Health Insurance Reform: The impact of a Medicare Buy-In

Gary D Hansen [*] Minchung Hsu[†] Junsang Lee[‡§]
UCLA GRIPS KDI

March 8, 2012

Abstract

Current U.S. policy provides medical insurance in the form of Medicare to individuals aged 65 and over. Younger individuals who do not qualify for special assistance may have group health insurance through their employer, purchase individual health insurance, or go without. This paper evaluates the general equilibrium and welfare consequences of health insurance reform in a calibrated life-cycle economy with incomplete markets and endogenous labor supply. Individuals face uncertainty each period about their future health status, medical expenditures, labor productivity, access to employer provided group health insurance, and the length of their life. In this environment, incomplete markets and adverse selection, which restricts the type of insurance contracts available in equilibrium, creates a potential role for health insurance reform. In particular, we consider a policy reform that would allow older workers (aged 55-64) to purchase insurance similar to Medicare coverage. We find that adverse selection eliminates any market for a Medicare buy-in if it is offered as an unsubsidized option to individual private health insurance. Hence, we compare the equilibrium properties of the current insurance system with those that obtain when the buy-in is optional, but subsidized by the government.

[*]University of California, Los Angeles. Email: ghansen@econ.ucla.edu.
[†]National Graduate Institute for Policy Studies, Tokyo. Email: minchunghsu@grips.ac.jp.
[‡]Korea Development Institute. Email: junsang@kdi.re.kr.
[§]All errors are ours.

1 Introduction

In the debate that led to enacting the ”Patient Protection and Affordable Care Act,” signed by President Obama in March 2010, much of the attention was focused on the desirability of a “public option,” that the government should offer a health insurance alternative that would compete with those offered by private insurance companies. Current U.S. policy does provide public health insurance in the form of Medicare to individuals aged 65 and over. This paper evaluates the general equilibrium and welfare consequences of a policy reform that has been discussed in the U.S. at least since the Clinton administration that would allow younger workers (aged 55-64) to purchase Medicare coverage from the government.

This policy analysis is carried out using a calibrated life-cycle economy with incomplete markets and endogenous labor supply. In our model, working age individuals face idiosyncratic productivity shocks, choose whether or not to work (labor is indivisible), accumulate claims to capital, and can purchase private health insurance if they do not receive group health insurance through their employer. They face uncertainty each period about their future health status, medical expenditures and the length of their life. Retired individuals receive social security and Medicare which, along with accumulated savings, is used to finance consumption and medical expenditures. Individuals who retire early, between age 55 and 64, might be offered group retiree health insurance.

We focus on the Medicare buy-in proposal because, unlike many compulsory programs that have been debated, the idea is to make a popular government program available as an option to individuals who currently do not qualify due to age and do not have another form of group insurance. In addition, this program targets the ten year age group with the highest percentage of uninsured adults in fair or poor health in the United States (Kaiser Foundation). That is, individuals younger than 55 are more likely to be uninsured, but they don’t need it as badly on average.

In this environment, incomplete markets and adverse selection, which restricts the type of insurance contracts available in equilibrium, creates a potential role for health insurance reform. However, the price of such a program, if it is to be self-financing, depends crucially on who chooses to enroll. Relatively healthy individuals may prefer individual health insurance or self-insurance and their exit from the pool would raise the cost of the buy-in program for those who remain. In fact, in our calibrated economy, this adverse selection problem eliminates any market for a self-financing Medicare buy-in program.

Hence, if this type of program is to have any impact on the number of uninsured, it must either be mandatory for those without another form of insurance or partially subsidized by the government to make it more attractive to healthy individuals. We therefore compare our benchmark economy, in which there is only individual health insurance or employer provided group insurance for those under age 65, with economies with a Medicare buy-in program that is subsidized at various rates by the government. We also consider an insurance mandate requiring everyone to purchase health insurance. In this setting, the market for an unsubsidized Medicare buy-in is eliminated for the same reason that it doesn't exist without the mandate – healthy individuals would prefer to purchase individual insurance coverage.

We find that by subsidizing the buy-in program, it is possible to bring the number of individuals aged 55-64 without insurance to below 5 percent without incurring large tax increases to finance the program. In particular, a 30 percent subsidy brings the fraction uninsured down from 30 percent in the benchmark to 4.5 percent. Due to the general equilibrium effects of introducing this policy, total labor taxes only need to be increased by 0.18 percentage points above the tax rate for the benchmark economy. In addition, while lifetime utility is somewhat lower for an individual born in this economy compared with that of an individual born in the benchmark economy, those of age 36 or higher enjoy greater lifetime utility on average from their current age forward. An insurance mandate, on the other hand, would decrease welfare for individuals of all ages. In addition we find that if the Medicare buy-in is priced differently depending on the age of the individual, a lower subsidy (17 percent) is required to bring the fraction uninsured below 5 percent and the tax increase needed to fund the subsidy is even smaller (a 0.1 percentage point increase relative to the benchmark).

Our paper contributes to the literature pioneered by Auerbach and Kotlikoff (1987) using calibrated general equilibrium life cycle models to study dynamic fiscal policy and social programs such as social security. While this literature has grown to be quite large, there are relatively few papers that have applied this approach to the study of health insurance programs.

Two exceptions are Attanasio, Kitao and Violante (2009) and Jeske and Kitao (2009). The first of these uses a model similar to ours to evaluate alternative funding schemes for Medicare given demographic projections for the next 75 years. Jeske and Kitao (2009) study the role of adverse selection in a model where individuals choose whether to or not to purchase health insurance, which is either group insurance, provided through employers, or individual insurance. The paper argues that a regressive tax policy that subsidizes insurance for those receiving it through their employers by making premiums tax deductible is welfare improving since it encourages healthy individuals to stay in the program rather than seek private insurance. That is, the tax policy serves a role similar to the subsidizing the Medicare buy-in in our model.

The remainder of the paper is organized as follows. We describe the theoretical model in section 2 and the model calibration in section 3. Results are presented in section 3, and concluding comments are given in section 4.

2 Model

A general equilibrium life-cycle model with endogenous demand for private health insurance, endogenous labor supply and incomplete markets is used for our analysis of health insurance reform. There is uncertainty resulting from idiosyncratic productivity shocks, health status, medical expenditure shocks, and the length of life.

2.1 Demographics

The economy is populated by overlapping generations of individuals of age $j = 1, 2, ..., J$. An individual of age j survives until next period with probability $\rho_{j,h'}$ which depends on age j and health status $h' \in \{h_g, h_b\}$. If an individual reaches the maximum age J, $\rho_{J,h'} = 0$. The size of new cohorts grows at a rate η.

2.2 Financial Market Structure

Individuals can hold non-state contingent assets which are claims to capital used in production. In particular, beginning of period asset holdings of a given individual of age j are denoted by a_j. We assume that $a_0 = 0$. In addition, all individuals receive a lump sum transfer, b, which is unintended bequests from individuals that did not survive from the previous period. The rate of return on asset holdings is denoted by r, which is equal to the marginal product of capital minus the rate of depreciation in equilibrium. These assets can be used by households to partially insure themselves against any combination of idiosyncratic labor productivity shocks and medical expenditure shocks.

The choice of next period asset holdings is subject to a borrowing constraint, $a' \geq 0$. This, along with an assumption of no annuity markets, is the source of market incompleteness in our model. The borrowing limit especially impacts the asset holding decision of low-wealth households since they cannot smooth their consumption over time when they are hit by negative shocks to their disposable income.

2.3 Preferences and the Labor Decision

Individuals are endowed with one unit of time that can be allocated to market work and leisure. If they choose to spend n hours on the market work, their earnings are given by (wzn), where w is the market wage per effective unit of labor, and z is an idiosyncratic labor productivity shock that is revealed at the beginning of the period.

