IRTG 1792 Discussion Paper 2019-012

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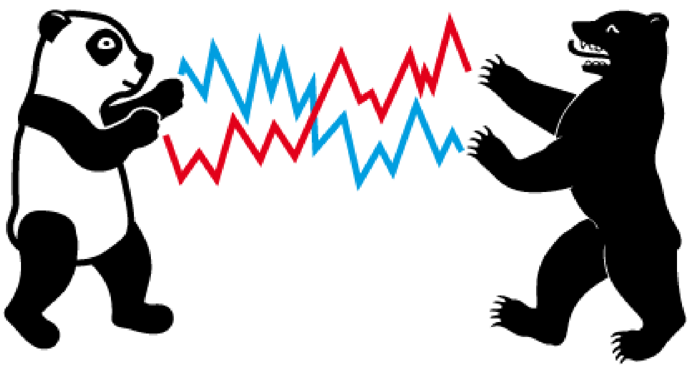

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This research was supported by the Deutsche
Forschungsgesellschaft through the
International Research Training Group 1792
"High Dimensional Nonstationary Time Series".

http://irtg1792.hu-berlin.de
ISSN 2568-5619

International Research Training Group 1792

# Voting for Health Insurance Policy: the U.S. versus Europe

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April 10, 2019

**Abstract**

In this paper, we build an overlapping generation model to examine the reason why developed countries with similar background have implemented different social health insurance systems. We propose two hypotheses to explain this phenomenon: (i) the different participation rates of the poor in the voting; (ii) the distinct attitudes towards the size of the government and the existence of a compulsory social health insurance system. Agents need to vote for one of two policies: Policy I without Social Health Insurance (SHI) but with the subsidy for the poor, and Policy II with fully covered SHI. By comparing either their current utility or the expected life time utility, households will choose one policy. We find that under Policy I, the derivative of the changes of expected utility with respect to income is not monotonic. This means that both the poorest and the richest dislike the social health insurance system. With the calibrated parameters, we solve the benchmark and find that the public's attitude towards the size of the government and the lower representation of the poor affect the election result. The changes in the minimum consumption level under Policy I affect the voting results most, followed by the attitude. Voting Participant rate plays the most insignificant role in the voting outcome. The sensitivity analysis shows that our main findings are robust to the input parameters.

**Keywords:** Social Health Insurance, Voting,

**JEL Classification:**

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# 1 Introduction

Over the past several decades, most industrialized countries have experienced an upward trend in the total medical expenses, reflected as an increasing share in GDP among most OECD countries. Prior to the financial crisis, the average growth rates of the healthcare expenses would range between 4% and 6% annually from 1960 onwards (Huber, 1999, Huber and Orosz, 2003 and Marino et al., 2017). Despite the financial crisis cause many governments to cut down the general public budget including medical costs funded by the public resources, the medical expenses of OECD have risen again at a fast speed (3.4% in 2016)[1] recently. Public expenditure on medical costs among OECD countries is expected to rise from 6% of GDP in 2010, up to around 9% in 2030 and further more to one seventh (around 14%) of GDP by 2060 (De la Maisonneuve and Oliveira Martins, 2013).

If we focus on a few most developed countries, such as the U.S., Switzerland, France, Germany, Netherlands, Japan, Belgium, Austria, Canada and the Nordic countries, the medical expenses play an even more important role than in other OECD countries. In 2014, more than 10% of GDP in the listed countries are health-related spending[2]. The leading country is the U.S., whose health expenditure amounted to 16% of GDP in 2014.

However, the U.S. exhibits a different path in the development of health care system compared with other developed countries. It is very unique that part of the health-related costs paid by the private sector is larger than the public costs in the U.S.. In 2015, medical expenses paid by the private sector are over 52% and the out-of-pocket spending is as high as 34%, whereas, the private contribution only accounts for 15% to 20% percent of the total medical costs for the representative European countries, and the out-of-pocket medical costs for France and Germany are as low as 14% and 13% [3]. As to the composition of healthcare expenses, in the U.S., more than half is outpatient services and only 18% is inpatient. For Germany, these two parts are both 29% [4]. The only OECD country, with a structure similar

[1] Source: OECD Health Statistics
[2] Source: OECD Health Statistics 2015
[3] Source: OECD Health Statistics 2016
[4] Source: OECD Health Statistics 2016

to that of the U.S. is Czech Republic (Marino et al., 2017). Meanwhile, the growth rate of the healthcare spending in the U.S. since 1970 is higher than that in the rest of the OECD countries (Huber, 1999 and Huber and Orosz, 2003).

Schoen et al. (2010) conducted a survey among eight high-income countries and found that the residents in the U.S. had the most serious financial problems related to medical costs and were less satisfied by the health services. By examining the inequality in health care utilization among 10 European countries and the U.S., Van Doorslaer et al. (2000) pointed out that the U.S has the most serious inequality problem. In the study of Schoen et al. (2010), they argued that for U.S. citizens, a universal and comprehensive health care system reform could contribute to resolving the inequality issues.

