Journal of Monetary Economics 56 (2009) 210–221

Contents lists available at ScienceDirect

Journal of Monetary Economics

journal homepage: www.elsevier.com/locate/jme

U.S. tax policy and health insurance demand: Can a regressive policy improve welfare?

Karsten Jeske [a], Sagiri Kitao [b,*]

[a] Mellon Capital Management, Investment Research, 50 Fremont Street, Suite 3900, San Francisco, CA 94105, USA
[b] Marshall School of Business, University of Southern California, 3670 Trousdale Parkway, Los Angeles, CA 90019, USA

ARTICLE INFO

Article history:
Received 19 November 2007
Received in revised form
9 December 2008
Accepted 10 December 2008
Available online 24 December 2008

JEL classification:
E21
E62
I10

Keywords:
Health insurance
Risk-sharing
Tax policy

ABSTRACT

The U.S. tax policy on health insurance is regressive because it subsidizes only those offered group insurance through their employers, who also tend to have a relatively high income. Moreover, the subsidy takes the form of deductions from the progressive income tax system giving high income earners a larger subsidy. To understand the effect of the policy, we construct a dynamic general equilibrium model with heterogenous agents and an endogenous demand for health insurance. A complete removal of the subsidy may lead to a partial collapse of the group insurance market, reduce the insurance coverage and deteriorate welfare. There is, however, room for improving the coverage and welfare by extending a refundable credit to the individual insurance market.

1. Introduction

The premium for employer-based health insurance in the U.S. can be both income and payroll tax deductible while individual health insurance (IHI) purchased outside the workplace does not offer this tax break. This tax policy is regressive in two ways. First, data indicate that labor income is positively correlated with the access to employer-based health insurance, thus workers with higher earnings are more likely to enjoy the tax break. Second, conditional on having access to employer-based health insurance, the progressive income tax code in the U.S. makes the policy regressive because high income individuals in a higher marginal tax bracket receive a larger tax break than those in a lower tax bracket.

We show that despite its regressiveness the deduction policy is welfare improving. Our result relies on the key difference between employer-based health insurance and IHI. The former, also called group health insurance (GHI), is required by law not to discriminate among employees based on health status, while in the latter insurance companies have an incentive to price-discriminate and offer favorable terms to healthy individuals. Insurance outside the workplace, therefore, offers less pooling and less risk-sharing. Pooling in GHI, however, relies on healthy agents, who are sensitive to the changes in the cost of insurance, to voluntarily cross-subsidize agents with higher health expenditures. Eliminating the tax subsidy can trigger a spiral of adverse selection and a rise in the group insurance premium. We show that completely abolishing the current policy can collapse the pooling in the GHI market and result in a welfare loss due to an increased exposure to health expenditure risks.

* Corresponding author. Tel.: +1 213 7406884; fax: +1 213 7406650.
E-mail address: skitao@marshall.usc.edu (S. Kitao).

0304-3932/$ - see front matter
doi:10.1016/j.jmoneco.2008.12.004

Our work is a contribution to the literature of dynamic equilibrium models with heterogenous agents in incomplete markets.[1] We add to this literature by incorporating idiosyncratic health expenditure risk which is partially insurable according to the endogenous insurance decisions. Our paper is also related to the literature on fiscal policy in incomplete markets.[2] Several recent papers studied the role of health and medical expenditures in Aiyagari–Bewley type models. Livshits et al. (2007) and Chatterjee et al. (2007) argue that health expenditure shocks are an important source of consumer bankruptcies. Hubbard et al. (1995) add health expenditure risk and study the role of social safety net in discouraging savings by low income households. Palumbo (1999), De Nardi et al. (2005) and Scholz et al. (2006) incorporate heterogeneity in medical expenses to understand the pattern of retirement savings. Our model, differently from these papers, endogenizes the health insurance decision, rather than treating households' out-of-pocket health expenditures as an exogenous shock.[3] We take into account important general equilibrium effects of a reform, including the interaction between the health insurance demand and precautionary savings and the effect on the fiscal variables. We also quantify the welfare effect of reforms by computing the transition dynamics.

The paper proceeds as follows. Section 2 introduces a simple two-period model to highlight the intuition of our results. Section 3 introduces the full dynamic model and Section 4 details the parameterizations of the model. Section 5 presents the numerical results and the last section concludes.[4]

2. A simple two-period model

We present a two-period model with endogenous health insurance demand to provide the intuition of our results. We demonstrate that changing the tax treatment of the health insurance premium has ambiguous welfare effects. Since the subsidy is regressive, it impedes risk-sharing among agents that face income risks. A subsidy, however, can help overcome the adverse selection in the group insurance market and enhance risk-sharing. The simple model highlights this tradeoff faced by a benevolent government.

Suppose there are two firms and a continuum of individuals who live for two periods and consume only in the second period. Assume that ex ante identical agents face an idiosyncratic health risk. With some probability, agents will fall into a bad health state and must pay health expenditures equivalent to a unit of the consumption good in period 2. In period 1, agents observe a noisy signal of their health expenditure shock. Specifically, a measure $\frac{1}{2}$ has a probability p^H of suffering from the expenditure shock and the remaining agents have a probability p^L, where $p^H > p^L$. Assume that all agents have access to the market of IHI where a competitive and risk-neutral insurance company offers an insurance contracts at price p^i based on the observed signal $i \in \{L, H\}$. Notice that all risk-averse agents will choose to sign up for insurance.

Agents receive a life-time labor income y from their employers. In period 1, one half of the agents are matched with a firm of type 1 that offers a GHI contract at price p^{GHI} to all employees independent of their signals. Workers in firm 1, therefore, have a choice between GHI and IHI. The other half of the agents work in firm 2 that does not offer such a group insurance and thus have access only to IHI.

Consider a policy of providing a subsidy s for the purchase of a GHI contract. Let the subsidy be $s = (p^H - p^L)/2$. One can show that all agents in firm 1, even those with signal p^L, sign up for GHI.[5] The average expenditure per agent is $(p^H + p^L)/2$ and the premium is $p^{GHI} = (p^H + p^L)/2 - s = p^L$, just low enough to make even the healthy individuals with p^L indifferent between GHI and IHI. For any subsidy value smaller than s, healthy agents would leave the GHI contract and go to the individual market.

