Quantitative Analysis of Health Insurance Reform: Separating Community Rating from Income Redistribution *

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Abstract

Two key components of the upcoming health reform are a reorganization 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 by more than four times. It also generates substantial welfare gains, equivalent to almost one percent of the annual consumption. 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. High burdens of health insurance premiums for this group are relieved disproportionately more by income-based measures than by the new rules in the individual market.

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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 reorganization 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. We allow agents to be heterogeneous by educational level (exogenously fixed), which together with age determines agents' ability to generate income.

We replicate 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 for the lowest-income individuals, while people with high income are more likely to get employer-based coverage. Third, the majority of 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 premiums that depend on their current medical shock and thus are exposed to premium fluctuations. 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 reorganization of the 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 the 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 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 some prespecified percentage of their income.

When evaluating welfare effects of the reform, as a welfare criterion we use ex-ante expected lifetime utility of a newborn in a stationary equilibrium. 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 healthy to sick (through community rating in the individual market); second, from high-income to 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 healthy to sick involves some redistribution from healthy who are poor to sick who are rich. Similarly every redistribution from rich to poor will involve some redistribution from rich who are sick to poor who are healthy.

We find that the reform has a large effect on the fraction of uninsured in the economy: this number decreases from 22.2 to 4.7%. The largest effect the reform has on young people in the lowest educational group with the fraction of uninsured among high-school dropouts aged 25 to 29 year old decreasing from 62.1 to 9.9%. Also the reform induces more participation in the individual market with the fraction of individually insured increasing from 7.4 to 18.3%.

In terms of welfare, we find that the reform brings substantial gains equivalent to almost 1% of the annual consumption. However, these welfare gains mostly come from the 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 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 reorganization of the individual market by itself has a limited effect on health insurance affordability for low-income people who

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[1]As of 2009, 14 states had Medicaid eligibility thresholds below 50% FPL, 20 states had it between 50 to 99% FPL, and 17 states had it higher than 100% FPL. The U.S. average constitutes 68% of FPL (Kaiser Family Foundation, 2009).

often prefer to stay uninsured if not subsidized.

The paper is organized as follows. Section 2 reviews the related literature. Section 3 introduces the model. Section 4 describes the changes introduces by the reform. Section 5 explains our calibration. Section 6 compares the performance of the model with the empirical facts about the U.S. insurance system. Section 7 describes the quantitative effects of the reform and decomposes its welfare effects. Section 8 concludes.

2   Related literature

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 (2008) evaluate general equilibrium effects of different Medicare reforms; Kopecky and Koreshkova (2009) study the effect of medical expenses risk on wealth accumulation over a life-cycle. The closest paper to ours is Kitao and Jeske (2009) who study tax subsidies for employer-based health insurance in the environment where private health insurance markets are explicitly modeled. Relative to Kitao and Jeske, our model introduces 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. His framework is a three-generation OLG model with endogenous medical expenses and with two health insurance options: Medicaid and employer-sponsored insurance (ESHI). Jung and Tran (2009) evaluate the welfare effect of introducing universal medical vouchers in the U.S. economy using an OLG model with endogenous medical expenditures. Brugemann and Manovskii (2010) study how the the Patient Protection and Affordable Care Act affects firms' decisions to offer health insurance. Close to ours is Jung and Tran (2010) who study macroeconomic consequences of the current health reform. However, their framework does not allow for welfare decomposition between two key components of the reform: reorganization of the individual market and income redistribution. The authors impose a simplifying assumption that the individual market has age-adjusted community rating even before the reform and thus abstract from changes the reform brings into this market.

Finally, our work relates to the literature that studies individual's life cycle behavior in the presence of exogenous out-of-pocket medical expenses shocks. Palumbo (1999) and De

Nardi, French, and Jones (2010) analyze the saving decisions of retirees. Scholz, Seshadri, and Khitatrakun (2006) study decisions to save for retirement, given that the retirees face out-of-pocket medical expenses. Unlike these studies, we introduce total charged medical expenses in a life-cycle model and allow individuals to buy partial insurance in the health insurance market.

3 Baseline Model

3.1 Households

3.1.1 Demographics and preferences

The economy is populated by overlapping generations of individuals. An individual lives to a maximum of N periods, works during the first $R - 1$ periods of life and retires at age R. Households supply labor inelastically[2].

The population is assumed to remain constant. Agents who die are replaced by the entry of newborn agents. There are intergenerational transfers through accidental bequests. The savings of each household who does not survive is transferred to a newborn agent.

Preferences are described with a CRRA utility function with risk aversion σ:

$$u(c) = \frac{c^{1-\sigma}}{1 - \sigma}$$

Agents discount the future at a rate β and survive until the next period with conditional probability ζ_t, which depends on age.

3.1.2 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 $G(x_{t+1}|x_t, t)$. Every individual of working age can buy health insurance (HI) against this 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 insurance through the employer-based pool (ESHI offer). The variable g_t characterizes the status of the offer: $g_t = 1$ in case an individual gets an offer, $g_t = 0$ in case he

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[2]The fact that the model has inelastic labor supply limits the set of redistributive policies it can be used to study. However, the redistributive measures embedded in the reform can be studied in our modeling framework because of their limited distorting effects. The subsidies introduced by the reform can only be used to purchase health insurance and their amount can never exceed the size of the health insurance premium.

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 obtain their health insurance from Medicaid for free. To qualify for this public insurance, individual labor income adjusted for out-of-pocket medical expenses[3] (y_t^{adj}) should be below some threshold value y_t^{pub4}.

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

We denote the health insurance status of an individual by i_t. If $i_t = 1$ individual is insured, otherwise $i_t = 0$.

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 the medical cost.

3.1.3 Labor income

Working-age agents supply labor inelastically. Households differ by their educational attainment e. Educational attainment can take three values: $e = 1$ corresponds to the absence of any degree, $e = 2$ corresponds to a high-school degree, and $e = 3$ corresponds to a college degree. Earnings are equal to $\widetilde{w} z_t^e$, where $\widetilde{w}$ is wage and z_t^e is the idiosyncratic productivity of a person with educational level e and age t.

3.1.4 Taxation and social transfers

Households pay income taxes in the amount $\mathcal{T}(y_t)$. Taxable income y_t is based on both labor and capital income. Since the ESHI premium is tax-deductible, the group insurance premium $\overline{p}$ is subtracted from taxable income.

We also assume a social welfare system, T_t^{SI}. The social welfare system guarantees that every household will have a minimum consumption level at $\underline{c}$. This reflects the option

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[3]When determining Medicaid eligibility we do not take capital income into account because it decreases the accuracy of the computational algorithm. The results of the model are robust to this assumption because most of the people who get Medicaid in our model have very low asset income.

[4]In reality eligibility for Medicaid is not based only on income. The major categories of the low-income population that qualify for Medicaid are children, their parents and pregnant women. Given limited demographic heterogeneity in our model, we avoid this complication by providing Medicaid to all people with low-income. We adjust labor income to account for the fact that 35 states operate the Medically Needy program which is a part of Medicaid. This program allows individuals to subtract medical expenses from their income when determining Medicaid eligibility.

available to U.S. households with a bad combination of income and medical shocks to rely on public transfer programs. Retired households receive Social Security benefits ss_e that depend on educational attainment e.

3.1.5 Optimization problem

Working age household $(t < R)$ The state variables for the working age household's optimization problem are liquid capital $(k_t \in \mathbb{K} = R^+ \cup \{0\})$, medical cost shock $(x_t \in \mathbb{X} = R^+ \cup \{0\})$, idiosyncratic labor productivity $(z_t \in \mathbb{Z} = R^+)$, ESHI offer status $(g_t \in \mathbb{G} = \{0, 1\})$, HI status $(i_t \in \mathbb{I} = \{0, 1\})$, educational attainment $(e \in \mathbb{E} = \{1, 2, 3\})$ and age $(t \in \mathbb{T} = \{1, .., N\})$.

In each period the household chooses consumption (c_t), savings (k_{t+1}), and HI choice for the next period (i'_H). If the adjusted labor income y_t^{adj} of the individual is below y_t^{pub} he is enrolled in Medicaid (we call this option BM). Otherwise, if he is offered an ESHI, he has three options: not buying HI (NB), buying individual HI (BI), or buying group HI (BG). If he does not have an ESHI offer, he has only two options: NB or BI.

$$
i'_H = \left\{ \begin{array}{ll} BM & ; \text{if } y_t^{adj} \leq y_t^{pub} \\ NB, BI, BG & ; \text{if } g_t = 1 \text{ and } y_t^{adj} > y_t^{pub} \\ NB, BI & ; \text{if } g_t = 0 \text{ and } y_t^{adj} > y_t^{pub} \end{array} \right\} \quad (1)
$$

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

$$
V(k_t, x_t, z_t, g_t, i_t, e, t) = \max_{c_t, k_{t+1}, i'_H} u(c_t) + \beta \zeta_t E_t V(k_{t+1}, x_{t+1}, z_{t+1}, g_{t+1}, i_{t+1}, e, t+1) \quad (2)
$$

$$
s.t. \quad k_t(1+r) + \widetilde{w} \, z_t^e + T_t^{SI} = c_t + k_{t+1} + x_t(1 - i_t q(x_t)) + P(x_t, i'_H) + \mathcal{T}(y_t) \quad (3)
$$

where

$$
\widetilde{w} = \left\{ \begin{array}{ll} w & ; \quad \text{if } g_t = 0 \\ w - c_E & ; \quad \text{if } g_t = 1 \end{array} \right\} \quad (4)
$$

$$
P(x_t, i'_H) = \left\{ \begin{array}{ll} 0 & ; \quad \text{if } i'_H = NB \text{ or } i'_H = BM \\ p_I(x_t, t) & ; \quad \text{if } i'_H = BI \\ \overline{p} & ; \quad \text{if } i'_H = BG \end{array} \right\} \quad (5)
$$

$$
y_t = \left\{ \begin{array}{ll} \widetilde{w} z_t^e + r k_t & ; \quad \text{if } i'_H \neq BG \\ \max(0, \widetilde{w} z_t^e + r k_t - \overline{p}) & ; \quad \text{if } i'_H = BG \end{array} \right\} \quad (6)
$$

$$
T_t^{SI} = \max(0, \underline{c} + x_t(1 - i_t q(x_t)) + \mathcal{T}(\widetilde{w} z_t^e + r k_t) - \widetilde{w} z_t^e - k_t(1+r)) \quad (7)
$$

$$
i_{t+1} = \left\{ \begin{array}{ll} 0 ; \text{if } i'_H = NB \\ 1 ; \text{if } i'_H \neq NB \end{array} \right\}. \quad (8)
$$

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The conditional expectation on the right-hand side of equation (2) is over $\{x_{t+1}, z_{t+1}, g_{t+1}\}$. Equation (3) is the budget constraint. In (4) w is wage per effective labor unit. If the household has an ESHI offer, the employer partly pays for his insurance premium. To maintain zero profit condition, the employer who offers HI deducts some amount c_E from the wage per effective labor unit, as shown in (4).

Equation (8) maps the current HI status and HI choices into the next period HI status. If the household does not buy HI and do not get Medicaid, he will be uninsured in the next period.

Retired household For a retired household $(t \geq R)$ the state variables are liquid capital (k_t), medical cost shock (x_t), educational attainment (e), and age (t). [5]

$$V(k_t, x_t, e, t) = \max_{c_t, k_{t+1}} \quad u(c_t) + \beta \zeta_t E_t V(k_{t+1}, x_{t+1}, e, t+1) \qquad (9)$$

$$s.t. \qquad k_t(1+r) + ss_e + T_t^{SI} = c_t + k_{t+1} + x_t(1 - q_{med}(x_t)) + p_{med} + \mathcal{T}(y_t) \qquad (10)$$

where

$$y_t = rk_t + ss_e$$

$$T_t^{SI} = \max(0, \underline{c} + x_t(1 - q_{med}(x_t)) + \mathcal{T}(y_t) + p_{med} - ss_e - k_t(1+r)) \qquad (11)$$

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 $\mathbf{s} \in \mathbb{S}$. Denote by $\Gamma(\cdot)$ the distribution of households over the state-space.

3.2 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

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[5]The problem of a newly retired household is slightly different from a retired household. The insurance status of a newly retired household depends on his insurance decision before retirement. Thus, the state variables are $\{k_t, x_t, i_t\}$. Also out-of-pocket medical expenses are equal to $x_t(1 - i_t q(x_t))$.

of both firms are the same. Consequently, we have

$$w = (1-\alpha) AK^\alpha L^{-\alpha}, \tag{12}$$

$$r = \alpha AK^{\alpha-1} L^{1-\alpha} - \delta, \tag{13}$$

where δ is 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. Zero profit condition implies

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

$\mathbf{1}_{\{\cdot\}}$ is a function mapping to one if its argument is true; otherwise the function is zero. 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. Thus $c_E \exp(z_t^e)$ is the wage reduction of every employee with an ESHI offer.[6]

3.3 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[7]. This assumption, together with zero profit conditions, allows us to write insurance premiums in the following way:

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

for the non-group insurance market and

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

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

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[6]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.

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

$$EM\left(x_t, t\right) = \zeta_t \int x_{t+1} q\left(x_{t+1}\right) G(x_{t+1}|x_t, t).$$

γ^I and γ^G are markups on actuarially fair prices due to the administrative costs in the individual and group markets correspondingly; π is the fixed costs of buying an individual policy[8]. The premium in the non-group insurance market is based on the discounted expected medical expenditures of the individual buyer. The premium for group insurance is based on a weighted average of the expected medical costs of those who buy group insurance.

