Does the Social Safety Net Improve Welfare? A Dynamic General Equilibrium Analysis*

Kai Zhao†

University of Western Ontario

May 19, 2013

Abstract

Does the social safety net improve welfare? Conventional wisdom says that means-tested social safety net programs improve welfare because they provide partial insurance against large negative shocks by guaranteeing a minimum consumption floor, but some economists have argued that they may also discourage labor supply and reduce capital accumulation. Furthermore, recent research suggests that the welfare gain from the insurance channel may be small since the social safety net significantly crowds out private insurance decisions. In this paper, I quantitatively assess the tradeoff between these channels in a dynamic general equilibrium model with incomplete markets and endogenous health insurance decision. I find that the social safety net generates a significant *welfare loss*. I then show that the social safety net has a large crowding out effect on private health insurance, and this crowding out is important for obtaining the *welfare loss* result. In a counterfactual economy with exogenous health insurance, the social safety net can generate a substantial *welfare gain*. I also find that the model can account for a puzzling fact about the US health insurance markets, that is, a large number of Americans do not have any health insurance. Since many Americans (who are currently not qualified for means-tested programs) would become qualified after being hit by large health expense shocks, they are better off not buying any health insurance. This finding challenges the popular view that policy makers should force the currently uninsured to buy private health insurance.

Keywords: Saving, Labor Supply, Health Insurance, Means Test, Welfare.
JEL Classifications: E20, E60, H30, I13

*This paper has greatly benefited from discussions with Karen Kopecky. I would also like to thank Betsy Caucutt, Jim Davies, Hui He, Kevin Huang, Sagiri Kitao, Igor Livshits, Jim MacGee, Tao Zha, and participants at the 2012 Midwest Macro annual meeting, and participants in the macro workshop at Western Ontario for their helpful comments.

†Zhao: Assistant Professor, DAN Management Program, The University of Western Ontario, Canada. Email: kzhao6@uwo.ca.

1. Introduction

Means-tested welfare programs in the United States, such as Medicaid, TANF and SNAP, provide American households with a social "safety net" that guarantees a minimum consumption floor.[1] Total spending on these programs is large and it has been the fastest growing component of US government spending over the past few decades. Making up only 1.2% of GDP in 1964, by 2004 it had grown to approximately 5% of GDP, even more than the Social Security program which is the largest single public program in the US. Meanwhile, policy makers have often proposed to reform the means-tested programs (mainly Medicaid).[2] Despite this, there are relatively few studies that quantitatively evaluate the welfare result of the social safety net, compared to the large literature that uses dynamic life-cycle models to quantify the welfare cost of other public programs such as Social Security.[3] This paper attempts to fill this gap in the literature.

Does the social safety net improve individual welfare? Conventional wisdom says that the social safety net can improve individual welfare because it insures poor households against large negative shocks. However, some economists have argued that the social safety net may discourage work and thus reduce labor supply (e.g. Moffitt(2002)), and other economists find that the social safety net discourage private saving and thus reduce capital accumulation (Hubbard, Skinner, and Zeldes (1995)). Furthermore, some recent empirical studies suggest that the welfare gain from the insurance channel may be small since the social safety net significantly crowds out private insurance decisions.[4] Therefore, the welfare consequence of the social safety net depends on the relative importance of the above-described mechanisms.

In this paper, I develop a dynamic general equilibrium model with heterogenous agents and incomplete markets, and use it to quantitatively evaluate the effects of the social safety net on individual welfare. Different from standard incomplete markets models, which usually do not model health insurance or assume exogenous health insurance coverage, I endogenize the health insurance decision. As a result, the model can capture the crowding out effect of the social safety net on private health insurance decisions. In the model, agents face health expense

[1] TANF is the Temporary Assistance for Needy Families program, which replaced the existing Aid to Families with Dependent Children (AFDC) program in 1996. The Food Stamps program was recently renamed as the Supplemental Nutrition Assistance (SNAP) program. Please see Moffitt (2002) for a detailed description of the means-tested programs in the US.

[2] An important motivation of their proposals is the large number of Americans without any health insurance. One example is the recent health care reform proposed by President Obama.

[3] The quantitative literature on Social Security was started by Auerbach and Kotlikoff (1987), and it includes Imrohoroglu, Imrohoroglu, and Joines (1995), Conesa and Krueger (1999), Fuster, Imrohoroglu, and Imrohoroglu (2007), Zhao (2010), etc.

[4] For example, Cutler and Gruber (1996a,1996b), Brown and Finkelstein (2008).

shocks, labor income shocks, and survival risks over the life cycle. In each period, agents endogenously determine their labor supply. They also decide whether to take up employer-sponsored health insurance if it is offered, and whether to purchase individual health insurance from the private market. The model economy features a social safety net program that is modeled as a minimum consumption floor financed by a payroll tax rate. It also include a pay-as-you-go Social Security program and a Medicare program, both financed by payroll taxes.

I use the Medical Expenditure Panel Survey (MEPS) dataset to calibrate the model such that the model economy replicates the key features of the US health insurance system. I then use the calibrated model to quantitatively assess the welfare effect of the social safety net. I find that the social safety net generates a significant *welfare loss* (i.e. 1.6% of consumption each period).[5] I also find that the social safety net has a large crowding out effect on private health insurance coverage (both employer-sponsored health insurance and individual health insurance). I then show that this crowding out is very important for obtaining the welfare loss result. To illustrate this point, I replicate the welfare analysis in a version of the model with exogenous private health insurance coverage, and find that the social safety net can now generate a *welfare gain* (i.e. 1.4% of consumption each period). The intuition behind this result is simple. The crowding out effect on private insurance undoes the welfare gain from the public insurance provided by the social safety net, thus it can change the welfare consequence from a net welfare gain to a net welfare loss.

It is worth noting that the social safety net does not only affect individuals who are already qualified for means-tested programs. It also affects any individual who will potentially become qualified for these programs after being hit by large negative shocks. This is the reason why the crowding out effect on private health insurance is so large in the model, much larger than one for one. In fact, the quantitative results show that enrolling one more person in the social safety net can crowd out the private insurance coverage on almost three persons. This finding suggests that the existence of the social safety net may even increase the fraction of individuals without any health insurance. It is well known that there are a large number of Americans lacking any health insurance (approximately 47 million persons according to Gruber (2008)). This fact is in particular puzzling because many uninsured Americans are median income people who can afford health insurance but choose not to purchase it. Furthermore, this fact has recently motivated many policy proposals aiming to reduce the number of uninsured. However, as argued

[5]Here the welfare measure used is the equivalent consumption variation (ECV) which refers to the change in consumption each period required to make a new born to achieve the same expected lifetime utility.

by Gruber (2008), we need to first understand why so many Americans are without any health insurance in order to design any sensible policy to address the problem of uninsured. After reviewing the literature, he concludes that the lack of health insurance is still puzzling, at least quantitatively. The finding of this paper suggests that many Americans do not have any health insurance may be due to the existence of the social safety net. Since these Americans (currently not qualified for means-tested programs) can rely on the social safety net if they are ever hit by large health shocks, they are better off not buying any health insurance. The quantitative experiment shows that the percentage of uninsured working population would drop by approximately a half if the minimum consumption floor is reduced from its current level ($9700) to $100. It is worth noting that this finding implies that many individuals are better off being without any health insurance as they are implicitly insured by the social safety net. Thus, it challenges the popular view that the government should require the currently uninsured to buy private health insurance.

