Social Insurance, Private Health Insurance and Individual Welfare*

Kai Zhao†

University of Connecticut

December 24, 2015

Abstract

This paper studies the impact of social insurance on private insurance and individual welfare in a dynamic general equilibrium model with uncertain medical expenses and individual health insurance choices. I find that social insurance (modeled as a combination of the minimum consumption floor and the Medicaid program) crowds out private health insurance coverage, and this crowd-out is important for understanding the welfare consequences of social insurance. When the crowding out effect on private insurance is taken into account, the welfare gain from social insurance becomes substantially smaller and under some certain conditions it becomes a welfare loss. The intuition for these results is that the crowding out effect partially offsets the insurance benefits provided by social insurance. The findings of the paper suggest that it is important to consider the endogenous responses on private insurance choices when examining any social insurance policy reform. They also imply that the existence of social insurance programs may be one reason why some Americans do not buy any health insurance.

Keywords: Saving, Uncertain Medical Expenses, Health Insurance, Means Testing.
JEL Classifications: E20, E60, H30, I13

*I would like to thank the editor B. Ravikumar and two anonymous referees for helpful comments. I would also like to thank Daniel Barczyk, Aaron Cooke, Zhigang Feng, Hui He, Roozbeh Hosseini, Minchung Hsu, Kevin Huang, Ayse Imrohoroglu, Selo Imrohoroglu, Karen Kopecky, Svetlana Pashchenko, Motohiro Yogo, and participants at the Midwest Macro annual meeting (2012), QSPS meeting (2013), and SED annual meeting (2013), and participants in the seminars at Western Ontario, CUHK, McGill, and York for their helpful comments. All errors are my own.

†Zhao: Department of Economics, The University of Connecticut, Storrs, CT 06269-1063, United States. Tel.: +1 860 486 4326. Email: kai.zhao@uconn.edu.

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 and provides public health insurance for the poor.[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, more than the cost of any other single public program (e.g., Social Security, Medicare). Meanwhile, policy makers have often proposed to reform the means-tested programs.[2] Despite this, there are relatively few studies that quantitatively evaluate the impact of means-tested social insurance on individual choices and welfare, compared to the large literature that uses dynamic life-cycle models to quantitatively examine other public programs such as Social Security.[3] This paper attempts to fill this gap in the literature.

Does the US social insurance system improve individual welfare? Conventional wisdom says that social insurance can improve individual welfare because it insures poor households against large negative shocks. However, some economists have argued that the social insurance programs may discourage work and thus reduce labor supply (e.g. Moffitt, 2002), and other economists find that social insurance 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 insurance programs significantly crowd out private insurance decisions.[4] Therefore, the welfare consequence of social insurance 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 to formalize all these relevant mechanisms and study the net welfare consequence of social insurance. Different from standard incomplete markets models, which usu-

[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 which significantly expands the Medicaid program.

[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 (2014), etc.

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

ally do not model health insurance or assume exogenous health insurance coverage, I endogenize the individual choices of health insurance coverage. As a result, the model can capture the crowding out effect of social insurance on the demand for private health insurance. In the model, agents face medical expense shocks, labor income shocks, and survival risks over the life cycle. In each period, agents endogenously determine their labor supply, and decide whether to take up employer-sponsored health insurance if it is offered and whether to purchase individual health insurance from the private market. Different from some earlier studies on social insurance (such as Hubbard et al., 1995), I separate Medicaid from other social insurance programs in the model, that is, the social insurance system is modeled as a combination of a minimum consumption floor and a means-tested public health insurance program (like the US Medicaid program).[5] This modelling choice is motivated by the fact that after the 1996 welfare reform, the Medicaid program was separated from the other major means-tested programs such as TANF/AFDC, and was allowed to impose different eligibility criteria. In addition, the model includes a pay-as-you-go Social Security program and a Medicare program.

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 economy, in particular the US health insurance system. I then use the calibrated model to quantitatively assess the impact of social insurance on individual choices and welfare. I find that social insurance reduces welfare in the benchmark model. That is, eliminating the social insurance system generates a significant *welfare gain* (i.e. 2.1% of consumption each period).[6] However, social insurance becomes welfare-improving if private health insurance coverage is exogenously fixed. The reason for the different welfare results is simple. Social insurance substantially crowds out the demand for private health insurance, and this crowd out undoes the welfare gain from the public insurance provided by social insurance.

It is worth noting that means-tested social insurance programs do not only affect individuals who are already qualified for the programs. They also affect any individual who will potentially become qualified for these programs after being hit by large negative shocks. As a result, the

[5]A concurrent paper by Pashchenko and Porapakkarm (2013b) also models the social insurance system as a combination of the minimum consumption floor and Medicaid. While they focus on the work incentives of Medicaid, this paper focuses on the crowding out effects of social insurance programs on the demand for private health insurance. Another related paper is De Nardi, French, and Jones (2013) who study the insurance role of Medicaid in old-age. However, they do not look at the crowding out effect of public insurance on private health insurance as their model features exogenous private health insurance coverage.

[6]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.

crowding out effect on private health insurance can be potentially much larger than one for one, which implies that the existence of social insurance 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 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 quantitative results of this paper show that the percentage of uninsured working population would drop by more than half if the social insurance system is completely removed. This finding implies that the existence of social insurance may be an important reason why many Americans do not have any health insurance. It also implies that many Americans are in fact better off being without any health insurance as they are implicitly insured by social insurance.