Assume that the government imposes a lump-sum tax on workers in firm 1 to finance the cost of subsidy, i.e. $\tau = s$. Such a policy has no effect on workers in firm 2 so that we can focus on the redistributional effect of the policy among those with the GHI offer in firm 1. The subsidy removes a mean-preserving spread in consumption, thus the welfare effect on risk-averse agents is unambiguously positive. To quantify the welfare effect of such a policy, assume that agents derive utility from the consumption in the second period according to the preference $u(c) = c^{1-\sigma}/(1-\sigma)$ with $\sigma = 3$, earn the life-time income $y = 2$. Suppose $p^L = 0.1$ and $p^H = 0.15$. The welfare effect measured in terms of consumption equivalent variation is 0.03%, but the gain rises to 0.11% with $p^H = 0.20$ and 0.46% with $p^H = 0.30$. The magnitude of the welfare gain depends on the variance of the health shocks that the policy helps alleviate: the greater the uncertainty of the health status, the larger are the potential welfare gains of the subsidy.

Income uncertainty and regressive policy: In addition to the uncertainty about health expenditures, assume that agents are heterogeneous in income as well. Firm 1 pays a wage y_1 and firm 2 pays y_2, where $y_1 > y_2$, i.e. people with a GHI offer

[1] The classic work of Bewley (1986), İmrohoroğlu (1989), Huggett (1993) and Aiyagari (1994) pioneered the literature. For more recent work, see, for example, Fernández-Villaverde and Krueger (2006) and Krueger and Perri (2005).

[2] See for example Domeij and Heathcote (2004), Castañeda et al. (2003), Conesa and Krueger (2006) and Conesa et al. (forthcoming).

[3] Papers that deal with health insurance policy outside of a heterogenous agent framework include Gruber (2004), who measures the effects of different subsidy policies for non-group insurance on the fraction of uninsured, using a micro-simulation model. Kotlikoff (1989) builds an OLG model where households face idiosyncratic health shocks and studies the effect of medical expenditures on precautionary savings. He considers different insurance schemes, which agents take as exogenously given.

[4] Jeske and Kitao (2008) that accompanies this paper contains supplementary materials that are not included in this paper due to space constraints. It provides more detailed description of the model's equilibrium, the calibration strategy and results, as well as a variety of sensitivity analysis and robustness studies of our model results and discussion of possible extensions of the current paper.

[5] For simplicity we assume that whenever agents are indifferent between the two contracts they pick GHI.

Table 1
Welfare effect of subsidy and effect of income uncertainty.

	Case A (%)	Case B (%)
All (ex ante)	+0.024	−0.425
Offered group insurance	+1.462	+1.132
Not offered group insurance	−1.354	−1.354

Notes: In case A (no income uncertainty), the income is constant at 2.0. In case B (income uncertainty), the incomes are $y_1 = 2.0$ and $y_2 = 2.5$ with equal probabilities. Welfare effects are expressed in terms of consumption equivalence.

earn more.[6] Notice that since people earn more at firm 1, the subsidy is a regressive policy from the perspective of an agent before the realization of the income shock. Consider the same policy of providing the subsidy for GHI, namely a subsidy s just large enough to make the agents with a low health risk sign up for the contract.

Now assume that the subsidy is financed by a lump-sum tax on every agent in the economy, even those in firm 2. With p^L and p^H set at 0.1 and 0.2, respectively, the welfare effect of the subsidy depends on the degree of income uncertainty as shown in Table 1. If the wages in the two firms are identical as in case A, the positive effect of increased risk-sharing in firm 1 dominates, causing an ex ante welfare gain. In contrast, if the income in firm 1 is large enough as in case B, the welfare loss from lower risk-sharing over income uncertainty dominates ex ante welfare. The marginal utility of workers in firm 1 with high income is lower and the welfare gain from pooling the risk in the GHI contract is smaller than the welfare loss of agents in firm 2.

As this basic model demonstrates, the welfare effect of the group insurance subsidy is ambiguous. Determining the welfare effect of the current tax policy requires a quantitative exercise based on a carefully calibrated dynamic model. The basic model provides intuition, but fails to capture key aspects of the macro-economy, the magnitude and persistence of the health risks and income uncertainty that individuals face over the life-cycle and institutions that make the insurance markets in the U.S. unique. The next section will present a quantitative dynamic general equilibrium model that achieves the task.

3. The full dynamic model

This section presents the dynamic general equilibrium model, which will be used to study the effects of current and alternative insurance policies.

3.1. Demographics, preferences and endowment

The economy is populated by two generations of agents, the young and the old. Young agents supply labor and earn wage income and old agents are retired from market work. Young agents become "old" with probability ρ_o every period and old agents die and leave the economy with probability ρ_d. The population is assumed to remain constant. Old agents who die and leave the model are replaced by the entry of new young agents. Bequests are accidental and they are transferred to the entire population in a lump-sum manner, denoted by b.

Preferences are time-separable with a constant subjective discount factor β. Instantaneous utility from consumption is defined as $u(c) = c^{1-\sigma}/(1-\sigma)$. Young agents supply labor inelastically and earn the labor income wz, that depends on an idiosyncratic stochastic component z and the wage rate w. Productivity shock z follows a Markov process that evolves jointly with the probability of being offered employer-based health insurance, which is discussed in Section 3.2.[7]

3.2. Health and health insurance

In each period, agents face an idiosyncratic health expenditure shock x, which follows a finite-state generation-specific Markov process. Young agents have access to the health insurance market, where they can purchase a contract that covers a fraction $q(x)$ of realized medical expenditures x. They purchase either IHI or GHI. While everyone has access to the individual market, GHI is available only if such a benefit is offered by the employer. The probability of receiving a GHI offer evolves jointly with the labor productivity shock z. As discussed in the calibration section, firms' offer rates differ significantly across earnings groups and the availability of such benefits is highly persistent while the degree of persistence varies by the earnings level.

GHI costs a premium p, which does not depend on any individual states, including current health expenditures x. This accounts for the practice that GHI does not price-discriminate among the insured. A fraction $\psi \in [0,1]$ of the premium is paid by the employer as a subsidy. In the IHI market, the premium is given by $p_m(x)$ and depends on the current health expenditure state x. This reflects the practice that in contrast to the group insurance market, there is price differentiation.

[6] In the panel data presented below, people with a GHI offer have a labor income about 2.15 times higher than those without a GHI offer.
[7] Newly born young agents make a draw from the unconditional distribution of this process. The initial assets of the entrants are assumed to be zero.

IHI contracts are often contingent on age, specific habits (such as smoking) and other conditions and can rule out payment for preexisting conditions.

Health insurance companies are competitive and they are free to offer contracts to different individuals in both group and individual markets. Therefore no-profit condition is satisfied in each type of contract and there is no cross-subsidy across different contracts. The premiums for GHI p and IHI $p_m(x)$ for each health status are determined as the expected expenditures for each contract plus a proportional markup denoted as ϕ.

