# Health Insurance Reform and Bankruptcy

Kuklik, Michal

University of Rochester

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Michael Kuklik†

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**Abstract**

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Medical bankruptcy was at the heart of the health care reform debate. According to Himmelstein et al. (2009), 62.1 percent of bankruptcies in the United States in 2007 were due to medical reasons. At the same time over 15 percent of Americans had no health insurance. The 2010 health care reform was designed to address the lack of health coverage and medical bankruptcies. In this paper, we employ a dynamic stochastic general equilibrium overlapping generations model with incomplete markets to quantitatively evaluate the impact of the health care reform on the health insurance market and the bankruptcy rate. We find that (i) the reform fails to address the bankruptcy problem as it cuts the bankruptcy rate by only 0.06 percentage point to 0.94 percent and the medical bankruptcy rate by 0.07 percentage point to 0.70 percent; (ii) the reform succeeds in providing almost universal insurance coverage with only 4.1 percent remaining uninsured; (iii) the average tax rate has to increase by 1.1 percent to finance the reform; (iv) the reform increases welfare by 5.2 percent; (v) the redistribution component of the reform drives the welfare gain by 5.8 percent, and the insurance market restructuring decreases welfare by 1.6 percent.

**Keywords:** unsecured credit, bankruptcy, default, health insurance, health care reform, risk sharing, dynamic stochastic general equilibrium model, overlapping generations, heterogeneous agents.

**JEL Classification:** D52, D60, G22, G33, E21, E60, I11.

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† Department of Economics, Harkness Hall, University of Rochester, Rochester, NY 14627

# 1 Introduction

In the United States there were 1.1 million consumer bankruptcy filings in 2004. People file for bankruptcy for various reasons. Some default due to loss of employment or divorce, but the most prominent reason for bankruptcy is health related. According to Himmelstein et al. (2009), illness and medical bills contributed to over 62.1 percent of all bankruptcies in 2007. Often bankruptcy is the only form of insurance against these types of rare, catastrophic events, but health and medical expenditure shocks are different because they are directly insurable.

Strikingly, 15 percent of the population had no health coverage in 2007. In the 2004 National Health Interview Survey, Adams and Barnes (2006) find that 53.3 percent of the uninsured cannot afford health coverage but less than 6 percent say they do not need insurance. In the event of a health shock, the uninsured can resort to bankruptcy to purge the cost of medical treatment, but having health insurance does not grant immunity against health shocks. Himmelstein et al. (2009) report that 69.2 percent of debtors who filed for medical bankruptcy had health insurance at the time of filing. Thus, not only the lack of coverage, but also quality of coverage is an important aspect of the health insurance system that contributes to medical bankruptcies.

The Patient Protection and Affordable Care Act of March 23, 2010 was designed to address the above issues. In heated political debates, medical bankruptcies were used in arguments by the proponents of the reform. President Obama, in his address to a joint session of Congress, described the uninsured as "living every day just one accident or illness away from bankruptcy." Various news outlets addressed the topic of medical bankruptcy. The New York Times ran the article, "From the Hospital to Bankruptcy Court," which portrayed the lives of several families who filed for medical bankruptcy. From a policy-making standpoint, the impact of the reform on bankruptcy is an important question that, to our knowledge, has not yet been addressed.

In this paper, we quantify the effect of the 2010 health care reform on the health insurance market and bankruptcy using a general equilibrium overlapping generations model with incomplete markets. The model is rich enough to capture salient features of health insurance markets and bankruptcy. Households are heterogeneous in income, health, group insurance offers, and medical expenditures. Bankruptcy is endogenous and credit markets internalize the cost of default. Households make decisions to purchase group insurance or individual insurance or to stay uninsured. The low-income households are covered

by Medicaid and retirees by Medicare. Government provides social assistance to poor households.

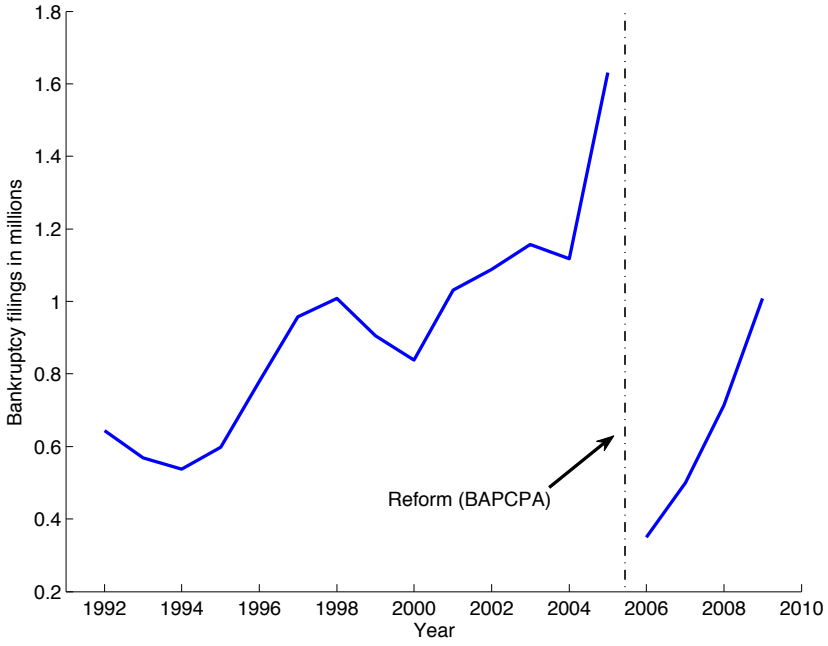
We find that the reform succeeds in establishing almost universal insurance coverage with only 4.14 percent remaining uninsured. It accomplishes wide coverage among the middle class through a combination of premium subsidies, individual mandate, and new risk-pooling mechanisms in the non-group insurance market. Premium subsidies and the individual mandate increase participation of the healthy households in all private insurance markets. This enhances risk-sharing and drives the premium down. The Medicaid expansion provides coverage to low-income uninsured households. However, the reform fails to address the bankruptcy problem as it cuts the bankruptcy rate by only 0.06 percentage point to 0.94 percent. Even though the reform reduces the household's likelihood of default and thus the bankruptcy rate, a general equilibrium effect in the credit markets dampens the reform's impact on bankruptcies.

To finance the reform the average tax rate has to increase by 1.11 percent. The reform increases welfare by 5.2 percent and low-income households are the main beneficiaries. Furthermore, we analyze the welfare effects of the two components: the first one is the income redistribution component in the form of free medical services and premium subsidies; the second is the insurance market restructuring, which captures changes to how private insurance markets work. The former drives the welfare gain, increasing welfare by 5.8 percent, while the latter decreases welfare by 1.6 percent. Interaction between the components of the reform raises welfare by more than otherwise would be expected.

Our paper contributes to the literature on default in dynamic equilibrium models with heterogeneous agents. The recent literature has focused on bankruptcy reforms and bankruptcy welfare implications. Athreya (2002) introduces bankruptcy to the Aiyagari (1994) model and analyzes quantitatively the welfare effects of a bankruptcy law reform. Chatterjee et al. (2007) make interest rates dependent on borrowers' characteristics and find welfare gains from an introduction of means-testing to bankruptcy law. Another strain of the literature uses a life-cycle framework. Livshits et al. (2007) compare American and European bankruptcy laws and find the current U.S. bankruptcy system more desirable. Athreya (2008) studies the interaction between bankruptcy and social insurance. Athreya et al. (2009) analyze the effect of bankruptcy on the transmission of income risk to consumption variability. In neither of those papers do the authors discuss the interaction of bankruptcy and health insurance.

The literature on health insurance in the general equilibrium framework is in an early stage of development. The work most closely related to ours is Jeske and Kitao (2009), who use a life-cycle

Fig. 1: Bankruptcies




model with a similar insurance choice to analyze the effects of tax policy on the medical insurance market. Attanasio et al. (2008) develop a general equilibrium life-cycle model to study alternative funding mechanisms for Medicaid. Neither paper discusses unsecured credit, bankruptcies, or health care reform. To the best of our knowledge, there is no other paper that evaluates the 2010 health care reform in the general equilibrium framework.

The paper is organized as follows. In Section 2, we present a few facts about bankruptcy and health insurance reform in the United States. In Section 3 we introduce the model. Calibration and results are presented in Section 4 and 5, respectively. Section 6 concludes.

## 2 Background

In this section we provide background information about bankruptcy in the U.S. We describe the U.S. health care system and the changes sanctioned by the health care reform bill.

## 2.1 Bankruptcy in the U.S.

In the United States a non-business bankruptcy is designed to help people in financial circumstances beyond their control such as illness or job loss. Distressed debtors have a choice between restructuring their debt through Chapter 13 bankruptcy or purging the unsecured debt under Chapter 7 bankruptcy, which accounts for 70 percent of all bankruptcies. Chapter 7 bankruptcy is appealing as it gives an opportunity for a fresh start by eliminating the unsecured debt. The consequences are a forfeit of non-collateralized assets above an exception limit and virtual exclusion from credit markets for a period of 10 years, at which point the bankruptcy is removed from credit records.

Regardless of its drawbacks, Chapter 7 bankruptcy is a prevalent phenomenon, which has been steadily growing over the last two decades (see Figure 1). In the first half of the 1990s there were roughly 600,000 bankruptcy filings each year (0.3 percent bankruptcy rate[1]). The number of bankruptcies reached a peak of 1.6 million (0.55 percent) in 2005 before the enactment of the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA). The act made it more difficult to file for Chapter 7 bankruptcy. Thus the 2005 spike in bankruptcies represents a buildup preceding the change in the law. Following the fallout from the new law, the number of bankruptcies has been growing, reaching 1 million in 2009.

The main reason for bankruptcy is job loss, which, according to Sullivan et al. (2000), accounted for 67.5 percent of bankruptcies in 1991. In a recent study Himmelstein et al. (2009) conducted the first survey based on a national random sample of 2300 bankruptcy filers. They found that 62.1 percent of bankruptcies[2] in 2007 were due to illness or medical bills (see Table 1). Relative to their previous study (Himmelstein et al. (2005)), medical bankruptcy increased by 50 percent (in relative terms) between 2001 and 2007. In the same time period, health insurance premiums grew by 78 percent (Claxton et al. (2007)), and the number of uninsured increased by 1 percent from 18.5 percent to 19.7 percent.[3]

As pointed out by Livshits et al. (2007), bankruptcy is a form of insurance as it allows individuals to smooth consumption across states by purging debt in a contingency. It is an especially attractive

[1] Bankruptcy rate is defined as the number of bankruptcy filings per capita.

[2] The estimates of medical bankruptcy vary widely. Dranove and Millenson (2006) put medical bankruptcy in 2001 at as low as 17 percent, while Himmelstein et al. (2005) estimated it at as high as 54.5 percent. These wide discrepancies in estimates come from the limited data. Studies based on national data sets like the PSID can identify only a small number of bankruptcies (e.g. 74 respondents in the PSID). Usually data sets with bankruptcy questions have limited medical information and vice versa. Thus it is hard to identify income loss due to illness. A majority of studies on medical bankruptcy were based on court records, where medical debt can be disguised as credit card debt or mortgages. These issues were addressed by Himmelstein et al. (2009).

[3] Non-elderly Uninsured Rate, the Current Population Survey, U.S. Census Bureau.

Tab. 1: Medical cause of bankruptcy, 2007

| Cause of bankruptcy: | % of all bankruptcies |
|---|---|
| Debtor said medical bills were reason for bankruptcy | 29.0 |
| Medical bills >$5000 or >10% of annual family income | 34.7 |
| Mortgaged home to pay medical bill | 5.7 |
| Medical bill problems (any of above 3) | 57.1 |
| Debtor or spouse lost ≥2 weeks of income due to illness or became completely disabled | 38.2 |
| Debtor or spouse lost ≥2 weeks of income to care for ill family member | 6.8 |
| Income loss due to illness (either of above 2) | 40.3 |
| Debtor said medical problem of self or spouse was reason for bankruptcy | 32.1 |
| Debtor said medical problem of other family member was reason for bankruptcy | 10.8 |
| Any of above | 62.1 |

Source: Table 2 in Himmelstein et al. (2009)

form of insurance against a rare catastrophic event like illness, for example, for young cohorts who are relatively healthy. But bankruptcy impairs one's ability to smooth consumption intertemporally due to exclusion from credit markets and higher interest rates. The latter is a general equilibrium effect as lenders have to compensate for losses from bad loans. Since lenders price loans to adjust for the risk of default, people who want to borrow the most have to pay a higher interest rate. This particularly affects young cohorts, who are at the lowest point of their earnings profile, and therefore rely on borrowing to smooth their consumption.

One argument in the health care reform debate is that bankruptcy is not the right way to insure against health shocks. The motivation for the reform was to provide affordable medical coverage to everyone.

## 2.2 Health care system and its reform

In the United States, the health insurance system is divided into public and private sectors. The largest part of the population, 67 percent in 2007, has private health insurance; 9 percent purchase coverage directly in the individual market and 59 percent are insured through their employers in the group market. Public insurance covers 29 percent of the population.[4] It consists of Medicare, Medicaid, and military insurance programs. Medicare insures retirees over 65 and people with certain conditions like ALS and kidney failure. It covers 14.3 percent of the population. Medicaid is a program covering children, young mothers, pregnant women, the blind, and the disabled; it is a means-tested program for low-income individuals only. Medicaid covers 14.1 percent of the population. Military programs primarily insure veterans and dependents of active-duty military personnel. They cover 3.8 percent of the population. The remaining 15.4 percent is uninsured.

This fraction of uninsured is the highest among the OECD countries, all of which have universal health coverage except the United States. The main objective of the 2010 health care reform[5] is to attain close-to-universal coverage in a market-driven health insurance system. Cost containment and improvement in health care quality are secondary objectives. The reform bill is very complex (it has over 2000 pages); thus we will outline only the main provisions that we model and the issues they are designed to address.