3.4 Government constraint

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

$$\int \mathcal{T}\left(y_t\right) \Gamma\left(\boldsymbol{s}\right) = \int_{t \geq R} \left(ss_e + q_{med}\left(x_t\right) x_t - p_{med}\right) \Gamma\left(\boldsymbol{s}\right) + \int T_t^{SI} \Gamma\left(\boldsymbol{s}\right) + \int_{t < R} \mathbf{1}_{\left\{i'_H(\boldsymbol{s})=BM\right\}} \times q\left(x_t\right) x_t \Gamma\left(\boldsymbol{s}\right)$$

(17)

The left-hand side is the total income tax revenue from all households. 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 cost of guaranteeing the minimum consumption floor for households. The last term is the cost of Medicaid.

3.5 Definition of stationary competitive equilibrium

Given the government programs $\left\{\underline{c}, ss_e, q_{med}\left(x_t\right), p_{med}, y_t^{pub}\right\}$, the fraction of medical costs covered by private insurers and Medicaid $\{q\left(x_t\right)\}$, and the employers' contribution (ψ), the competitive equilibrium of this economy consists of the set of time-invariant prices $\{w, r, p, p_I\left(x_t, t\right)\}$, wage reduction $\{c_E\}$, households' value functions $\{V\left(\boldsymbol{s}\right)\}$, decision rules of working-age households $\{c_t\left(\boldsymbol{s}\right), k_{t+1}\left(\boldsymbol{s}\right), i'_H\left(\boldsymbol{s}\right); t = 1, ..., R - 1\}$ and retired households $\{c_t\left(\boldsymbol{s}\right), k_{t+1}\left(\boldsymbol{s}\right); t = R, ..., T\}$, and the tax function $\{\mathcal{T}\left(y\right)\}$ such that the following conditions are satisfied:

1. Given the set of prices and the tax function, the decision rules solve the households' optimization problems.

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[8]We add fixed costs only to individual insurance contracts because we assume in a group market these costs almost disappear due to the economy of scale.

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

$$K = \int k_{t+1}(\boldsymbol{s})\,\Gamma(\boldsymbol{s}) + \int\limits_{t<R} \mathbf{1}_{\{i'_H(\boldsymbol{s})=BG\}} p\Gamma(\boldsymbol{s}) + \int\limits_{t<R} \mathbf{1}_{\{i'_H(\boldsymbol{s})=BI\}} p_I(x,t)\,\Gamma(\boldsymbol{s}),$$

$$L = \int\limits_{t<R} z_t^e \Gamma(\boldsymbol{s}).$$

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

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

5. The tax function $\{\mathcal{T}(y)\}$ satisfies the government budget constraint (17).

4   Changes introduced by the reform

This section describes what 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 do not change after the reform[9]. This assumption is relaxed in the Appendix.

4.1   Household problem

After the reform, a working-age household has to take into account the fact that, depending on his insurance decision, he may be subject to penalties or receive subsidies. Also, more households become eligible for Medicaid. The subsidies and the Medicaid eligibility depend on a household's labor income; penalties are a function of the total income[10]. If we denote labor income of a household by y_t^{lab}, with $y_t^{lab} = \widetilde{w} z_t^e$, we can

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[9]This assumption results from the absence of consensus in the economic literature about the firms response to the reform. Some economists express the 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. There is also a view 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.

[10]In the Bill, subsidies depend on total income. Given our earlier assumption that Medicaid is a function of labor income, we maintain the same assumption for subsidies. This is done to preserve the relationship between Medicaid and the subsidy eligibility rules specified in the Bill. In general this

rewrite the budget constraint in the following way:

$$k_t (1 + r) + \widetilde{w} z_t^e + T_t^{SI} + Sub(y_t^{lab}, i_H') =$$

$$c_t + k_{t+1} + x_t (1 - i_t q(x_t)) + P(x_t, i_H') + \mathcal{T}(y_t) + Pen(y_t^{lab} + rk_t, i_H')$$

where

$$P(i_H') = \begin{cases} 0 & ; \text{ if } i_H' = NB \text{ or } i_H' = BM \\ p_I(t) & ; \text{ if } i_H' = BI \\ \bar{p} & ; \text{ if } i_H' = BG \end{cases}$$

A subsidy is determined in the following way

$$Sub\left(y_t^{lab}, i_H'\right) = \begin{cases} 0 & ; \text{ if } i_H' = NB, BG \text{ or } y_t^{lab} \geq th_6 FPL \text{ or } (g_t = 1 \text{ and } \frac{\bar{p}}{y_t^{lab}} > t\_g) \\ \frac{p_I(t)}{t\_c_1} - y_t^{lab} & ; \quad \text{if } \frac{p_I(t)}{y_t^{lab}} > t\_c_1 \text{ and } th_1 FPL \leq y_t^{lab} < th_2 FPL \\ \frac{p_I(t)}{t\_c_2} - y_t^{lab} & ; \quad \text{if } \frac{p_I(t)}{y_t^{lab}} > t\_c_2 \text{ and } th_2 FPL \leq y_t^{lab} < th_3 FPL \\ \frac{p_I(t)}{t\_c_3} - y_t^{lab} & ; \quad \text{if } \frac{p_I(t)}{y_t^{lab}} > t\_c_3 \text{ and } th_3 FPL \leq y_t^{lab} < th_4 FPL \\ \frac{p_I(t)}{t\_c_4} - y_t^{lab} & ; \quad \text{if } \frac{p_I(t)}{y_t^{lab}} > t\_c_4 \text{ and } th_4 FPL \leq y_t^{lab} < th_5 FPL \\ \frac{p_I(t)}{t\_c_5} - y_t^{lab} & ; \quad \text{if } \frac{p_I(t)}{y_t^{lab}} > t\_c_5 \text{ and } th_5 FPL \leq y_t^{lab} < th_6 FPL \end{cases}$$

A penalty is determined in the following way

$$Pen(y_t^{lab} + rk_t, i_H') = \begin{cases} 0 & ; \text{ if } i_H' = BI, BG \text{ or } \frac{p_I(t)}{y_t^{lab} + rk_t} > p\_c \\ \max\{\varkappa y_t^{lab} + rk_t, \overline{\varkappa}\} & ; \qquad\qquad\qquad\qquad \text{otherwise} \end{cases}$$

Here, $Sub\left(y_t^{lab}, i_H'\right)$ is a subsidy to individual that depends on his labor income and deci-sion to purchase insurance. Only individuals purchasing insurance outside the employer-based market can get subsidy. The subsidy is determined on a sliding scale in the following way. Individuals qualify for subsidy if their labor income is less than some factor th_6 of the federal poverty line (FPL). An individual with labor income in the bracket $[th_i FPL, th_{i+1} FPL]$ receives a subsidy that guarantees that his health insurance premium does not exceed a fraction t_c_{i+1} of his income ($i = 1, .., 5$). Individuals who get an ESHI offer can qualify for a subsidy only if the share of employee's contribution to their income is higher than some number t_g.

People with income below $th_1 FPL$ qualify for Medicaid. At the same time individuals who qualified for Medicaid before the reform maintain their eligibility. In other words, even if an individual's labor income is above th_1, he still qualifies for Medicaid if his income is below y_t^{pub} after subtracting medical expenses[11].

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assumption is unlikely to affect the main results because the majority of people benefiting from the reform have low labor and asset income. Thus, counting asset income will not affect the eligibility of this group.

[11] The Bill changes general Medicaid eligibility rules but does not introduce changes in the Medically

Penalty $Pen(y_t^{lab} + rk_t, i'_H)$ works in the following way. If an individuals purchases insurance or if the insurance premium exceeds fraction p_c of his income, he does not need to pay a penalty. Otherwise the penalty is equal to the greater of a flat rate $\overline{\varkappa}$ and a fraction $\varkappa$ of his income.

4.2 Insurance sector

After the reform premiums in the individual insurance market are not allowed to depend on the current medical costs of policy buyers. The insurance premium of an individual of age $\widetilde{t}$ is determined in the following way:

$$p_I\left(\widetilde{t}\right) = (1+r)^{-1}\gamma^I \frac{\left(\int \mathbf{1}_{\left\{i'_H(\mathbf{s})=BI, \mathbf{t}=\widetilde{t}\right\}} \times EM\left(x_{\widetilde{t}}, \widetilde{t}\right)\Gamma\left(\mathbf{s}\right)\right)}{\int \mathbf{1}_{\left\{i'_H(\mathbf{s})=BI, \mathbf{t}=\widetilde{t}\right\}}\Gamma\left(\mathbf{s}\right)} + \pi^{12}.$$

4.3 Government constraint

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

$$\int \mathcal{T}\left(y_t\right)\Gamma\left(\boldsymbol{s}\right) + \int_{t<R} Pen(y_t^{lab} + rk_t, i'_H)\Gamma\left(\boldsymbol{s}\right) = \tag{18}$$

$$\int_{t\geq R}\left(ss_e + q_{med}\left(x_t, t\right)x_t - p_{med}\right)\Gamma\left(\boldsymbol{s}\right) + \int T_t^{SI})\Gamma\left(\boldsymbol{s}\right) + \int_{t<R} Sub(y_t^{lab}, i'_H)\Gamma\left(\boldsymbol{s}\right)$$

$$+ \int \mathbf{1}_{\left\{i'_H(\mathbf{s})=BM\right\}} \times q\left(x_t, t\right)x_t\Gamma\left(\boldsymbol{s}\right)$$

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 category of expenditures - subsidies.

5 Data and calibration

5.1 Data

We calibrated the model using the Medical Expenditure Panel Survey (MEPS) dataset. The MEPS collects detailed records on demographics, income, medical costs and insur-

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Needy program, which stays at the discretion of the states.

[12]We maintain the assumption that there are fixed costs associated with issuing the individual insurance contract after the reform. This way we can measure how much welfare changes are due to the reorganization of the individual market and not due to possible gains in efficiency.

ance for a nationally representative sample of households. It consists of two-year over-lapping panels and covers the period of 1996-2006. We use eight waves of the MEPS - from 1999 to 2007[13].

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 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 person who has the highest income in the HIEU. A different definition of the head (based on gender) does not give statistically different results. We use longitudinal weights provided in the MEPS to compute all the statistics. Given that all individuals are observed for at most two years, we pool together all eight waves of the MEPS. Since each wave is a representation of population in each year, the weight of each individual was divided by eight in the pooled sample.

In our sample we include all household heads whose age is at least 24 and who have labor income (to be defined later) which is non-negative. In addition, we exclude people who are younger than 65 and receive Medicare. Most non-elderly Medicare beneficiaries are disabled, and this status is not present in our model. The sample size for each wave is presented in Table 1.

We use 2003 as a base year. All level variables were normalized to the base year using Consumer Price Index (CPI). We also adjust for the growth in average medical expenditures.

Table 1: Number of observations in eight waves of MEPS (1999-2007)

Panel	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	Total
Obs.	4,291	3,360	6,848	5,149	5,179	5,198	5,005	5,313	40,343

5.2   Demographics, preferences and technology

In the model, agents are born at age 25 and can live to a maximum age of 80.[14] The model period is one year so the maximum lifespan N is 56 periods. Agents retire at age 65, so R is 40 periods. For the conditional survival probabilities ζ_t we use the female life tables from the Social Security Administration.

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[13]We do not use the first two waves of the MEPS because they do not contain the variables we use in constructing a household unit.

[14]Agents in our model have a shorter than usual lifespan because the MEPS has very few observations on individuals that are older than 80 year old.

The risk aversion parameter σ is set to 4, which is in the range of values commonly used in the life-cycle literature. The discount factor β is calibrated to match the aggregate capital output ratio of 3.

The Cobb-Douglas function parameter α is set at 0.33, which corresponds to the U.S. economy capital income share. 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 average labor income equals one in the baseline model.

5.3   Government

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

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

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 people with the highest income, a_1 determines the curvature of marginal taxes and a_2 is a scaling parameter. We set a_0 and a_1 to be equal to the original estimates in Gouveia and Strauss (1994), 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. 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.

The minimum consumption floor $\underline{c}$ was calibrated to match the fraction of people with assets below $5,000 in the baseline economy: the fraction of people whose assets are non-negative and less than $5,000 was 12.1% in 2001 (Kennickel, 2003). Social Security replacement rates were set to 55, 45 and 35% of average education-specific labor income for high-school dropouts, high-school and college graduates correspondingly. These replacement rates result from applying the Social Security benefit calculation formula to the average income profiles for each educational group.

Medicaid eligibility threshold y_t^{pub} was set to match the age profile of the fraction of uninsured among people with the lowest educational attainment[15]. In particular, we allow y_t^{pub} to take two values by increasing the Medicaid eligibility threshold for those older than 55 year old. This reflects the fact that Medicaid primarily covers people with dependent children and pregnant women, and after age 55 fewer individuals fall into these

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[15]We choose to match the fraction of uninsured among high-school dropouts because people in this group are most likely to become eligible for Medicaid.

categories.

5.4 Insurance sector

The share of health insurance premium paid by the firm (ψ) was chosen to match the aggregate ESHI take-up rate[16]. The resulting number (77.5%) is consistent with the one observed in the U.S. economy, which is in the range of 75-85% (Kaiser Family foundation Employer Health Benefits Survey, 2002-2009).

We set the proportional loads for group and individual insurance policies (γ^I and γ^G) to 1.11. This number comes from the study of Kahn et al.(2005). The fixed costs of buying an individual policy π is set to 0.45% of average labor income (the average labor income in our sample was $38,950 in 2003) or $253. This parameter was used to match the aggregate fraction of people with individual insurance.

5.5 Labor income

We divide households into three educational groups: high-school dropouts, high-school graduates and college graduates. The fraction of each group in the population is 15, 50, and 35% correspondingly. Workers with different education have different income processes, specified as following:

$$z_t^e = \exp(\lambda_t^e)\exp(v_t)$$

where

$$\lambda_t^e = \varphi_0^e + \varphi_1^e t + \varphi_2^e t^2 + \varphi_3^e t^3$$

$$v_t = \rho v_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim N(0,\sigma_\varepsilon^2) \tag{19}$$

The education-specific coefficients $\varphi_0^e, \varphi_1^e, \varphi_2^e$ and φ_3^e were estimated from the MEPS dataset. These coefficients are based on the following regression equation:

$$\log(inc_t) = \varphi_0^e + \varphi_1^e t + \varphi_2^e t^2 + \varphi_3^e t^3 + \varphi_3^e t^3 + \Phi D_t$$

where inc_t is household labor income normalized by the average labor income ($38,950), and D_t is a set of dummies for each year[17]. Household labor income was defined as a sum of wages (variable WAGEP) and 75% of income from business (variable BUSNP). This definition is the same as used in the Panel Study of Income Dynamics Dataset (PSID), which has been commonly used for income calibration in the macroeconomic literature.