These differences are mainly caused by the distinct public health care systems and policies of the European countries and of the U.S. on one hand. There are three types of health care systems: National Health Care (NHC), Social Health Insurance (SHI), and private insurance-based systems (Blank et al., 2017). The national care system, financed by taxation, is found in the U.K, Greece, Italy, Portugal, Spain and the five Nordic countries in Europe. The second healthcare model, which is based on compulsory insurance, is representative of countries such as Germany, France, Belgium, Austria, Netherlands and Switzerland (Saltman et al., 2004). Both of these types of health care systems, called the Western-type by Marino et al. (2017), are universal and comprehensive, and offer the residents of these countries good protection from out-of-pocket costs. The U.S. is the only industrialized country which is characterized by the private insurance based system (Berwick and Hackbarth, 2012). The main differences between the U.S. system and the Europe system could be summarised as follows (Table 1):

Many studies have discussed the reasons behind the adoption of specific welfare systems, and in particular on the deep differences between the social health systems in the U.S. and European countries. In their book, Blank et al. (2017) pointed out that social values, cultural factors, biomedical technology as well as demographic factors could cause the adoption of different healthcare systems among industrialized countries. More specifically, legal systems, political systems, social structures, public expectations and demands, interest groups,

| U.S. System | Europe System (Germany as the representative country) |
|---|---|
| private insurance-based healthcare systems | universal healthcare |
| not compulsory | compulsory |
| partially covered | "sufficient, necessary and meaningful services" |
| premium depended on health condition | depended on salaried income |
| relative low insurance premium | high insurance premium |
| but high Out-of-Pocket costs | but low OOP costs |
| not surely includes family members | includes |
| from the insurance pool | "pay as you go" |

Table 1: Main Differences between the U.S. Healthcare System and the Europe Social Health System

mass media, health care sector and insurance structure could all contribute to shape these differences. Alesina et al. (2001) excluded income difference and deadweight loss for taxation. They believed that the low representation of minorities in the U.S, the distinct legal systems, the political structure, the behavioural differences in voting and racial discord all play significant roles.

Based on previous studies in literatures and the general review of the different development in the history of the U.S. and Europe (Appendix **??**), we put forward two hypotheses to explain the existence of the entirely different social healthcare systems in the U.S. and in European countries. Firstly, we believe that in the U.S., the voice of the poor is less important than the rich, because poor voters are less willing to participate in the elections. In Hill and Leighley (1992) and in Hill et al. (1995), the relevant empirical evidence is illustrated. Riker and Ordeshook (1968) argued that because of the costs of attending the election, the poor have less chance to vote. Blakely et al. (2001) found that political inequality in voting was associated with poor self-health conditions. Kingdon and Thurber (1984) highlighted the effects of political organisations, such as labor unions. In Europe, the power of labor unions is much bigger and has helped the poor to be better represented.

The second hypothesis is that the different attitudes towards the size of the government and the existence of a compulsory social health insurance affect the voting outcomes. Blank et al. (2017) pointed out that residents trended to be communitarian in the health political culture, while people are individualistic in the U.S.. Jacoby (1994) analyzed public attitudes towards government spending. Blais et al. (1993) and Risse-Kappen (1991) emphasized the spirit of freedom, liberalization and democracy in the U.S. which leaded to a naturally negative attitude towards growing power of the government.

In this paper, we build a multi-period overlapping generation model to test these two hypotheses and further quantify the importance of each of the proposed factors. The rest of the paper is structured as follows. Section 2 lays out the theoretical framework. Sections 3 and 4 show the benchmark's simulation results and the counterfactual results. Our concluding remarks are found in section 5.

# 2 Model

In this section, we describe the theoretical framework. We develop an overlapping generation model, which is mainly an extension of Huggett (1996). In addition, we also introduce idiosyncratic shock in medical expenses, as well as the role of government.

## 2.1 The Environment

Time is discrete and infinite indexed by $n = 0, 1....$ At the beginning of each period, a continuum of agents are born. The size of each cohort is normalized to be $1$. We do not consider accidental death along the life-cycle, so agents survive from age $0$ to age $N$. The instantaneous utility function at each period takes the standard CRRA form:

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}$$

where $\sigma$ is the coefficient of relative risk aversion $(\sigma \geq 1)$.

We assume that agents are heterogeneous along two dimensions: i) the non-asset income $(y_t)$, ii) the medical expenditure $(m_t)$. Following the convention in the literature, we assume each individual's labor income follows an stochastic $AR(1)$ process:

$$y_{t+1} = (1-\rho) * \mu_y + \rho * y_t + e_t$$

where $e_t \sim N(0, \sigma_y)$ and $\rho$ is the $AR(1)$ coefficient. The stochastic labor income can be further discretized into a finite-state Markov Chain with a finite number of possible values in the set $Z$ according to Tauchen(1986). Moreover, the shocks are also i.i.d across agents. Therefore, there is no aggregate level uncertainty in the economy.

