MPRA
Munich Personal RePEc Archive

Quantitative analysis of health insurance reform: separating regulation from redistribution

Pashchenko, Svetlana and Porapakkarm, Ponpoje

17 August 2012

Online at https://mpra.ub.uni-muenchen.de/41193/
MPRA Paper No. 41193, posted 13 Sep 2012 06:04 UTC

Quantitative Analysis of Health Insurance Reform: Separating Regulation from Redistribution *

Svetlana Pashchenko†
Uppsala University

Ponpoje Porapakkarm‡
University of Macau

August 17, 2012

Abstract

Two key components of the upcoming health reform in the U.S. are a new regulation of the individual health insurance market and an increase in income redistribution in the economy. Which component contributes more to the welfare outcome of the reform? We address this question by constructing a general equilibrium life cycle model that incorporates both medical expenses and labor income risks. We replicate the key features of the current health insurance system in the U.S. and calibrate the model using the Medical Expenditures Panel Survey dataset. We find that the reform decreases the number of uninsured more than twice and generates substantial welfare gains. However, these welfare gains mostly come from the redistributive measures embedded in the reform. If the reform only reorganizes the individual market, introduces individual mandates but does not include any income-based transfers, the welfare gains are much smaller. This result is mostly driven by the fact that most uninsured people have low income.

Keywords: health insurance, health reform, risk sharing, general equilibrium

JEL Classification Codes: D52, D91, E21, E65, I10

---

*We thank Gadi Barlevy, Marco Bassetto, Mariacristina De Nardi, Eric French, Leora Friedberg, John Jones, John Kennan, Toshihiko Mukoyama, Steven Stern, Marcelo Veracierto, Gianluca Violante, Eric Young, two anonymous referees, and all seminar participants at the Federal Reserve Bank of Chicago, University of Virginia, Federal Reserve Bank of Richmond, City University of Hong Kong, Midwest Macro meeting in Nashville, SED meeting in Ghent, PET meeting in Bloomington, National Tax Association annual meeting, and Greater Stockholm Macro Group for their comments and suggestions. The hospitality of the Federal Reserve Bank of Chicago is gratefully acknowledged. Porapakkarm acknowledges financial support from the Research and Development Administrative Office at the University of Macau. All errors are our own.

†Email: sap9v@virginia.edu

‡Email: ponpojep@umac.mo

1 Introduction

In Spring of 2010 the President of the U.S. signed the Patient Protection and Affordable Care Act which culminated a long and vigorous health reform debate. This bill introduces a wide range of measures aiming primarily to increase health insurance coverage. In particular, the bill substantially changes the rules under which the individual insurance market operates and introduces penalties for those without insurance. At the same time it contains a set of measures that increase income redistribution in the economy. The goal of this paper is to provide a quantitative analysis of the upcoming reform in order to isolate the welfare effects of the new regulation of the individual market from the effects of the increased income redistribution.

To do this, we construct a general equilibrium life cycle model where agents face two types of risks: uninsurable labor income risk and persistent medical expenses risk that can be partially insured. People with high medical expenses have higher disutility from work and suffer a loss in productivity. We allow agents to be heterogeneous by educational level (exogenously fixed), which affects their ability to generate income and to access employer-based health insurance.

We replicate the key features of the current health insurance system. First, in our model the insurance system consists of three components: individual market, employer-based market, and public insurance. Second, public insurance is available only to the lowest-income individuals, while people with high income are more likely to get employer-based coverage. Third, the majority of the uninsured can obtain insurance only from the individual market because they do not have access to the employer-based market and are not eligible for public insurance. At the same time this group of people tends to have low income. Fourth, public insurance is free and employer-based premiums are community rated. Those who purchase insurance in the individual market face risk-rated premiums that depend on their current medical shock. After calibrating the model to the key facts of the U.S. insurance system using the Medical Expenditures Panel Survey, we introduce the changes specified in the Patient Protection and Affordable Care Act (hereafter called the Bill).

These changes can be broadly divided into two groups. First, there is a new regulation of the individual health insurance market that aims to create a risk-pooling mechanism outside the employer-sponsored market. In particular, insurance companies will be banned from conditioning premiums on individuals' health status or history of claims. The price of an insurance policy can only vary by age. This restriction is known as age-adjusted community rating. To prevent cream-skimming by insurers, another provision in the Bill is guaranteed issue which prevents insurance companies from denying coverage to individuals based on their health status. A possible outcome of a combination of community rating with guaranteed issue is an adverse selection spiral and to prevent this, the Bill requires all individuals without health insurance to pay a penalty unless the insurance premium constitutes too high a proportion of their income.

Second, the Bill includes a set of redistributional measures. In particular, the Bill includes provisions to expand Medicaid. Currently, Medicaid covers several categories of population (for instance, adults with dependent children, pregnant women) with income below a threshold that varies significantly from state to state.[1] After the reform *all* people under 65 years old with income below 133% of the Federal Poverty Line (FPL) will become eligible for Medicaid. Also low-income people will be able to get subsidies when buying insurance in the individual market. The goal of the subsidy is to keep premiums people pay for a standard insurance policy below a prespecified percentage of their income.

When evaluating the welfare effects of the reform, as a welfare criteria we use the average utility of people who are alive at the beginning of the reform and live through the transition period. This welfare function favors redistribution across people with different income net of medical expenses. The reform introduces two additional channels of redistribution in the economy: first, from the healthy to the sick (through community rating in the individual market); second, from the high-income to the low-income (through subsidies and Medicaid expansion). Since neither of these new redistributional mechanisms is conditioned on income net of medical expenses, the resulting welfare effect of each mechanism is unclear: any redistribution from the healthy to the sick involves some redistribution from the healthy who are poor to the sick who are rich. Similarly every redistribution from the rich to the poor will involve some redistribution from the rich who are sick to the poor who are healthy. To adequately gauge the welfare effects of these redistributive channels we need to carefully capture the correlation between labor income and medical expenses. We do this by explicitly accounting for the fact that people with high medical expenses have lower productivity and lower labor supply.

We find that the reform has a large effect on the fraction of the uninsured in the economy: this number decreases from 19.7% to 8.9%. The reform has the largest effect on young people in the lowest educational group, with the fraction of uninsured among high-school dropouts aged between 25 to 29 years old decreasing from 61.2% to 7.5%. Also the reform induces more participation in the individual market with the fraction of individually insured increasing from 7.3% to 18.5%.

In terms of welfare, we find that the reform brings substantial gains equivalent to 0.64% of the annual consumption. However, these welfare gains mostly come from the

[1]As of 2009, 17 states had a Medicaid eligibility threshold below 50% of the Federal Poverty Line (FPL), 17 states had it between 50 to 99% FPL, and 17 states had it higher than 100% FPL (Kaiser Family Foundation, 2010).

redistributive measures embedded in the reform. If the reform is implemented without subsidies and Medicaid expansion, its welfare effects are significantly smaller.

The intuition behind this result is as follows. Welfare gains from the reform are largely driven by the change in the welfare of low-income people. For the majority of this group, insurance premiums constitute a high fraction of income and they gain a lot from having subsidized coverage. On the other hand, the new regulation of the individual market by itself has a limited effect on health insurance affordability for low-income people who often prefer to stay uninsured if not subsidized.

Our paper is related to the literature on dynamic general equilibrium models with heterogeneous agents and incomplete markets (Imrohoroglu, 1989; Hugget, 1993; Aiyagari, 1994). We belong to the branch of this literature that augments the standard incomplete market model with an idiosyncratic health expenditure risk. For example, Attanasio, Kitao, and Violante (2011) evaluate general equilibrium effects of different Medicare reforms; Kopecky and Koreshkova (2011) study the effect of medical and nursing home expenses on wealth accumulation over a life-cycle. The closest paper to ours is Jeske and Kitao (2009) who study tax subsidies for employer-based health insurance in the environment where private health insurance markets are explicitly modeled. Comparing to Jeske and Kitao (2009), our model introduces endogenous labor supply, public health insurance and also has more dimensions of heterogeneity of individuals: we allow for a full life-cycle and different educational levels. This augmented heterogeneity is important for studying the health insurance reform because of its potentially significant redistributive consequences.

Our paper is also related to the literature studying different versions of health insurance reform in the U.S. Feng (2009) studies the macroeconomic consequences of four alternative reform proposals. Hansen et al (2011) analyze the reform that expands Medicare towards people aged 55-64 years old. Close to ours are Janicki (2011) and Jung and Tran (2011) who also study the current health reform. In contrast to these two studies, our focus is welfare decomposition between the two key components of the reform: the new regulation of the individual market and income redistribution. Their framework does not allow for such decomposition.

The paper is organized as follows. Section 2 introduces the model. Section 3 describes the changes introduces by the reform. Section 4 explains our calibration. Section 5 compares the performance of the model with the empirical facts about the U.S. insurance system. Section 6 describes the quantitative effects of the reform and decomposes its welfare effects. Section 7 concludes.

2 Baseline Model

2.1 Households

2.1.1 Demographics and preferences

The economy is populated by overlapping generations of individuals. An individual lives to a maximum of N periods. During the first $R-1$ periods of life an individual can choose whether to work or not; at age R all individuals retire. We denote the labor supply decision of a household by l_t, $l_t \in \{0, \bar{l}\}$.[2]

Agents are endowed with one unit of time that can be used for either leisure or work. There is a fixed cost of work $\phi_{t,e}$ treated as a loss of leisure. Thus working individuals' leisure time can be expressed as $1 - \bar{l} - \phi_{t,e}$. The fixed cost of work depends on age (t) and education (e). In addition, individuals in bad health incur higher costs of work: $\phi_{t,e} = \phi_1(t,e) + \phi_2(t,e)\mathbf{1}_{\{health=bad\}}$ where $\mathbf{1}_{\{.\}}$ is an indicator function mapping to one if its argument is true, while $\phi_1(t,e)$ and $\phi_2(t,e)$ are non-negative functions.

We assume Cobb-Douglas specification for preferences over consumption and leisure[3]:

$$u(c_t, l_t) = \frac{\left(c_t^{\chi}\left(1 - l_t - \phi_{t,e}\mathbf{1}_{\{l_t>0\}}\right)^{1-\chi}\right)^{1-\sigma}}{1-\sigma}.$$

Here χ is a parameter determining the relative importance of consumption, and σ is the risk-aversion over the consumption-leisure composite.

Agents discount the future at the rate β and survive till the next period with conditional probability ζ_t, which depends on age and health. We assume that the savings (net of out-of-pocket medical expenses) of each household who does not survive are equally allocated among all survived agents of a working age within the same educational group. The population grows at the rate η.

2.1.2 Health expenditures and health insurance

Each period an agent faces a stochastic medical expenditure shock x_t. Medical shocks evolve according to a Markov chain $\mathcal{G}(x_{t+1}|x_t, t)$. We categorize individuals into two groups according to their medical expenses. Individuals with low medical expenses ($x_t \leq \overline{x_t}$) are referred to as 'healthy' or 'people in good health', while individuals with high

[2]Using the MEPS dataset we find that the working hours profiles for the employed are not much different among people with different educational attainment or different medical expenses. However, there are noticeable differences in their labor force participation profiles. Similar patterns are reported by French (2005). Because of this we focus on the extensive margin for labor supply adjustment.

[3]We experimented with additive functional forms, however, the Cobb-Douglas form provides a noticeably better match of the life-cycle labor supply profiles for each health and educational group.

medical expenses ($x_t > \overline{x_t}$) are referred to as 'unhealthy' or 'people in bad health'. Here $\overline{x_t}$ is a threshold separating people into these two groups.

Every individual of working age can buy health insurance (HI) against a medical shock in the individual health insurance market. The price of health insurance in the individual market is a function of an agent's current medical shock and age, and is denoted by $p_I(x_t, t)$.

Every period with some probability $Prob_t$ an agent of working age gets an offer to buy employer-sponsored health insurance (ESHI). The variable g_t characterizes the status of the offer: $g_t = 1$ if an individual gets an offer, and $g_t = 0$ if he does not. All participants of the employer-based pool are charged the same premium p regardless of their current medical expenses and age. An employer pays a fraction ψ of this premium. If the worker chooses to buy group insurance, he only pays $\overline{p}$ where:

$$\overline{p} = (1 - \psi) p.$$

Low-income individuals of working age can obtain their health insurance from Medicaid for free. There are two pathways to qualify for Medicaid. First, an individual can become eligible if his total income is below threshold y^{cat}. Second, an individual can become eligible through the Medically Needy program. This happens if his total income minus medical expenses is below threshold y^{need} and his assets are less than the limit k^{pub}.[4]

We use i_t to index the current health insurance status as follows:

$$i_t = \left\{ \begin{array}{lll} 0 & ; & \text{if uninsured} \\ 1 & ; & \text{if insured by Mediciad} \\ 2 & ; & \text{if privately insured} \end{array} \right\}$$

All types of insurance contracts - group, individual, and public - provide only partial insurance against medical expenditure shocks. We denote by $q(x_t, i_t)$ the fraction of medical expenditures covered by the insurance contract. This fraction is a function of medical expenditures and the type of insurance a household has.

All retired households are enrolled in the Medicare program. The Medicare program charges a fixed premium of p_{med} and covers a fraction $q_{med}(x_t)$ of medical costs.

[4]As of 2009 35 states operate the Medically Needy program. All states running this program have asset tests when determining eligibility. As for the general Medicaid program, most of the states do not have asset tests as part of the eligibility requirement (Ross et al, 2009, and Kaiser Family Foundation statistics available at www.statehealthfacts.org).

2.1.3 Labor income

Households differ by their educational attainment e. Educational attainment can take two values: $e = 1$ corresponds to the absence of any degree, $e = 2$ corresponds to at least a high-school degree.[5] Earnings are equal to $\widetilde{w} z_t^{e,x} l_t$, where $\widetilde{w}$ is wage and $z_t^{e,x}$ is the idiosyncratic productivity that depends on educational level (e), age (t) and medical expenses (x_t) of an individual.

2.1.4 Taxation and social transfers

All households pay income taxes that consist of two parts: a progressive tax denoted by $\mathcal{T}(y_t)$ and a proportional tax denoted by τ_y.[6] Taxable income y_t is based on both labor and capital income. Working households also pay payroll taxes - Medicare tax (τ_{med}) and Social Security tax (τ_{ss}). The Social Security tax rate for earnings above $\overline{y}_{ss}$ is zero. The U.S. tax code allows households to subtract out-of-pocket medical expenditures that exceed 7.5% of their income when the taxable income is calculated. In addition, ESHI premium ($\overline{p}$) is tax-deductible in both income and payroll tax calculations. Consumption is taxed at a proportional rate τ_c.

We also assume a public safety-net program, T_t^{SI}. The program guarantees that every household will have a minimum consumption level at $\underline{c}$. This reflects the option available to U.S. households with a bad combination of income and medical shocks to rely on public transfer programs such as food stamps, Supplemental Security Income, and uncompensated care.[7] Retired households receive Social Security benefits ss_e that depend on educational attainment e.

2.1.5 Optimization problem

Households of a working age ($t < R$) The state variables for the working age household's optimization problem are capital ($k_t \in \mathbb{K} = R^+ \cup \{0\}$), medical cost shock ($x_t \in \mathbb{X} = R^+ \cup \{0\}$), idiosyncratic labor productivity ($z_t^{e,x} \in \mathbb{Z} = R^+$), ESHI offer status ($g_t \in \mathbb{G} = \{0, 1\}$), health insurance status ($i_t \in \mathbb{I} = \{0, 1, 2\}$), educational attainment ($e \in \mathbb{E} = \{1, 2\}$) and age ($t$).

[5] In the earlier version of this paper (Pashchenko and Porapakkarm, 2011) we considered three educational groups: high-school dropouts, high-school graduates and college graduates. The first educational group differs substantially from the other two in insurance statistics, but the difference between high-school and college graduates is small. Because of this we combined the last two educational groups to reduce the computational costs.

[6] The progressive part $\mathcal{T}(y_t)$ approximates the actual income tax schedule in the U.S., while the proportional tax represents all other taxes that we do not model explicitly. In this approach we follow Jeske and Kitao (2009).