This paper is most related to the seminal work by Hubbard et al.(1995) who model social insurance as a minimum consumption floor and study its impact on precautionary saving. They find that means-tested social insurance 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 choices. In addition, I separate the Medicaid program from other means-tested programs, motivated by the fact that the Medicaid program was delinked from other major means-tested programs such as TANF/AFDC after the 1996 welfare reform in the US. That is, I model the social insurance system as a combination of a minimum consumption floor and a means-tested public health insurance program (that likes the US Medicaid). It is worth noting that I find a significantly smaller saving effect of social insurance than Hubbard et al.(1995). The reason for that is simple. In the model with endogenous health insurance choices, social insurance crowds out private health insurance coverage and thus increases the out-of-pocket medical expenses facing individuals. The higher out-of-pocket medical expenses encourage private saving and partially offset the negative effect of social insurance on capital accumulation.

This paper belongs to the literature studying incomplete market models with heterogenous agents.[7] In particular, it is closely related to a number of recent studies that endogenize the demand for health insurance.[8] Jeske and Kitao (2009) use a similar model to study the tax exemption policy on employer-sponsored health insurance. Pashchenko and Porapakkarm (2013a) 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 social insurance with the special attention to the crowding out effect of the partial insurance provided by social insurance programs on private health insurance choices.

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. In a dynamic general equilibrium model with uncertain medical expenses and endogenous health insurance choices, I quantitatively examine the crowding out effect of social insurance on private health insurance. In contrast to what have been found and suggested in previously mentioned studies, I find that the crowding out effect is mainly from the minimum consumption floor but not the Medicaid program.

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

[7] Huggett (1993), Aiyagari (1994), Hubbard et al.(1995), Livshits, MacGee, and Tertilt (2007), De Nardi, French, and Jones (2010), and Kopecky and Koreshkova (2014), etc.

[8] Jeske and Kitao (2009), Pashchenko and Porapakkarm (2013a), Hansen, Hsu, and Lee (2012), Zhao (2015), etc.

leisure. They face survival probabilities P and medical 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 $s = \{j, a, m, e_h, h, \epsilon, m_d, \eta\}$, where j is age, a is assets, m is medical 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, m_d indicates whether the agent is qualified for Medicaid, 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

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

$$a' \geq 0,$$

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

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

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 health insurance copay rate is represented by $\kappa(h, m_d)$, 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.[9] β is the subjective discount factor and I is an indicator function.

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

On the government side, Tr is the transfer from social insurance, which guarantees a minimum consumption floor and will be specified further in the following. $SS(\eta)$ is the 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 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 medical 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. Medical expense shocks are assumed to be independent of labor productivity shocks.[10]

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

Social insurance guarantees a minimum consumption floor $\underline{c}$ and provides means-tested public health insurance, and it is financed by the payroll tax τ_w. The minimum consumption floor is provided via the transfer Tr which can be simply determined by the following equation,

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

[10]This assumption significantly simplifies the analysis here. In addition, this assumption is supported by some empirical evidence. For instance, Daniel Feenberg and Jonathan Skinner (1994) find a very low income elasticity of catastrophic health care expenditures, suggesting that expenditure (at least for large medical shocks) does not vary much with income. Livshits, MacGee, and Tertilt (2007) find in the MEPS 1996/1997 dataset that income does not significantly decrease in response to a medical shock.

The means-tested public health program is specified as follows. The agent is qualified for this program (i.e. $m_d = 1$) if his income and assets (net of out of pocket medical expenses) are below certain thresholds and he does not have any private health insurance. That is, for $j \leq R$, the agent is automatically enrolled into the Medicaid program if $\widetilde{w}\epsilon l \leq \Theta_{income}$, $a - m \leq \Theta_{asset}$ and $h = 1$. For $j >$, the conditions are $SS(\eta) \leq \Theta_{income}$, $a - (1 - \kappa_m)m \leq \Theta_{asset}$ and $h = 1$.

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 medical 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,

$$\int Tr(s)d\Phi(s) + \int m_d\kappa(h, m_d)[(1-\kappa_m)mI_{j\geq R} + mI_{j<R}]d\Phi(s) = \int \tau_w(\widetilde{w}\epsilon l(s) - p_3 I_{h'(s)=3})d\Phi(s) \quad (3)$$

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

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

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,

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

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,

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

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

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 price of 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.[11] As a result, the prices for these insurance policies can be expressed respectively as follows,

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

$$p_2(j,m) = (1+\lambda_2)\kappa(2,)P_j \frac{\int Em'(s) I_{m,j} I_{h'(s)=2} d\Phi(s)}{1+r}, \forall m, j. \tag{10}$$

$$P_3 = \pi(1+\lambda_3)\kappa(3,)\frac{\int P_j Em'(s) I_{h'(s)=3} d\Phi(s)}{1+r}. \tag{11}$$

Here $I_{m,j}$ is the indicator function for having medical 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_2 and λ_3 represent the part of insurance premium that covers the administrative cost of insurance companies. 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,

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

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

[11] In the market for individual health market, agents could have private information about their expected medical expenses, e.g. family medical history, personal health-related behaviors. In that case, the individual health insurance market would feature some adverse selection issues. While it is conceptually straightforward to incorporate these elements into the model, doing so would significantly expand the state space and thus be computationally challenging. Here I refer to Einav, Finkelstein, and Cullen (2010) and Bundorf, Levin, and Mahoney (2012) who study the welfare implications of pooled pricing and private information in health insurance markets.

2.5. Market Clearing Conditions

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

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

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

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, social insurance; private health insurance contracts, 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, social insurance, 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 17).