When the labor decision is made at the beginning of the period, individuals can choose n as follows: $n = \{0, \bar{n}\}$ if $j < J^r$; $n = 0$ if $j \geq J^r$, where J^r is the age of mandatory retirement. Individuals choose consumption and hours worked to maximize utility, which is given by

$$E\left[\sum_{j=1}^{J} \beta^{j-1} \left(\prod_{t=1}^{j-1} \rho_{t,h}\right) u\left(c_j, n_j\right)\right], \tag{1}$$

Here, $0 < \beta < 1$ is the subjective discount factor and $u(c,n)$ is the period utility function, which is compatible with balance growth:

$$u\left(c, 1-n\right) = \frac{\left[c^{\phi}\left(1-n\right)^{1-\phi}\right]^{1-\mu} - 1}{1-\mu};$$

where μ governs the degree of risk aversion.[1]

2.4 Health, Medical Expenditure and Health Insurance

2.4.1 Heath status and medical expenditure uncertainty

Given their beginning of period health status h determined in the previous period, individuals face exogenous uncertainty about their current health status h' and resulting medical expenditure x.[2] Health status evolves according to a two-state Markov chain where $h \in \{h_g, h_b\}$, denoting good and bad health. The transition matrix, $\pi_j^h(h', h)$, depends on age.

[1] A separable utility between consumption and leisure is often used in the related literature, but this form is consistent with balanced growth only when μ is one:

$$u\left(c, 1-n\right) = \frac{c^{1-\mu} - 1}{1-\mu} - \psi \frac{n^{1+1/\varepsilon}}{1+1/\varepsilon},$$

where ψ is a disutility parameter and ε is Frisch elasticity of labor supply.

[2] We say that the uncertainty is exogenous because there is no sense in which actions taken by individuals can affect their health status. This assumption eliminates moral hazard from our model economy.

The probability distribution of the idiosyncratic medical expenditure shock x depends on age and current health status, h'. We assume that h' and x are revealed after the health insurance decision has been made. In particular, x is drawn from the conditional distribution $\pi_j^x(x|h')$, where $x \in X_{j,h'} = \{x^1_{j,h'}, x^2_{j,h'}, ..., x^m_{j,h'}\}$. Hence, the probability of an individual of age j with beginning of period health status h having expenditure equal to x (and beginning of next period health status h') is given by $\pi_j^x(x|h')\pi_j^h(h',h)$.

2.4.2 Group health insurance for employees and retirees (EHI and RHI) and individual health insurance (IHI)

Individuals can partially insure medical expenditure uncertainty with health insurance that covers a fraction ω of realized medical expenditures x.

To characterize the current US health insurance market, three types of insurance are incorporated in the model – employment-based group health insurance (EHI), group health insurance for early retirees (RHI), and individual (private) health insurance (IHI). The group insurance options, which are offered by employers, is required by law not to discriminate based on health status. In the latter, insurance companies are permitted to price-discriminate based on individual characteristics.

We assume that everyone has access to IHI, but EHI and RHI are available only if offered by the employer, and RHI is is only available to early retirees, individuals aged J^g to $J^r - 1$, which will correspond to ages 55-64 in our quantitative analysis. If an individual leaves the labor market prior to age J^g, he/she will also lose EHI coverage. The premium charged for EHI, q^e, does not depend on an individual's age or health status. If EHI is offered, the premium is paid by the employer but the amount will be subtracted from an employee's pre-tax wage income to ensure that total compensation is consistent with labor market equilibrium. An offer of EHI comes with the job offer (the revelation of the idiosyncratic productivity shock) at the beginning of a period when agents make their labor supply decisions. We denote whether or not an individual has an EHI offer by e, where $e \in \{0, 1\}$. Whether or not the individual actually accepts the EHI offer is denoted by an indicator ι_{EHI}, where $\iota_{EHI} = 1$ if $e = 1$ and $n = \bar{n}$; $\iota_{EHI} = 0$ otherwise.

Once an individual reaches age J^g, he/she will be offered RHI if $e = 1$ and $n = 0$. That is, to have retiree health insurance, one must have been offered a job with with EHI, but then choose not to work. In this case, if the insurance is accepted, we set $\iota_{RHI} = 1$ and the individual gets charged an insurance premium equal to q^g. This form of insurance is particularly desirable for individuals in the model because it is subsidized; a fraction σ_g of the total cost of the insurance is paid by the firm and $1 - \sigma_g$ by the individual. Once the individual reaches age J^r, he/she is eligible for

Medicare, which is the only health insurance offered in our model to those J^r and over.

If an agent decides to buy IHI to insure medical expenditures, a premium $q^i(j,h)$, which depends on the individual's current age and health status, needs to be paid at the beginning of the period before the medical expenditure shock is realized. This reflects the practice that there is price discrimination in the IHI market. In addition, we denote whether or not the individual has an IHI insurance contract by ι_{IHI}, where $\iota_{IHI}=1$ if the individual has IHI and $\iota_{IHI}=0$ otherwise. Finally, because IHI requires that individuals be screened to determine how much they should be charged for insurance, we follow Jeske and Kitao (2009) by assuming that a markup of $\psi > 1$ is applied to the premium that would be charged in equilibrium if there were no screening costs.

2.4.3 Stochastic process for z and e

We assume that z, idiosyncratic productivity, can take on one of N possible values. In addition, we assume that the probability that EHI is offered ($e=1$) is a function of the realized value of z. We also assume that the probability of a particular (z,e) draw depends on health status and age. Therefore, we assume that the vector (z,e) follows a Markov chain with a $(2N)X(2N)$ transition matrix $P^{g,j}$ for individuals of age j with good beginning of period health status ($h=h_g$) and a transition matrix $P^{b,j}$ for individuals with $h=h_b$.

2.5 Government and Social Programs

2.5.1 Medicare

Medicare is a public program sponsored by the government that provides health insurance for the elderly. Once individuals reach the eligibility age of J^r (which corresponds to age 65), they are covered by Medicare automatically. Medicare covers a fraction ω_m of realized medical expenditure x. In addition, the government pays a fraction σ_m of the total premium required to offer Medicare in equilibrium, leaving participants to pay a fraction $1-\sigma_m$ of the premium.

The program is financed by a combination of contributions from the general government budget and the Medicare premium charged to benefit recipients, q^m.

2.5.2 Social Security

The social security program provides the elderly with a benefit s when they reach the eligibility age of J^r and retire. This program is also financed by the general government budget.

2.5.3 Minimum Consumption Guarantee

In addition to Medicare and social security, the government provides means-tested social insurance in this economy. The government guarantees a minimum level of consumption $\underline{c}$ by supplementing income by an amount T in case the household's disposable income plus assets (net after medical expenditures) falls below $\underline{c}$. That is, we employ the simple transfer rule proposed by Hubbard et al. (1995). This plays the same role in our model economy as transfer programs such as Medicaid, food stamps, and Supplemental Security Income do in the U.S.

2.5.4 Government Budget

Government revenue consists of tax revenue from a labor income tax τ_l, capital income tax τ_k, and a consumption tax τ_c. Additional revenue is obtained from the Medicare premium, q^m. The government uses its revenue to finance all public programs and its own consumption G, which is determined as the residual, but is held constant across our policy experments. The government's budget constraint is given by:

$$\int \{\tau_l [(wzn - q^e \cdot e) + s] + \tau_k r (a+b) + \tau_c c + q^m\} d\Phi \tag{2}$$

$$= \int [T + s + \omega_m \cdot x] d\Phi + G, \tag{3}$$

where Φ is the distribution of population over state variables.

2.6 Production Technology

On the production side, we assume competitive firms operate a technology with constant returns to scale. Aggregate output Y is given by

$$Y = F(K, L) = K^{\theta} L^{1-\theta},$$

where K and L are aggregate capital and effective labor. Capital is assumed to depreciate at the rate δ each period.

2.7 Agent's Problem

2.7.1 Timeline

At the beginning of each period, individuals observe their asset holdings a determined in the previous period, a job offer that consists of a productivity draw z and an indicator e (0 or 1) as to whether the job comes with EHI, and their health status h. That is, their beginning of period state is given by $s=(j,a,h,z,e)$. They then make a decision to accept or reject the job offer and whether or not to purchase a private individual insurance contract (ι_{IHI}) or early retiree health insurance (ι_{RHI}) before this period's medical shock x is realized. After the insurance purchase and labor decisions are made, health status h' and medical expenditure x are realized and then households make decisions on consumption c and asset holdings a'.