Medical expenditure, $m_t$, is defined as out-of-pocket medical costs. Throughout the paper we treat the medical costs as exogenous shocks to the agents, since the major focus of the paper is to examine the effects of medical expenditure on the aggregate outcome and individual's decision. The shocks are also assumed to be age dependent. Each individual of age $t$ draws a medical cost $m_t$ from a log-normal distribution at the beginning of each age, $log(m_t) \sim N(\mu_{mt}, \sigma_{mt})$, where $\mu_{mt}$ and $\sigma_{mt}$ are the mean and the standard deviation of the normal distribution for the agents of age $t$. $\mu_y$, $\sigma_y$ $\mu_{mt}$, and $\sigma_{mt}$ are independent. We have done robustness check by allowing the covariance between income and health expenses, the quantitative results remain robust.

The timeline of the economy is as follows: agents draw idiosyncratic income and medical expense at the beginning of each period. Agents will then make the saving decision accordingly. Borrowing is not allowed in our basic model. Agents are not endowed with any initial wealth: $a_0$ equals to $0$ for all. At age $N$, the last period of their lives, agents will consume everything when the bequests motive is absent.

## 2.2 Two Different Policies

In the model, we have two different policies for all agents to vote: policy I (without fully covered social health insurance) and policy II (with a compulsory social health insurance). For policy I, agents should take charge of their medical expenditures themselves. Government subsidies will support the poorest agents who are endowed with low income or draw high medical costs. Under policy II with fully covered social health insurance, agents pay a premium (or tax) which is a proportion of their income to join the insurance pool. Then the government will take full responsibility of everyone's medical services. Since the medical expense is waived from budget constraints, the government will no longer supply the subsidy. Once more than half of the households support one policy in the election, then the policy will become permanent.

Under Policy I, every agent needs to pay income tax to the government. Meanwhile, the government will supply a subsidy to the poor. A typical budget constraint for a representative agent at age $t$ is:

$$a_{t+1} = (1-\tau)y_t + (1+r)a_t - c_t - m_t + b_t$$

where $a_t$ is the saving (assets) at age t, $\tau$ denotes the income tax and $b_t$ describes the government transfer.

Each agent takes the government transfer as given. But from the perspective of the government, $b_t$ is determined such that all the agents are able to afford at least $\underline{c}$ unit of consumption as well as paying for the incurring medical expenses within the period. Specially, $b_t$ is given as:

$$b_t = max \ \ \{0, \underline{c} + m_t - [(1-\tau) * y_t + (1+r) * a_t]\}$$

where $\underline{c}$ denotes the minimum consumption provided by the government transfer. The above implies that when the agents have very low income or draw very high medical expenses, while at the same time they are endowed with low assets from the last period, the government will protect those vulnerable groups, so they can maintain a minimum standard of living.

In this paper, $\underline{c}$ is endogenous. The government would decide the minimum consumption level based on the poverty fraction $p^p$. The government finances its transfer through taxation. We assume balanced government budget, so government budget in each period can be written as:

$$\int_{i \in \boldsymbol{\Omega^p}} b^i \,\mathrm{d}i = \int_{\boldsymbol{\Phi}} (\tau * y^i) \,\mathrm{d}i$$

where $\boldsymbol{\Phi}$ denotes the entire population set, and $\boldsymbol{\Omega^p}$ is the set for agents who receive subsidy from the government. Therefore, the poverty fraction is:

$$p^p = \frac{|\mathbf{\Omega^p}|}{|\mathbf{\Phi}|}$$

We assume government can perfectly monitor those agents who receive transfer, and they are not allowed to own any assets and transfer it to the next period.

At each age, agents solve the dynamic programming problem by choosing consumption $c$ for this period and a risk-free asset $a'$ for the next period. The value function for each individual is as follows:

$$\begin{aligned} V(a,m,y,t) &= \max_{c,a'} u(c) + \beta \mathbb{E}_{(y',m')}[V(a',y',m',t+1)|(a,y,m)] \\ s.t. \quad c + a' &\leq (1-\tau)y + (1+r)a - m + b \\ a' &\geq 0 \end{aligned}$$

From these equations, we can see that the agents must pay the medical costs $m$ themselves and also need to factor in the expectation for the future medical expenses $m'$.

Under Policy II, agents need to "donate" a fee as the cost of purchasing a health insurance, afterwards the government or the government-owned health insurance company will pay for all the medical services for the entire population. Therefore, a typical budget constraint for a representative agent at age $t$ under Policy II is:

$$a_{t+1} = (1 - \tau_{SHI})y_t + (1+r)a_t - c_t$$

where $\tau_{SHI}$ denotes the social health insurance premium. It may also be treated as a tax since it is compulsory. We assume balanced government budget, and thus the government decides $\tau_{SHI}$ according to its budget constraint:

$$\int_i m^i \, \mathrm{d}i = \int_i [\tau_{SHI} * y^i] \, \mathrm{d}i$$

Since it is a compulsory social health insurance, agents may hold different attitudes towards Policy II. An exogenous fraction $p^A$ of agents prefer a small government rather than a powerful one who holds huge funds and controls everyone's lives. We assume a utility loss for those agents, $\overline{A}$, under the policy with SHI. Specifically, the utility becomes:

$$u^i(c) = \begin{cases} \frac{c^{1-\sigma}}{1-\sigma} - \overline{A} & i \in \mathbf{\Phi_1} \\ \frac{c^{1-\sigma}}{1-\sigma} & \text{otherwise} \end{cases}$$

where $\mathbf{\Phi_1} \subset \mathbf{\Phi}$ is the set of agents who initially dislike the policy with fully covered SHI.