This paper is most related to the seminal work by Hubbard, Skinner, and Zeldes (1995). They also model the social safety net as a minimum consumption floor financed by payroll taxes, and find that the social safety net has a large crowding out effect on precautionary saving and it is the reason why a significant fraction of individuals do not accumulate any wealth over the life cycle. I extend their model to a general equilibrium setting and incorporate endogenous labor supply and endogenous health insurance decisions. I use the model to study the welfare effect of the social safety net. It is worth noting that I find a significantly smaller saving effect of the social safety net than Hubbard, Skinner, and Zeldes (1995). The reason for that is twofold. First, this model capture the general equilibrium effect which partially offsets the negative saving effect of the social safety net, i.e. a higher interest rate encouraging private saving. Second, in this model the social safety net crowds out private health insurance coverage and thus increases the out-of-pocket health expenses facing individuals, which also encourages private saving. The results of the quantitative experiments suggest that the effect of the social safety net on aggregate capital in this model may be significantly smaller than in the Hubbard, Skinner, and Zeldes model.

This paper belongs to the literature studying incomplete market models with heterogenous agents.[6] In particular, it is closely related to a number of recent studies that endogenize the demand for health insurance.[7] Jeske and Kitao (2009) use a similar model to study the tax ex-

[6] Huggett (1993), Aiyagari (1994), Hubbard, Skinner, and Zeldes (1995), Livshits, MacGee, and Tertilt (2007), De Nardi, French, and Jones (2010), and Kopecky and Koreshkova (2011), etc.

[7] Jeske and Kitao (2009), Pashchenko and Porapakkarm (2012), Hansen, Hsu, and Lee (2012), etc.

emption policy on employer-sponsored health insurance. Pashchenko and Porapakkarm (2012) use an environment similar to that in this paper to evaluate the welfare effect of the 2010 PPACA reform. Hansen, Hsu, and Lee (2012) study the the impact of a Medicare Buy-In policy in a dynamic life-cycle model with endogenous health insurance. In contrast to these studies, this paper studies the welfare effect of the social safety net with the special attention to the crowding out effect of the partial insurance provided by the social safety net on private health insurance decisions.

This paper is also related to the public finance literature that studies the crowding out effects of the partial public insurance from means-tested programs on private insurance decisions. Cutler and Gruber (1996a,1996b) find empirical evidence suggesting that Medicaid crowds out the coverage from employer-based health insurance. Brown and Finkelstein (2008) use a partial equilibrium dynamic programming model to show that Medicaid crowds out the demand for a specific type of individual health insurance: long term care insurance. I develop a dynamic general equilibrium model and adopt the approach in Hubbard, Skinner, and Zeldes (1995) to model means-tested programs as a social safety net (a minimum consumption floor). I quantify the crowding out effects of the social safety net on both employment-sponsored health insurance and individual health insurance, and quantitatively evaluate the welfare effect of the social safety net.

The rest of the paper is organized as follows. I specify the model in section 2 and calibrate it in section 3. I present the results of the main quantitative exercise in section 4 and provide further discussion on related issues in section 5. I conclude in section 6.

2. The Model

2.1. The Individuals

Consider an economy inhabited by overlapping generations of agents whose age is $j = 1, 2, ..., T$. Agents are endowed with one unit of time in each period that can be used for either work or leisure. They face survival probabilities P and health expense shocks m in each period over the whole life cycle, and idiosyncratic labor productivity shocks ϵ in each period up to the retirement age R. The agents' state in each period can be characterized by a vector $s = \{j, a, m, e_h, h, \epsilon, \eta\}$, where j is age, a is assets, m is health expense shock, e_h indicates whether employer-provided health insurance is offered, h is the type of health insurance currently held, ϵ is labor productivity shock, and η is the cumulated earnings which will be used to determine future Social Security payments. In each period, agents simultaneously choose consumption, labor supply, and the type of health insurance to maximize their expected lifetime utility, and this optimization problem $(P1)$ can be formulated recursively as follows:

$$V(s) = \max_{c,l,h'} u(c,l) + \beta P_j E[V(s')] \tag{1}$$

subject to

$$\begin{cases} \frac{a'}{1+r} + c + (1-\kappa_h)m + p_{h'} - \tau p_3 I_{h'=3} = \widetilde{w}\epsilon l(1-\tau) + a + Tr & \text{if} \quad j \leq R \\ \frac{a'}{1+r} + c + (1-\kappa_h)(1-\kappa_m)m + p_{h'} = SS(\eta) + a + Tr, & \text{if} \quad j > R \end{cases} \tag{2}$$

$$a' \geq 0,$$

$$l \in \{0,1\},$$

$h' \in \{1,2,3\}$ if $e_h = 1$ and $l = 1$, otherwise $h' \in \{1,2\}$.

Here V is the value function, and $u(c,l)$ is the current period utility flow which is a function of consumption c and labor supply l. There are three private health insurance statuses, no private insurance $(h = 1)$, individual health insurance $(h = 2)$, and employer-provided health insurance $(h = 3)$. e_h is the indicator function for whether employment-provided health insurance is offered in the current period with $e_h = 1$ indicating it is available and $e_h = 0$ indicating otherwise. The coinsurance rate for the private health insurance policy of type h is represented by κ_h, the price of that insurance policy is denoted by p_h. Note that $\widetilde{w} = w - c_e$ if $e_h = 1$, and $\widetilde{w} = w$ otherwise, where w is the wage rate and c_e is the amount collected by the firm to cover a fraction of employer-sponsored health insurance premiums. As shown in the worker's budget constraint, the employer-sponsored health insurance premiums are exempted from taxation, which is an important feature of the US tax policy.[8] β is the subjective discount factor and I is an indicator function.

On the government side, Tr is the transfer from the social safety net, which is the key component of the economy for this study and will be specified further in the following. $SS(\eta)$ is the

[8] For a detailed analysis of this issue, please see Jeske and Kitao (2009), Huang and Huffman (2010).

Social Security payment after retirement, and κ_m is the coinsurance rate of the Medicare program. All these programs are financed by proportional payroll tax rates.

Note that in this economy agents may die with positive assets, i.e. accidental bequests, which are assumed to be equally redistributed to the new-born cohort. Thus, in each period, a new cohort of agents is born into the economy with initial assets determined by the last period's accidental bequests. For simplicity, the population growth rate is assumed to be constant and equal to zero in the benchmark model.

The health expense shock m is assumed to be governed by a 6-state Markov chain which will be calibrated using the Medical Expenditure Panel Survey (MEPS) dataset. The log of the idiosyncratic labor productivity shock ϵ is determined by the following equation,

$$\ln \epsilon = a_j + y,$$

where a_j is the age-specific component, and y follows a joint process with the probability of being offered employer-sponsored health insurance, that will be specified in the calibration section.

The distribution of the individuals is denoted by $\Phi(s)$, and it evolves over time according to the equation $\Phi' = R_\Phi(\Phi)$. Here R_Φ is a one-period operator on the distribution, which will be specified in the calibration section.

2.2. The Government

The social safety net guarantees a minimum consumption floor $\underline{c}$, and it is financed by a payroll tax τ_w. Therefore, the transfer Tr from social safety net can be simply determined by the following equation,

$$\begin{cases} Tr = \max\{0, \underline{c} + (1-\kappa_h)m - a - \widetilde{w}\epsilon l(1-\tau)\}, & \text{if} \quad j \leq R \\ Tr = \max\{0, \underline{c} + (1-\kappa_h)(1-\kappa_m)m - a - SS(\eta)\}, & \text{if} \quad j > R \end{cases}$$

The Social Security program provides annuities to agents after retirement, and the Medicare program provides health insurance to agents after retirement by covering a κ_m portion of their health expenses. The Social Security benefit formula $SS(\eta)$ is modeled as in Fuster, Imrohoroglu, and Imrohoroglu (2007) so that it matches the progressivity of the current US Social

Security program. These two programs are financed by payroll tax rates, τ_s and τ_m, respectively. By construction, $\tau = \tau_w + \tau_s + \tau_m$.