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, and the discount factor β is set to match an annual interest rate of 4%.

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	
Medical 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, Medical Expense Shock, and Employment-sponsored Health Insurance

I use the Medical Expenditure Panel Survey (MEPS) dataset to calibrate the labor productivity process, the medical expense process, and the probabilities of being offered employer-sponsored health insurance. 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 medical expenses and 6 states are constructed with the bins of the size $(25\%, 50\%, 75\%, 90\%, 95\%)$ for the medical expense shock m. To capture the life-cycle profile of medical expenses, I assume that the medical expense shock m is age-specific and calibrate the distribution of medical expenses 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 17. The transition matrices for medical expense shocks are reported in Table 16.

3.4. Government

The US social insurance system includes a variety 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 and providing them public health insurance. As argued previously, the Medicaid program was separated from other major welfare programs after the 1996 welfare reform, and was allowed to impose different criteria. Thus, here I model the social insurance system as a combination of two programs, i.e., a minimum consumption floor and a means-tested public health insurance program. The existing estimates of the value of the minimum consumption floor approximately range from 10% to 20% of average earnings of full-time workers, so in the benchmark calibration I set $\underline{c}$ to $7000 which is approximately 15% of average earnings of the workers in the model.[12] The income and assets testing criteria for Medicaid directly affect the fraction of people enrolled in the program and they may affect different age groups differently. Thus, they are calibrated to match the life-cycle profile of the fraction of people enrolled in Medicaid.[13] The resulting values are, $\Theta_{income} = \$12750$ and $\Theta_{asset} = \$20000$, which are fairly reasonable values compared to the values used in other existing studies in the literature.

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 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 medical expenses are paid by Medicare, thus I set the Medicare coinsurance rate k_m to 0.5.[14] The Medicare payroll tax rate τ_m is endogenously determined by Medicare's self-financing budget constraint, and the resulting value is 4.9%.

[12]The existing estimates include Hubbard et al (1994), Moffitt (2002), Scholz et al. (2006), De Nardi et al. (2010), Kopecky and Koreshkova (2014). The value of the floor used here is consistent with most of these existing estimates. One exception is De Nardi, et al. (2010) who find a much lower consumption floor (i.e. $2663) by estimating their model. However, their model is significantly different from the model studied here, e.g. they do not model the Medicaid program, hence their estimate is not directly comparable to the minimum consumption floor used in this model.

[13]This calibration strategy is also adopted by Pashchenko and Porapakkarm (2013b).

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

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. Health Insurance

The values of $\kappa(2,)$ and $\kappa(3,)$ represent the fraction of medical expenses 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 $65\% - 85\%$.[15] In addition, the coinsurance rate provided by Medicaid $\kappa(, 1)$ is assumed to be the same as in private health insurance policies. 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 calibrate λ_2, the individual insurance premium mark-up, to match the share of working population purchasing individual health insurance in the data, that is, 4.6%. The value of λ_3 is calibrated to match the average take-up rate for employment-based health insurance in the data, that is, 93.8% according to Pashchenko and Porapakkarm (2013a).

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

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 social insurance on labor supply, saving, private health insurance decisions, and individual welfare by running counterfactual

[15]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/Moment
σ	2	Macro literature
α	0.33	Macro literature
δ	0.06	Macro literature
β	0.95	4% annual interest rate
τ_s	12.4%	US Social Security tax rate
κ_m	0.5	Attanasio, et al (2008)
$\underline{c}$	$7000	15% of ave. earnings
A	25000	GDP per capita: $40293
λ_2	0.09	Popu. share with individual HI: 4.6%
λ_3	0.02	ESHI take-up rate: 93.8%
π	0.2	Sommers(2002)
ζ	0.25E-4	Employment rate: 73%

computational experiments in the calibrated model, i.e., comparing the benchmark economy with counterfactual economies with different social insurance policies.

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. Table 6 presents the fractions of individuals enrolled in Medicaid by age group. The trend in these fractions also matches the MEPS data reasonably well. For example, the young and elderly groups are more likely to be enrolled in Medicaid than the prime-age groups.

Figures 1 plots the life-cycle profiles of consumption and saving. Both profiles are hump-shaped, and are fairly standard results compared to what have been found in life-cycle models of consumption and saving. Figure 2 plots the employment rates and employment-sponsored health insurance coverage rates by age. Note that the employment rates in the early years of life in the model may be on the high side. This is largely because agents want to build up precau-

Table 5: Key Statistics of the Benchmark Economy

Statistics	Model	Data
Interest rate	4.0%	4.0%
Employment rate	74%	73%
Output per person	$38640	$40293
ESHI take-up rate	91.5%	93.8%
% of working popu. with		
Individual HI	4.0%	4.6%
ESHI	52.2%	55.1%
public HI	8.9%	8.9%
No HI	34.9%	31.4%

tionary wealth quickly to insure against medical expense shocks.[16]

4.2. Social Insurance and Individual Welfare

To understand how the social insurance programs affect individual welfare, I adopt the steady-state comparison strategy.[17] That is, I compare the welfare of individuals in the benchmark economy to those in a counterfactual economy with no Medicaid program and a minimal consumption floor of $1000.[18] To construct this counterfactual economy, I remove the Medicaid program and reduce the value of $\underline{c}$ to $1000 and then reset the payroll tax rate τ_w to make the social insurance system self-financing while keeping the rest of the parameter values constant, and then compute the new stationary equilibrium.