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[16]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.

[17]Since the dependent variable is a log of income, we restrict the sample to individuals whose annual income is greater than $1,000.

For the persistence parameter in the stochastic part of income ρ we use the value 0.985, and the variance of innovation σ_ε^2 was set to 0.02. These values were chosen so the model can reproduce the empirical fact that the cross-sectional variance of log of consumption increases over the life-cycle,[18],[19]. Our parameters are in the range estimated in Storesletten, Telmer and Yaron (2004) and Hubbard, Skinner, and Zeldes (1994).

In our computation we use a discretized version of the income process. To construct the age and education-specific grids and transition matrix we use the method suggested by Floden (2008)[20] to discretize the stochastic part of the income process v_t. Then, we scale each grid by the deterministic education-specific component λ_t^e. To construct the distribution of newborn individuals, we draw v_1 in equation (19) from the normal $N(0, \sigma_\varepsilon^2)$ distribution. Figure (1) compares the actual and simulated labor income profiles.
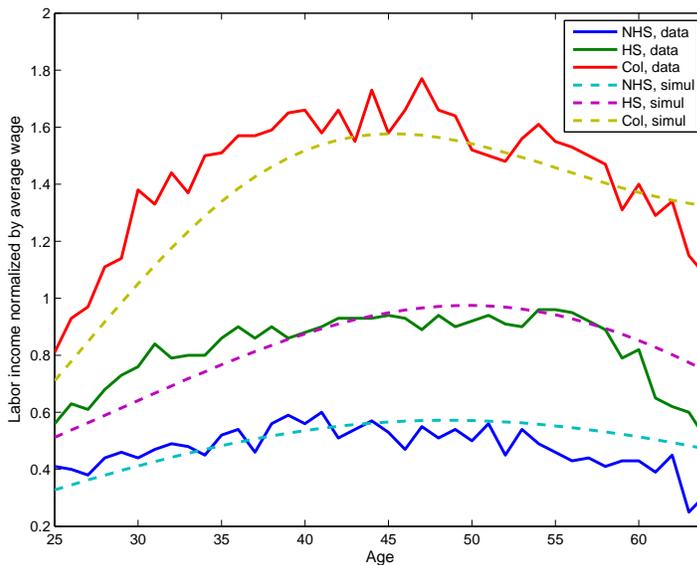

Figure 1: Simulated vs. actual labor income

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[18]The dynamics of variance of log of consumption over the life cycle is extensively discussed in Deaton and Paxson (1994), Storesletten et al (2004), and Guvenen (2006).

[19]We approximate the income process in this way as opposed to estimating it from the MEPS because in this dataset each individual is observed only for two periods. The transition matrix for income constructed from a two-year panel fails to produce a high persistence of the income process and thus underestimates a lifetime income risk in a full life-cycle model.

[20]The method suggested by Floden (2008) gives higher accuracy than the more commonly used Tauchen and Hussey (1991) discretization method if the persistence parameter of the AR(1) process is high, as it is in our case.

5.6 Offer rate

We assume that probability of getting an offer of ESHI coverage is a logistic function[21]:

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

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

$$u_t = \eta_0^e + \eta_1^e \log(inc_t) + \eta_2^e \left[\log(inc_t)\right]^2 + \eta_3^e \left[\log(inc_t)\right]^3 + \eta_4^e \mathbf{1}_{\{g_{t-1}=1\}} + \Theta^e D_t \quad (20)$$

Here $\eta_0^e, \eta_1^e, \eta_2^e, \eta_3^e, \eta_4^e$ and Θ^e are education-specific coefficients. The initial offer rate (g_0 in equation (20)) was constructed based on the fraction of people having an offer at age 24 for each educational group. The simulated and actual offer rates are presented in Figure (2). Our simulated offer rates can replicate large differences in age profiles of ESHI offer rates among educational groups. We are also able to capture the dynamics of the offer rate. Table 2 compares the probability of getting an offer this period conditional on having an offer last period for different educational groups.
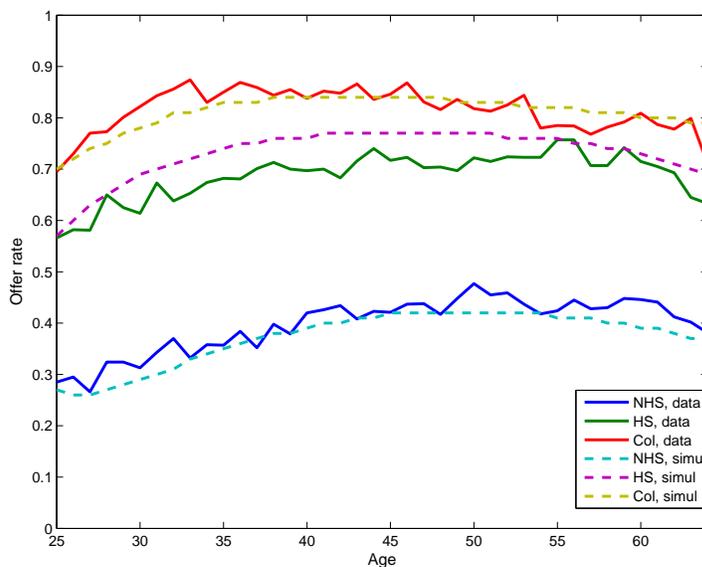

Figure 2: Simulated vs. actual offer rates

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[21]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.

NHS	Data	Model
Offer previous period	0.87	0.87
No offer previous period	0.06	0.08

College	Data	Model
Offer previous period	0.96	0.96
No offer previous period	0.19	0.21

HS	Data	Model
Offer previous period	0.94	0.94
No offer previous period	0.14	0.19

Table 2: Conditional probability to get ESHI offer: data vs. model

5.7 Insurance status

In the MEPS the question about the source of insurance coverage is asked retrospectively for each month of the year. When measuring the insurance status in the data we use the following approach. We define the person as having employer-based insurance if he reports having ESHI for at least eight months during the year (variables PEGJA-PEGDE). The same criteria was 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 the 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[22].

5.8 Medical expenditures

Medical costs in our model correspond to the total paid medical expenditures in the MEPS dataset (variable TOTEXP). This includes not only out-of-pocket medical expenses but also the part of costs covered by the insurer. In calibration we categorize medical expenditures for each age into seven bins, corresponding to 20th, 40th, 60th, 80th, 95th and 99th percentiles. To adjust for medical costs growth, we normalize each year's medical expenses by a health inflation index. This index was constructed by computing the growth rate of average medical expenses for each year relative to the base year 2003. 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). The mean and variance of medical expenses simulated by our model and observed in the data are compared in Figures (3) and (4). Our medical shock process tracks closely the empirical mean and variance and also captures the fact

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

that both the mean and variance of medical expenses increase steeply with age.
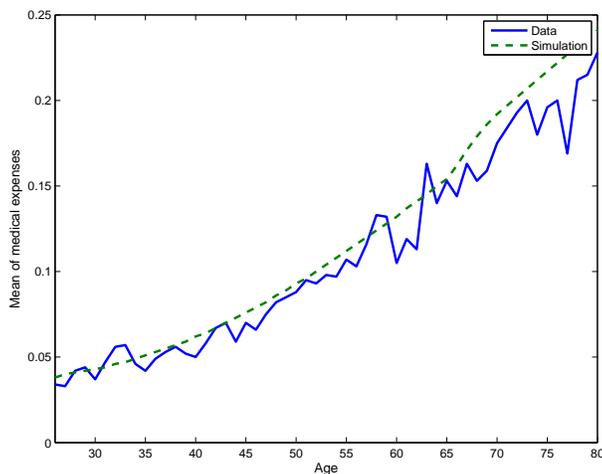
Figure 3: Mean of medical expenses normalized by average wage
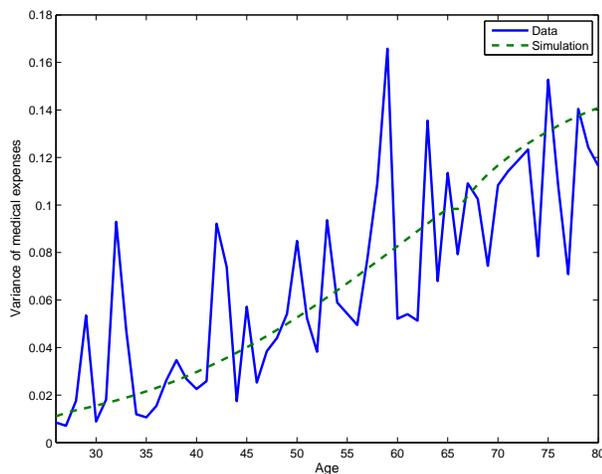

Figure 4: Variance of medical expenses normalized by average wage

To determine the fraction of medical expenses covered by insurance policies $q(x_t)$ and $q_{med}(x_t)$, we use the following approach. For working age households we estimated medical expenditures paid by insurers (variable TOTPRV) as a quadratic function of total paid medical expenditures and year dummy variables. For retired households we estimated Medicare payments (variable TOTMCR) as a linear function of total paid medical expenses[23] and year dummy variables. We include only single households with positive health expenses in our sample. We use these estimates to compute the ratio of medical costs covered by insurance for each gridpoint of medical expenses for each age. The estimated ratios for private insurance and Medicare are presented in Figures (5) and (6). The lines show the fraction of medical costs covered by private insurance (for working age households) or Medicare (for retired households) for each discretized medical expense grid.

5.9 Summary of the parametrization of the baseline model

The model parametrization is summarized in Tables 3 and 4. Table 3 presents the parameters that were set outside the model, and Table 4 shows the parameters that were used to match some targets in the model.

5.10 Health reform parameters

The values for the parameters related to the reform are taken from the Patient Protection and Affordable Care Act signed on March 23, 2010. These values are summarized

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[23]The second order term is not significant, so we removed it from the estimated equation. The R^2 for people of working age is 0.75, while that for retirees is 0.72.
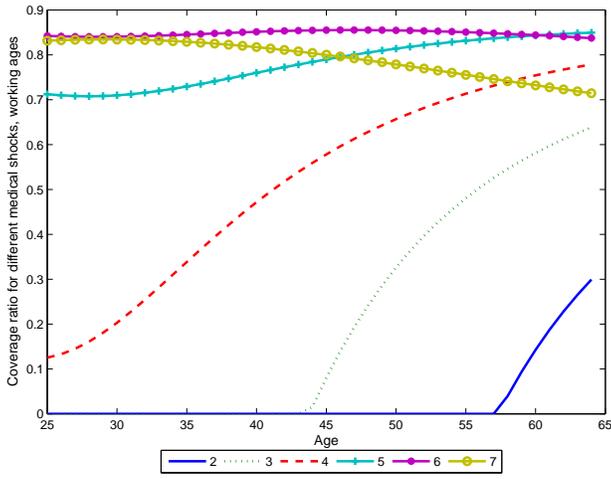
Figure 5: Coverage ratio, private plans
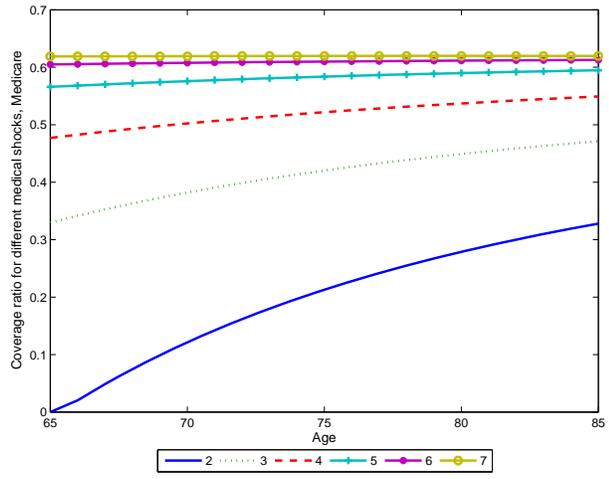
Figure 6: Coverage ratio, Medicare

Parameter name	Notation	Value	Source
Risk aversion	σ	4	-
Cobb-Douglas parameter	α	0.33	Capital share in output
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	55%	SS Benefits formula
High-School	ss_2	45%	SS Benefits formula
College	ss_3	35%	SS Benefits formula
Insurance loads:			
Individual market	γ^I	1.11	Kahn et all (2005)
Group market	γ^G	1.11	Kahn et all (2005)
Medicare premium	p^{med}	$1,055	Total premiums =2.11% of Y
Federal Poverty Line	FPL	$9,573	Data

Table 3: Parameters set outside the model

in Table 5.

The penalty for not having insurance ($\varkappa$) is set to 2.5% of the taxable income. The lowest fraction of health insurance premium in taxable income that allows for exemption from penalties (p_c) is set to 8%. For the fractions of the highest allowable share of insurance premium in income we use the numbers that correspond to the midpoints of the intervals specified in the Bill.

The lowest share of employee contribution to taxable income that allows an individual with an ESHI offer to qualify for subsidies (t_g) is set to 9.5%. The Federal Poverty Level (FPL) is set to 23% of the average labor income. This corresponds to the Census poverty line for a family of one in 2009 ($9,573).