Lack of health insurance is prevalent among low-income and middle-class households. The Census Bureau reports that in 2008 the fractions of people without health insurance in households with income below $25,000 and with income in the $25,000 - $50,000 bracket was 25.4 and 21.1 percent, respectively. Uninsured adults with income below the federal poverty level[6] (FPL) are usually not eligible for Medicaid, which mainly covers children and pregnant women. Those uninsured with income above the FDL are either unemployed or working for an employer that does not offer group coverage. Many individuals find non-group insurance unaffordable. In their national survey, the Kaiser Foundation (2010) reports that an average non-group insurance premium is $3,606 for single coverage with an average deductible

[4] Types of coverage are not mutually exclusive; people can be covered by more than one type of health insurance during the year. Source: "Income, Poverty, and Health Insurance Coverage in the United States: 2007," U.S. Census Bureau.

[5] The 2010 health care reform consists of Patient Protection and Affordable Care Act (PPACA), which was signed into law by President Barack Obama on March 23, 2010, and the Health Care and Education Reconciliation Act of 2010 (signed into law on March 30, 2010).

[6] The federal poverty level (FPL) is the federal poverty measure issued each year by the Department of Health and Human Services (HHS). The guidelines are a simplification of the poverty thresholds (the Census Bureau poverty measures used for statistical purposes) for administrative purposes — for instance, determining financial eligibility for certain federal programs.

of $2,498, and $7,102 for a family plan with an average deductible of $5,149. Given that the median household income was $50,303 in 2008, the premium in the individual insurance market combined with the out-of-pocket expenditures takes a significant portion of household income.

The reform facilitates obtaining coverage for low- and median-income households. It expands Medicaid to all individuals (including adults without dependent children) under 65 with income up to 133 percent of the FPL. Those enrolled are guaranteed a benchmark benefit package that provides essential benefits. Individuals and families with income between 133-400 percent of the FPL are eligible to receive premium credits to purchase health insurance through the Exchange.[7] Credits are calculated so that the insured premium contribution is no more than a specific percentage of income (Table 7). In order to reduce out-of-pocket expenditures the government will provide cost-sharing subsidies. The cost-sharing credits reduce co-payments and deductibles so that out-of-pocket expenditures are no more than a specific percent of total medical spending for a given income level (Table 8).

The high premium of non-group insurance is not the only reason for people to stay uninsured. Many industry practices are widely criticized for contributing to the inaccessibility of coverage for some people. The unregulated non-group insurance market allows insurance companies to price discriminate based on individual characteristics like health. People with preexisting medical conditions have to pay extremely high premiums if they are not denied coverage outright. The practice of rescinding or denying coverage renewal due to medical conditions, even though sporadic, has attracted a lot of media attention and public criticism. All these practices have been prohibited in the group insurance market and now the reform prohibits them in the non-group insurance market as well.

There is no doubt that these new market restrictions will contribute to increases in the insurance premium. This will consequently impair insurers' abilities to pool risk as healthy individuals will decide to stay uninsured. To alleviate the adverse selection problem common in health insurance markets, and to maintain a wide enough pool for risk-sharing, the reform imposes a tax penalty for a lack of health insurance. The penalty is the greater of 2.5 percent of household income or $695 per person up to a maximum of $2,085 per family. Similarly, employers are penalized for not providing adequate group insurance coverage. Companies with more than 50 employees have to pay $2000 for each employee who receives a premium subsidy for individual insurance purchase through the Exchange.

[7] The Exchange is a health insurance marketplace organized by the government where individuals can purchase subsidized public or private insurance plans. An additional function of the Exchange is to regulate and oversee insurers beyond current insurance regulations.

We are able to model the most important elements of the reform, described above. We briefly summarize other details of the reform below. The secondary objective of the reform is to contain the growing cost of health care. In the last decade, health care expenditures grew from 13.5 percent of GDP in 1998 to 16.2 percent of GDP in 2008.[8] A large part of health care expenditures is administrative costs. According to Kahn et al. (2005), administrative costs accounted for 25 percent of private health care spending in 2000 in California; a large portion of it, 20-22 percentage points, was attributed to billing and insurance-related costs. The reform imposes industry-wide administrative simplification measures. Insurance companies are required to spend at least 80-85 percent of group and individual plan premiums on clinical services and quality improvement or to provide rebates to customers for the difference.

To reduce health care costs in the long run, the reform promotes preventive care and wellness. This policy is primarily designed to target obesity and overweight, the prevalence of which reached 33.8 and 68 percent in 2008, respectively (Flegal et al. (2010)). Obesity is a risk factor for many chronic conditions like diabetes and heart diseases; thus it contributes to raising health care costs. Finkelstein et al. (2003) report that the combined medical expenditures accounted for 9.1 percent of total annual U.S. medical expenditures in 1998 attributable to overweight and obesity; at which point the prevalence of obesity and overweight was 30.5 and 64.5 percent, respectively. The health care bill provides funding for several preventive care programs. Government insurance programs are encouraged to cover preventive services at no additional charge. Employers are permitted to offer employees rewards, in the form of premium discounts, for participation in wellness programs. Small employers can apply for grants to establish wellness programs.

## 3 Model

In this section, we present our model in detail. We describe the economic environment, market arrangements, and the household problem. Lastly, we define the equilibrium of our model.

We use the following notation throughout this paper. Households are heterogeneous in age $j$, credit rating $d$, health insurance type $i_H$, and assets $a$. Each period, households face idiosyncratic uncertainty about the labor productivity shock $z$, health status $h$, insurance offer indicator $i_E$, and medical expenditure shock $m$, all of which are described in later subsections. We denote a random vector of idiosyncratic

[8] Source: The National Health Expenditure Accounts published by the Centers for Medicare & Medicaid Services.

shocks by $s \equiv (i_E, h, m, z)$. The corresponding transition probability is age dependent and denoted by $\Pi_j^s(s'|s)$. A household is characterized by a vector $(j, s, d, i_H, a)$. A measure over households is denoted by $\mu$.

## 3.1 Demographics, preferences, and legal environment

The economy is populated by $J$ overlapping generations of households. Each period households face a positive probability of dying. We denote the conditional probability of dying at age $j+1$ when being of age $j$ by $\psi_j$. Each dying, household is replaced by a newly born household. We assume population remains constant. The measure of newly born households is normalized to 1.

Households value only consumption and supply labor inelastically. Preferences are time-separable with a constant subjective discount factor $\beta$. Instantaneous utility over consumption takes CRRA functional form $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$. In the case of default or a bad credit history, households incur a non-pecuniary cost of default, $\lambda_j$, which is age dependent.

## 3.2 Labor endowment

During working age, households receive a stochastic endowment of efficiency units of labor, $n_{j,h}$, which depends on age and health status. The mandatory retirement age is $j^R$. We adopt the following process for effective labor:

$$\log n_{j,h} = \bar{n}_{j,h} + z_j \tag{1}$$

where $\bar{n}_{j,h}$ is the age- and health-dependent average log-income and $z_j$ is a persistent component following an AR(1) process, $z_j = \rho_z z_{j-1} + \eta_j$, $\eta_j \sim N\left(0, \sigma_\eta^2\right)$. Households' gross income, $y$, is a wage multiplied by efficiency units of labor. The detailed description of a wage can be found in Section 3.5.

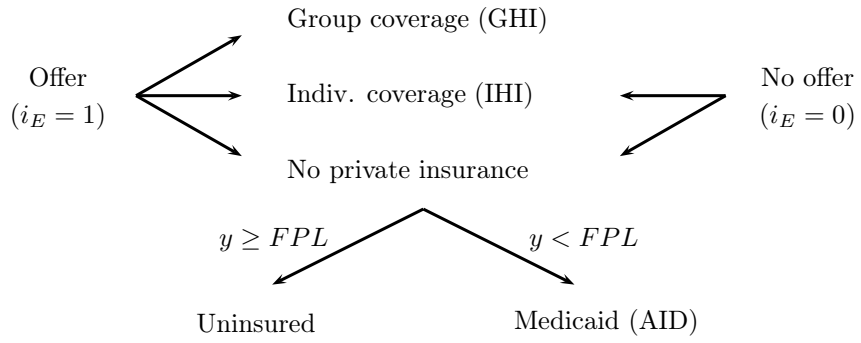
## 3.3 Health and medical insurance

Households are heterogeneous in health status, $h$, which follows an exogenous Markov process $\pi_j^h(h'|h)$[9]. Health transition probabilities vary with household age.[10] Each period, a household faces an idiosyn-

[9] An alternative approach is to model health as a form of human capital. Health would enter a utility function. Households would have to invest in health to replenish it as it depreciates each period (see Grossman (1972)). Since our focus is on bankruptcy and health insurance we decided to model health in a simple way as an exogenous process. Endogenizing health remains a subject for further study.

[10] We abstract from the causal effect of income on health. Most of the recent literature finds this link to be very weak, often statistically insignificant. Frijters et al. (2005) review the literature on this topic. Currie and Madrian (1999) has a

Fig. 2: Insurance choice diagram




cratic medical expenditure shock, $m$, which is randomly drawn from the age- and health-dependent distribution $\pi^m_{j,h}(m)$. The medical shock is realized at the beginning of a period and households can purchase health insurance against this shock one period in advance. There are two competitive health insurance markets: the individual health insurance (IHI) market and the group health insurance (GHI) market. All households have access to the IHI market. To purchase group health insurance (GHI), a household needs to work for an employer who offers a group insurance plan. In the model, households receive a GHI offer exogenously. The GHI offer flag is denoted by $i_E$. In the data the probability of a GHI offer is positively correlated with earnings. Thus, we assume that $i_E$ follows an income-dependent Markov process $\pi^E(i'_E|i_E, n)$. Households have a choice to purchase only one insurance contract or to stay uninsured.[11] Low-income households without health insurance are covered by Medicaid. All other uninsured households have to pay for all medical expenditures out-of-pocket. Reimbursement for medical expenses provided by insurance coverage is governed by a transfer function $tr^m(m, i_H)$.

In the group insurance market, the law prohibits insurance companies from price-discriminating based on age or preexisting medical conditions. Thus, the GHI premium $p^{GHI}$ is the same for all households regardless of their age or health status.[12] Many employers subsidize group insurance policies

more general discussion about the relationship between health and income.

[11] Some households may be covered by two types of insurance. Unemployed households can purchase a temporary continuation of the group coverage from a former employer under COBRA. To keep the model parsimonious we assume that households can be covered by at most one type of insurance.

[12] For simplicity we assume that a firm offers only one group insurance plan. We find this assumption not too restrictive as only 15 percent of firms offering health benefits offer more than one health insurance plan (Employer Health Benefits:

for their employees as part of a benefit package. In the model a firm pays a fraction $\xi \in [0,1]$ of the premium and a household pays the remaining $(1-\xi)p^{GHI}$. A firm will transfer the cost of subsidy onto its employees by adjusting wages accordingly (see Section 3.5).

In the individual insurance market, law permits insurance companies to price discriminate based on age and preexisting medical conditions. Hence, in the model, the IHI premium, $p^{IHI}(j,h)$, depends on age and health status.

Health insurance markets are perfectly competitive. Insurers cover all losses from contracts with collected premiums and make zero profits. We assume that insurers do not cross-subsidize the two types of insurance contracts. In the GHI market, insurers pool the risk over all participants. Thus, the GHI premium is the discounted average medical expenditure adjusted for a fixed administrative cost, $\phi^{GHI}$.

$$p^{GHI} = \phi^{GHI} + \frac{\int tr^m(m, i_H)\,\mathbf{1}_{\{GHI\}}(i_H)\,d\mu}{(1+r)\int \mathbf{1}_{\{GHI\}}(i_H)\,d\mu} \tag{2}$$

Each IHI contract is priced individually. The IHI premium is the discounted expected payout adjusted for a fixed administrative cost, $\phi^{IHI}$.

$$p^{IHI}(j,h) = \phi^{IHI} + \frac{\psi_j \int\int tr^m(m', IHI)\,\pi^m_{j+1,h'}(m')\,dm'\pi^h_j(h'|h)\,dh'}{(1+r)} \tag{3}$$

The government runs the Medicaid program, which provides medical coverage to low-income households. Uninsured working-age households whose income is below the eligibility threshold, $y^{FPL}$, automatically qualify for Medicaid coverage. The threshold, $y^{FPL}$, corresponds to the federal poverty level (FPL). Medicaid coverage is denoted by $tr^{AID}(m)$.

All retired households are covered by Medicare. While working, households pay the Medicare tax, $\tau_m$, and during retirement pay a premium, $p^{MED}$. Medicare coverage is governed by a transfer function $tr^{MED}(m)$. The program is self-financed.

We denote out-of-pocket expenditures by $\chi$. Households with private insurance coverage pay $m - tr^m(m, i_H)$ out-of-pocket. Copayments for households qualified for Medicaid and Medicare are $m -$

2009 Annual Survey).

$tr^{AID}(m)$ and $m - tr^{MED}(m)$, respectively. Uninsured households with income above the Medicaid eligibility threshold, $y \geq y^{FPL}$, are liable for all medical expenditures $m$. For $j \leq j^R$, out-of-pocket expenditures are defined by

$$\chi = \begin{cases} m - tr^m(m, i_H) & \text{if } i_H \neq 0 \\ m - tr^{AID}(m) & \text{if } i_H = 0,\ y < y^{FPL} \\ m & \text{otherwise} \end{cases} \tag{4}$$

and $\chi = m - tr^{MED}(m)$ for retirees, $j > j^R$.

## 3.4 Credit market

Households can save and borrow. The incentive to borrow comes from life-time consumption smoothing and precautionary saving motives. The former is due to the hump shape of the life-cycle income profile. The latter is a consequence of the idiosyncratic productivity and medical expenditure shocks faced by households. Borrowing is in the form of one-period unsecured loans. We allow households to file for bankruptcy and discharge their debt. The credit market is perfectly competitive. Creditors incorporate the likelihood of default into the price of unsecured loans to ensure that they break even on each loan. In order to forecast a probability of default in the next period, creditors observe all household characteristics: age, $j$, and idiosyncratic shocks, $s$.[13] So the price of each loan depends on those characteristics, $(j, s)$, and the quantity borrowed, $a'$. We denote the loan price by $q_j(s, a')$.