All old agents are enrolled in the Medicare program and assumed not to purchase GHI or IHI. Each old agent pays a fixed premium p_{med} every period and the program will cover a fraction $q_{med}(x)$ of the medical expenditures x. Young agents pay the Medicare tax at rate τ_{med} on earnings.

3.3. *Firms and production technology*

A continuum of competitive firms operate a technology with constant returns to scale, $F(K,L) = AK^{\alpha}L^{1-\alpha}$, where K and L are the aggregate capital and labor efficiency units and A is the total factor productivity, which is assumed to be constant. Capital depreciates at rate δ. If a firm offers GHI, a fraction $\psi \in [0,1]$ of the insurance premium is paid at the firm level. The firm needs to adjust the wage to ensure the zero profit condition, and subtracts the cost c_E from the wage rate, which is just enough to cover the total premium cost for the firm.[8]

3.4. *The government*

The government levies tax on income and consumption to finance expenditures G and the social insurance program. The government budget is balanced every period. Agents' income is taxed according to a progressive tax function $T(\cdot)$ and consumption is taxed at a proportional rate τ_c. The social insurance guarantees a minimum level of consumption $\bar{c}$ for every agent by supplementing the income in case an agent's disposable assets fall below $\bar{c}$, as in Hubbard et al. (1995). Social security and Medicare systems are self-financed by proportional taxes τ_{ss} and τ_{med} on labor income and Medicare premium p_{med}. Each old agent receives the social security benefit ss every period.

3.5. *Households*

The state vector of a young agent is given by $s_y = (a, z, x, i_{HI}, i_E)$, where a denotes assets, z the idiosyncratic productivity shock, x the idiosyncratic health expenditure shock from the last period that has to be paid in the current period, and i_{HI} and i_E indicator functions for the health insurance coverage and the availability of a GHI offer.

The timing of events is as follows. Young agents observe the state s_y at the beginning of a period, pay last period's health care bill x, make the optimal decision of consumption c and savings $a' \geqslant 0$, pay taxes, receive transfers and decide on whether to be covered by health insurance, $i'_{HI} \in \{0,1\}$. After they have made all decisions, this period's health expenditure shock x', productivity shock z' and offer status i'_E are revealed. They also learn next period's generation, i.e. whether they retire or not. Agents make the health insurance decision i'_{HI} after they find out whether the employer offers GHI but before the health expenditure shock for the current period x' is known. Agents pay an insurance premium one period before the expenditure payment occurs.

The state vector of an old agent is given by $s_o = (a, x)$.[9] The maximization problem is written in a recursive form with value functions V_j, where the subscript $j = y$ or o denotes young or old generation.

Young agents' problem:

$$V_y(s_y) = \max_{c,a',i'_{HI}} \{u(c) + \beta\{(1-\rho_o)E[V_y(s'_y)] + \rho_o E[V_o(s'_o)]\}\} \tag{1}$$

subject to

$$(1+\tau_c)c + a' + (1 - i_{HI}\cdot q(x))x = \tilde{w}z - \tilde{p} + (1+r)(a+b) - Tax + T_{SI} \tag{2}$$

where

$$\tilde{w} = \begin{cases} (1 - 0.5(\tau_{med} + \tau_{ss}))w & \text{if } i_E = 0 \\ (1 - 0.5(\tau_{med} + \tau_{ss}))(w - c_E) & \text{if } i_E = 1 \end{cases} \tag{3}$$

[8] The adjusted wage is given as $w_E = w - c_E$, where $w = F_L(K,L)$. c_E, the employer's cost of health insurance per efficiency unit, is defined as $c_E = [\mu_E^{ins} p\psi]/[\sum_{k=1}^{N_z} z_k \bar{p}_{Z,E}(k|i_E = 1)]$, where μ_E^{ins} is the fraction of workers that purchase GHI, conditional on being offered such benefits. $i_E = 1$ is an indicator function for the group insurance offer, and $\bar{p}_{Z,E}(k|i_E = 1)$ is the stationary probability of drawing productivity z_k conditional on $i_E = 1$.

[9] In the actual computation, old agents who just retired in the previous period are distinguished from the rest of the old agents. Their health bills from the previous year incurred as young agents are covered by the insurance if $i_{HI} = 1$ and not by Medicare. Therefore, for this age group, the state vector is given by (a, x, i_{HI}).

$$\tilde{p} = \begin{cases} p \cdot (1-\psi) & \text{if } i'_{HI} = 1 \text{ and } i_E = 1 \\ p_m(x) & \text{if } i'_{HI} = 1 \text{ and } i_E = 0 \\ 0 & \text{if } i'_{HI} = 0 \end{cases} \tag{4}$$

$$Tax = T(y) + 0.5(\tau_{med} + \tau_{ss})(\tilde{w}z - i_E \cdot \tilde{p}) \tag{5}$$

$$y = \max\{\tilde{w}z + r(a+b) - i_E \cdot \tilde{p}, 0\} \tag{6}$$

$$T_{SI} = \max\{0, (1+\tau_c)\bar{c} + (1 - i_{HI} \cdot q(x))x + T(\tilde{y}) - \tilde{w}z - (1+r)(a+b)\} \tag{7}$$

$$\tilde{y} = \tilde{w}z + r(a+b)$$

Old agents' problem:

$$V_o(s_o) = \max_{c,a'}\{u(c) + \beta(1-\rho_d)E[V_o(s'_o)]\} \tag{8}$$

subject to

$$(1+\tau_c)c + a' + (1 - q_{med}(x))x = ss - p_{med} + (1+r)(a+b) - T(r(a+b)) + T_{SI} \tag{9}$$

$$T_{SI} = \max\{0, (1+\tau_c)\bar{c} + (1 - q_{med}(x))x + p_{med} - ss - (1+r)(a+b) + T(r(a+b))\} \tag{10}$$

Eq. (2) is the budget constraint of a young agent. Consumption, saving, out-of-pocket medical expenditures and payment for the insurance premium are financed by labor income, assets, net of income and payroll taxes *Tax* plus social insurance transfer T_{SI} if applicable. The marginal cost of the insurance premium $\tilde{p}$ depends on the state i_E as given in (4).

4. Calibration

In this section, parametrization of the model is outlined.[10] Table 2 summarizes the values of key parameters of the model.

4.1. Demographics, preferences and technology

The model period is one year. Young agents are between the ages of 20 and 64, and old agents are 65 and over. Young agents' probability of aging ρ_o is set at $\frac{1}{45}$ so that they stay for an average of 45 years in the labor force before retirement. The death probability ρ_d is calibrated so that old agents above age 65 constitute 20% of the population, based on the panel data set discussed below. Every period a measure $\rho_d\rho_o/(\rho_d + \rho_o)$ of young agents enter the economy to replace the deceased old agents.