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Parameter name	Notation	Value	Source/Target
Discount factor	β	0.962	$\frac{K}{Y}=3$
Depreciation rate	δ	0.07	$r=0.04$
Tax function parameters:	a_2	0.652	Balanced government budget
Consumption floor	$\underline{c}$	$5,265	% with assets<$5,000=12.1%
Insurance loads:			
Fixed costs	π	$253	% of individually insured=7.6%
Employer contribution	ψ	77.5%	ESHI take-up rate=94%
Stochastic productivity process			
Persistence parameter	ρ	0.985	Life-cycle profile of
Variance of innovations	σ_ε^2	0.02	log of consumption variance
Medicaid eligibility threshold	y_t^{pub}	$\left\{\begin{array}{l}0.95\text{FPL if age}\leq 55\\ 0.65\text{FPL if age}>55\end{array}\right\}$	% of uninsured HS dropouts

Table 4: Parameters used to match some targets

6 Baseline model performance

Table 6 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 and individual insurance rates. However, the model also produces numbers on the fractions of uninsured and publicly insured close to the data. The model slightly underestimates the fraction of publicly insured (4.5% in the model vs. 6.1% in the data). This is due to the fact that our model has a very stylized representation of Medicaid. An underestimation of the number of publicly insured leads to an overestimation of those uninsured given that both the publicly insured and uninsured are predominantly composed of low income people without an ESHI offer.

Table 7 shows insurance statistics by educational groups. Our model does not target most of these statistics (except the uninsurance rate among high-school dropouts), but it still fares well along these dimensions.

Figures (7) and (8) compare the life-cycle profiles of the fraction of people with ESHI and ESHI take-up rates 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 employer-based insurance rates and ESHI take-up rates. However, it underestimates the take-up rates for young people. This is due to the fact that in our model there is only one insurance policy available from the employer. Individuals of all ages have to pay the same price for employer-based insurance and it involves significant cross-subsidization from young to old. Many young people are unwilling to buy this unfair insurance. The higher take-up rates for young in the data indicate that some risk-separation may exist in firms that offer several insurance policies and some contracts may be more suited for

Parameter name	Notation	Value
Penalty (fraction of taxable income)	$\varkappa$	2.5%
Flat penalty rate	$\overline{\varkappa}$	$695
Premium/income for penalty exempt	p_c	8%
Income level thresholds for subsidies		
	th_1	1.3
	th_2	1.5
	th_3	2.0
	th_4	2.5
	th_5	3.0
	th_6	4.0
Premium/income targeted by subsidy		
	t_c_1	2.0%
	t_c_2	3.5%
	t_c_3	5.2%
	t_c_4	7.2%
	t_c_5	8.8%
	t_c_6	9.5%
Premium/income to get subsidy with ESHI offer	t_g	9.5%

Table 5: Parameters of the reform

the young and some - for the old.

In general, the insurance purchase decision depends on the agent's wealth in a non-linear way. People do not buy insurance if they are very poor because when hit by a big medical shock they can rely on the consumption minimum floor. Also, people do not buy insurance when they accumulate enough wealth to self-insure. A preference for self-insurance arises because available health insurance contracts are not actuarially fair because of the administrative costs. The preference for self-insurance as opposed to buying health insurance is especially strong for individuals with low expected medical expenses.

Variable	Data	Model
Insured by ESHI (%)	66.1	66.2
Individually insured (%)	7.6	7.4
Uninsured (%)	20.2	22.2
Publicly insured (%)	6.1	4.1
ESHI take-up rate (%)	93.8	93.9
Group premium ($)	3,383	2,643

Table 6: Insurance statistics: data vs. model

Variable	Data	Model	Variable	Data	Model
Individually insured (%)			**Publicly insured (%)**		
No High-School degree	5.7	6.6	No High-School degree	15.8	17.6
High-School degree	7.5	8.1	High-School degree	6.1	2.5
College degree	8.6	6.9	College degree	1.9	0.4
Uninsured (%)			**ESHI take-up rate (%)**		
No High-School degree	42.0	43.3	No High-School degree	87.4	87.3
High-School degree	20.5	20.5	High-School degree	93.4	94.2
College degree	10.3	15.7	College degree	95.9	94.8

Table 7: Insurance statistics for educational groups
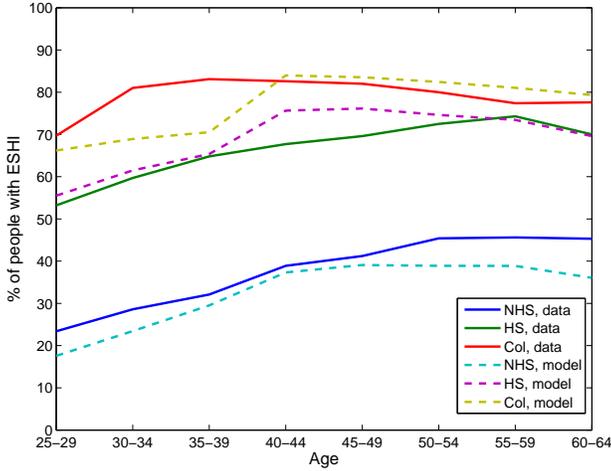
Figure 7: Percent of people with ESHI
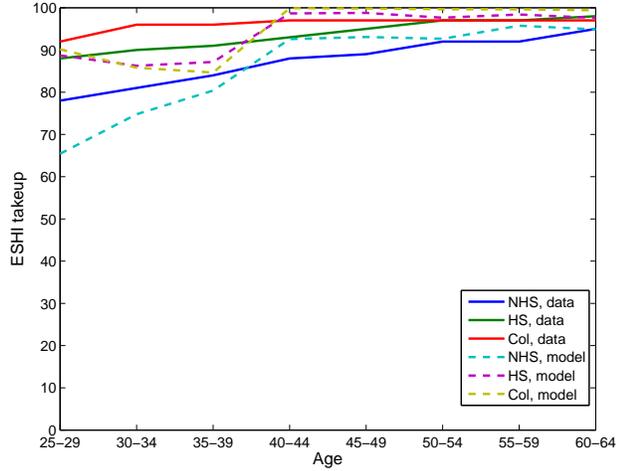
Figure 8: ESHI take-up rate

Figure (9) compares the percentage of uninsured produced by the model with the data. The model was calibrated to match the uninsurance rates for high-school dropouts, but it is able to capture the life-cycle uninsurance profiles for people with high-school degree. However, the model overestimates the number of uninsured among college graduates. In our model, the insurance behavior of high-school and college graduates is more similar than in the data. This suggests that differences in life-cycle labor income profiles alone are not enough to generate the observed differences in insurance behavior. In reality, college and high-school graduates differ not only in labor-income profiles, but also in initial wealth and the quality of available insurance policies.

Figure (10) plots the percentage of publicly insured people in the model and in the data. The model tends to underpredict the number of publicly insured with high-school and college degrees. This is due to the fact that we use uniform eligibility criteria while in reality all states have different Medicaid rules. For some states, the Medicaid eligibility income threshold can go up to 200% FPL, which explains why in the data we observe
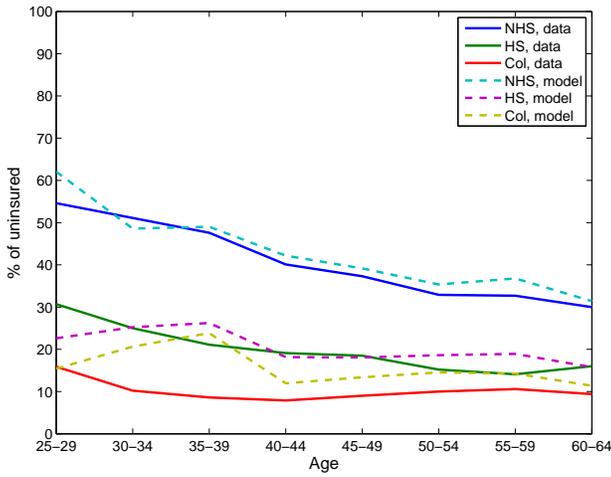
Figure 9: Percent of people without insurance
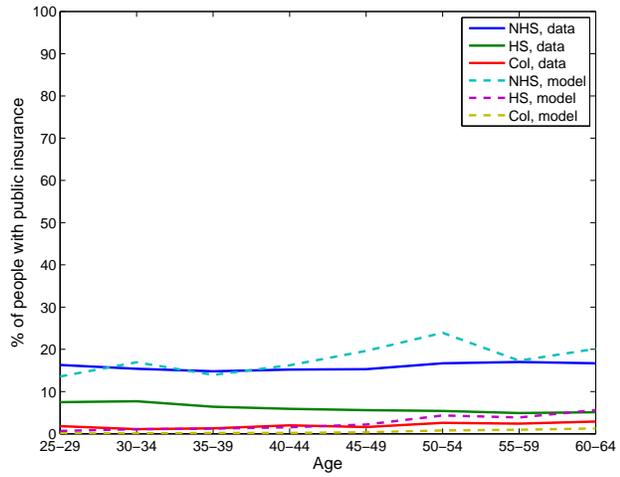
Figure 10: Percent of people with public insurance

college graduates with public insurance more often than in the model[24].

Figure (11) plots the percentage of people with individual insurance for each educational group. The model matches the overall participation in the individual market, but the number of people purchasing individual insurance at very young ages is too high. This is due to the fact that in our model people start their working life at age 25, being relatively poor. In the data many people have already accumulated some assets by age 25. As was mentioned before, once a healthy person accumulates capital he has a strong preference for self-insurance, which explains the sharp decline in individual insurance purchases in older age groups. The difference in individual insurance take-up rates observed in the model and in the data is thus due to the difference in wealth distribution of the 25 year old people.

7   Effects of the reform

This section describes the new steady-state that the economy converges to after the reform is implemented.

7.1   Aggregate insurance statistics

Table 8 compares aggregate insurance statistics between the two steady-states - in the baseline and in the reformed economies.

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

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[24]An alternative strategy is to introduce a probability to enroll in Medicaid as in Feng (2009). However, this requires an additional state variable, and thus exponentially increases the computational costs.
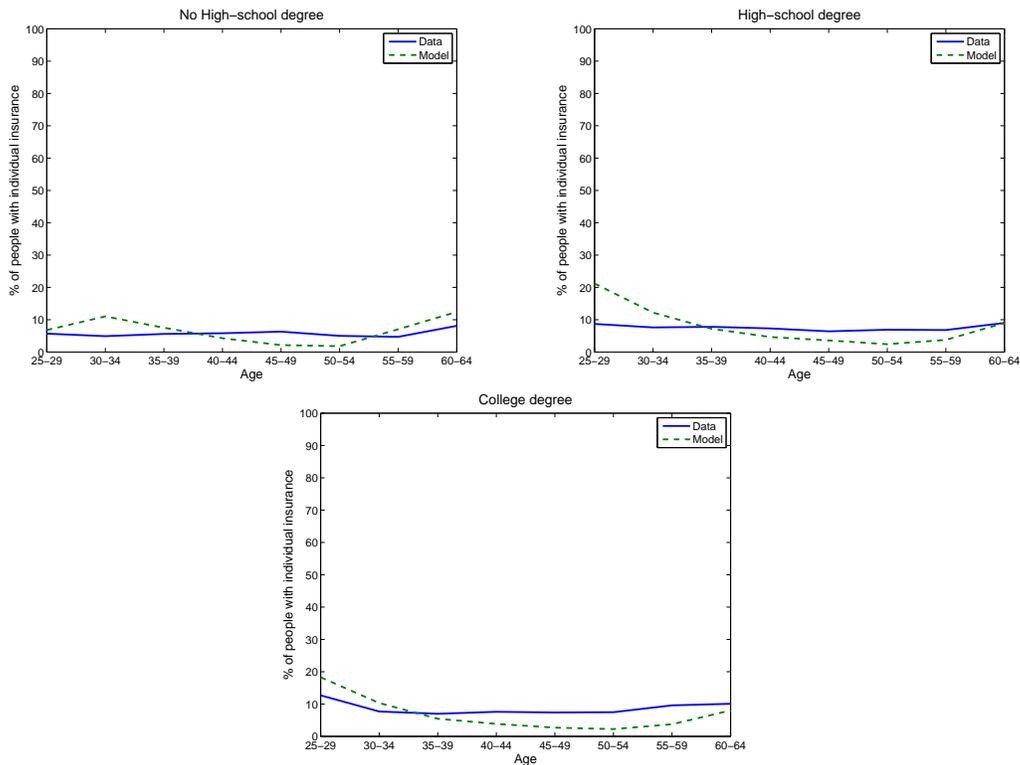
Figure 11: Percent of people with individual insurance

more than twofold: from 7.4% to 18.3%. At the same time, there is a big drop in the uninsurance rate which goes down from 22.2% to 4.7%, thus decreasing by 78%.[25]

The number of publicly insured increases from 4.1% to 9.4% due to the expansion of Medicaid. Finally, there is a small increase in the ESHI take-up rate from 93.9 to 95.7% due to the effect of penalties.

Table 9 displays changes in government finances after the reform. The increase in government spending on subsidies net of penalties and on Medicaid expansion constitutes around 130%. 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 more than 70%. This explains why the marginal tax rate for a person with average income increases by only 0.91 percentage points in the reformed economy[26].

7.2   Effect on different educational groups

The left panel of Figure (12) compares the percentage of people without health insurance at each age and educational group before and after the reform. In all educational

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[25]This number is close to the results of the health reform in Massachusetts, which has a design similar to the national health reform. In Massachusetts the fraction of uninsured dropped by around 75% after the reform - from 11% in 2005 to 2.7% in 2009 (Massachusetts Health Connector).

[26]The change in the tax rates after the reform is discussed in detail in the Appendix.

