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

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Abstract

Current U.S. policy extends medical insurance in the form of Medicare to individuals aged 65 and over. Younger individuals may have group health insurance through their employer, purchase individual health insurance, or go without. The fact that many individuals have no insurance, or have relatively expensive individual insurance, is a motivation for health insurance reform. This paper evaluates the general equilibrium and welfare consequences of health insurance reform in a calibrated life-cycle economy with incomplete markets, uncertain lifespans, and endogenous labor supply. In particular, we consider a policy reform that would allow younger workers (aged 55-64) to purchase Medicare coverage. 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. Retired individuals receive social security and Medicare which, along with accumulated savings, is used to finance consumption and medical expenditures. Preliminary results indicate that adverse selection renders a Medicare buy-in program infeasible unless at least 40 percent of the costs of the program are financed through government subsidy.

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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 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, uncertain lifespans, 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. Retired individuals receive social security and Medicare which, along with accumulated savings, is used to finance consumption and medical expenditures.

We focus on Medicare buy-in proposals 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 for the program due to age. Perhaps the most controversial element of the recent health insurance legislation is its central element, the individual mandate, a requirement that most U.S. citizens and legal residents have health insurance starting in 2014. A Medicare buy-in is optional coverage that could benefit individuals who do not currently have access to group insurance. However, the price of such a program, if it is to be self-financing, depends crucially on who chooses to enroll in the program given that it would be optional. Relatively healthy individuals may prefer individual health insurance and their exit from the pool would raise the cost of the buy-in program for those who remain.

The 55-64 age group that this program would target is the ten year age group with the highest percentage of uninsured adults in fair or poor health (reference Kaiser Foundation). That is, individuals younger than 55 are more likely to be uninsured, but they dont need it as badly on average. Also, those aged 55-64 who have individual health insurance (rather than group insurance through their employer) are less than half as likely to be in fair or poor health as those who are uninsured. This, presumably, follows from the fact that private health insurance is prohibitively expensive for those in poor health. This raises the possibility that an unsubsidized Medicare buy-in program will be infeasible due to adverse selectionhealthy individuals will opt for private insurance or will self-insure through savings. In the limit, even the unhealthiest may leave the program because it will offer no cost advantage relative to private health insurance. This leads us to consider how a subsidizing the program would make it less sensitive to adverse selection. Preliminary results indicate that adverse selection renders a Medicare buy-in program infeasible unless at least 40 percent of the costs of the program are financed through government subsidy.

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 is the closest to ours in approach. Like us, they use a general equilibrium life cycle model with incomplete markets, endogenous labor decision and medical expenditure shocks. Their goal is 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.

2 Model

A general equilibrium life-cycle model with endogenous demand of private health insurance, endogenous labor supply and incomplete markets is undertaken for our analysis.

2.1 Demographics

The economy is populated by overlapping generations of individuals of age $j = 1,2,...,J$. Lifespan is uncertain. An individual of age j survives until next period with probability $\rho_{j,h}$ which depends on her/his age j and health status $h \in \{h_g, h_b\}$. When individuals reach the maximum age J, $\rho_{J,h} = 0$. The size of new cohorts grows at a rate g.

2.2 Endowment, Income Uncertainty and Preferences

Individuals enter the economy with no assets and are endowed with one unit of time. They can spend their time on market work, earning wage income, or on leisure. If they choose to spend n hours on the market work, their earnings are given by $(w\eta_j zn)$, where w is the market wage, η_j is age-specific productivity, and z is idiosyncratic labor productivity that evolves stochastically to characterize income uncertainty.

Individuals value consumption and leisure over the life-cycle and determine the sequence of consumption and labor supply according to a utility function $u(c,n)$, 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] Individuals retire at J_r.

2.3 Health, Medical Expenditure and Health Insurance

2.3.1 Heath status and medical expenditure uncertainty

Agents face exogenous uncertainty about their health status h. The health status evolves according to the Markov chain between two states of good and bad, $\{h_g,h_b\}$, with a transition matrix $\pi_j^h(h',h)$ that depends on age.

Individuals face an idiosyncratic medical expenditure shock x in each period. Medical expenditure $x\in X_{j,h}$ is a random draw according to an age- and heath-specific distribution $\pi^x_{j,h}$. $X_{j,h}$ is an age and health dependent finite set, $X_{j,h}=\{x^1_{j,h},x^2_{j,h},...,x^m_{j,h}\}$.

2.3.2 Employment-based health insurance and individual health insurance

Agents can partially insure medical expenditure uncertainty with access to health insurance that covers a fraction $\omega(x)$ of realized medical expenditure x.

[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.

To characterize the current US health insurance market, two types of insurance are incorporated in the model – employment-based health insurance (EHI) and individual (private) health insurance (IHI). The former, which is offered by employers and required by law not to discriminate based on health status, is also called group health insurance (GHI). In the latter, insurance companies have an incentive to price-discriminate.