The subjective discount factor β is calibrated to achieve an aggregate capital output ratio of 3. The risk aversion parameter σ is set at 3. Total factor productivity A is normalized so that the average labor income equals one in the benchmark economy. The capital share α is set at 0.33 and the depreciation rate δ at 0.06.

4.2. Endowment, health insurance and health expenditures

For labor endowment, health expenditure shocks and health insurance, we use earnings and health data from a single source, the Medical Expenditure Panel Survey (MEPS). The MEPS is based on a series of national surveys conducted by the U.S. Agency for Health Care Research and Quality. It consists of two-year panels since 1996/1997 and includes data on demographics, income and most importantly health expenditures and insurance.[11]

The endowment process is calibrated jointly with the stochastic probability of being offered employer-based health insurance. Wage income of all heads of households (both male and female) are used to calibrate the earnings distribution. The process is specified over five states and each agent belongs to one of the five bins of equal size. Table 3 shows the stationary distribution. There is an asymmetry in the earnings distribution for the agents with a GHI offer and those without. High earners are more likely to have a GHI offer.

The process of health expenditure shocks is estimated using the MEPS data. We use seven states for the expenditures with the bins of size $(20\% \times 4, 15\%, 4\%, 1\%)$, separately for young and old generations. Young agents' expenditure grids are given as $\mathbb{X}_y = \{>0.000, 0.006, 0.022, 0.061, 0.171, 0.500, 1.594\}$, which are the mean expenditures in each of the seven bins in the first year of the last panel in 2003, normalized in terms of the average earnings. The old generation's expenditure grids are given as $\mathbb{X}_o = \{0.007, 0.044, 0.096, 0.185, 0.418, 1.036, 2.265\}$. Unconditional expectations of x_y and x_o are 7% and 18% of average earnings or about \$2,200 and \$6,300 in 2003 dollars.

[10] Jeske and Kitao (2008) provide a complete description of the calibration and details that are not presented here due to space constraints.

[11] We drop the first three panels and use five panels up to 2003/2004 because one crucial variable that is necessary to determine the joint endowment and insurance offer process is missing in those panels.

Table 2
Parameters of the model.

Parameter	Description	Values
Demographics		
ρ_o	Aging probability	2.22%
ρ_d	Death probability after retirement	8.89%
Preferences		
β	Discount factor	0.934
σ	Relative risk aversion	3.0
Technology and production		
α	Capital share	0.33
δ	Depreciation rate of capital	0.06
Government		
$\{a_0, a_1, a_2\}$	Income tax parameters (progressive part)	$\{0.258, 0.768, 0.716\}$
τ_y	Income tax parameter (proportional part)	4.46%
τ_c	Consumption tax rate	5.67%
$\bar{c}$	Social insurance minimum consumption	23.9% of average earnings ($7,832)
τ_{ss}	Social security tax rate	10.61%
	Social security replacement rate	45%
τ_{med}	Medicare tax rate	1.51%
p_{med}	Medicare premium	2.11% of per capita output
Health insurance		
p	Group insurance premium	6.2% of average earnings ($2,018)
ψ	Firms' group insurance subsidy	80%
ϕ	Premium mark-up	11%

Table 3
Stationary distribution of earnings and group insurance offer.

Earnings grid number	1	2	3	4	5	Total
Group insurance offered (%)	3.1	11.3	14.9	16.4	16.9	62.6
Group insurance not offered (%)	17.1	8.6	5.0	3.6	3.1	37.4

4.3. Health insurance

The coverage ratios of health insurance are calibrated using the same MEPS panels. We estimate a polynomial $q(x)$, the coverage ratio as a function of expenditures x. The mark-up on the insurance premium is set at 11% based on the study in Kahn et al. (2005).

The group insurance premium p is determined in equilibrium to ensure zero profit of the insurance company in the group insurance market. The average annual premium of an employer-based health insurance was $2,051 in 1997 or about 7% of average annual labor income (Sommers, 2002). Model simulations yield a premium of 6.2% of average annual labor income. A firm offering employer-based health insurance pays a fraction ψ of the premium. According to the MEPS, the average percentage of total premium paid by employees varies between 11% and 23% depending on the industry (Sommers, 2002) and the fraction $(1-\psi)$ is set to 20%.

With regards to IHI, the insurance company sets $p_m(x)$ to satisfy no-profit condition for each contract, that is, $p_m(x) = (1+\phi)E\{q(x')x'|x\}/(1+r)$. In the benchmark model, the premiums $p_m(x)$ for the seven expenditure states are given as $\{0.0156, 0.0245, 0.0488, 0.0860, 0.1221, 0.2358, 0.4905\}$, expressed in terms of average earnings.

4.4. Government

Expenditures and taxation: The exogenous government expenditure G is set to 18% of GDP in the benchmark economy. The consumption tax rate τ_c is 5.67%, based on Mendoza et al. (1994).

The income tax function consists of two parts, a non-linear progressive income tax and a proportional income tax. The non-linear part captures the progressive income tax schedule in the U.S. following the functional form studied by Gouveia and Strauss (1994), while the proportional part stands in for all other taxes, that is, non-income and non-consumption

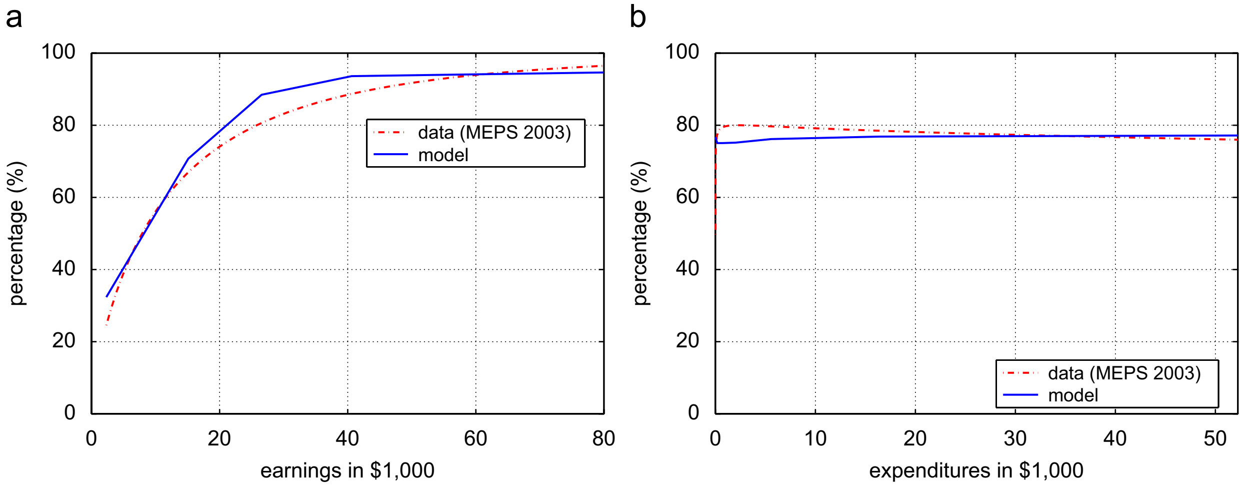

Fig. 1. Health insurance take-up ratios: (a) over earnings z; (b) over expenditures x_y.