Variable	Baseline	Reform
Insured by ESHI (%)	66.2	67.5
Individually insured (%)	7.4	18.3
Uninsured (%)	22.2	4.7
Publicly insured (%)	4.1	9.4
ESHI takeup rate (%)	93.9	95.7
Group premium ($)	2,643	2,510
Aggregate capital	3.40	3.24

Table 8: Insurance statistics before and after the reform

Change in	Value
Spending on health insurance for working-age (%)	+131.3
Spending to guarantee minimum consumption for working-age (%)	-72.6
Marginal tax for average wage (percentage point)	0.91

Table 9: Change in the government finances after the reform

and age groups there is a noticeable decline in the fraction of uninsured. The largest reduction in the number of uninsured is observed among the 25-29 year old high-school dropouts: the percentage of uninsured in this group goes down from 60% to 10%. For older high-school dropouts the decline in uninsurance is relatively less (the minimum decline is 29%) but the percentage is still large. The fact that the reform has the largest effect on those uninsured without high-school degree is not surprising. People in this educational group have low income and are more likely to qualify for Medicaid or subsidies. In contrast, the noticeable decline in the number of uninsured college graduates is mostly due to the effect of penalties because only a few in this group are eligible for expanded Medicaid or subsidies.

The right panel of Figure (12) displays the fraction of people with public insurance. The expansion of Medicaid does not have much effect on college graduates. However, its effect is noticeable for high-school graduates, and there is a big increase in the number of publicly insured high-school dropouts. For example, the fraction of publicly insured among 25-29 year old high-school dropouts increases from 14% to 45%. For all educational groups we observe an increase in the number of publicly insured after age 55. In the baseline economy people above 55 have lower Medicaid eligibility income threshold than younger people. The reform has introduced a new eligibility threshold which applies to everybody, so the nearly elderly who previously did not qualify for Medicaid can now get public coverage. This captures the important effect of the reform: it not only
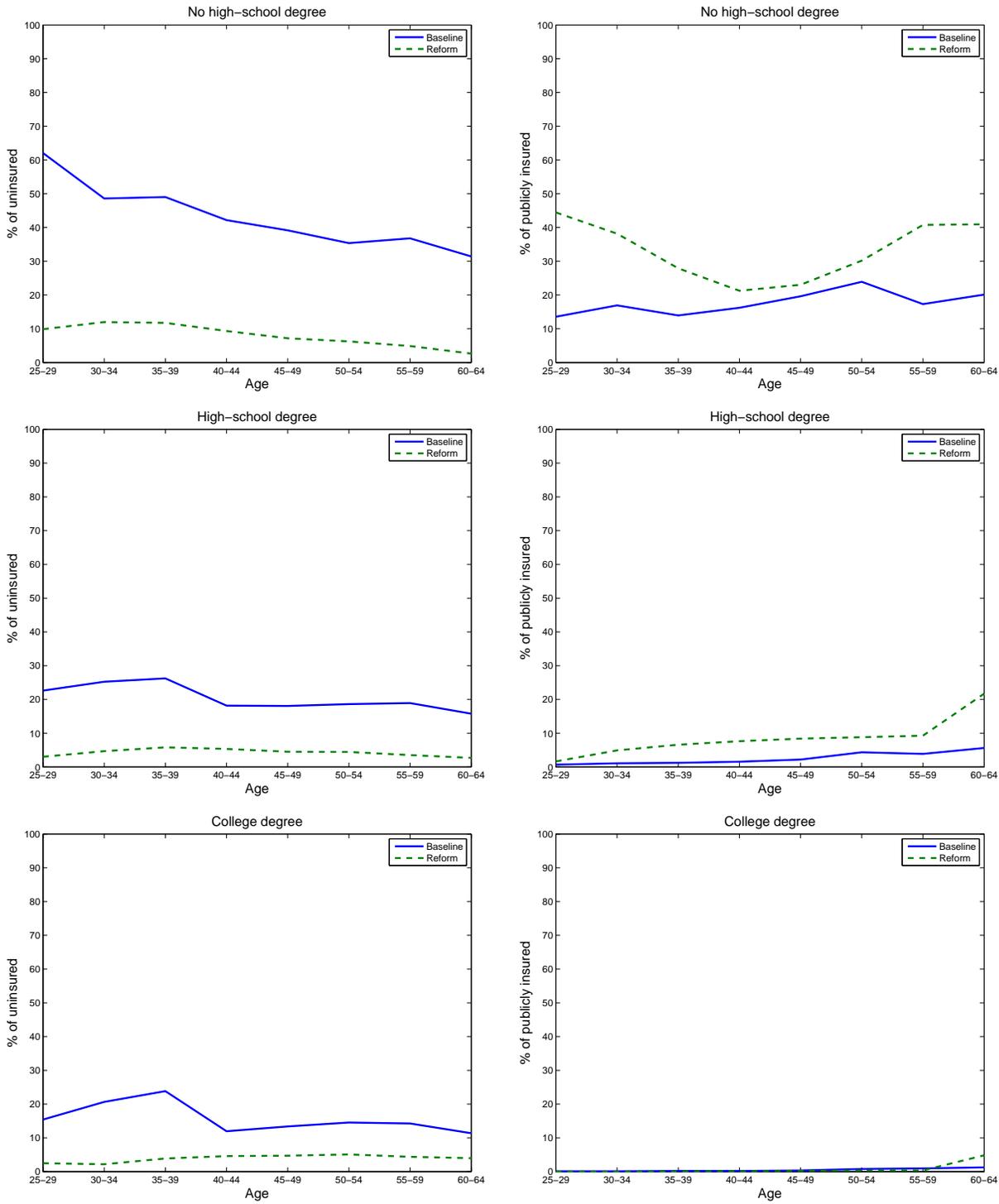
Figure 12: Percent of uninsured (left panel) and publicly insured (right panel) before and after the reform

increases the income eligibility threshold, but also treats all people equally by removing categorical eligibility requirements.

The left panel of Figure (13) compares the individual insurance rates in the baseline and reformed economies. The fraction of individually insured people increases in all age groups and educational groups. As a result of income-based subsidies, the largest increase in the number of individual market participants is observed among high-school dropouts.
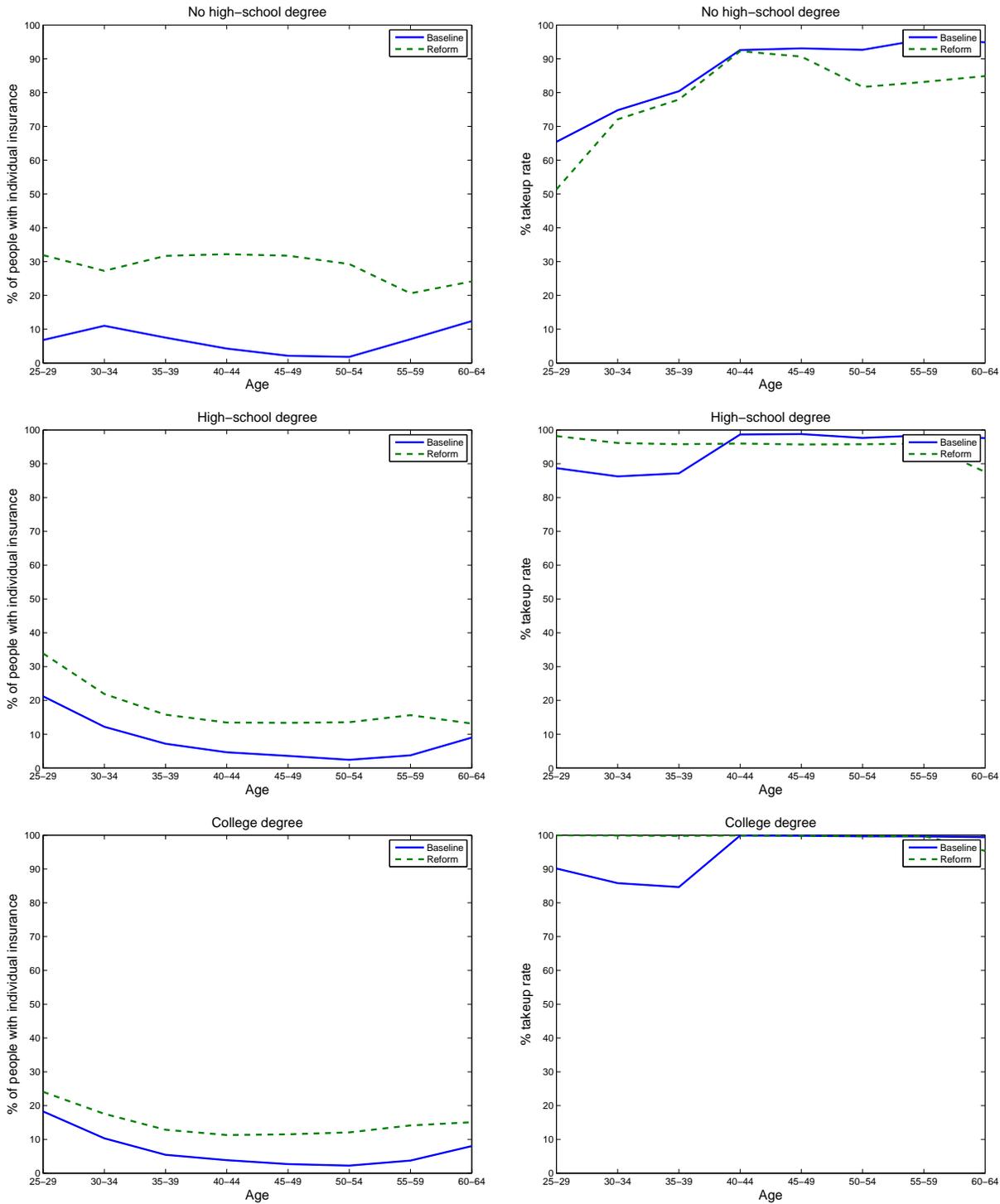
Figure 13: Percent of people with individual insurance (left panel) and ESHI take-up rates (right panel) before and after the reform

The right panel of Figure (13) displays ESHI take-up rates before and after the reform and shows the direction of change in take-up rates to be different across educational groups. For high-school dropouts there is a decrease in take-up rates for all age groups. This is due to the effect of Medicaid expansion and also to the fact that only people buying insurance in the individual market qualify for subsidies. Thus, we observe a crowd-out of ESHI by Medicaid and subsidized individual insurance[27].

For high-school graduates this crowd-out effect is observed only among people older than age 40 - while the take-up rates actually increase among younger ages. This asymmetric effect is explained by two factors. First, the subsidy is linked both to income and individual market insurance premiums; to get a subsidy a person not only has to have a low income but also has to face high insurance premiums. Second, insurance premiums in the individual market are age-adjusted and so increase with age. Thus many young high-school graduates do not qualify for subsidies because their income is too high relative to premiums. However, older high-school graduates face higher premiums in the individual market, which makes it easier for them to qualify for subsidies, hence they drop their employer coverage.

To illustrate this point further, Figure (14) plots the share of the individual market premium in average income for each age and educational group in the reformed economy. One can see that across all educational groups the burden of health insurance premiums increases with age. For high-school dropouts the share of premium to income is always above 10%. For college graduates this share is always below 10% and reaches 7.5% only by age 55. For high-school graduates the premium to income ratio reaches 7.5% much sooner - by age 40.
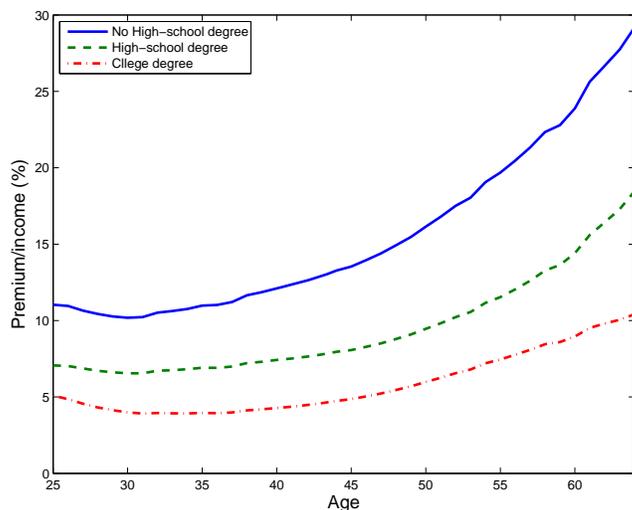

Figure 14: Share of individual premiums in average income for each educational group

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[27]Cutler and Gruber (1996) also found that Medicaid expansion over the 1987-1992 period caused crowd-out of ESHI resulting from the fact that employees do not take coverage when it is offered.

In contrast to high-school dropouts and high-school graduates, college graduates increase the ESHI take-up rates in almost every age except for several years before retirement. This pattern is due to the fact that people in this educational group have to pay penalties if they do not buy insurance and they do not qualify for subsidies in the individual market.

Figure (15) shows the percentage of people who receive subsidies or are enrolled in Medicaid. The highest number of beneficiaries is observed among young high-school dropouts: almost 90% of this group is enrolled in Medicaid or receive subsidies. For all educational groups there is an increase in the fraction of beneficiaries towards pre-retirement ages because of the raising share of the individual market premium in income.

