health insurance market the insurance company is allowed to price-discriminate based on health status and age.

I assume fixed costs of issuing health insurance which capture the combined effects of

administrative and screening costs, and translate into premiums that exceed actuarially fair values. This drives some rich and/or healthy agents to choose to be uninsured. I also model the provision of U.S. federal law which requires hospitals to treat individuals in urgent need of medical attention, regardless of ability to pay (Emergency Medical Treatment and Active Labor Act). As a result some poor individuals choose to be uninsured because they anticipate receiving free care in the event of a large negative health shock. This free rider problem due to limited liability leads to uncompensated care costs to the hospital, and to make up these costs, the hospital charges those who can pay more for the services provided, resulting in higher insurance premiums (Gruber (2008))¹.

I calibrate a joint stochastic process for earnings, health status, medical expenses, and availability of public and employer-provided insurance using panel data from the Survey of Income and Program Participation (SIPP) and the Medical Expenditure Panel Survey (MEPS). The process for health status and medical expenses varies with insurance status, to capture the idea that the insured enjoy easier access to primary care. I then estimate the key structural parameters – the degree of risk aversion and the fixed costs of issuing health insurance – so that the model broadly replicates the current insurance coverage pattern in the U.S. Specifically, the model replicates the joint distribution of insurance coverage by age, health, earnings and wealth of active participants in the individual insurance market – the population that is neither eligible for public health insurance nor offered employer-provided insurance, the target population of the policy reform. The resulting estimates show that risk aversion is in the range of the standard models but relatively low (1.23), and the fixed costs of issuing insurance are high and constitute 26% of the average premium. I then conduct a decomposition exercise in which I assess the relative importance in accounting for low current coverage rates of (i) high fixed costs in the insurance market, (ii) relatively low risk aversion within the pool of potential buyers of insurance, and (iii) limited liability in the

¹Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007) document that household bankruptcy generates a mark-up in the medical service market. The mechanism whereby the uninsured population and the free rider problem generate negative externalities in the form of higher premiums in this paper is similar to Smith and Wright (1992) who study automobile insurance markets.

health services market.

With a diagnosis of what ails the current insurance market in hand, I move to assess whether the ACA is an appropriate remedy. In particular, I use the model to examine the implications of the two key provisions in the ACA aiming to expand the coverage rate in the individual health insurance market. First, community rating together with guaranteed issue prohibits insurers from rejecting or price-discriminating against applicants based on health status, and creates a pool of risks in the individual insurance market. Second, to avoid adverse selection problems, the ACA penalizes those without health insurance, and establishes health insurance exchanges that provide insurance premium subsidies for individuals with income up to 400% of the poverty line².

The counter-factual experiment of implementing the ACA delivers three sets of quantitative results. First, the reform substantially increases the participation rate in the individual insurance market, from 22.9% to 88.1%. It reduces the mark-up in the medical services market due to uncompensated care, because the number of people who take advantage of the free care substantially decreases. Those who remain uninsured tend to be wealth rich, have moderate income, and be in good health. This group is well positioned to self-insure expenditure shocks, and faces an especially actuarially unfair premium due to community rating on top of administrative costs. The higher aggregate coverage results in an improvement in the average health status among the working age population because more people have access to primary care. Nevertheless the fraction of aggregate health spending in GDP increases by 0.3 percentage points because of a significant increase in the usage of primary care.

Second, wealth inequality decreases: the Gini coefficient of the active participants declines from 0.653 to 0.634. The uninsured poor – the major users of free care before the reform – are mostly insured after the reform. Once they no longer fear that any savings

²Some states have already introduced similar types of regulations. For example, Maine, Massachusetts, Vermont, and Washington introduced modified community rating that prohibits insurers from risk-rating applicants based on health. New Jersey and New York enacted pure community rating that bans any price-discrimination. Massachusetts also has mandated health insurance holdings since 2006.

could be lost to pay for health care expenses, they have stronger incentive to accumulate savings. Thus they are no longer trapped at the bottom of the wealth distribution. On the other hand, as the reform provides easier access to private insurance when having an adverse health or income shock, it effectively reduces the risk exposure of the rich, discouraging precautionary saving. Therefore, the wealth accumulation increases among the poor and decreases among the rich.

Third, the reform generates a significant welfare gain on average for the active participants of the individual insurance market (equivalent to 0.2% of consumption). More than 50% of them are in favor of the reform. The unhealthy and those with low income tend to gain thanks to the direct transfers associated with community rating and income-tested premium subsidies. However, because the reform forces those with little or no wealth to obtain insurance rather than take advantage of limited liability, they experience overall welfare losses. In contrast, the wealth rich tend to experience welfare gains, because the reform makes it easier to access to insurance when one's health deteriorates and/or one is hit by a negative income shock.

The contribution of this paper is threefold. First, this paper is one of the first quantitative macroeconomic studies to tackle the issue of the large uninsured population in the United States, using a dynamic general equilibrium incomplete markets model with heterogeneous agents in the tradition of [Bewley \(1986\)](#), [Imrohoroglu \(1989\)](#), [Huggett \(1993\)](#), and [Aiyagari \(1994\)](#). Specifically, I explicitly incorporate the two main explanations for the large uninsured population proposed in [Gruber \(2008\)](#), i.e., actuarial unfairness in the U.S. insurance market, and implicit insurance through uncompensated care. I then estimate the individual risk attitudes and the fixed costs of issuing health insurance from the observed pattern of the insurance coverage in the U.S. Understanding why the U.S. has such a large uninsured population is an important prerequisite for studying the implications of upcoming health care reform.

The second contribution of this paper is that, departing from the literature, I carefully

estimate a process for eligibility for public health insurance jointly with the other shocks using panel data on income, health status, and insurance status. This is important because existing papers that analyze the effect of the health care reform using macroeconomic models assume – counterfactually – that low income guarantees public insurance eligibility. Thus those models generate too few low income households in the pool of the uninsured, the target population of the reform (Jeske and Kitao (2009), Janicki (2011), Jung and Tran (2011), Hansen, Hsu, and Lee (2012), Pashchenko and Porapakkarm (forthcoming))³. In contrast, my model successfully replicates the income and wealth distribution within the uninsured population. This further allows me to investigate the welfare effects of the reform on the population with different characteristics – age, earnings, health status and wealth.

The third contribution is that I show that the free care option due to limited liability distorts the savings decision of the poor. A similar mechanism is proposed in Hubbard, Skinner, and Zeldes (1995) who study the role of social insurance on savings and document that the social safety net discourages low income households from savings. I show that limited liability in the medical services market plays the same role as the social safety net in their model, and poor households are trapped at the bottom of the wealth distribution by a similar mechanism. I then analyze the effect of the reform on this margin, showing that higher insurance coverage potentially weakens this distortion and reduces wealth inequality. This linkage between higher insurance coverage and lower wealth inequality is not typically present in the existing papers that assume income-tested public health insurance before the policy reform and hence exhibit no change in the insurance status of low income households before and after the reform.

This paper contributes to the growing literature that incorporates idiosyncratic health risks over the life-cycle into the incomplete market model with heterogeneous agents and

³In the United States, poverty alone does not guarantee eligibility for public insurance. Individuals must also fall into a specific eligibility category such as veterans, pregnant women, the disabled, parents of the eligible child. Specifically, in 43 states, adults without any dependent child can never qualify for Medicaid even if they are penniless. Among the active participants with income in the bottom quartile, i.e., those who are automatically eligible for Medicaid in the existing papers, 82.3% are uninsured and 75.3% are not having any dependent child in the SIPP data.

analyzes households' insurance decision. The paper by [Jeske and Kitao \(2009\)](#) is the first work that has endogenous health insurance decision built into the standard incomplete market model. They analyze the policy implications of tax benefits for the employer-provided health insurance. [Attanasio, Kitao, and Violante \(2010\)](#) study the effect of Medicare reform in a heterogeneous-agent economy. [Hansen, Hsu, and Lee \(2012\)](#) investigate the effect of introducing Medicare Buy-in that allows people of age 55 to 64 to purchase Medicare. Other quantitative papers that incorporate health production in the incomplete market model include [Zhao \(2011\)](#), [Jung and Tran \(2011\)](#), [He and Huangy \(2012\)](#), and [Cole, Kim, and Krueger \(2012\)](#).

The closest paper to this study is the recent work by [Pashchenko and Porapakarm \(forthcoming\)](#) who build a rich model of insurance and labor participation choice, and analyze the welfare implications of the policy reform similar to this paper⁴. The main innovation of my paper relative to theirs is the focus here on replicating the current pattern of insurance coverage, which allows for a sharper characterization of the effects of the reform on savings, insurance purchase and welfare for actual U.S. participants in the individual insurance market. [Pashchenko and Porapakarm \(forthcoming\)](#) model the discrete labor supply decision from which this paper abstracts and find a reduction in the aggregate labor participation after the reform, although the main driving force of this change is not the tax distortion associated with the redistributive policy change but the Medicaid expansion in their model.

This paper also contributes to the literature that studies precautionary savings in response to health risks. [Kotlikoff \(1989\)](#) argues that idiosyncratic health shocks can have a large effect on saving behavior. [Kopecky and Koreshkova \(2011\)](#) investigate how medical and nursing home expenses affect the savings of the wealthy. [De Nardi, French, and Jones](#)

⁴Unlike [Pashchenko and Porapakarm \(forthcoming\)](#), this paper does not consider the effect of the Medicaid expansion proposed in the ACA. The reason is because the ACA originally planned to expand Medicaid to people with income up to 133% of the federal poverty line. However, in 2012, the Supreme Court ruled that participation in the Medicaid expansion is voluntary for states. Hence, the eligibility would vary across states. In fact, five states have already announced that they would decline to participate. Also, because of this, there is still the potential for the eligibility condition to be altered before becoming effective. Therefore, I do not analyze this policy change in this paper.