taxes, which for simplicity are lumped together into a single proportional tax τ_y levied on income. The tax function is given as $T(y) = a_0\{y - (y^{-a_1} + a_2)^{-1/a_1}\} + \tau_y y$. Parameter a_0 is the limit of marginal taxes in the progressive part as income goes to infinity, a_1 determines the curvature of marginal taxes and a_2 is a scaling parameter. To preserve the shape of the tax function estimated by Gouveia and Strauss, their parameter estimates $\{a_{0,}a_1\} = \{0.258, 0.768\}$ are used and the scaling parameter a_2 is chosen within the model such that the share of government expenditures raised by the progressive part of the tax function equals 65%, which matches the fraction of total revenues financed by income tax (OECD Revenue Statistics, 2002). τ_y in the proportional term is chosen in equilibrium to balance the overall government budget.

Social insurance, social security and Medicare: The minimum consumption floor $\bar{c}$ for the social insurance is calibrated so that the model achieves the target share of households with a low level of assets. Households with net worth of less than $5,000 constitute 20.0% (Kennickell, 2003, averaged over 1989–2001 SCF data) and this fraction is used as a target to match in the benchmark economy.

The replacement rate of social security benefit is set at 45% based on the study by Whitehouse (2003). In equilibrium, the social security tax τ_{ss} is adjusted to equate the total benefit payment with the total social security tax revenues.

Every old agent is assumed to be enrolled in Medicare Part A and Part B. MEPS data are used to calculate the coverage ratio $q_{med}(x)$ of Medicare. The annual Medicare premium for Part B is $799.20 in 2004 or about 2.11% of GDP and we use the ratio. Medicare tax rate τ_{med} is determined so that the Medicare system is self-financed.

5. Numerical results

In this section, we will first discuss the features of our benchmark model. Second, the effects of a policy to eliminate the current subsidy are analyzed to understand the role of the policy. Finally, three alternative policies are studied.

5.1. Benchmark model

Although the model is not calibrated to directly target and generate the patterns of health insurance coverage, our model succeeds in matching them fairly well not only qualitatively but in most cases also quantitatively. The take-up ratio, defined as the share of agents holding health insurance, is 75.7% among all young agents in our model (73.1% in the data) and 35.5% conditional on not being offered GHI (34.8% in the data). Fig. 1(a) displays the take-up ratios of the model over earnings with the same statistics from the MEPS data.[12] Both in the data and model, the take-up ratios increase in earnings. Agents with higher earnings are more likely to be offered group insurance and very few agents in the lowest earnings level receive such a benefit, which contributes to the lower take-up ratio among low-earnings agents. Many of them have a low level of assets and are more likely to be eligible for the social insurance. In case the agents face a high expenditure shock and can only purchase IHI at a high premium, some may choose to remain uninsured in the hope of having the health cost be covered by the government through the social insurance.

[12] We estimate the empirical take-up ratios over earnings via a probit model on three regressors: a constant, log of earnings and squared log earnings. Likewise for the plots over expenditures we use a constant log of expenditures and squared log expenditures.

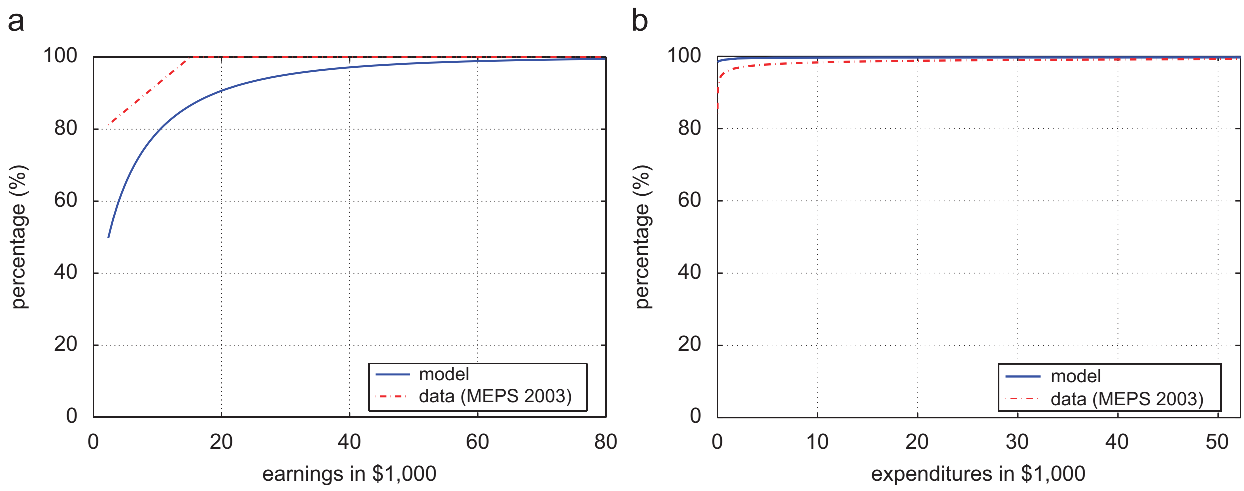

Fig. 2. Health insurance take-up ratios for agents with GHI offer: (a) over earnings z; (b) over expenditures x_y.