We assume that everyone has access to IHI, but EHI is available only if it is offered by the employer. If an agent leaves the labor market, 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 wage to ensure that total compensation is consistent with labor market equilibrium. An offer of EHI comes with the job offer when agents make their labor supply decisions.

If an agent decides to buy IHI to cover medical shocks, a premium $q_i(j,h,x)$, which depends on the agent's current age and health information j, h and x, need to be paid at the beginning of the period before the medical shocks are realized. This reflects the practice that there is price discrimination in the IHI market.

2.4 Government and Social Programs

2.4.1 Medicare

Medicare is a public program administeredd by the government that provides health insurance for the elderly. Once individuals reach the eligibility age of j^{med}, they are covered by Medicare automatically. Medicare covers a fraction $\omega_o(x)$ of realized medical expenditure x.

The program is financed by a combination of contributions from the general government budget, payroll taxes (2.9% of earnings) and the Medicare premium q_{med} charged to benefit recipients (on average 12% of total cost).

2.4.2 Social Security

The social security program provides the elderly with a benefit ss when they reach the eligibility age of j^{ss} and retire.

2.4.3 Social insurance (safety net)

In addition to Medicare and social security, the government also provides a means-tested social insurance in this economy. The government guarantees a minimum level of consumption $\underline{c}$ by supplementing income in case the household's disposable income plus assets (net after medical expenditure) falls below $\underline{c}$. We consider a simple transfer rule proposed by Hubbard et al. (1995). The transfer T will be made if the household's disposable income plus assets (net after medical expenditure) is smaller than a minimum level of consumption. The transfer amount will be exactly equal to the difference. It plays the same role in our model economy as transfer programs such as Medicaid and Supplemental Security Income do in the U.S.

Government revenue consists of various forms of tax revenue including a labor income tax τ_l, capital income tax τ_k, consumption tax τ_c, social security tax τ_{ss} and the Medicare premium. The government use its revenue to finance all public programs and its own consumption G, which is constant over time.

2.5 Production Technology

On the production side, we assume that there is a continuum of competitive firms operating a technology with constant returns to scale. Aggregate output Y is given by

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

where K and L are aggregate capital and effective labor employed by the firm's sector and A is total factor productivity which we assume to be constant. Capital is assumed to depreciate at the rate δ each period.

2.6 Financial Market Structure

In addition to state-contingent health insurance, individuals can hold assets that are non-state contingent. They can rent the assets to firms as capital input with the rate of return r. Households can partially insure themselves against any combination of idiosyncratic labor productivity shocks and medical expenditure shocks by accumulating precautionary asset holdings. They are assume to face a borrowing constraint, which is a source of market incompletness in our model (we also do not permit annuity markets). The borrowing limit especially affects 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.

2.7 Agent's Problem

2.7.1 Timeline

At the beginning of each period, agents observe their asset holdings determined by decisions made in the previous period a, 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. At this point they only know their medical expenditure x realized **last** period. In order to maximize the expected lifetime utility:

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

they make decisions to accept or reject their job offer, and whether or not to purchase a private individual insurance contract (i_{IHI}) 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'. The states for an agent is summarized by a vector $s = (a,h,x,z,e,j)$, where j is the age, and e the indicator that takes a value of 1 if the agent is offered an EHI coverage and 0 otherwise.

2.7.2 Recursive transformation

An agent's problem can be expressed by:

$$V(s) = \max_{n,\ i_{IHI}} \sum_{x'} P_{x'|x} \left\{ \max_{c,\ a'} u(c,n) + \beta \rho_{j,h} \sum_{(z',e')} P_{(z',e')|(z,e)} \left[V(a',h',x',z',e',j+1) \right] \right\}$$

subject to

$$(1+\tau_c)c + a' + \hat{q} = Wel + T \tag{1}$$

$$Wel \equiv (1-\tau_{ss}-\tau_l)(w\eta_j zn - q_e * i_{EHI}) + \hat{ss} + (1+(1-\tau_k)r)a - (1-\hat{\omega})x' \tag{2}$$

$$T = \max\{0,\ (1+\tau_c)\underline{c} - Wel\} \tag{3}$$

$$\hat{q} = \begin{cases} q_i(j,h,x) & \text{if } i_{IHI} = 1 \text{ and } i_{EHI} = 0 \text{ and } j < j^{med} \\ q_{med} & \text{if } j \geq j^{med} \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

$$\hat{\omega} = \begin{cases} \omega_e(x) & \text{if } \ e = 1,\ i_{EHI} = 1, \text{ and } \ n = \bar{n} \\ \omega_i(x) & \text{if } i_{IHI} = 1,\ i_{EHI} = 0 \text{ and } j < j^{med} \\ \omega_o(x) & \text{if } j \geq j^{med} \\ 0 & \text{otherwise} \end{cases} \tag{5}$$

$$\hat{ss} = \begin{cases} ss & \text{if } j \geq j^{ss} \text{ and } n = 0 \\ 0 & \text{otherwise} \end{cases} \tag{6}$$

$$n = \begin{cases} \{0, \bar{n}\} & \text{if } j < j^r \\ 0 & \text{if } j \geq j^r \end{cases} \tag{7}$$

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

$$i_{IHI} = \{0,1\};\ \ a' \geq \underline{a};\ \ c \geq 0; \tag{9}$$

where T is the transfer made by the means-tested social insurance system, and ss is the social security benefit.