To quantify the welfare result, I use 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

[16]The employment rates during these years may decrease if the model is extended to incorporate more life-cycle elements such as human capital investment decisions. I do not consider this possibility here as it is are less relevant for the main theme of the paper.

[17]In the sensitivity analysis, I also explore the welfare implications along the transition path.

[18]It is well known in the literature with exogenous expense shocks that the economy without a consumption floor is not well-defined, because there are always a tiny fraction of population who are extremely unlucky (hit by a series of bad income and medical expense shocks) and do not have enough resources to cover their medical expenses. Here I follow Hubbard et al.(1995) and consider the counterfactual with a consumption floor of $1000. As robustness check, I also explore other values and find that the main results do not significantly change.

slightly increases when the social insurance system is completely removed. In term of ECV, an increase of 2.1% 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 without social insurance. This result suggests that social insurance generates a small welfare loss. It is worth noting that the welfare effect of social insurance varies dramatically across the income distribution. Table 8 presents the welfare consequence of eliminating social insurance by labor productivity. The welfare gain is only 0.8% for a new born with the lowest labor productivity, and it rises significantly as the productivity increases. For agents with the highest productivity, the welfare gain is 2.6%. This different welfare results by income simply reflects the fact that poorer individuals are more likely to use social insurance programs because these programs are means-tested.

As argued in the introduction, social insurance 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 insurance suggests that the welfare gain from the insurance channel is dominated by the welfare loss from the other channels.

Table 6: Fraction of Individuals on Medicaid by Age Group

Age Group	Model	Data
21-35	6.4%	10.4%
36-45	8.2%	8.8%
46-55	5.8%	7.0%
56-65	5.2%	6.4%
66-75	13.0%	12.9%
76-	23.4%	12.3%

4.3. Social Insurance and Private Health Insurance

Several empirical studies found that social insurance programs can crowd out the demand for 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 Finkelstein (2008) show that Medicaid crowds out the demand for a specific type of individual

Table 7: The Main Quantitative Results

Statistic	Benchmark	Counterfactual I (No SI)	II ($1000 Floor)	III (No Medicaid)
Utility	-1.138E-3	-1.122E-3	-1.128E-3	-1.136E-3
Welfare (ECV)	n.a.	2.1%	1.2%	0.3%
% of working popu. w/				
Individual HI	4.0%	23.3%	11.3%	8.9%
ESHI	52.2%	60.0%	57.2%	55.9%
Medicaid	8.9%	0%	5.7%	0%
No HI	34.9%	16.7%	15.8%	35.2%
ESHI take-up rate	91.5%	99.9%	95.6%	97.3%
ESHI premium	$2928	$2827	$2914	$2801
Employment rate	74.5%	79.0%	78.4%	74.7%
SI tax rate τ_w	2.4%	$\leq$0.2%	1.2%	1.9%

Table 8: Welfare Effect of Eliminating Social Insurance by Income

Labor Productivity (from low to high)	1	2	3	4	5
Welfare gain/loss	0.8%	1.8%	2.2%	2.5%	2.6%

health insurance: long term care insurance.

As shown in Table 7, the results of the computational experiments suggest that crowding out effect is quantitatively large. As can be seen, when the social insurance system is completely removed, the share of working-age individuals with employer-sponsored health insurance increases from 52.2% to 60.0%, and the share of those with individual health insurance increases from 4.0% to 23.3%. It is worth mentioning that the crowding out effect on employer-sponsored health insurance comes from two sources. First, social insurance reduces the take up rate for the workers with employer-sponsored health insurance offers. Second, it discourages work, thus lowering the number of individuals being offered employer-sponsored health insurance. As can be seen, when social insurance is eliminated, the take-up rate increases from 91.5% to 99.9%, meanwhile the employment rate increases from 74.5% to 79.0%. A simple decomposition calcu-

Table 9: Social Insurance and Exogenous Private Health Insurance

Statistic	Benchmark	Counterfactual I (No SI)	II ($1000 Floor)	III (No Medicaid)
Utility	-1.138E-3	-1.141E-3	-1.138E-3	-1.151E-3
Welfare (ECV)	n.a.	-0.4%	0.3%	-1.4%

Table 10: Crowding Out Effects by Labor Productivity

Labor Productivity Shock (from low to high)	1	2	3	4	5
Individual HI					
Benchmark	7.4%	4.2%	2.4	1.5%	2.0%
Counterfactual	46.1%	28.2%	12.6%	6.3%	3.2%
Employer-sponsored HI					
Benchmark	13.0%	44.5%	68.4	80.3%	88.6%
Counterfactual	33.9%	51.7%	69.1	80.2%	88.7%

lation suggests that over half of the change in employer-sponsored health insurance is from the labor supply channel, while the rest is attributed to the increase in take-up rate.

I conduct further counterfactual experiments to decompose the effects of the minimum consumption floor and the Medicaid program. The decomposition exercise shows that the crowding out effect from the minimum consumption floor is as large as that from the Medicaid program. As shown in the 4th and 5th columns of Table 7, when only the minimum consumption floor is reduced to $1000, the share of working-age individuals with employer-sponsored health insurance increases from 52.2% to 57.2%, and the share of those with individual health insurance increases from 4.0% to 11.4%. However, when only the Medicaid program is eliminated, the private health insurance coverage only increases slightly, that is, from 52.2% to 55.9% for employer-sponsored health insurance, and from 4.0% to 8.9% for individual insurance.

In addition, I find that the crowding out effect is important for understanding the welfare consequence of social insurance. To understand whether the crowding out effect matters for the welfare consequences of social insurance, I conduct the following counterfactual experiment.