[7] In 2004 85% of uncompensated care were paid by the government. The major portion is sourced from the disproportionate share hospital (DSH) payment (Kaiser Family Foundation, 2004).

In each period a household chooses consumption (c_t), labor supply (l_t), savings (k_{t+1}), and health insurance status for the next period (i'_H). If he is eligible for Medicaid, he can get free public insurance (we call this option M). If he works in a firm offering an ESHI, he can buy a group insurance (G). In addition, everyone can choose to be uninsured (U), or buy individual insurance (I). We can summarize insurance choices as follows.[8] If an individual is eligible for Medicaid:

$$i'_H = \left\{ \begin{array}{ll} \{M, I, G\} & ; \text{if } \; g_t = 1 \text{ and } l_t > 0 \\ \{M, I\} & ; \text{if } \; g_t = 0 \text{ or } l_t = 0 \end{array} \right\}. \tag{1}$$

Otherwise

$$i'_H = \left\{ \begin{array}{ll} \{U, I, G\} & ; \text{if } \; g_t = 1 \text{ and } l_t > 0 \\ \{U, I\} & ; \text{if } \; g_t = 0 \text{ or } l_t = 0 \end{array} \right\}. \tag{2}$$

The value function of a working-age individual can be written as follows:

$$V_{t,e}\left(k_t, x_t, z_t^{e,x}, g_t, i_t\right) = \max_{k_{t+1}, c_t, l_t, i'_H} \quad u\left(c_t, l_t\right) + \beta \zeta_t E_t V_{t+1,e}\left(k_{t+1}, x_{t+1}, z_{t+1}^{e,x}, g_{t+1}, i_{t+1}\right) \tag{3}$$

subject to

$$k_t\left(1+r\right) + \widetilde{w}\; z_t^{e,x} l_t + T_t^{SI} + Beq_e = \left(1+\tau_c\right) c_t + k_{t+1} + x_t\left(1 - q\left(x_t, i_t\right)\right) + P_t + Tax \tag{4}$$

$$\widetilde{w} \quad = \quad \left\{ \begin{array}{lcl} w & ; & \text{if } g_t = 0 \\ \left(w - c_E\right) & ; & \text{if } g_t = 1 \end{array} \right\} \tag{5}$$

$$P_t \quad = \quad \left\{ \begin{array}{ccl} 0 & ; & \text{if } i'_H \in \{U, M\} \\ p_I\left(x_t, t\right) & ; & \text{if } i'_H = I \\ \overline{p} & ; & \text{if } i'_H = G \end{array} \right\} \tag{6}$$

$$i_{t+1} \quad = \quad \left\{ \begin{array}{l} 0\ ; \ \text{if } i'_H = U \\ 1\ ; \ \text{if } i'_H = M \\ 2\ ; \ \text{if } i'_H \in \{I, G\} \end{array} \right\} \tag{7}$$

$$Tax = \mathcal{T}\left(y_t\right) + \tau_y y_t + \tau_{med}\left(\widetilde{w} z_t^{e,x} l_t - \overline{p}\mathbf{1}_{\left\{i'_H = G\right\}}\right) + \tau_{ss} \max\left(\widetilde{w} z_t^{e,x} l_t - \overline{p}\mathbf{1}_{\left\{i'_H = G\right\}}, \overline{y}_{ss}\right) \tag{8}$$

$$y_t = r k_t + \widetilde{w} z_t^{e,x} l_t - \overline{p}\mathbf{1}_{\left\{i'_H = G\right\}} - \max\left(0, x_t\left(1 - q\left(x_t, i_t\right)\right) - 0.075\left(\widetilde{w} z_t^{e,x} l_t + r k_t\right)\right) \tag{9}$$

$$T_t^{SI} = \max\left(0, \left(1+\tau_c\right)\underline{c} + x_t\left(1 - q\left(x_t, i_t\right)\right) + Tax - \widetilde{w} z_t^{e,x} l_t - k_t\left(1+r\right) - Beq_e\right). \tag{10}$$

[8] An individual can buy an ESHI coverage through his/her spouse's employer. Since we abstract from family structure, only those who work can buy ESHI in our model. In addition, since Medicaid is free, Medicaid-eligible person cannot stay uninsured.

An individual is eligible for Medicaid if

$$\left\{ \begin{array}{cc} y_t^{tot} \leq y^{cat} & \text{or} \\ y_t^{tot} - x_t \left(1 - q\left(x_t, i_t\right)\right) \leq y^{need} & \text{and } k_t \leq k^{pub} \end{array} \right\}$$

$$y_t^{tot} = rk_t + \widetilde{w}\ z_t^{e,x} l_t$$

Beq_e is accidental bequest. The conditional expectation on the right-hand side of Equation (3) is over $\left\{x_{t+1}, z_{t+1}^{e,x}, g_{t+1}\right\}$. Equation (4) is the budget constraint. In Equation (5), w is wage per effective labor unit. If the household has an ESHI offer, his employer pays part of his insurance premium. To maintain zero profit condition, the employer who offers ESHI deducts an amount c_E from the wage per effective labor unit, as shown in (5). Equation (7) maps the current HI choice into the next period HI status. In Equation (8), the first two terms are income taxes and the last two terms are payroll taxes.[9]

Retired households For a retired household ($t \geq R$) the state variables are capital (k_t), medical expenses shock (x_t), educational attainment (e), and age (t).[10]

$$V_{t,e}\left(k_t, x_t\right) = \max_{k_{t+1}, c_t} \quad u\left(c_t, 0\right) + \beta\zeta_t E_t V_{t+1,e}\left(k_{t+1}, x_{t+1}\right) \tag{11}$$

subject to

$$k_t\left(1+r\right) + ss_e + T_t^{SI} = \left(1+\tau_c\right)c_t + k_{t+1} + x_t\left(1 - q_{med}\left(x_t\right)\right) + p_{med} \ + Tax$$

$$Tax = \mathcal{T}\left(y_t\right) + \tau_y y_t$$

$$y_t = rk_t + ss_e - \max\left(0, x_t\left(1 - q_{med}\left(x_t\right)\right) - 0.075\left(ss_e + rk_t\right)\right)$$

$$T_t^{SI} = \max\left(0, \left(1+\tau_c\right)\underline{c} + x_t\left(1 - q_{med}\left(x_t\right)\right) + Tax + p_{med} - ss_e - k_t\left(1+r\right)\right).$$

Distribution of households To simplify the notation, let $\mathbb{S}$ define the space of a household's state variables, where $\mathbb{S} = \mathbb{K} \times \mathbb{Z} \times \mathbb{X} \times \mathbb{G} \times \mathbb{I} \times \mathbb{E} \times \mathbb{T}$ for working-age households and $\mathbb{S} = \mathbb{K} \times \mathbb{X} \times \mathbb{E} \times \mathbb{T}$ for retired households. Let $\mathbf{s} \in \mathbb{S}$, and denote by $\Gamma(\mathbf{s})$ the distribution of households over the state-space.

[9] In practice, employers contribute 50% of Medicare and Social Security taxes. For simplicity, we assume that employees pay 100% of payroll taxes.

[10] The problem of a just retired household is slightly different since he is still under insurance coverage from the previous period. Thus, i_t is an additional state variable and out-of-pocket medical expenses are $x_t\left(1 - q\left(x_t, i_t\right)\right)$.

2.2 Production sector

There are two stand-in firms which act competitively. Their production functions are Cobb-Douglas, $AK^{\alpha}L^{1-\alpha}$, where K and L are aggregate capital and aggregate labor and A is the total factor productivity. The first stand-in firm offers ESHI to its workers but the second stand-in firm does not. Under competitive behavior, the second firm pays each employee his marginal product of labor. Since capital is freely allocated between the two firms, the Cobb-Douglas production function implies that the capital-labor ratios of both firms are the same. Consequently, we have

$$
\begin{aligned}
w &= (1-\alpha)\, AK^{\alpha}L^{-\alpha}, && (12)\\
r &= \alpha AK^{\alpha-1}L^{1-\alpha} - \delta, && (13)
\end{aligned}
$$

where δ is the depreciation rate.

The first firm has to partially finance the health insurance premium for its employees. These costs are passed on to its employees through a wage reduction. In specifying this wage reduction, we follow Jeske and Kitao (2009) . The first firm subtracts an amount c_E from the marginal product per effective labor unit. The zero profit condition implies

$$
c_E = \frac{\psi p \left(\int \mathbf{1}_{\{i'_H(\boldsymbol{s})=G\}} \Gamma(\boldsymbol{s}) \right)}{\int l_t z_t^{e,x} \mathbf{1}_{\{g_t=1\}} \Gamma(\boldsymbol{s})}. \tag{14}
$$

The numerator is the total contributions towards insurance premiums paid by the first firm. The denominator is the total effective labor working in the first firm.[11]

2.3 Insurance sector

Health insurance companies in both private and group markets act competitively. We assume that insurers can observe all state variables that determine future medical expenses of the individuals.[12] This assumption, together with zero profit conditions, allows us to write insurance premiums in the following way:

$$
p_I(x_t, t) = (1+r)^{-1} \gamma EM(x_t, t) + \pi \tag{15}
$$

[11] The assumed structure implies a proportional transfer from high-income to low-income workers. An alternative structure is a lump-sum wage reduction. This alternative structure is difficult to implement in our setup since some workers will end up earning zero or negative wage.

[12] Currently most states allow insurance firms to medically underwrite applicants for health insurance.

for the non-group insurance market and

$$p = (1+r)^{-1} \frac{\gamma \left(\int \mathbf{1}_{\{i'_H(\mathbf{s})=G\}} EM(x_t,t)\,\Gamma(\boldsymbol{s}) \right)}{\int \mathbf{1}_{\{i'_H(\mathbf{s})=G\}} \Gamma(\boldsymbol{s})} \tag{16}$$

for the group insurance market. Here, $EM(x_t, t)$ is the expected medical cost of an individual of age t and with current medical costs x_t that will be covered by the insurance company:

$$EM(x_t,t) = \int x_{t+1} q(x_{t+1}, 2)\, \mathcal{G}(x_{t+1}|x_t, t).$$

γ is a markup on prices due to the administrative costs in the individual and group markets; π is the fixed costs of buying an individual policy.[13] The premium in the non-group insurance market is based on the discounted expected medical expenditure of an individual buyer. The premium for group insurance is based on a weighted average of the expected medical costs of those who buy group insurance.

2.4 Government constraint

We assume that the government runs a balanced budget. This implies

$$\int [Tax(\boldsymbol{s}) + \tau_c c_t(\boldsymbol{s})]\,\Gamma(\boldsymbol{s}) - G = \tag{17}$$

$$\int_{t\geq R} [ss_e + q_{med}(x_t)\,x_t - p_{med}]\,\Gamma(\boldsymbol{s}) + \int T_t^{SI}\Gamma(\boldsymbol{s}) + \int_{t<R} \mathbf{1}_{\{i'_H=M\}} q(x_t,1)\,x_t\Gamma(\boldsymbol{s})$$

The left-hand side is the total tax revenue from all households net of the exogenous government expenditures (G). The first term on the right-hand side is the net expenditures on Social Security and Medicare for retired households. The second term is the costs of guaranteeing the minimum consumption floor for households. The last term is the costs of Medicaid.

2.5 Definition of stationary competitive equilibrium

Given the government programs $\left\{\underline{c}, ss_e, q_{med}(x_t), p_{med}, y^{cat}, y^{need}, k^{pub}, G\right\}$, the fraction of medical costs covered by private insurers and Medicaid $\{q(x_t, i_t)\}$, and the employers' contribution (ψ), the competitive equilibrium of this economy consists of the set of time-invariant prices $\{w, r, p, p_I(x_t,t)\}$, wage reduction $\{c_E\}$, households' value functions $\{V_{t,e}(\boldsymbol{s})\}$, decision rules of working-age households $\{k_{t+1}(\boldsymbol{s}), c_t(\boldsymbol{s}), l_t(\mathbf{s}), i'_H(\boldsymbol{s})\}$

[13]Fixed costs capture the difference in overhead costs for individual and group policies. An alternative setup would be to assume different proportional loads γ. We choose fixed costs because they allow us to better match the life-cycle profile of individual insurance rates.

and retired households $\{c_t(\boldsymbol{s}), k_{t+1}(\boldsymbol{s})\}$ and the tax functions $\{\mathcal{T}(y), \tau_{med}, \tau_{ss}, \tau_c, \tau_y\}$ such that the following conditions are satisfied:

1. Given the set of prices and the tax functions, the decision rules solve the households' optimization problems in equations (3) and (11).

2. Wage (w) and rent (r) satisfy equation (12) and (13), where

$$K = \int k_{t+1}(\boldsymbol{s})\Gamma(\boldsymbol{s}) + \int_{t<R} \left[\mathbf{1}_{\{i'_H(\mathbf{s})=G\}}p + \mathbf{1}_{\{i'_H(\mathbf{s})=I\}}(p_I(x,t)-\pi)\right]\Gamma(\boldsymbol{s}),$$

$$L = \int_{t<R} z_t^{e,x} l_t(\mathbf{s})\Gamma(\boldsymbol{s}).$$

3. c_E satisfies equation (14), thus the firm offering ESHI earns zero profit.

4. The non-group insurance premiums $p_I(x_t, t)$ satisfy equation (15), and the group insurance premium satisfies equation (16), so health insurance companies earn zero profit.

5. The tax functions $\{\mathcal{T}(y), \tau_{med}, \tau_{ss}, \tau_c, \tau_y\}$ balance the government budget (17).

3 Changes introduced by the reform

This section describes the modifications we introduce to the baseline model after the reform. When modeling the reform, we assume that there is no response from production firms. In other words, the probability of getting an ESHI offer and the employer contribution rate (ψ) do not change after the reform.[14] This assumption is relaxed in the Appendix G.

3.1 Household problem

After the reform, a working-age household may be subject to penalties if he stays uninsured or may receive subsidies to buy *individual* health insurance. Also, more households

[14]This assumption results from the absence of consensus in the literature about firms' response to the reform. Some economists express concern that the reform will induce many small firms to drop coverage due to the availability of subsidized insurance for their employees in the individual market. On the other hand, Brugemann and Manovskii (2010) show in a quantitative model that the number of firms offering coverage may increase. Another view suggests that the reform will not change the number of firms offering coverage. The Bill requires firms with more than 50 employees to pay penalties if they do not offer coverage. However, 96% of firms with more than 50 employees already offer coverage and among firms with more than 200 employees this number goes up to 99%. Also, the Bill allows for tax credits for firms with less than 25 employees who offer health insurance coverage to their workers. However, these tax credits are only in effect for two years.

will be eligible for Medicaid. The eligibility for subsidies and the Medicaid expansion depends on a household's total income (y_t^{tot}); penalties are a function of the taxable income (y_t). We can rewrite the budget constraint of a working-age household (4) in the following way:

$$k_t\,(1+r)+\widetilde{w}\;z_t^{e,x}l_t+T_t^{SI}+Beq_e+Sub(y_t^{tot},i'_H)=(1+\tau_c)\,c_t+k_{t+1}+ \\ x_t\,(1-q\,(x_t,i_t))+P_t+Tax+Pen(y_t,i'_H). \tag{18}$$

Here $Sub(y_t^{tot},i'_H)$ and $Pen(y_t,i'_H)$ are subsidies and penalties correspondingly. A household with income above 400% of the Federal Poverty Line (FPL) cannot get subsidies. People having income below 400% of FPL and receiving an ESHI offer are eligible for premium subsidies in the individual market only if their employee's contribution ($\overline{p}$) exceeds 9.5% of their total income. The subsidy structure ensures that individuals within a certain income category do not spend more than a certain fraction of their income on health insurance. More specifically, spending on individual insurance premiums is limited to the following percentage of total income[15]:

Maximum premium spending (% of income)	Income categories (% of FPL)
2.0	<133
3.5	133-150
5.2	150-200
7.2	200-250
8.8	250-300
9.5	300-400

The income eligibility threshold for the general Medicaid program is increased to 133% of FPL. There are no changes in the Medically Needy program.