The budget constraints for each of these three government programs can be written respectively as follows,

$$\int Tr(s)\Phi(s) = \int \tau_w(\widetilde{w}\epsilon l(s) - p_3 I_{h'(s)=3})\Phi(s) \tag{3}$$

$$\int SS(\eta)\Phi(s) = \int \tau_s(\widetilde{w}\epsilon l(s) - p_3 I_{h'(s)=3})\Phi(s) \tag{4}$$

$$\int \kappa_m m I_{j\geq R}\Phi(s) = \int \tau_m(\widetilde{w}\epsilon l(s) - p_3 I_{h'(s)=3})\Phi(s) \tag{5}$$

2.3. The Production Technology

On the production side, I assume that the production is taken in competitive firms and is governed by the following standard Cobb-Douglas function,

$$Y = K^{\alpha}(AL)^{1-\alpha}. \tag{6}$$

Here α is the capital share, A is the labor-augmented technology, K is capital, and L is labor. Assuming capital depreciates at a rate of δ, the firm chooses K and L by maximizing profits $Y - wL - (r+\delta)K$. The profit-maximizing behaviors of the firm imply,

$$w = (1-\alpha)A(\frac{K}{AL})^{\alpha} \tag{7}$$

$$r = \alpha(\frac{K}{AL})^{\alpha-1} - \delta \tag{8}$$

2.4. Private Health Insurance Markets

There are two types of private health insurance policies: employment-provided health insurance and individual health insurance. The employer-provided health insurance is community-rated and provided by the employer, but the individual health insurance is traded in the private market and usually not community-rated. In the model, I assume that the individual health insurance is conditioned on age j and the current health shock m, and the health insurance companies for both types of insurance are operating competitively. As a result, the prices for these insurance policies can be expressed respectively as follows,

$$p_1 = 0. \tag{9}$$

$$p_2(j,m) = \lambda\kappa_2 P_j \frac{\int Em'(s) I_{m,j} I_{h'(s)=2}\Phi(s)ds}{1+r}, \forall m, j. \tag{10}$$

$$P_3 = \pi\lambda\kappa_3 \frac{\int P_j Em'(s) I_{h'(s)=3}\Phi(s)}{1+r}. \tag{11}$$

Here $I_{m,j}$ is the indicator function for having health expense shock m and being at age j. Since $h = 1$ means no private health insurance, the first price equation $p_1 = 0$ is simply by construction. λ represents the mark up on the health insurance premiums. Note that p_3 is the price individuals directly pay for employer-sponsored health insurance, which is only a π fraction of its total cost. The rest of the cost is paid by the firm with c_e, that is,

$$\int c_e \epsilon l(s)\Phi(s) = (1-\pi)\lambda\kappa_3 \frac{E\int P_j m'(s) I_{h'(s)=3}\Phi(s)}{1+r}. \tag{12}$$

Since agents can only live up to T periods, the dynamic programming problem can be solved by iterating backwards from the last period.

2.5. Market Clearing Conditions

The market clearing conditions for the capital and labor markets are respectively as follows,

$$K' = \int a'(s)\Phi(s) \tag{13}$$

$$L = \int \epsilon l(s)\Phi(s) \tag{14}$$

2.6. Stationary Equilibrium

A stationary equilibrium is defined as follows,

Definition: A **stationary equilibrium** is given by a collection of value functions $V(s)$, individual policy rules $\{a', l, h'\}$, the distribution of individuals $\Phi(s)$; aggregate factors $\{K, L\}$; prices $\{r, w, \widetilde{w}\}$; Social Security, Medicare, the social safety net; private health insurance contracts defined by pairs of price and coinsurance rate $\{p_h, \kappa_h\}$, such that,

1. Given prices, government programs, and private health insurance contracts, the value

function $V(s)$ and individual policy rules $\{a', l, h'\}$ solve the individual's dynamic programming problem (P1).

2. Given prices, K and L solve the firm's profit maximization problem.

3. The capital and labor markets clear, that is, conditions (13-14) are satisfied.

4. The government programs, the social safety net, Social Security, and Medicare are self-financing, that is, conditions (3-5) are satisfied.

5. The health insurance companies are competitive, and thus the insurance contracts satisfy conditions (9-11).

6. The distribution $\Phi(s)$, evolves over time according to the equation $\Phi' = R_\Phi(\Phi)$, and satisfies the stationary equilibrium condition: $\Phi' = \Phi$.

7. The amount of initial assets of the new born cohort is equal to the amount of accidental bequests from the last period.

I focus on stationary equilibrium analysis in the rest of the paper. Since analytical results are not obtainable, numerical methods are used to solve the model.

3. Calibration

3.1. Demographics and Preferences

One model period is one year. Individuals are born at age 21 ($j = 1$), retire at age 65 ($R = 45$), and can live up to age 85 ($T = 65$). The survival probability P_j over the life cycle is calibrated using the 2004 US life table (see Table 11).

The utility function is assumed to take the following form, $u(c,l) = \frac{c^{1-\sigma}}{1-\sigma} - \zeta l$. The risk aversion parameter σ is set to 2, which is the commonly used value in the macro literature. The disutility parameter for labor supply ζ is calibrated to match the employment rate in the data. The discount factor β is set to 0.97.

3.2. Production

The capital share α in the production function is set to 0.33, and the depreciation rate δ is set to 0.06. Both are commonly-used values in the macro literature. The labor-augmented technology parameter A is calibrated to match the output per person in 2004.

Table 1: Income and Health Expenditure Grids

Labor productivity shock	1	2	3	4	5	
	0.34	0.67	1	1.47	2.88	
Health exp. shock ($)	1	2	3	4	5	6
Age 21-35	0	143	775	2696	6755	17862
Age 36-45	5	298	1223	4202	9644	29249
Age 46-55	46	684	2338	6139	12596	33930
Age 56-65	204	1491	3890	9625	20769	58932
Age 66-75	509	2373	5290	11997	21542	50068
Age 76-85	750	2967	7023	16182	30115	53549

Note: I normalize the 3rd labor productivity shock to 1.

Table 2: The Transition Matrix for Income and Employer-sponsored Health Insurance

		Offered					Not offered				
		1	2	3	4	5	1	2	3	4	5
Offered	1	0.348	0.089	0.030	0.014	0.004	0.328	0.119	0.034	0.021	0.012
	2	0.250	0.379	0.196	0.088	0.032	0.026	0.015	0.007	0.007	0.000
	3	0.116	0.151	0.430	0.215	0.060	0.008	0.004	0.012	0.005	0.000
	4	0.080	0.066	0.179	0.485	0.172	0.004	0.003	0.005	0.004	0.002
	5	0.036	0.025	0.050	0.162	0.715	0.001	0.001	0.002	0.002	0.008
Not offered	1	0.348	0.089	0.030	0.014	0.004	0.328	0.119	0.034	0.021	0.012
	2	0.178	0.109	0.064	0.017	0.011	0.162	0.287	0.123	0.042	0.008
	3	0.149	0.113	0.108	0.057	0.010	0.103	0.129	0.222	0.082	0.026
	4	0.072	0.051	0.080	0.101	0.036	0.080	0.116	0.138	0.225	0.101
	5	0.160	0.012	0.037	0.062	0.222	0.062	0.074	0.123	0.025	0.222

3.3. Labor Productivity Shock, Health Expenditure Shock, and Employment-sponsored Health Insurance

I use the Medical Expenditure Panel Survey (MEPS) dataset to calibrate the labor productivity process, the health expenditure process, and the probabilities of being offered employer-sponsored health insurance.[9] Since the probability of being offered employer-sponsored health insurance varies significantly across the income distribution, I calibrate the labor productivity process jointly with the probability of being offered employer-sponsored health insurance.