I first fix the private health insurance decisions in the benchmark economy, and then replicate the welfare analysis conducted in the previous section. Since the private health insurance decisions are exogenously fixed, eliminating the social insurance programs would not change the private health insurance coverage any more. The key results of this counterfactual experiment are reported in Table 9. 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 social insurance is now welfare-improving. Using equivalent consumption variation, I find that eliminating social insurance generates a welfare loss (i.e. 0.4 % of consumption each period) when private health insurance decisions are exogenously fixed. The intuition behind the different welfare results is simple. Since the crowding out effect on private insurance partially offsets the insurance benefits provided by social insurance, taking into account of this crowding out effect can change the welfare consequence of social insurance from a net welfare gain to a net welfare loss.

In Table 10, I break down the crowding out effects by labor productivity. As can be seen, the crowding out effect of social insurance is larger among individuals with lower labor productivity. For example, for individuals with the lowest labor productivity, eliminating social insurance increases the population share with individual health insurance from 7.4% to 46.1%, and increases the population share with employer-sponsored health insurance from 13.0% to 33.9%. For individuals with the highest labor productivity, however, eliminating social insurance only changes their private health insurance coverage slightly. The intuition for the different results by labor productivity is simple. Poorer individuals are more likely to rely on social insurance, therefore their health insurance choices are affected more by the social insurance programs.

It is noteworthy that the results in Table 10 show that social insurance 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 social insurance after being hit by a series of large negative shocks, even though they are currently well above the welfare criteria. This is also the reason why the crowding out effect in the model is quantitatively large, much larger than one for one.

4.4. Social Insurance and Labor Supply

Social insurance also discourages work and thus reduces labor supply. As shown in Table 7, if social insurance is eliminated, the employment rate increases from 74.5% to 79.0%. Here the labor supply effect is from two channels. First, since social insurance 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 insurance, 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 eliminate the social insurance system but keep the payroll tax rate constant (at 2.4%). I find that the labor supply effect now becomes slightly smaller, that is, the employment rate increases from 74.5% to 78.5%. 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 social insurance.

4.5. Social Insurance and Precautionary Saving

The seminal work by Hubbard, Skinner and Zeldes (1995) shows that social insurance 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 3, 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 the standard hump shape. 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 et al.(1995). The intuition behind this result is the following. As argued by Hubbard et al.(1995), 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 without social insurance. As shown in Figure 4, when the social insurance programs are eliminated, 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, eliminating social insurance 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 social insurance in the model is quantitatively smaller than in Hubbard et al.(1995), although they are qualitatively the same as discussed above. The reason for that is as follows. In the model with endogenous private health insurance choices, social insurance crowds out private health insurance coverage and thus increases the out-of-pocket medical expenses facing individuals, which encourages private saving and partially offsets the negative saving effect of social insurance. To verify this point, I compare the effect of eliminating social insurance on aggregate capital in the two model economies, the benchmark economy, and the economy with exogenous health insurance. I find that in the benchmark economy, eliminating social insurance increases the aggregate capital by 14%. However, in the economy with fixed private health insurance coverage, eliminating social insurance can increase the aggregate capital by 18%. The different results suggest that the effect of social insurance on capital accumulation in Hubbard et al.(1995) may be biased upward because their model does not feature endogenous private health insurance.

5. Further Discussions

5.1. Why Are So Many Americans 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 possible explanation for this puzzle. That is, many Americans do not purchase any private health insurance because of the existence of social insurance. The intuition behind this argument is simple. Social insurance affects individuals who are currently qualified for social insurance programs. In addition, it impacts any individual who will potentially qualify for social insurance if hit by a series of negative shocks. As can be seen in Table 7, the share of the uninsured drops by more than a half (i.e. from 34.9% to 16.7%) when the social insurance system is eliminated. This quantitative result suggests that the existence of social insurance may explain over half of the uninsured population's decision to not obtain health insurance. It also provides an upper bound on the quantitative importance of other potential explanations, such as uncompensated care and the market frictions in the health insurance markets (see Gruber (2008) for a detailed review of these explanations). In addition, this result implies that many individuals are better off without any health insurance, as they are implicitly insured by social insurance.

5.2. Alternative Counterfactual Consumption Floors

In the benchmark case, I follow Hubbard et al. (1995) and set the counterfactual minimal consumption floor to \$1000 to study the impact of consumption floor. Here I explore the sensitivity of the results with respect to alternative counterfactual floors. I consider a wide range of values from \$10 to \$3000. The results from these cases are reported in Table 11. As this table clearly shows, the impact of the minimal consumption floor on individual welfare is not monotone. As the minimal consumption floor decreases from its current value to around \$500, individual utility gradually increases. However, after the floor drops below \$500, the impact of consumption floor on individual welfare is reversed. For instance, when the minimal consumption floor is set to \$10, individual utility becomes significantly lower than in the case with a floor of \$500. These results suggest that while the current consumption floor in the U.S. may be too high, completely eliminating the consumption floor is also not optimal. According to the results in Table 11, the optimal consumption floor is around \$500.

5.3. Alternative Redistribution Strategy for Accidental Bequests

It has been already noticed in the literature that public insurance policies may crowd out bequests income in a general equilibrium model, which in turn has important welfare implications.[19] For similar reasons, the welfare implications of public insurance policies in general equilibrium models are sensitive to alternative redistribution strategies for accidental bequests. As is standard in the literature, I assume that accidental bequests are redistributed back equally to the new-born cohort in each period in the benchmark case. Here I explore the sensitivity of the results with respect to alternative redistribution strategies for accidental bequests. Following Imrohoroglu, Imrohoroglu, and Joines (1995), I consider three alternative strategies. First,

[19] Imrohoroglu, Imrohoroglu, and Joines (1995), Caliendo, Guo, and Hosseini (2014), etc.