Similar to the situation under Policy I, at each age, every household solves the dynamic programming problem by choosing consumption $c$ for this period and a risk-free asset $a'$ for the next period. Then, the value function for each individual is as follows:

$$\begin{aligned} V(a, y, t) &= \max_{c,a'} u(c) + \beta \mathbb{E}_{(y')}[V(a', y', t+1)|(a, y)] \\ s.t. \quad c + a' &\leq (1 - \tau_{SHI})y + (1 + r)a \\ a' &\geq 0 \end{aligned}$$

## 2.3 Decision Rules, Participant Rate and Voting Results

Agents could be **Myopic** or have **Perfect Foresight**. If the agents are **Myopic**, they place more emphasis on the situation at present and compare the current utility between $U_{no}$ under the Policy I without any social health insurance with $U_{SHI}$ under Policy II. Otherwise, if the agents have **Perfect Foresight**, they compare the life time expectations between $V_{no}$ and $V_{SHI}$ under the two different policies.

After comparing their current utilities or their life time utility expectations, agents will form their preference of the policies.

$$\Gamma^i_{m,pf} = \begin{cases} 1 & \text{if } U^i_{no} < U^i_{SHI} \text{ for Myopic or } V^i_{no} < V^i_{SHI} \text{ for Perfect Foresight} \\ 0 & \text{otherwise} \end{cases}$$

If $\Gamma^i_{m,pf} = 1$, then agent $i$ is a supporter of Policy II with the social health insurance, $i \in \Psi_{m,pf}$. The $m, pf$ denotes whether the agent is **Myopic** $(m)$ or have **Perfect Foresight** $(pf)$.

If all agents participate in the elections, the voting outcome equals to $\frac{|\Psi_{m,pf}|}{|\Phi|}$. However, in reality, not all agents will attend the election. Voting results depend not only on each agent's preference, but also on their participation rate $w_y$ in the elections. $w_y$ is income dependent. Then,

$$\text{voting results} = \frac{\int w(y)|\Psi_{m,pf}(y)|\,\mathrm{d}y}{\int w(y)|\Phi(y)|\,\mathrm{d}y}$$

## 2.4 Stationary Equilibrium

Income $y$, medical costs $m$ and assets $a$ are given and known at the beginning of each period. At the age $N$, agents face the value function $V(t+1) = 0$. Then, in our basic model, there are three state variables: $m_t$, $y_t$ and $a_t$, and one control variable: $c_t$.

The distribution of agents is defined over age, asset holdings, non-asset income status and medical expense status. Let $x = (a, m, y)$, and let $(X, B(X), \psi_t)$ be a probability space where $\psi_t(B_0)$ is the fraction of age $t$ agents whose state $x$ lies in set $B_0$ as a proportion of all age-$t$ agents with initial distribution $\psi_t$. These agents make up a fraction $\psi_t(B_0)\mu_t$ of all agents in the economy, where $\mu_t$ is the share of age-$t$ agents in $t$.

A **stationary equilibrium** consists of $\{c(a, m, y, t),\ a'(a, m, y, t),\ r\}$ and an invariant measure of agent distribution for every age $t$ $(\psi_1, \psi_2, ..., \psi_N)$ in the defined state space, such that

1 The individual agent solves its utility maximization problem by choosing the optimal rules of $c(x, t)$ and $a'(x, t)$.

2 The aggregate savings of all elderly in this system, $\bar{s}$ is assumed to be positive:

$$\sum_t \mu_t \int_X a'(x, t) d\psi_t = \bar{s}$$

3 The law of motion for the measuring of age-$t$ agents is

$$\psi_{t+1}(B) = \int_X T(x,t,B) d\psi_t, \forall B \in B(X)$$

where $T(x,t,B)$ is a transition function. It gives the probability that the age-$t$ agent transits from the current state ($x$) to state $B$ in the next period. The transition function is determined by the optimal decision rule on asset holdings, by the exogenous transition probabilities on the labor income shock $y$ and by the exogenous probabilities on the medical expenditure shock $m_t$.

4 Since we discretize both $y$ and $m$, the law of motion becomes

$$\begin{aligned}&\psi_{t+1}(a', m', y') \\ &= \sum_{a:a'=A_t(x)} \sum_{m:m'=M_t(x)} \sum_{y:y'=Y_t(x)} \Gamma([m,y],[m',y'])\psi_t(a,m,y)\end{aligned}$$

where $\Gamma([m,y],[m',y'])$ is the transition probability matrix for the joint process of the pair, $[m,y]$.