The age-specific deterministic component a_j in the labor productivity process is calibrated using the average wage income by age in the MEPS dataset. I use the data on the wage income distribution of individuals to construct 5 states with five bins of equal size for the random labor productivity component y. The data on total health expenditures is used to calibrate the distribution of health expenditures and 6 states are constructed with the bins of the size $(25\%, 50\%, 75\%, 90\%, 95\%)$ for the health expenditure shock m. To capture the life-cycle profile of health expenditures, I assume that the health expense shock m is age-specific and calibrate the distribution of health expenditures for each 10 or 15 years group. The income grids and health expenditure grids are reported in Table 1. The joint transition matrix for income and employer-sponsored health insurance is also calculated from the MEPS dataset and is reported in Table 2. The age-specific deterministic income components are reported in Table 11. The transition matrices for health expenditure shocks are reported in Table 10.

3.4. Government

The social safety net in the US consists of means-tested programs such as Medicaid, AFDC/TANF, SNAP (formerly food stamps), SSI, etc. It insures poor Americans against large negative shocks by guaranteeing a minimum consumption floor. Directly measuring the value of the minimum consumption floor $\underline{c}$ is difficult, as benefits from social safety net programs vary dramatically by program and by individual characteristics such age and family structure. Thus, in the benchmark calibration I calibrate the value of $\underline{c}$ such that the model matches the fraction of working population (between age 21 and 65) covered by Medicaid in the MEPS dataset, that is, 9.6%. The resulting value of $\underline{c}$ is \$9700 (approximately \$5300 in 1984 dollars), which is slightly lower than the value used in Hubbard, Skinner, and Zeldes (1995), i.e. \$7000 in 1984 dollars. The corresponding payroll tax rate τ_w for the social safety net is endogenously chosen such that the social safety net is self-financing. The resulting value of τ_w is 5.3%.

Social Security in the model is designed to capture the main features of the US Social Security program. The Social Security payroll tax rate is set to 12.4%, according to the SSA (Social Security Administration) data. Following Fuster, Imrohoroglu, and Imrohoroglu (2007), the Social

[9] Specifically, I use the 2008/2009 MEPS panel.

Security benefit formula $SS(\eta)$ are chosen so that the Social Security program has the marginal replacement rates listed in Table 3. I rescale every beneficiary's benefits so that the Social Security program is self-financing.

The Medicare program provides health insurance to every individual aged 65 and above. According to the CMS data, approximately 50% of the elderly's health expenditures are paid by Medicare, thus I set the Medicare coinsurance rate k_m to 0.5.[10] The Medicare payroll tax rate τ_m is endogenously determined by Medicare's self-financing budget constraint, and the resulting value is 4.7%.

Table 3: The Social Security Benefit Formula $SS(\eta)$.

	Marginal Replacement Rate
$\eta \in [0, 0.2\overline{\eta})$	90%
$\eta \in [0.2\overline{\eta}, 1.25\overline{\eta})$	33%
$\eta \in [1.25\overline{\eta}, 2.46\overline{\eta})$	15%
$\eta \in [2.46\overline{\eta}, \infty)$	0

Note: $\overline{\eta}$ is the population average of η.

3.5. Private Health Insurance

The values of κ_2 and κ_3 represent the fraction of health expenditures covered by the individual health insurance policy and employer-sponsored health insurance policy. I set their values to 0.75 in the benchmark calibration because the coinsurance rates of most private health insurance policies in the US fall in the range from $65\% - 85\%$.[11] Following Jeske and Kitao (2009), I set the fraction of total employer-sponsored health insurance premiums paid by employees, π, to 0.2. This value is consistent with the empirical evidence provided in Sommers (2002) who finds that the average fraction of total employer-sponsored health insurance premiums paid by employees varies from 11% to 23%. I set the value of λ, the mark-up on health insurance premiums, to 11% based on Kahn et al. (2005).

The key results of the calibration are summarized in Table 4.

[10]See Attanasio, Kitao, and Violante (2008) for a detailed description of Medicare.

[11]Note that κ_1 is equal to 0 by construction, since $h = 1$ means no private health insurance.

Table 4: The Benchmark Calibration

Parameter	Value	Source
σ	2	Macro literature
α	0.33	Macro literature
δ	0.06	Macro literature
β	0.97	Macro literature
τ_s	12.4%	US Social Security tax rate
κ_m	0.5	Attanasio, et al (2008)
τ_m	4.7%	
$\underline{c}$	$9,700	% of working pop. on Medicaid
τ_w	5.3%	
A	24500	Output per person: $40293
λ	0.11	Kahn et al. (2005)
π	0.2	Sommers(2002)
ζ	0.2E-4	Employment rate: 73%

4. Quantitative Analysis

In this section, I first describe the key statistics of the calibrated benchmark economy, and show that the benchmark economy captures the key features of the current US economy, especially the current US health insurance system. I then study the effects of the social safety net on labor supply, saving, private health insurance decisions, and individual welfare by comparing the benchmark economy with counterfactual economies with different levels of the minimum consumption floor.

4.1. The Benchmark Economy

Table 5 summarizes the key statistics of the benchmark economy. As can be seen, the model does a good job matching the key moments of the US economy. In particular, the simulated shares of working population with different health insurance statuses generally match the corresponding values in the data, although I do not directly target these values in the calibration.[12]

[12]Note that the share of individuals with employer-sponsored health insurance in the model is sightly lower than that in the data. This is because in the model I assume that individuals do not get access to employer-sponsored

Table 5: Key Statistics of the Benchmark Economy

Statistics	Model	Data
Interest rate	3.2%	
Employment rate	72%	73%
Output per person	$41007	$40293
ESHI take-up rate	92.9%	90.7%
% of working popu. with		
Individual HI	3.7%	4.4%
ESHI	52.7%	59.4%
Medicaid	9.5%	9.6%
No HI	34.1%	26.7%

Data source: MEPS

Table 6 presents the fractions of individuals on the social safety net by age group. These fractions also match those documented in the MEPS data fairly well. For example, the simulated fraction of individuals aged 21-35 is 10.5%, compared with the corresponding value of 10.4% in the data. This fraction declines significantly as individuals are reaching their prime working ages. The simulated fraction of individuals aged 46-55 is 8.2%, compared with the corresponding value of 7.0% in the data. After retirement, the fraction rises significantly.

Figures 1-4 plot the life-cycle profiles of consumption, saving, employment rate, and earnings,. The consumption, earnings, and saving profiles are all hump-shaped, generally consistent with what have been found in standard dynamic life-cycle models and documented empirical facts. The employment rate is fairly stable during the working age.

4.2. Welfare Effect of the Social Safety Net

To evaluate the welfare consequence of the social safety net, I study how changing the value of the minimum consumption floor ($\underline{c}$) affects individual welfare. Specifically, I compare the welfare of individuals in the benchmark economy (with a $9700 consumption floor) with those in a counterfactual economy with a $100 consumption floor.[13] To construct this counterfactual

health insurance if they do not work, but in the data some of them can still get employer-sponsored health insurance through their family members (mainly the spouse).

[13] The reason I do not construct and compare to a counterfactual economy with $0 consumption floor is because the economy without social safety net is not well-defined. That is, there are always a tiny fraction of population who

economy, I exogenously reduce the value of $\underline{c}$ to \$100 and reset the payroll tax rate τ_w to make the social safety net program self-financing while keeping the rest of the parameter values constant, and then compute the new stationary equilibrium.