2.7.2 Individual's Dynamic Program

Given prices and tax rates, the problem solved by an individual of age $j=1,...,J^r-1$ can be written as follows:

$$V(s)=\max_{n\in\{0,\bar{n}\},\ \iota_{IHI},\ \iota_{RHI}}\sum_{(h',x)}\pi_j^x(x|h')\pi_j^h(h',h)\left\{\max_{c,\ a'}\ u(c,n)+\beta\rho_{j,h'}\sum_{(z',e')}P^{h'}_{(z',e')|(z,e)}V(s')\right\}$$

subject to

$$(1+\tau_c)c+a'+q^i(j,h)\iota_{IHI}+q^g\iota_{RHI}=W+T \tag{4}$$

$$W\equiv(1-\tau_l)(wzn-q^e*\iota_{EHI})+(1+(1-\tau_k)r)(a+b)-(1-\hat{\omega})x \tag{5}$$

$$T=\max\{0,\ (1+\tau_c)\underline{c}-W\} \tag{6}$$

$$\hat{\omega}=\begin{cases}\omega & \text{if } \iota_{EHI}=1,\ \iota_{RHI}=1, \text{ or } \iota_{IHI}=1\\ 0 & \text{otherwise}\end{cases} \tag{7}$$

$$\iota_{EHI}=\begin{cases}1 & \text{if } e=1 \text{ and } n=\bar{n}\\ 0 & \text{otherwise}\end{cases} \tag{8}$$

$$\iota_{RHI}\in\begin{cases}\{0,1\} & \text{if } e=1,\ n=0 \text{ and } J^g\leq j\leq J^r-1\\ \{0\} & \text{otherwise}\end{cases} \tag{9}$$

$$a'\geq 0;\ \ c\geq 0. \tag{10}$$

Similarly, the problem of an individual aged $j=J^r,...,J$ is the following, where h' and x are revealed before any decisions need to be made:

$$V(j,a,h)=\max_{c,\ a'}\left\{u(c,0)+\beta\rho_{j,h'}V(j+1,a',h')\,|h',x\right\}$$

subject to

$$(1+\tau_c)c + a' = W + T \tag{11}$$

$$W \equiv s + (1+(1-\tau_k)\,r)\,(a+b) - (1-\omega_m)x - q^m \tag{12}$$

$$T = \max\{0,\ (1+\tau_c)\underline{c} - W\} \tag{13}$$

$$a' \geq 0;\ \ c \geq 0. \tag{14}$$

2.7.3 Equilibrium Definition

A competitive equilibrium consists of a set of individual decision rules [$n(s)$, $\iota_{IHI}(s)$, $\iota_{RHI}(s)$, and $a'(s,x,h')$], a set of factor demands [K and L], and a set of prices [w, r, $q^i(j,h)$, q^e, q^g, and q^m] such that

1. Given prices, the individual decision rules solve the households dynamic program.
2. Factor demands must satisfy

$$w = (1-\theta)A\,(K/L)^{\theta} \tag{15}$$

$$r = \theta A\,(L/K)^{(1-\theta)} - \delta \tag{16}$$

3. Markets clear

$$L = \int n(s)z d\Phi \tag{17}$$

$$K = \int (a+b) d\Phi \tag{18}$$

where

$$b = \int \frac{(1-\rho_{j-1,h})a}{1+\eta} d\Phi \tag{19}$$

$$q^i\,(j,h) = \psi \sum_{(h',x)} \pi_j^x(x|h')\pi_j^h(h',h)\omega\ x \tag{20}$$

$$q^e = \int \sum_{(h',x)} \pi_j^x(x|h')\pi_j^h(h',h)\omega\ (\iota_{EHI} + \sigma_g\ \iota_{RHI})\ x\ d\Phi \tag{21}$$

$$q^g = \int \sum_{(h',x)} \pi_j^x(x|h')\pi_j^h(h',h)\omega\ (1-\sigma_g)\ \iota_{RHI})\ x\ d\Phi \tag{22}$$

$$q^m = (1-\sigma_m)\int \sum_{(h',x)} \pi_j^x(x|h')\pi_j^h(h',h)\omega_m\ (\iota_{j\geq J^r})\ x\ d\Phi \tag{23}$$

where $\iota_{j \geq J^r}$ is an indicator that is equal to one if the individual is of Medicare eligible and zero otherwise.

2.8 Policy Experiment – Medicare buy-in

Let J^b be the age at which an individual becomes eligible to participate in the Medicare buy-in program by paying a premium equal to q^b. We consider cases where this premium is and is not dependent on age. We also consider the possibility of introducing a government subsidy to overcome the adverse selection problem. In our quantitative experiments, we will set J^b and J^g equal to each other. In evaluating the Medicare buy-in proposal, we will consider cases where firms continue to offer group insurance to early retirees as an option that competes with the Medicare buy-in and cases where firms do not offer early retirement insurance given the existence of the buy-in (in the current version we only consider cases where RHI competes with the Medicare buy-in program).

If this program is available, the problem of an individual eligible for the buy-in, those of age J^b to $J^r - 1$, becomes:

$$V(s) = \max_{n \in \{0, \bar{n}\},\ \iota_{IHI},\ \iota_{RHI},\ \iota_{MB}} \sum_{(h',x)} \pi_j^x(x|h') \pi_j^h(h',h) \left\{ \max_{c,\ a'} u(c,n) + \beta \rho_{j,h'} \sum_{(z',e')} P^{h'}_{(z',e')|(z,e)} V(s') \right\}$$

subject to

$$(1+\tau_c)c + a' + q^i(j,h)\iota_{IHI} + q^g \iota_{RHI} + q^b(j)\iota_{MB} = W + T \tag{24}$$

$$W \equiv (1-\tau_l)(wzn - q^e * \iota_{EHI}) + (1 + (1-\tau_k)r)(a+b) - (1-\hat{\omega})x \tag{25}$$

$$T = \max\{0,\ (1+\tau_c)\underline{c} - W\} \tag{26}$$

$$\hat{\omega} = \begin{cases} \omega & \text{if } \iota_{EHI} = 1,\ \iota_{RHI} = 1,\ \iota_{MB} = 1, \text{ or } \iota_{IHI} = 1 \\ 0 & \text{otherwise} \end{cases} \tag{27}$$

$$\iota_{EHI} = \begin{cases} 1 & \text{if } e = 1 \text{ and } n = \bar{n} \\ 0 & \text{otherwise} \end{cases} \tag{28}$$

$$\iota_{RHI} \in \begin{cases} \{0,1\} & \text{if } e = 1,\ n = 0 \text{ and } J^g \leq j \leq J^r - 1 \\ \{0\} & \text{otherwise} \end{cases} \tag{29}$$

$$a' \geq 0; \ \ c \geq 0, \tag{30}$$

where ι_{MB} is an indicator that takes a value of one if the agent qualifies for the Medicare buy-in and indeed buys it, and takes a value of zero otherwise.

In competitive equilibrium, if the Medicare buy-in program is subsidized at the rate σ_b, the equilibrium premium will be as follows:

$$q^b(j) = (1-\sigma_b)\int \sum_{(h',x)} \pi_j^x(x|h')\pi_j^h(h',h)\omega_b\, \iota_{MB}\, \iota_j\, xd\Phi \tag{31}$$

where ι_j is an idicator equal to one if the individual is age j and zero otherwise. If the Medicare buy-in is not priced by age, the premium becomes

$$q^b = (1-\sigma_b)\int \sum_{(h',x)} \pi_j^x(x|h')\pi_j^h(h',h)\omega_b \iota_{MB}\, xd\Phi \tag{32}$$

3 Calibration

To calibrate the earning processes, health expenditure shocks and to obtain empirical estimates of health insurance coverage rates, we use income, health status, health expenditures and insurance status from the Medical Expenditure Panel Survey (MEPS). We use eight two-year panels from 1999/2000 up to 2006/2007. We focus only on heads of households, which we define to be the individual (male or female) with the highest income in a particular residential unit. Attached to each of these household heads is a weight that can be used to make adjustments for the possibility that the MEPS sample of individuals may not reflect the distribution of individuals in the population as a whole.