5 For simplicity, we assume there is no population growth and population share of each $t$ is equal, i.e., $u_t = u = 1/6$. Hence, $1 = \sum_{t=1}^{N} \mu_t^j$ at time $j$.

# 3 Quantitative Analysis

In the quantitative analysis, we focus on the analysis of the principle factors for the agents' voting decisions. We firstly calibrate the parameters for the benchmark model. Then, we build two counter models to test our two hypotheses: i) the voice of the poor is less important than the rich, because poor voters are less willing to participate in the elections.; ii) the distinct attitudes towards the size of the government and its power, which can be augmented with a compulsory social health insurance system, affect the voting outcomes.

| Parameter | Model | Value |
|---|---|---|
| $N$ | Maximum model age | 6 |
| $\sigma$ | coefficient of relative risk aversion | 1.5 |
| $\beta$ | subjective discount rate | 0.9 |
| $\mu_y$ | mean income, normalized | 1 |
| $\rho_y$ | AR coefficient of Markov chain approximation of AR(1) process for income | 0.85 |
| $\sigma_y$ | s.d. of the error term in Markov chain approximation of AR(1) process for income | $\sqrt{0.3}$ |
| $\mu_{m,t}$ | mean of lognormal distribution of the medical expense process, $m_t$ | age group-specific |
| $\sigma_{m,t}$ | s.d. of lognormal distribution of the medical expense process, $m_t$ | age group-specific |
| $r$ | interest rate per model period (5 years) | 10% |
| $u_t$ | population share of each age, $t$ | $1/6$ |
| $p^A$ | fraction who prefers smaller government, PEW | 53% |
| $p^p$ | poverty level, U.S. Census 2013,2014 | 14.8% |
| $w_y$ | election participant rate, CPS 2014 | income dependent |

Table 2: Parameters from Data or Existing Literature

## 3.1 Parameterization

We have three kinds of parameters based on their different sources: the parameters which are directly calibrated from data or borrowed from literature, the calibrated parameters, and the parameters predicted from the model. The parameter space in our model contains $\{N, \sigma, \beta, \mu_y, \rho_y, \sigma_y, \mu_{m,t}, \sigma_{m,t}, r, u_t, p^A, p^p, w_y, \overline{A}, \underline{c}, \tau, \tau_{SHI}\}$ (seen in Tables 2, 3 and 4 ).

$N$ denotes the maximum age in the model. In this paper, we assume that each age represents a period of 5 years. $\sigma$ is the coefficient of relative risk aversion and controls

| Parameter | method |
|---|---|
| $\overline{A}$ | calibrated by given ACA voting results, PEW |
| $\underline{c}$ | calibrated by given poverty level |

Table 3: Calibrated Parameters

| Parameter | method |
|---|---|
| $\tau$ | solved for given minimum consumption level |
| $\tau_{SHI}$ | solved by given the health services cost |

Table 4: Model Predicted Parameters

the utility function. $\beta$ denotes the subjective discount rate and will reflect how important the future utility is for the agents. We assume that the annual interest rate equals to 2%, therefore, the 5 years interest rate, $r$, will be 10% in our benchmark model. These three parameters $\sigma, \beta$ and $r$ are borrowed from literatures. For simplicity, we assume there is no population growth and the population share of agents at each age $t$ ($u_t$) is equal.

In this paper, we use 2014 HRS (the Health and Retirement Study) data to calibrate the income and medical cost related parameters. HRS supplies survey data with rich details focusing on health related costs, financial and social status, etc., among the retired population (50 and older) in the U.S.. Specifically, the HRS dataset includes data falling under the topics of health status, medical expenses, pension situation, social and health insurance status and so on. For the purpose of our analysis, we chose the HRS. After registration, the HRS dataset is free and publicly accessible. The available data starts from 1992 and the most recently published data is from 2016.

$\rho_y$ and $\sigma_y$ are the AR coefficient of the Markov chain approximation of the AR(1) process for income and its s.d. of the error term in Markov chain approximation respectively. Following Guvenen (2009), we extract those two parameters using the HRS 2014. Note that there are other available data sources which we can adopt to estimate an income process from a group of more representative individuals. HRS only focuses on agents whose age are between 50 and 80. However, we stick to HRS dataset because of its detailed documentation

| 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-80 |
|---|---|---|---|---|---|
| 25.53% | 24.03% | 21.11% | 16.34% | 14.14% | 13.92% |

Table 5: Share of the Agents with Non Medical Costs

on medical expenditure, which is the major focus of the paper. In addition, if income process is indeed a stationary process, then estimation using a truncated series will still deliver the unbiased results.

We denote the out-of-pocket payments for medical services as the medical expenses. In more detail, these include hospital costs, nursing home costs, outpatient surgery costs, doctor visit costs, dental costs, RX costs, in-home health care costs and other services costs. The original data size is 18,747. In order to fit the model, we excluded samples with age under 50 or older than 80. Then, we group the participants into the corresponding age groups. For the 6 groups, the sample size is respectively $1128$, $3595$, $3193$, $2289$, $2460$, and $2795$. The total number of participants is $15460$ in the data.