Table 11: Alternative Counterfactual Consumption Floors

Statistic	Utility	Welfare (ECV)
Benchmark ($7000)	1.138E-003	1.3%
Counterfactual floors		
$10	1.133E-003	0.8%
$50	1.130E-003	1.1%
$100	1.129E-003	1.1%
$250	1.128E-003	1.2%
$500	1.128E-003	1.2%
$750	1.128E-003	1.2%
$1000	1.128E-003	1.2%
$2000	1.129E-003	1.2%
$3000	1.131E-003.	0.9%

it is assumed that all accidental bequests are destroyed. Second, it is assumed that accidental bequests are redistributed in a lump-sum fashion to everyone in the economy. Third, I consider the case with a perfect annuity market, in which no accidental bequest occurs. The results from these alternative cases are presented in Table 12. As can be seen, the welfare effects of consumption floor are substantially different for alternative redistribution strategies, while the impact of Medicaid remains similar. This result is mainly due to the consumption floor's significant crowding out effect on accidental bequest transfers. For instance, in the benchmark case, bequest transfers increase by approximately 10% as the consumption floor is reduced from $7000 to $1000.

5.4. Alternative Tax Financing Schemes for Social Insurance

The US social insurance system consists of a large number of means-tested programs, and its actual financing structure is complicated. In the benchmark case, I assume that the social insurance system is completely financed a payroll tax rate (on labor income), τ_w. In this section, I explore alternative tax financing schemes for the social insurance programs. I consider two cases. In the first case, I assume that the social insurance system is financed by a flat income tax rate (on both labor income and capital income). In the second case, I assume the income tax rate (on both labor and capital income) is progressive. To capture the progressivity of the US tax

Table 12: Alternative Redistribution Strategies for Accidental Bequests

Statistic	Benchmark	Counterfactual I (No SI)	II ($1000 Floor)	III (No Medicaid)
Perfect Annuity Market				
Utility	-1.32E-3	-1.48E-3	-1.46E-3	-1.31E-3
Welfare (ECV)	n.a.	-13.4%	-12.4%	0.5%
Acc. Bequests to Everyone				
Utility	-1.29E-3	-1.38E-3	-1.38E-3	-1.28E-3
Welfare (ECV)	n.a.	-8.6%	-8.5%	0.6%
Acc. Bequests Wasted				
Utility	-1.34E-3	-1.48E-3	-1.45E-3	-1.34E-3
Welfare (ECV)	n.a.	-8.6%	-8.5%	0.6%

system, I use the functional form studied by Gouveia and Strauss (1994). That is, the tax payment as a function of income $T(y)$ is given as $T(y) = a_0[y - (y^{-a_1} + a_2)^{-1/a_1}]$. Roughly speaking, here a_0 and a_1 determine the degree of progressivity while a_2 is a scaling parameter. Therefore, I directly use the estimates from Gouveia and Strauss for a_0 and a_1 ($\{a_0, a_1\} = \{0.258, 0.768\}$) and calibrate the value of a_2 to balance the budget.[20]

The results from these two cases with alternative tax financing schemes are presented in Table 13. As can be seen, the results remain qualitatively similar as different financing schemes for social insurance are assumed.

Table 13: Alternative Tax Financing Schemes for Social Insurance

Statistic	Benchmark	Counterfactual I (No SI)	II ($1000 Floor)	III (No Medicaid)
Flat income tax				
Utility	-1.139E-3	-1.121E-3	-1.128E-3	-1.136E-3
Welfare (ECV)	n.a.	2.2%	1.4%	0.3%
Progressive income tax				
Utility	-1.134E-3	-1.122E-3	-1.125E-3	-1.132E-3
Welfare (ECV)	n.a.	1.5%	1.1%	0.3%

[20]This strategy was adopted in Jeske and Kitao (2009).

5.5. Transitional Welfare Implications

The main focus of the paper is on the long-term welfare implications of social insurance policies, and the quantitative strategy so far is to compare steady states with different social insurance programs. While the steady-state comparison strategy is transparent and computationally less demanding, it is worth noting that this strategy does not capture any welfare implications during the transition path. Therefore, the welfare results presented previously cannot directly apply to the current people in the economy. To shed some lights on the transitional welfare implications of social insurance programs, I compute the transition paths for the three main counterfactual cases considered in the steady state analysis. Specifically, I study the impact of eliminating social insurance on the current population while taking into account the whole transition path toward the new steady state. The results are presented in Table 14. As can be seen, while eliminating social insurance may be welfare-improving in the long run, it is always welfare-reducing for the current population.