2.7.3 Optimal decisions

An agent's asset holding decision $a'(s,x')$ and consumption decision $c(s,x')$, if the borrowing constraint is not binding, can be characterized by the Euler equation:

$$u_c(c,n) = \beta\rho_{j,h}\sum_{z',e'} P_{z',e'|z,e}\left\{\sum_{x''} P_{x''|x'}\left[1+(1-\tau_k)r\right]u_{c'}(c',n')\right\}. \tag{10}$$

If the borrowing constraint is binding, $a' = \underline{a}$. Labor and insurance purchase decisions are discrete and determined by which combination gives higher lifetime utility.

2.8 Policy Experiment – Medicare buy-in

Allowing agents between j^{mb} and $j^{med}-1$ (e.g. 55 to 64) to purchase Medicare coverage with a premium $q_{mb}(j)$, which could be age dependent. In order to reduce the number of the uninsured by introducing a Medicare buy-in, a government subsidy on the premium might be necessary.

The individual's problem becomes:

$$V(s) = \max_{n,\ i_{IHI},\ i_{MB}} \sum_{x'} P_{x'|x}\left\{\max_{c,\ a'} u(c,n) + \beta\rho_{j,h}\sum_{(z',e')} P_{(z',e')|(z,e)}\left[V\left(a',h',x',z',e',j+1\right)\right]\right\}$$

subject to (1), (2), (3), (6), (7), (8), (9), and

$$\hat{q} = \begin{cases} q_i(j,h,x) & \text{if } i_{IHI}=1 \text{ and } i_{EHI}=0 \text{ and } j<j^{med} \\ q_{med} & \text{if } j \geq j^{med} \\ q_{mb}(j) & \text{if } i_{MB}=1 \\ 0 & \text{otherwise} \end{cases} \tag{11}$$

$$\hat{\omega} = \begin{cases} \omega_e(x) & \text{if } e=1,\ i_{EHI}=1, \text{ and } n=\bar{n} \\ \omega_i(x) & \text{if } i_{IHI}=1,\ i_{EHI}=0 \text{ and } j<j^{med} \\ \omega_o(x) & \text{if } j\geq j^{med}, \text{ or } i_{MB}=1 \\ 0 & \text{otherwise} \end{cases} \tag{12}$$

$$i_{MB} = \begin{cases} \{0,1\} & \text{if } j^{mb} \leq j < j^{ss} \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

where i_{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.

3 Calibration

This section describes the calibration of the model.

To calibrate the earning processes, health expenditure shocks and health insurance, we use income,health status, health expenditures and health data from one source, the Medical Expenditure Panel Survey (MEPS). We include eight two-year panels from 1999/2000 up to 2006/2007.

3.1 Earnings and Employment Health Insurances

First, in order to get the grids for z, we compute the average earning from the whole sample in 2007 dollars. We compute average income in 2007 dollars as $30,678$. We specify the earning distribution over the five earning states and an equal measure of agents belong to each of the five bins of equal size over the aggregate earning distribution. The z relative to average income are

$$Z = \{0.05,\ 0.43,\ 0.79,\ 1.23,\ 2.50\}$$

We calibrate the earning process jointly with the stochastic probability of being offered employment health insurance (EHI). We construct the age-group specific transition matrices. Given the five earning states and each age group, we determine for each individual in which bin he or she stays over the two consecutive years and thus construct the joint transition probabilities $p_{Z,E}\left(z, i_E | z', i'_E\right)$ of going from income bin z with insurance status i_E to income bin z' with i'_E. Recall i_E is an indicator function that takes a value 1 if employment health insurance is offered and 0 otherwise. The joint Markov process is defined over $N_z \times 2$ states with a transition matrix $P_{(z', i'_E)|(z, i_E)}$ of size $(N_z \times 2) \times (N_z \times 2)$.

Table 1 displays the joint transition matrix of Age-group 20-24 as an example and the other matrices are provided in the appendix.

We found that a high earning is more likely to be associated with the employment health insurance offer and this fact is persistent over time.