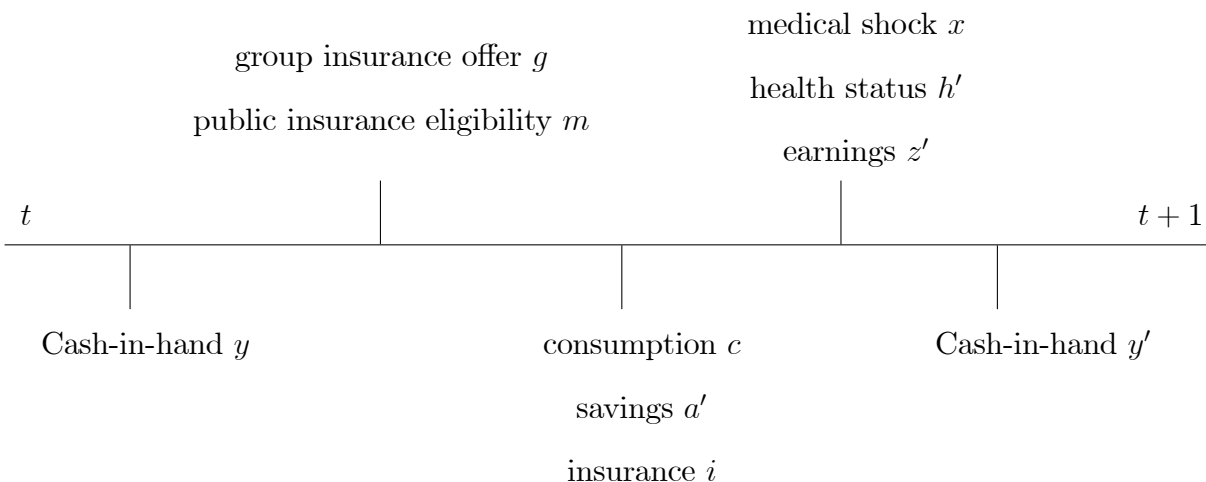
(2010) study the effect of uncertainty about longevity and health expenditures on the saving behavior of the elderly.

2 Dynamic Model of Insurance Choice

I describe the heterogeneous-agent life-cycle model of insurance choice in a stationary economic environment to account for the *pre-Act* situation in the United States. In the model, households face a combination of idiosyncratic income and health risk. They are also subject to medical expenditure shocks. They have two ways to bear these risks: obtaining health insurance and accumulating assets.

2.1 Economic environment

The timing of the economy is illustrated in the following figure and described in detail below.



Demographics

Time is discrete. There are J overlapping generations of households of equal measure in the economy. Households enter the labor market at age $j = 0$, retire at $j = J_R$ and die at $j = J$ with certainty.

Health Status

Households face uncertainty about their health status h and it takes one of the two values, $h \in \mathbb{H} \equiv \{good, bad\}$. The health status evolves stochastically according to the Markov chain $\Gamma_h(h'|h, j, i)$ whose evolution depends on the current health status h , age j and insurance status i . The dependence of Γ_h on the insurance status captures the fact that households with health insurance have access to *primary care* in the U.S. that improves their health status. This is a reduced-form notion of health production that is originally considered in [Grossman \(1972\)](#), and having health insurance and hence receiving primary care are interpreted as health investment.

Medical Services

Medical treatment is non-discretionary. The medical shock $x \in \mathbb{X} \subseteq \mathbb{R}_+$ conceptually comprises two types of care, *urgent care* and *primary care*. The urgent care corresponds to urgent medical attention, including emergency care, whereas the primary care corresponds to all treatments that improve one's health outcome such as preventive care, treatments of diabetes and kidney dialysis treatment. Only insured people have access to the primary care, for in the United States hospitals can and often do decline treatment of the uninsured unless it is urgent. Therefore, the random medical shocks x are from the distribution that depends on insurance status i as well as health status h , and age j , i.e., $\Pi(x|h, j, i)$. The persistence in medical shocks is captured by the persistence in health status. For an amount of medical care x , households are charged qx by the medical service provider, where $q \geq 1$ is the mark-up of the medical services, which is described in [Section 2.3](#).

Earnings

Households obtain labor earnings of $w\varepsilon z$ every period, where $w \in \mathbb{R}_+$ is the market wage, $\varepsilon \in \mathbb{R}_+$ is the age-dependent labor efficiency, and $z \in \mathbb{R}_+$ is the idiosyncratic labor productivity shock. The age-dependent labor efficiency ε captures the hump-shaped labor productivity

over the life-cycle and evolves deterministically. On the other hand, z evolves stochastically according to the Markov chain $\Gamma_z(z'|z, h')$ that depends on the previous productivity z and the health status in the same period h' . Healthy people are more likely to be productive.

Insurance

There are three types of health insurance for the working age population in this economy: public insurance (i.e., Medicaid), employer-provided group insurance and individual insurance. Households are randomly assigned Medicaid eligibility, but those with low income and/or in poor health are more likely to be eligible for Medicaid. This captures the fact that Medicaid is designed for designated eligibility categories such as the disabled, pregnant women and low income parents, but poverty alone does not guarantee eligibility. Specifically, the eligibility for Medicaid $m \in \{0, 1\}$ is stochastic and follows the Markov chain $\Gamma_m(m'|m, z', h')$. Also, Medicaid is free.

When households are not eligible for Medicaid, they can purchase private health insurance before the medical shock realizes. Employer-provided group insurance is available only if it is offered by the employer, while individual insurance is available for everybody. They both have the same reimbursement schedule, but differ in the premium $p \in \mathbb{R}_+$. In the United States, group plans benefit from tax-deductibility of the premium and the employer's contribution, which is implicitly captured through the premium p in the model. The employer-provided group insurance offer $g \in \{0, 1\}$ is stochastic and follows the Markov chain $\Gamma_g(g'|g, z')$. Note that the process depends on the realization of the labor productivity z' . More precisely, the higher is the labor income, the higher is the probability of the group plan being offered.

If employer-provided group insurance is not offered by the employer, households choose whether to purchase private insurance from the individual insurance market. Individual insurance have the same reimbursement schedule as employer-provided group insurance, but agents need to pay premium p on their own. The premium is described in Section 2.4.

After the retirement age J_R , all households are covered by the Medicare which is assumed to be free for simplicity.

The reimbursement schedule is given by a function λ . That is, given an amount of the medical shock qx and an insurance plan, the function λ determines the fraction of qx that is reimbursed to the agent by the insurance plan. The insurance plan is either private insurance or public insurance for the working age population, and Medicare for the retired population.

Social Security and Government

After the retirement, households get Social Security benefit $ss \in \mathbb{R}_+$ in each period. The government imposes a proportional tax τ on the labor income of the working age population in order to finance the Social Security benefit in addition to Medicaid and Medicare.

2.2 Household Problem

Households choose consumption, savings and insurance status to maximize their lifetime utility:

$$\mathbb{E}_0 \sum_{j=0}^J \beta^j u(c_j).$$

I separate the problem into the working age problem and the after-retirement problem. I construct these household problems in a recursive fashion.

Working Age Problem

The timing is as follows. Households start a period with cash-in-hand, $y \in \mathbb{R}_+$. They observe the group insurance offer $g \in \{0, 1\}$ and Medicaid eligibility $m \in \{0, 1\}$. Next, households make decisions about consumption $c \in \mathbb{R}_+$, savings $a' \in \mathbb{R}_+$, and insurance status $i \in \{0, 1\}$. Then, the medical shock $x \in \mathbb{R}_+$ is realized. Finally, the new health status $h' \in \mathbb{H}$ and idiosyncratic labor productivity $z' \in \mathbb{R}_+$ are given, and tomorrow's cash-in-hand y' is determined with which households enter next period. See also the figure in Section 2.1.

The determination of y' reflects limited liability in the medical services market. Suppose a household faces the medical bill of qx . A fraction determined by a function λ is covered if insured, and the residual represents out-of-pocket expenses. If the household's asset holdings after earning interest $(1+r)a'$ are not large enough to settle the out-of-pocket medical expenditure, then it pays as much as it can, and is exempted from the remaining charge. Therefore, the asset holdings net of medical expenditure is determined by $\max\{(1+r)a' - (1 - \lambda(qx, m)i)qx, 0\}$. Note that the reimbursement schedule $\lambda : \mathbb{R}_+ \times \{0, 1\} \rightarrow [0, 1]$ is a function of the size of the medical expenditure and the types of the insurance, i.e., $m = 0$ or 1. Then, y' is given by the sum of this term and the current income, that is,

$$y' = \max\{(1+r)a' - (1 - \lambda(qx, m)i)qx, 0\} + (1 - \tau)wz'\varepsilon'.$$

Note that even when households go into medical bankruptcy, they can keep the income in the same period, which is consistent with U.S. law (Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007)).

I define the joint state vector of the working age problem as $s = (j, z, g, m, h) \in \mathbb{S}$ where $j \in \{0, \dots, J_R - 1\}$ stands for the household's age. Then the recursive formulation of the working age problem is given by

$$\left\{ \begin{array}{l} V(y, s) = \max_{c \geq 0, a' \geq 0, i \in \{0, 1\}} u(c) + \beta \mathbb{E}V(y', s') \\ \text{s.t.} \quad c + a' = y - ip(s), \\ y' = \max\{(1+r)a' - [1 - \lambda(qx, m)i]qx, 0\} + (1 - \tau)wz'\varepsilon_{j+1}. \end{array} \right. \quad (1)$$

The expectation is described as the product of $\Gamma_{ss'}^i$ and $\Pi_{s,x}^i$ where

$$\begin{aligned} \Gamma_{ss'}^i &= \Gamma_h(h'|h, j, i) \Gamma_z(z'|z, h') \Gamma_m(m'|m, z', h') \Gamma_g(g'|g, z'), \\ \Pi_{s,x}^i &= \Pi(x|h, j, i). \end{aligned}$$

Note that the insurance premium is a function of the state variable, $p : \mathbb{S} \rightarrow \mathbb{R}_+$.