3.1 Health Insurance

The take-up rates for the various forms of insurance are constructed from MEPS data as follows. To be considered as having EHI in a given year, the respondent in the MEPS survey must have been employed and covered by some form of group insurance during the year. In particular, to be classified as ”employed,” the respondent must have answered that they were employed in at least two of the three interviews conducted in a given year. In order to be considered as covered by insurance, the respondent must declare that they are covered at least eight months of a given year. To be counted as having RHI, the respondent needs to be covered by some form of group insurance and not be employed. To be counted as being covered by IHI, the respondent would have been covered by private insurance (source unknown), nongroup insurance, or self-employment insurance.

We follow Attanasio, Kitao and Violante (2009) and set the expenditure coverage of private health insurance, ω, equal to 0.7, and the expenditure coverage of Medicare, ω_m, equal to 0.5. We set the markup for private IHI, ψ, so that the IHI take-up rates predicted by our model match observed rates in MEPS data for individuals (household heads) aged 55 to 64. The fraction of the total cost of Medicare paid by the government, σ_m, is set equal to 0.88. The remaining cost is financed by the Medicare premium, q^m. Finally, we set the subsidy rate for early retirement insurance, σ_r, equal to 0.6 based on findings from the 2006 Kaiser/Hewitt Retiree Health Benefits Survey.

3.2 Earnings and Employment Health Insurance

We jointly calibrate earnings and access to EHI or RHI, which we take as being attached to an employment opportunity. We set the number of earnings states to $N = 5$. In order to obtain values for these five grid points for z, we compute the average wage earnings from the whole sample in 2007 dollars, which turns out to be $34,958. Next, we compute average earnings for the top 15% of earners, the next 20% , 30%, 20%, and the bottom 15%. Our earnings states are then computed as the ratio of these averages to the average of the whole sample:

$$Z = \{0.0029,\ 0.2667,\ 0.6811,\ 1.2011,\ 2.4235\}$$

Transition matrices are computed for five year age groups from 21 to 65. Each individual in the MEPS database is interviewed in two adjacent years, so we can compute the probability of moving from one earnings/EHI bin to another in one year, conditional on age and reported health status, by simply computing the weighted fraction of individuals who made that transition. In this way we construct the joint transition probabilities $P^{h,j}(z', e'|z, e)$ of going from income bin z with insurance status e to income bin z' with e'.[3] Hence, the joint Markov process is defined over 5×2 states with a transition matrix $P^{h,j}(z', e'|z, e)$ of size 10×10. For each age group, we compute two transition matrices corresponding to good and bad health status.

Table 1 displays the joint transition matrices of age-group 51-55 for both $h = h_g$ and $h = h_b$ as an example and the other matrices are provided in the appendix.

[3] Let the X be the set of all 10 possible earnings/EHI states and let $G^{h,j}(x, x')$ be the group of households who move from state $x \in X$ to state $x' \in X$. The gross flow from state x to x' is given by $F^{h,j}(xx') = \sum_{i \in G^{h,j}(x,x')} w_i$, where w_i is the weight associated with individual i in the MEPS sample. The transition probabilities can then be calculated from these flows, $P^{h,j}(x'|x) = \frac{F^{h,j}(x,x')}{\sum_{y \in X} F^{h,j}(x,y)}$.

Table 1: Joint transition matrices of earnings and EHI offer by age group 51-55 ($h = h_g$)

Age 51-55 ($h = h_g$)	$e' = 1$ $z' = z_1$	$e' = 1$ $z' = z_2$	$e' = 1$ $z' = z_3$	$e' = 1$ $z' = z_4$	$e' = 1$ $z' = z_5$	$e' = 0$ $z' = z_1$	$e' = 0$ $z' = z_2$	$e' = 0$ $z' = z_3$	$e' = 0$ $z' = z_4$	$e' = 0$ $z' = z_5$
$e = 1$ $z = z_1$	0.446	0.028	0.103	0.147	0.052	0.091	0.008	0.107	0.019	0.000
$e = 1$ $z = z_2$	0.000	0.243	0.356	0.086	0.081	0.022	0.076	0.115	0.021	0.000
$e = 1$ $z = z_3$	0.006	0.057	0.569	0.221	0.068	0.004	0.026	0.035	0.009	0.005
$e = 1$ $z = z_4$	0.006	0.016	0.147	0.575	0.222	0.001	0.007	0.012	0.013	0.002
$e = 1$ $z = z_5$	0.003	0.008	0.037	0.143	0.779	0.002	0.002	0.001	0.012	0.015
$e = 0$ $z = z_1$	0.000	0.019	0.005	0.000	0.015	0.712	0.188	0.046	0.015	0.000
$e = 0$ $z = z_2$	0.000	0.039	0.067	0.008	0.008	0.091	0.465	0.256	0.025	0.043
$e = 0$ $z = z_3$	0.002	0.017	0.081	0.045	0.005	0.039	0.157	0.469	0.130	0.054
$e = 0$ $z = z_4$	0.000	0.018	0.044	0.110	0.037	0.020	0.056	0.252	0.242	0.220
$e = 0$ $z = z_5$	0.000	0.000	0.012	0.037	0.087	0.010	0.076	0.074	0.216	0.488

Table 2: Joint transition matrices of earnings and EHI offer by age group 51-55 ($h = h_b$)

Age 51-55 ($h = h_b$)	$e' = 1$ $z' = z_1$	$e' = 1$ $z' = z_2$	$e' = 1$ $z' = z_3$	$e' = 1$ $z' = z_4$	$e' = 1$ $z' = z_5$	$e' = 0$ $z' = z_1$	$e' = 0$ $z' = z_2$	$e' = 0$ $z' = z_3$	$e' = 0$ $z' = z_4$	$e' = 0$ $z' = z_5$
$e = 1$ $z = z_1$	0.614	0.087	0.038	0.069	0.070	0.123	0.000	0.000	0.000	0.000
$e = 1$ $z = z_2$	0.056	0.372	0.313	0.010	0.020	0.109	0.061	0.059	0.000	0.000
$e = 1$ $z = z_3$	0.046	0.067	0.528	0.188	0.038	0.024	0.034	0.076	0.000	0.000
$e = 1$ $z = z_4$	0.023	0.002	0.230	0.537	0.172	0.006	0.000	0.000	0.010	0.020
$e = 1$ $z = z_5$	0.000	0.012	0.060	0.199	0.720	0.004	0.005	0.000	0.000	0.000
$e = 0$ $z = z_1$	0.007	0.001	0.008	0.000	0.008	0.871	0.095	0.005	0.006	0.000
$e = 0$ $z = z_2$	0.000	0.043	0.050	0.004	0.000	0.194	0.535	0.131	0.031	0.012
$e = 0$ $z = z_3$	0.000	0.055	0.116	0.037	0.000	0.072	0.194	0.451	0.076	0.000
$e = 0$ $z = z_4$	0.000	0.092	0.028	0.192	0.202	0.000	0.144	0.157	0.186	0.000
$e = 0$ $z = z_5$	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.500	0.272	0.176

We found that a high earners are more likely to be offered EHI ($e = 1$), and that this state is persistent over time.