3.2 Health Status and Health Expenditures

We calibrate the health status transition and the distribution of medical expenditures by using MEPS. The measure of health status in MEPS is reported by interviewee. MEPS survey has three measures every year, and we compute the numerical average of the answer to the subjective health

Table 1: Joint transition matrices of earnings and EHI offer by age group 20-24

Age 20-24	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1 \quad z=z_1$	0.08	0.24	0.25	0.09	0.07	0.10	0.11	0.07	0.00	0.00
$i_E=1 \quad z=z_2$	0.04	0.38	0.24	0.09	0.02	0.07	0.11	0.04	0.00	0.00
$i_E=1 \quad z=z_3$	0.01	0.11	0.48	0.24	0.03	0.02	0.04	0.05	0.03	0.00
$i_E=1 \quad z=z_4$	0.01	0.04	0.16	0.58	0.13	0.01	0.01	0.02	0.04	0.01
$i_E=1 \quad z=z_5$	0.01	0.02	0.03	0.19	0.63	0.00	0.00	0.03	0.03	0.06
$i_E=0 \quad z=z_1$	0.01	0.04	0.02	0.02	0.00	0.59	0.24	0.05	0.01	0.01
$i_E=0 \quad z=z_2$	0.01	0.06	0.05	0.02	0.01	0.22	0.47	0.13	0.03	0.01
$i_E=0 \quad z=z_3$	0.01	0.04	0.07	0.05	0.01	0.09	0.26	0.35	0.10	0.01
$i_E=0 \quad z=z_4$	0.01	0.02	0.04	0.15	0.06	0.08	0.14	0.18	0.27	0.05
$i_E=0 \quad z=z_5$	0.00	0.00	0.04	0.17	0.00	0.04	0.12	0.08	0.21	0.33

question across the three measures, which ranges from 1 to 5.[2] . We choose to define two levels of an individual health status: good (h_g) and bad (h_b). For each individual, we then define an individual to be in bad health that year if the average was strictly above 3. The transition matrices of the health status for different age groups are reported in Table 3.

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 (top 5%, 35% and 60%) for each age and health status. The distribution of health expenditures by age and health status displayed in Table 2. The transition matrix for the health status is displayed in Table 3.

3.3 Health Insurance

We follow Attanasio, Kitao and Violante (2009) to set the expenditure coverage of private health insurance ω_e and ω_i as 0.7, and the expenditure coverage of Medicare ω_m as 0.5 based on MEPS. The markup of private IHI is set so that IHI take-ups match the data. Medicare premium

[2]MEPS asks "In general, compared to other people of (PERSON)s age, would you say that (PERSON)s health is excellent (1), very good (2), good (3), fair (4), or poor (5)?"

Table 2: Health expenditures from MEPS by age group and health status (in 2007 US dollars)

Age	Health	60%	35%	5%
20-29	Good	62.24	1,353.79	10,870.31
	Bad	158.46	3,132.55	20,560.57
30-39	Good	110.85	1,670.87	12,259.37
	Bad	252.50	4,108.59	33,161.37
40-49	Good	214.85	2,285.58	14,394.40
	Bad	548.58	6,082.23	40,926.92
50-64	Good	521.32	3,863.10	24,336.28
	Bad	1,225.67	9,645.65	53,103.65
65-	Good	1,258.56	8,118.15	47,871.10
	Bad	2,597.58	15,540.36	63,096.84

Table 3: Transition Matrices between good health and bad health from MEPS by age group

Age		Good	Bad
20-29	Good	0.87	0.13
	Bad	0.31	0.69
30-39	Good	0.85	0.15
	Bad	0.25	0.75
40-49	Good	0.83	0.17
	Bad	0.19	0.81
50-59	Good	0.82	0.18
	Bad	0.18	0.82
60-69	Good	0.79	0.21
	Bad	0.17	0.83
70-79	Good	0.75	0.25
	Bad	0.18	82
80-	Good	0.71	0.29
	Bad	0.20	0.80

is set at 12% of total Medicare cost and the remaining cost is financed by government general revenue.

3.4 Demographics, Preference and Technology

The utility discount factor β is set so that the capital out ratio equal to 2.8 (we use $\beta = 0.96$ for preliminary analysis); Risk aversion μ is set at 3. ϕ is selected to match aggregate labor hours equal to 0.3.

Survival probabilities over the life cycle are calculated based on the report in Attanasio, Kitao and Violante (2009) and Imrohoroglu and Kitao (2009).

In the production function, the capital income share (θ) is set at 0.33, and the depreciation rate of capital (δ) is set at 0.08. The scaling production parameter A is calibrated to normalize the average wage income in the benchmark into unity.

3.5 Social Security, Safety Net and Government taxation

The social security payment is set at 45% of the average labor income of young adults. The minimum consumption floor provided by the safety net is set to 10% of average earning as in Attanasio et al. (2009). The consumption tax rate is set at 5%, capital income tax is 40% and labor income lax rate is 35% (including social security tax). The above parameters are selected to match the features in the US and are also used in the literature.

4 Quantitative Analysis

4.1 Benchmark economy

The benchmark economy is to characterize the current economy in which Medicare covers the people aged 65 and over. Figures 1 to 3 show the preliminary simulation results of the age profiles of labor supply, asset holdings, consumption and private health insurance take-ups.