Creditors compute the probability of default, $\pi_j(s, a')$, on a loan of size $a'$ using the household's default decision rule, $d^*_{j,d}(s, a')$.

$$\pi_j(s, a') = \int d^*_{j+1,0}(s, a')\, \Pi_j(s'|s)\, ds' \tag{5}$$

Then, the zero-profit condition implies

[13] The Fair Credit Reporting Act (FCRA) limits the way financial companies can use medical information for credit pricing. Lenders cannot ask about medical conditions and must treat medical bills like any other debt in deciding whether to make a loan. The Equal Credit Opportunity Act (ECOA) prohibits lenders from discriminating based on age, race, and gender. Due to the computational complexity, we abstract from this. If loans were not conditioned on age and health, lenders would have to use a distribution to integrate out both unknowns. This would require iterating on a distribution to solve a household problem.

$$q_j(s,a') = \begin{cases} \frac{\psi_j}{1+r} & \text{for } a' \geq 0 \\ \frac{\psi_j\left(1-\pi_j\left(s,a'\right)\right)}{1+r} & \text{for } a' < 0 \end{cases} \tag{6}$$

Notice that we account for a possibility of losses and gains due to the death of some borrowers and depositors.

## 3.5 Production

There is a continuum of competitive firms that operate a constant return-to-scale technology $F(K,L)$. The marginal products of capital and labor are $r$ and $w$, respectively. If a firm offers group health insurance, it pays a fraction, $\xi$, of the premium for each insured worker. The firm's cost of health insurance per efficiency unit of labor is

$$c^{GHI} = \xi p^{GHI} \frac{\int_{j<j^R} \mathbf{1}_{\{GHI\}}(i_H)\, d\mu}{\int_{j<j^R} n\mathbf{1}_{\{1\}}(i_E)\, d\mu} \tag{7}$$

where $\mu$ is a measure of households.

For the zero-profit condition to hold, firms must adjust the market wage rate for their cost of health insurance. All households that received a GHI offer will receive the adjusted wage, $w - c^{GHI}$, regardless of the insurance purchase.

## 3.6 Medical sector

Health care providers receive a full payment from households that did not file for bankruptcy. But from defaulted households, providers receive a payment from the insurer, $m - \chi$, and whatever out-of-pocket expenditures, $\chi$, can be recovered from the household assets, $max\{0,a\}$.

Revenue from a household of type $(j,d,s,i_H,a)$ is

$$d_{j,h}\left(m - \chi + max\{0,a\}\right) + \left(1 - d_{j,h}\right) m. \tag{8}$$

The medical sector clearing constraint is

$$\int \left[d^*_{j,h}\left(m - \chi + max\{0,a\}\right) + \left(1 - d^*_{j,h}\right) m\right] d\mu = \int \frac{m}{\varpi} d\mu, \tag{9}$$

where $\varpi$ is a sector markup used to clear the medical sector.

## 3.7 Household problem

When household is working, the timing of events is as follows: (i) all shocks are realized, i.e., labor productivity $z$, employer-sponsored insurance offer $i_E$, and medical expenditure shock $m$, (ii) capital and labor are employed and households earn wages, and (iii) households make default, consumption, borrowing/saving, and insurance purchase decisions. An insurance contract is purchased one period ahead.

The following notation is used for the problem. The value function of a household of age, $j$, with a default flag, $d$, is denoted by $V_{j,d}(s, i_H, a)$. The employer-sponsored insurance offer, health status, medical shock, and productivity shock are combined to a vector $s \equiv (i_E, h, m, z)$. All expectations below are taken with respect to the random vector $s$. The type of health insurance purchased last period and household net worth are denoted by $i_H$ and $a$, respectively. We refer to the insurance premium by $p(i'_H)$, which equals $(1-\xi)\, p^{GHI}$, $p^{IHI}(j,h)$, or 0 depending on the type of coverage purchased. the out-of-pocket expenditures, $\chi$, the social transfers, $tr^s$, and taxes, $tax$, are defined in equations 4, 21, and 22.

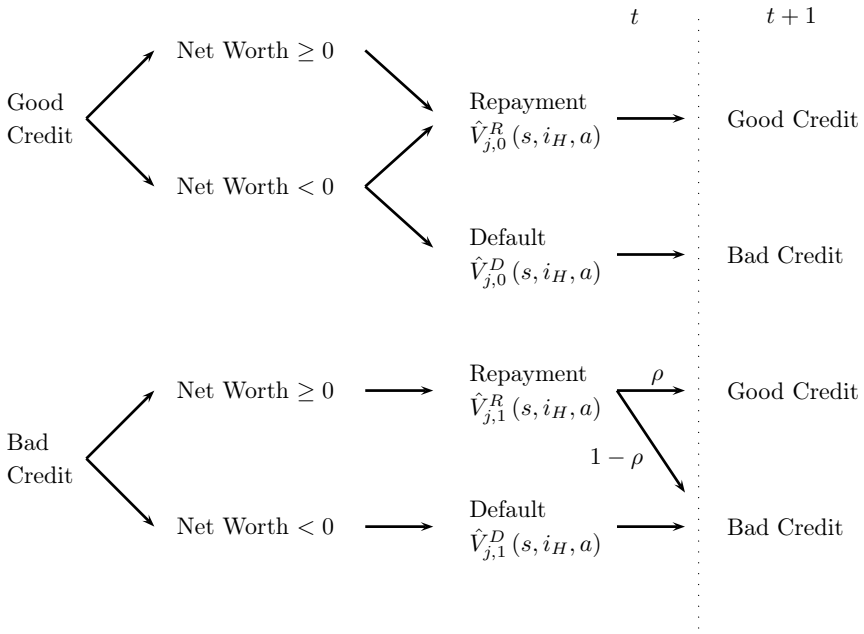
The structure of the value function is illustrated in Figure 3. The household problem is laid out by cases of credit rating and bankruptcy decision:

1. Let us first consider a household with a good credit history, $d = 0$. The household can file for bankruptcy only if its net assets are negative, $a - \chi < 0$. When the household decides to default, it cannot save or borrow and it has to pay a utility cost of bankruptcy, $\lambda_j$:

$$\begin{aligned} \hat{V}_j^D(s, i_H, a) &= \max_{c, i'_H} u(c) - \lambda_j + \beta\psi_j E\left[V_{j+1,1}(s', i'_H, 0)\right] \qquad (10) \\ &\quad s.t \\ (1+\tau_c)\, c &\leq y + tr^s - p(i'_H) - tax \qquad (11) \end{aligned}$$

If the household decides to pay its net liabilities or if its net assets are nonnegative, then it faces the following problem:

Fig. 3: Household problem diagram




$$\hat{V}_j^R(s, i_H, a) = \max_{c, a', i'_H} u(c) + \beta\psi_j E\left[V_{j+1,0}(s', i'_H, a')\right] \tag{12}$$

$$s.t$$

$$(1+\tau_c)c + q_j(s, a')a' \leq y + tr^s - p(i'_H) - tax + a - \chi \tag{13}$$

The value function of the household with good credit is

$$V_{j,0}(s, i_H, a) = \max\left\{\hat{V}_j^D(s, i_H, a), \hat{V}_j^R(s, i_H, a)\right\} \tag{14}$$

2. A household with a bad credit history, $d = 1$, pays a utility cost of bankruptcy, $\lambda_j$, which can be interpreted as a default stigma. If the household has non-negative net assets, $a - \chi \geq 0$, it can save and it will have a good credit rating next period with a positive probability, $\rho$. Given these conditions, the household problem is:

$$V_{j,1}(s, i_H, a) = \max_{c,a' \geq 0, i'_H} u(c) - \lambda_j + \beta\psi_j \begin{cases} \rho E\left[V_{j+1,0}(s', i'_H, a')\right] + \\ (1-\rho) E\left[V_{j+1,1}(s', i'_H, a')\right] \end{cases} \quad (15)$$

$$s.t$$

$$(1+\tau_c) c + q_j(s, a') a' \leq y + tr^s - p(i'_H) - tax + a - \chi \quad (16)$$

The household with negative net assets, $a - \chi < 0$, pays only up to its assets and cannot save or borrow this period. The household carries a bad credit rating to the next period.[14]

$$V_{j,1}(s, i_H, a) = \max_{c, i'_H} u(c) - \lambda_j + \beta\psi_j E\left[V_{j+1,1}(s', i'_H, 0)\right] \quad (17)$$

$$s.t$$

$$(1+\tau_c) c \leq y + tr^s - p(i'_H) - tax \quad (18)$$

Wage is conditional on receiving a GHI offer

$$y = \begin{cases} \left(w - c^{GHI}\right) n & \text{if } i_E = 1 \\ w \cdot n & \text{otherwise} \end{cases} \quad (19)$$

Taxable labor income is defined as

$$y^t = \begin{cases} (1 - 0.5\tau_m) y - 0.5\tau_{ss} \min\{y, \bar{y}\} - p(i'_H) & \text{if } i'_H = GHI \\ (1 - 0.5\tau_m) y - 0.5\tau_{ss} \min\{y, \bar{y}\} & \text{otherwise} \end{cases} \quad (20)$$

Notice that half of the Social Security tax paid is deductible. The other half is paid by the employer, but through wages, the household pays for it in full; thus the entire Social Security tax is effectively paid by the household. There is no tax base for Medicare. Tax liabilities consist of income tax $T(y)$,

[14] In the U.S. a household is not allowed to file for a second Chapter 7 bankruptcy for 6 years after its first bankruptcy. Instead, households can file for Chapter 11 bankruptcy only. For simplicity, we abstract from Chapter 13 bankruptcy; thus we allow households with bad credit a second discharge of net liabilities under Chapter 7.

Social Security, and Medicare.

$$tax = T\left(y^t\right) + \tau_{ss} \max\left\{y, \bar{y}\right\} + \tau_m y \tag{21}$$

Social assistance is a means-tested transfer, which is based on assets and income,[15]

$$tr^s = \max\left\{0, \underline{c} - \max\left\{0, a\right\} - y\right\} \tag{22}$$

## 3.8 Retirement

When retired, a household receives a pension, $ss = vwn_{j^R} + \Upsilon\overline{w}$, equal to a fraction of the last working period's income plus a fraction of average income in the economy. Recently retired households, $j = j^R$, may still have individual or employer-sponsored health insurance. During the first year of retirement, the household is not covered by Medicare but only by private health insurance if purchased last period. Households pay the mandatory Medicare premium, $p^{MED}$, one period ahead starting in the first year of retirement. Medical expenditures are partially covered by Medicare and partially out-of-pocket. Retired households do not pay income tax. Bankruptcy is permitted during retirement. After the first period of retirement, the group insurance offer indicator, $i_E$, is dropped from the state space as it is redundant.

During retirement the budget constraint of a household with good credit that repays its debt is

$$\left(1 + \tau_c\right) c + q_j\left(s, a'\right) a' \leq ss - p^{MED} + tr^s\left(ss - p^{MED}, a\right) + a - \chi \tag{23}$$

A household with bad credit and positive net assets has the same budget constraint with the additional no-borrowing restriction, $a' \geq 0$. The budget constraint of a household that purged debt, regardless of its credit rating, is

$$\left(1 + \tau_c\right) c \leq ss - p^{MED} + tr^s\left(ss - p^{MED}, a\right) \tag{24}$$

Social assistance during retirement is based on Social Security net of the Medicare premium:

$$tr^s = \max\left\{0, \underline{c} - \max\left\{0, a\right\} - \left(ss - p^{MED}\right)\right\} \tag{25}$$

[15] Social assistance is a last-resort insurer, which guarantees a minimum level of consumption $\underline{c}$. See Athreya (2008) for more details on the interaction of social insurance and bankruptcy.

## 3.9 Equilibrium

A steady-state competitive equilibrium is a set of prices $\{w^*, r^*\}$, a non-negative loan price function $q^*$, a default probability function $\pi_j^*$, a set of health insurance premiums $\left\{p^{*GHI}, p^{*IHI}(\cdot)\right\}$, a non-negative hospital markup $\varpi$, a value function $V$, decision rules $c^*(\cdot), d^*(\cdot), a'^*(\cdot)$, and a probability measure $\mu^*$ such that:

1. Given prices $w^*, r^*, q^*, p^{*GHI}, p^{*IHI}$, the value function $V$ and decision rules $c^*(\cdot), d^*(\cdot), a'^*(\cdot)$ solve the household's optimization problem.

2. Prices $r^*$ and $w^*$ are given by the firm's marginal productivity of capital and labor:

$$r^* = \alpha \left(K^*/N^*\right)^{\alpha-1} - \delta \tag{26}$$

$$w^* = (1-\alpha)\left(K^*/N^*\right)^{\alpha} \tag{27}$$

3. A wage at a firm offering GHI is adjusted for the employer's cost of insurance (eq. 7).

4. The health insurance company is competitive and the insurance premiums satisfy (eq. 3, 2).

5. Loans are priced by financial intermediaries according to a zero-profit condition (eq. 6).

6. The hospital sector clears (eq. 9).

7. The labor market clears, $N^* = \int n d\mu^*$.

8. The capital market clears

$$K^* = \int q^* a'^* d\mu^* + \int p\left(i'_H\right) d\mu^* \tag{28}$$

   where the latter term is interest earned by insurance companies on premiums.

9. Social Security and Medicare are self-financed

$$ss \int_{j \geq j^R} d\mu = \tau_{ss} \sum_{j<j^R} \int \min\left\{y, \bar{y}\right\} d\mu \tag{29}$$

$$\int_{j \geq j^R} tr^{MED}(m)\, d\mu^* = \tau_m \int_{j<j^R} y d\mu^* + p^{MED} \int_{j \geq j^R} d\mu^* \tag{30}$$

10. The government's budget is balanced

$$G + \int \left[tr^s + tr^{AID}\right] d\mu^* = \int \left[\tau_c c^* + T\left(y^t\right)\right] d\mu^* \tag{31}$$

11. The goods market clears

$$\int c^* d\mu^* + \int \frac{m}{\varpi} d\mu^* + G + X = F\left(K^*, N^*\right) - \delta K^* \tag{32}$$

where $X$ is total administrative costs

$$X = \phi^{GHI} \int \mathbf{1}_{\{GHI\}}\left(i_H\right) d\mu^* + \phi^{IHI} \int \mathbf{1}_{\{IHI\}}\left(i_H\right) d\mu^* \tag{33}$$

# 4 Calibration

In this section we specify the parameters of the model. Since we do not model the bankruptcy reform of 2005, we calibrate the model to 2004. All calibration details are presented in Appendix A. Table 2 summarizes key parameters. Calibrated parameters with corresponding target statistics are listed in Table 3.