An uninsured person whose insurance premium in the individual market is less than 8% of his income has to pay a penalty. The penalty is determined as

$$Pen(y_t,i'_H)=\max\{0.025y_t,\$695\}\quad\text{if}\quad i'_H=U$$

3.2 Insurance sector after the reform

The reform imposes a heavy regulation on the individual insurance market. Insurance companies can no longer condition premiums on the current medical cost of individuals.

[15] The subsidy function specified in the Bill is slightly more complicated: for each income category it specifies the range of maximum premium spending as a fraction of income. We approximate this range by selecting the midpoint of a corresponding interval. For example, the range for the income category 133-150% of FPL is 3-4% and we approximate it by the midpoint 3.5%.

The insurance premium of an individual of age $\widehat{t}$ will be determined by

$$p_I\left(\widehat{t}\right) = (1+r)^{-1}\gamma \frac{\left(\int_{\mathbf{t}=\widehat{t}} \mathbf{1}_{\left\{i'_H(\mathbf{s})=I\right\}} EM\left(x_t, t\right)\Gamma\left(\boldsymbol{s}\right)\right)}{\int_{\mathbf{t}=\widehat{t}} \mathbf{1}_{\left\{i'_H(\mathbf{s})=I\right\}} \Gamma\left(\boldsymbol{s}\right)} + \pi.$$

3.3 Government constraint

We maintain the assumption that the government runs a balanced budget. This implies

$$\int \left[Tax\left(\boldsymbol{s}\right) + \tau_c c_t\left(\boldsymbol{s}\right)\right]\Gamma\left(\boldsymbol{s}\right) - G + \int_{t<R} Pen(y_t, i'_H)\Gamma\left(\boldsymbol{s}\right) =$$

$$\int_{t\geq R} \left[ss_e + q_{med}\left(x_t\right)x_t - p_{med}\right]\Gamma\left(\boldsymbol{s}\right) + \int T_t^{SI}\Gamma\left(\boldsymbol{s}\right) + \int_{t<R} \mathbf{1}_{\left\{i'_H=M\right\}} q\left(x_t, 1\right)x_t\Gamma\left(\boldsymbol{s}\right)$$

$$+ \int_{t<R} Sub(y_t^{tot}, i'_H)\Gamma\left(\boldsymbol{s}\right)$$

The left-hand side now has an additional source of revenue - penalties from those unwilling to purchase insurance. The right-hand side has an additional expenditure - subsidies. To balance the government budget we adjust $\mathcal{T}\left(y_t\right)$ to make it more progressive (details are provided in the next section). This is done to reflect the fact that the current administration plans to finance the reform by increasing the tax burden on people with the highest income.[16]

4 Data and calibration

4.1 Data

We calibrated the model using the Medical Expenditure Panel Survey (MEPS) dataset. The MEPS collects detailed records on demographics, income, medical costs and insurance for a nationally representative sample of households. It consists of two-year overlapping panels and covers the period of 1996-2008. We use nine waves of the MEPS - from 1999 to 2008.

The MEPS links people into one household based on eligibility for coverage under a typical family insurance plan. This Health Insurance Eligibility Unit (HIEU) defined in

[16] More specifically, the Bill increases hospital insurance payroll tax on people with income above \$200,000 by 0.9% and imposes a 3.8% tax on unearned income for higher-income tax-payers (Kaiser Family Foundation, 2011). Our calibration strategy assumes a standard log-normal income process commonly used in macro-literature, which cannot generate the empirical fraction of top-earners. Because of this we increase the progressivity of the general tax code to capture the main idea of financing the reform by taxing the rich more.

the MEPS dataset corresponds to our definition of a household. All statistics we use were computed for the head of the HIEU. We define the head as the male with the highest income in the HIEU. If the HIEU does not have a male member we assign a female with the highest income as its head. We use longitudinal weights provided in the MEPS to compute all the statistics. Since each wave is a representation of population in each year, the weight of each individual was divided by nine in the pooled sample.

In our sample we include all household heads who are at least 24 years old and have non-negative labor income (to be defined later). The sample size for each wave is presented in Table 1. We use 2002 as the base year. All level variables were normalized to the base year using Consumer Price Index (CPI).

Panel	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	Total
Obs.	5,290	4,165	8,648	6,471	6,628	6,569	6,380	6,876	5,165	56,192

Table 1: Number of observations in nine waves of MEPS (1999-2008)

4.2 Demographics, preferences and technology

In the model, agents are born at age 25 and can live to a maximum age of 99. The model period is one year so the maximum lifespan N is 75. Agents retire at the age of 65, so R is 41.

To adjust conditional survival probabilities ζ_t for the difference in medical expenses we follow Attanasio et al. (2011). In particular, we use Health and Retirement Survey (HRS) and MEPS to estimate the difference in survival probabilities for people in different medical expense categories and use it to adjust the male life tables from the Social Security Administration (more details are available in Appendix B). The population growth rate was set to 1.35% to match the fraction of people older than 65 in the data.

We set the consumption share in the utility function χ to 0.6 using the estimates of French (2005).[17] The parameter σ is set to 5 which corresponds to the risk-aversion over consumption equal to 3.4 which is in the range commonly used in the life-cycle literature.[18] The discount factor β is calibrated to match the aggregate capital output ratio of 3. We set labor supply of those who choose to work ($\bar{l}$) to 0.4

Fixed leisure costs of work $\phi_{t,e}$ are calibrated to match the employment profiles in each educational and health group.[19] More specifically, we assume that fixed costs for

[17]Given that we have indivisible labor supply we cannot pin down this parameter using a moment in the data.

[18]The relative risk aversion over consumption is given by $-cu_{cc}/u_c = 1 - \chi(1 - \sigma)$.

[19]We define a person as employed if he works at least 520 hours per year, earns at least $2,678 per

people in good health $\phi_1(t,e)$ do not vary with age and use this parameter to match the employment rate for the age group 55-59 for each educational group.[20] For the additional fixed costs of people with bad health $\phi_2(t,e)$, we assume it is a linear function of age. For each educational group we adjust the intercept and the slope of this function to match two moments: the employment rate of people in the 25-29 and 55-59 age groups who have bad health. The resulting fixed costs are presented in Table 2.

	High-school dropouts	HS and College graduates
ϕ_1	0.2800	0.2650
ϕ_2 intercept	0.0200	0.0450
ϕ_2 slope	0.0008	0.0025

Table 2: Parameters characterizing disutility from work

The Cobb-Douglas function parameter α is set at 0.33, which corresponds to the capital income share in the US. The annual depreciation rate δ is calibrated to achieve an interest rate of 4% in the baseline economy. The total factor productivity A is set such that the total output equals one in the baseline model.

4.3 Government

In calibrating the tax function $\mathcal{T}(y)$ we use a nonlinear function specified by Gouveia and Strauss (1994):

$$\mathcal{T}(y) = a_0 \left[y - \left(y^{-a_1} + a_2 \right)^{-1/a_1} \right]$$

This functional form is commonly used in the quantitative macroeconomic literature (for example, Conesa and Krueger, 2006; Jeske and Kitao, 2009). In this functional form a_0 controls the marginal tax rate faced by the highest income group, a_1 determines the curvature of marginal taxes and a_2 is a scaling parameter. We set a_0 and a_1 to the original estimates as in Gouveia and Strauss (1994), which are 0.258 and 0.768 correspondingly. The parameter a_2 is used to balance the government budget. When implementing the reform we keep a_2 fixed at a level that balances the budget in the baseline economy. To achieve a balanced budget in the reformed economy, we adjust the parameter a_0.

We set proportional income tax τ_y to 6.62% to match the fact that around 65% of tax revenues come from income taxes that are approximated in our calibration by the progressive function $\mathcal{T}(y)$. The minimum consumption floor $\underline{c}$ was set to \$2,700 following

year in base year dollars (this corresponds to working at least 10 hours per week and earning a minimum wage of \$5.15 per hour), and does not report being retired or receiving Social Security benefits.

[20]Our model tends to overestimate the employment rate of healthy young people with high education, possibly due to the borrowing constraints and the lack of intra-family transfers. Matching employment at a young age will result in counter-intuitive *decreasing* leisure costs over the life-cycle.

the estimates of De Nardi et al. (2010). The Social Security replacement rates were set to 40% and 30% of the average labor income for people with low and high education correspondingly, reflecting the progressivity of the system.

Medicaid eligibility rules were taken from the data. The income eligibility threshold for general Medicaid (y^{cat}) is set to 64% of FPL which is the median value for this threshold among all states in 2009. The income eligibility threshold for the Medically Needy program (y^{need}) and asset test for this program (k^{pub}) are set to 53% of FPL and $2,000 correspondingly. These numbers are equal to the median values for the corresponding eligibility criteria in 2009 in the states that have Medically Needy program.[21]

The Medicare, Social Security and consumption tax rates were set to 2.9%, 12.4% and 5.67% correspondingly. The maximum taxable income for Social Security is set to $84,900. The fraction of exogenous government expenses in GDP is 18%.

4.4 Insurance sector

The share of health insurance premium paid by the firm (ψ) was chosen to match the aggregate ESHI take-up rate.[22] The resulting number (76.3%) is consistent with the one observed in the U.S. economy, which is in the range of 75-85% (Kaiser Family Foundation, 2009).

We set the proportional loads for group and individual insurance policies (γ) to 1.11 (Kahn et al., 2005). The fixed costs of buying an individual policy π is set to $23 to match the aggregate fraction of people with individual insurance.

4.5 Labor income

We divide households into two educational groups: high-school dropouts and people with at least a high-school degree. The fraction of each group in the population is 15% and 85% correspondingly. Individuals with different education and health have different productivity, specified as follows:

$$z_t^{e,x} = \lambda_t^{e,x} \exp(v_t) \exp(\xi_t) \tag{19}$$

where $\lambda_t^{e,x}$ is the deterministic function of age, education and medical expenses category, and

$$v_t = \rho v_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \tag{20}$$

$$\xi_t \sim N(0, \sigma_\xi^2)$$

[21]In our model FPL does not change after the reform so the Medical eligibility thresholds are not affected by the change in the aggregate variables.

[22]In this paper we use the term "take-up rate"only in relation to the employer-based market, and it defines the fraction of people among those with an ESHI offer who choose to buy group insurance.

For the persistent shock v_t we set ρ to 0.98 and σ_ε^2 to 0.018 following the incomplete market literature (Storesletten et al (2004); Hubbard et al (1994); Erosa et al (2011); French (2005)). We set the variance of the transitory shock (σ_ξ^2) to 0.1 which is in the range estimated by Erosa et al (2011). In our computation we discretize the stochastic shocks v_t and ξ_t using the method in Floden (2008).[23] To construct the distribution of newborn individuals, we draw v_1 in equation (20) from $N(0, 0.124)$ distribution following Heathcote et al. (2010).

To identify the deterministic part of productivity $\lambda_t^{e,x}$ we need to take into account that in the data we only observe labor income of workers and we do not know the potential income of non-workers. In the data people in different medical expenses categories have similar average labor income but differ substantially in their employment profiles. If people with low productivity tend to drop out from the employment pool there will be a selection bias when estimating labor income from the data.

To address this problem we use the method developed by French (2005). We start by estimating the labor income profiles of workers based on the MEPS dataset.[24] Then we guess $\lambda_t^{e,x}$ in equation (19) and feed these productivity profiles into our model. After solving and simulating the model we compute the average labor income profile of workers in our model and compare it with the income profiles from the data. If our simulated labor income is too high, we update the deterministic part of productivity $\lambda_t^{e,x}$ downwards, and if it is too low - upwards. We reiterate until the labor income profile generated by our model is the same as in the data.[25,26] The advantage of this approach is that we can reconstruct the productivity $z_t^{e,x}$ of individuals *whom we do not observe working in the data.*

Figure (1) plots the labor income profiles of *workers* observed in the data and simulated by the model, and compares them with the average potential labor income computed for *everyone* in the model. The later profile takes into account the unobserved productivity of those people who do not work. The average labor income of workers is higher than the average labor income that includes potential income of non-workers because people with low productivity tend to drop out from the employment pool. This also suggests

[23]We use 9 grid points for v_t and 2 grid points for ξ_t. The grid of v_t is expanding to capture the increasing cross-sectional variance. Our discretized process for v_t generates the autocorrelation of 0.98 and 0.016 for its innovation variance.

[24]Household labor income is defined as the sum of wages (variable WAGEP) and 75% of the income from business (variable BUSNP). This definition is the same as the one used in the Panel Study of Income Dynamics Dataset (PSID), which has been commonly used for income calibration in the macroeconomic literature.

[25]More specifically, for a given educational and age group we specify $\lambda_t^{e,x}$ as a cubic function of age, thus we need to find four coefficients. To recover these four coefficients we use the following four moments: average labor income for workers at age 25, 40, 50, and 60 for each educational group.

[26]Based on our experiments, for a given set of model parameters there seems to be a unique set of coefficients defining $\lambda_t^{e,x}$ that can match the labor income profile in the data. See French (2005) for a more detailed discussion of identification.

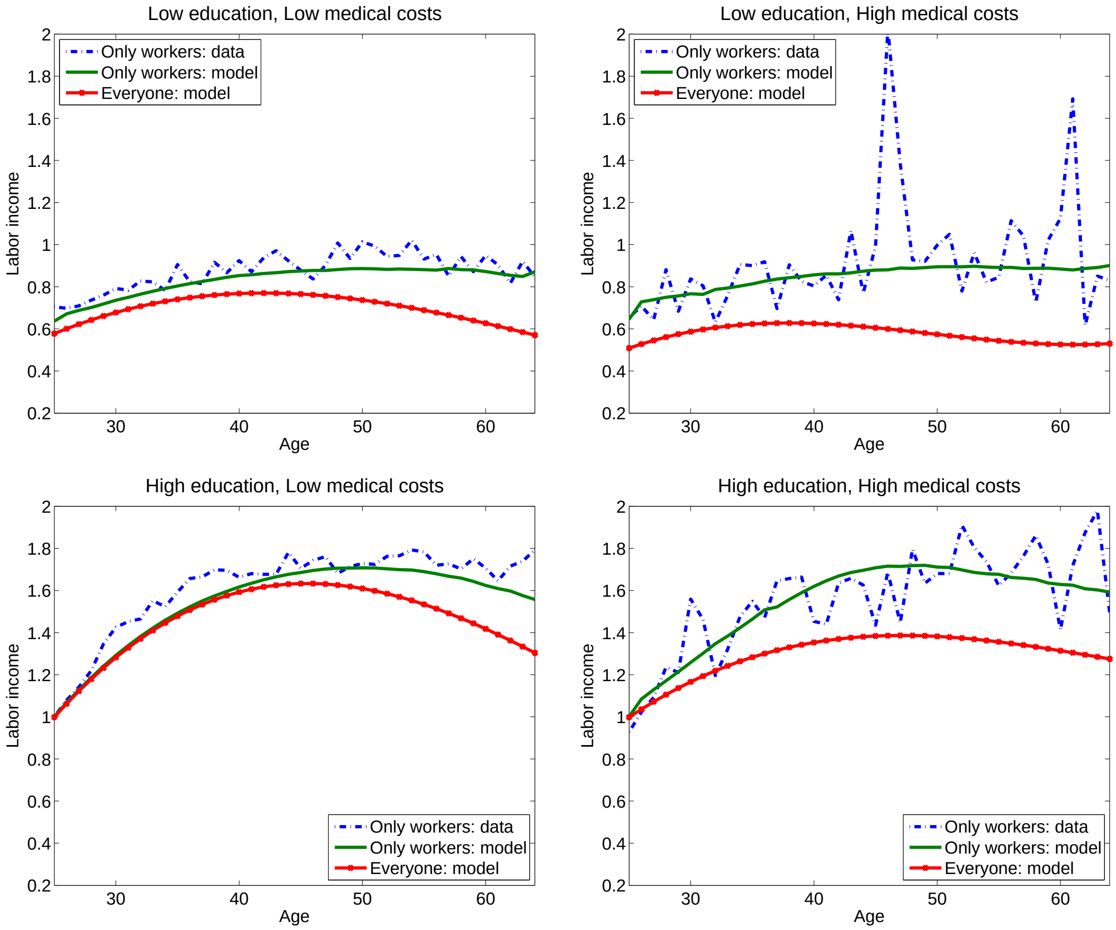

Figure 1: Average labor income of workers (data and model) and of everyone (model). The later profile takes into account the unobserved productivity of those people who do not work.

that if we do not use the correction described above we would *overestimate* the labor income for non-participating individuals and this bias is especially strong in the case of unhealthy workers and workers at pre-retirement age, i.e. groups with lower employment rate. Our estimates also show that unhealthy people are inherently less productive. The drop in productivity due to bad health depends on age but it can be as high as 22% for high-school dropouts and as high as 15% for people with at least a high-school degree.[27]

[27] Capatina (2011) also finds that the negative impact of bad health on productivity is more pronounced for people with low education.