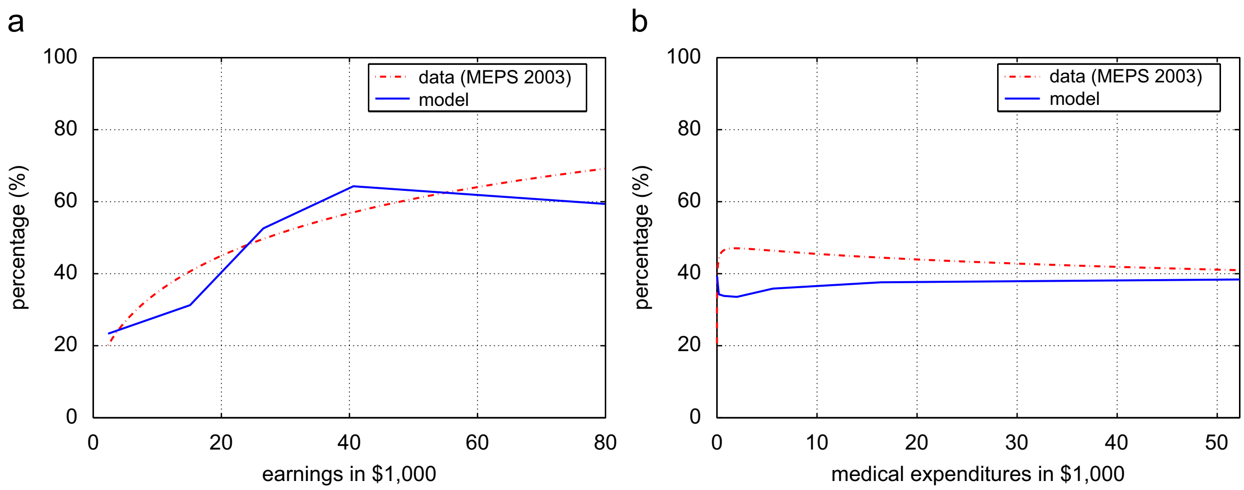

Fig. 3. Health insurance take-up ratios for agents without GHI offer: (a) over earnings z; (b) over expenditures x_y.

Fig. 1(b) displays the take-up ratios over health expenditures. The data show a fairly flat take-up ratio in the range of 70–80% except for the agents with very low expenditures. Our model also generates a flat pattern of take-up ratios, although the model is slightly off at the very low end, where the data exhibit a drop in the coverage. One possible reason for this difference is our assumption that all the employers pay 80% of the premium, which is based on the average in the data. In practice, however, different firms cover a varying fraction of the premium and the data may capture some of those agents not taking-up with a less generous employer subsidy. The healthiest agents with relatively low expected expenditures may choose not to be insured if the employer subsidy is sufficiently low.

Figs. 2(a) and (b) plot take-up ratios over earnings and expenditures for those offered GHI. The take-up ratio is very high across different levels of both earnings and expenditures. Group insurance is an attractive deal given the firm's subsidy and the tax break. The take-up ratio falls slightly among agents with very low earnings, some of whom may expect to be covered by the Medicaid (social insurance in our model). The model somewhat overstates the health insurance demand among them and our abstraction from heterogeneous subsidy rates may help explain the difference. Also evident in Fig. 2(b) is that the take-up ratio does not vary much over expenditures, both in the data and in the model.

Finally, Figs. 3(a) and (b) plot take-up ratios for those not offered GHI. Both over earnings and expenditures the model replicates the empirical take-up ratios fairly well, most of the time within 10 percentage points. If agents face higher health expenditures, the demand for insurance would be high. At the same time, however, the premium will reflect the higher expected cost of coverage in the individual insurance market, which offsets the rise in demand.

Table 4
Policy experiments.

	Benchmark	A	B	C	D
Group insurance premium	\$2,018	\$5,316	\$2,013	\$2,017	\$2,016
Take-up ratio: all	75.7%	48.4%	76.0%	89.8%	94.5%
Take-up ratio: group insurance not offered	35.5%	38.0%	35.4%	73.8%	86.7%
Take-up ratio: group insurance offered	99.0%	57.4%	99.6%	99.0%	99.1%
Purchase group insurance	99.0%	17.6%	99.6%	99.0%	99.1%
Purchase individual insurance	0.0%	39.8%	0.0%	0.0%	0.0%
Aggregate capital	–	+0.81%	−0.29%	−0.69%	−1.77%
Aggregate consumption	–	+0.38%	−0.09%	−0.27%	−0.62%
Interest rate	4.99%	4.93%	5.02%	5.05%	5.13%
Wage rate	–	+0.27%	−0.09%	−0.23%	−0.59%
Income tax rate τ_y	4.46%	3.74%	4.46%	4.72%	5.11%
Social insurance covered (% of population)	6.34%	6.55%	6.34%	6.24%	6.15%

Notes: Policy A eliminates tax deductibility of group insurance premium. Policy B provides a lump-sum subsidy for the group insurance. Policies C and D provide tax deductibility and refundable credit for individual insurance, respectively.

5.2. *Policy experiments*

We now conduct experiments to study the effect of health insurance policies. In the experiments, the level of government expenditure G is fixed and the proportional tax rate τ_y is adjusted to balance the government budget.[13]

In each experiment, a steady state implied by the new policy is computed first and then the transition dynamics are computed. In the latter, we assume that in period 0, the economy is in the steady state of the benchmark economy. In period 1, an unanticipated change of the policy is announced and implemented and the economy starts to make a transition to the new steady state. Throughout the transition, the proportional tax rate τ_y as well as payroll taxes τ_{ss} and τ_{med} are adjusted to balance the overall budget of the government, social security and Medicare, respectively. The GHI premium also changes as the insurance demand and the decomposition of the insured evolve over time.

In order to assess the welfare effect of a reform, the consumption equivalent variation is computed. It measures an increment in percentage of consumption in every state of the world that has to be given to the agent so that he is indifferent between remaining in the benchmark and moving to another economy which is about to make a transition to the new steady state.

5.2.1. *Abolishing tax deductibility of group insurance premium (Policy A)*

In order to understand the economic and welfare effects of the current health insurance policy, we ask what the agents would do if there was no such policy. The experiment invokes a radical change—the government abolishes the entire deductibility of the group insurance premium for both income and payroll tax purposes. Taxes are now collected on the entire portion of the premium, including the employer-paid portion. Hence, the taxable income is given as $y = \tilde{w}z + r(a+b) + i_E i'_{HI}\psi p$.

We allow supply side effects as a result of policy changes, both on the extensive and intensive margins, i.e. the probability of GHI offers and firms' subsidy rate.[14] On the intensive margin, we assume that employers pay ψ^m for every dollar of premium above the benchmark premium p^{bench}, that is, employers pay a total subsidy worth $\psi p^{bench} + \psi^m(p - p^{bench})$, where p is the new premium. This specification is motivated by the observation that at the margin employers tend to carry a smaller share of the GHI premium, i.e. $\psi^m < \psi$. Gruber and McKnight (2003) argue that "the key dimension along which employers appear to be adjusting their health insurance spending is through the generosity of what they contribute." Sommers (2005) argues that wage stickiness prevents firms from reducing wages when the premium increases. We chose to set ψ^m at 50%.[15]

For the extensive margin, to gauge the effect on the offer probability we rely on work by Gruber and Lettau (2004) who run a probit model of GHI offers on the after-tax price of health insurance. They estimate that taking away the income and payroll tax subsidy will reduce the share of workers that are offered GHI by 15.5%. The transition matrix of offer probabilities is adjusted to achieve this ratio.