After-retirement Problem

After the retirement age J_R , households get Social Security benefit ss and are covered by Medicare. They die at age J and there is no bequest. Then the recursive formulation of the after-retirement problem is given by

$$\left\{ \begin{array}{l} V(y, h, j) = \max_{c \geq 0, a' \geq 0} u(c) + \beta \mathbb{E}V(y', h', j + 1) \\ \text{s.t.} \quad c + a' = y, \\ y' = \max\{(1 + r)a' - [1 - \lambda(qx)]qx, 0\} + ss. \end{array} \right. \quad (2)$$

with $V(\cdot, \cdot, J + 1) = 0$. The expectation is described as the product of $\Gamma_h(h'|h, j)$ and $\Pi(x|h, j)$ ⁵. Also the dependence of the reimburse schedule λ on m is suppressed because all the retired people are covered by Medicare.

2.3 Medical Service Sector

I assume a competitive medical service sector and hence zero profits. The medical service technology transforms one unit of the composite good into one unit of medical services.

U.S. federal law requires hospitals to treat individuals in urgent need of medical attention, regardless of ability to pay (Emergency Medical Treatment and Active Labor Act). This free rider problem of limited liability leads to uncompensated care costs to the hospital, and to make up these costs, hospital charge those who can pay more for the services provided (Gruber (2008)). However, this cost shift is borne almost exclusively by private insurance providers through the medical services market (Stoll and Bailey (2009)). This is because the Medicare and Medicaid programs use restrictive and inflexible reimbursement schedules. I therefore assume that the medical services market for Medicaid and Medicare holders is

⁵These are degenerated (conditional) distributions of $\Gamma_h(h'|h, j, i)$ and $\Pi(x|h, j, i)$ when $i = 1$.

separated from that for private insurance holders and the uninsured, and the uncompensated amounts in those markets are paid for by the government through the Medicaid and Medicare Disproportionate Share Hospital payments. See 2.6 for details.

Hospitals charge a mark-up $q \geq 1$ for the supply of medical services x .

Hospital Revenue

Suppose a patient with resources $(1+r)a'$ is charged the amount qx . Suppose further he is uninsured. He pays the entire bill if he can, and if not, he just pays as much as possible. Thus the hospital revenue from the treatment of this uninsured agent is

$$\min\{(1+r)a', qx\}.$$

Now suppose he has insurance. Then again he pays the out-of-pocket expenditure if he can, and otherwise, he just pays as much as possible. The insurer pays the amount specified in the plan, $\lambda(qx)qx$, where the dependence of the reimbursement schedule λ on m is suppressed because here I am considering the private insurance provider only, i.e., $m = 0$. Thus the hospital revenue from the treatment of this insured agent is

$$\begin{aligned} & \underbrace{\min\{(1+r)a', [1-\lambda(qx)]qx\}}_{\text{Payment by the patient}} + \underbrace{\lambda(qx)qx}_{\text{Payment by the insurer}} \\ &= \min\{(1+r)a' + \lambda(qx)qx, qx\}. \end{aligned}$$

Therefore, in sum, the hospital revenue from the treatment of a patient is

$$\begin{aligned} & \underbrace{(1-i)\min\{(1+r)a', qx\}}_{\text{Uninsured patient}} + \underbrace{i\min\{(1+r)a' + \lambda(qx)qx, qx\}}_{\text{Insured patient}} \\ &= \min\{(1+r)a' + i\lambda(qx)qx, qx\}. \end{aligned}$$

Hospital's Break Even

The hospital's break even condition balances the cost and benefit of the medical services. The break even within the medical services market of the working age population without public health insurance coverage becomes

$$\underbrace{\int \mathbb{E}_x \min\{(1+r)a' + i\lambda(qx)qx, qx\} d\mu(m=0, j < J_R)}_{\text{Revenue}} = \underbrace{\int \mathbb{E}_x x d\mu(m=0, j < J_R)}_{\text{Cost}}, \quad (3)$$

where μ denotes the probability measure over the measurable space defined by the state space $\mathbb{R}_+ \times \mathbb{S}$ (see 2.7 for the formal definition). Note that the mark-up q is an equilibrium object pinned down by this condition.

2.4 Insurance Company

I assume a competitive private insurance market and hence zero profits. The markets for group insurance and nongroup insurance are segmented, so there is no cross subsidy. Households' states are public information⁶.

Issuing an insurance plan incurs fixed costs ϕ that capture the combined effects of administrative and screening costs. The premium is a function of age j and health status h , and is given by

$$p(j, h) = (1+r)^{-1} \mathbb{E}_x[\lambda(qx)qx | j, h] + \phi. \quad (4)$$

Note that the insurance premium is actuarially unfair due to the fixed costs ϕ . The dependence of the reimbursement schedule λ on m is suppressed (i.e., $m=0$).

⁶In the data, as opposed to the implication of the standard adverse selection literature, healthy people are more likely to be insured than unhealthy people. There are several possibilities to account for this fact. One interpretation is that the insurance companies spend costs ϕ (or at least a part of ϕ) and successfully verify agents' health status, which is the assumption in the present paper. On the other hand, according to the advantageous selection, people who have strong tastes for being healthy might be at the same time more risk averse (Cutler, Finkelstein, and McGarry (2008)). This paper does not dig into this issue, and further assumes that the fixed costs ϕ are policy-invariant. Separating the screening costs from the other administrative costs in ϕ using micro-data is my future work.

When households have a employer-provided group insurance offer, $g = 1$, the employer fully contributes the premium, and hence agents take up the employer-provided group insurance as long as it is available. This assumption is made because the employer's decision about its contribution is out of the scope of this paper, but is also innocuous since in the data almost all employees take up the offer whenever they are offered⁷.

The premium collected by the insurance companies is saved and used as a capital by the production sector.

2.5 Firm

The aggregate production technology is given by a Cobb-Douglas function, $F(K, L) = AK^\theta L^{1-\theta}$. I assume that the firm pays the group insurance premium for the employees who have the employer-provided insurance, but the assignment of the employer-provided insurance is unknown when the firm is choosing its labor input L . Denote by η the expected marginal payment of employer's group insurance premium per efficiency unit. Then, the firm's problem is given by

$$\max_{K,L} AK^\theta L^{1-\theta} - wL - (r + \delta)K - \eta L$$

where the last term is the employer's premium contribution. Then by zero profit condition, the factor prices are given by

$$\begin{aligned} r &= F_K(K, L) - \delta, \\ w &= F_L(K, L) - \eta \\ &= F_L(K, L) - \frac{\int p d\mu(g = 1, j < J_R)}{L}, \end{aligned} \tag{5}$$

⁷Brügemann and Manovskii (2010) study the employers' decision of providing group insurance to their employees.

where the last equality comes from the fact that the marginal employer's premium payment per efficiency unit is simply given by the total premium payment divided by the total labor input.

2.6 Government

The government imposes a proportional tax τ on the labor income of the working age population in order to finance the Social Security benefit. The tax revenue is also used to finance Medicaid and Medicare Disproportionate Share Hospital payments that compensate the deficit of the Medicaid and Medicare providers. Then, assuming the balanced budget for each period, the government budget constraint is given by

$$\begin{aligned} \tau \int wze d\mu(j < J_R) &= \int ss d\mu(j \geq J_R) \\ &+ \int \mathbb{E}_x [x - \min\{(1+r)a' + \lambda(qx, 1)qx, qx\}] d\mu(m = 1, j < J_R) \\ &+ \int \mathbb{E}_x [x - \min\{(1+r)a' + \lambda(qx, m)qx, qx\}] d\mu(j \geq J_R), \end{aligned} \quad (6)$$

where the second and third lines represent the net cost of the Medicaid and the Medicare, respectively.

2.7 Stationary Equilibrium

I define the state space as $\Omega \equiv \mathbb{R}_+ \times \mathbb{S}$ and the sigma algebra on Ω as Σ_Ω . Then I denote the probability measure over the measurable space (Ω, Σ_Ω) by μ . Now I formally define the stationary equilibrium of this economy.

Definition 1 *A stationary equilibrium of this economy is a set of policy functions $\{c, a', i | c : \Omega \rightarrow \mathbb{R}_+, a' : \Omega \rightarrow \mathbb{R}_+, i : \Omega \rightarrow \{0, 1\}\}$, a value function $V : \Omega \rightarrow \mathbb{R}$, market prices $\{w, r, p | w \in \mathbb{R}_+, r \in \mathbb{R}_+, p : \mathbb{S} \rightarrow \mathbb{R}_+\}$, a mark-up in the medical services market $q \in \mathbb{R}_+$, government policies $\{\tau, ss | \tau \in \mathbb{R}_+, ss \in \mathbb{R}_+\}$ and a stationary distribution μ such that*

- (i) Given prices, $\{c, a', i\}$ solves the households' problem (1) and (2), and achieves V .
- (ii) q satisfies the hospitals' zero profit condition (3).
- (iii) p satisfies the insurance company's zero profit condition (4).
- (iv) $\{w, r\}$ satisfies the firms' marginal profit conditions (5).
- (v) $\{\tau, ss\}$ satisfies the government budget constraint (6).
- (vi) All markets clear:

$$\begin{aligned}
K &= \int a' d\mu + \int ip(s) d\mu (m = 0, j < J_R), \\
L &= \int z\varepsilon d\mu (j < J_R), \\
F(K, L) &= \int cd\mu + \int xd\mu + \delta K.
\end{aligned}$$

- (vii) The distribution μ is stationary.