Table 14: Transitional Welfare Implications

Statistic	Benchmark	Counterfactual I (No SI)	II ($1000 Floor)	III (No Medicaid)
Utility	-1.138E-3	-1.122E-3	-1.128E-3	-1.136E-3
Welfare (ECV) (steady-state)	n.a.	2.1%	1.3%	0.3%
Utility	-1.138E-3	-1.122E-3	-1.128E-3	-1.136E-3
Welfare (ECV) (transition)	n.a.	-9.1%	-8.5%	-7.2%

5.6. Wealth Distribution

It is interesting to look at the wealth distribution generated in the model. As is well known in the literature, the U.S. wealth distribution features two puzzling facts: (1) a large number of households at the bottom of the distribution hold little wealth, and (2) a major portion of the total wealth is held by a small number of households at the top of the distribution. Table 15 displays the wealth distribution implied in the model together with the data. As can be seen, the benchmark model matches the wealth distribution in the data fairly well except the very top of the distribution. In particular, the model generates a large fraction of the population with little wealth, consistent with fact (1). The reason for this result is simply that mean-tested social insurance crowds out private saving for relatively poor people. It is worth noting that as social insurance is most relevant for people at the bottom of the distribution, it is a favorable feature of the model that it matches the bottom of the wealth distribution.

Table 15: Wealth Distribution

	1st Quintile	2nd Q	3rd Q	4th Q	5th Q	Top 5%	Top 1%
Data	1.1%	5.0%	12.2%	12.6%	69.1%	57.8%	34.7%
Model	0.3%	4.4%	11.5%	25.7%	58.1%	15.9%	4.7%

Data source: from De Nardi and Yang (2015).

6. Conclusion

In this paper, I examine the social insurance programs in a dynamic general equilibrium with endogenous health insurance choices. I find that social insurance (modeled as a combination of the minimum consumption floor and the Medicaid program) crowds out private health insurance coverage, and this crowd-out is important for understanding the welfare consequences of social insurance. When the crowding out effect on private insurance is taken into account, the welfare gain from social insurance becomes substantially smaller and under some certain conditions it becomes a welfare loss. The different welfare results are due to that in the model with endogenous insurance choices, social insurance can substantially crowd out the demand for private health insurance and this crowd out offsets the insurance benefits provided by social insurance. These findings suggest that it is important to consider the endogenous responses on private insurance choices when examining any social insurance policy reform. They also imply that the existence of social insurance programs may be one of the reasons why many Americans do not buy any 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.

BUNDORF, M. K., J. LEVIN, AND N. MAHONEY (2012): "Pricing and Welfare in Health Plan Choice," *American Economic Review*, 102(7), 3214–48.

CALIENDO, F., N. L. GUO, AND R. HOSSEINI (2014): "Social security is NOT a substitute for annuity markets," *Review of Economic Dynamics*, 17, 739–755.

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.

——— (2013): "Medicaid insurance in old age," NBER Working Paper No. 19151.

DE NARDI, M., AND F. YANG (2015): "Wealth Inequality, Family Background, and Estate Taxation," NBER WP 21047.

EINAV, L., A. FINKELSTEIN, AND M. R. CULLEN (2010): "Estimating Welfare in Insurance Markets Using Variation in Prices," *The Quarterly Journal of Economics*, 125(3), 877–921.

FEENBERG, D., AND J. SKINNER (1994): "The Risk and Duration of Catastrophic Health Care Expenditure," *Review of Economics and Statistics*, 76(4), 633–47.

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

GOUVEIA, M., AND R. P. STRAUSS (1994): "Effective federal individual income tax functions:an exploratory empirical analysis," *National Tax Journal*, 47, 317–339.

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 (1994): "TheImportance of Precautionary Motives in Explaining Individual and Aggregate Saving," *Carnegie-Rochester Conference Series on Public Policy*, 40, 59–125.

——— (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 (2014): "The Impact of Medical and Nursing Home Expenses on Savings," *American Economic Journal: Macroeconomics*, 6(3), 29–72.

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 (2013a): “Quantitative Analysis of Health Insurance Reform: Separating Regulation from Redistribution,” *Review of Economic Dynamics*, 16, 383–404.

——— (2013b): “Work Incentives of Medicaid Beneficiaries and the Role of Asset Testing,” unpublished manuscript.

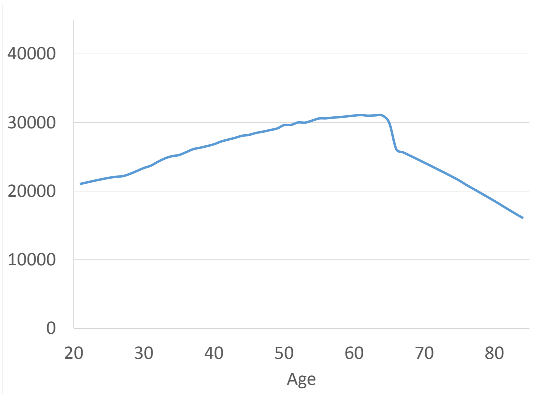
SCHOLZ, J. K., A. SESHADRI, AND S. KHITATRAKUN (2006): “Are Americans Saving Optimally for Retirement?,” *Journal of Political Economy*, 114(4), 607–643.

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

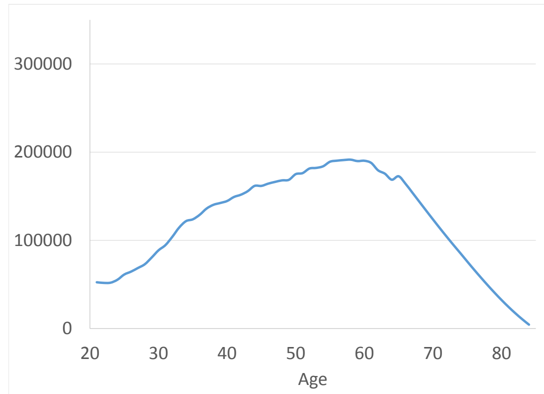
ZHAO, K. (2014): “Social Security and the Rise in Health Spending,” *Journal of Monetary Economics*, 64, 21–37.