In the literature, e.g. Duan et al. (1983), Manning et al. (1987) and others, medical expenses follows a log-normal distribution. In this paper, we define the medical costs as out-of-pocket expenditure. Therefore, in the data, we found many samples with medical costs equal to zero. In such cases, the log expenses will be minus infinity. To deal with this, we first calculate the proportions of those endowed with zero medical costs in each age group. From Table 5 we can see that this ratio is strictly decreasing with age. Then, we take the log of all the non-zero medical costs and use the results to fit the normal distribution. Figure 1 shows the fitted results. The six panels represent the results from six distinct age groups. The x-axis denotes the logged medical costs. The blue bars represent the density. The red lines are the fitted normal distribution. The calibrated mean $\mu_{m,t}$ and the standard deviation $\sigma_{m,t}$ are also shown in the upper right corner in each subgraph. The fitted mean and the s.d. do not seem to change much among ages groups. However, if we take the proportion of individuals with zero medical cost into account, we will observe a rise of mean costs with age and an increasing volatility. Then, the results will match those reported in the literature.

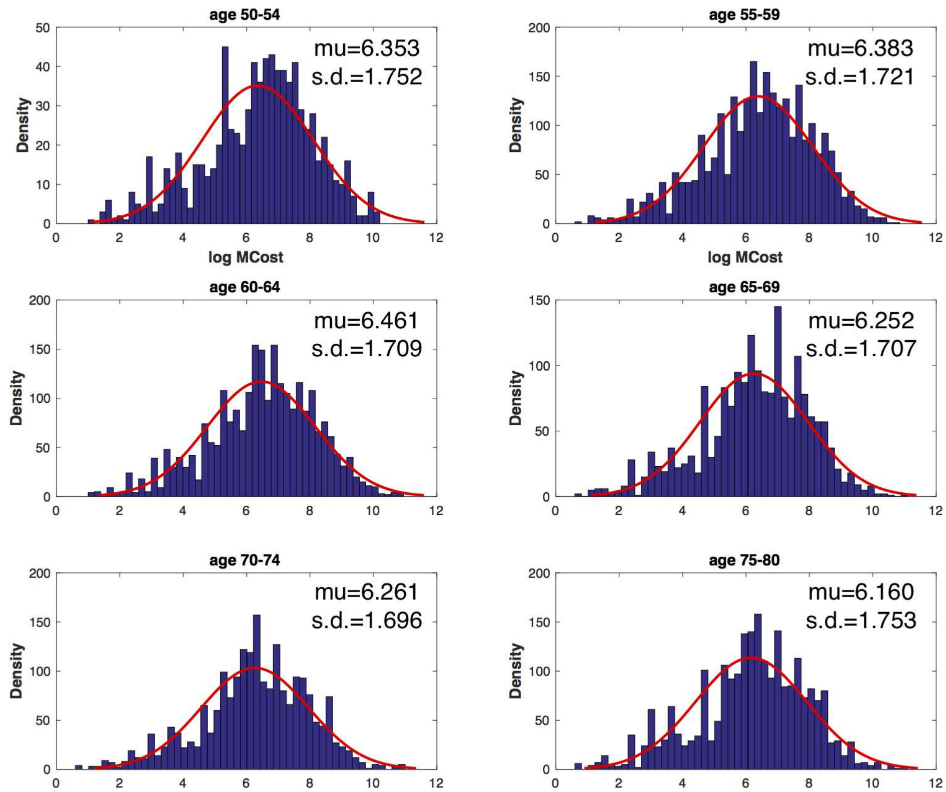


Figure 1: Medical Expenses Distribution in Age Groups

In our model, we assume the medical expenses for each agent is a random shock. At the beginning of each time period, the individual draws a number from a certain distribution. The distribution function which we calibrated using HRS 2014 is not a simple log normal distribution and it is a piecewise-defined function with one sub-function assigning the value equal to zero and another sub-function following log normal distribution. Therefore, when we draw the medical shocks, there will be two steps: firstly, according to a given probability, the agents will be assigned one of two conditions: i)“in perfect health” with no medical costs in the coming period, or ii) “in not perfect health”, who will arrive at the second step drawing from the log normal distribution to determine how high the medical expenditures are.

There are three additional important parameters related to the two policies. $p^p$ is the fraction of poverty in the economy. We use the poverty ratio from the U.S. Census 2013 and

2014. In both years, it equals to 14.8%. $p^A$ denotes the probability of agents who prefer a smaller government and therefore have a negative attitude towards Policy II which comprises the compulsory social health insurance. The PEW (Pew Research Center), a non-advocacy American fact tank, has conducted surveys and provided information on the citizens' views about the size of government since April 1976 (Figure 2). Since the fraction of citizens who support a smaller government with fewer services is dynamic, we take the average from 1990 (after the Cold War) until 2014. $w_y$ is the rate of participation in elections. $w_y$ is income different. The data we used to calibrate is CPS 2014 (U.S. Census Bureau, Current Population Survey, November 2014). The corresponding election participation rates of the ten income groups ranked from the lowest to the highest are 27.35%, 33.68%, 34.32%, 38.35%, 44.93%, 46.71%, 52.75%, 58.01%, 60.93% and 63.37% respectively. We can see that the poorer the agents are, the less they get involved in elections.