2.8 Policy Reform

The Affordable Care Act comprises two key provisions to increase the coverage rate in the individual insurance market.

Community Rating and Guaranteed Issue

Community rating and guaranteed issue prohibit insurers from price-discriminating or rejecting against applicants based on health status. Therefore, after the reform, the insurance premium is no longer a function of h :

$$\tilde{p}(j) = (1 + \tilde{r})^{-1} \frac{\int i \mathbb{E}_x[\lambda(\tilde{q}x)\tilde{q}x | j, h] d\tilde{\mu}(j)}{\int i d\tilde{\mu}(j)} + \phi$$

Here I put the tildes on the objects that are different from those of the pre-reform economy.

Note that the premium is an equilibrium object that depends on the individual decision i .

This is interpreted as a fixed point problem for each age j , hence J_R fixed point problems. Note also that the premium depends on the new mark-up \tilde{q} derived from the hospitals' break even constraint, which is different from q because the individual insurance decision changes.

Insurance Mandate and Insurance Exchanges

The other key provision is the individual mandate which penalizes those without health insurance. The size of the penalty is based on the income and given by \$695 or 2.5% of the income, whichever is greater.

The ACA also establishes health insurance exchanges that provide insurance premium subsidies for individuals with low income. Specifically, the insurance exchanges are going to provide the premium subsidy for those with income from 100% to 400% of the federal poverty line (FPL). The ACA does not specify the premium subsidies for those with income under 100% of FPL, as it originally planned to expand Medicaid to all the people with income up to 133% of FPL. However, because in 2012 the Supreme Court of the United States ruled that participation in the Medicaid expansion is voluntary for states, the treatment of poor individuals who are not eligible for Medicaid after the reform is unclear. Thus, I assume that the premium subsidy is extended to those with income below 100% of FPL, and apply the same premium cap of those with 100% of FPL (i.e., 2% of income) to those population. Figure 1 displays this extended subsidy schedule. I assume this subsidy is financed by a proportional income tax, and hence the tax rate changes to $\tilde{\tau}$.

Working Age Household's Budget Constraint after the Reform

The budget constraint of the working age household can be written by

$$c + a' = y - i \min\{\tilde{p}(j), pcap(\tilde{w}z\varepsilon)\} - (1 - i) \max\{\$695, 2.5\% \times \tilde{w}z\varepsilon\},$$

where $pcap$ is the premium cap illustrated in Figure 1.

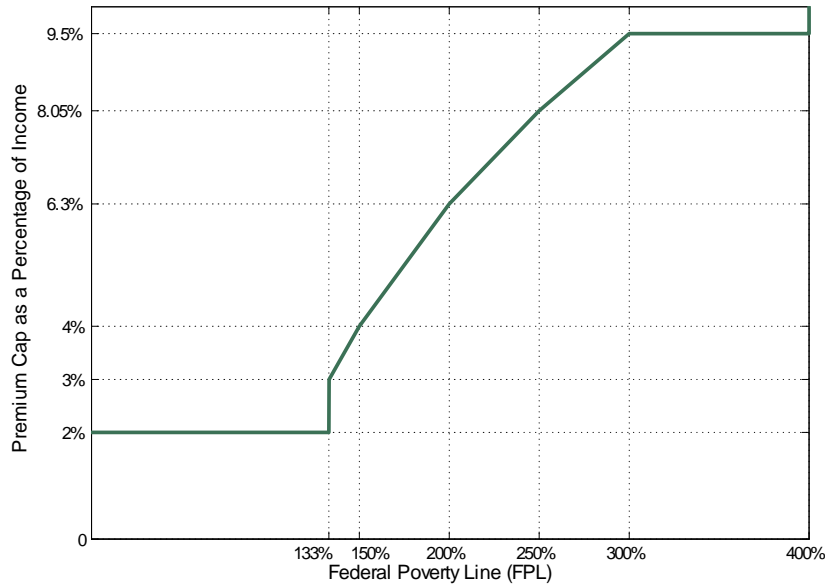


Figure 1: Premium Cap as a Percentage of Income, by Federal Poverty Line (FPL). Note the subsidy is extended to 0-100% of FPL (see the text). Source: Congressional Research Service (2010), "Private Health Insurance Provisions in PPACA"

3 Data and Estimation

This section describes the data I use and parametrization of the model.

3.1 The data

I use data from the Survey of Income and Program Participation (SIPP), and the Medical Expenditure Panel Survey (MEPS). These continuous series of national panels provide information about health insurance and medical expenditures of the U.S. households. I use the 2001 panel and the 2004 panel of the SIPP, and the five panels of the MEPS from 1999 to 2004. Taking into account the fact that some states such as Massachusetts have introduced drastic policy reforms after 2006, I assume the U.S. economy is in a steady state prior to 2006.

I use the SIPP as the main data set since it provides key information about health insurance, self-assessed health status and wealth. I do not use panels before 1996, because

the key question asking the source of the health insurance was significantly different from the panels after 2001.

I also use the MEPS as it provides information about medical expenditures and medical charges. To the best of my knowledge, no other national data provide this information. I match the information in the MEPS with that in the SIPP using self-reported health status whose summary statistics are comparable as is shown in Table 1.

The SIPP consists of core wave files and topical module files. Respondents are surveyed every 4 months. In the core wave files, for many variables such as income and health insurance coverage they are questioned about each of the previous 4 months since the last interview wave. Some of the topical module files report key variables for this analysis such as net worth and self-reported health status. I merge all the core waves of each panel with the topical module files that report this key information. Specifically, for the 2001 panel I use all the core waves and the wave 3, 6 and 9 of the topical module files, whereas for the 2004 panel I use all the core waves and the wave 3 and 6 of the topical module files. I also use the medical expenditure and charge data from the MEPS.

Samples

The decision making unit in the model is the Health Insurance Eligibility Unit (HIEU), which is different from the Census definition of a family or a household. The basic concept of this subfamily relationship unit is that an HIEU comprises individuals in the household who are eligible for one health insurance policy. The policyholder, policyholder's spouse, and their unmarried minor children are typically considered an HIEU. Thus, one household can potentially consist of multiple HIEUs. For the general definition of the HIEU, see [State Health Access Data Assistance Center \(2012\)](#)⁸.

I use the HIEU identifiers provided by the MEPS. However, unlike the MEPS, the SIPP does not provide identifiers for HIEUs. Therefore I construct HIEUs for the SIPP samples

⁸They use the term "Health Insurance Unit (HIU)" instead of the Health Insurance Eligibility Unit (HIEU).

from other variables regarding family relationship, following the definition provided by [State Health Access Data Assistance Center \(2012\)](#). To be consistent with the HIEU definition in the MEPS data, I also include children under age 24 who are full-time students as eligible children.

A head of a HIEU is defined as the single adult for the HIEUs of single adults and the male adult for the HIEUs of married couples. The sample consists of the heads of the HIEUs whose age is from 25 to 80⁹.

The sample weights provided by the SIPP and the MEPS are then rescaled proportionally so that the sum of the weights in each panel is equal to the number of the observations of the panel. All the dollar values are converted into 2001 dollars.

Summary Statistics

Table 1 provides the summary statistics of the working age population of the SIPP and the MEPS. Note that the statistics of the self-reported health status, which I use to link the two data sets, are similar.

3.2 Calibration

This section constructs stochastic processes and parameters I use in the numerical analysis.

Demographics

One model period corresponds to one year. The decision making unit in the model which I call as a household is the HIEU described above. I assume households enter the economy at age 25, get retired at age 65, and die at the end of age 80.

⁹I do not use samples that have a sample weight of zero.

Table 1: Summary Statistics of the Working Age Population in the SIPP and the MEPS

	Obs.*	Mean	Median	Std. Dev.
SIPP				
Age	64417	44	44	11
Health Score**	63507	2.27	2	1.08
Income***	64310	\$33,629	\$25,865	\$35,246
Wealth***	62243	\$180,838	\$95,725	\$295,423
MEPS				
Age	30673	43	43	11
Health Score**	30573	2.29	2	1.10
Medical Expenditure***	30673	\$2,689	\$667	\$9,066

* Pooled sample of heads of HIEU of age 25-64

** Health score is calculated from the answers to the subjective health status question that range from 1 (excellent) to 5 (poor).

*** Amounts are in 2001 dollars.

Health Status

I use self-reported health status in the SIPP as the measure of health¹⁰. The SIPP asks respondents' general health in the topical module files, and the respondents report their health as being "excellent", "very good", "good", "fair", or "poor" every year. Given the fact that the median health status of the sample is "very good", I define healthy adults as those who report their health status as "excellent" or "very good", and unhealthy adults as the complement¹¹. In the same way, using self-reported health status in the MEPS, I also construct a health status variable for each individual for the MEPS samples.

I compute the transition probability of health status for each age and insurance status. Specifically, I first construct 10-year age bins from 25-34 to 55-64 for each panel. Then for

¹⁰Self-reported health status is widely used as the measure of health in the literature, e.g. Clemens (2012), Imrohoroglu and Kitao (2012), and Yogo (2012). For example, although he uses different survey data (i.e., the Health Retirement Survey), Yogo (2012) sets self-reported health status as the primary measure of health in his study about the elderly. He argues that "self-reported general health status is highly correlated with doctor-diagnosed health problems, difficulty with activities of daily living, health care utilization, and future mortality."

¹¹Clemens (2012) uses the similar definition of healthy/unhealthy agents in his analysis using the Current Population Survey.

each bin, I compute the conditional probability of being healthy or unhealthy in the next period given today's health and insurance status. When doing this, I limit my sample to those who are not disabled in order to capture the effect of the primary care on the health. I then take the weighted average of all the transition probabilities over the panels using the relative weights. Finally, I interpolate the conditional probabilities along the age in order to obtain smooth transition matrix for each age.