——— (2015): “The Impact of the Correlation between Health Expenditure and Survival Probability on the Demand for Insurance,” *European Economic Review*, 75, 98–111.

Figure 1: Average Consumption and Saving over the Life Cycle

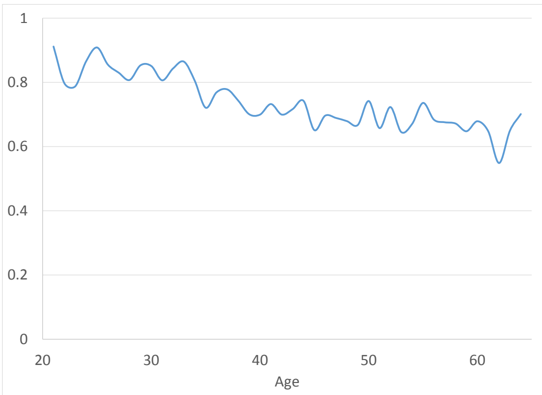


(a) Consumption

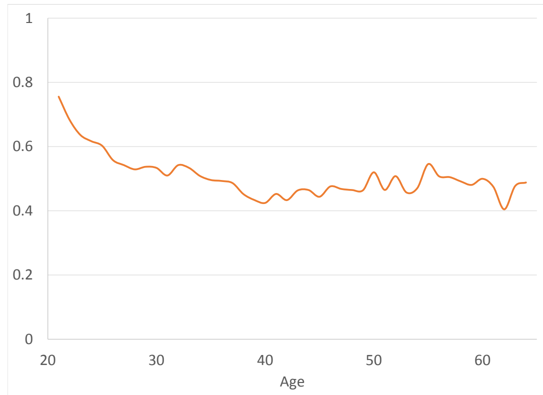


(b) Saving

Figure 2: Employment and Employment-based HI over the Life Cycle



(a) Employment Rate



(b) Employment-based Health Insurance

Figure 3: Wealth over the Life Cycle By Percentile

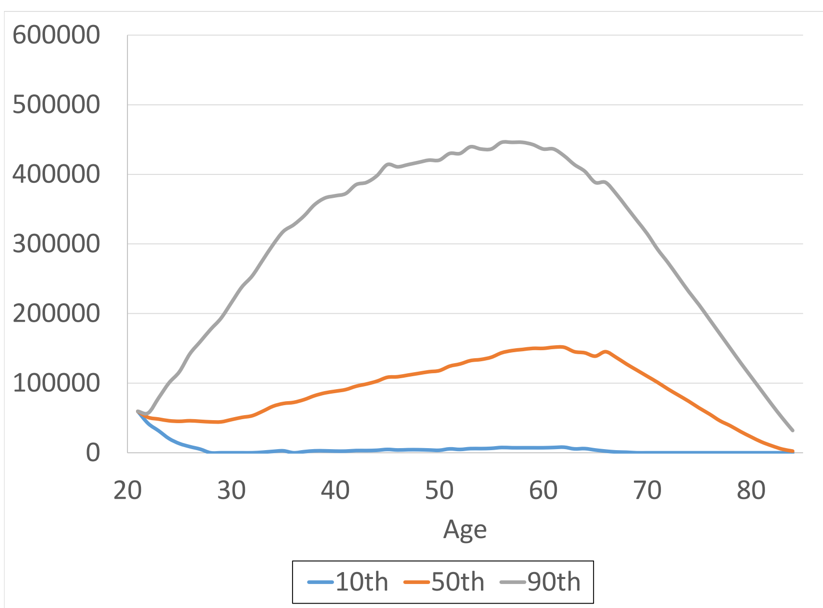


Figure 4: Wealth over the Life Cycle: Benchmark vs. a $1000 floor

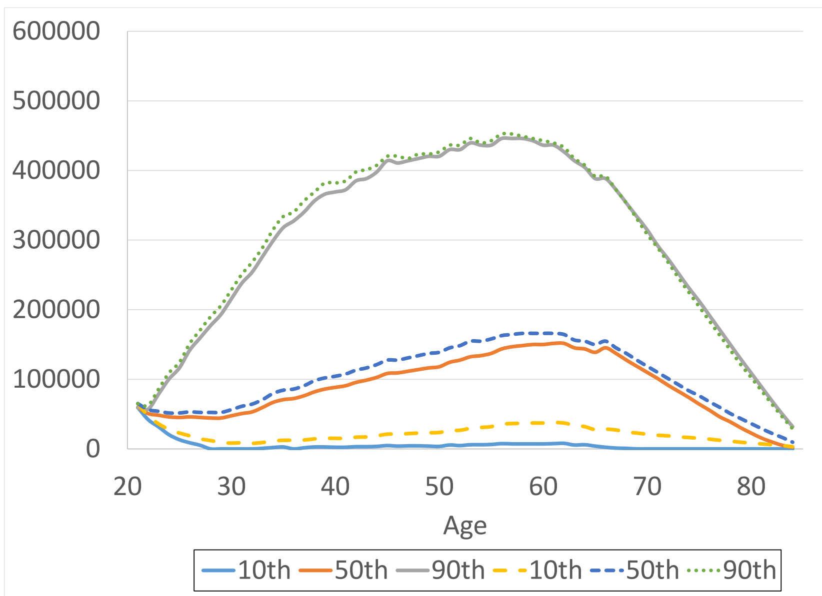


Table 16: The Transition Matrix for Medical Expense Shock

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 17: 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			