Table 3: Transition probabilities of health status by age group

Age		$h' = h_g$	$h' = h_b$
21-30	$h = h_g$	0.96	0.04
	$h = h_b$	0.48	0.52
31-40	$h = h_g$	0.96	0.04
	$h = h_b$	0.38	0.62
41-50	$h = h_g$	0.94	0.06
	$h = h_b$	0.32	0.68
51-60	$h = h_g$	0.93	0.07
	$h = h_b$	0.28	0.72
61-70	$h = h_g$	0.90	0.10
	$h = h_b$	0.30	0.70
71-80	$h = h_g$	0.88	0.12
	$h = h_b$	0.31	0.69
81-	$h = h_g$	0.87	0.13
	$h = h_b$	0.34	0.66

3.3 Health Status and Health Expenditures

The MEPS database is also used to calculate age dependent transition matrices for health status and the probability distribution of health expenditures conditional on health status. Each individual is interviewed three times in a given a year and we compute the average of the health status indicator (1 - 5) that is provided by the individual's response to the question, "In general, compared to other people of your age, would you say that your health is excellent (1), very good (2), good (3), fair (4), or poor (5)?" If the average is greater than 3, we say $h = h_b$ and set $h = h_g$ otherwise. We can then construct age dependent transition matrices as described above for the earnings state. The transition matrices of the health status for different age groups, which are calculated using the same method as in the previous subsection, are reported in Table 3.

Table 4: Health expenditures from MEPS (2007 dollars)

		Medical expenditure		
Age	Health	Bottom 60%	Next 35%	Top 5%
20-29	h_g	76.19	1520.49	12163.42
	h_b	389.14	5027.02	33470.09
30-39	h_g	136.80	1898.03	13644.96
	h_b	621.60	7055.62	60358.85
40-49	h_g	275.13	2769.24	19939.88
	h_b	1055.28	9410.88	55337.89
50-64	h_g	639.93	4630.72	29758.45
	h_b	1947.97	13234.47	66826.10
65-	h_g	1560.28	9703.30	49647.48
	h_b	3402.35	19590.86	74479.44

In order to capture the long-tail in the distribution of the health expenditures and a small probability of incurring very large and catastrophic expenditures, we use three expenditure states with uneven measures (average of top 5%, next 35% and bottom 60%) for each age and health status. The distribution of health expenditures by age and health status is displayed in Table 4.

3.4 Demographics, Preference and Technology

Following studies similar to ours, the utility discount factor β is set so that the capital output ratio is equal to 3.0, the risk aversion parameter μ is set equal to 3, and ϕ is selected so that aggregate labor hours is equal to 0.3. The health dependent survival probabilities over the life cycle are taken from Attanasio, Kitao and Violante (2009) and Imrohoroglu and Kitao (2009).

The capital income share parameter (θ) in the production function is set equal to 0.36 and the depreciation rate of capital (δ) is set equal to 0.08.

Table 5: Summary of parameters

Parameters	*Notations*	*Values*	*Target/Note*
Discount Factor	β	0.967	K/Y ratio $= 3$
Risk Aversion	μ	3	
Depreciation Rate	δ	0.08	
Labor Parameter	ϕ	0.72	Labor participation of age 55-64 $=$ 71% (MEPS)
Capital Income Share	θ	0.36	
IHI Premium Markup	ψ	9.2%	IHI take up ratio of age 55-64 $=$ 5.9% (MEPS)
RHI subsidy rate	σ_g	60%	Kaiser/Hewitt retiree health benefits survey
Social Welfare	$\underline{c}$	14% of avg earnings	Fraction with asset holdings $<$ \$1000 =13% (Kennickell, 2003)
Social security benefit	s	45% of avg earnings	
PHI exp.coverage rate	ω	0.70	Attanasio et.al.(2008)
Medicare exp.coverage rate	ω_m	0.50	Attanasio et.al.(2008)
Cons. tax rate	τ_c	0.05	
Capital tax rate	τ_k	0.40	
Labor tax rate	τ_l	0.35	

Table 6: Benchmark properties

PHI coverage 21-64	PHI coverage 55-64	Labor hours	Labor participation (age < 65)	Capital-output ratio	r
73%	70%	0.32	87%	3.0	4%

Note: PHI=EHI+RHI+IHI.

3.5 Social Security, Consumption Guarantee and Government taxation

The social security payment is set equal to 45% of the average labor income of working age adults. The minimum consumption floor is calibrated so that the proportion of individuals with asset levels lower than $1,000 is equal to 13%. The consumption tax rate (τ_c) is set equal to 5%, the capital income tax rate (τ_k) is 40%, and the labor income lax rate (τ_l) is 35%.

4 Quantitative Analysis

We first describe the properties of the benchmark economy that characterizes some features of the current US insurance market. We will then compare this economy to one with an insurance mandate and/or a Medicare buy-in program as policy alternatives.

4.1 Benchmark economy

Table 6 presents some summary statistics from our benchmark economy, including health insurance take-up ratios, aggregate labor supply, capital-output ratio and the equilibrium interest rate.

Figure 1 shows health insurance take-up rates by age for the model economy and from MEPS data. In particular, we show EHI (employer provided health insurance) plus RHI (retirement health insurance) take-up rates as well as IHI (individual private health insurance). Recall that we calibrated the parameter ψ in order to match IHI take-up rates for those aged 55-64, and our success on this dimension can be seen in the figure. Our model, however, predicts that more people aged 21-50 should purchase IHI than observed in the data. The EHI+RHI take-up rates in the model are similar to those in the data for all ages, and this is due to our estimation of the joint transition matrices of earnings and EHI offers from MEPS data. Figure 2 shows EHI+RHI and EHI

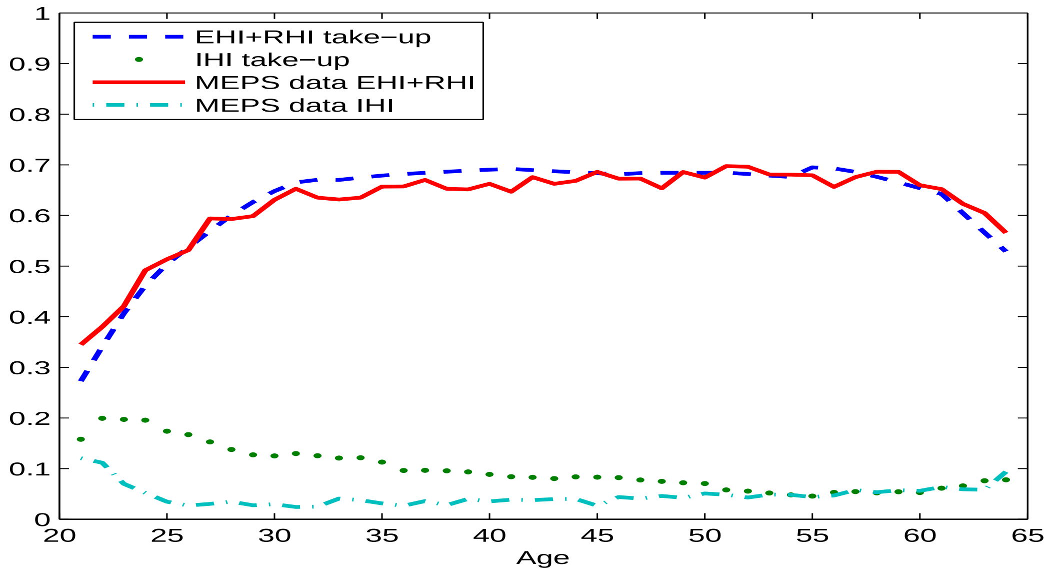


Figure 1: EHI+RHI and IHI take-up ratios (Benchmark)