## 4.1 Model Specification

Demographics and Preferences: Households enter the model economy at age 20 and retire at age 65 ($J^R = 46$). The survival probabilities $\psi_j$ are taken from Bell and Miller (2002). All households live for no longer than 80 years ($J = 60$). The utility function is CRRA with a relative risk-aversion coefficient $\sigma = 2.0$, which implies an intertemporal elasticity of substitution of 0.5, in the middle of the range of micro estimates in the literature (see Attanasio (1999), for a survey). In the U.S., bankruptcy stays on a credit history for 10 years. We set the probability of restoring a good credit rating, $\rho$, to 0.1, which gives an average duration of exclusion from access to credit of 10 years. The discount rate, $\beta = 0.983$, is calibrated to equate the capital-output ratio to 3.0.

We assume that our non-pecuniary cost of default, $\lambda_j$, monotonically decreases with age. As pointed out by Fay et al. (2002), bankruptcy carries a stigma, which affects job prospects and consequently lifetime income. The cost of default is highest when young, as it reflects the discounted loss of income

over the remaining lifetime. We assume $\lambda_j$ takes the functional form $max\,(a_\lambda - b_\lambda \cdot j,\, c_\lambda)$. Parameters $\{a_\lambda, b_\lambda, c_\lambda\}$ are calibrated to match the bankruptcy profile from the Survey of Consumer Finances taking values $\{3.5, 0.1, 0.05\}$. We assume that all households are born with zero assets and good credit ratings.

Technology: The aggregate production function is Cobb-Douglas in capital and effective labor:

$$Y = ZK^{\alpha}L^{1-\alpha} \tag{34}$$

We set the capital share of output, $\alpha$, to 0.36, and the physical depreciation rate, $\gamma$, to 8 percent. Total factor productivity, $Z$, is chosen so that income per household ($42,414 in 2004) is normalized to 1.0 in the steady state.

Earning process: An income age-profile is estimated from the Medical Expenditure Panel Survey (MEPS) using methodology from Hubbard et al. (1994). For the estimation details, see Appendix A.2. The stochastic process for the idiosyncratic part of log-wages is an AR(1) process with persistence parameter $\rho_z$ and unconditional standard deviation $\sigma_z^2$. We set $\rho_z$ to 0.99, which is in line with Storesletten et al. (2004), and we calibrate $\sigma_z^2$ to 0.29 to match the earnings Gini, which is 0.63 in the U.S. (Castaneda et al. (2003)). Both values are in line with the estimates from Storesletten et al. (2004). The process is discretized using the Tauchen and Hussey (1991) method with 9 grid points.

Health and medical expenditure process: We define household health status, $h$, as a binary variable taking values: good (1) or bad (0). The age-dependent Markov transition matrix for health status is estimated from MEPS using a logistic regression model (see Appendix A.3). For the medical expenditure shock, we use a four-point grid. The distribution over the grid points is fixed. To capture a fat tail distribution of medical events, we choose the probabilities for the grid points to be $\{0.5, 0.4, 0.09, 0.01\}$. The persistence of medical expenditures comes from the persistence of the health shock. The shock values depend on age and health. Figure 12 shows the shock values. The estimation details can be found in Appendix A.4.

Health insurance: In the data, households with high income are more likely to work for a company offering group health insurance. Additionally, we observe a significant persistence in receiving a GHI

offer. Thus, we assume the GHI offer indicator, $i_E$, to follow a Markov process conditional on household income, $\pi^E\left(i'_E|i_E,n\right)$. The initial measure of households with a GHI offer is 35.7 percent. More details on the estimation can by found in Appendix A.5.

We obtain the medical insurance transfer function, $tr^m\left(m,i_H\right)$, by estimating the coverage rate, $q = tr^m/m$. In MEPS, the private insurance coverage rate increases with the size of medical expenditures. Therefore we choose a cubic polynomial as a functional form for the coverage rate. For Medicaid and Medicare, we fix $q$ at a value corresponding to the mean coverage rate. The estimation details are in Appendix A.6.

In the National Health Expenditure Accounts, the net cost of private health insurance in 2004 is \$85.8 billion. In the same year 201 million people had private health coverage. Thus, the fixed administrative cost is \$427 per person or \$1,067.5 per average household with 2.5 people. We set both $\phi^{GHI}$ and $\phi^{IHI}$ to the latter value. According to MEPS in 2004, an average employer-sponsored insurance premium is $\$3,705$ and an average employee's contribution is \$671. Thus, we set the employer's share of the GHI premium, $\xi$, to 82 percent.

Government: Government consumption, $G$, represents federal, state, and local government consumption expenditures excluding social benefit payments, interest payments, and subsidies. It is calibrated to match its share of GDP, which is 15.7 percent in 2004 (U.S. Government 2009).

Our income tax is composed of progressive and proportionate taxes. The latter represents all taxes other than income and consumption tax. The former takes a functional form borrowed from Gouveia and Strauss (1994).

$$T\left(y\right) = a_0\left\{y - \left(y^{-a_1} + a_2\right)^{-1/a_1}\right\} + \tau_y y \tag{35}$$

Parameter $a_0$ is the maximum marginal tax rate, $a_1$ governs the curvature of the progressive tax, and $a_2$ is a scaling parameter. We take their values, $a_0 = 0.258$, $a_1 = 0.768$, from the estimates by Gouveia and Strauss (1994) to preserve the shape of the progressivity of the U.S. tax system. The parameter $a_2$ is calibrated to match the portion of the progressive part of income tax in the total income tax collected. This target is set to 63 percent, which is the 10-year average fraction of the individual income tax to the total Internal Revenue collections.[16] Parameter $\tau_y$ is used to clear the government budget constraint (31). A consumption tax rate, $\tau_c$, is set to 5.6 percent following Mendoza et al. (1994).

[16] IRS Data Book

A minimum consumption floor, $\underline{c}$, is calibrated to match the fraction of households on social welfare, which the CPS reports at 10.2 percent in 2004. We set the Medicaid eligibility threshold to the federal poverty level, $y^{FPL}$, which is calibrated to match the fraction of people covered by Medicaid.

Social Security and Medicare: A household retires at the mandatory retirement age, $j^R = 65$. We set the Social Security benefit parameters, $\upsilon$ and $\Upsilon$, to 0.4 and 0.2, respectively, to match an average replacement rate of 45 percent following Whitehouse (2003). The Social Security tax, $\tau_{ss}$, is determined so that Social Security is self-financed. In the benchmark economy we get the equilibrium $\tau_{ss} = 11.49$, which is approximately the tax rate of Social Security's Old-Age, Survivors, and Disability Insurance (OASDI) program of 12.4 percent in 2004.

In 2004 the Medicare Part B premium was $799.20 annually, or about 2.11 percent of GDP per capita. We set the Medicare premium, $p^{MED}$, to match this ratio. The Medicare tax rate, $\tau_m$, is pinned down by the budget clearing of Medicare, which is self-financed. Since the Medicare coverage rate, $tr^{MED}(m)/m$, is scattered without any visible pattern, we set it to 0.48, which is the average Medicare coverage rate in MEPS.

## 5 Results

In this section we elaborate on results from the benchmark model. We describe how each element of the reform is modeled. The impact of the reform on insurance markets and bankruptcy is presented. Lastly, we evaluate the welfare implications and decompose the redistribution and insurance market restructuring components of the reform.

### 5.1 Benchmark model

Even though we did not target bankruptcy and health insurance statistics directly, our model succeeds in matching them not only qualitatively but quantitatively as well. The life-cycle dimension of these statistics is also replicated reasonably well.

The overall bankruptcy rate is 1.0 percent (0.98 percent in the data). In the model we define medical bankruptcy as the fraction of filers who would not have defaulted had they not received a bad medical expenditure shock. Without direct targeting the model generates medical bankruptcies at 75.97 percent

Tab. 2: Benchmark parameters

| Parameter | Description | Values | Target/Source |
|---|---|---|---|
| Preferences | | | |
| $\beta$ | discount factor | 0.983 | K/Y=3.0 |
| $\sigma$ | risk aversion | 2.0 | |
| $\rho$ | prob. of good credit | 0.1 | 10 years exclusion |
| $\{a_\lambda, b_\lambda, c_\lambda\}$ | cost of bankruptcy | $\{3.5, 0.1, 0.05\}$ | bankruptcy profile |
| Technology | | | |
| $\alpha$ | capital share | 0.36 | |
| $\gamma$ | depreciation rate | 0.08 | |
| Labor | | | |
| $\rho_z$ | persist. coeff. | 0.99 | Storesletten et al. (2004) |
| $\sigma_z$ | std. dev. $z$ | 0.29 | earnings Gini=0.63 |
| Other | | | |
| $\xi$ | firm premium share | 0.89 | MEPS, 2004 |
| $\phi^{GHI}, \phi^{IHI}$ | fixed admin. cost | \$1,067.5 | NHEA |
| Government | | | |
| $a_0, a_1$ | prog. income tax | $0.258, 0.768$ | Gouveia and Strauss (1994) |
| $a_2$ | prog. income tax | 2.16 | $Prog./T\,tax = 0.65$ |
| $\tau_y$ | prop. income tax | 0.013 | const. clearing |
| $\tau_c$ | consumption tax | 0.06 | Mendoza et al. (1994) |
| $\tau_s$ | Social Security tax | 0.1 | const. clearing |
| $\tau_m$ | Medicare tax | 0.012 | const. clearing |
| G | gov. consumption | 18.92 | $G/Y = 0.16$ |
| $p^{MED}$ | Medicare premium | 0.042 | $p^{MED}/Y = 0.0211$ |

Tab. 3: Calibrated parameters

| Parameter | Target | Data | Value |
|---|---|---|---|
| $\beta$ | K/Y | 3.00 | 2.95 |
| $v, \Upsilon$ | avg. ss/avg. income | 0.45 | 0.45 |
| $\underline{c}$ | fraction on Soc. Ass. | 0.10 | 0.11 |
| $p^{MED}$ | $p^{MED}/Y$ | 0.0211 | 0.0210 |
| $G$ | G/Y | 0.156 | 0.158 |
| $a_2$ | prog. tax/tot. tax | 0.65 | 0.67 |

Tab. 4: Benchmark: bankruptcy

| % | Bankruptcy | Medical bankruptcy | Medical bk. share | Med. bk. w/o health ins. |
|---|---|---|---|---|
| Data | 0.98 | 0.61 | 62.1 | 31 |
| Model | 1.01 | 0.76 | 75.97 | 30 |

of all bankruptcies (62.1 percent in the data). Among medical bankruptcy filers 30 percent had no health insurance (31 percent in the data). In Figure 4 we plot a fitted-value profile of bankruptcy from the model and from the 2004 Survey of Consumer Finances. With respect to the life-cycle literature on bankruptcy the model achieves a good fit of the bankruptcy profile. Only early in life does the model generate more bankruptcies than in the data. A possible reason for this discrepancy is a lack of parental transfers, which allow young households to cushion negative income and medical expenditure shocks.

Figure 5 presents the offer and acceptance rate profiles. The group insurance offer rate is 67.0 percent, which is a little higher than in the data (65.3 percent). Among households that received an offer, 89.2 percent accepted it (91.2 percent in the data). The profile of the acceptance rate is endogenously generated and matches the data quite well (Figure 6).

Tab. 5: Benchmark: insurance

| | Group Insurance | | Insurance Coverage | | | |
|---|---|---|---|---|---|---|
| % | offered | accepted | GHI | IHI | Medicaid | Uninsured |
| Data | 65.31 | 91.22 | 59.58 | 9.76 | 10.81 | 19.85 |
| Model | 67.02 | 89.16 | 59.78 | 10.26 | 10.13 | 19.83 |

Source: MEPS, Census Bureau's March 2004 Current Population Survey (CPS; ASES), Kaiser