The average amount of the subsidy for those who receive it is displayed in Figure (16). Average subsidy increases with age because individual market premiums increase with age faster than income for many subsidy recipients. In order to keep the fraction of premium in income low these people have to receive more subsidies as they age. The average amount of subsidies for those who receive it does not differ much by educational groups. In general the average size of the subsidy varies from around $500 to $900 for people aged 25-29 year old depending on education. For people of pre-retirement age the size of the subsidy varies from $3,800 to $4,000 depending on education.
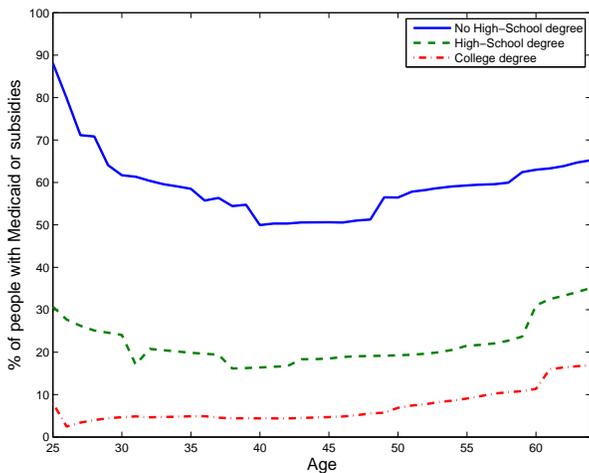

Figure 15: Percent of people getting subsidies and enrolled in Medicaid
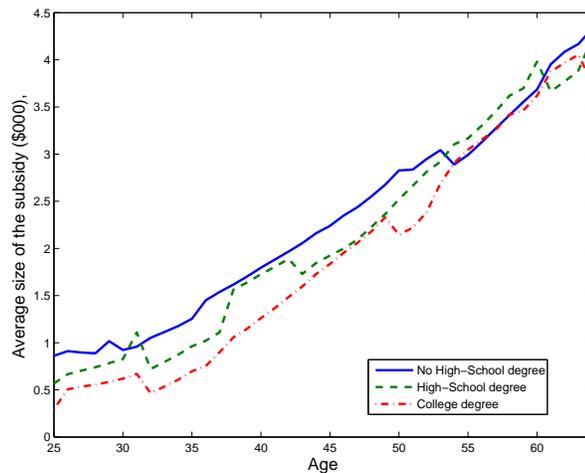
Figure 16: Average size of the subsidy

Figure (17) shows the fraction of people who pay penalties. This fraction is very low for all educational groups: it never exceeds 5%. For all educational groups we observe an inverse U-shaped pattern of the fraction of penalty payers after age 30 because middle-aged people have the highest preferences for self-insurance: their incomes have increased but their expected medical costs are still low so even with the penalty some of them are better off staying uninsured.

Surprisingly, for the group aged 30 to 50 year old the highest fraction of people paying

penalties is observed among high-school dropouts. However, this is the group that does not qualify for subsidies due to low premium to income ratio and they do not have an offer of ESHI. In this situation they prefer paying penalties to buying non-subsidized individual insurance.

Figure (18) plots the average size of the penalty for those who pay it. The penalty increases with age because it is linked to individual income. If young people pay an average penalty of $800, it can go up to more than $2,000 for individuals by their retirement age.
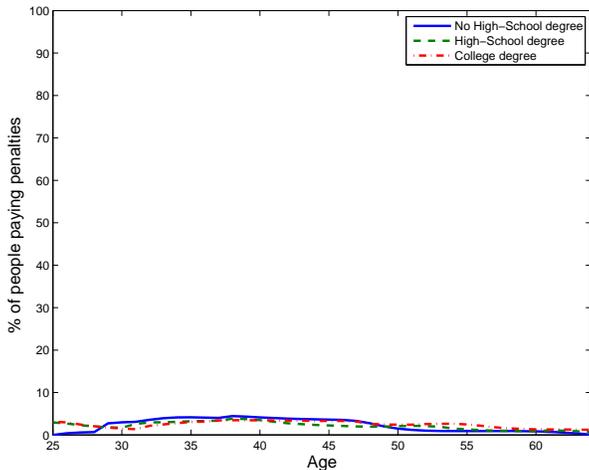

Figure 17: Percent of people getting penalties
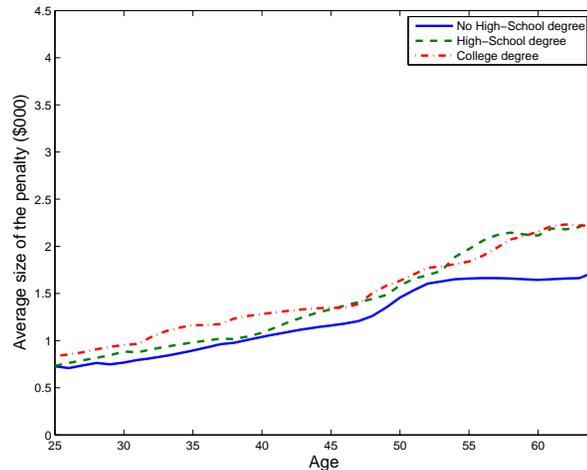
Figure 18: Average size of the penalty

7.3 The effect on the individual market insurance premiums

Figure(19) shows the age-adjusted community-rated premium that will be charged in the individual market after the reform[28]. The premium increases with age due to the increase in the mean of medical expenses. Figure(19) allows a comparison of premiums in the individual and employer-based markets. The latter premium is also community rated although not age-adjusted. The individual market premium stays below the group premium for people younger than age 44, while for those over 44 the individual premium exceeds the group premium, and the gap increases with age.

Figure(19) also allows to compare the community-rated premium in the individual market with risk-adjusted premiums in the unregulated market. The dashed lines plot individual premiums conditioned on medical expenses for the five lowest grids of medical expenses. It is clear that the community-rated premium exceeds the risk-adjusted

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[28]Because of the subsidy schedule embedded in the reform we do not have to consider the possibility of equilibrium when only people with high medical expenses participate in the market and the resulting price is very high. The subsidy guarantees that the fraction of paid insurance premiums in income does not depend on the actual size of the premium. This significantly reduces the sensitivity of market participants to the price of insurance.

premium for the three lowest medical expenses groups. It stays around the level of the unregulated premium for people on the 4th grid of medical expenses. The fact that the community rated premium is below the risk-adjusted premiums for the highest three medical expense groups means that after the reform we observe a good risk-pooling in the individual market without the evidence of adverse selection spiral. The next section will discuss how much this outcome is due to penalties and how much - to subsidies.
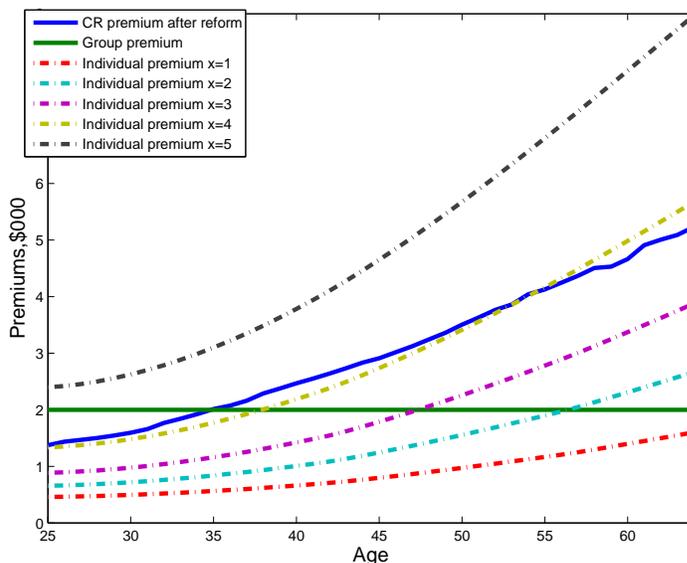

Figure 19: Individual vs group market premiums

7.4 Welfare

Consumption equivalent variation for the reformed economy is presented in the first row of Table 10. The reform brings a significant welfare improvement: a newborn in the baseline economy is willing to give up 0.97% of consumption every period to be born in the reformed economy[29]. To illustrate the source of these welfare gains Figures (20) and (21) plot the level and the log-variance of consumption over the life-cycle before and after the reform. On average after the reform we observe a decrease in consumption at all ages. At the same time the reform brings a significant decline in consumption variance. This means the welfare gains of the reform come from the increased risk-sharing in the economy. This increased risk-sharing is a result of two things. First, people with bad labor market outcomes get transfers from people with good labor market outcomes in terms of subsidies for health insurance purchase. Second, people with high medical

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[29]We compare welfare between two steady-states without taking into account the transition period. Since the aggregate capital in the reformed economy is lower than in the baseline, taking the transition period into account will make welfare gains even larger.

expenses get cross-subsidized by people with low medical expenses through community rated individual market.

		CEV(%)			Agg. capital
	All newborns	No high-school degree	High-school degree	College degree	(% of the baseline)
Reform	0.97	2.37	1.79	-0.06	95.3
Only CR	0.05	0.20	0.15	-0.06	100.1
Only CR+high penalties	0.09	0.15	0.13	0.04	99.4
Only redistribution	1.16	2.46	1.98	0.15	95.8
Only redistribution+penalties	1.10	2.38	1.92	0.09	95.3

Table 10: Welfare effect of different versions of the reform

Once educational attainment is realized there is a significant variation in the welfare effects of the reform for newborns in different educational groups. High-school dropouts gain the most from the reform: the consumption equivalent variation for this group is 2.37%. On the other hand, newborns with college education prefer the unreformed economy though their welfare losses are very small: the consumption equivalent variation for this group is -0.06%. This asymmetric effect is a result of two things. First, there is an income redistribution embedded in the reform. Second, the reformed economy has a lower aggregate capital (95.3% of the baseline value), and this mostly hurts people with high productivity.

Variable	Reform	Only CR	Only CR+ high penalties	Only redistribution	Only redistr+ penalties
Insured by ESHI (%)	67.5	67.8	69.1	64.8	67.6
Individually insured (%)	18.3	2.8	10.1	15.4	22.4
Uninsured (%)					
Total	4.7	25.2	16.8	10.2	0.5
High-school dropout	8.1	47.9	39.8	9.6	0.2
High-school graduates	4.3	24.8	16.5	8.9	0.5
College graduates	3.9	16.2	7.7	12.3	0.6
Publicly insured (%)	9.4	4.1	3.9	9.4	9.4
ESHI take-up rate (%)	95.7	96.2	98.0	92.0	95.9

Table 11: Insurance statistics for counterfactual reforms
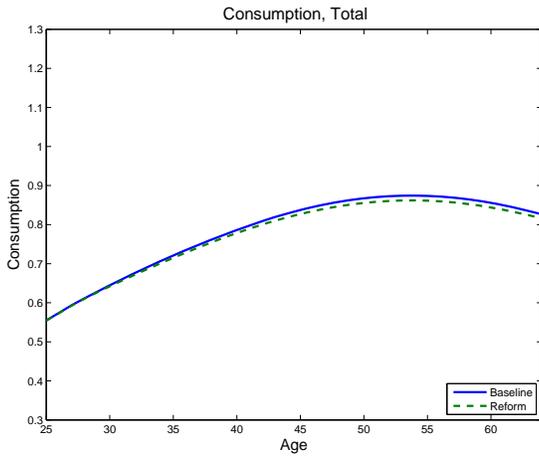
Figure 20: Consumption before and after the re-form (normalized by average wage)
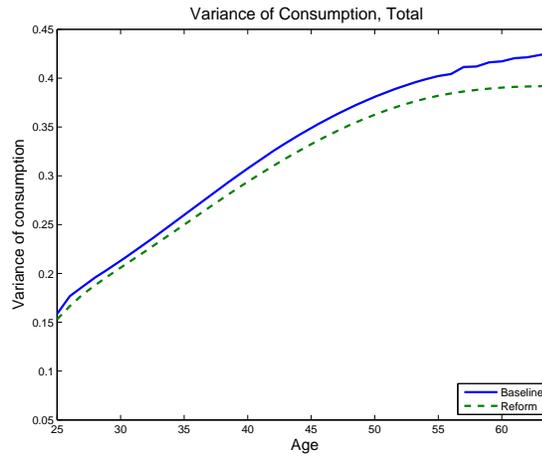
Figure 21: Variance of consumption before and after the reform (normalized by average wage)

Figure (22) compares the level and the log-variance of the average consumption before and after the reform for each educational group. The reform has the opposite effect on the level of consumption for people with low and high educational attainment. For high-school dropouts consumption after the reform is higher for all ages. For high-school and college graduates the reform brings a decline in average consumption. At the same time, the variance of log consumption decreases in each educational group. It may seem surprising that the variance of log consumption decreases significantly even for college graduates. The majority of this group buys insurance in the employer-based market and are less affected by the new rules in the individual market. However, it is important to note that in the baseline economy these people face the risk of loosing ESHI every period. This event likely coincides with a negative income shock. If it also coincides with a large medical shock, these people experience a significant change in the price of their health insurance: instead of a community rated group premium they have to buy insurance at a price fully adjusted for their high expected medical costs. After the reform the loss of the ESHI becomes less painful for two reasons. First, the individual market also becomes community rated. Second, people who loose their job with ESHI can become eligible for a subsidized insurance coverage.