To quantify the welfare result, I adopt the equivalent consumption variation (ECV) as the welfare criteria. That is, the change in consumption each period required for a new born to achieve the same expected lifetime utility. As shown in Table 7, the expected lifetime utility of a new born increases significantly when the minimum consumption floor is reduced from \$9700 to \$100. In term of ECV, an increase of 1.6% in consumption each period is required to make a new born in the benchmark economy to achieve the same expected lifetime utility as in the counterfactual economy with \$100 consumption floor. This result suggests that the social safety net generates a significant welfare loss. It is worth noting that the welfare effect of the social safety net varies dramatically across the income distribution. Table 8 presents the welfare consequence of reducing the consumption floor from \$9700 to \$100 for various labor productivity shocks. The social safety net is welfare-improving for a new born with low labor income productivity shocks, but it is welfare-reducing for those with high labor productivity shocks. For example, reducing the consumption floor from \$9700 to \$100 generates a welfare loss of 0.6% for a new born with the lowest labor productivity shock, but it generates a welfare gain of 3.8% for those with the highest productivity. This differential welfare result simply reflects the fact that poorer individuals are more likely to use social safety net programs because these programs are means-tested.

As argued in the introduction, the social safety net provides individuals partial insurance against large income and health shocks, but it can also have welfare-reducing effects, such as negative effects on labor supply and capital accumulation. The finding of a net welfare loss for social safety net suggests that the welfare gain from the insurance channel is dominated by the welfare loss from the other channels.

4.3. Social Safety Net and Private Health Insurance

Several empirical studies found that means-tested programs have a large crowding out effect on private health insurance decisions. For example, Cutler and Gruber (1996a,1996b) found that Medicaid discourages individuals from taking up employer-based health insurance. Brown and

are extremely unlucky (hit by a series of bad income and health expense shocks) and do not have enough resources to cover their health expenses. As a result, I set the minimum consumption floor in the counterfactual economy to \$100. As robustness check, I also explore other values (i.e. \$50, \$10) and find that the main results do not significantly change.

Table 6: Fraction of Individuals on Medicaid by Age Group

Age Group	Model	Data
21-35	10.5%	10.4%
36-45	11.5%	8.8%
46-55	8.2%	7.0%
56-65	7.2%	6.4%
66-75	10.3%	12.9%
76-	23.2%	12.3%

Data source: MEPS

Finkelstein (2008) show that Medicaid crowds out the demand for a specific type of individual health insurance: long term care insurance. In this section, I quantify the crowding out effect of the social safety net on both employer-sponsored health insurance and individual health insurance using a dynamic general equilibrium model. Then, I study whether the crowding out is important for understanding the welfare implication of the social safety net.

I find that the crowding out effect is quantitatively large. As shown in Table 7, when the minimum consumption floor is reduced from $9700 to $100, the share of working-age individuals with employer-sponsored health insurance increases from 52.9% to 63.6%, and the share of those with individual health insurance increases from 3.7% to 18.2%. It is worth mentioning that the crowding out effect on employer-sponsored health insurance comes from two sources. First, the social safety net reduces the take up rate for working individuals who are offered employer-sponsored health insurance. Second, it discourages work, thus lowering the number of individuals being offered employer-sponsored health insurance. As shown in Table 7, when the minimum consumption floor is reduced from $9700 to $100, the take-up rate increases from 92.9% to 97.1%, meanwhile the employment rate increases from 72% to 87%. A simple decomposition calculation suggests that only close to a quarter of the change in employer-sponsored health insurance is from the take-up rate channel, and the rest is from the labor supply channel.

Furthermore, I find that the crowding out effect is important for understanding the welfare result of the social safety net. To illustrate this point, I conduct the following computational experiment. I first fix the private health insurance decisions in the benchmark economy (with a $9700 floor), and then replicate the welfare analysis conducted in the previous section. That is,

Table 7: The Main Quantitative Results

Statistic	Benchmark	Counterfactual (with $100 floor)	Counterfactual (Exog. HI)	Counterfactual (Exog. Labor)	Counterfactual (Partial Equi.)
Expected ave. lifetime utility	-1.59E-3	-1.57E-3	-1.61E-3	-1.65E-3	-1.56E-3
Welfare Consequence	n.a.	1.6%	-1.4%	-4.4%	2.7%
% of working popu. with					
Individual HI	3.7%	18.2%		26.1%	19.2%
ESHI	52.7%	63.6%		52.2%	56.1%
Public HI	9.5%	≤0.01%		≤0.01%	≤0.01%
No HI	34.1%	18.2%		21.7%	24.7%
ESHI take-up rate	92.9%	97.1%		89.6%	91.0%
ESHI premium	$3323	$3225		$3583	$3420
Social safety net tax rate τ_w	5.3%	≤0.01%	≤0.01%	≤0.01%	≤0.01%
Employment rate	72%	87%	85%		82%
Aggregate labor	0.89	0.95	0.93		0.90
Aggregate capital (in $1000)	147	193	210	193	213
Output per person	$41007	$46755	$47463	$45201	$46620
Interest rate	3.2%	2.0%	1.4%	1.7%	3.2%

Table 8: Welfare Effect of the Social Safety Net by Labor Productivity

(Reducing the consumption floor from $9700 to $100)

Labor Productivity (from low to high)	1	2	3	4	5
Welfare gain/loss	-0.6%	0.9%	2.0%	2.8%	3.8%

I construct a counterfactual economy with a $100 floor and compare it to the benchmark economy. Since the private health insurance decisions are exogenously fixed, reducing the consumption floor will not change the private health insurance coverage any more. The key statistics of this counterfactual economy are reported in Column 4 of Table 7. As can be seen, the expected lifetime utility of the new born in the counterfactual economy is lower than in the benchmark economy now, suggesting the social safety net is now welfare-improving. Using equivalent consumption variation, I find that reducing the consumption floor from $9700 to $100 generates a welfare loss (i.e. 1.4 % of consumption each period) when private health insurance decisions are exogenously fixed. The intuition behind the differential welfare results in models with and without endogenous private health insurance is simple. Since the crowd out on private insur-

Table 9: Crowding Out Effects by Labor Productivity

Labor Productivity Shock (from low to high)	1	2	3	4	5
Individual HI					
Benchmark	5.4%	4.6%	2.1	1.7%	3.0%
Counterfactual	33.8%	23.9%	10.9%	5.0%	2.6%
Employer-sponsored HI					
Benchmark	11.7%	46.8%	72.1	82.6%	87.5%
Counterfactual	38.2%	56.1%	73.9	84.1%	88.9%

ance offsets part of the welfare gain from the public insurance provided by the social safety net, taking into account of this crowding out effect can change the welfare consequence of the social safety net, i.e. from a net welfare gain to a net welfare loss.

In Table 9, I break down the crowding out effects by labor productivity. As can be seen, the crowding out effect of the social safety net is larger among individuals with lower labor productivity. For example, for individuals with the lowest labor productivity shock, reducing the consumption floor from $9700 to $100 increases the fraction with individual health insurance from 5.4% to 33.8%, increases the fraction with employer-sponsored health insurance from 11.7% to 38.2%. For individuals with the highest labor productivity, however, the decrease in consumption floor only slightly changes their private health insurance coverage. The intuition for this result is simple. Poorer individuals are more likely to rely on the social safety net, therefore their health insurance decisions are affected more by the social safety net. The results in Table 9 also show that the social safety net does not only affect poor individuals. It also has a significant effect on individuals with median labor income. This is because these individuals will potentially become qualified for the social safety net after being hit by a series of large negative shocks, even though they are currently well above the welfare criteria. Note that this is also the reason why the crowding out effect in the model is quantitatively so large, much larger than one for one. As can be seen in Table 7, increasing the consumption floor from $100 to $9700 enrols 9.5% of working-age individuals more in the social safety net, but meanwhile it crowds out the private health insurance coverage on 25.4% of working-age individuals. That is, enrolling one more person in the social safety net crowds out the private insurance coverage of almost three persons.