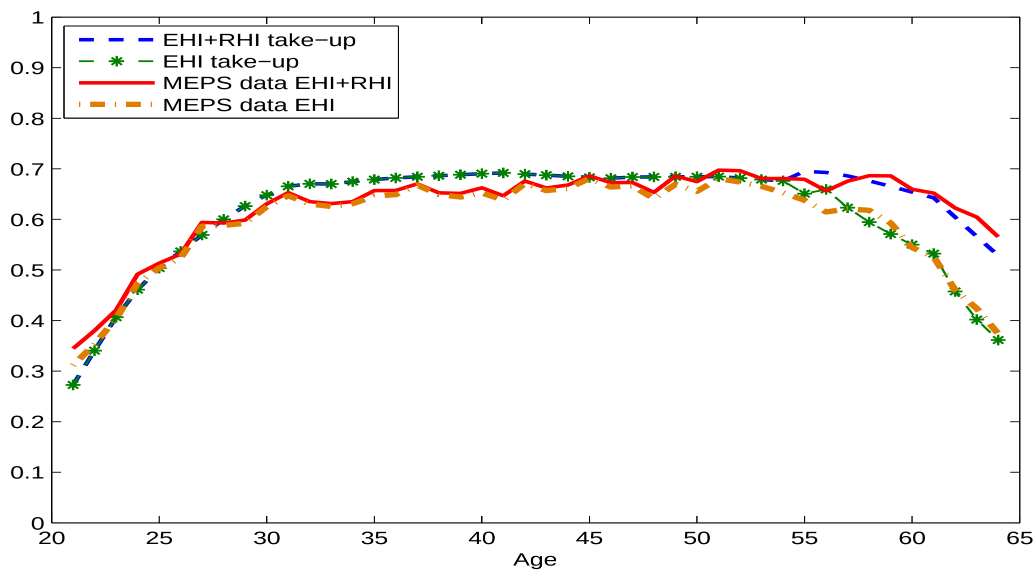


Figure 2: EHI and RHI take-up ratios (Benchmark)

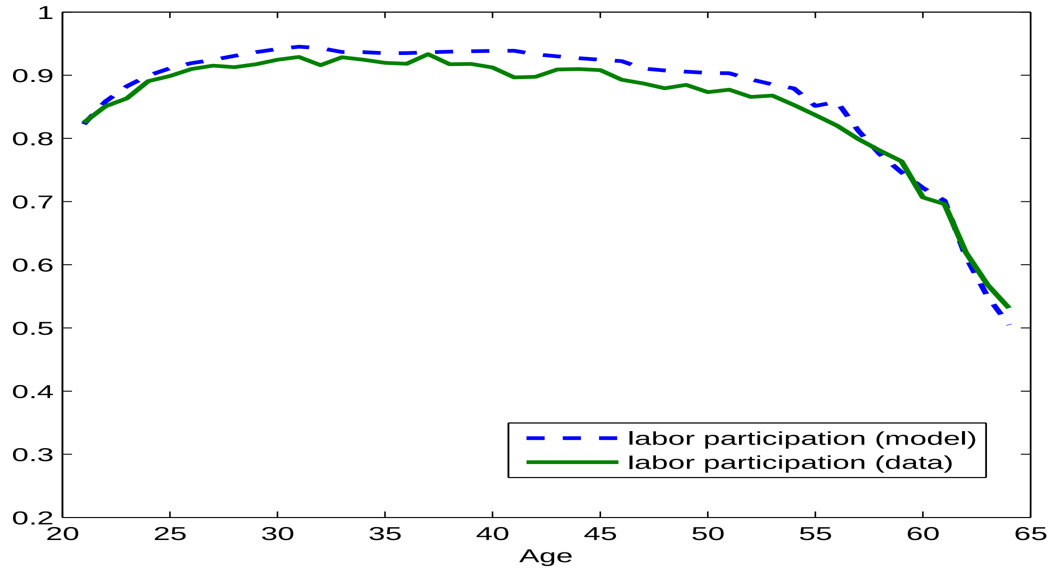


Figure 3: Age profile of Labor Participation (Benchmark)

separately.

Finally, Figure 3 shows that labor participation rates by age predicted by our model are very similar to those computed from MEPS data.

4.2 Policy Experiments

We consider several types of policy experiments designed to increase the fraction of individuals with health insurance. First, we explore what happens when a mandate to purchase health insurance is introduced without introducing any new insurance options. This requires us to modify our model slightly. In particular, we need to modify the income/wealth test for qualifying for the minimum consumption guarantee since in our formulation (see equations 4 through 6) optional insurance purchases are not subtracted from wealth when checking if an individual qualifies for social insurance.[4] But, once such purchases are required, it is possible that someone would suffer

[4]Allowing optional insurance expenditures to be part of the test qualifying someone for a social insurance transfer introduces a distortion that induces people to purchase insurance that they otherwise would not in order to qualify for welfare. Medicaid programs, which we have not modeled, presumably eliminate this incentive in the U.S. economy.

Table 7: Insurance coverage (age 55–64) and tax burden

Policy Reform	Percent without Insurance	MB take-up rate without EHI offer	MB tax rate (τ_{MB})	Labor tax rate (τ_n)	$\tau_{MB}+\tau_n$
Benchmark	30.00%	–	–	35.00%	35.00%
Mandate	0.00%	–	–	35.07%	35.07%
MB (20% S)	26.29%	15.10%	0.03%	35.01%	35.04%
MB (29% S)	5.63%	85.83%	0.15%	35.01%	35.16%
MB (30% S)	4.50%	89.05%	0.16%	35.02%	35.18%
MB (50% S)	4.27%	89.70%	0.26%	35.03%	35.29%
MB PA (15% S)	17.96%	44.09%	0.04%	35.01%	35.05%
MB PA (17% S)	4.98%	87.68%	0.09%	35.01%	35.10%
MB PA (20% S)	4.83%	88.10%	0.10%	35.01%	35.11%
MB PA (30% S)	4.47%	89.13%	0.16%	35.02%	35.18%
MB PA (50% S)	4.20%	89.86%	0.26%	35.03%	35.29%

negative consumption if we do not change the nature of the qualification test. In particular, we replace equations 4 through 6 with the following:

$$(1+\tau_c)c+a'=W+T \tag{33}$$

$$W \equiv (1-\tau_l)\left(wzn-q^e * \iota_{EHI}\right)+\left(1+(1-\tau_k)\,r\right)(a+b)-(1-\hat{\omega})\,x$$
$$-q^i(j,h)\,i_{IHI}-q^g\,i_{RHI}-q^b(j)\,\iota_{MB} \tag{34}$$

$$T=\max\{0,\ (1+\tau_c)\underline{c}-W\} \tag{35}$$

Table 7 shows some summary features of our economy under the various policy scenarios we consider. The first line shows that under the benchmark calibration, 30 percent of individuals aged 55-64 have no health insurance and the tax rate on labor income, τ_n, is 35 percent. When an insurance mandate is introduced, the tax rate on labor income needs to be increased slightly to 35.075 percent in order to maintain the same level of government spending.

Next, we consider the implications of introducing a Medicare Buy-in program for individuals aged 55-64, with one price for all and fully funded by program participants, as an option to private health insurance. We find that, with or without an insurance mandate, adverse selection eliminates

Table 8: Characteristics of those without HI coverage (age 55–64)

Economy	Without any HI	a_{un}/a_{EHI}	a_{un}/a_{MB}	$earnings_{un}/earnings_{EHI}$	$earnings_{un}/earnings_{MB}$	SW_{un}
Benchmark	30.00%	47.73%	–	26.63%	–	12%
MB (30% S)	4.50%	0.79%	1.03%	0.71%	1.96%	75%
MB PA (17% S)	4.98%	1.19%	1.54%	2.09%	5.77%	69%

Note: a_{un}: average asset holdings of those without HI coverage. a_{EHI}: average asset holdings of those with EHI, a_{MB}: average asset holdings of those participating MB. *earnings*: average labor earnings. SW_{un}: proportion of those qualifying for the social welfare among those without any HI.

the market for this form of insurance. That is, healthy individuals would rather purchase IHI or self-insure and their refusal to participate drives up the equilibrium price for others. In the end, there doesn't exist a price at which this program would have participants and at the same time be fully funded.