4.2 Medicare buy-in

We consider a policy reform that allows individuals aged under 65, in particular from 55 to 64, to purchase Medicare coverage. We first assume that the price discrimination is not allowed for the

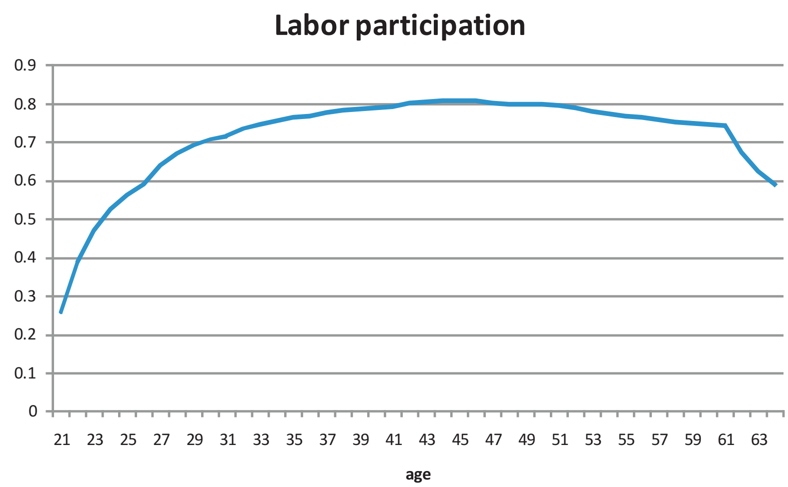

Figure 1: Age profile of labor participation (Benchmark)

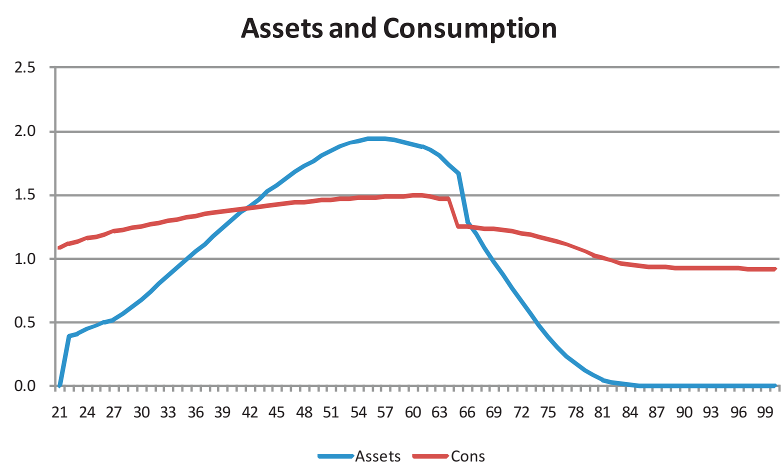

Figure 2: Age profile of average asset holdings and consumption (Benchmark)

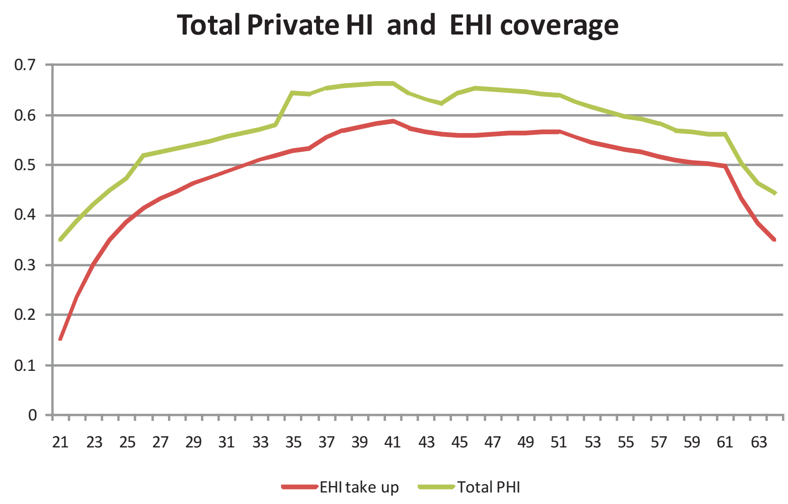

Figure 3: Age profile of total PHI and EHI coverage (Benchmark)

Medicare Buy-In program. In this case, adverse selection would occur if there is no subsidy on the premium. The preliminary result shows that it needs at least 40 percent subsidy on the premium to make the Medicare Buy-In program feasible. With a 70 percent subsidy, the uninsured rate of this age group could be reduced to almost zero, and the IHI would be fully crowded out. See figure 4.