Fig. 4: Bankruptcy profile

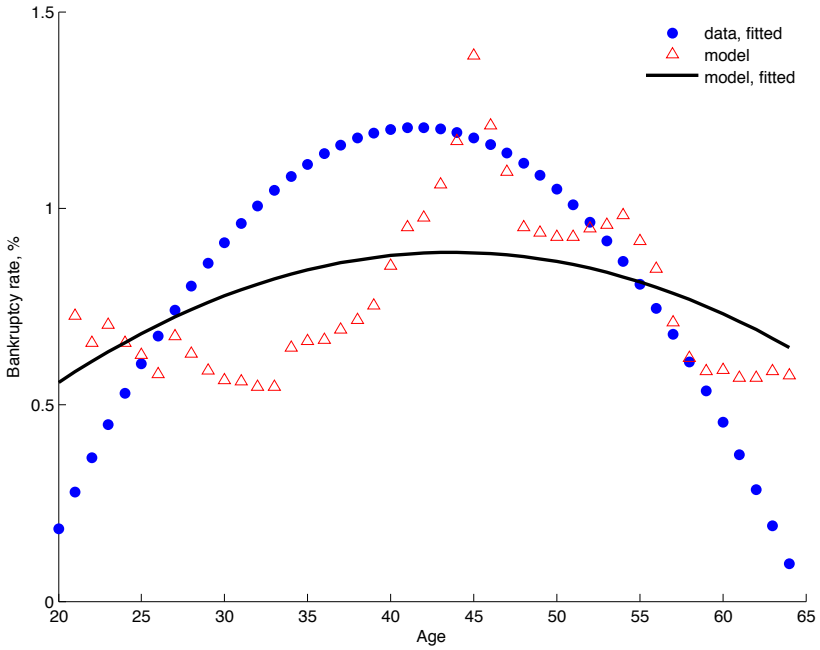



Fig. 5: GHI offer

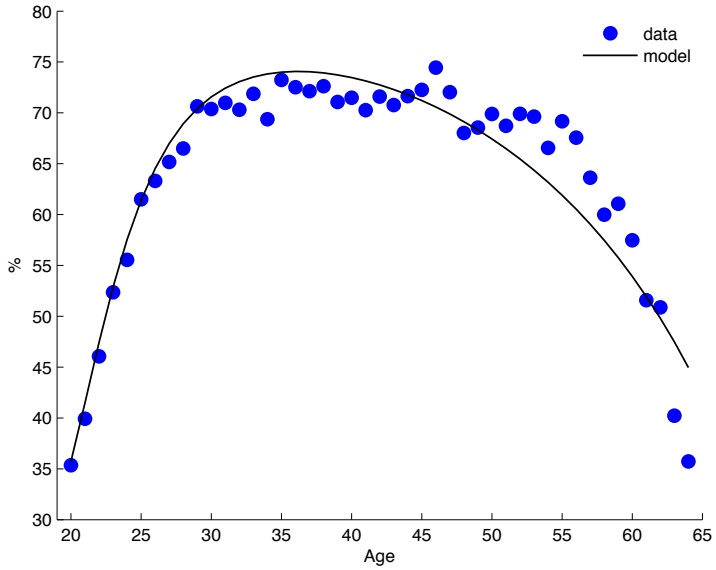
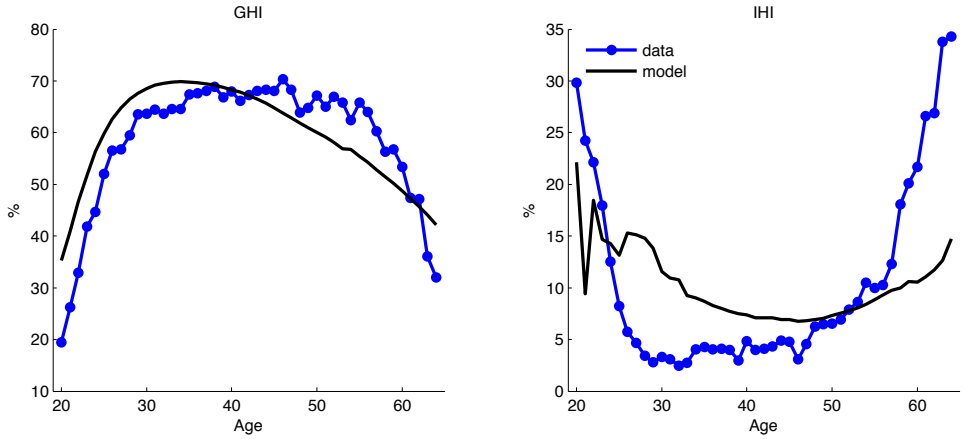


Fig. 6: Insurance take-up rates




Source: MEPS, author's calculations.

The results on insurance coverage are presented in Table 5. Less than a quarter of households are uninsured (19.7 percent in the model and 19.9 percent in the data). Medicaid covers 10.1 percent of households (10.8 percent in the data). Group and individual insurance coverage is 59.8 and 10.3 percent, respectively (59.6 percent and 9.8 percent in the data). Medicaid coverage is targeted in calibrating the federal poverty level, $y^{FPL}$, but the share of uninsured and the profile of those with private coverage are endogenously generated by the model (Figure 6) and match the data well. We consider the model's ability to replicate health insurance statistics a success.

The premiums and risk pools are reported in Table 6. In MEPS, the fraction of households in bad health is 14.7 percent in both private insurance markets and 18.4 percent among the uninsured. The model replicates the GHI risk pool quite well at 14 percent. In the IHI market, the model generates a worse pool than in the data. One possible explanation is that insurance companies can improve their pool by not accepting sick individuals or canceling an existing policy, but we do not model the denial and rescission of coverage.

## 5.2 Policy experiments

In our experiments we keep the government consumption, $G$, consumption tax, $\tau_c$, and progressive income tax, $(a_0, a_1, a_2)$ unchanged from the benchmark. The proportionate part of income tax adjusts to balance the government budget constraint. Both Social Security and Medicare remain self-financed.

Tab. 6: Benchmark: premium and risk pools

| | Data | | Model |
|---|---|---|---|
| | Individual | Family | |
| GHI | $3,383.00 | $9,068.00 | $3,296.79 |
| IHI | $1,786.00 | $3,331.00 | $1,292.33 |

| Bad Health, % | Data | Model |
|---|---|---|
| GHI | 14.7 | 15.50 |
| IHI | 14.7 | 20.91 |
| Uninsured | 18.4 | 13.98 |

Source: Kaiser FamilyFoundation 2004 (premium); MEPS (health).

We keep Social Security benefits, $ss$, and the Medicare premium, $p^{MED}$, at the benchmark level. The tax rates, $\tau_s$ and $\tau_m$, adjust to balance both systems.

We can evaluate the welfare effects of policies only by comparing two steady states, before and after the reform, through the consumption equivalent variation (CEV). The consumption equivalent variation measures the percentage increase in the household's initial consumption required to make the household indifferent between benchmark and reform steady states. Given the form of the utility function, the welfare measure is given by

$$CEV = \left( \frac{\int V^R_{j,d} d\mu^*_{j=0,d=0}}{\int V^B_{j,d} d\mu^*_{j=0,d=0}} \right)^{1/(1-\sigma)} - 1 \tag{36}$$

where $V^B$ and $V^R$ are the indirect utility functions at birth of households with a good credit rating associated with the benchmark and the reform, respectively.

### 5.2.1 Health reform components

The health care reform bill is very complex, but the core of the reform can be summarized by five essential provisions. In this section we describe how each element of the health reform is modeled.

1. Individual mandate

   The reform requires all individuals to maintain minimum essential coverage. Those without coverage pay a tax penalty of 2.5 percent of income with a minimum of $95 in 2014, $325 in 2015, and $695 in 2016. In our experiment we take the latter as a minimum penalty.

2. Prohibition of discrimination based on health

   Prior to the reform, insurance companies were free to price coverage based on any individual char-

acteristics, including health. The common practice was to deny new coverage due to preexisting conditions or refusing to renew coverage due to health problems. The reform requires insurers to accept every individual who applies for coverage and to renew coverage regardless of health status, utilization of health services, or any other related factor. It prohibits denying coverage due to any preexisting condition or discrimination against those who have been sick in the past. We model this provision by allowing the individual premium to vary with age only. Not knowing the health status of an applicant, an insurer has to use the distribution of health over age to calculate expected expenditures. The new IHI premium is given as

$$p^{IHI}(j) = \phi^{IHI} + \frac{\psi_j \int tr^m(m', IHI)\, d\mu(\cdot|j+1, i'_H = IHI)}{(1+r)} \tag{37}$$

3. Expanding Medicaid to all in poverty

   Prior to the reform Medicaid covered only children, pregnant women, and people with disabilities from families with income below the FPL. Many people and family members were not covered, i.e., all adult males and females without children. To provide coverage to all people in poverty, the reform extends Medicaid coverage to all individuals in families with incomes less than 133 percent of the FPL.

   In the benchmark model, the Medicaid coverage rate was estimated using all households under 100 percent of the FPL whether eligible or not. In MEPS, Medicaid covered only 37.38 percent of all medical expenditures on average, even though it covered 71.02 percent of medical expenditures for eligible individuals. To account for the expansion of coverage to everyone in poverty, we increase the Medicaid coverage rate for households to the pre-reform level for eligible individuals only, $tr^{AID}(m)/m = 0.71$.

4. Premium subsidies

   The reform provides premium subsidies for individuals and families with income between 133 percent and 400 percent of the FPL. Households are not eligible for the credit if they are covered by Medicaid or if their employer offers group insurance coverage. The subsidy depends on income, and its amount is determined so that the premium would not exceed a percentage of income as specified in Table 7. Subsidies are in the form of a refundable tax credit, which can be paid in

Tab. 7: Premium subsidies

| Income Level % of FPL | Maximum Premium % of Income |
|---|---|
| Up to 133 | 2 |
| 133-150 | 3-4 |
| 150-200 | 4-6.3 |
| 200-250 | 6.3-8.05 |
| 250-300 | 8.05-9.5 |
| 300-400 | 9.5 |

Note: The amount of premium credits is determined so that the individual/family premium contribution is limited to the percent of income listed above.

Tab. 8: Cost-sharing reduction

| Income Level % of FPL | Out-of-pocket spending limits as a fraction of the HSA limit |
|---|---|
| 100-200 | 1/3 |
| 200-300 | 1/2 |
| 300-400 | 2/3 |

advance. They are fully funded by the government from general taxation. We implement the subsidies as an instantaneous adjustment to the premium.

5. Cost-sharing reduction

   The reform enacts limits on out-of-pocket expenditures for those with income below 400 percent of the FPL. This cost-sharing reduction applies to non-group policies only. The reference point is the standard out-of-pocket spending limits for Health Savings Accounts (HSA), which are $5,950 for individuals and $11,900 for families in 2010. The out-of-pocket maximum limits are set at one-third of the HSA limit for those between 100-200 percent of the FPL, one-half of the HSA limit for those between 200-300 percent of the FPL, and two-thirds of the HSA limit for those between 300-400 percent of the FPL (Table 8). In our analysis we take the HSA limit to be equal to $11,900. We implement cost-sharing subsidies by imposing out-of-pocket limits on the payouts of IHI coverage. The higher premium is reimbursed by the premium subsidies only if households qualify.

Fig. 7: Insurance take-up rate, reform


### 5.2.2 Reform implications

#### Health Insurance Market

Table 9 presents the impact of the reform on insurance markets. The reform achieves its goal of almost universal coverage. The number of uninsured drops to 4.1 from 19.8 percent. This is in line with the Congressional Budget Office's 5 percent estimate of the post-reform uninsured rate.[17] Medicaid absorbs 5.5 percentage points of the uninsured as the eligibility income threshold goes up to 133 percent of the FPL. Private-sector coverage draws the remaining 10.1 percent of the uninsured. The group insurance take-up rate increases by 3.6 percent, to 63.3 percent. The individual mandate is mainly behind the increase in group insurance market share. Without the penalty in the reform the GHI take-up rate would fall to 60.1 percent. The non-group insurance market participation rate increases by 6.7 percent, to 16.9 percent. The result is driven by the combination of premium subsidies, which make coverage more affordable, and the individual mandate, which increases the cost of being uninsured. When either component is removed from the reform, the IHI take-up rate drops below the benchmark level.

The prohibition of discrimination creates a new risk-sharing mechanism. Inability to price coverage based on health forces insurers to increase premiums as they spread the risk related to a lack of information about health over all insured households within each age group. Intrinsically, healthy households

[17] The CBO uses a microsimulation model to estimate the effects of proposed policies. For more details see "CBO's Health Insurance Simulation Model: A Technical Description," 2007.

Tab. 9: Reform with marginal contributions: health insurance

| | | | Δ from Reform without: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (%) | Benchmark | Reform | Penalty | IHI by age | Medicaid | Subsidy | Cost-sharing | market restructuring | redistribution |
| Insurance | | | | | | | | | |
| GHI | 59.8 | 63.3 | -3.19 | 0.04 | 2.07 | -0.13 | -0.01 | 65.8 | 60.3 |
| IHI | 10.3 | 16.9 | -7.7 | 0.57 | 9.07 | -8.79 | -0.69 | 10.2 | 13.5 |
| Medicaid | 10.1 | 15.6 | 0.65 | -0.06 | -10.28 | 1.97 | 0.29 | 10.5 | 16.2 |
| Uninsured | 19.8 | 4.1 | 10.24 | -0.55 | -0.86 | 6.95 | 0.4 | 13.5 | 10.0 |
| accepted \| GHI offered | 59.8 | 63.3 | -3.2 | 0.0 | 2.1 | -0.1 | 0.0 | 65.8 | 60.3 |
| Premium, $ | | | | | | | | | |
| GHI | $3,297 | $3,389 | -$40 | $0 | -$37 | -$1 | -$0 | $3,356 | $3,351 |
| Average IHI: | $1,292 | $2,816 | $119 | -$221 | -$16 | -$167 | -$81 | $2,511 | $2,498 |
| in bad health | $1,605 | $3,409 | -$17 | $1,353 | -$117 | -$65 | -$73 | $3,252 | $4,654 |
| in good health | $1,210 | $2,652 | $11 | -$626 | $22 | -$257 | -$67 | $2,258 | $1,793 |
| % with bad health | | | | | | | | | |
| GHI | 15.5 | 15.5 | 0.14 | 0.01 | -0.18 | -0.05 | -0.01 | 15.3 | 15.7 |
| IHI | 20.9 | 21.6 | 15.63 | -0.80 | -1.18 | 5.05 | -1.73 | 25.5 | 24.7 |
| AID | 36.2 | 25.9 | 0.09 | -0.09 | 15.66 | 3.02 | 1.76 | 37.1 | 25.9 |
| NO | 14.0 | 6.2 | -0.50 | 3.02 | 0.67 | 0.40 | -0.09 | 8.1 | 9.4 |

Fig. 8: Medicaid and uninsured, reform


subsidize coverage for households in bad health. This drives the healthy individuals out of the non-group market, putting additional upward pressure on premiums. If the health discrimination provision had not been part of the reform, the risk pool in the non-group market would have consisted of fewer households in bad health (20.8 vs. 21.6 percent) and the average IHI premium would have been lower ($2,595 vs. $2,815). This effect is relatively small due to the presence of the premium subsidies in the counterfactual experiment. Without subsidies, the prohibition of discrimination would have a much more significant impact on the non-group insurance market. Subsidies target the healthy households, who would not buy expensive coverage otherwise. These households are important for hedging risk within the insurers' risk pools. Without subsidies, the IHI risk pools deteriorate as the fraction of households in bad health increases by 5.1 percent, to 26.7 percent. Thus, subsidies are crucial to the success of the new risk-sharing mechanism created by the introduction of the prohibition of discrimination.