This finding led us to consider the implications of offering the Medicare buy-in at a discounted price funded by a government subsidy. In Table 7 we show results for various subsidy levels in the third block of rows in the table. As the subsidy percentage is increased, the fraction of those aged 55-64 without health insurance falls. No matter how large the subsidy, some individuals will still not purchase health insurance because they are effectively being insured through the means tested social insurance program. In fact, the reduction in uninsured is relatively small for any subsidy level above 30 percent. At this level, the total tax on labor income needed to fund all government spending ($\tau_n + \tau_{MB}$) is 35.18 percent. In addition, this tax rate can be decomposed into the tax rate needed to fund the Medicare buy-in subsidy ($\tau_{MB} = 0.16\%$) and the tax rate needed to fund the rest of the government budget, which is $\tau_n = 35.02\%$.

Next, we consider the implications of price discriminating by age, as is done with many Medicare supplemental insurance programs offered in the U.S. We find that the adverse selection problem continues to eliminate a market for this form of insurance if the program is not subsidized. That is, the market disappears for all ages.

The last block of rows in Table 7 shows results where the price paid for Medicare buy-in insurance depends on the age of the insured. In this case, a subsidy rate of 17 percent brings the number of uninsured down to level similar to the 30 percent subsidy when the same premium is

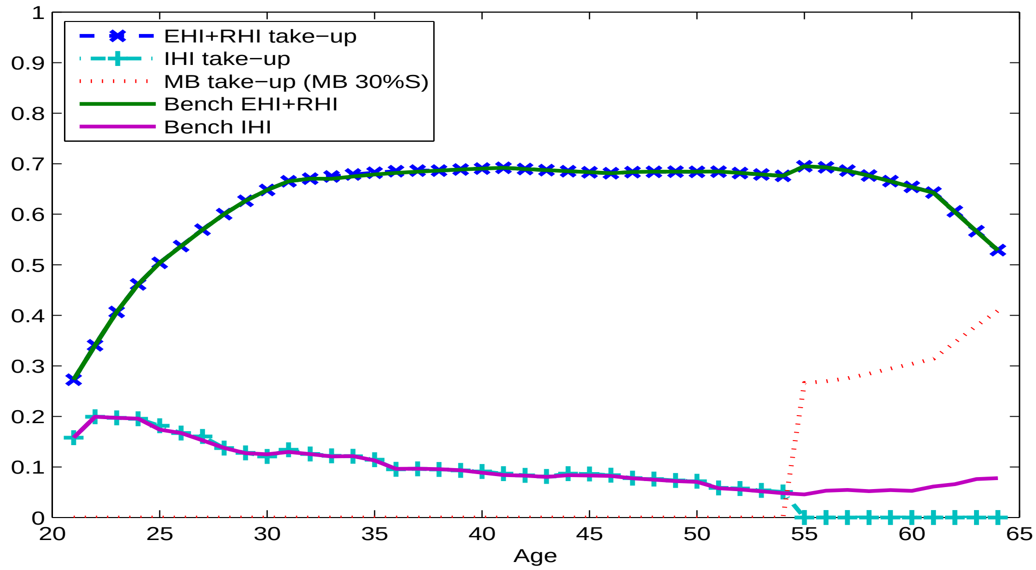


Figure 4: Health insurance take-up ratios (MB 30% Subsidy vs. Benchmark)

charged to all participants. The total tax on labor income needed to fund all government programs is 35.01 percent, which is only tiny increase above the benchmark tax rate and is slightly less than the tax rate for the 30 percent subsidy case when price doesn't differ by age.

In Table 8 we highlight a few characteristics of those aged 55-64 who do not have any health insurance under the different scenarios we consider. This table shows that, while in benchmark economy individuals with substantial asset levels may go without health insurance, when a subsidized Medicare buy-in is offered, those without insurance have about one percent the assets on average as someone with coverage from either EHI or the Medicare buy-in. In addition, labor earnings of those without health insurance are substantially lower than earnings of those with insurance. The last column of this table shows that 75% of those without insurance when a subsidized Medicare buy-in is offered (the one price for all case) qualify for welfare.

Figures 4 and 5 show health insurance take-up rates by age for the subsidized Medicare buy-in cases compared with those for the benchmark economy. The introduction of the Medicare buy-in has essentially no effect on the take-up rates for individuals below age 55 and no effect on EHI take-up rates at any age. The Medicare buy-in completely eliminates demand for IHI among those aged 55-64. In addition, Figures 6 and 7 show that availability of a subsidized Medicare buy-in

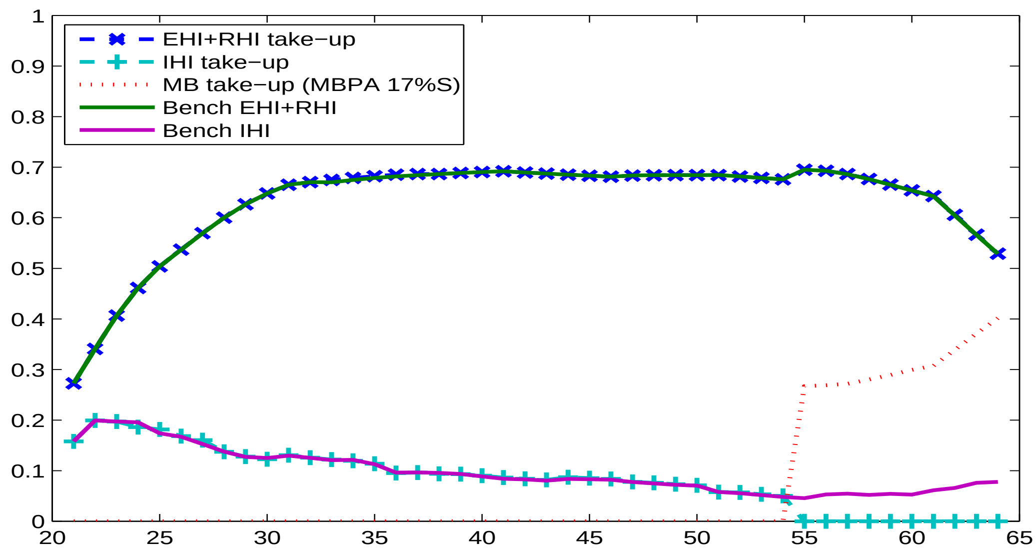


Figure 5: Health insurance take-up ratios (MB PA 17% Subsidy vs. Benchmark)

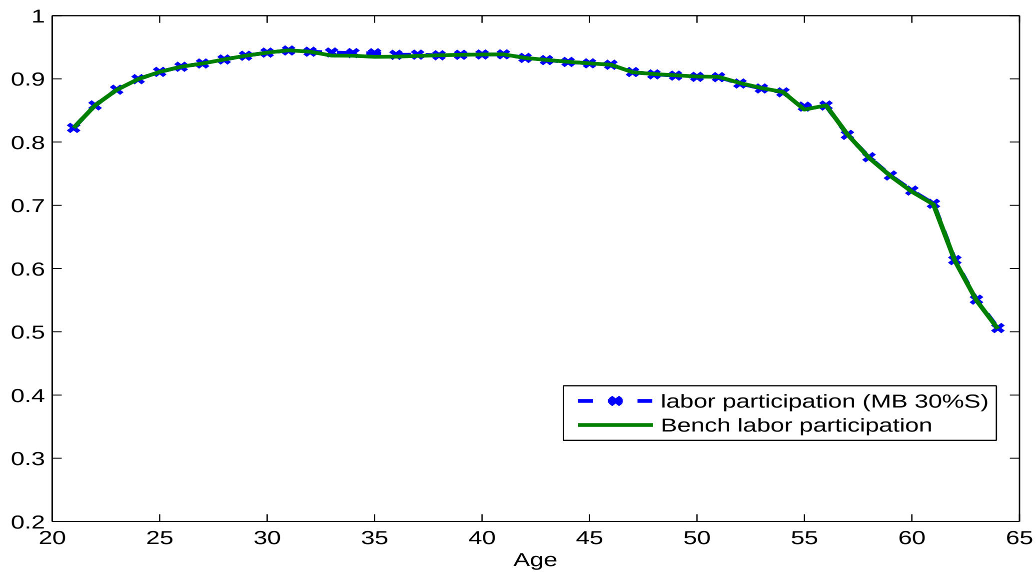


Figure 6: Labor Participation (MB 30% Subsidy vs. Benchmark)