4.4. Social Safety Net and Labor Supply

The social safety net also discourages work and thus reduces labor supply. As shown in Table 7, as the consumption floor is reduced from $9700 to $100, the employment rate increases from 72% to 87%.[14] Here the labor supply effect of the social safety net is from two channels. First, since the social safety net is means-tested, it imposes implicit taxes on some workers. For instance, for workers already on the consumption floor, receiving additional one dollar income simply reduces the welfare transfer by one dollar. That is, they face %100 implicit income tax rate. For those who are potentially qualified for social safety net, additional labor income also reduces their future opportunity of receiving welfare transfers. Second, the corresponding payroll tax rate lowers the after-tax wage and thus also reduces labor supply via substitution effect.

To understand the relative importance of the above two channels, I conduct a computational experiment in which I reduce the consumption floor from $9700 to $100 but keep the payroll tax rate constant (at 5.3%). I find that the labor supply effect now becomes slightly smaller, that is, the employment rate increases from 72% to 85%. This suggests that the payroll tax channel only accounts for a small part of the labor supply effect, and majority of the labor supply effect is due to the means-testing feature of the social safety net.

As argued before, the negative labor supply effect reduces welfare, which is an important reason why the social safety net generates a net welfare loss in the benchmark economy. To illustrate this point, I conduct the following computational experiment. I fix the labor supply decisions in the benchmark economy, and then replicate the benchmark welfare analysis. That is, constructing a counterfactual economy with a $100 floor and compare it to the benchmark economy. The key statistics of this counterfactual economy are reported in Column 5 of Table 7. As can be seen, the expected lifetime utility of the new born in the counterfactual economy becomes much lower than in the benchmark economy now. Using equivalent consumption variation, I find that reducing the consumption floor from $9700 to $100 generates a large welfare loss (i.e. 4.4 % of consumption each period). The large difference in welfare consequence suggests that the labor supply effect has an important implication for the welfare consequence of the social safety net.

[14]Note that the corresponding increase in aggregate labor supply is 7%, which is significantly smaller than the increase in employment rate. This is because the social safety net mainly discourages the individuals with low labor productivity from working.

4.5. Social Safety Net and Precautionary Saving

The seminal work by Hubbard, Skinner and Zeldes (1995) shows that the social safety net reduces precautionary saving, and is the reason why many relatively poor individuals do not accumulate any wealth over the life cycle. In this section, I investigate whether this result also holds true here. In Figure 5, I present the level of wealth at the 10th, 50th, and 90th percentiles of the wealth distribution by age over the life cycle. As can be seen, for the individuals at the 50th and 90th percentiles of the wealth distribution, the life cycle profiles of wealth are standard, that is hump-shaped. However, for individuals on the bottom of the distribution, wealth is near zero for all ages over the life cycle. This result is consistent with the data and the finding in Hubbard, Skinner and Zeldes (1995). The intuition behind this result is the following. As argued by Hubbard, Skinner and Zeldes, the minimum consumption floor provides partial insurance against large negative shocks, and thus reduces private saving. Since the consumption floor is larger fraction of lifetime income for poor individuals, the negative saving effect is larger for them. This point can be confirmed by comparing the life cycle profiles of wealth in the benchmark model and in the counterfactual model with a $100 consumption floor. As shown in Figure 6, when the minimum consumption floor is reduced from $9700 to $100, the poor individuals (at the 10th percentile of the distribution) start to accumulate much more wealth. The shape of their life cycle wealth profile becomes hump-shaped, not significantly different from the profiles for other individuals. On the other hand, reducing the minimum consumption floor affects richer individuals much less, and it almost does not affect the wealth profile for individuals at the 90th percentile of the distribution.

It is worth mentioning that the saving effect of the social safety net in the model may be quantitatively smaller than in the Hubbard, Skinner, and Zeldes (1995) model, although they are qualitatively the same as discussed above. The reason for that is twofold. First, this model captures the general equilibrium effect which partially offsets the negative saving effect of the social safety net, that is, a higher interest rate encouraging private saving. As shown in Table 7, when the consumption floor changes from $100 to $9700, the interest rate increases from 2.0% to 3.2%. Second, in this model the social safety net crowds out private health insurance coverage and thus increases the out-of-pocket health expenses facing individuals, which also encourages private saving. To verify this point, I compare the effect of reducing the consumption floor from $9700 to $100 on aggregate capital in three model economies, the benchmark economy, the economy with exogenous health insurance, and the partial equilibrium economy. As shown in

Table 7, when the minimum consumption floor is reduced from \$9700 to \$100, the aggregate capital would increase from \$147,000 to \$193,000 in the benchmark economy, but it would increase to \$210,000 in the economy with exogenous health insurance, and increase to \$213,000 in the partial equilibrium economy. This result suggests that the effect of the social safety net on capital accumulation in Hubbard, Skinner, and Zeldes (1995) may be biased upward because their model does not feature general equilibrium and endogenous private health insurance.

5. Why So Many Americans Are Uninsured?

As is well known in the data, a large number of Americans are currently without any type of health insurance in the US (approximately 47 millions according to Gruber (2008)). This fact has attracted growing attention from both academics and policy-makers, and it has motivated a variety of policy proposals aiming to reduce the number of uninsured. What is the right policy to solve this problem? As argued by Gruber (2008), the answer to this question really depends on why these Americans are uninsured in the first place. However, after reviewing the literature, Gruber (2008) concludes that it is still a puzzle why so many Americans choose to be uninsured (at least quantitatively).

I argue that the model provides a promising explanation for this puzzle. That is, many Americans do not purchase any private health insurance because of the existence of the social safety net. The intuition behind this argument is simple. The social safety net does not only affect individuals who are currently qualified for social safety net programs. It also affects any individual who will potentially be qualified for the social safety net if ever being hit by a series of large negative shocks. As can be seen in Table 7, the share of the uninsured drops by more than a half (i.e. from 34.1% to 18.2%) when the consumption floor is reduced from \$9700 to \$100. This quantitative result suggests that the existence of the social safety net may account for approximately a half of the population who do not have any health insurance. This result also provides an upper bound on the quantitative importance of the other potential explanations such as uncompensated care, the market frictions in the health insurance markets (see Gruber (2008) for a detailed review of these explanations).

It is worth noting that the model implies that many individuals are better off being without any health insurance as they are implicitly insured by the social safety net. Thus, it challenges the popular view that the government should require the currently uninsured to buy private health insurance.

6. Conclusion

In this paper, I conduct a dynamic general equilibrium analysis of the social safety net. As opposed to standard dynamic general equilibrium models with incomplete markets, I endogenize the health insurance decisions in the model, and thus capture the crowding out effect of the social safety net on private health insurance. First, I find that the social safety net generates a significant *welfare loss* (i.e. 1.6% of consumption each period). I then show that to understand the welfare consequence of the social safety net, it is very important to take into account the crowding out effect on private health insurance because the crowding out can undo the welfare gain from the partial insurance provided by the social safety net. In a counterfactual experiment, I find that when the private health insurance decisions are fixed exogenously, the social safety net can generate a *welfare gain*, that is, 1.4% of consumption each period.

I also find that the existence of the social safety net is an important cause of a puzzling fact about the US health insurance system. That is, a large number of Americans do not purchase any health insurance. Since many Americans (who are currently not qualified for social safety net programs) can potentially rely on the social safety net if ever being hit by large health shocks, the model implies that they are better off not buying any health insurance. The quantitative result suggests that the existence of the social safety net can account for approximately a half of the population without any health insurance in the US. Since the result suggests that many uninsured individuals are better off not buying any health insurance, it also challenges the popular view that the government should require the currently uninsured to buy private health insurance.