4.6 Offer rate

We assume that probability of getting an offer of ESHI coverage is a logistic function[28]:

$$Prob_t = \frac{\exp(u_t)}{1+\exp(u_t)},$$

where the variable u_t is an odds ratio that takes the following form:

$$u_t = \eta_0^e + \eta_1^e \log(inc_t\ ) + \eta_2^e \left[\log(inc_t\ )\right]^2 + \eta_3^e \left[\log(inc_t\ )\right]^3 + \eta_4^e \mathbf{1}_{\{g_{t-1}=1\}} + \Theta^e D_t \qquad (21)$$

Here $\eta_0^e, \eta_1^e, \eta_2^e, \eta_3^e, \eta_4^e$ and Θ^e are education-specific coefficients, inc_t is individual labor income (normalized by the average labor income), and D_t is a set of year dummy variables. To construct the initial offer rate (g_1 in equation (21)) we run a separate logistic regression for people aged 24-26 where we do not include offer in the previous period but include dummies for medical expenses categories.

4.7 Insurance status

In the MEPS the question about the source of insurance coverage is asked retrospectively for each month of the year. We define a person as having employer-based insurance if he reports having ESHI for at least eight months during the year (variables PEGJA-PEGDE). The same criterion is used when defining public insurance (variables PUBJA-PUBDE) and individual insurance status (variables PRIJA-PRIDE). For those few individuals who switch sources of coverage during a year, we use the following definition of insurance status. If a person has both ESHI and individual insurance in one year, and each coverage lasted for less than eight months, but the total duration of coverage lasted for more than eight months, we classify this person as individually insured. Likewise, when a person has a combination of individual and public coverage that altogether lasts for more than eight months, we define that individual as having public insurance.[29]

4.8 Medical expenditures

Medical costs in our model correspond to the total paid medical expenditures in the MEPS dataset (variable TOTEXP). These include not only out-of-pocket medical expenses but also the costs covered by insurers. In our calibration medical expense shock is approximated by a 5-state discrete Markov process. For each age, we divide medical

[28] In our estimation we assume that an individual has an offer if any member of his HIEU reports having an offer in at least two out of three interview rounds during a year (variables OFFER31x, OFFER42x, OFFER53x). In addition, we exclude household heads whose income was below $1,000 when estimating the logistic regression.

[29] The results do not significantly change if we change the cutoff point to 6 or 12 months.

expenditures into 5 bins, corresponding to 30th, 60th, 90th and 99th percentiles (more details on this are available in Appendix C). We set $\overline{x_t}$ that separates people into different medical expenses categories to the 90th percentile of medical expenses distribution of the corresponding age. In other words, people whose medical expenses are in the lowest three bins are classified as healthy, while people whose medical expenses are in the highest two bins are classified as unhealthy. To construct the transition matrix we measure the fraction of people who move from one bin to another between two consecutive years separately for people of working age (25-64) and for retirees (older than 65).

We use MEPS to estimate the fraction of medical expenses covered by insurance policies $q(x_t, i_t)$ (we explain more in Appendix C). We find that Medicaid provides better coverage than private insurance for low medical expenses but for higher expenses private insurance is more generous. For retired households we set $q_{med}(x_t)$ to 0.5 to match the fraction of medical expenses of the retirees financed by the government (3.0% of GDP).

The model parametrization is summarized in Table 9 in Appendix A.

5 Baseline model performance

Figure (2) compares the employment profiles observed in the data with the ones generated by the model. The model closely tracks the employment profiles for each educational and health group though it slightly overestimates employment rate of the youngest group.

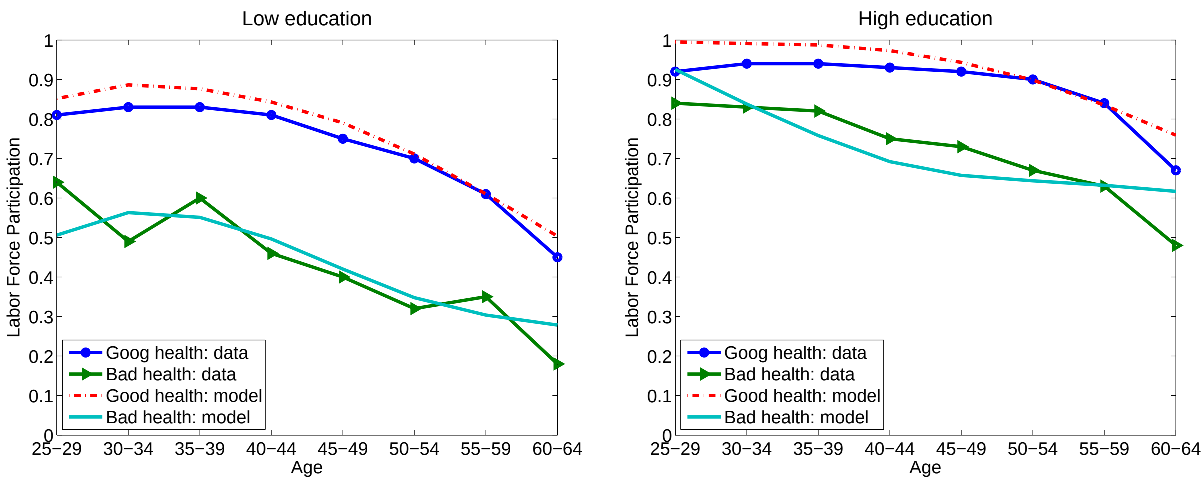

Figure 2: Employment profiles for people with low education (left panel) and high education (right panel): data vs. model

Table 3 compares the aggregate health insurance statistics generated by the model with the ones observed in the data. The model was calibrated to match the data on

ESHI take-up rates and individual insurance rates. However, the model also produces numbers on the fractions of uninsured and publicly insured close to the data. The last four columns of Table 3 show insurance statistics by educational groups. Our model does not target any of these statistics, but it still fares well along these dimensions.

	All		Low education		High education	
	Data	Model	Data	Model	Data	Model
Insured by ESHI (%)	63.0	64.4	33.3	29.1	68.5	70.6
Individually insured (%)	7.6	7.3	5.5	3.8	8.0	8.0
Uninsured (%)	20.2	19.7	39.5	43.2	16.6	15.6
Publicly insured (%)	9.2	8.6	21.7	23.8	6.9	5.9
ESHI take-up rate (%)	94.3	94.2	85.9	81.6	93.9	95.3
Offer rate (%)	67.6	68.3	38.8	35.7	72.9	74.1
Group premium/avg.income (%)	7.0	6.7	-	-	-	-

Table 3: Insurance statistics: data vs. model

The top panel of Figure (3) plots the percentages of the uninsured and those publicly insured in the model and in the data. For both educational groups, the model can match the corresponding empirical profiles. There is an overprediction in the number of publicly insured for people of preretirement age due to our simplified Medicaid eligibility criteria. The bottom panel of Figure (3) compares the life-cycle profiles of the fraction of people with private insurance for different educational groups in the model and in the data. The model reproduces the general life-cycle pattern and differences in educational group in insurance rates. However, for low educated people it underestimates the fraction of people with ESHI among the older group which happens because we overestimate the fraction of the publicly insured for this age category. The model also tends to underpredict the fraction of people with individual insurance among young low-educated people because we abstract from different Medicaid rules by state and assume only one choice of plan in the individual insurance market.

It is well-known that a standard incomplete-market model cannot generate wealth concentration as in the data. However, we are able to reproduce a reasonable amount of wealth inequality. People in the top 20th, 40th and 60th percentiles in our model hold 55.2%, 81.5% and 95.1% of the aggregate wealth while in the data these numbers are 84.4%, 95.7% and 99.6% correspondingly (Wolff, 2010). The numbers produced by our model are similar to the numbers produced by other quantitative models featuring incomplete labor markets and medical expenses shocks (see, for example, Imrohoroglu and Kitao, 2012). Our model also produces a reasonable number of poor people: the

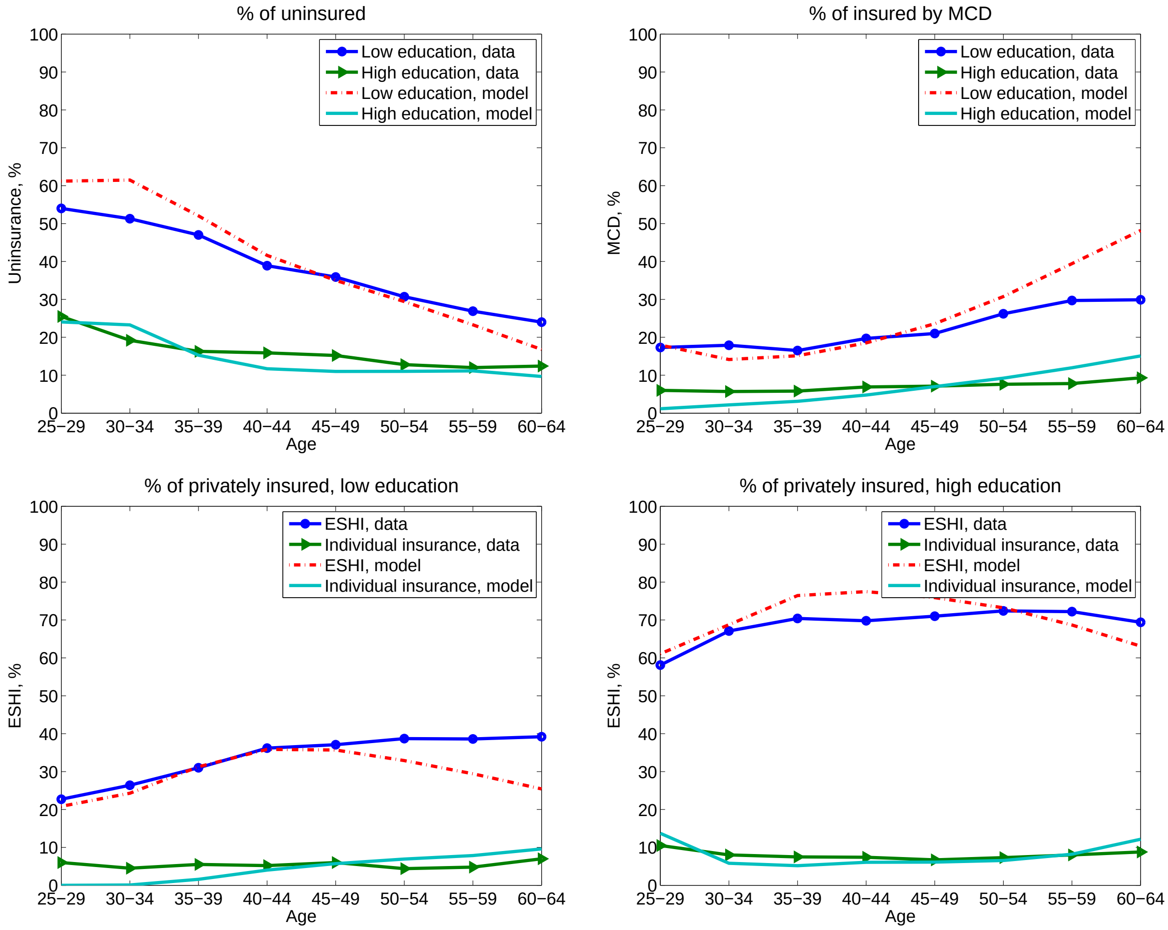

Figure 3: Percent of uninsured and publicly insured (top panel) and privately insured (bottom panel) data vs. model

fraction of people (including retirees) with assets less than \$1,000 is 10.9%. In the Survey of Consumer Finance (SCF) this number is 11.1% in 2004 (Kennickell, 2006).

6 Effects of the reform

In this section we describe the effects of the reform on employment, insurance and government finances by comparing the two steady-states: before and after the reform (the transition dynamics is described in Appendix E). Then we provide the analysis of the welfare effects which takes into account the transition period to the new steady-state.

6.1 Effect on the employment

The reform does not have a significant impact on the aggregate employment rate which slightly decreases from 89.7% to 89.1%. Figure (4) compares the employment profiles before and after the reform. There is a noticeable change in employment of people with bad health. Unhealthy people with low education increase their labor supply while for unhealthy people with high education labor supply goes down. This opposite direction of adjustment in labor supply is due to the effect of Medicaid and ESHI. In general, for unhealthy group health insurance is very valuable but very expensive if obtained through the individual market. Before the reform, unhealthy people with low education have to rely on Medicaid while the highly educated group has to rely on ESHI. In order to satisfy the income eligibility requirements for Medicaid, unhealthy low educated people may need to stop working. In contrast, unhealthy people with high education have to work in order to be eligible for ESHI. After the reform, given the relaxed eligibility requirements for Medicaid and the availability of subsidies, these distorting effects are substantially diminished.[30]

The response in employment mainly comes from people with low productivity. For unhealthy people with low education, the average productivity profile among workers decreases after the reform, implying that people with lower than average productivity join the employment pool. For unhealthy people with high education, the average productivity profile goes up, implying that people who leave the employment pool have lower than average productivity.

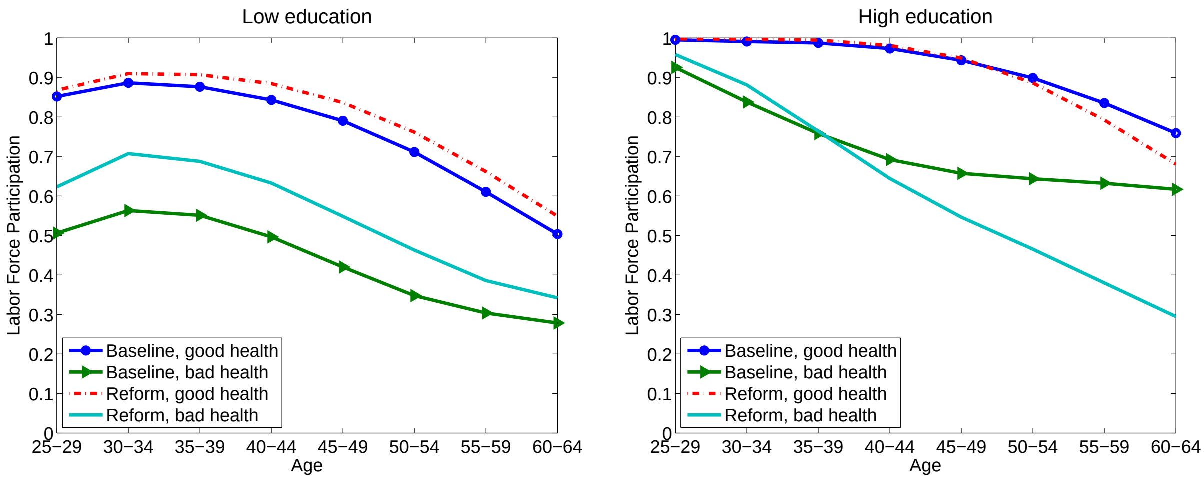

Figure 4: Employment profiles before and after the reform for people with low education (left panel) and high education (right panel). The comparison is done for the steady-states.

6.2 Effect on insurance

Table 4 compares the aggregate insurance statistics between the two steady-states - the baseline and the reformed economies.

[30]Pohl (2011) finds a similar pattern when using a structural model to simulate the effects of the current reform on the labor supply of single mothers. In particular, he finds that individuals with medical conditions are more likely to increase labor supply in response to the Medicaid expansion and the introduction of subsidies, or to quit job that offers ESHI.