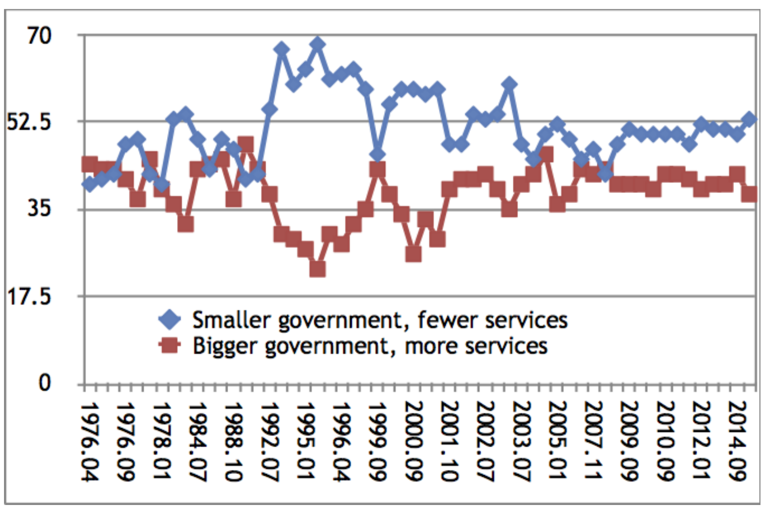


Figure 2: Views about Size of Government of Americans from 1976 to 2015

Note: survey data from PEW

Under Policy I, there is no social insurance system, so all agents must take full responsibility of their own medical expenses. There is a certain chance that the agent is endowed with low income or with extreme high medical costs. In such cases, the relevant agents will face severe financial problems. Under these circumstances, the government will supply a subsidy for the poorest agents. The government first decides on the fraction of people who need help and then the minimum consumption level (consumption floor) can be solved to match the poverty rate. In order to calibrate the consumption floor, we repeatedly throw different levels of $\underline{c}$ into the model and the model will generate results about the fraction of the population in need of subsidies. From Figure 3 we can see that with the increase of consumption floor (x-axis), the fraction of agents who take subsidies raises (left y-axis). The horizontal light blue line is the fraction of the determined poverty level ($14.8\%$). The blue line intersects the light blue line where the consumption floor is located between 0.11 and 0.12. Eventually, the $\underline{c}$ solved in the baseline model equals to 0.113250122.

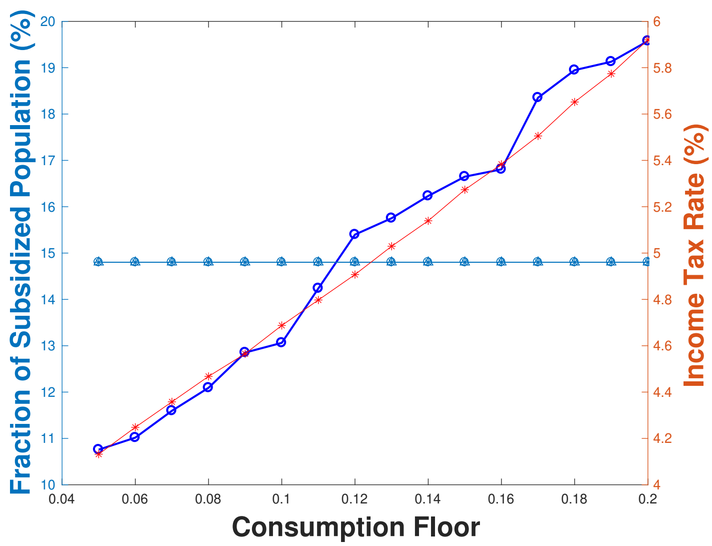


Figure 3: Calibrate the Minimum Consumption Level

The minimum consumption level is guaranteed by government transfers, which are supplied by the income tax collected at certain tax rate for each period. Given $\underline{c}$ equals to $0.113250122$, the $\tau$ solved by the model is 4.88% (the orange line in Figure 3).

Since Policy II is based on a compulsory social health insurance model, for those agents who prefer smaller government with fewer services, there will be a negative effect $\overline{A}$ as part of their utility. This parameter is hard to be calibrated directly from the data. However, if the voting result is available, we can arrive at the solution of $\overline{A}$ via backward induction in the benchmark. Then, the problem becomes a matter of estimating the election results.