References

AIYAGARI, R. (1994): "Uninsured idiosyncratic risk and aggregate saving," *Quarterly Journal of Economics*, 109, 659–684.

ATTANASIO, O., S. KITAO, AND G. L. VIOLANTE (2008): "Financing Medicare: A General Equilibrium Analysis," in Demography and Economics, edited by J. Shoven, NBER.

AUERBACH, A. J., AND L. J. KOTLIKOFF (1987): "Dynamic Fiscal Policy," Cambridge: Cambridge University Press.

BROWN, J., AND A. FINKELSTEIN (2008): "The Interaction of Public and Private Insurance: Medicaid and the Long-Term Insurance Market," *American Economic Review*, 98(3), 1083–1102.

CONESA, J. C., AND D. KRUEGER (1999): "Social Security Reform with Heterogeneous Agents," *Review of Economic Dynamics*, 2(4).

CUTLER, D. M., AND J. GRUBER (1996a): "Does Public Insurance Crowd Out Private Insurance?," *Quarterly Journal of Economics*, 111(2), 391–430.

——— (1996b): "The Effect of Expanding the Medicaid Program on Public Insurance, Private Insurance, and Redistribution," *American Economic Review*, 86(2), 368–373.

DE NARDI, M., E. FRENCH, AND J. B. JONES (2010): "Why do the Elderly Save? The Role of Medical Expenses," *Journal of Political Economy*, 118 (1), 37–75.

FUSTER, L., A. IMROHOROGLU, AND S. IMROHOROGLU (2007): "Elimination of Social Security in a Dynastic Framework," *Review of Economic Studies*, 74(1).

GRUBER, J. (2008): "Covering the Uninsured in the United States," *Journal of Economic Literature*, 46(3), 571–606.

HANSEN, G. D., M. HSU, AND J. LEE (2012): "Health Insurance Reform: The impact of a Medicare Buy-In," unpublished manuscript.

HUANG, K. X., AND G. W. HUFFMAN (2010): "A Defense of the Current US Tax Treatment of Employer-Provided Medical Insurance," unpublished manuscript, Vanderbilt University.

HUBBARD, R. G., J. SKINNER, AND S. P. ZELDES (1995): "Precautionary Saving and Social Insurance," *Journal of Political Economy*, 103(2).

HUGGETT, M. (1993): "The risk-free rate in heterogeneous-agent incomplete-insurance economies," *Journal of Economic Dynamics and Control*, 17, 953–969.

IMROHOROGLU, A., S. IMROHOROGLU, AND D. H. JOINES (1995): "A Life Cycle Analysis of Social Security," *Economic Theory*, 6, 83–114.

JESKE, K., AND S. KITAO (2009): "U.S. tax policy and health insurance demand: Can a regressive policy improve welfare?," *Journal of Monetary Economics*, 56(2).

KAHN, J., R. KRONICK, M. KREGER, AND D. GANS (2005): "The cost of health insurance administration in California: Estimates for insurers, physicians, and hospitals," *Health Affairs*, 24, 1629–1639.

KOPECKY, K. A., AND T. KORESHKOVA (2011): "The Impact of Medical and Nursing Home Expenses on Savings and Welfare," unpublished manucript, University of Western Ontario.

LIVSHITS, I., J. MACGEE, AND M. TERTILT (2007): "Consumer Bankruptcy: A Fresh Start," *American Economic Review*, 97(1), 402–418.

MOFFITT, R. A. (2002): "Welfare programs and labor supply," in: A. J. Auerbach and M. Feldstein (ed.), *Handbook of Public Economics*, edition 1, volume 4.

PASHCHENKO, S., AND P. PORAPAKKARM (2012): "Quantitative Analysis of Health Insurance Reform: Separating Regulation from Redistribution," *Review of Economic Dynamics*, forthcoming.

SOMMERS, J. (2002): "Estimation of expenditures and enrollments for employer-sponsored health insurance," Agency for Healthcare Research and Quality, MEPS Methodology Report 14.

ZHAO, K. (2010): "Social Security and the Rise in Health Spending: A Macroeconomic Analysis," unpublished manuscript.

Figure 1: Consumption over the Life Cycle

Figure 2: Saving over the Life Cycle

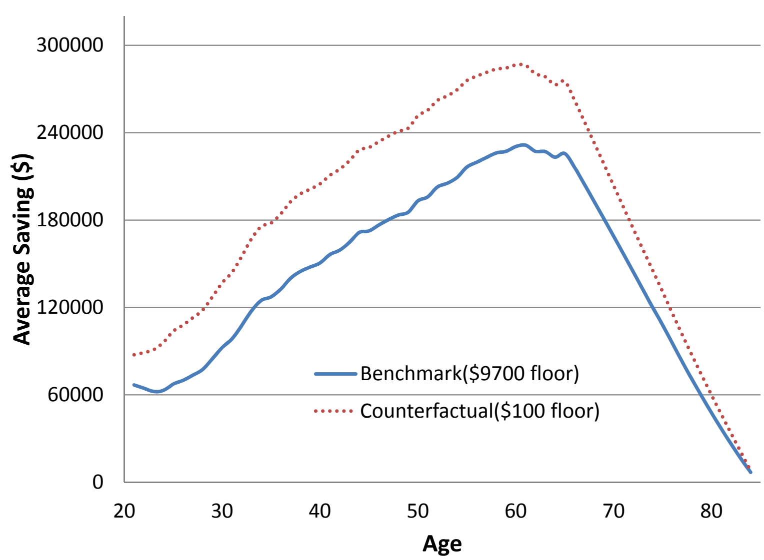

Table 10: The Transition Matrix for Health Expenditure Shock

Age 21-35		1	2	3	4	5	6
	1	0.366	0.366	0.166	0.065	0.018	0.018
	2	0.366	0.366	0.166	0.065	0.018	0.018
	3	0.200	0.200	0.314	0.158	0.072	0.055
	4	0.114	0.114	0.283	0.258	0.096	0.136
	5	0.165	0.165	0.278	0.205	0.063	0.125
	6	0.089	0.089	0.253	0.190	0.115	0.264

Age 36-45		1	2	3	4	5	6
	1	0.656	0.209	0.084	0.032	0.008	0.010
	2	0.290	0.382	0.210	0.087	0.024	0.006
	3	0.134	0.272	0.333	0.204	0.037	0.019
	4	0.084	0.149	0.259	0.314	0.111	0.084
	5	0.056	0.065	0.121	0.371	0.194	0.194
	6	0.073	0.122	0.073	0.220	0.130	0.382

Age 46-55		1	2	3	4	5	6
	1	0.662	0.223	0.073	0.029	0.007	0.007
	2	0.296	0.406	0.187	0.082	0.013	0.015
	3	0.103	0.251	0.386	0.174	0.046	0.040
	4	0.065	0.090	0.281	0.329	0.135	0.101
	5	0.059	0.092	0.193	0.261	0.160	0.235
	6	0.102	0.102	0.076	0.169	0.110	0.441

Age 56-65		1	2	3	4	5	6
	1	0.718	0.168	0.068	0.023	0.013	0.013
	2	0.234	0.406	0.212	0.105	0.025	0.017
	3	0.120	0.272	0.347	0.167	0.050	0.045
	4	0.066	0.158	0.270	0.307	0.112	0.087
	5	0.038	0.063	0.188	0.288	0.238	0.188
	6	0.138	0.025	0.150	0.250	0.113	0.325