Variable	Baseline	Reform
Insured by ESHI (%)	64.4	62.5
Individually insured (%)	7.3	18.5
Uninsured (%)	19.7	8.9
Publicly insured (%)	8.6	10.1
Group premium/avg.income (%)	6.7	6.0
Employment	89.7	89.1
Aggregate capital	3.00	2.92

Table 4: Insurance statistics before and after the reform (steady-state comparisons)

The fraction of people with ESHI stays almost the same. This is not surprising given our assumption that neither ESHI offer rates nor employer contribution rates change in response to the reform. The percentage of people with individual insurance increases more than twofold: from 7.3% to 18.5%. At the same time, there is a big drop in the uninsurance rate which goes down from 19.7% to 8.9%. The number of publicly insured increases from 8.6% to 10.1% due to the expansion of Medicaid.[31,32]

The top panel of Figure (5) compares the percentages of people without health insurance before and after the reform. In all educational and age groups there is a noticeable decline in the fraction of the uninsured. The largest reduction in the number of uninsured is observed among high-school dropouts especially at young ages.

The bottom panel of Figure (5) displays the fraction of people with public insurance. For both educational groups the fraction of people insured by Medicaid increases at young age but decreases at preretirement age. In our calibration Medicaid provides a better coverage for low medical expenses but for high medical expenses private insurance is more generous. Since medical expenses increase steeply with age, subsidized private insurance becomes more attractive than Medicaid as people get older. As shown in the bottom panel of Figure (6), the fraction of people with individual insurance increases sharply with age.

The top panel of Figure (6) compares the fraction of people with ESHI before and

[31] The percentage of people newly eligible for Medicaid (in the income category 64-133% of FPL) is around 7.7% in the pre-reform economy. However, the expansion of Medicaid does not increase the percentage of publicly insured much because many of newly eligible people prefer to buy subsidized individual insurance. This is because the subsidy scheme is very generous for people in this income category and individual insurance provides better coverage in case of high medical shocks.

[32] Table 4 shows that even though the reform substantially decreases the number of uninsured, the insurance coverage is far from universal: around 9% of people will stay uninsured. People who stay uninsured after the reform have low expected medical expenses and they are not eligible for subsidies. These people prefer to pay penalties because community-rated premiums are substantially higher than premiums they face in the unregulated market.

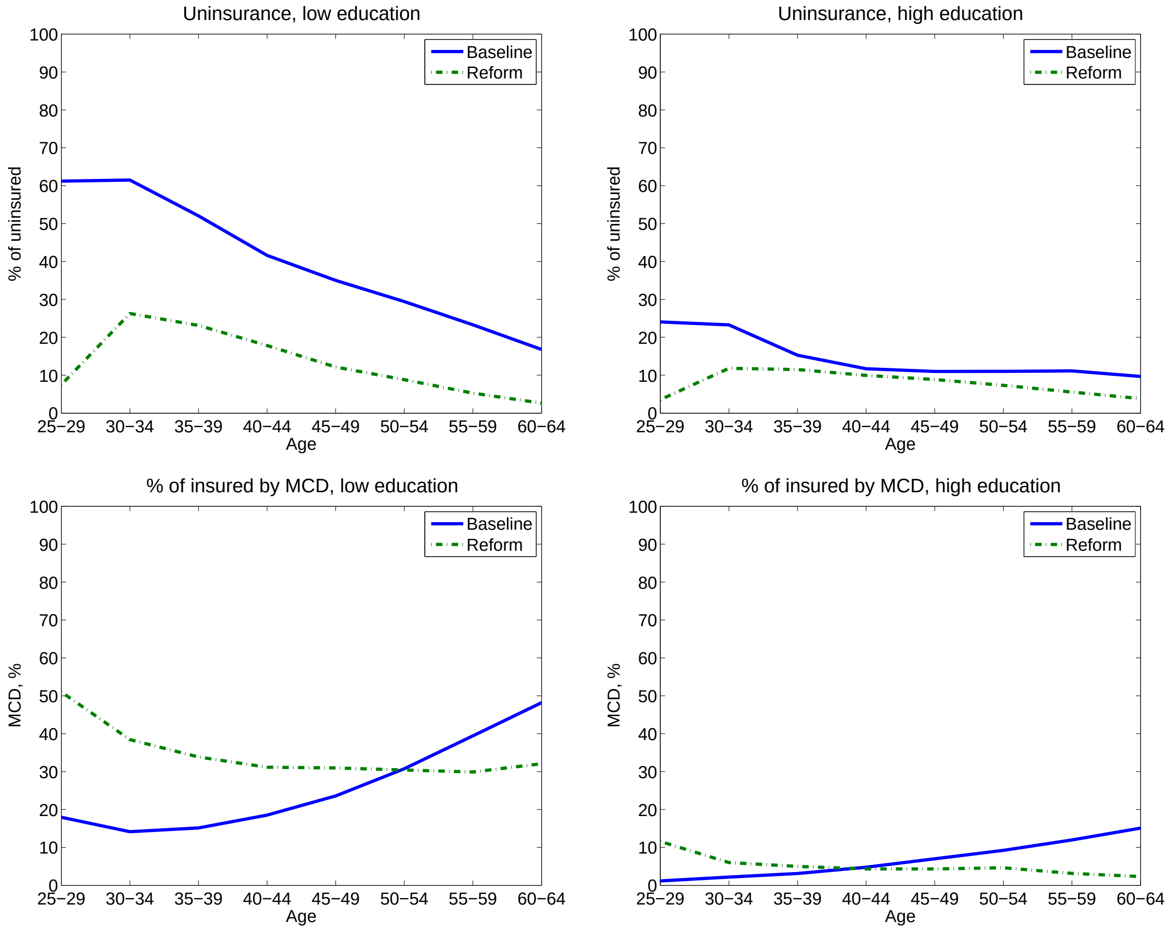

Figure 5: Percent of uninsured and publicly insured before and after the reform for people with low education (left panel) and high education (right panel). The comparison is done for the steady-states.

after the reform. For people older than 40 there is a decrease in ESHI coverage for both educational groups. This is due to the crowd-out by Medicaid and subsidized individual insurance.[33] Older people have higher disutility from work when they are unhealthy, and after the reform they do not need to work in order to access ESHI since they have alternative insurance options.[34]

6.3 Effect on government finances

Table 5 shows the changes in government finances after the reform. The government spending on health insurance for the working-age group (including subsidies net

[33]Cutler and Gruber (1996) also found that Medicaid expansion over the 1987-1992 period caused the crowd-out of ESHI.

[34]The decrease in the group premium reported in Table 4 can be explained by this tendency of older unhealthy people to leave the employment pool, thus resulting in better risk composition. Clemens (2012) describes similar patterns when studying the effect of the Medicaid expansion in the end of 1990s on the community-rated markets in some states. In particular, he finds that sick people switch to newly available public coverage thus reducing community-rated premiums.

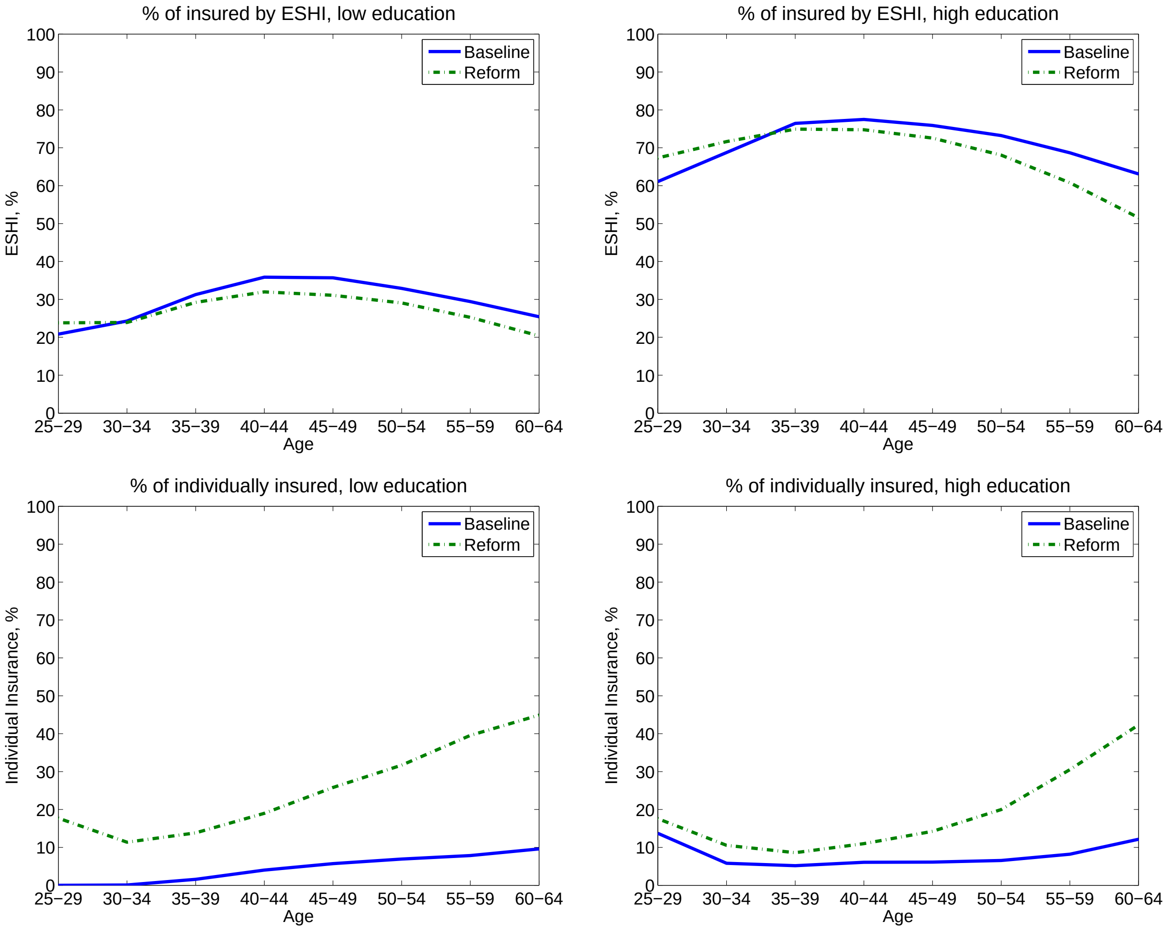

Figure 6: Percent of people with ESHI and individual insurance before and after the reform for people with low education (left panel) and high education (right panel). The comparison is done for the steady-states.

Change in	Value
Spending on health insurance for working-age (%)	+124.1
Spending to guarantee minimum consumption for working-age (%)	-45.6
Average tax for average wage (percentage point)	1.20

Table 5: Changes in the government finances after the reform

of penalties and Medicaid expansion) increases by 124%. On the other hand, there is a significant decline in spending on transfers to guarantee the minimum consumption floor. For working-age households these transfers drop by almost 46%. The average tax rate for a person with average income increases by 1.20 percentage points in the reformed economy.[35,36]

[35]The change in marginal taxes for different income groups is discussed in Appendix H.

[36]Even though the reform increases income redistribution in the economy it does not have a noticeable impact on wealth inequality. The Gini coefficient after the reform changes very slightly going down from 0.556 to 0.552.

6.4 Welfare analysis

Consumption equivalent variation (CEV) for the reformed economy is presented in Table 6.[37] The reform brings a significant welfare improvement: the average welfare gains of people who live through the transition period are equal to 0.64%.[38] Around 66% of people gain from the reform. People who gain the most are low educated people: their average CEV exceeds 1%.[39] People with high education also gain from the reform though their gains are substantially lower. High welfare gains for low educated people are not surprising since they are the main beneficiaries of the expanded Medicaid and subsidies for health insurance purchase. The fact that even highly educated people tend to gain despite the higher tax burden is due to the lower ESHI premium (fifth row of Table 4) and the improved risk-sharing in the economy[40]. Before the reform highly-educated people rely on ESHI as the main source of insurance coverage and this has several disadvantages. First, people face the risk of losing ESHI every period and this event is likely to coincide with negative income shock. If this happens, the availability of public or subsidized health insurance becomes valuable, especially if a person is unhealthy. Second, an individual can buy ESHI only if he works, which may be a constraint for older people in bad health whose disutility from work is high but insurance is very valuable. The availability of subsidized coverage not conditioned on working substantially increases the welfare of this group.

If we decompose the welfare effects by age, we see that retirees lose from the reform (Table 6) with an average loss equal to - 0.65%. This happens because the reform does not improve insurance possibilities for retirees who are already covered by public insurance. However, they share the burden of reform financing through higher taxes.

[37]Let V^B denote the value function in the baseline economy and V^R - the value function in the reformed economy. The CEV for an individual with state variables s can be defined as:

$$CEV\left(s\right) = 100 * \left[1 - \left(\frac{V_{t,e}^{B}\left(s\right)}{V_{t,e}^{R}\left(s\right)}\right)^{\frac{1}{\chi(1-\sigma)}}\right]$$

The resulting number represents the percentage of the annual consumption an individual in the reformed economy is willing to give up in order to be indifferent between the baseline and reformed economies. The positive number implies welfare gains. The CEV reported in Tables 6 and 7, and Figure 7 averages out $CEV\left(s\right)$ for all people who are alive at the beginning of the transition period and using the distribution of people over states as in the steady-state in the baseline economy.

[38]We show in Appendix G that if employers respond to the reform by substantially decreasing their contributions the welfare gains will be smaller (0.47%). This is mostly driven by decrease in the welfare of people with high education who suffer from the partial unraveling of the employer-based market.

[39]This result is different from Janicki (2011) who finds that the main beneficiaries of the reform are high-income people. His finding is mostly driven by the fact that the consumption minimum floor in his model is tied to the aggregate output. The aggregate output decreases after the reform, consequently fewer people can rely on means-tested transfers. This disproportionately hurts low-income households, outweighing any benefits they may have from the reform. In contrast, Jung and Trun (2011) find that poor people gain more from the reform.

[40]After the reform the interest rate goes up slightly, which also mostly benefits highly educated people.

	CEV(%)		
		Low	High
	All	education	education
All ages	0.64	1.43	0.51
Age 25-64	0.95	1.85	0.79
Age 65-99	-0.65	-0.37	-0.69
% who gains	66.2	76.7	64.4

Table 6: Welfare effects of the reform (including the transition period)

For people of working age the average CEV is equal to 0.95%. Figure (7) reports the average CEV during the transition for each education, productivity and health group. This figure shows that people who gain most are those with high education/low productivity and low education/high productivity.[41] People with low education/low productivity do not gain much because they get access to public insurance even before the reform. Since highly productive people with high education are not usually eligible for benefits from the reform, their gains are small or negative. Unhealthy people tend to gain substantially more than the healthy. There is a noticeable drop in welfare for people over 50-55 because this group has less time to enjoy the benefits of the reform.

6.5 Decomposing the effect of the reform

To decompose the welfare effects of the reform we use several experiments. First, we remove the subsidies and Medicaid expansion from the original reform but keep provisions for the community rated individual market and penalties for individuals without insurance. We call this case 'only community rating'. Second, we keep all the redistributive measures embedded in the original reform (subsidies and Medicaid expansion) but we allow for the unregulated individual insurance market (no community rating) and remove penalties. We call this version of the reform 'only redistribution'. Table 7 compares the results of these modified reforms with the original one, and Table 8 reports insurance statistics for each counterfactual reform.

The second row of Table 7 shows the results of implementing the reform with only community rating. In this case, the welfare gains from the reform become negative, decreasing from 0.64 to -0.11%.

After the implementation of the reform with only community rating the individual market suffers from an adverse selection spiral. As can be seen from the left panel of

[41] The welfare gains of the latter group can be as high as 3.5%. These high gains are mostly driven by the previously uninsured members of this group who did not have access to ESHI and who were not eligible for Medicaid before the reform.