### Bankruptcy

The reform reduces the bankruptcy rate by a modest 0.06 percentage point (from 1.0 percent to 0.94 percent). The bankruptcy breakdown by the FPL income groups in Table 10 reveals that the bankruptcy rate drops mainly among households with income below 200 percent of the FPL. The expansion of Medicaid is responsible for fewer bankruptcies of households below 133 percent of the FPL. Eliminating the Medicaid expansion from the reform would drive the bankruptcy rate up by 0.45 and 0.02 percentage

Tab. 10: Reform with marginal contributions: bankruptcy

| | | | Δ from Reform without: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (%) | Benchmark | Reform | Penalty | IHI by age | Medicaid | Subsidy | Cost-sharing | market restructuring | redistribution |
| Bankruptcy: | 1.0 | 0.94 | 0 | -0.01 | 0.01 | 0.03 | 0.01 | 1.03 | 0.94 |
| GHI | 8.6 | 7.4 | -1.8 | 0.0 | 5.3 | -0.8 | -0.1 | 10.3 | 5.6 |
| IHI | 2.4 | 9.6 | -5.0 | 0.2 | 33.8 | -9.1 | 0.5 | 1.7 | 4.6 |
| Medicaid | 48.4 | 67.3 | -0.3 | 0.9 | -33.6 | -5.9 | -0.9 | 46.1 | 68.5 |
| Uninsured | 40.6 | 15.6 | 7.1 | -1.0 | -5.5 | 15.7 | 0.5 | 41.9 | 21.3 |
| Bankruptcy rate (%) by the FPL income group | | | | | | | | | |
| $4.0 \cdot FPL \leq y$ | 0 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0.01 | 0 |
| $3.5 \leq y < 4.0 \cdot FPL$ | 0.04 | 0.03 | 0.01 | -0.01 | 0 | 0.01 | 0 | 0.04 | 0.03 |
| $3.0 \leq y < 3.5 \cdot FPL$ | 0.11 | 0.1 | 0.06 | -0.03 | -0.02 | 0.08 | 0.01 | 0.13 | 0.12 |
| $2.5 \leq y < 3.0 \cdot FPL$ | 0.16 | 0.14 | 0.07 | -0.02 | -0.01 | 0.09 | 0.01 | 0.17 | 0.16 |
| $2.0 \leq y < 2.5 \cdot FPL$ | 0.42 | 0.49 | 0.13 | 0 | -0.23 | 0.3 | 0.01 | 0.48 | 0.59 |
| $1.5 \leq y < 2.0 \cdot FPL$ | 0.75 | 0.7 | 0.1 | -0.02 | -0.34 | 0.52 | 0.06 | 0.83 | 0.78 |
| $1.33 \leq y < 1.5 \cdot FPL$ | 1.48 | 1 | 0.12 | -0.05 | -0.32 | 1 | 0.2 | 1.6 | 1.05 |
| $1.0 \leq y < 1.33 \cdot FPL$ | 2.57 | 1.64 | -0.05 | -0.01 | 0.02 | -0.08 | 0.06 | 2.79 | 1.59 |
| $y < 1.0 \cdot FPL$ | 2.93 | 2.66 | -0.07 | 0 | 0.45 | -0.24 | -0.05 | 2.86 | 2.61 |

Note: FPL is the federal poverty level, which is the poverty thresholds used for administrative purposes — for instance, determining financial eligibility for certain federal programs.

point among the two lowest FPL income groups. The cost-sharing and premium subsidies contribute to lowering the bankruptcy rate among households with incomes between 133 and 400 percent of the FPL. Both policies work progressively by lowering bankruptcies more in the lower income brackets. In the absence of the cost-sharing provision, the bankruptcy rate in the 130-150 percent and 150-200 percent FPL income groups would increase by 0.2 and 0.06 percentage point. The premium subsidies have a large impact on the bankruptcy rate. If the reform did not include the premium subsidies, the bankruptcy rate would rise by 1.0 and 0.52 percentage point with respect to the same FPL income groups.

The individual mandate also contributes to the reduction in the number of bankruptcies in all

groups above 133 percent of the FPL. However, its mechanism differs from the two former provisions. The penalty for a lack of coverage enhances risk pooling as it induces the low-risk healthy households to buy coverage. This is distinctly apparent in the IHI market, where the fraction of households in bad health would increase by 15.63 percent in the reform without the individual mandate. Better risk pooling leads to lower premiums ($2,816 vs $2,935 without the penalty) and thus higher demand for coverage. The bankruptcy rate drops as more households purchase health coverage. Notice that the price effect of enhanced pooling is absent in the GHI market as the pool composition would change insignificantly without the mandate (by 0.14 percent from 15.5 percent). Group insurance has the tax incentive mechanism, which has already attracted most households with a group offer to buy coverage (GHI has 89.16 percent acceptance rate). The IHI discrimination provision is the only element of the reform that increases the bankruptcy rate across all income groups. The higher premium makes coverage less affordable and thus draws some households into being uninsured. But the effect is very small; a change in the bankruptcy rate is measured in hundredths of a percentage point.

Overall, medical bankruptcy decreases slightly by 0.06 percentage point (Table 11). The main contributor to the drop in medical bankruptcies is the premium subsidy, which expands private coverage to the uninsured. In the counterfactual experiment, it lowers the medical bankruptcy rate by 0.06 percent. By the same token the cost-sharing provision reduces medical bankruptcy by 0.01 percent. Medicaid expansion affects medical bankruptcy in two opposite ways. On the one hand, it decreases the number of medical bankruptcies among low-income households below 100 percent of the FPL as it enhances coverage quality. On the other hand, it increases the number of medical bankruptcies in all other income groups. In the latter case the Medicaid expansion drives households away from the private insurance markets, where risk pooling deteriorates and premiums increase. In the absence of Medicaid expansion, participation in the group and individual insurance markets would increase by 2 and 9 percent, the risk pools would improve by 0.18 and 1.18 percent, and average premiums would drop by $37 and $16. Fewer households would be uninsured and the fraction of medical bankruptcies in where health insurance was not purchased would drop by 6.7 percent. Thus, medical bankruptcy would rise by 0.23 percent among households below 100 percent of the FPL and drop in all other income groups. The net effect on the medical bankruptcies is -0.05 percentage point. Overall, the Medicaid expansion causes more medical bankruptcies than it prevents. In a similar fashion, the prohibition of discrimination in the individual insurance market drives premiums up and increases the number of

Tab. 11: Reform with marginal contributions: medical bankruptcy

| | | | Δ from Reform without: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (%) | Benchmark | Reform | Penalty | IHI by age | Medicaid | Subsidy | Cost-sharing | market restructuring | redistribution |
| Medical bk rate | 0.76 | 0.70 | 0.01 | -0.01 | -0.05 | 0.06 | 0.01 | 0.80 | 0.70 |
| Medical bk share | 76.0 | 73.9 | 1.11 | -0.33 | -5.33 | 3.92 | 0.48 | 77.9 | 74.7 |
| Uninsured | 30.0 | 11.3 | 4.8 | -0.7 | -6.7 | 14.5 | 0.6 | 33.5 | 14.8 |
| Medical bk rate (%) by the FPL income group | | | | | | | | | |
| $4.0 \cdot FPL \leq y$ | 0.004 | 0.005 | 0.001 | -0.002 | -0.0003 | 0.002 | 0.0003 | 0.01 | 0.004 |
| $3.5 \leq y < 4.0 \cdot FPL$ | 0.02 | 0.01 | 0.01 | -0.003 | -0.001 | 0.01 | 0.0001 | 0.02 | 0.01 |
| $3.0 \leq y < 3.5 \cdot FPL$ | 0.09 | 0.08 | 0.06 | -0.03 | -0.02 | 0.07 | 0.01 | 0.12 | 0.1 |
| $2.5 \leq y < 3.0 \cdot FPL$ | 0.07 | 0.04 | 0.06 | 0.0 | -0.01 | 0.09 | 0.01 | 0.08 | 0.07 |
| $2.0 \leq y < 2.5 \cdot FPL$ | 0.33 | 0.39 | 0.13 | -0.002 | -0.22 | 0.3 | 0.01 | 0.38 | 0.5 |
| $1.5 \leq y < 2.0 \cdot FPL$ | 0.5 | 0.47 | 0.07 | -0.01 | -0.32 | 0.52 | 0.05 | 0.63 | 0.52 |
| $1.33 \leq y < 1.5 \cdot FPL$ | 1.06 | 0.56 | 0.06 | -0.02 | -0.3 | 0.94 | 0.2 | 1.17 | 0.58 |
| $1.0 \leq y < 1.33 \cdot FPL$ | 2.04 | 1.24 | -0.01 | -0.01 | -0.11 | -0.04 | 0.06 | 2.28 | 1.23 |
| $y < 1.0 \cdot FPL$ | 2.29 | 2.08 | -0.04 | -0.01 | 0.23 | -0.18 | -0.05 | 2.26 | 2.05 |

Note: FPL is the federal poverty level, which is the poverty thresholds used for administrative purposes — for instance, determining financial eligibility for certain federal programs.

medical bankruptcies in all income groups above 100 percent of the FPL, but the overall effect is very small (0.01 percent). The individual mandate contributes to the lower medical bankruptcy rate by 0.01 percentage point through enhancing risk-sharing in the private insurance market.

#### Why the reform fails to address the problem of bankruptcy

The modeled reform failed to address the problems of bankruptcy and medical bankruptcy. Why does the expansion of coverage have such a small impact on bankruptcies? There are two opposite forces involved in the process. On the one hand, providing coverage to people without insurance and enhancing existing coverage decreases households' exposure to medical shocks; thus it reduces out-of-pocket expenditures and contributes to a decline in bankruptcies. On the other hand, in general equilibrium, credit markets internalize the lower likelihood of default and extend extra credit to households. More debt makes households more vulnerable to relatively small productivity shocks and out-of-pocket medical

expenditures. In our model the credit market effect offsets the extension of coverage effect, generating the very small decrease in the bankruptcy rate.

Due to the reform more households can afford to purchase subsidized coverage and households already covered can get better coverage; thus households' exposure to medical shocks and the chance of filing for bankruptcy diminish. Banks internalized this change in the likelihood of household default by adjusting the interest rate schedule. Banks lower the interest rate and effectively increase borrowing limits.

Figure 9 shows examples of the loan price schedule (a reciprocal of the interest rate) for households in bad health and without the GHI offer before and after the reform. Households in the upper and lower rows are 30 and 40 years old, respectively. Households in the left and right columns are hit by the productivity shocks, $z$, at grid points 3 and 6, respectively. In each graph dotted lines represent the loan prices for households who bought the individual coverage before (dotted dash line) and after (dash line) the reform. As a reference we show the price schedule for households without coverage in the benchmark (solid line). Reform has a small impact on household borrowing while young. The loan price schedule has not changed for the 30-year-old households (two upper panels). But as households age, medical expenditure shocks increase. The insurance coverage for older households provided by the reform enables them to borrow more. The price schedule of 40-year-old households shifts left toward the higher loan values (two lower panels). Thus, borrowing is cheaper and the credit limit is higher (e.g., from $-0.1$ to $-0.17$ for households in the lower left panel). Households take advantage of more favorable loan offers and borrow more. The impact of the reform on the credit market is significant as the measure of borrowers increases from 17 to 21 percent (Table 12). By accumulating more debt, households are more susceptible to productivity shocks and out-of-pocket medical expenditures. Due to higher indebtedness households' default threshold is lower. After the reform, the relatively small productivity shocks and out-of-pocket medical expenditures can trigger bankruptcy.[18]

### Aggregates and welfare

Table 12 presents aggregates and welfare calculations. The reform has a very small effect on aggregate output and capital as it mainly affects poor households. The interest rate and wages do not change.

[18] To make the model computationally feasible, we assume that creditors can observe the household's health, i.e., the loan price schedule is a function of health status. Thus, creditors can price discriminate based on health. If the health status is not observable by the creditors, the loan price would be higher as creditors cross-subsidize loans to sick households. This would most likely reduce the dampening effect of the credit markets on the bankruptcy rate.

Fig. 9: Interest rate schedule, benchmark vs. reform


Note: Graphs present the price schedules of bonds (a reciprocal of the interest rate) with a nominal value of 1.0. The example shows households who are 30 and 40 years old, in bad health, without a group insurance offer, and with the grid points 3 and 6 of the labor productivity shocks $z$.

The only significant aggregate consequence of the reform is higher taxes. The average tax rate rises by 1.1 percentage points, to 27.0 percent. The expansion of the Medicaid program is the most expensive part of the reform. An increase in the income eligibility threshold to 133 percent of the FPL results in the 58 percent increase in the number of households eligible for Medicaid (from 15 to 23 percent). The government cost of Medicaid more than doubles, from 0.23 to 0.58 percent of GDP. The second most expensive element of the reform is the premium subsidies, which account for 0.28 percent of GDP. The government income from the individual mandate is very small (0.02 percent of output).

In the post-reform equilibrium, welfare is 5.2 percent higher than in the benchmark equilibrium. The Medicaid expansion is the main contributor to the increase in welfare. In the absence of this policy, welfare in the post-reform equilibrium would decline by 0.26 percent. The large impact on welfare is due to the scale of Medicaid expansion, which reaches an additional 8 percent of households. The cost-sharing and premium subsidies contribute marginally to the increase in welfare. The individual mandate decreases welfare . Even though it enhances risk-sharing, it also directly reduces household disposable income through the budget constraint. The latter effect dominates so that in the reform without the penalty, welfare would be 0.6 percentage point higher. By the same token, the ban on discrimination in

Tab. 12: Reform with marginal contributions: aggregates and welfare

| | | | Δ from Reform without: | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (%) | Benchmark | Reform | Penalty | IHI by age | Medicaid | Subsidy | Cost-sharing | market restructuring | redistribution |
| interest rate, $r$ | 2.11 | 2.11 | -0.02 | -0.01 | -0.01 | 0.01 | 0 | 2.16 | 2.09 |
| wage, $w$ | 1.12 | 1.12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.11 | 1.12 |
| output, $Y$ | 128.63 | 128.62 | 0.14 | 0.06 | 0.07 | -0.03 | 0.02 | 128.4 | 128.76 |
| capital, $K$ | 381.67 | 381.59 | 1.4 | 0.58 | 0.7 | -0.27 | 0.17 | 379.4 | 382.94 |
| avg. tax rate | 25.93 | 27.04 | -0.16 | 0.01 | -0.24 | -0.31 | -0.05 | 26.14 | 26.93 |
| measure of borrowers | 0.17 | 0.21 | 0.0 | 0.0 | -0.02 | -0.01 | -0.01 | 0.17 | 0.2 |
| measure on Medicaid | 0.15 | 0.23 | 0.0 | 0.0 | -0.08 | 0.0 | 0.0 | 0.15 | 0.23 |
| Welfare gain, % | | 5.19 | 0.59 | 0.11 | -5.45 | -0.25 | -0.05 | -1.61 | 5.79 |

the IHI market has a negative impact on welfare as it induces a higher premium for non-group coverage. The reform without the discrimination provision would increase welfare by an additional 0.1 percentage point.