Age 66-75		1	2	3	4	5	6
	1	0.656	0.163	0.077	0.059	0.027	0.018
	2	0.204	0.353	0.281	0.113	0.014	0.036
	3	0.127	0.262	0.303	0.222	0.041	0.045
	4	0.038	0.180	0.241	0.301	0.083	0.158
	5	0.068	0.045	0.159	0.318	0.159	0.250
	6	0.068	0.045	0.182	0.182	0.068	0.455

Age 76-85		1	2	3	4	5	6
	1	0.539	0.195	0.162	0.065	0.019	0.019
	2	0.200	0.361	0.265	0.110	0.026	0.039
	3	0.065	0.226	0.400	0.219	0.039	0.052
	4	0.065	0.108	0.247	0.398	0.032	0.151
	5	0.065	0.097	0.065	0.484	0.129	0.161
	6	0.097	0.032	0.161	0.258	0.161	0.290

Table 11: Survival Probabilities over the Life Cycle

Age	Age-specific Productivity	Survival Probability	Age	Age-specific Productivity	Survival Probability
21	0.66	0.9991	56	1.33	0.9932
22	0.78	0.9990	57	1.31	0.9927
23	0.81	0.9990	58	1.31	0.9921
24	0.92	0.9990	59	1.26	0.9914
25	1.01	0.9990	60	1.30	0.9905
26	0.93	0.9990	61	1.22	0.9896
27	0.97	0.9990	62	1.06	0.9886
28	1.00	0.9990	63	1.16	0.9876
29	1.14	0.9990	64	1.07	0.9866
30	1.18	0.9990	65	1.26	0.9855
31	1.11	0.9990	66		0.9843
32	1.26	0.9989	67		0.9829
33	1.31	0.9989	68		0.9814
34	1.21	0.9988	69		0.9797
35	1.06	0.9987	70		0.9779
36	1.19	0.9986	71		0.9760
37	1.27	0.9985	72		0.9738
38	1.19	0.9984	73		0.9713
39	1.13	0.9982	74		0.9684
40	1.15	0.9981	75		0.9656
41	1.24	0.9979	76		0.9626
42	1.19	0.9977	77		0.9592
43	1.26	0.9975	78		0.9552
44	1.32	0.9973	79		0.9506
45	1.14	0.9970	80		0.9455
46	1.24	0.9968	81		0.9402
47	1.24	0.9965	82		0.9346
48	1.23	0.9962	83		0.9284
49	1.24	0.9959	84		0.9215
50	1.41	0.9956	85		0.9141
51	1.28	0.9953			
52	1.39	0.9949			
53	1.27	0.9945			
54	1.32	0.9941			
55	1.41	0.9937			

Figure 3: Earnings over the Life Cycle

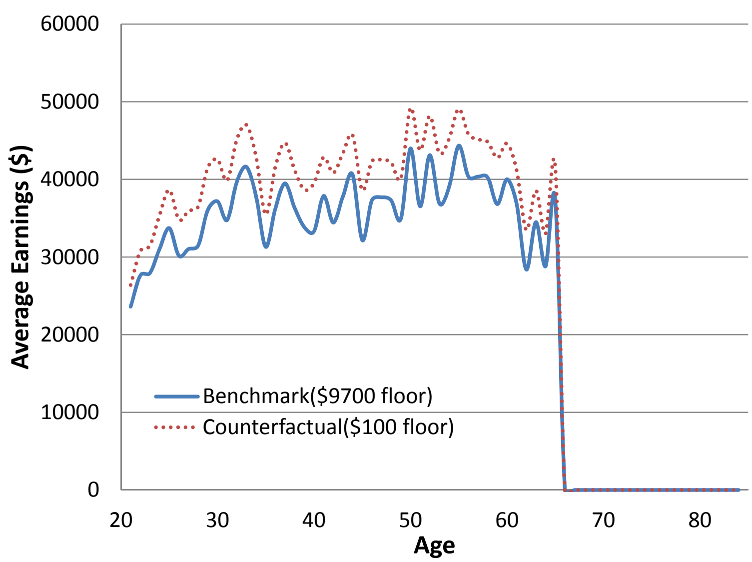

Figure 4: Employment Rate over the Life Cycle

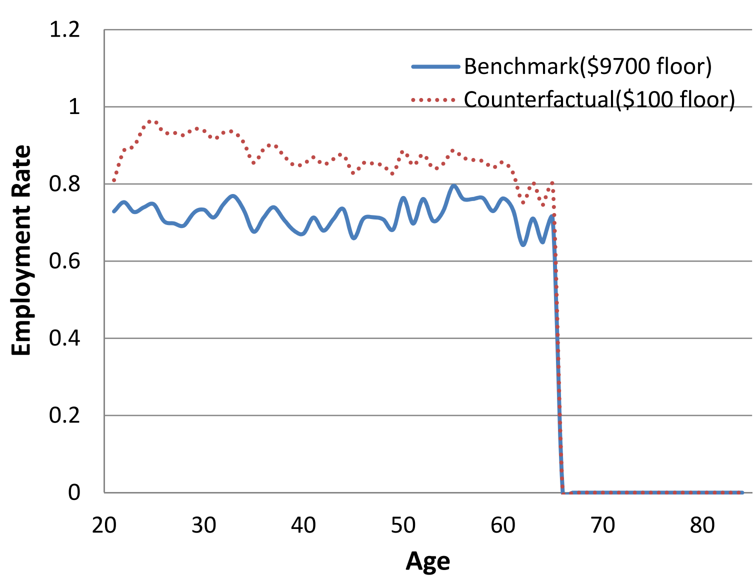

Figure 5: Wealth over the Life Cycle By Percentile

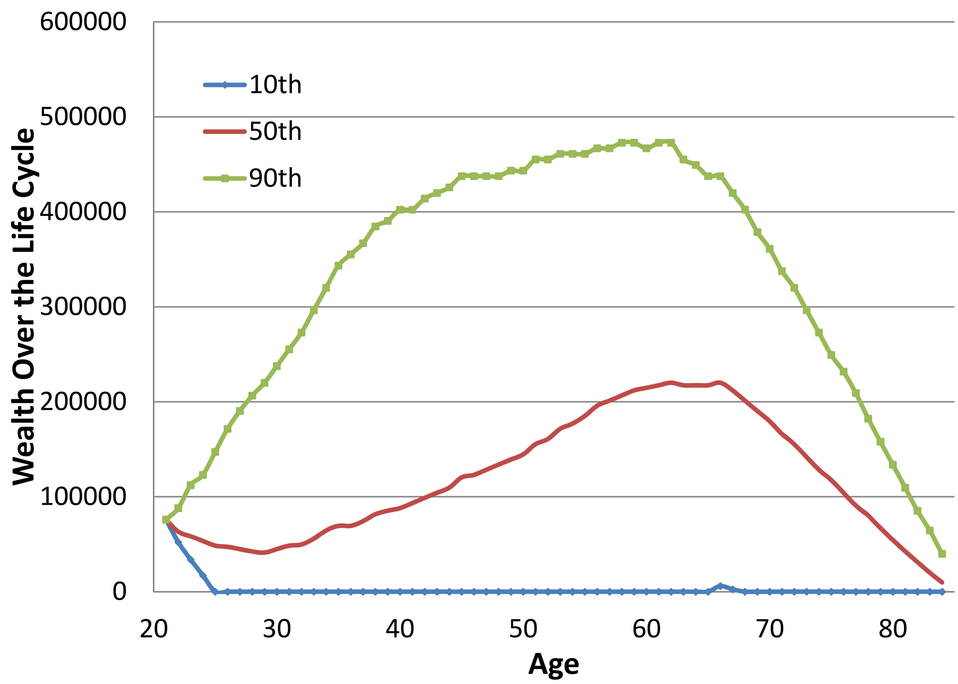

Figure 6: Wealth over the Life Cycle: Benchmark vs. a $100 floor