5 Conclusion

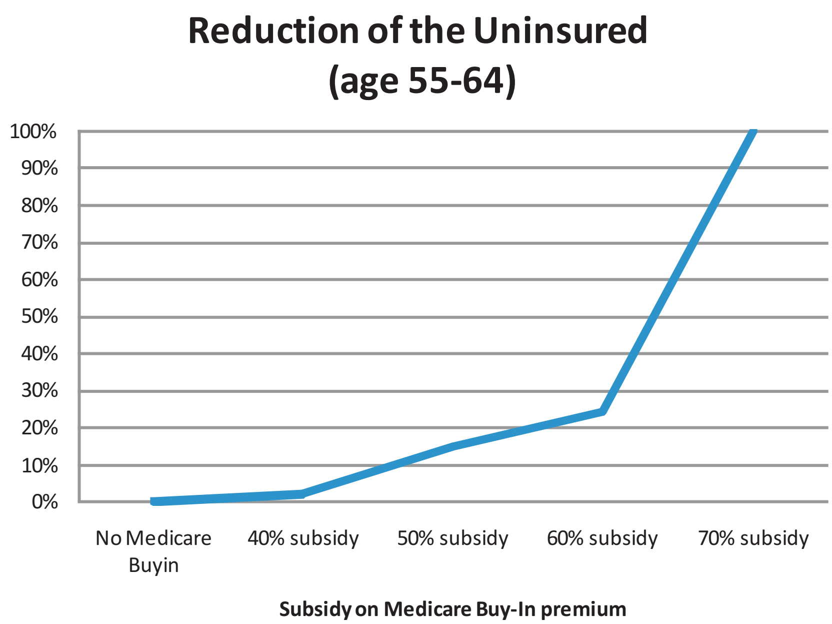

Figure 4: Reduction (%) of the uninsured with Medicare Buy-In subsidy policies

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

Table 4: Joint transition matrices of earnings and EHI offer by age group 20-24 and 25-29

Age 20-24	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.08	0.24	0.25	0.09	0.07	0.10	0.11	0.07	0.00	0.00
$i_E=1$ $z=z_2$	0.04	0.38	0.24	0.09	0.02	0.07	0.11	0.04	0.00	0.00
$i_E=1$ $z=z_3$	0.01	0.11	0.48	0.24	0.03	0.02	0.04	0.05	0.03	0.00
$i_E=1$ $z=z_4$	0.01	0.04	0.16	0.58	0.13	0.01	0.01	0.02	0.04	0.01
$i_E=1$ $z=z_5$	0.01	0.02	0.03	0.19	0.63	0.00	0.00	0.03	0.03	0.06
$i_E=0$ $z=z_1$	0.01	0.04	0.02	0.02	0.00	0.59	0.24	0.05	0.01	0.01
$i_E=0$ $z=z_2$	0.01	0.06	0.05	0.02	0.01	0.22	0.47	0.13	0.03	0.01
$i_E=0$ $z=z_3$	0.01	0.04	0.07	0.05	0.01	0.09	0.26	0.35	0.10	0.01
$i_E=0$ $z=z_4$	0.01	0.02	0.04	0.15	0.06	0.08	0.14	0.18	0.27	0.05
$i_E=0$ $z=z_5$	0.00	0.00	0.04	0.17	0.00	0.04	0.12	0.08	0.21	0.33
Age 25-29	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.06	0.23	0.16	0.12	0.07	0.18	0.11	0.04	0.04	0.00
$i_E=1$ $z=z_2$	0.03	0.35	0.24	0.12	0.02	0.07	0.09	0.06	0.01	0.00
$i_E=1$ $z=z_3$	0.01	0.12	0.44	0.26	0.04	0.02	0.03	0.04	0.04	0.01
$i_E=1$ $z=z_4$	0.01	0.03	0.13	0.54	0.17	0.01	0.02	0.02	0.04	0.03
$i_E=1$ $z=z_5$	0.00	0.00	0.04	0.14	0.73	0.01	0.00	0.01	0.02	0.06
$i_E=0$ $z=z_1$	0.01	0.02	0.02	0.01	0.00	0.64	0.23	0.04	0.02	0.01
$i_E=0$ $z=z_2$	0.01	0.05	0.04	0.02	0.01	0.18	0.49	0.16	0.04	0.01
$i_E=0$ $z=z_3$	0.00	0.03	0.08	0.05	0.02	0.07	0.21	0.37	0.14	0.03
$i_E=0$ $z=z_4$	0.00	0.02	0.04	0.12	0.06	0.03	0.09	0.20	0.33	0.11
$i_E=0$ $z=z_5$	0.00	0.00	0.02	0.05	0.19	0.03	0.06	0.04	0.21	0.39

Table 5: Joint transition matrices of earnings and EHI offer by age group 30-34 and 35-39