Figure 2 displays the conditional probability of being healthy next period given health and insurance status today. As is seen in the Figure, the insured agents who have access to primary care have higher probability of being healthy in the next period than the uninsured for both the healthy and the unhealthy.

For the elderly, I construct 5-year age bins from 65-69 to 75-79 for each panel. I then use the same procedure as the estimation for the working age population described above, but for old households, the transition does not depend on the insurance status, because all of them are covered by Medicare.

Earnings

Households' endowment is a product of age-dependent productivity ε , idiosyncratic earnings shock z , and the market wage rate w that is equal to the marginal product of labor. I calibrate ε and z .

For the idiosyncratic earnings shock, I use non-asset income of the heads of the HIEUs in the data. The definition of non-asset income follows [Glover, Heathcote, Krueger, and Ríos-Rull \(2012\)](#), and includes wage and salary income, two thirds of business or farm income, social security income, and a variety of public and private transfers such as unemployment compensation and money from relatives. To construct annual income, I sum up all these variables for 12 months in the core wave files of the SIPP.

The basic calibration strategy of the earnings process is similar to [Jeske and Kitao \(2009\)](#), but in this study, the evolution of the earnings depends also on health status, as described in

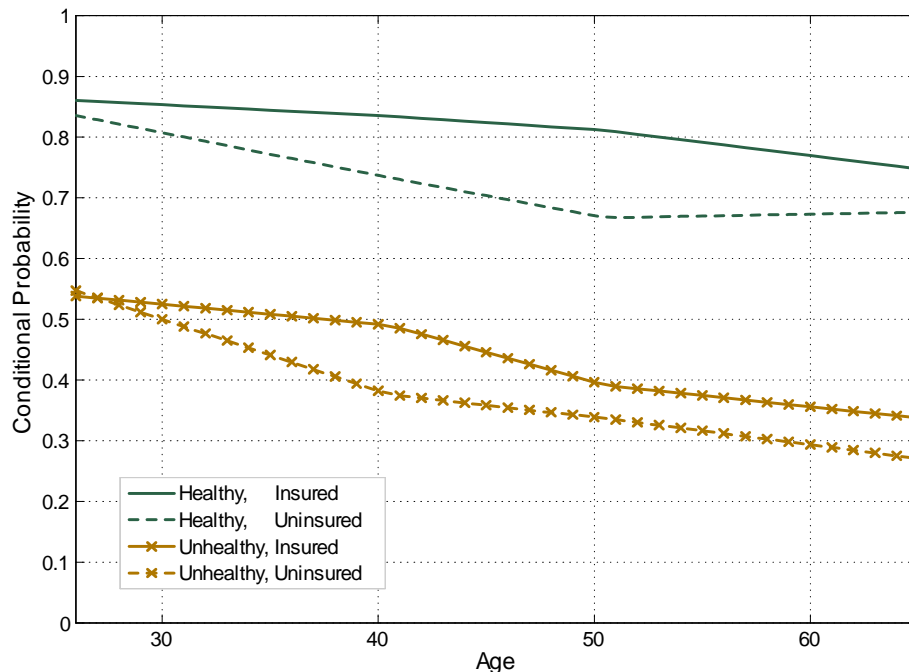


Figure 2: Conditional Probability of Being Healthy Next Period for Each Health and Insurance Status from the SIPP

Section 2.1. Given the data of households’ annual income, I create five income classes with equal size of population for each year. Using these five states, I then compute the conditional transition probabilities separately for each health status for each panel. Specifically, given h' , the transition probabilities are directly calculated from the panel data and I obtain $\Gamma_z(z'|z, h')$ for each panel. Finally, I take the weighted average of these transition probabilities and the income grids over the panels using the relative weights. The associated income grids are normalized. The resulting earnings grid space is $\mathbb{Z} \equiv \{0.14, 0.46, 0.77, 1.18, 2.45\}$ relative to the average annual income of \$33,575 in 2001 dollars.

The age-dependent productivity is taken from Hansen (1993) as in Imrohoroglu and Kitao (2012).

Public Health Insurance

I define that one is covered by public health insurance if she is covered by Medicaid, Medicare, or other public insurance such as TRICARE for more than 6 months of the year. For more detailed definition of insurance, see section 3.3.

Given the data of public insurance status, I compute the conditional transition probabilities separately for each level of tomorrow's earnings and health status for each panel. Specifically, given z' and h' , the transition probabilities are directly calculated from the panel data and I obtain $\Gamma_m(m'|m, z', h')$ for each panel. I then take the weighted average of these transition probabilities over the panels using the relative weights.

Employer-Provided Group Health Insurance

As described in Section 2.1, because the actual take-up rate of the employer-provided group health insurance in the data is above 95% when it is available, I assume that households obtain group insurance as long as it is offered from the employer. Hence, I use the group insurance status in the data as a proxy of the group insurance offer.

I define that one is covered by employer-provided group insurance if she is covered by a health plan through her current or prior employer, or union for more than 6 months of the year. For more detailed definition of insurance, see Section 3.3.

Given the data of employer-provided group insurance status, I compute the conditional transition probabilities separately for each level of tomorrow's earnings for each panel. Specifically, given z' , the transition probabilities are directly calculated from the panel data and I obtain $\Gamma_g(g'|g, z')$ for each panel. Finally, I take the weighted average of these transition probabilities over the panels using the relative weights.

Medical Expenditure

It is important to note that what is observed in the data is not the medical resource cost x but the medical expenditures qx .

I estimate the medical expenditure shock separately for the insured and the uninsured. This is because the medical spending of the insured is substantially higher than that of the uninsured. The insured have access to primary care, and receive medical care to maintain their health status. On the other hand, the uninsured mainly receive urgent care, and they often delay non-urgent medical care because it is very expensive.

I use the variables of total medical expenditures and charges in the MEPS. The variable of total medical expenditures is sum of the amounts actually paid for each medical event, and does not include the amount unpaid due to medical bankruptcy. On the other hand, the variable of total medical charges is sum of the amounts charged by the medical service providers, and includes the amounts unpaid due to medical bankruptcy. The former is suitable for the medical shocks for the insured, and the latter is suitable for those for the uninsured¹².

For each panel, I construct 10-year age bins from 25-34 to 55-64 for each health and insurance status. For each age bin, I create five states for the expenditures/charges with the bins of size of 25%, 25%, 25%, 20%, 5% population separately for each year. For example, the first state means the expenditures of the lowest 25%, and the second state means the next 25% and so on. The top bin is intended to capture the catastrophic events. Then I compute the weighted average of each bin and normalize the values in 2001 dollars. Next, I take the weighted average of the values over the panels for each health and insurance status using the relative weights. I approximate these average medical expenditures of each bin by second order polynomial functions of ages, separately for each health and insurance status. Figure 3 displays these average medical expenditures and the fitted values. The amounts are higher for the insured, while the catastrophic events are equally severe for both the insured and the uninsured.

¹²Jeske and Kitao (2009) and Pashchenko and Porapakarm (forthcoming) use the medical expenditure data. This might underestimates the size of the shocks for the uninsured, since the variable largely reflects the insurance discount that is unavailable for the uninsured. On the other hand, they do not distinguish the medical usage of the insured from that of the uninsured. However, the medical spending of the insured is substantially higher than that of the uninsured. Thus, the size of the shocks for the uninsured might be overestimated.

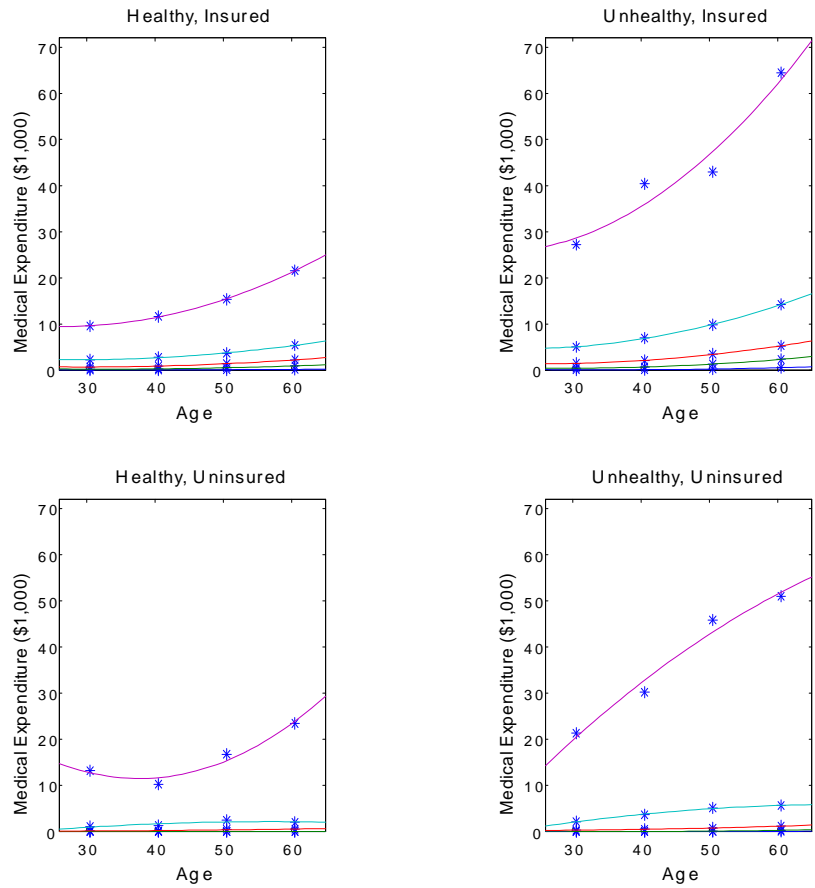


Figure 3: Distribution of Medical Expenditures of the Working Age Population by Insurance and Health Status from the MEPS. Each figure displays the average medical expenditures for each 10-year age bin (stars) and its approximation (lines) of each expenditure group ranging from the bottom 25% to the top 5% (see the text for the detailed information).