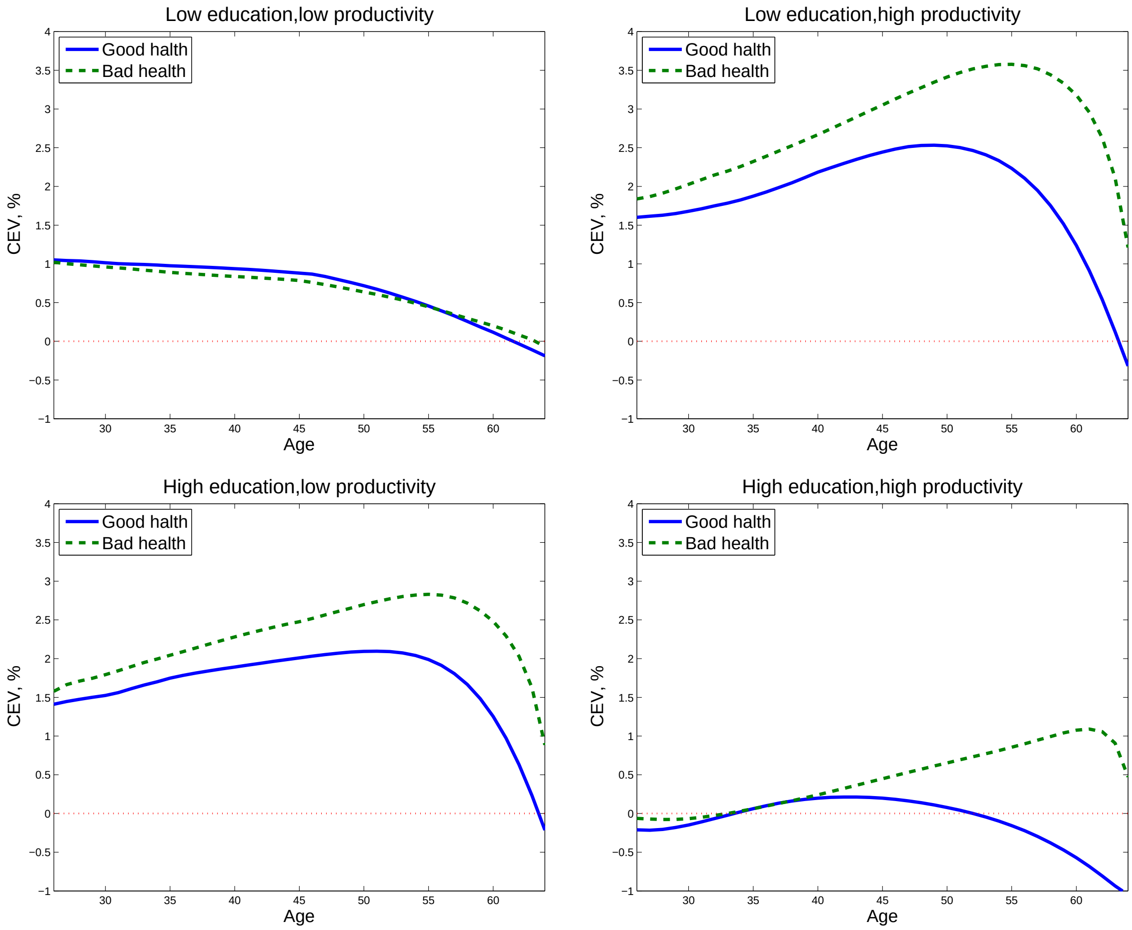

Figure 7: Consumption equivalent variation by health and productivity for people with low education (top panel) and high education (bottom panel). We define a person as having high productivity if his persistent shock falls in the highest two grid points, and as having low productivity if this shock is in the lowest three grid points. Welfare calculations include the transition period.

Figure (8), the premium in the individual market is at the level of risk-adjusted premiums for people in the highest grid of medical expenses. In other words, only people with high expected medical expenses participate in the individual market. The second row of Table 8 clarifies this point by showing that participation in the individual market decreases to 0.7%. This suggests that penalties are not enough to enforce participation in the community rated individual market. The fact that in the original reform many people participate in the individual market is primarily due to the effect of subsidies but not of penalties.[42] This suggests that subsidies are enough to solve the problem of adverse

[42]This result is different from Jung and Tran (2011) who find that penalties are effective to make people buy health insurance. This discrepancy can be explained by two observations from their model. First, uninsured people in their model do not have a problem with affordability of premiums: when the authors consider a counterfactual reform without subsidies, 97% of people can afford health insurance. Second, the individual market in their model does not suffer from the adverse selection problem even if penalties are removed: the individual insurance premium stays almost the same as in the original reform even though the number of insured decreases from 98% to 72%.

	CEV(%)		
	All	Low education	High education
1. Reform	0.64	1.43	0.51
2. Only CR	-0.11	-0.07	-0.12
3. Only CR+high penalties	0.06	-0.02	0.07
4. Only redistribution	0.50	1.36	0.35
5. Only Medicaid expansion	-0.02	0.32	-0.08
6. Only subsidies	0.43	1.19	0.29

Table 7: Welfare effect of different versions of the reform (including the transition period)

	ESHI	Individual insurance	Uninsured	Public insurance
Baseline	64.4	7.3	19.7	8.6
1. Reform	62.5	18.5	8.9	10.1
2. Only CR	65.3	0.7	25.4	8.6
3. Only CR+high penalties	67.1	11.4	13.1	8.3
4. Only redistribution	61.9	18.1	9.9	10.1
5. Only Medicaid expansion	62.0	5.2	14.6	18.2
6. Only subsidies	64.3	21.8	11.5	2.4

Table 8: Insurance statistics for different versions of the reform (steady-state comparisons)

selection in the community-rated individual market after the reform.[43]

To understand whether the small welfare effect of the reform with only community rating is a result of the adverse selection spiral, we implemented the same reform but with penalties that are three times higher than in the original reform. In this case we do not observe the adverse selection spiral in the individual market for people younger than 55.[44] As shown on the right panel of Figure (8), the price of the individual insurance is much lower and closer to the premium in the original reform. Also, the participation in the individual market increases to 11.4% (third row of Table 8). The third row of Table 7 shows that comparing to the case with lower penalties the welfare slightly increases (from -0.11 to 0.06%). However it is still much lower than in the original reform.

The fourth row of Table 7 shows the results for the reform with only redistribution. This version of the reform brings high welfare gains: the consumption equivalent variation

[43] We confirm this by considering a counterfactual reform when we remove penalties but keep all other provisions as in the original reform. In this case the premium in the individual market does not change much comparing to the original reform: it slightly increases at young ages but stay almost the same at older ages.

[44] Even increasing penalties five times cannot eliminate adverse selection spiral for people at pre-retirement ages. This happens because medical expenses for unhealthy members of this group are very high and the community rated premium for many people exceeds their income.

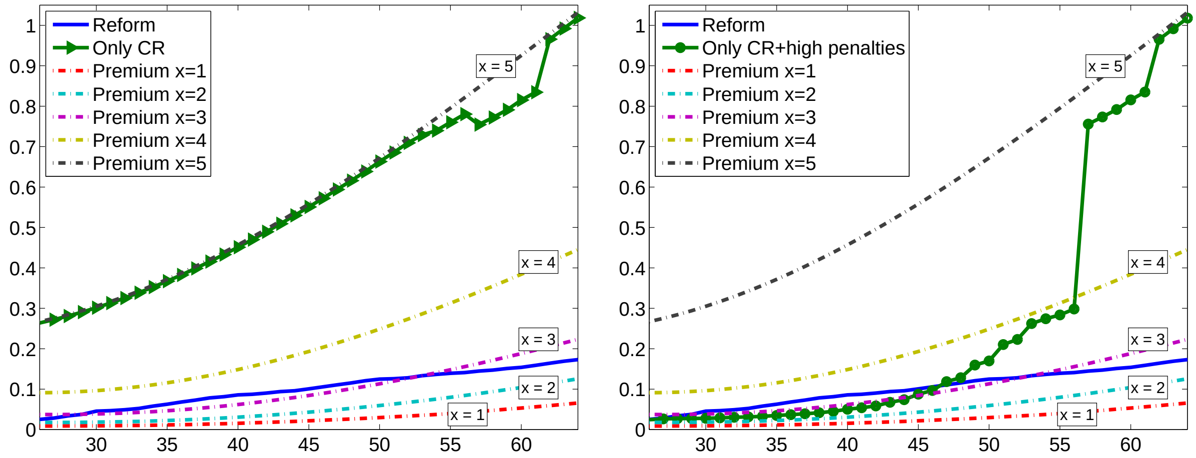

Figure 8: Individual market premiums before the reform, after the original reform, and after the reform with only community rating (left panel) or community rating with high penalties (right panel). The set of five dashed lines shows the risk-adjusted premiums before the reform for each medical expense grid. The solid line shows the community-rated premium after the reform. The line with triangle marks (circle marks for the right panel) shows the community-rated premium for the reform with only community rating (only community rating with high penalties for the right panel). All comparisons are done for the steady-states.

is equal to 0.50%.

The important result is that the reform with only redistribution brings substantially higher welfare gains than the reform with only community rating. This suggests that income-based transfers improve the welfare of people more than the new rules in the individual market. Many individual market participants have low income and insurance premiums constitute a significant fraction of their income. Without subsidies they often prefer to stay uninsured. To illustrate this point further, Figure (9) compares the fraction of individual market premiums in the average income for low educated people before the reform and after the two versions of reform: with only community rating (with high penalties) and with only income redistribution. If the reform is implemented with only community rating with high penalties, the share of premiums in income increases for people with low medical expenses and decreases for people with high medical expenses. However, the share of community rated premium in income is high: it increases fast and exceeds 20% after age 50. On the other hand, when reform is implemented without community rating but with subsidies, the share of subsidized individual market premiums in income is significantly lower even for people with high medical expenses.

To understand how different redistributive measures embedded in the reform contribute to its welfare outcome we consider two versions of the reform with only redistribution: i) the reform that only expands Medicaid, and ii) the reform that only introduces subsidies. The welfare effects of these reforms are presented in fifth and sixth rows of Table 7. In welfare terms, subsidies are the most important element of the reform: just

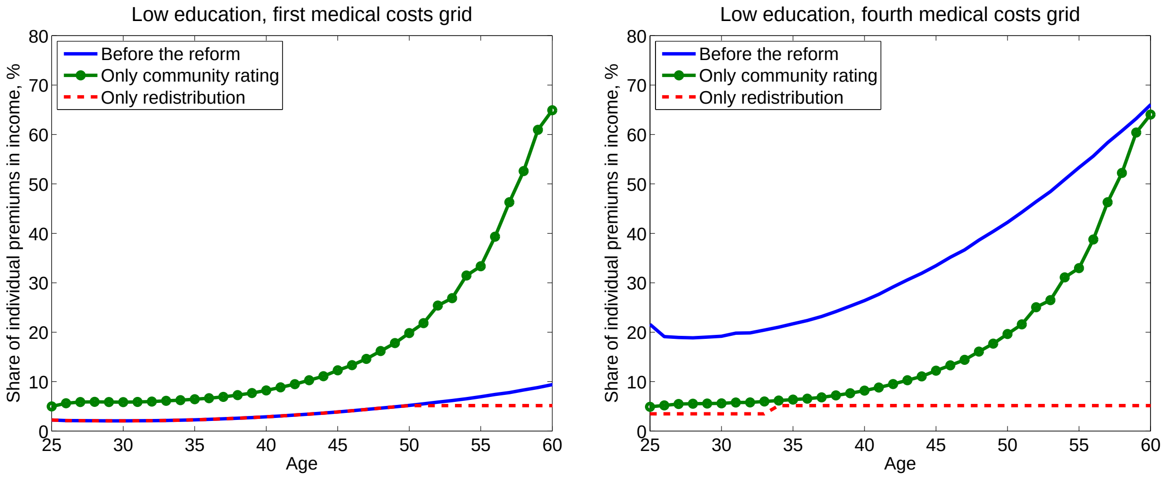

Figure 9: Fraction of individual insurance premiums in income for people with low (left panel) and high (right panel) medical costs for the original reform and two counterfactual reforms. All comparisons are done for the steady-states.

introducing subsidies brings CEV equal to 0.43%, while Medicaid expansion alone results in small welfare losses (-0.02%). This is because the subsidy scheme has transfers well targeted at people with low income and/or high medical expenses. This directly addresses the affordability problem and thus has a large impact on welfare. Medicaid expansion, on the other hand, affect only a small group of people with very low income whose gains are not big enough to offset welfare losses from the increased taxes.[45]

7 Conclusion

The health reform bill recently signed by the President includes a wide range of measures which aim to increase the health insurance coverage in the U.S. The new law significantly changes the rules under which the individual insurance market operates. At the same time, it includes a set of redistributive measures that decrease the price of insurance for low-income people. This paper measures the welfare effects of the reform and decomposes them into two parts - one that is due to the new regulation of the individual market, and other due to the increased income redistribution in the economy.

We construct a general equilibrium heterogeneous model with a rich representation of the current U.S. health insurance system. We calibrate the model using Medical Expenses Panel Survey to match the key insurance statistics of the U.S. economy.

We find that the reform brings significant welfare gains, however these gains are mostly achieved by the redistributive part of the reform - Medicaid expansion and pre-

[45]More specifically, the welfare gains of people of a working age are not enough to offset the welfare losses of the retirees in this version of the reform. If comparisons are done only for the steady-states, the expansion of Medicaid results in ex-ante welfare gains equal to 0.18%.

mium subsidies. If the reform only changes the regulation of the individual market and introduces penalties for the uninsured, the welfare gains almost disappear. Most of the currently uninsured have low-income and they gain a lot from having subsidized health insurance. Reorganizing the individual insurance market alone has a limited effect on these people because non-subsidized insurance premiums, whether community rated or not, constitute such a significant portion of their income that they often prefer to stay uninsured if not subsidized.

A Summary of the parametrization of the baseline model

Parameters set outside the model			
Parameter name	Notation	Value	Source
Risk aversion	σ	5	-
Consumption share	$\varkappa$	0.6	French (2005)
Cobb-Douglas parameter	α	0.33	Capital share in output
Labor supply	$\bar{l}$	0.4	-
Cutoff medical expenses	$\overline{x_t}$	90th percentile	-
Consumption floor	$\underline{c}$	\$2,700	De Nardi et al., 2010
Tax function parameters:	a_0	0.258	Gouveia and Strauss (1994)
	a_1	0.768	Gouveia and Strauss (1994)
Social Security replacement rates:			
Below High-School	ss_1	40%	-
High-School & College	ss_2	30%	-
Insurance loads	γ	1.11	Kahn et all (2005)
Medicaid income threshold:			
Medicaid	y^{cat}	64%	Data
Medically Needy	y^{need}	53%	Data
Asset test for Medically Needy	k^{pub}	\$2,000	Data
Medicare premium	p^{med}	\$1,055	Total premiums =2.11% of Y
Persistent shock			
Persistence parameter	ρ	0.98	Heathcote et al (2010)
Variance of innovations	σ^2_ε	0.018	Heathcote et al (2010)
Variance of transitory shock	σ^2_ξ	0.10	Erosa et al (2011)
Parameters used to match some targets			
Parameter name	Notation	Value	Source/Target
Discount factor	β	0.992	$\frac{K}{Y} = 3$
Depreciation rate	δ	0.07	$r = 0.04$
Population growth	η	1.35%	% of people older than 65
Tax function parameter	a_2	0.652	Balanced government budget
Proportional tax	τ_y	6.62%	Composition of tax revenue
Fixed costs for insurance	π	\$22.7	% of individually insured
Employer contribution	ψ	76.3%	ESHI take-up rate
Fixed costs of work			Employment profiles
Healthy:			
low education	$\phi_1(1)$	0.2800	
high education	$\phi_1(2)$	0.2650	
Unhealthy, low educ:	$\phi_2(t, 1)$		
intercept	-	0.0200	
slope	-	0.0008	
Unhealthy, high educ:	$\phi_2(t, 2)$		
intercept	-	0.0450	
slope	-	0.0025	

Table 9: Parameters of the model

B Adjustment of survival probabilities

To adjust the survival probabilities for difference in health we follow Attanasio et al (2011). We use the HRS dataset to estimate the survival probability for males as a function of age, health and gender using a probit model. In this regression we use a binary variable for health (good and bad) defined from self-reported health in the following way: people reporting their health as excellent, very good or good are classified as 'healthy', and people reporting their health as fair or poor are classified as 'unhealthy'. However, in our model we define health based on the category of medical expenses. To adjust for the different definitions we use MEPS to get the fraction of people with good and bad self-reported health in each medical expense category at each age. Then using the estimates from the probit model we compute the average survival probability for each age and medical expenses category.