7.5   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 provi-sions for the community rated individual market and penalties for individuals without insurance. We call this case "only community rating". Second, we keep all the redis-tributive measures embedded in the original reform (subsidies and Medicaid expansion) but we allow for the unregulated individual insurance market (no community rating) and

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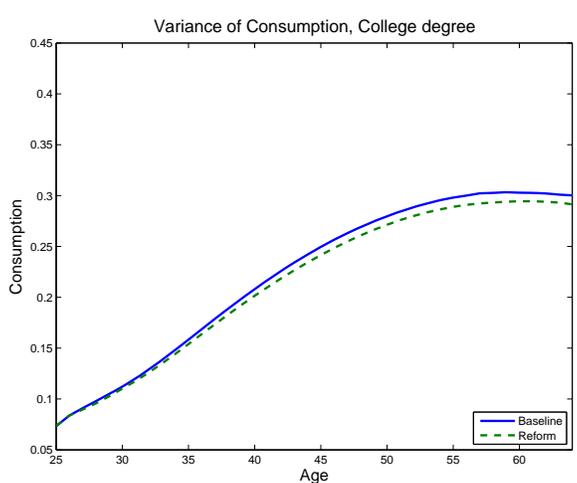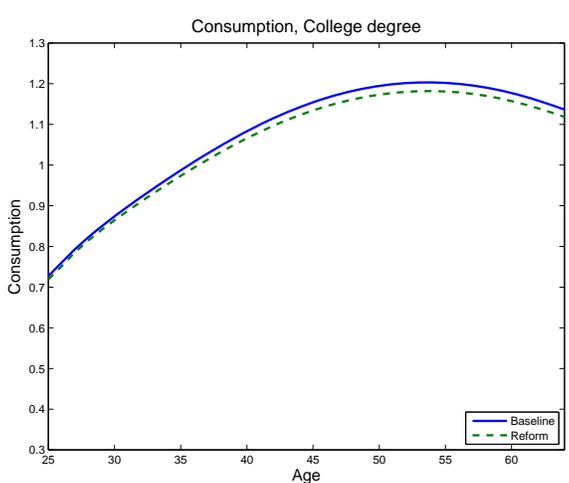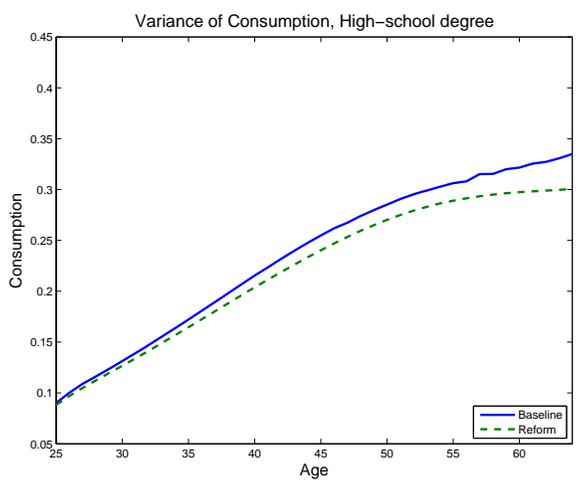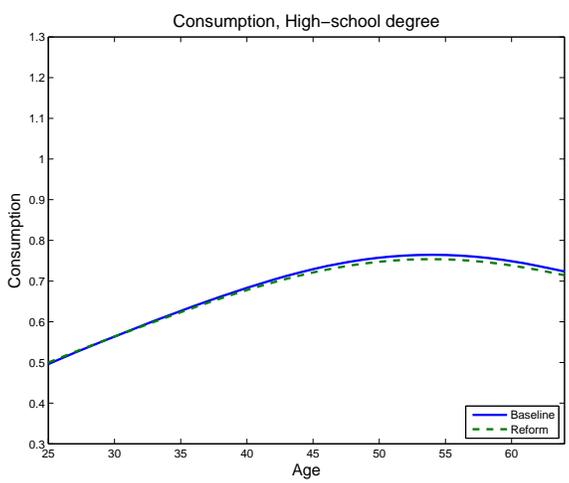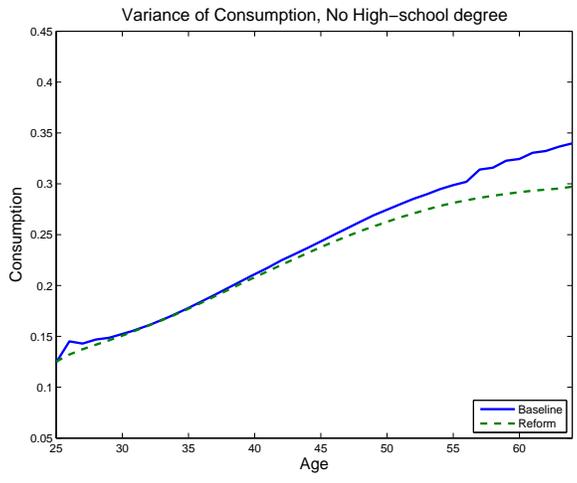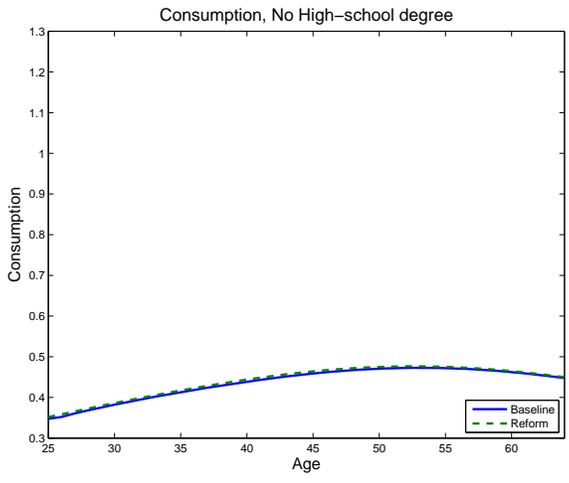
Figure 22: Level (left panel) and variance (right panel) of consumption before and after the reform (normalized by average wage)

remove penalties. We call this version of the reform "only redistribution".

Table 10 compares the results of these modified reforms with the original one. The second row of the table shows the results of implementing the reform with only community rating. In this case the welfare gains from the reform almost disappear, decreasing from 0.97 to 0.05%. The most significant changes are observed among high-school dropouts: their welfare gains go down from 2.37 to 0.20%. For college graduates the welfare effect of the reform with the community rating is the same as in the original reform. This is due to the offsetting effect of the higher aggregate capital which affects this group most.

After the implementation of the reform with only community rating the individual market suffers from the adverse selection spiral. As can be seen from Figure (23), the premium in the individual market increases very fast with age and reaches 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 column of Table 11 clarifies this point by showing that participation in the individual market decreases to 2.8%. This suggests that penalties are not large enough to enforce participation in the community rated individual market. The fact that in the original version of the reform many people participate in the individual market is primarily due to the effect of subsidies but not penalties.

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 double penalties. In this case we do not observe the adverse selection spiral in the individual market: as shown in Figure (23), the price of the individual insurance is much lower and closer to average medical expenses. Also, the participation in the individual market increases to 10.1% (third column of Table 11). The welfare results of this modified reform are presented in the third row of Table 10. Comparing to the reform with only redistribution the welfare increases (from 0.05 to 0.09%) but it is still much lower than in the original reform.

The fourth row of Table 10 shows the results for the reform with only redistribution. This version of the reform has even larger welfare gains than the original reform: the consumption equivalent variation goes up from 0.97 to 1.16%[30]. The increase in welfare is observed for all educational groups: for high-school dropouts CEV increases from 2.37 to 2.46% while for college graduates it goes up from -0.06 to 0.15%. Part of these gains comes from the elimination of penalties that increases the welfare of those who prefer to self-insure. To understand to what extent the larger welfare gains of the reform with only redistribution comes from the elimination of penalties we ran an experiment where we

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[30]Because households in our model supply labor inelastically we underestimate the distortionary effect of income redistribution. However the income redistribution we are considering here is very specific and has only limited distortionary effects in general. First, subsidies only go towards purchase of health insurance. Second, the amount of subsidies can never exceed the size of a health insurance premium.

keep the penalties but abandon community rating. In other words, the only modification to the original reform is a removal of the ban on insurers in the individual market to condition premiums on risk. We call this version of the reform "only redistribution with penalties" and its results are presented in the last row of Table 10. If we compare the reform with only redistribution and penalties with the original version of the reform, we see that the former still brings higher welfare gains: 1.10 comparing to 0.97%.

The important result is that the reform with only redistribution brings significantly higher welfare gains than the reform with only community rating. This suggests that income-based transfers improve the welfare of people much 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 (24) compares the fraction of individual market premiums in average income 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, the share of premiums in income increases for people with the lowest medical expenses and decreases for people with the highest medical expenses. However, for people with low educational attainment the share of community rated premium in income is high: for high-school dropouts it is never below 10% and can go up to almost 60% for people of preretirement age. On the other hand, when reform is implemented without community rating but with subsidies, the share of subsidized individual market premiums in income for low educational groups is significantly lower even for people with the highest medical expenses.

Another result from Table 10 is that the elimination of community rating from the reformed economy increases welfare. At the same time, the introduction of community rating in the baseline economy also increases welfare.

The opposite welfare effect of community rating in the reformed and the baseline economy can be explained as follows. On the one hand, community rating has a positive effect on welfare because it pools health risks and allows people to buy insurance at a price independent of their expected medical expenses. In other words, in the environment with persistent medical expenses, community rating protects people against the risk of premium fluctuations. On the other hand, community rating has a negative effect on welfare in the environment where people are exposed not only to medical expenses risk but also to income shocks. This negative effect arises because community rating induces transfers from healthy to sick that are not conditioned on income. In other words, it introduces some welfare-reducing transfers from healthy with low income to sick with high income.

The positive welfare effect of introducing community rating in the *baseline* economy

results from the fact that in this economy people without access to the employer-based pool do not have any mechanisms protecting them against the risk of premium fluctuations. Thus they value the new risk-pooling mechanism introduced by community rating. However, their welfare gains are small because many low-income people choose not to buy insurance given that premiums constitute a high fraction of their income and they are likely to be exempt from penalties.

In contrast, community rating has a negative welfare effect in the *reformed* economy because people are to a large degree sheltered from the risk of premium fluctuations by the subsidy scheme. The amount of subsidy is such that it keeps the share of insurance premiums in income at a low level. For example, for a person with income between 150 and 200% of FPL the subsidy guarantees that his premium does not exceed 3.5% of his income regardless of how high his premium in the individual market is. Because of subsidies, community rating does not add much value in terms of elimination of the premiums fluctuations risk. Thus, the negative effect of transfers from healthy with low-income to sick with high-income dominates.
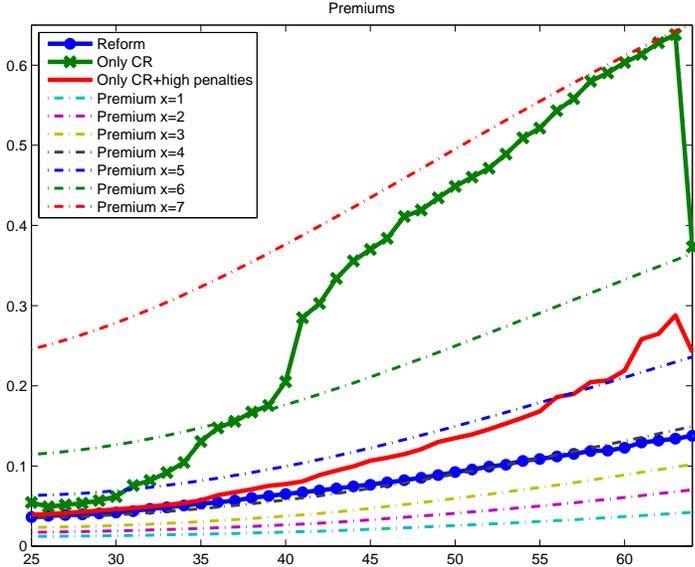

Figure 23: Individual market premiums for different version of the reform
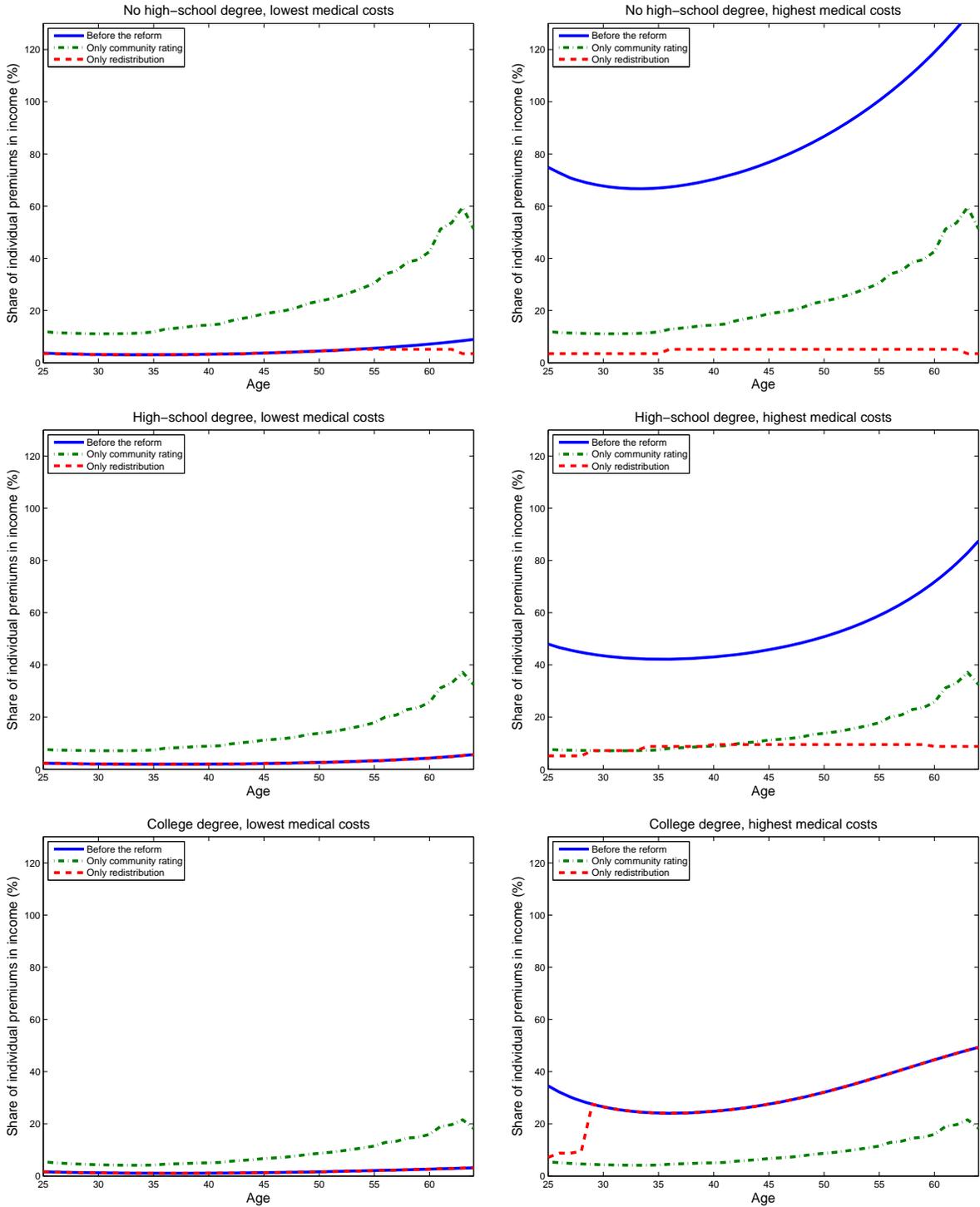
Figure 24: Fraction of individual insurance premiums in income for people with the lowest (left panel) and highest (right panel) medical costs

8   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 effect of the reform and decomposes it into the part that is due to the reorganization of the individual market, and that which is 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 key insurance statistics of the U.S. economy.