For the elderly, I construct 5-year age bins from 65-69 to 75-79 for each panel. I then use the same procedure as the estimation for the working age population described above, but for old households, the expenditure distribution does not depend on the insurance status, because all of them are covered by Medicare.

Insurance Reimbursement Schedule

The model abstracts from the detail of insurance plans such as deductible and copayment. Instead, following [Jeske and Kitao \(2009\)](#), I estimate the reimbursement schedule of health

insurance for private insurance, Medicaid and other public insurance, and Medicare separately. Specifically, first I compute the reimbursed amounts out of medical expenditures for each agent using MEPS. Then I run regressions for each insurance type of the form

$$\log(oop) = \beta_0 + \beta_1 \log(ex) + \beta_2 (\log(ex))^2,$$

where ex is the total medical expenditure, and oop is the out-of-pocket expenditure that is not reimbursed by the insurance, i.e., ex less the reimbursed amounts¹³. Here, I limit the sample to those with positive expenditures. The weighted least squares estimation finds coefficient estimates that are all significant at the 1% level¹⁴. Using the resulting coefficients, I compute the reimburse schedule, which is displayed in Figure 4. It shows that public insurance is more generous for small amounts of medical expenditures than private plans, whereas the opposite is true for large amounts of medical expenditures. Medicare is not as generous as Medicaid.

Preference

The discount factor β is chosen so that the capital-output ratio of the economy is equal to three. I use the standard CRRA utility function of the form $\frac{c^{1-\gamma}}{1-\gamma}$. The estimation for γ is described in Section 3.3.

Technology

I use a constant-return-to-scale Cobb-Douglas production technology $F(K, L) = AK^\theta L^{1-\theta}$ with the capital share of $\theta = 0.33$. The TFP A is calibrated so that the average income is equal to one. The capital depreciation is set so that the real interest rate is equal to 3%. Note that after the policy reform, the average income and interest rate will change because of the general equilibrium effects.

¹³I do not use the reimbursed amounts directly as a dependent variable because people sometimes report the reimbursed amounts of zero and hence I cannot take the logarithm.

¹⁴The R-squares are 0.558 for private insurance, 0.501 for Medicaid and other public insurance, and 0.788 for Medicare, respectively.

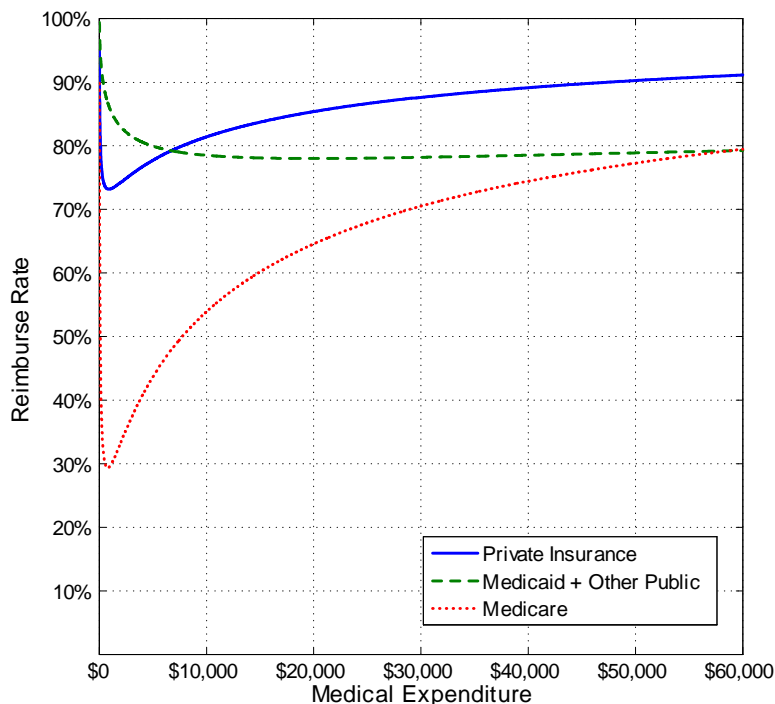


Figure 4: Estimated Insurance Reimbursement Schedule from the MEPS

Social Security

The Social Security replacement rate is set to 45% of the average income as in [Jeske and Kitao \(2009\)](#). Although this rate might be slightly higher than the values usually used in the literature, this is reasonable given that the population on which this study focuses, the active participants of the individual health insurance market, has substantially lower income on average through their working age¹⁵. The proportional income tax rate is calibrated so that the government's budget is balanced.

Calibrated Parameters

Table 2 displays the summary of the calibrated parameters. The top panel shows the parameters exogenously given and the bottom panel shows the parameters calibrated inside the

¹⁵[Pashchenko and Porapakarm \(forthcoming\)](#) use 30% and 40% for each person with low and high education, respectively.

Table 2: Parameters of the Model

Remark	Parameter	Value	Target
Max Age	J	55	Live from age 25 to 80
Capital Share	θ	0.33	-
SS Replacement	ss	0.45	45% of Ave. Income
Discount Factor	β	0.958	Capital-output Ratio: 3
TFP	A	0.965	Ave. Income = 1
Depreciation	δ	0.082	Interest Rate: 3%

model.

3.3 Estimation

This section describes empirical moments with which I match the model, and the estimation strategy. Before explaining the estimation procedure, I first illustrate the data construction of households' net worth and insurance status. I then describe the estimation.

Wealth

I construct households' wealth using detailed data about assets and liabilities in the SIPP, following the U.S. Census Bureau (2008), "Net Worth and the Assets of Households: 2002". To briefly explain, the net worth is defined as the sum of the assets such as interest-earning assets, stocks, bonds and properties owned, subtracted by the sum of the liabilities such as mortgages, debt, and loans. To construct the net worth of heads of HIEUs, I use variables in the SIPP describing the entitlements for each property. For some asset and liability variables for which the amounts are already aggregated within the household, I split the amounts by the fraction calculated from the heads' income.

There are two reasons why it is desirable to construct households' wealth from each component of assets and liabilities in the data rather than simply using the households' total net worth provided by the SIPP. One is that the decision making units in the model are

not households but HIEUs, and there is no systematic way to allocate total net worth of a household to multiple HIEUs that form the household together. The other is that the variable for households' total net worth in the SIPP is top-coded by itself. Hence direct utilization of the variables about assets and liabilities in the SIPP, even though some are also top-coded, provides more precise information about households' wealth distribution.

Insurance Status

For each month, the SIPP provides the information about insurance sources in addition to the insurance status for each individual. I define agents to be insured if they have insurance for more than 6 months of the year from any source. The uninsured are the complement.

One is insured by public insurance if she is covered by Medicaid, Medicare, or other public plans for specific populations such as TRICARE for more than 6 months. I define that one is covered by employer-provided group insurance if she is not covered by the public plan and is covered by a health plan through her current or prior employer, or union for more than 6 months of the year¹⁶. Finally, one is covered by individual insurance, if she is not covered by the public plan and directly purchases a health plan for more than 6 months of the year. When one is insured but no single source covers her for more than 6 months, then I choose the one with the longest length of the coverage as the source.

Estimation

There are two key parameters for the insurance choice in the model, the risk aversion γ and the fixed costs of issuing insurance ϕ , i.e., the extent to which health insurance is priced above its actuarially fair values. Intuitively, the higher is the risk aversion, the more insured are people. Similarly, the lower are the fixed costs, the more insured are people.

To capture the insurance coverage distribution in the individual health insurance market, I target the joint distribution of insurance coverage of active participants of the individual

¹⁶By the Consolidated Omnibus Budget Reconciliation Act (COBRA), employees can continue health insurance coverage after leaving employment (for up to 18 months in most cases).

Table 3: Estimated Parameters

Remark	Parameter	Value	Target
Risk Aversion	γ	1.234	Joint dist. of insurance coverage
Fixed Costs of Insurance	ϕ	\$803	Joint dist. of insurance coverage

health insurance market. Specifically, I use the insurance coverage rate of those with neither public insurance nor employer-provided insurance for each of three income classes ($z \times 3$), three wealth classes ($a \times 3$), two age classes ($j \times 2$), and two health status ($h \times 2$). With 36 moments in total, I solve

$$\min_{\gamma, \phi} \sum \alpha_{z,a,j,h} [i_{Data}(z, a, j, h) - i_{Model}(z, a, j, h)]^2$$

where i_{Data} and i_{Model} are the insurance coverage rate of each subpopulation in the data and the model, respectively, and α is the population weights of each subpopulation taken from the SIPP data.

Table 3 provides the estimated parameters. The estimated risk aversion is in the range of the standard models, but relatively low. Also the fixed costs of insurance are high in that it constitutes of 26% of the average premium. Given that the very low rate of coverage among the active participants (i.e., 23.5%), these seem to be reasonable. In the next section, I further conduct a decomposition exercise in order to investigate the driving force of the low insured rate.

4 Quantitative Analysis

This section provides the results of the quantitative analysis. First, I describe how the model fits the data. I compare the model and the data regarding the insurance coverage and the wealth and income distribution of the uninsured. Second, I conduct a decomposition exercise in which I assess the relative importance for explaining the high uninsured rate. Finally, I

present the implications of the health care reform.