[13] Medicare and social security systems remain self-financed and the Medicare tax τ_{med} and the social security tax τ_{ss} are adjusted to balance the budget of the programs.

[14] In Jeske and Kitao (2008) we report the results without supply side effects and with effects on only the extensive or the intensive margin. They are qualitatively very similar.

[15] Simon (2005) estimates that the employers pass 75% of the premium hike as increased employee contributions (i.e. 25% paid by employers), but we regard this estimate of employer contribution is too low for our model given that the study is focused on small firms that tend to be less generous with their group insurance subsidy.

Table 5
Welfare effects of policy experiments.

	A (%)	B (%)	C (%)	D (%)
All (young)	−0.34	+0.07	+0.24	+0.58
Young with group insurance offer	−0.46	+0.06	+0.16	+0.37
Young without group insurance offer	−0.12	+0.09	+0.38	+0.95
Fraction of young agents with welfare gain	19.2	79.9	79.8	99.3

Note: Welfare effects in the top three rows are expressed in terms of consumption equivalence.

Column A of Table 4 summarizes the results of the policy experiment. The upper section of the table displays statistics on health insurance. The lower section displays changes in aggregate variables and prices. Removing the tax subsidy leads to a partial collapse of the group insurance market. The take-up ratio conditional on being offered group insurance falls from 99.0% in the benchmark to 57.4%. About two-thirds of those who remain insured opt out of the GHI market and purchase IHI. Those are the agents in a better health condition who face a lower premium in the individual insurance market. The exit of healthy agents out of the group insurance market significantly deteriorates the health quality in the pool of the insured and the price of the group insurance premium soars to $5,316 from the benchmark price of $2,018. The overall coverage ratio falls by more than a third to 48.4%. An increased exposure to the health expenditure shocks raises the precautionary savings demand and the aggregate capital increases by 0.81%. The magnitude of the increase in capital may seem relatively small given the large size of the decrease in the coverage. Many agents who become uninsured by declining the group insurance offer are healthy and less concerned about expenditure shocks in the immediate future given the persistence of the expenditure process. The number of agents who are eligible for the social insurance coverage will rise from 6.34% of the population to 6.55% and the increase is not so significant for the same reason. The proportional tax τ_y on income that balances the government budget falls from 4.46% to 3.74%, since the income tax base is expanded by eliminating the deductibility of the GHI premium.

Column A of Table 5 shows the welfare effect of the policy change. Although the wage rate is higher and the tax rate τ_y is lower than in the benchmark, they are not enough to compensate for the welfare loss due to the lower insurance coverage and increased exposure to health expenditure shocks. Not only the agents with the group insurance offer but also those with no access to the group insurance will face a welfare loss since the group insurance offer they may receive in future is not so attractive any more and they suffer from more future expenditure risks as well. Only 19.2% of young agents would experience a welfare gain from such a reform, and the average welfare effect is negative, in the order of 0.34% in consumption equivalence.

5.2.2. *Alternative policies*

In this subsection, alternative policies on health insurance are studied. We consider correcting regressiveness of the group insurance subsidy (Policy B), extending the deduction to the individual insurance contracts (Policy C) and providing a refundable credit for the purchase of individual insurance (Policy D).

Policy B. Fixing regressiveness: The government continues to provide a benefit for the group insurance, but abolishes the premium deductibility from the progressive income tax and instead provides a *lump-sum subsidy* for the purchase of group insurance. The amount of subsidy is determined so that the government maintains the budget balance while keeping the income tax rate τ_y unchanged.

Compared to the benchmark, this policy is intended to be more beneficial if the agent with a group insurance offer belongs to a lower earnings group, because under the benchmark the deduction was based on their lower marginal tax rate. The subsidy under this policy is common across agents and it is higher than the tax deduction for agents in a low tax bracket. The take-up ratio of GHI goes up from 99.0% to 99.6% and the rise to the nearly perfect take-up comes from the increased demand of the low-earnings people. Welfare is improved, although the magnitude is relatively small.

Policy C. Extending tax deductibility to the individual insurance market: The government keeps the current tax deductibility for the group insurance premium but aims to provide some benefit for the individual insurance market. One way to do it is to extend the same tax advantage to everyone, i.e. agents who purchase a contract in the individual market can also deduct the premium cost from their income and payroll tax bases. As shown in Column C of Table 4, the policy would increase the insurance coverage among agents without access to the group insurance market by 38.3% to 73.8% and the overall coverage by 14.1% to nearly 90%. The fiscal cost of extending the deduction universally is reflected in the higher proportional tax, though the change is small. The coverage rises across different health expenditure levels, which reduces the precautionary savings. Aggregate capital falls by 0.69%.

In terms of welfare, the policy brings a relatively large welfare gain for those without an insurance offer from the employer, at 0.38% in consumption equivalence. Despite the decrease in the aggregate consumption in the final steady state, the reform will enable agents to smooth consumption across states and enhance overall welfare. The number of agents who are eligible for the social insurance goes down slightly, since agents are better insured and less exposed to a catastrophic health shock that would bring their disposable assets down to the minimum consumption level.

Policy D. Providing credit to the individual insurance market: The government offers a refundable credit of $1,000 to supplement for the purchase of individual insurance, if the person is not offered group insurance. As shown in Column D of Table 4, there is a significant effect on the insurance coverage among those without access to group insurance. The conditional take-up ratio increases from 35.5% to 86.7%. Compared to the tax deduction in Policy C, there is a much larger increase of the take-up ratios among agents with low earnings. Providing a refundable credit as in Policy D is more effective than a tax deduction because low-earnings agents who are more likely to be uninsured belong to lower tax brackets and benefit less from a deduction policy.

Increased risk-sharing together with the higher tax rate will reduce the saving motive and the aggregate capital falls by 1.77%. Despite the increased tax burden and a fall in the aggregate consumption, the gain from the better insurance coverage and an increased protection against expenditure uncertainty dominate the negative effects and the welfare effect among young agents is positive on average with a consumption equivalent variation of 0.58%. The number of agents eligible for the social insurance falls from 6.34% to 6.15%. The vast majority of the agents would support such a reform proposal.

6. Conclusion

Our policy experiments indicate that despite some issues entailed in the current tax system on health insurance, providing some form of subsidy and an incentive for the group insurance coverage has a merit. Employer-provided group insurance has the feature that everyone can purchase a contract at the same premium irrespective of any individual characteristics, most importantly current health status. Healthy agents would have an incentive to opt out of this contract and either self-insure or find a cheaper insurance contract in the individual market. A subsidy on group insurance can encourage them to sign up, maintain the diverse health quality of the insurance pool and alleviate the adverse selection problem that could plague the group insurance market. We conduct an experiment that confirms this intuition by showing that a complete removal of the subsidy would result in a deterioration of health quality in group insurance, a rise in the premium and a significant reduction in the insurance coverage, which together reduce welfare. Jeske and Kitao (2008) show robustness of our results across a wide variety of alternative model assumptions and parameterizations.