We find that the reform brings significant welfare gains (almost 1% of the annual consumption) measured as ex-ante welfare of a newborn in the steady-sate of the reformed economy. However, higher welfare gains can be achieved by just the redistributive part of the reform without introducing community rating in the individual market. The majority of individual market participants have low-income and they gain a lot from having subsidized health insurance. In addition, the subsidy scheme also plays a role as insurance against the risk of insurance premiums fluctuations. 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. Moreover, community rating induces some transfers from healthy people with low income to sick people with high-income. These transfers can only be partially offset by income-based subsidies and thus reduce welfare.

9   Appendix

9.1   Effective tax rates

Figure (25) compares marginal income tax rates before and after the reform. The burden of the tax increase falls disproportionately on people with high income. If for a person with income at the level of the average wage the marginal tax rate increases by 0.91 percentage points, for a person with income three times higher than the average wage the tax rate increases by around 1.2 percentage points.

Apart from changing income tax rates, the reform also introduces two additional types of transfers. First, low-income people get subsidies to finance their health insurance purchase. Second, people with low medical expenses cross-subsidize people with high-medical expenses through the community rated individual market. Thus the former
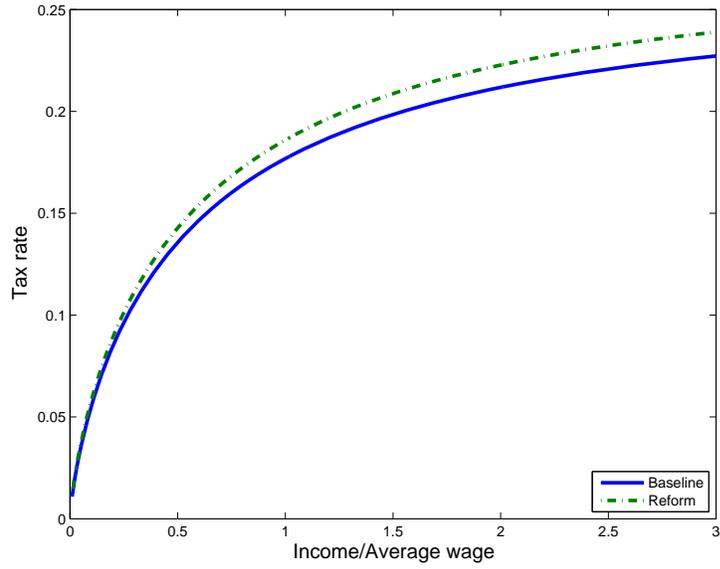
Figure 25: Change in the marginal tax rates after the reform
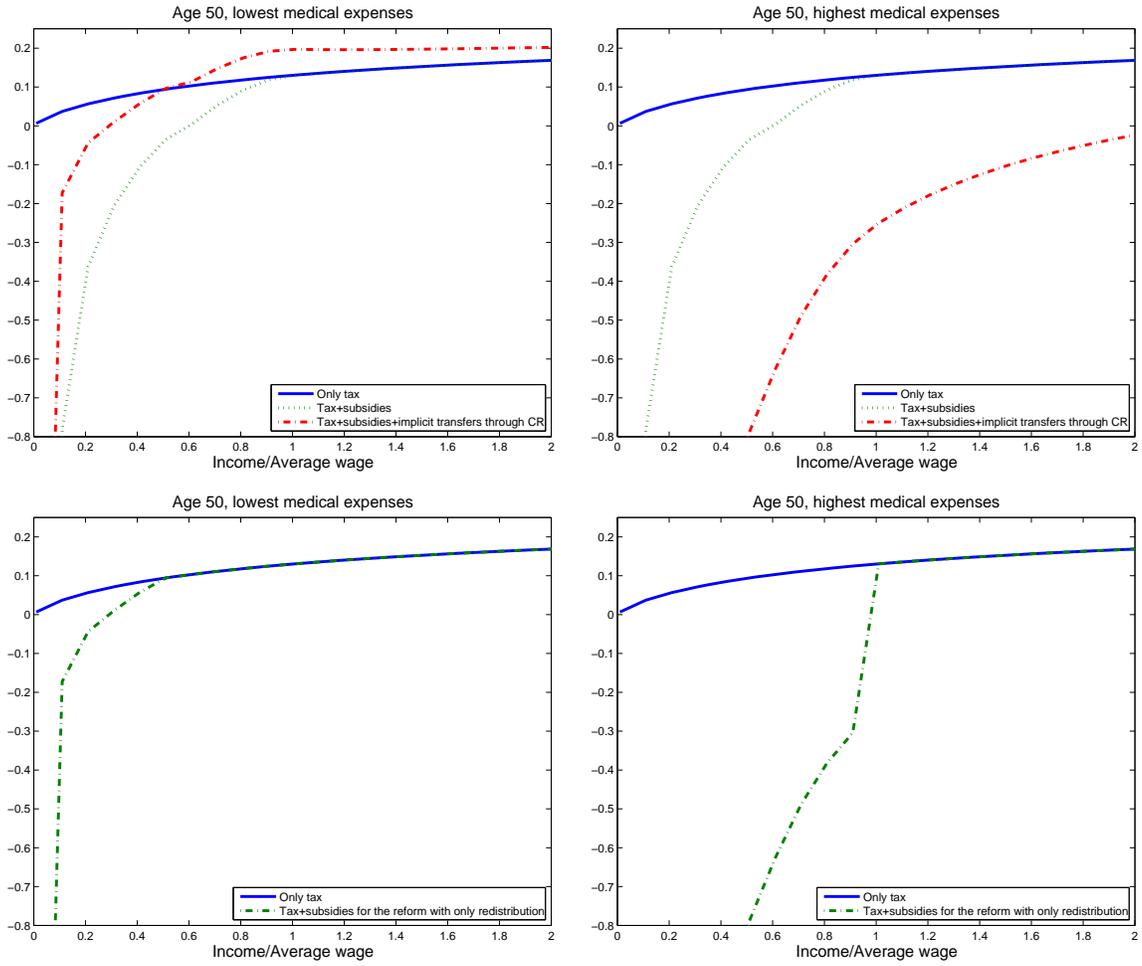
Figure 26: Implicit and explicit transfers and effective tax rates in the reformed economy

group of people pays an implicit health tax, while the later group receives an implicit health subsidy. Figure (26) shows how these additional transfers change the average effective tax rates in the economy[31]. Because implicit transfers through the community rated individual market depend on individual health expenditures, Figure (26) compares effective tax rates for people with the lowest and highest medical costs. The comparison is done using an example of a 50 year old person because for this age group the difference in medical costs is very pronounced and this makes the illustration clearer.

In all four graphs the solid line represents the average income tax people pay after the reform. The dotted line in the top two figures shows the tax rate once the subsidies are taken into account. Because insurance premiums are the same for people with high and low medical expenses, the size of the subsidy is the same for all people in the same income group. However, once implicit transfers through community rating is taken into account (as represented by dash-dotted line in the top two graphs), the effective tax rates become different for people with low and high medical expenses. For a person with the highest medical expenses the effective tax rate decreases, while for a person with the lowest medical expenses the tax rate increases.

Another observation is that while subsidies decrease effective tax rates only for people with income below 400% FPL (which corresponds to income to average wage ratio equal approximately to one), implicit transfers through community rating change effective tax rates for all categories of income. When implicit health tax is taken into account, people with low medical expenses pay more than what is implied by a pure income tax. At the same time people with high medical expenses pay less.

The bottom two graphs show how the effective tax rates change if the reform is implemented with only redistribution. In this case there is no implicit transfers through community rating. Because people with different medical expenses face different premiums, they receive subsidies of a different size. Moreover, the effective tax rate for people at low income level is the same as effective tax rates in the original reform when implicit transfers are taken into account. This means that after the reform with only redistribution implicit transfers through community rating are incorporated into explicit subsidies. However, in contrast to the original reform, the reform with only redistribution eliminates medical expenses-based transfers to people with high income. For this group of people effective taxes are the same as income taxes.

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[31]Note that both subsidies and implicit transfers through community rating only affect those who participate in the individual market. Thus all the graphs in Figure (26) are constructed for people who buy individual insurance.

9.2 Partial equilibrium

The implementation of the reform in the baseline economy leads to a decrease in the aggregate capital from 3.40 to 3.23 due to increased risk-sharing and a decline in precautionary savings. In this section we reevaluate the welfare effects of the reform in the partial equilibrium setup. Thus we consider the U.S. as an open economy that faces fixed interest rate. The results of this experiment are presented in Table 12. Under

		CEV(%)			Agg. capital
	All newborns	No high-school degree	High-school degree	College degree	
Reform	1.54	2.31	2.31	0.67	3.40
Only CR+high penalties	0.16	0.16	0.18	0.13	3.40
Only redistribution	1.68	2.34	2.45	0.83	3.40

Table 12: Welfare effect of different versions of the reform in the partial equilibrium

the assumption of partial equilibrium the results do not significantly change because the change in the aggregate capital in the general equilibrium environment was not large. Comparing to the first row of Table 10 the most noticeable changes are observed among people with college education: their CEV increases from -0.06 to 0.67. This is due to the fact that this group is the most productive and thus is most affected by the decrease in the aggregate capital observed in the general equilibrium case. However, the relative importance of the redistributive measures of the reform compared to the regulation of the individual market stays the same. As in the general equilibrium environment most of the welfare gains from the reform come from subsidies and Medicaid expansion.

9.3 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 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 13 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%[32]. When the reform induces firms to decrease contribution

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[32]The scenario when an average employer contribution rate decreases from more than 70 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.

		CEV(%)			Agg. capital
	All newborns	No high-school degree	High-school degree	College degree	
ψ does not change	0.97	2.37	1.79	-0.06	3.24
ψ decreases to 50%	0.60	2.46	1.44	-0.54	3.26

Table 13: Welfare effects of the reform under different assumptions on ESHI

rates this mostly affects people with a college degree: their CEV goes down from -0.06 to -0.54. For people with the highest educational attainment 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 buying ESHI. For people with lower educational attainment who rely less on ESHI, the welfare does not change much. Because of this the overall welfare effects of the reform are still large and positive despite a large decline in the employer contribution rate.

9.4   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, and the amount the firm offering ESHI subtracts from the wage of their workers c_E.

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 multiplicity of equilibriums becomes less of an issue. In particular, our equilibrium price tends to be invariant to the initial guess.

2. Set initial value for the parameter a_2.

3. Solve for the households' decision rules using backward induction. In the last period ($t = N$), the value function and policy functions can be solved for analytically. For every age t prior to N and for each point in the state space, we optimize with respect to savings and insurance decisions. We evaluate the value function for points outside the state space grid using a Piecewise Cubic Hermite Interpolating Polynomial (PCHIP).

4. Guess an initial asset distribution of newborns (which corresponds to the distribution of bequests).

5. Given policy functions and the distribution of newborns, simulate the households distribution using a non-stochastic method as in Young (2010). We reiterate until the distribution of bequests converges.

6. Use the distribution of households and policy functions to compute government budget deficit/surplus. Update tax function parameter a_2 and repeat steps 3-6 until the government budget is balanced. More specifically, we use function zbrent to find a_2 that balances the budget.

7. Using the distribution of households and policy functions check if market clearing conditions and zero profit conditions for insurance firms hold. If not, update r, p, and c_E and repeat steps 1-8.

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 8. As was mentioned in the main text, in the case of the original reform the multiplicity of equilibriums is not likely to be an issue; individuals' insurance decisions are less sensitive to 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.

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., 2008. Financing Medicare: A General Equilibrium Analysis. In Shoven, J.B. (Ed.), Topics in Demography and the Economy.

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

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

[7] Deaton, A., Paxson, C., 1994. Intertemporal Choice and Inequality. Journal of Political Economy 102(3), 437-467.

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

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

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

[11] Gruber, J., 1998. Health Insurance and the Labor Market. In Newhouse, J., Culyer, A. (Eds.), The Handbook of Health Economics. Amsterdam: North Holland, pp. 645-706.

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

[13] Guvenen, F., 2006. Learning Your Earning: Are Labor Income Shocks Really Very Persistent? American Economic Review 97(3), 687-712.

[14] 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.

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

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

[17] Imrohoroglu, A., 1992. The welfare Cost of Inflation Under Imperfect Insurance. Journal of Economic dynamic and Control, 16(1), 953-969.

[18] Jeske, K., Kitao, S., 2007. U.S. Tax Policy and Health Insurance Demand: Can a Regressive Policy Improve Welfare? Journal of Monetary Economics, 56(2), 210-221.

[19] Jung, J., Tran, C., 2009. Health Care Financing Over the Life Cycle, Universal Medical Vouchers and Welfare. Mimeo, University of New South Wales.

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

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

[22] 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.

[23] Kennickel, A., 2003. A Rolling Tide: Changes in the Distribution of Wealth in the U.S., 1989-2001. Mimeo, Federal Reserve Board

[24] Kopecky, K., Koreshkova, T., 2009. The Impact of Medical and Nursing Home Expenses and Social Insurance Policies on Savings and Inequality. Mimeo, University of Western Ontario.

[25] Palumbo, M., 1999. Uncertain Medical Expenses and Precautionary Saving in the End of Life Cycle. Review of Economic Studies 66(2), 395-421.

[26] Pauly, M., 1970. The Welfare Economics of Community Rating. The Journal of Risk and Insurance 37(3), 407-418.

[27] Pauly, M., 2010. Health Reform Without Side Effects. Hoover Institution Press Publication No. 580.

[28] Sholz, J.K., Seshadri, A., Khitatrakun, S., 2006. Are Americans Saving Optimally for Retirement? Journal of Political Economy, 114(4), 607-643.

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

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

[31] 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.