4.1 Model Performance

This section describes how the model fits the data. First, I look at the insurance status of the working age population. Then I focus on the active participants of the individual health insurance market, those who are neither eligible for public health insurance nor offered employer-provided insurance, because those are the target population of the reform. Finally I compare the wealth and income distribution of the uninsured in the model with those in the data.

Insurance Coverage

The aggregate insurance rate of the working age population is presented in Table 4. The top panel shows the insurance status of all the working age population. The model fits the data well, although it overestimates the number of the active participants. This results in the higher uninsured rate in the model than that in the data. The bottom panel shows the insurance status of the active participants, the target population of the policy reform. This population is the main focus both of this study and the upcoming reform, and the model captures the fraction of the insured among this population.

Next, I construct subgroups from these active participants. Specifically, I decompose the population by wealth, income, health status and age. Figure 5 plots the uninsured rate for each wealth and income quintile of the model and the data, and shows that the model replicates the insurance pattern reasonably well. In the bottom panel, more than 20% people with the income of the 1st quintile, i.e., very low income households, are insured in the data. The model cannot capture this pattern because those are typically rich individuals retired earlier than age 65, yet the model assumes that everyone gets retired all at once at age 65.

The top panel of Table 5 is the decomposition by age and health status, and displays the uninsured rate of the young (age 25-44), the old (age 45-64), and the healthy and the

Table 4: Insurance Status (Data vs Model)

Insurance Status	Data	Model
All Working Age		
Individual	5.0%	5.9%
Uninsured	16.2%	19.7%
Employer-based	66.3%	60.3%
Public	12.5%	14.1%
Active Participants*		
Insured	23.5%	22.9%
Uninsured	76.5%	77.1%

* "Active participants" are those who are neither eligible for public health insurance nor offered employer-provided insurance.

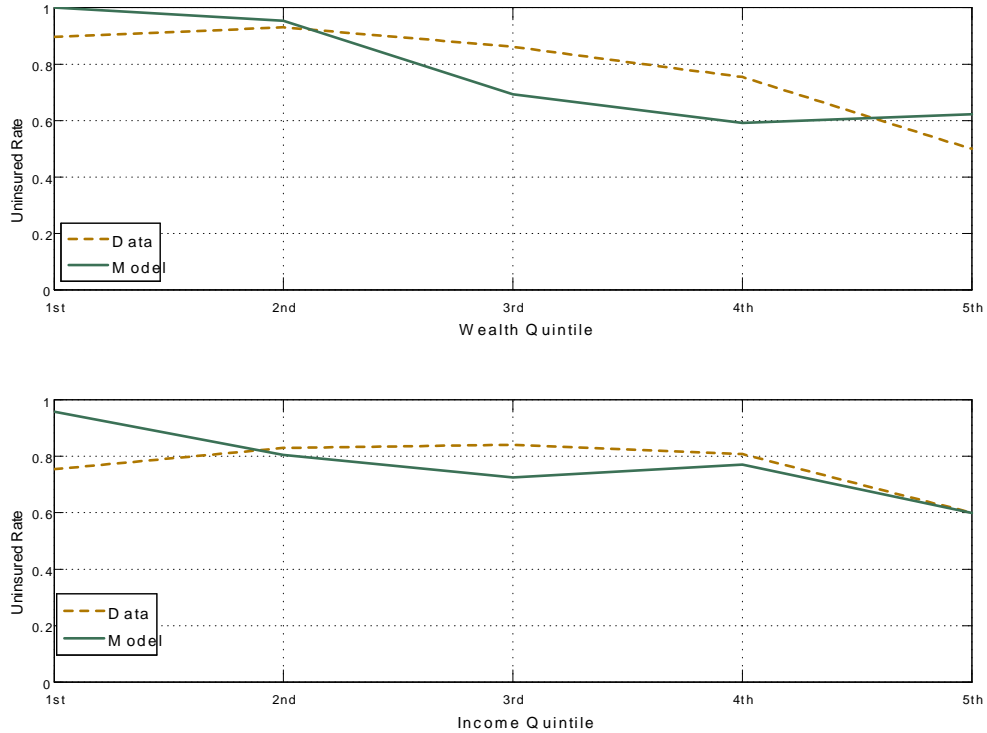


Figure 5: Uninsured Rate of the Active Participants for Each Quintile of Wealth and Income (Data vs Model)

Table 5: Insurance Coverage Pattern of the Active Participants (Data vs Model)

Statistics	Data	Model
Uninsured Rate		
Age 25-44	82.3%	81.4%
Age 45-64	67.9%	72.4%
Unhealthy	83.4%	88.4%
Healthy	71.1%	70.7%
Correlation of Insurance Status		
$Corr(insurance, wealth)$	0.396	0.261
$Corr(insurance, income)$	0.208	0.259
$Corr(insurance, age)$	0.196	0.089
$Corr(insurance, health)$	0.143	0.202

unhealthy. The model overestimates the uninsured rate of the young population, but the overall insurance pattern is similar. The bottom panel shows the correlation of the insurance status with wealth, income, age and health. Those correlations are all positive both in the data and the model.

Characteristics of the Uninsured

Covering the uninsured population is one of the main goals of the health care reform. Therefore, it is important to look at the characteristics of the uninsured. While the model does not target those moments, it replicates the income and wealth distribution of the uninsured fairly well, as displayed in Table 6. There is a large skewness in the wealth distribution among the uninsured in the data, which is only partially captured in the present model. Note that the uninsured population includes many low income households, because they are not necessarily eligible for Medicaid. The model replicates this important margin, and the reform has a significant implication for these uninsured poor households.

Table 6: Income and Wealth Distribution of the Uninsured (Data vs Model, 2001 dollars)

Statistics	Data	Model
Income Percentile		
25%	5,720	3,853
50%	12,792	12,068
75%	19,832	20,127
Wealth Percentile		
25%	0	0
50%	6,027	13,137
75%	71,273	79,286

4.2 Source of Low Insured Rate

This section conducts a decomposition exercise. I assess the relative importance in accounting for low current insured rates, 23.5%, of (i) high fixed costs in the insurance market, (ii) low risk aversion within the pool of potential buyers of insurance, and (iii) limited liability in the health services market. Through the exercise, I fix all the other parameters but the parameter under consideration and the prices. Hence this is a general equilibrium analysis.

First, I change the fixed costs of issuing insurance in the baseline economy. I gradually increase the parameter ϕ from zero to twice as much as the baseline.

The top-left panel in Figure 6 displays the result. Specifically, it plots the change in the insured rate of the active participants when the fixed costs of insurance change. The vertical line corresponds to the estimated value in the baseline model. The figure shows that the insured rate is decreasing in the size of the fixed costs, and people are very sensitive to how actuarially unfair the premium is. If there is no cost ($\phi = 0$) and hence the premiums are actuarially fair values, then more than 50% of the population purchase the individual insurance. On the other hand, if the fixed costs are increased so that it constitutes more than 70% of the average premium, then almost nobody would buy the individual insurance.

Second, I change the risk aversion in the baseline economy. I gradually increase γ from almost risk neutral $\gamma = 0.1$ to $\gamma = 5$, a relatively higher γ value in the standard models.

The top-right panel in Figure 6 displays the result. It plots the change in the insured rate of the active participants when the risk aversion changes, and the vertical line corresponds to the estimated value in the baseline model. The figure shows that the insured rate is increasing in the risk aversion. With high risk aversion, households have incentive to accumulate a lot of assets, yet they also have incentive to hold insurance. On the other hand, some households buy insurance even when they are almost risk neutral, i.e., the risk aversion is close to zero. The reason is because having insurance gives people to access to primary care, and in some cases people are able to reduce the expected medical expenditure by having insurance since the primary care improves the health status.

Third, I change the condition of the limited liability in the baseline economy. Previously, as stated in the U.S. law, households' income was secured even when filing medical bankruptcy. Now, I consider a situation in which a fraction $\alpha \in [0, 1)$ of their income could be confiscated. The cash-in-hand after being hit by the medical shock y' is then given by

$$\begin{aligned} y' &= \max\{(1+r)a' - (1-\lambda(qx)i)qx + \alpha(1-\tau)wz'\varepsilon', 0\} + (1-\alpha)(1-\tau)wz'\varepsilon' \\ &= \max\{(1+r)a' - (1-\lambda(qx)i)qx + (1-\tau)wz'\varepsilon', (1-\alpha)(1-\tau)wz'\varepsilon'\}. \end{aligned}$$

The parameter α describes the intensity of the limited liability condition, and $\alpha = 0$ corresponds to the baseline model.

The bottom-left panel in Figure 6 displays the result. It plots the change in the insured rate of the active participants when I change this intensity parameter. The insured rate gradually increases as the condition of the limited liability gets intensified. When the intensity parameter is really high in the sense that more than 90% of the current income is confiscated after medical bankruptcy, then the insured rate substantially increases. When people lose 99.9% of the income, then the insured rate is doubled from the baseline, i.e., 43.3% people would purchase health insurance. However, more than half of the households still remain uninsured. This is because the limited liability is not a relevant consideration

for the uninsured rich. Moreover, there are some households who simply cannot afford the insurance.

Lastly, I change the condition of limited liability in the economy without the fixed costs, i.e., $\phi = 0$. This exercise is informative because it illustrates how many of the uninsured arise from limited liability and from poverty under the actuarially fair premiums.

The bottom-right panel in Figure 6 displays the result. The insured rate increases as the condition of the limited liability gets stronger as is the previous case, and if people lose 99.9% of the income when filing medical bankruptcy, then more than three-fourths become insured (75.9%). This exercise uncover the fact that those who chose to be uninsured even with the actuarially fair premiums become insured if the condition of limited liability is very strict. The remaining households, one-fourths of the active participants, are too poor to afford insurance. The premium subsidy of the policy reform is effective to help them purchase insurance.