Age 30-34	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.15	0.22	0.24	0.07	0.07	0.07	0.13	0.07	0.00	0.00
$i_E=1$ $z=z_2$	0.03	0.42	0.25	0.09	0.04	0.03	0.07	0.05	0.02	0.01
$i_E=1$ $z=z_3$	0.01	0.10	0.48	0.23	0.05	0.01	0.03	0.04	0.04	0.01
$i_E=1$ $z=z_4$	0.00	0.03	0.12	0.55	0.18	0.01	0.01	0.02	0.06	0.02
$i_E=1$ $z=z_5$	0.01	0.01	0.01	0.11	0.76	0.01	0.00	0.01	0.03	0.06
$i_E=0$ $z=z_1$	0.00	0.02	0.02	0.01	0.00	0.67	0.20	0.04	0.02	0.01
$i_E=0$ $z=z_2$	0.00	0.05	0.04	0.02	0.01	0.16	0.49	0.17	0.05	0.01
$i_E=0$ $z=z_3$	0.00	0.02	0.06	0.06	0.02	0.08	0.22	0.36	0.15	0.03
$i_E=0$ $z=z_4$	0.00	0.01	0.02	0.14	0.08	0.02	0.10	0.16	0.34	0.11
$i_E=0$ $z=z_5$	0.00	0.01	0.02	0.07	0.21	0.02	0.05	0.08	0.15	0.38
Age 35-39	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.08	0.29	0.10	0.10	0.07	0.19	0.12	0.03	0.00	0.02
$i_E=1$ $z=z_2$	0.02	0.35	0.27	0.08	0.04	0.06	0.11	0.04	0.027	0.01
$i_E=1$ $z=z_3$	0.01	0.11	0.42	0.26	0.06	0.03	0.03	0.04	0.03	0.00
$i_E=1$ $z=z_4$	0.00	0.03	0.12	0.57	0.17	0.01	0.01	0.02	0.04	0.03
$i_E=1$ $z=z_5$	0.00	0.01	0.02	0.11	0.76	0.01	0.00	0.01	0.02	0.05
$i_E=0$ $z=z_1$	0.00	0.02	0.01	0.01	0.01	0.72	0.16	0.050	0.02	0.01
$i_E=0$ $z=z_2$	0.01	0.03	0.03	0.02	0.01	0.19	0.47	0.18	0.05	0.01
$i_E=0$ $z=z_3$	0.00	0.02	0.11	0.06	0.02	0.04	0.18	0.37	0.14	0.06
$i_E=0$ $z=z_4$	0.00	0.01	0.09	0.12	0.09	0.03	0.09	0.12	0.31	0.14
$i_E=0$ $z=z_5$	0.01	0.02	0.01	0.08	0.23	0.01	0.06	0.05	0.10	0.43

Table 6: Joint transition matrices of earnings and EHI offer by age group 40-44 and 45-49

Age 40-44	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.16	0.16	0.20	0.09	0.13	0.16	0.07	0.02	0.02	0.00
$i_E=1$ $z=z_2$	0.02	0.35	0.27	0.09	0.02	0.06	0.09	0.05	0.03	0.01
$i_E=1$ $z=z_3$	0.01	0.10	0.47	0.24	0.04	0.01	0.03	0.05	0.03	0.02
$i_E=1$ $z=z_4$	0.00	0.03	0.13	0.55	0.16	0.01	0.01	0.02	0.05	0.03
$i_E=1$ $z=z_5$	0.00	0.01	0.02	0.11	0.74	0.01	0.01	0.01	0.02	0.08
$i_E=0$ $z=z_1$	0.00	0.01	0.01	0.01	0.00	0.72	0.19	0.03	0.02	0.01
$i_E=0$ $z=z_2$	0.00	0.05	0.04	0.01	0.02	0.18	0.47	0.16	0.05	0.02
$i_E=0$ $z=z_3$	0.00	0.02	0.06	0.05	0.02	0.07	0.19	0.35	0.19	0.05
$i_E=0$ $z=z_4$	0.00	0.01	0.04	0.13	0.07	0.04	0.07	0.12	0.37	0.15
$i_E=0$ $z=z_5$	0.00	0.01	0.01	0.07	0.22	0.01	0.03	0.03	0.11	0.51
Age 45-49	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.07	0.29	0.19	0.10	0.17	0.05	0.10	0.02	0	0.02
$i_E=1$ $z=z_2$	0.03	0.39	0.25	0.10	0.03	0.08	0.06	0.05	0.01	0.01
$i_E=1$ $z=z_3$	0.02	0.08	0.46	0.27	0.06	0.02	0.02	0.05	0.02	0.01
$i_E=1$ $z=z_4$	0.01	0.04	0.10	0.53	0.21	0.01	0.01	0.02	0.04	0.02
$i_E=1$ $z=z_5$	0	0.01	0.02	0.11	0.74	0.01	0.01	0	0.03	0.07
$i_E=0$ $z=z_1$	0	0.02	0.01	0	0	0.80	0.12	0.03	0.01	0.01
$i_E=0$ $z=z_2$	0	0.06	0.03	0.02	0.01	0.18	0.47	0.15	0.06	0.03
$i_E=0$ $z=z_3$	0	0.01	0.06	0.05	0.03	0.08	0.20	0.34	0.15	0.06
$i_E=0$ $z=z_4$	0	0.01	0.03	0.11	0.08	0.03	0.09	0.15	0.34	0.16
$i_E=0$ $z=z_5$	0	0.01	0.01	0.04	0.23	0.03	0.03	0.06	0.13	0.46