#### Redistribution vs insurance market restructuring

The health care bill consists of two components. The first part restructures the insurance market. It prohibits price discrimination based on health in the non-group insurance market and it imposes a penalty for lacking health coverage. The former enhances risk-sharing among people of different health, but it also induces adverse selection as higher premiums drive healthy people out of the insurance market. The individual mandate addresses this issue by increasing the cost of being uninsured. The second part is the income redistribution from high-income to low- and middle-income households. This includes an expansion of Medicaid coverage, which is a transfer to poor households, and premium and cost-sharing subsidies that target the middle class. To evaluate the welfare implications of the health care reform, it is important to disentangle the contributions of each component. We use our model to separate the welfare effects of the insurance market reorganization and the income redistribution in a setting where bankruptcy is a vital part of the health insurance system.

The redistribution component of the reform increases welfare by 5.8 percent, while the insurance

market restructuring decreases welfare by 1.6 percent. The combined welfare gain is 5.2 percent. The benefits of synergy between the two components are evident in the insurance market. The market restructuring alone fails to achieve almost universal coverage as the number of uninsured decreases only to 13.5 percent (19.8 percent in the benchmark). This is mainly due to the individual mandate, which induces participation in the group insurance market. The non-group insurance participation drops by 0.1 percent as the negative effect of higher premiums due to the discrimination ban and the positive effect of the individual mandate cancel out. The risk pool in the non-group market deteriorates to 25.5 percent of households in bad health (20.9 percent in the benchmark). The redistribution component alone fails to address the high rate of uninsured as well, decreasing the number of uninsured to only 10 percent. The expansion of Medicaid accounts for two-thirds of this drop. The rest of the newly insured purchase individual coverage with the help of premium subsidies. The risk pool in the non-group market worsens to 24.7 percent of households in bad health. But when the two components interact, the number of uninsured drops to 4.1 percent and the fraction of households in bad health stays at 21.6 percent. The restructuring creates a new risk-sharing mechanism in the non-group insurance market. But it cannot be fully utilized unless more healthy households participate. The premium subsidies of the redistribution component facilitate participation among healthy households. Thus, the redistribution is crucial for the restructuring to work and the restructuring is necessary to take full advantage of the increased redistribution.

The interaction between these two reform components in the health insurance markets is positive, but from the perspective of bankruptcy, there are no gains from the interplay between the redistribution and the restructuring. The redistribution component helps to bring down the bankruptcy rate to 0.94 percent (1.00 percent in the benchmark), mainly through the expansion of Medicaid. The restructuring alone increases the bankruptcy rate to 1.03 percent above the benchmark level as the premium rises due to the ban on price discrimination. When combined, the bankruptcy rate drops to 0.94 percent. Thus there are no benefits from the interaction. In fact, if the reform's main objective was a reduction in the number of bankruptcies, the restructuring of the insurance market would not be advised.

#### Alternative Policy: Cash Transfer

Since the redistribution component drives the majority of the reform results, a noteworthy alternative to the reform would be a simple cash transfer to income groups targeted by the reform. We conduct an

experiment in which we distribute a cash equivalent to the cost of the redistribution program to targeted households equally. The extra cost of the Medicaid expansion is equally redistributed to households that would have qualified for it, and the cost of subsidies is equally redistributed to households with income between 133 and 400 percent of the FPL. This policy results in a welfare increase of 12.4 percent (5.2 percent in the reform). The transfer to low-income households accounts for 72 percent of the welfare gain. This group has high marginal utility and any extra cash has a significant impact on their utility and thus overall welfare. The bankruptcy rate goes up to 1.4 percent (1 percent in the benchmark) as the cash transfer increases households' ability to pay off credit and thus loosens their credit constraint. The uninsured rate drops by 3 percent, to 15 percent, as the households with a group insurance offer purchase group coverage. These 3 percent of households cannot afford group coverage and the cash transfers facilitate their purchase.

The cash transfer policy achieves higher welfare but does not address the high number of uninsured and aggravates the problem of bankruptcy.

## 6 Conclusion

According to Himmelstein et al. (2009), 62.1 percent of bankruptcies in the United States in 2007 were due to medical reasons. At the same time the number of Americans without health insurance reached 17 percent. The health care reform, which was signed into law in March 2010, aims to address this issue. Medical bankruptcy was at the heart of the health care reform debate. Proponents of the reform argued that providing health coverage to all Americans will reduce the number of medical bankruptcies. We employ a dynamic stochastic general equilibrium overlapping generations model with incomplete markets to quantitatively evaluate the impact of the health care reform on the bankruptcy rate and the health insurance market. We find that the reform fails to address the bankruptcy problem as it cuts the bankruptcy rate by only 0.06 percentage point, to 0.94 percent. Even though the reform reduces the household's likelihood of default and thus the bankruptcy rate, a general equilibrium effect in the credit markets dampens the reform's impact on bankruptcies. The reform succeeds in providing almost universal insurance coverage with only 4.1 percent of the population remaining uninsured. To finance the reform, the average tax rate has to increase by 1.1 percent. The reform increases welfare by 5.2 percent and low-income households are the main beneficiaries. The welfare gain is attributed to the

redistribution component of the reform, which by itself would increase welfare by 5.8 percent. The insurance market restructuring component decreases welfare by 1.6 percent.

We abstract from several noteworthy aspects of health care in the United States, which deserve attention in future research. One is the growing cost of medical services, which is potentially a factor in bankruptcy and health insurance market dynamics. A second is the quality of health care coverage, which plays an important role in contributing to low-income households' default decisions as these households are very sensitive to any out-of-pocket expenditures.

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# A Data and Calibration

We discuss calibration details regarding health, income, insurance, and medical expenditures.

## A.1 MEPS

The Medical Expenditure Panel Survey is a nationally representative household survey of medical care use, medical expenditures, and health insurance coverage. The survey uses a complex overlapping panel design with stratification, clustering, and disproportionate sampling. Each year a new panel of sample households is selected, and data are collected for two years in five rounds of interviews. The data are available from 1996. We employ data from 2002 to 2006 because those panels have a common variance structure that allows data pooling. An annual sample consists of approximately 32,500 people in 12,800 households.

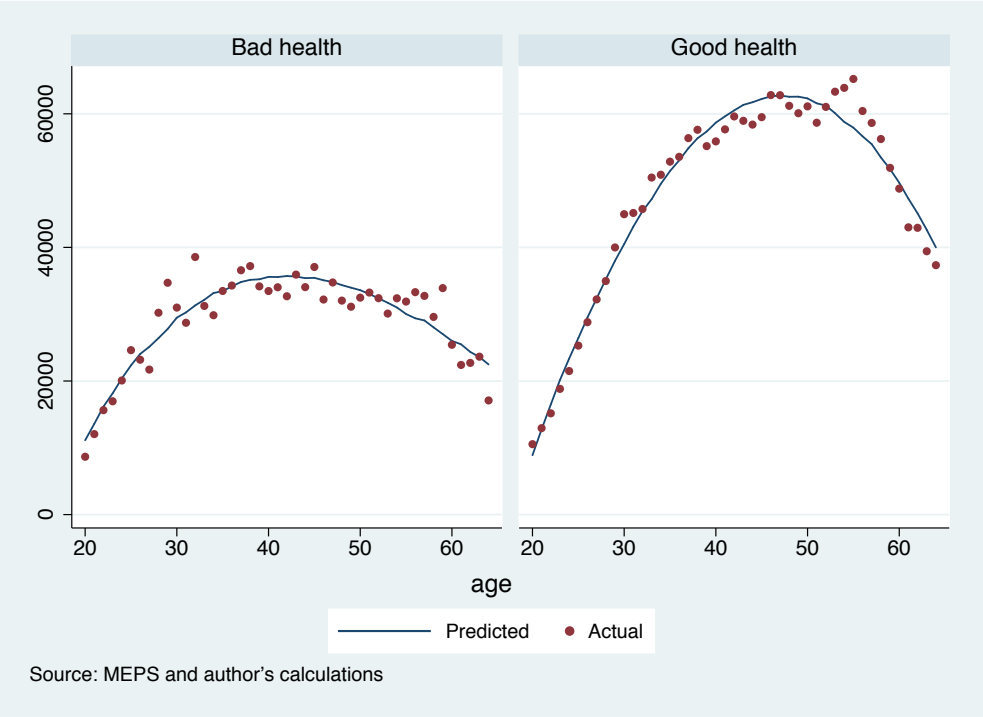
Since the model's focus is on health insurance, we use a definition of household based on the Health Insurance Eligibility Unit (HIEU). An HIEU is constructed from the CPS family unit and includes adults and other family members who would typically be eligible for coverage under the family health insurance plan. Each CPS household may potentially consist of multiple HIEUs. HIEUs comprise adults, their spouses, and their natural or adopted children under age 18. An HIEU includes children under age 24 who are full-time students living at home or away from home. We define a head of household as the person with the highest income in the first year of the panel. If household members have the same income, we select the older one.

We drop all individuals under 20 or over 80 years old. We keep only individuals in the U.S. civilian non-institutionalized population (INSC1231). All dollar values are converted to the base year 2004 using the CPI deflator. We pool all the panels. In all estimates we use the weight of the household head (PERWT).

## A.2 Income process profile

In the sample approximately 15 percent of households have no income. Many low-income households are headed by females. In our analysis we do not want to exclude these low-income households. Hence, we cannot use a typical approach to estimate the income profile using a log transformation of earnings and

Fig. 10: Income profile




only the male sample.[19] Instead, we keep all households led by females and use a fixed effects estimator in which we regress the level of earnings on a polynomial of age, and year dummies.

$$y_h = \beta^y_{h,0} + \beta^y_{h,1} age + \beta^y_{h,2} age^2 + \beta^y_{h,3} age^3 + \beta_y \mathbf{1}\,(year) \tag{38}$$

Due to heteroscedasticity the standard error may be biased but the profile will be estimated consistently. For the purpose of our analysis we define family earnings as the sum of wage income (wageYYp) and unemployment benefits (unempYYx) of all household members. We estimate the earnings profile for each health status separately. The regression coefficients are reported in Table 13 and the profiles are displayed in Figure 10.

[19] For example, Storesletten et al. (2004) conducted a similar exercise using PSID. They drop females and individuals with non-positive income.

Tab. 13: Parameter estimation of age-health-earnings profile

| Parameter/Variable | Bad Health | Good Health |
|---|---|---|
| Constant | −18585.96 | −82170 |
| Age | 1400.22 | 4946.86 |
| $\text{Age}^2/100$ | −69.82 | −1902.24 |
| $\text{Age}^3/10000$ | −2168.27 | −4858.94 |
| Year= 2003 | 743 | 1885.42 |
| Year= 2004 | 3213.53 | 3953 |
| Year= 2005 | 3899.22 | 6088.72 |
| Year= 2006 | 5155.08 | 10266.03 |
| $R^2$ | 0.0256 | 0.1267 |
| Obs | 28055 | 41249 |

## A.3 Health

MEPS contains detailed questions about each person's health. We choose a self-reported health status (RTHLTH) as a proxy for a person's health.[20] Respondents were asked to evaluate their health relative to other people of their age on a scale of 1 to 5: excellent (1), very good (2), good (3), fair (4), and poor (5). In the model we define the health status $h$ as a binary variable: good (1) and bad (0) health. To construct an individual's annual health status, we take an average of reported health across the three waves. We define an individual to be in bad health if the average is strictly greater than three. To construct a household's health status, $h$, we need to aggregate health information over household members in each year. We define a household to be in good health only if all household members are healthy. We also considered an alternative definition of household health by calculating an average self-reported health status within a household in three ways. A household was in bad health if the average household self-reported health status was strictly more than three. Using this alternative definition the average of binary health status is slightly higher in the data but the model implications are the same.

To estimate the health transition matrix we use a logistic regression model

$$logit\, P\left(h' = 1|h, age\right) = \gamma^h \cdot h + \beta_0^h + \beta_{h,1}^h age + \beta_{h,2}^h age^2 \tag{39}$$

where health status is conditional on a lag of health status and its interactions with a polynomial of

[20] Other measures of health status

Tab. 14: Parameter estimation of a health transition matrix

| Coeff. | Value | Std. Err. |
|---|---|---|
| $h$ | -1.3322 | 0.4131 |
| const. | 3.2716 | 0.2666 |
| $age \mid bad$ | -0.1403 | 0.0114 |
| $age^2 \mid bad$ | 0.0010 | 0.0001 |
| $age \mid good$ | 0.0372 | 0.0112 |
| $age^2 \mid good$ | -0.0005 | 0.0001 |

age.

The coefficients of the estimation are presented in Table 14. Figure 11 presents a profile of health transition probabilities. The initial distribution of health is that 84.68 percent of households are in good health. The estimates are consistent with the transition probabilities in Attanasio et al. (2008).