Next we compute the 'survival premium' - the difference between survival probabilities of males with high and low medical expenses for each age. From the Social Security Administration life table we know the average survival probability of males. From MEPS we can construct the fraction of people in each medical expense category for each age. Using this information we can recover survival probabilities of people with high and low medical expenditures for each age. Figure (10) illustrates the resulting survival probabilities for people in different medical expense categories.

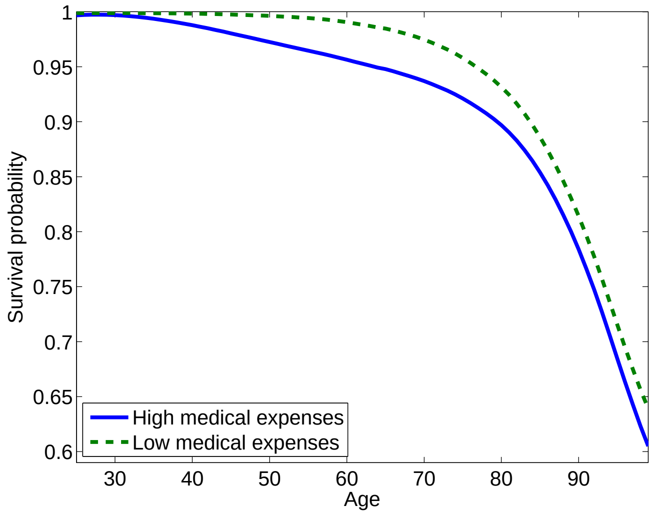

Figure 10: Survival probabilities for people in different medical expense categories

C Medical expenses and insurance coverage

To calibrate medical expenses we separate our sample into 13 age groups (25-29, 30-34, ..., 85+). We assign the age of each group to the mid-point of a corresponding age interval. For example, 27 for 25-29, 32 for 30-34, etc. For each year and each age group we divide medical expenditures into 5 bins, corresponding to 30th, 60th, 90th and 99th percentiles. To get a value of medical expenses in each bin we run a regression of medical expenses on a set of age and year dummies. Since 9 waves of MEPS cover 10 years and there are 13 age groups, we have 130 observations for each such regression. The coefficients on age dummies in this regression correspond to the average medical expenses for the corresponding age in a particular bin. Then we fit our estimated coefficients with a cubic function of age.

The MEPS tends to underestimate the aggregate medical expenditures (Sing et al, 2002). To account for this we compare the average medical expenses between the MEPS and the National Health Expenditure Account (NHEA) in 2002.[46] The downward bias in the medical expenses from the MEPS is much larger for the elderly (particulary after age 75) than for the young.[47] Because of this, we multiply our estimated medical expenses by 1.37 for people younger than 75 years old and by 1.93 for people older than 75 years old. This adjustment allows us to match the share of total expenses in GDP (12.6%) and the share of medical expenses of people younger than 65 in GDP (6.5%) as in NHEA. The resulting profiles are shown in the left panel of Figure (11).

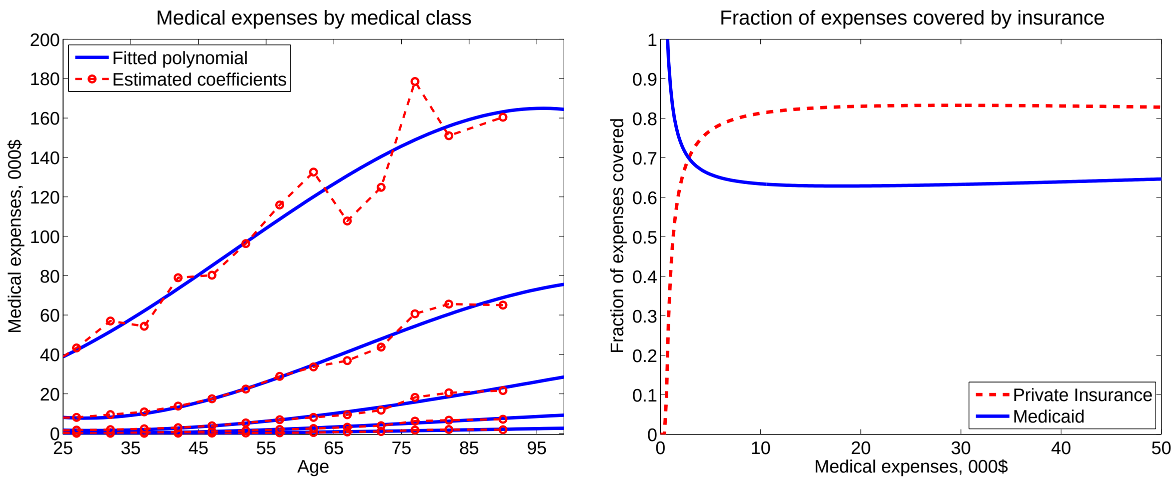

Figure 11: Medical expenses for each bin (left panel) and fraction of medical expenses covered by private insurance and Medicaid (right panel)

To determine the fraction of medical expenses covered by private insurance and Medicaid ($q(x_t, i_t)$), we use the following approach. For working age households we estimate medical expenditures paid by private insurers (variable TOTPRV) or Medicaid (variable TOTMCD) as a quadratic function of total paid medical expenditures and year dummy

[46]NHEA reports age decomposition of medical expenses only for 2002 and 2004.
[47]MEPS underepresents institutionalized population and the fraction of people in nursing homes increases dramatically after age 75 (see Kopecky and Koreshkova, 2011).

variables.[48] The right panel of Figure (11) illustrates the fraction of medical expenses covered by private insurance and Medicaid.

D Discussion of the assumption of exogenous medical expenses

In our model we treat medical expenses as exogenous shocks, i.e. we abstract from the fact that people have some degree of control over their medical expenses. Our modeling choice arises because medical expenses to a significant extent represent exogenous shocks, and our goal is to evaluate how well the reform improves the insurance possibilities in the economy. We realize that by treating medical expenses as an exogenous process we can miss some effects of the reform arising from possible adjustments in medical expenses. Here we provide a brief discussion of the potential direction and size of these effects.

In general, most of the models of endogenous medical expenses are based on Grossman's framework (Grossman, 1972). The key feature of this framework is that medical expenses can increase the stock of health which increases utility. Another important aspect of Grossman's framework is the possibility to intertemporally allocate medical spending. First, people with bad health can delay treatment. Second, people can invest in preventive care in order to decrease the probability to face high medical shocks in the future.

Under this framework we can expect the following effects. First, currently uninsured people can increase their medical spending because they have previously delayed their medical treatment, and medical spending increase their utility.[49] This can increase insurance premiums, implying higher government spending on subsidies and higher taxes. This will lead to lower welfare gains from the reform. On the other hand, since medical spending can increase utility it will lead to higher welfare gains from the reform.

Second, we can expect that currently uninsured people will increase their preventive medical spending.[50] This can improve the distribution of medical shocks in the future and decrease their exposure to medical risk.[51] In the long run this can lead to a decrease in medical expenses partially offsetting the effect of moral hazard described earlier and positively affecting welfare gains of the reform.

[48] The R^2 from these regressions are 0.86 for private insurance and 0.70 for Medicaid.

[49] We expect this effect to be small based on the results of Kolstad and Kowalski (2010) who did not find an increase in costs at the hospital level after the health reform in Massachusetts which has a design very similar to the national reform.

[50] Kolstad and Kowalski (2010) find that after the health reform in Massachusetts hospitalizations for preventable conditions were reduced. Miller (2011) finds that the reform results in a decline in emergency room usage in Massachusetts mostly accounted for by a reduction in preventable emergencies.

[51] For a quantitative examination of such mechanism see Ozkan (2011).

In terms of the relative importance of community rating and income redistribution, we do not expect the effects described above to change the dominant role of income redistribution. In Grossman's framework people can adjust their medical expenses in response to a change in insurance status. However, our results show that community rating is not an effective policy to increase the number of insured because it does not solve the problem of affordability. Thus, even if medical expenses are endogenous, we expect that income redistribution will still play a dominant role in welfare effects of the reform.[52]

E Transition to the reformed economy

This section describes how the economy makes a transition from the initial steady-state to the new steady-state. The economy is assumed to be in the steady-state in period 0 and in period 1 the reform is announced and implemented. Figure (12) shows how aggregate capital, tax function parameter a_0, employment and uninsurance rates for each educational group evolve over time.

Aggregate capital is slowly decumulated until it reaches its new equilibrium value while other variables adjust much faster. The tax rate jumps up immediately because the government needs to start financing the subsidies and the expansion of Medicaid. After the first period the tax sharply decreases and then slowly moves up until it reaches its new steady-state value. This overshoot of the tax happens because at the start of the reform there is still a lot of uninsured people and the government has to provide consumption floor to the uninsured with large medical shocks. Once the number of uninsured decreases the government spends less money to finance the consumption floor (see also Table 5). The further increase in taxes happens because of the erosion of the tax base due to a decline in the aggregate capital. The employment and uninsurance rates adjust quickly to their new equilibrium values after the transition starts.

[52] Another possible consequence of the reform not reflected in our model is the change in hospital behavior. In particular, there is a view that hospitals will increase prices after the reform. This can happen because sometimes hospitals overcharge private insurers in order to compensate for low Medicaid reimbursement rates, and since more people will be enrolled in Medicaid after the reform the "extra"charge on private insurers can increase. However, according to the CBO's estimates the effect of this cost-shifting will be minimal (CBO, 2009). First, based on the existing empirical evidence, the CBO concludes that the amount of cost-shifting that currently exists is small. Second, even if the degree of cost-shifting increases after the reform it will be offset by the decline in the number of uninsured since this will significantly decrease the amount of uncompensated care that hospitals provide.

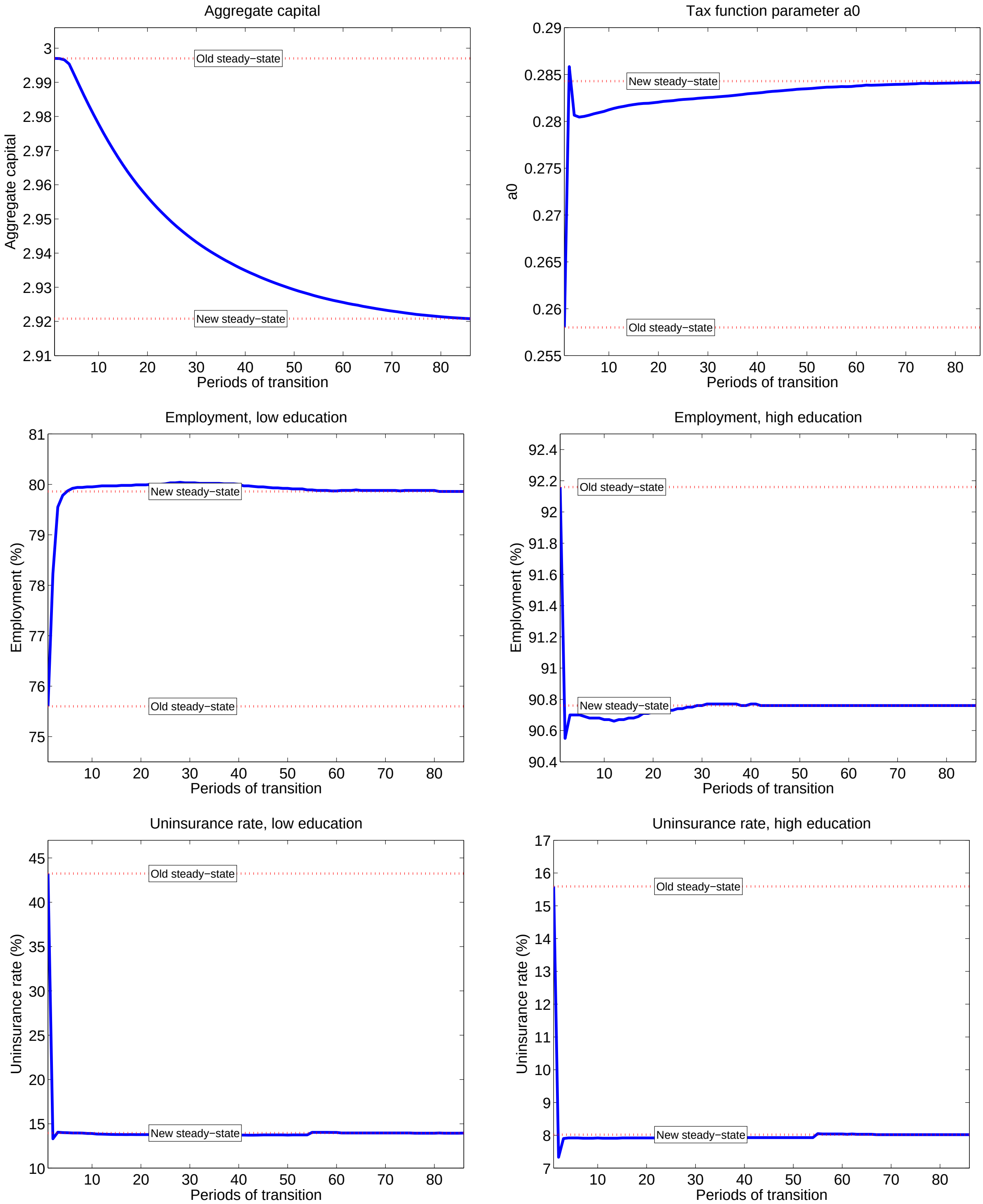

Figure 12: Transition of aggregate variables

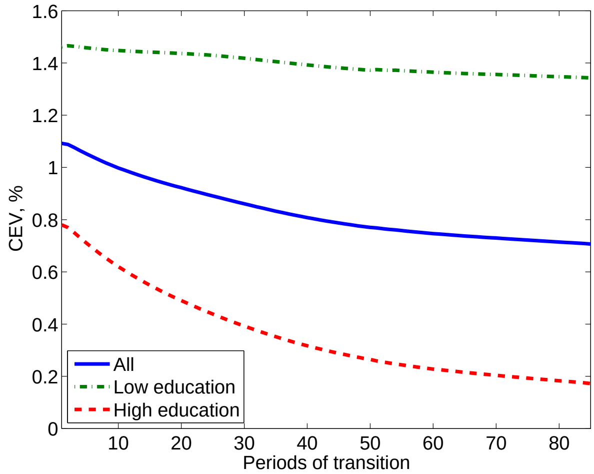

Figure 13: CEV of newborns during the transition period

Figure (13) plots consumption equivalent variation of newborns in each period during the transition. People born immediately after the transition have the highest welfare gains and each new generation has lower welfare. The welfare declines because the aggregate capital gradually decreases and the tax rate increases.

F Welfare effects of the different versions of the reform

Figure (14) compares the average welfare gains (including the transition period) from different versions of the reform for people with different productivity and health.[53] The reform with only community rating and high penalties results in significantly lower welfare gains than the reform with only redistribution for most people except those with high education and high productivity. Most members of the later group lose from the reform with only redistribution because it increases the tax burden while providing them with little benefits. The reform with only community rating with high penalties does not affect the welfare of the healthy members of this group but increases welfare of the unhealthy because they can benefit from better risk-sharing in the individual market.

G The ESHI response to reform

When evaluating the welfare implications of the reform, we assumed that there is no response from the firm offering ESHI. This section reevaluates the welfare effects of the reform when this assumption is relaxed. In particular, we consider how the results

[53]In Figure (14) we omit the reform with only community rating because the only effect of this version of the reform is the unraveling of the individual market.