4.3 Implications of the Reform

This section describes the implications of the reform.

First, the reform has effects on the aggregate variables and prices, as displayed in Table 7. The insured rate of the active participants significantly increases after the reform, resulting in the low uninsured rate among the working age population, 3.1%. This means that the reform achieves its primary goal, i.e., the expansion of the insurance coverage. Those who remain uninsured tend to be rich, have moderate income, and be in good health. For this group the penalty for not buying insurance is relatively small and the premium is actuarially unfair due to community rating.

The low uninsured rate induces the reduction in the mark-up in the medical services market because the number of people who take advantage of the free care substantially decreases. The mark-up decreases from 6.7% to 1.6%, and hence the medical cost for the

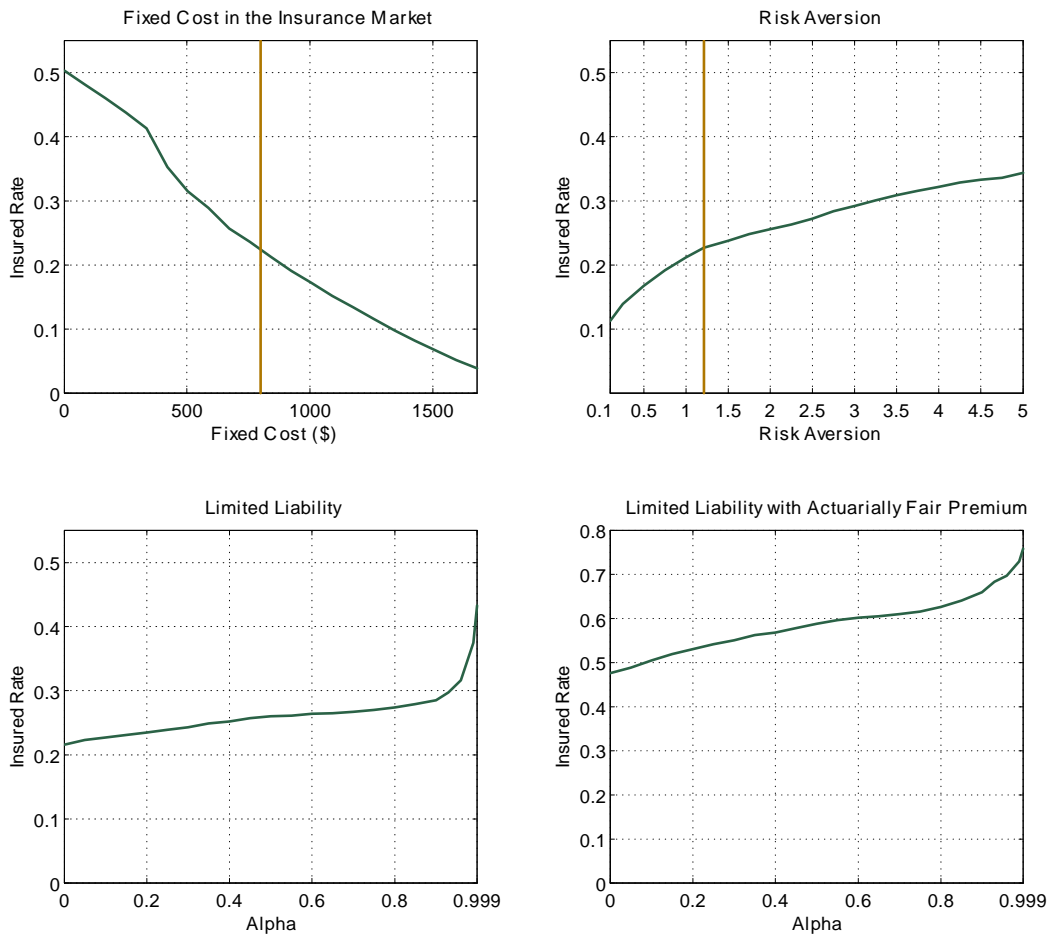


Figure 6: Relative Importance in Accounting for High Uninsured Rates among the Active Participants: (i) Fixed Cost in the Insurance Market, (ii) Risk Aversion, (iii) Limited Liability, (iv) Limited Liability when Premiums are Actuarially Fair. The vertical lines in the top panels represent the estimated values in the baseline economy.

Table 7: Implications of the Reform for Aggregate Variables and Prices

	Before	After
Uninsured Rate: working age population	19.8%	3.1%
Uninsured Rate: active participants	77.1%	11.9%
Aggregate Output	1.126	1.133
Aggregate Capital	3.31	3.32
Interest Rate	3.00%	3.06%
Income Tax Rate	25.0%	25.9%
Mark-up in the Medical Services	6.70%	1.62%
Fraction of Healthy	63.7%	70.3%
Health Care Spending in GDP (age 25+)	9.61%	9.85%

same care decreases by 5%¹⁷. However, the fraction of the aggregate health spending in GDP increases by 0.2 percentage points. This is because more people are insured after the reform and they use primary care. This results in the improvement in the average healthy status among the working age population. The number of people who enjoy healthy life increases by about 7% by the reform.

There are also slight increases in the aggregate output and the aggregate capital.

Wealth Inequality

The reform has an implication for wealth inequality. As is shown in Table 8, the Gini coefficient drops from 0.555 to 0.545 for all working age people and from 0.653 to 0.634 for the active participants. This decline comes from the significant increase in the wealth accumulation among the poor and decrease among the rich. In fact, the asset holdings of the household in the top 20th percentiles drops from 55.0% of the aggregate wealth to 54.6%, whereas that in the bottom 40th percentiles rises from 5.0% to 6.0%.

Before the reform, the uninsured poor are the major users of free care. Because their accumulated asset is confiscated when a sizable medical shock hits, they have strong incentive

¹⁷This 6.7% of mark-up before the reform is comparable to [Stoll and Bailey \(2009\)](#) which reports 7.7% of the mark-up using the MEPS data.

Table 8: Wealth Distribution before and after the Reform

	Before	After
Gini wealth: working age population	0.555	0.545
Gini wealth: active participants	0.653	0.634
Wealth Percentile (active participants)		
25%	\$2,820	\$4,979
50%	\$26,857	\$30,692
75%	\$106,032	\$104,182

to dissave. Hence, they are trapped at the bottom of the wealth distribution. This mechanism is similar to the one proposed in [Hubbard, Skinner, and Zeldes \(1995\)](#), but in this case, limited liability in the medical services market is acting the same role as the social safety net in their paper. The reform gets this population to obtain insurance, and hence they do not take advantage of the free care opportunity. Once they no longer fear that any savings could be lost to pay for health care expenses after receiving emergency care, they have stronger incentive to accumulate savings.

On the other hand, the biggest fear before the reform is to experience a large negative medical shock as well as a negative income shock. As the reform induces richer households to purchase insurance, it effectively reduces the risk exposure of that group. Specifically, the reform makes it easier to access to insurance through the community rating and the premium subsidy. This discourages precautionary saving.

Welfare Analysis

This section describes the implications of the reform on the welfare. The welfare effects are measured by the consumption equivalent variation for the economies before and after the reform.

As [Table 9](#) displays, the reform generates a moderate welfare gain for the working age population (0.08%) and more than 50% are in favor of the reform. On the other hand, there

Table 9: Welfare Effect of the Reform (Consumption Equivalent Variation)

	All Working Age	Active Participants
Welfare Gain	0.08%	0.19%
Fraction who gains	51.8%	52.8%

is a more gain on average for the active participants (equivalent to 0.19% of consumption), and 52.8% of them are in favor of the reform.

Next, I decompose the active participants into subgroups. In Table 10, I compute the average welfare gains for the group of (i) age 25-34 and age 55-64, (ii) those who are the least and the most productive, (iii) the healthy and the unhealthy, and (iv) those with wealth in the bottom and top quartile.

It is clear from Table 10 that there is a contrast in the welfare effects between the rich and the poor. Perhaps surprisingly, the poor who have wealth in the bottom quartile are worse off by the reform. This is because the reform gets them to buy insurance, and hence they no longer take advantage of limited liability. Therefore the reform brings welfare losses for this population, even with the premium subsidy. The unhealthy poor are suffered more than the healthy poor, because they rely more on the free care before the reform.

On the other hand, for the rich who have wealth in the top quartile, the limited liability is not a relevant consideration. The reform eliminates the risk exposure of this population. As described in the previous section, the reform makes it easier to access to insurance when one's health is deteriorated and one is hit by a negative income shock. Thus the rich decrease their precautionary saving and increase consumption, resulting in the welfare gains among this population. Especially, the rich with low income have substantial welfare gains because of the direct transfers associated with the premium subsidies.

Table 10: Welfare Effect of the Reform on the Active Participants (CEV, %)

Age	Income*	Health	Wealth Quartile	
			Bottom	Top
25-34	Low	Good	-0.15	1.00
		Bad	-0.21	0.97
	High	Good	-0.17	0.03
		Bad	-0.19	0.05
55-64	Low	Good	-0.21	0.98
		Bad	-0.44	1.02
	High	Good	-0.87	-0.44
		Bad	-0.88	-0.40

* "Low income" and "High income" mean the least and the most productive households, respectively.

5 Conclusion

This paper quantifies the implications of the upcoming health care reform in the United States participation in private health insurance markets, individual saving behavior, and distribution of welfare gains and losses. The reform substantially decreases the uninsured population. As the poor obtain insurance and no longer take advantage of the free care opportunity in the medical services market, they accumulate more assets. On the other hand, the rich decrease the precautionary saving, because they are less exposed to medical expenditure risks after the reform. Therefore, the reform decreases the wealth inequality. The reform also brings welfare gains for the rich, but losses for the poor because they are much less likely to use the free care option.

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