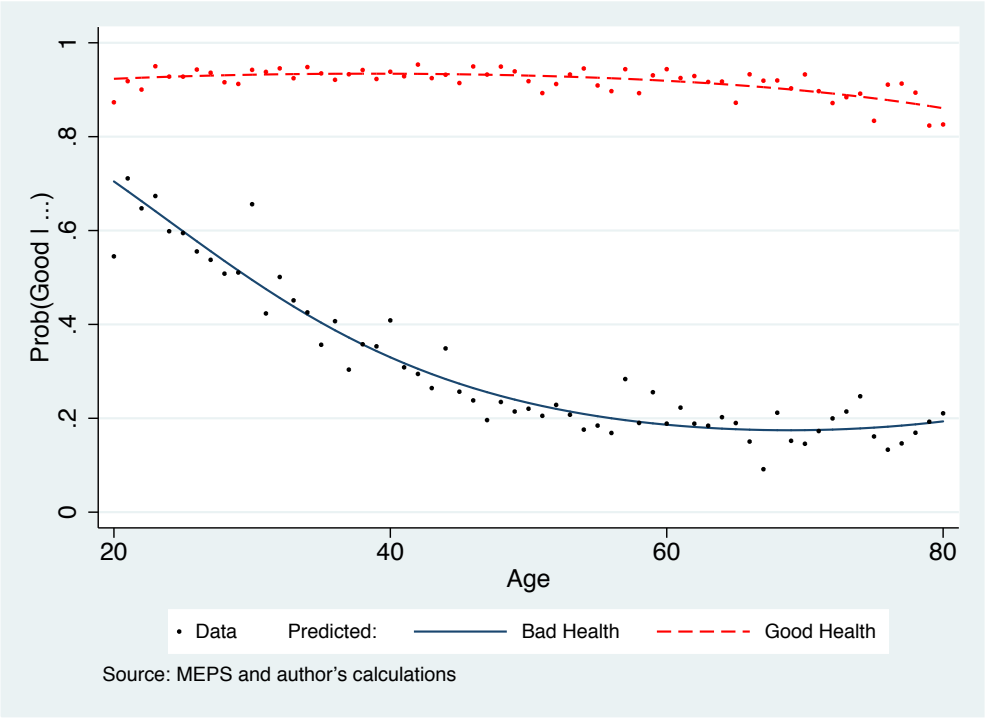
## A.4 Medical Expenditures

MEPS contains detailed information about medical expenditures and sources of payments. To compute total medical expenditures corresponding to our model, we sum up all categories but Veterans' Administration (TOTVA), TRICARE (TOTTRI), Worker's Compensation (WCP), and other unclassified sources (TOTOSR). Since our model abstracts from very rare cases of Medicare eligibility when under 62 years old, we exclude Medicare expenditures (TOTMCR) while working age. We aggregate medical expenditures at the household level by summing up expenditures of all household members.

In MEPS, medical expenditures are defined as the sum of payments, rather than charges, for medical services during the year. This approach is due to a common practice of health care providers offering large discounts to insurance companies. Further, all charges associated with uncollected liability and bad debt are not included as expenditures in MEPS. Thus our estimates of medical expenditures should be treated as a lower bound.

To discretize our medical expenditures shock, we use a grid with four points. The grid values vary with age and health status but not probabilities. We divide medical expenditures into four bins by 50th, 90th, and 99th percentiles for each health status. Each bin is associated with one grid point. Each grid point has a fixed probability of occurrence, $\{0.5, 0.4, 0.9, 0.01\}$, but its value varies with age and health status. The choice of bins accounts for the observed fat tail of the medical expenditure shocks, which

Fig. 11: Health transition probabilities



are generated by a small number of catastrophic medical events. For each health status in each bin, we regress medical expenditures on a cubic polynomial of age. This way we get a smooth profile of medical expenditures. Figure 12 presents the predicted and actual value of medical expenditure shocks. The regression results are reported in Table 15.

## A.5 Group insurance offer

MEPS contains a few employment-related health insurance questions. Respondents are asked whether they had health insurance at a current main job (HELD31X, HELD42X, HELD53X) and whether they were offered health insurance through a current main job (OFFER31X, OFFER42X, OFFER53X). Their choice of health insurance at a current main job is reported as well (CHOIC31, CHOIC42, CHOIC53). To aggregate an offer indicator at the family level, we assume a household received an offer if any household member reported an offer in at least one interview during the year.

We assume the GHI offer indicator follows a Markov process conditional on household income, $\pi^E\left(i'_E|i_E,n\right)$. We use a logit regression model to estimate the probability of receiving an offer.

$$logit\, P\left(i_{E,t}=1\,|\,i_{E,t-1},n_t\right)=\beta_0^g+\beta_1^g i_{E,t-1}+\beta_2^g n_t \tag{40}$$

The regression coefficients are reported in Table 16. The conditional probability of a GHI offer is plotted against income in Figure 13.

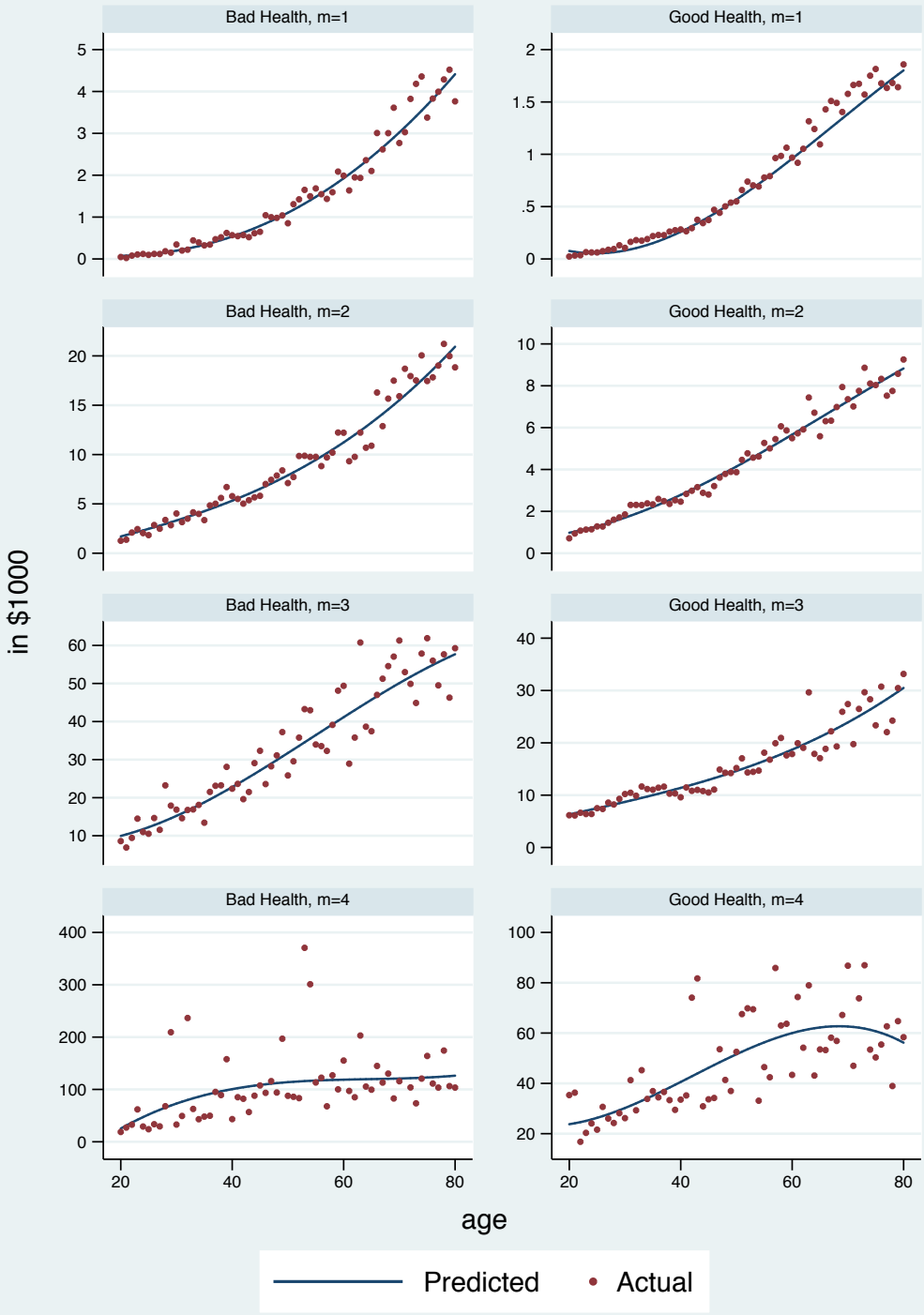
## A.6 Coverage rates

We use medical expenditure data from MEPS to estimate a coverage rate, $q$, which is the fraction of medical expenditures, $x$, covered by health insurance. To estimate the coverage rate for the group and individual insurance we use a cubic polynomial in log expenditures.

$$q=\beta_0^q+\beta_1^q log(x)+\beta_2^q log(x)^2+\beta_3^q log(x)^3 \tag{41}$$

In this regression we use only households with positive expenditures that are covered for the entire year by each type of insurance. For Medicaid and Medicare we use a mean coverage rate, since there's no clear relationship between the coverage rate and expenditures in the data. The coverage rate is 0.71

Fig. 12: Medical expenditure shock




Source: MEPS and author's calculations

Tab. 15: Medical expenditure regressions

| | Bad Health | | | | Good Health | | | |
|---|---|---|---|---|---|---|---|---|
| Bin | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 |
| const. | 1163.83 | 3135.8 | 15429.54 | -96333.34 | 679.27 | 671.17 | 3057.11 | 30801.74 |
| | (421.49) | (1631.43) | (9880.32) | (98321.51) | (67.51) | (299.97) | (1861.41) | (39740.23) |
| age | -74.97 | -57.91 | -450.12 | 9559.49 | -54.27 | -33.07 | 173.2 | -1608.84 |
| | (27.94) | (108.23) | (654.25) | (6587.11) | (4.83) | (21.46) | (133.19) | (2837.57) |
| age$^2$ | 151.56 | 217.38 | 2001.46 | -16278.56 | 125.72 | 217.98 | -116.95 | 7491.03 |
| | (57.96) | (224.55) | (1355.63) | (13752.97) | (10.67) | (47.4) | (294.22) | (6254.13) |
| age$^3$ | -16.11 | 124.21 | -1074.86 | 9839.12 | -49.72 | -43.62 | 517.91 | -5977.84 |
| | (37.88) | (146.82) | (885.48) | (9027.66) | (7.35) | (32.64) | (202.59) | (4297.32) |
| $Adj.\,R^2$ | 0.4021 | 0.4664 | 0.4060 | 0.1141 | 0.4523 | 0.5495 | 0.5779 | 0.1540 |
| # obs. | 8049 | 6441 | 1449 | 192 | 30866 | 24694 | 5552 | 648 |

Fig. 13: GHI offer probability


Tab. 16: Health insurance offer regression

| | $P\left(i_E^{'}=1\right)$ | Std. Err. |
|---|---|---|
| const. | -9.493504 | 0.403397 |
| $i_E$ | 3.596696 | 0.066153 |
| $n$ | 0.786088 | 0.039211 |
| # of obs. | 20234 | |

Tab. 17: Coverage

| | $q^{GHI}$ | $q^{IHI}$ |
|---|---|---|
| const. | 0.111045 | -0.735191 |
| | (0.11605) | (0.43126) |
| $log(x)$ | 0.161530 | 0.482093 |
| | (0.05) | (0.2) |
| $log(x)^2$ | -(0.02090) | -(0.07508) |
| | (0.01) | (0.03) |
| $log(x)^3$ | 0.001179 | 0.004103 |
| | (0.00030) | (0.00145) |
| $Adj.\ R^2$ | 0.10220 | 0.10670 |
| # obs. | 27865 | 1070 |

for Medicaid and 0.41 for Medicare. In the above calculations we use the sample weights. The regression results and corresponding figures are reported in Table 17, Figure 14, and Figure 15.

Fig. 14: GHI coverage

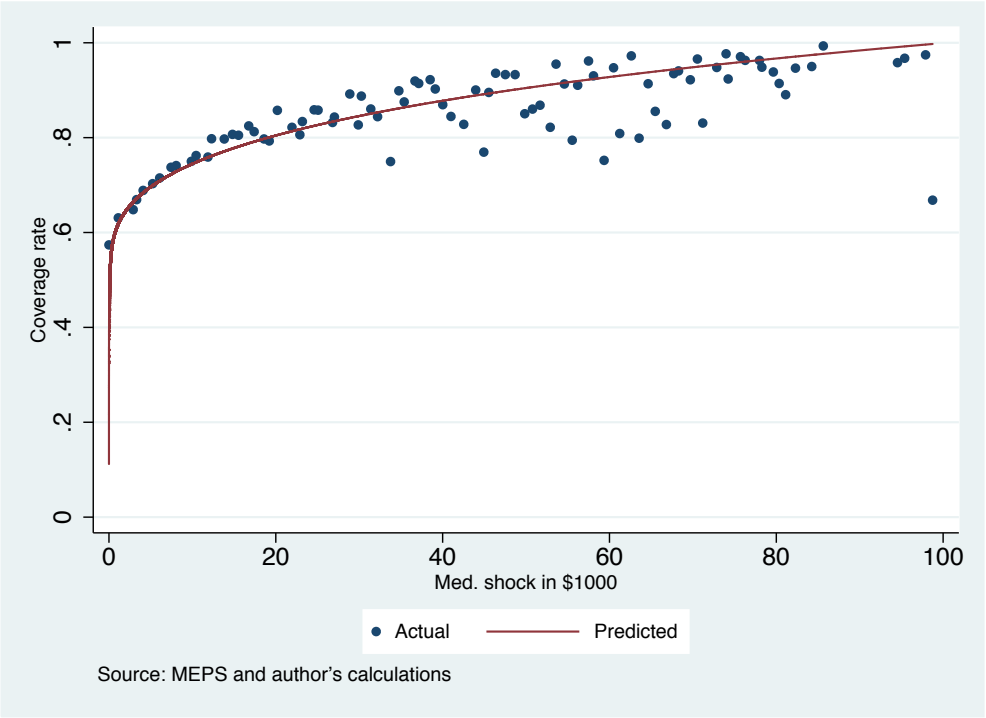


Fig. 15: IHI coverage