Our work complements the existing studies on the health insurance policy by highlighting the additional insights one can obtain by employing a general equilibrium model. An alternative tax treatment of the health insurance premium affects the composition of agents who sign up and therefore the equilibrium insurance premium. Changing the exposure to health expenditure risks affects precautionary saving motives, which in turn affects the level of factor prices, consumption and ultimately welfare. We have also shown that it is important to capture fiscal consequences of a reform because providing a subsidy will affect the magnitude of distortionary taxation. Moreover, the changes in insurance demand are shown to affect other public welfare programs such as Medicaid.

We also find that there is room for significantly increasing the insurance coverage and improving welfare by restructuring the current subsidy system. Extending the benefit to the individual insurance market is more effective if the subsidy is refundable than if it takes the form of deductions. The refundable credit policy is shown to raise the coverage by nearly 20% and enhance welfare despite an increase in the fiscal burden and a decrease in the aggregate output and consumption due to the lower demand for precautionary savings.

Since our focus is on the effect of the tax policy, we chose not to alter other features of the model along the transition. An interesting extension will be to ask how agents' insurance and saving decisions as well as the government's fiscal position will be affected in response to the future changes in the environment, in particular, the combination of the rising health costs and aging demographics. We leave these subjects for future research.

Acknowledgments

The authors thank an anonymous referee, Robert King, Thomas Sargent, Gianluca Violante and seminar participants at ASSA meetings in Chicago Atlanta Fed, Chicago Fed, Columbia GSB, Duke, Emory, European Central Bank, German Macro Workshop, Illinois at Urbana-Champaign, Michigan, Maryland, NYU, NYU Stern, Pennsylvania, SED meetings in Vancouver, University of Tokyo, USC Marshall and Western Ontario for helpful comments, and Katie Hsieh for research assistance. All remaining errors are ours.

References

Aiyagari, R., 1994. Uninsured idiosyncratic risk and aggregate saving. Quarterly Journal of Economics 109, 659–684.
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. North-Holland, Amsterdam, pp. 79–102.
Castañeda, A., Díaz-Giménez, J., Ríos-Rull, J.V., 2003. Accounting for the U.S. earnings and wealth inequality. Journal of Political Economy 111, 818–857.
Chatterjee, S., Corbae, D., Nakajima, M., Ríos-Rull, J.V., 2007. A quantitative theory of unsecured consumer credit with risk of default. Econometrica 75, 1525–1589.
Conesa, J.C., Kitao, S., Krueger, D., Taxing capital? Not a bad idea after all! American Economic Review, forthcoming.
Conesa, J.C., Krueger, D., 2006. On the optimal progressivity of the income tax code. Journal of Monetary Economics 53, 1425–1450.
De Nardi, M., French, E., Jones, J.B., 2005. Differential mortality, uncertain medical expenses, and the saving of elderly singles. Working paper.

Domeij, D., Heathcote, J., 2004. On the distributional effects of reducing capital taxes. International Economic Review 45, 523–554.
Fernández-Villaverde, J., Krueger, D., 2006. Consumption over the life cycle: facts from Consumer Expenditure Survey data. Review of Economics and Statistics 89, 552–565.
Gouveia, M., Strauss, R.P., 1994. Effective federal individual income tax functions: an exploratory empirical analysis. National Tax Journal 47, 317–339.
Gruber, J., 2004. Tax policy for health insurance. NBER Working Paper No. 10977.
Gruber, J., Lettau, M., 2004. How elastic is the firm's demand for health insurance? Journal of Health Economics 88, 1273–1293.
Gruber, J., McKnight, R., 2003. Why did employee health insurance contributions rise? Journal of Health Economics 22, 1085–1104.
Hubbard, R.G., Skinner, J., Zeldes, S.P., 1995. Precautionary saving and social insurance. Journal of Political Economy 103, 360–399.
Huggett, M., 1993. The risk-free rate in heterogeneous-agent incomplete-insurance economies. Journal of Economic Dynamics and Control 17, 953–969.
İmrohoroğlu, A., 1989. Cost of business cycles with indivisibilities and liquidity constraints. Journal of Political Economy 97, 1364–1383.
Jeske, K., Kitao, S., 2008. U.S. tax policy and health insurance demand: can a regressive policy improve welfare? Supplementary document. Available at ⟨http://sagiri.kitao.googlepages.com/JK_supplementary.pdf⟩.
Kahn, J.G., Kronick, R., Kreger, M., Gans, D.N., 2005. The cost of health insurance administration in California: estimates for insurers, physicians, and hospitals. Health Affairs 24, 1629–1639.
Kennickell, A.B., 2003. A rolling tide: changes in the distribution of wealth in the U.S., 1989–2001. Working paper, Federal Reserve Board.
Kotlikoff, L.J., 1989. Health expenditures and precautionary savings. In: Kotlikoff, L.J. (Ed.), What Determines Savings? MIT Press, Cambridge, MA, pp. 141–163.
Krueger, D., Perri, F., 2005. Does income inequality lead to consumption inequality? Evidence and theory. Review of Economics Studies 73, 163–193.
Livshits, I., Tertilt, M., MacGee, J., 2007. Consumer bankruptcy: a fresh start. American Economic Review 97, 402–418.
Mendoza, E.G., Razin, A., Tesar, L.L., 1994. Effective tax rates in macroeconomics: cross-country estimates of tax rates on factor incomes and consumption. Journal of Monetary Economics 34, 297–323.
Palumbo, M.G., 1999. Uncertain medical expenses and precautionary saving near the end of the life cycle. Review of Economic Studies 66, 395–421.
Scholz, J.K., Seshadri, A., Khitatrakun, S., 2006. Are Americans saving "optimally" for retirement? Journal of Political Economy 114, 607–643.
Simon, K.I., 2005. Adverse selection in health insurance markets? Evidence from state small-group health insurance reforms. Journal of Public Economics 89, 1865–1877.
Sommers, B.D., 2005. Who really pays for health insurance? The incidence of employer-provided health insurance with sticky nominal wages. International Journal of Health Care Finance and Economics 5, 89–118.
Sommers, J.P., 2002. Estimation of expenditures and enrollments for employer-sponsored health insurance. Agency for Healthcare Research and Quality, MEPS Methodology Report 14.
Whitehouse, E., 2003. The value of pension entitlements: a model of nine OECD countries. OECD Social, Employment and Migration Working Papers No. 9.