Table 7: Joint transition matrices of earnings and EHI offer by age group 50-54 and 55-59

Age 50-54	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.15	0.21	0.06	0.06	0.06	0.15	0.21	0.03	0.03	0.03
$i_E=1$ $z=z_2$	0.04	0.41	0.21	0.09	0.03	0.07	0.07	0.04	0.02	0.02
$i_E=1$ $z=z_3$	0.01	0.10	0.52	0.20	0.04	0.02	0.03	0.03	0.01	0.01
$i_E=1$ $z=z_4$	0.01	0.03	0.11	0.53	0.20	0.01	0.01	0.02	0.04	0.04
$i_E=1$ $z=z_5$	0	0.01	0.03	0.11	0.74	0.01	0.01	0	0.02	0.07
$i_E=0$ $z=z_1$	0	0.01	0.01	0	0	0.85	0.10	0.02	0.01	0
$i_E=0$ $z=z_2$	0	0.05	0.04	0.01	0	0.23	0.45	0.15	0.05	0.03
$i_E=0$ $z=z_3$	0.01	0.02	0.08	0.07	0.03	0.06	0.19	0.33	0.15	0.05
$i_E=0$ $z=z_4$	0	0.01	0.02	0.10	0.08	0.05	0.09	0.13	0.36	0.16
$i_E=0$ $z=z_5$	0	0.01	0.02	0.03	0.17	0.04	0.02	0.06	0.17	0.47

Age 55-59	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.10	0.21	0.07	0.10	0.07	0.24	0.10	0.10	0	0
$i_E=1$ $z=z_2$	0.03	0.42	0.21	0.09	0.02	0.08	0.06	0.05	0.03	0.01
$i_E=1$ $z=z_3$	0.02	0.11	0.49	0.21	0.07	0.03	0.02	0.03	0.02	0.02
$i_E=1$ $z=z_4$	0.01	0.04	0.10	0.53	0.20	0.02	0.02	0.03	0.03	0.03
$i_E=1$ $z=z_5$	0	0.01	0.02	0.11	0.72	0.02	0	0.01	0.01	0.08
$i_E=0$ $z=z_1$	0	0.01	0.01	0	0	0.85	0.09	0.03	0.01	0
$i_E=0$ $z=z_2$	0	0.04	0.02	0.01	0	0.25	0.43	0.15	0.07	0.03
$i_E=0$ $z=z_3$	0	0.03	0.06	0.03	0.03	0.10	0.18	0.30	0.18	0.09
$i_E=0$ $z=z_4$	0	0.01	0.03	0.10	0.06	0.09	0.12	0.12	0.35	0.12
$i_E=0$ $z=z_5$	0	0	0.01	0.05	0.17	0.07	0.04	0.07	0.14	0.45

Table 8: Joint transition matrices of earnings and EHI offer by age group 60-64

Age 60-64	$i'_E=1$ $z'=z_1$	$i'_E=1$ $z'=z_2$	$i'_E=1$ $z'=z_3$	$i'_E=1$ $z'=z_4$	$i'_E=1$ $z'=z_5$	$i'_E=0$ $z'=z_1$	$i'_E=0$ $z'=z_2$	$i'_E=0$ $z'=z_3$	$i'_E=0$ $z'=z_4$	$i'_E=0$ $z'=z_5$
$i_E=1$ $z=z_1$	0.09	0.22	0.07	0.04	0.07	0.33	0.18	0	0	0
$i_E=1$ $z=z_2$	0.01	0.42	0.20	0.01	0	0.14	0.15	0.05	0.01	0.01
$i_E=1$ $z=z_3$	0.01	0.18	0.40	0.13	0.02	0.07	0.08	0.06	0.05	0.01
$i_E=1$ $z=z_4$	0.01	0.05	0.14	0.47	0.13	0.08	0.03	0.02	0.06	0.02
$i_E=1$ $z=z_5$	0.01	0.02	0.02	0.09	0.69	0.04	0.02	0.01	0.03	0.08
$i_E=0$ $z=z_1$	0.01	0.01	0.01	0	0	0.87	0.06	0.02	0.01	0.01
$i_E=0$ $z=z_2$	0.01	0.05	0.02	0.01	0.01	0.35	0.38	0.10	0.05	0.02
$i_E=0$ $z=z_3$	0.01	0.03	0.03	0.03	0.01	0.21	0.23	0.25	0.13	0.07
$i_E=0$ $z=z_4$	0	0.02	0.03	0.05	0.04	0.25	0.12	0.10	0.22	0.17
$i_E=0$ $z=z_5$	0.01	0	0.02	0.02	0.09	0.11	0.09	0.07	0.13	0.46