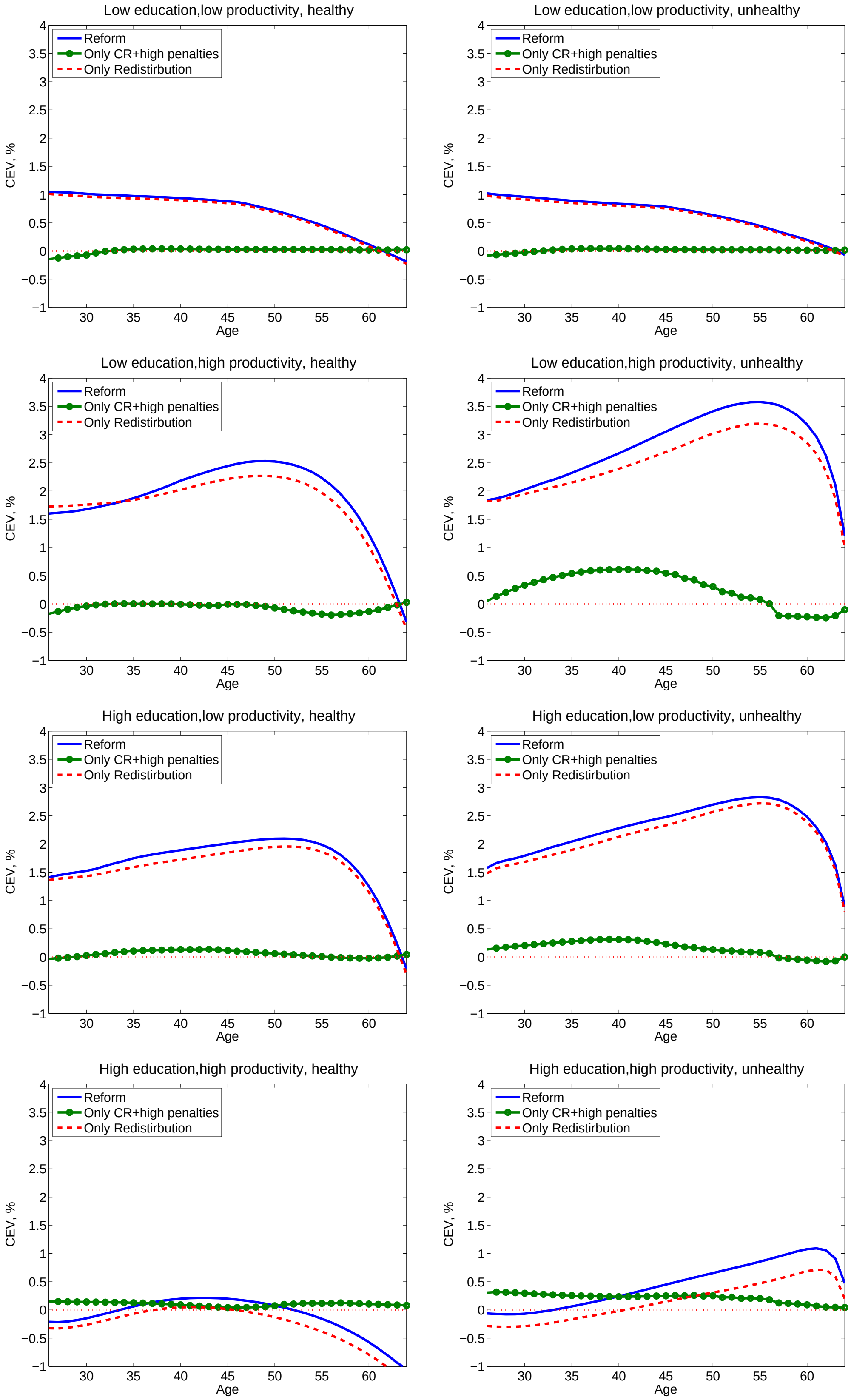

Figure 14: CEV (including the transition) for different versions of the reform for healthy (left panel) and unhealthy (right panel). Productivity groups are defined the same way as in Figure 7

change if in response to the reform firms offering ESHI decrease their contribution rate. This experiment is motivated by the result in Gruber and McKnight (2003) who found that expansion in Medicaid eligibility in the late 1980s and early 1990s led to a decline in employers' contributions to health insurance premiums. Table 10 compares the welfare effects of the reform if there is no change in the employer contribution rate (ψ) to a case when it decreases to 50%.[54]

	CEV(%)		
	All	Low education	High education
ψ *does not change*	0.64	1.43	0.51
ψ *decreases to 50%*	0.47	1.28	0.32

Table 10: Welfare effects of the reform under different assumptions on ESHI (welfare calculations include the transition period)

When the reform induces firms to decrease the contribution rate, this mostly affects people with high education: their CEV goes down from 0.51 to 0.32. For this educational group the employer-based pool is a primary source of coverage. When the employer contribution rate declines, it leads to a partial destruction of this pool because younger people prefer to switch to the individual market where premiums are age-adjusted. This increases the group premium and reduces the welfare of people relying on ESHI. For people with lower educational attainment who rely less on ESHI, the welfare changes much less. Because of this the overall welfare effects of the reform are still large and positive despite a large decline in the employer contribution rate.

H Change in marginal taxes after the reform

Table 11 reports the change in marginal taxes after the reform.[55] Because we assume that the reform is financed by increasing the progressivity of the income tax code, people with high income face a larger increase in taxes than people with low income. For example, people in the lowest income group face increase in taxes equal to 0.3% while people in the highest income group have to pay on average 2.2% more in taxes.

[54]The scenario when an average employer's contribution rate decreases to 50% after the reform is unlikely because the Bill requires employers whose workers face high group premiums to pay penalties. However we construct this experiment to emphasize the directions of the welfare change.

[55]The reported numbers are average marginal taxes faced by people in each income category.

Income categories (% of FPL)	Marginal tax		
	Baseline	Reform	Change
<64	9.1	9.4	0.3
64-133	16.7	17.3	0.6
133-200	19.3	20.6	1.3
200-300	21.8	23.4	1.6
300-400	23.8	25.6	1.8
400-600	25.7	27.6	1.9
600-800	27.4	29.5	2.1
800-1000	28.5	30.7	2.2

Table 11: Average marginal tax rate in each income category before and after the reform

I Computational algorithm

We solved for the steady state equilibrium of the baseline model as follows.

1. Guess an initial interest rate r, price in the group insurance market p, the amount the firm offering ESHI subtracts from the wage of their workers c_E, tax parameter a_2, and bequest Beq_e.[56]

2. Solve for the households' decision rules using backward induction. We evaluate the value function for points outside the state space grid using a Piecewise Cubic Hermite Interpolating Polynomial (PCHIP).

3. Given policy functions simulate the households distribution using a non-stochastic method as in Young (2010).

4. Using the distribution of households and policy functions, check if market clearing conditions and zero profit conditions for insurance firms hold, and government budget balances. If not, update r, p, c_E, a_2, and Beq_e, and repeat Steps 1-3.

The computation of the steady-state for the reformed economy is complicated by the fact that we now need to compute additional 40 prices (for each working age) in the individual community rated market. We modified the algorithm above by guessing these 40 prices at Step 1 and updating them at Step 4. The multiplicity of equilibriums in the original reform is not likely to be an issue because individuals' insurance decisions are less sensitive to the equilibrium price because of the subsidy scheme. When the reform is implemented without subsidies we cannot rule out the multiplicity of equilibriums. In this case we trap the price from below starting from a guess that is too low to be an equilibrium. Then we update the price upwards slowly.

The algorithm to solve the equilibrium during the transition is similar to the above

[56] In general, insurance markets where firms are not allowed to risk-adjust premiums, as in the group market, can have multiple equilibriums. However, because the major part of the premium is contributed by the employer, people are less sensitive to the price of insurance and thus the multiplicity of equilibriums becomes less of an issue. In particular, our equilibrium price tends to be invariant to the initial guess.

algorithm, except that we need to guess the sequence of equilibrium variables in Step 1. However, the computation is very costly and requires a large memory. Unlike a steady-state, each generation living through the transition periods is different and we need to keep track of each generation separately. Since it takes 85 periods to converge to a new steady-state, and a household lives up to 75 periods, we have 160 different generations living during the transition.

References

[1] Aiyagari, S. R., 1994. Uninsured Idiosyncratic Risk and Aggregate Saving. Quarterly Journal of Economics 109(3), 659-684.

[2] Attanasio, O., Kitao, S., Violante G., 2011. Financing Medicare: A General Equilibrium Analysis. In Shoven, J.B. (Ed.), Demography and the Economy, University of Chicago Press.

[3] Bewley T. F., 1986. Stationary Monetary Equilibrium with a Continuum of Independently Fluctuating Consumers. In Hildenbrand, W., Mas-Colell, A. (Eds.), Contributions to Mathematical Economics in Honor of Gerald Debreu, Amsterdam: North-Holland, pp 79-102.

[4] Brugemann, B., Manovskii, I., 2010. Fragility: A Quantitative Analysis of the US Health Insurance System. Manuscript, Yale University

[5] Capatina, E., 2011. "Life-cycle Effects of Health Risk". Mimeo, University of New South Wales.

[6] Clemens, J., 2012. "Regulatory Redistribution in the Market for Health Insurance". Mimeo, Stanford University.

[7] Conesa, J. C., Krueger, D., 2006. On the Optimal Progressivity of the Income Tax Code. Journal of Monetary Economics 53(7), 1425-1450.

[8] Congressional Budget Office, 2009. An Analysis of Health Insurance Premiums Under the Patient Protection and Affordable Care Act. Letter to the Honorable Evan Bayh. November 30, 2009.

[9] Congressional Budget Office. An Estimate of the Budgetary Effects of the Reconciliation Proposal. Letter to the Honorable Nancy Pelosi. March 20, 2010.

[10] Cutler, D., Gruber, J., 1996. Does Public Insurance Crowd Out Private Insurance? Quarterly Journal of Economics 111(2), 391-430.

[11] De Nardi, M., French, E., Jones, J., 2010. Why Do the Elderly Save? Journal of Political Economy, 118(1), 39-75.

[12] Erosa, A., Fuster, L., Kambourov, G. 2011 Towards a micro-founded theory of aggregate labor supply. IMDEA Working Papers N 2011-13

[13] Feng, Z., 2009. Macroeconomic Consequences of Alternative Reforms to the Health Insurance System in the U.S. Mimeo, University of Zurich.

[14] Floden, M., 2008. A Note on the Accuracy of Markov-chain Approximations to Highly Persistent AR(1) Processes. Economic Letters 99(3), 516-520.

[15] French, E., 2005. The Effects of Health, Wealth, and Wages on Labor Supply and Retirement Behaviour. Review of Economic Studies, 72(2), pages 395-427.

[16] Gouveia, M., Strauss, R., 1994. Effective Federal Individual Income Tax Functions: An Exploratory Empirical Analysis. National Tax Journal, 47(2), 317-339.

[17] Grossman, M., 1972. On the Concept of Health Capital and the Demand for Health. Journal of Political Economy, 80, 223-255.

[18] Gruber, J., McKnight, R., 2003. Why Did Employee Health Insurance Contributions Rise? Journal of Health Economics, 22(5), 1085-1104.

[19] Hansen, G., Hsu, M., Lee, J., 2011. Health Insurance Reform: The impact of a Medicare Buy-In. Mimeo, GRIPS.

[20] Heathcote, J., Storesletten, K., Violante, G. 2010 The Macroeconomic Implications of Rising Wage Inequality in the United States. Journal of Political Economy, vol. 118(4), pages 681-722

[21] Hubbard, G., Skinner, J., Zeldes, S., 1994. The Importance of Precautionary Motives in Explaining Individual and Aggregate Saving. Carnegie-Rochester Conference Series on Public Policy 40(1), 59-125.

[22] Hugget, R., 1993. The Risk-free Rate in Heterogeneous-Agent Incomplete-insurance Economies. Journal of Economic Dynamics and Control 17, 953-969

[23] Imrohoroglu, A., 1989. Cost of Business Cycles with Individibilities and Liquidity Constraints. Journal of Political Econoomy, 97(6), 1364-1383.

[24] Imrohoroglu, S., Kitao, S., 2011. Social Security Reforms: Benefit Claiming, Labor Force Participation and Long-run Sustainability. American Economic Journal: Macroeconomics, forthcoming.

[25] Janicki, H., 2011. Distributional Effects of Public Health Insurance Reform. Manuscript, Arizona State University.

[26] Jeske, K., Kitao, S., 2009. U.S. Tax Policy and Health Insurance Demand: Can a Regressive Policy Improve Welfare? Journal of Monetary Economics, 56(2), 210-221.

[27] Jung, J., Tran, C., 2011. Market Inefficiency, Insurance Mandate and Welfare: U.S. Health Care Reform 2010. Mimeo, University of New South Wales.

[28] Kaiser Family Foundation, 2004. The Cost of Care for the Uninsured. What Do We Spend, Who Pays, and What Would Full Coverage Add to Medical Spending? Available at http://www.kff.org/uninsured/upload/The-Cost-of-Care-for-the-Uninsured-What-Do-We-Spend-Who-Pays-and-What-Would-Full-Coverage-Add-to-Medical-Spending.pdf

[29] Kaiser Family Foundation, 2008. Tax Subsidies for Health Insurance: An Issue Brief. Available at http://www.kff.org/insurance/upload/7779.pdf

[30] Kaiser Family Foundation, 2009. Employer Health Benefits Survey. Available at http://ehbs.kff.org/2009.html

[31] Kaiser Family Foundation, 2010. Medicaid: A Primer. Available at www.kff.org/medicaid/upload/7334-04.pdf

[32] Kaiser Family Foundation, 2011. Summary of New Health Reform Law. Available at www.kff.org/healthreform/upload/8061.pdf

[33] Kahn, J., Kronick, R., Kreger, M., Gans, D. 2005. The Cost of Health Insurance Administration in Califarnia: estimates for insurers, physicians, and hospitals. Health Affairs 24.

[34] Kennickel, A., 2006. Currents and undercurrents: Changes in the distribution of wealth, 1989-2004. Mimeo, Federal Reserve Board.

[35] Kolstad, J., Kowalski, A., 2010. The Impact of Health Care Reform on Hospital and Preventive Care: Evidence from Massachusetts. NBER Working Paper N 16012.

[36] Kopecky, K., Koreshkova, T., 2011. The Impact of Medical and Nursing Home Expenses and Social Insurance Policies on Savings and Inequality. Mimeo, Federal Reserve Bank of Atlanta.

[37] Miller, S., 2011. The Effect of Insurance on Emergency Room Visits: An Analysis of the 2006 Massachusetts Health Reform. Mimeo, University Of Illinois At Urbana-Champaign.

[38] Ozkan, S., 2011. Income Differences and Health Care Expenditures over the Life Cycle. Mimeo, Federal Reserve Board.

[39] Pashchenko, S., Porapakkarm, P., 2011. Quantitative Analysis of Health Insurance Reform: Separating Community Rating from Income Redistribution. Mimeo, University of Virginia.

[40] Pohl, V., 2011. Medicaid and the Labor Supply of Single Mothers: Implications for Health Care Reform. Mimeo, Yale University.

[41] Ross, D., Jarlenski, J., Artiga, S., Marks, C., 2009. A Foundation for Health Reform: Findings of a 50 State Survey of Eligibility Rules, Enrollment and Renewal Procedures, and Cost-Sharing Practices in Medicaid and CHIP for Children and Parents During 2009. Kaiser Commission on Mediaid and the Uninsured.

[42] Sing, M., Banthin,J., Selden,T., Cowan, C., Keehan,S. 2006. Reconciling Medical Expenditure Estimates from the MEPS and NHEA, 2002. Health Care Financing Review, Vol 28(1)

[43] Storesletten, K., Telmer, C., Yaron, Y., 2004. Consumption and Risk Sharing Over the Life Cycle. Journal of Monetary Economics 51(3), 609-633.

[44] Tauchen, G., Hussey, R., 1991. Quadrature-Based Methods for Obtaining Approximate Solutions to Nonlinear Asset Pricing Models. Econometrica 59(2), 371-396.

[45] Wolff, E., 2010. Recent Trends in Household Wealth in the United States: Rising Debt and the Middle-Class Squeeze—an Update to 2007. Levy Economics Institute of Bard College Working Paper No. 589.

[46] Young, E., 2010. Solving the Incomplete Markets Model with Aggregate Uncertainty Using the Krusell-Smith Algorithm and Non-Stochastic Simulations. Journal of Economic Dynamics and Control, 34(1), 36-41.