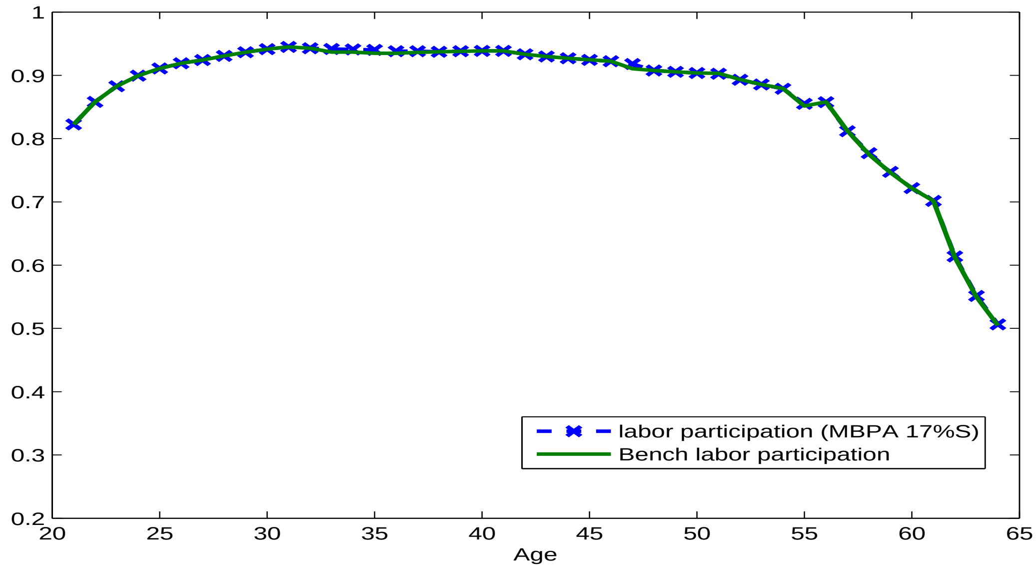


Figure 7: Labor Participation (MBPA 17% Subsidy vs. Benchmark)

Table 9: Welfare comparison (CEV from Benchmark)

	Mandate	**Voluntary MB with subsidy**	
	Without new option	MB (30% S)	MB PA (17% S)
CEV (new-born)	-1.15%	-0.19%	-0.11%

has no effect on employment rates at any age.

Table 9 compares welfare across the different cases considered. In particular, we calculate the percentage change in consumption each period in the benchmark economy required to make an individual of age $i = 1$ as well off in terms of expected lifetime utility as an individual of the same age in the particular alternative economy being considered. With an insurance mandate, new-born individuals are worse off than in the benchmark and the welfare cost is equal to a -1.15 % change in per period consumption relative to the benchmark. The subsidized Medicare buy-in policies also reduce welfare compared with the benchmark, but the costs are much smaller than for the insurance mandate.

Figure 8: CEV by age (MB 30% Subsidy)

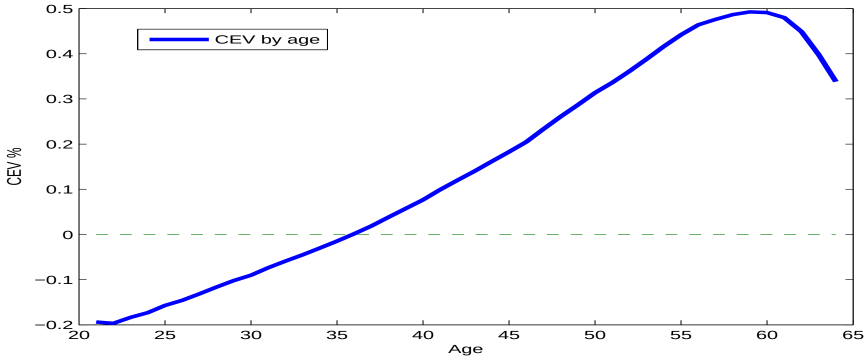


Figure 9: CEV by age (MBPA 17% Subsidy)

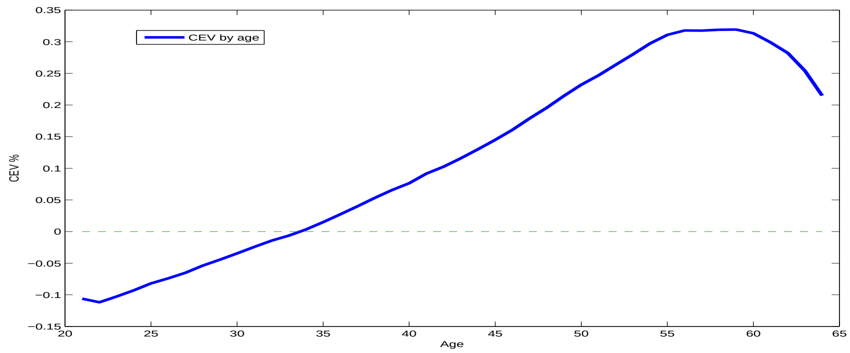
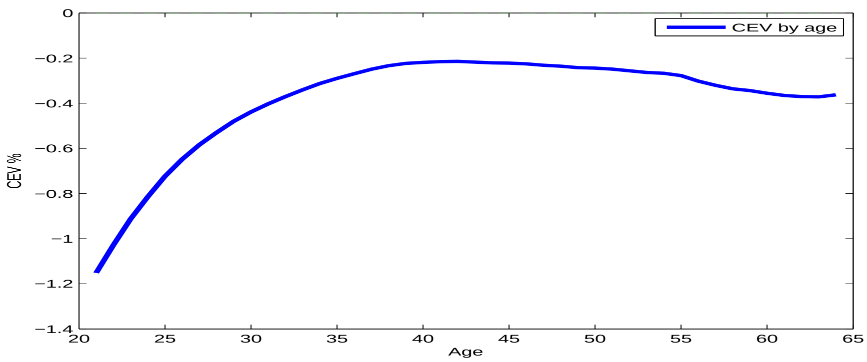


Figure 10: CEV by age (Mandate)



Finally, Figures 8 to 10 show the same welfare measure computed for individuals by age. That is, the welfare benefit to an individual of a particular age is the percentage increase in consumption each period from that age forward in the benchmark economy needed to make average expected lifetime utility equal to that in the alternative economy. Figure 8 shows that all working age individuals 36 and above would prefer living in the subsidized Medicare buy-in economy rather than the benchmark economy when everyone pays the same price to participate in the program. Figure 9 shows that this is true for working age individuals 34 and above if the subsidized program is priced by age. On the other hand, all working age individuals prefer the benchmark relative to the mandate.

5 Conclusion

In this paper we have studied the impact of introducing an optional Medicare buy-in program for individuals aged 55-64 to an overlapping generations economy calibrated to features of the U.S. economy. We find that unless this program is subsidized by the government, an equilibrium with an active market for the Medicare buy-in will not exist due to adverse selection. This result continues to hold even if there is a mandate requiring everyone to purchase some form of health insurance. Healthy individuals will prefer to purchase individual health insurance policies instead of being pooled with less healthy individuals.

If the Medicare buy-in is subsidized, we find that it is possible to bring the number of individuals aged 55-64 without insurance to below 5 percent without incurring large tax increases to finance the program. In particular, a 30 percent subsidy brings the fraction uninsured down from 30 percent in the benchmark to 4.5 percent. In addition, due to the general equilibrium effects of introducing this policy, labor taxes only need to be raised a small amount relative to our benchmark economy. If the the Medicare buy-in is priced differently depending on an individual's age, a 17 percent subsidy is sufficient to bring the fraction uninsured below 5 percent. In addition, those of age 36 or higher (34 if there is pricing by age) would prefer to live in a world with a subsidized Medicare buy-in program than in the benchmark economy without this program. All individuals prefer living in the steady state of the benchmark economy rather than in one with an insurance mandate.

Appendix: Joint transition matrices of earnings and EHI offer by age groups

To be added.