On March 23, 2010, president Barack Obama signed the Patient Protection and Afford-

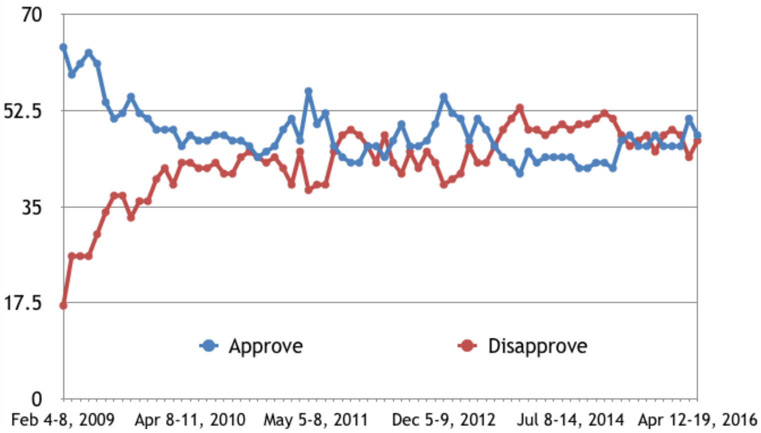


Figure 4: Public's Overall View of Obama Care since 2009

Sources: PEW research center, http://www.people-press.org/datasets/2016/

able Care Act (in short the Affordable Care Act (ACA) or Obamacare). The PEW research centre kept track of the public support level since 2009 (Figure 4). On average, the approval rate was $48.14\%$, while disapproval was measured at $43.04\%$. In our model, we only allow agents to approve or to disapprove Policy II in the election. Abstention is not considered as an option. Therefore, we need to transfer the approval fraction over the whole population in the survey to the approval fraction over the voters in the election. Therefore, we take $52.80\% = \frac{48.14\%}{48.14\%+43.04\%}$ as the election result to solve the attitude parameter $\overline{A}$.

As mentioned in our model outline, agents can be either **Perfectly-Foresighted** or **Myopic**. Figures 5 and 6 show the changes in citizens' views about Policy II with SHI with respect to the increase of $\overline{A}$ in the both cases. We can see that the rise of the attitude value leads to a smaller fraction of people who prefer the SHI policy.

Figure 5 shows the fraction of supporters (**Perfect Foresight**) for Policy II with universal medical insurance given different attitudes towards government size. The green points denote the voting results corresponding to distinct attitude levels. The brown horizontal line is the benchmark model result ($52.80\%$). Then, via backward induction, the solved attitude $\overline{A}^{pf}$ (**Perfect Foresight**) equals to 0.308175 when the agents make their decisions based on the expected value function of the rest of their lives.

In a similar way, Figure 6 exhibits the voting results for the given attitude magnitude

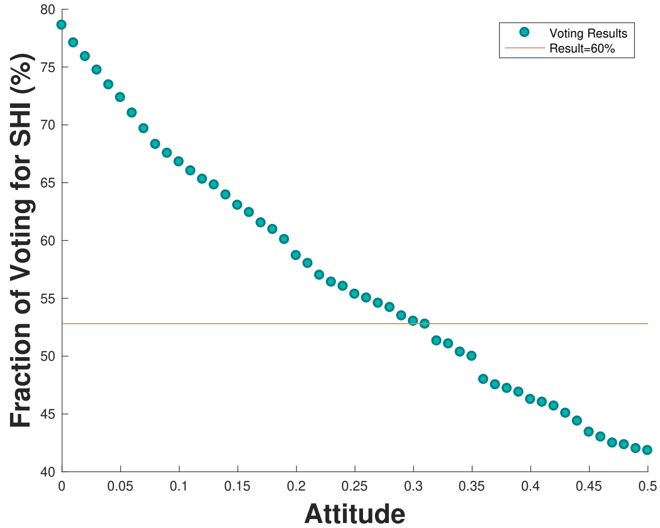


Figure 5: Fraction of Supporters for SHI Policy given Different Attitude towards Government Size (**Perfectly Foresighted** Agents)

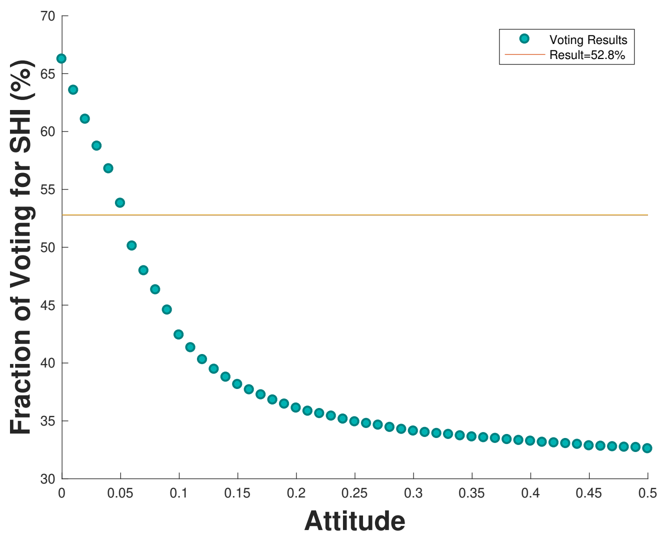


Figure 6: Fraction of Supporters for SHI Policy given Different Attitude towards Government Size (**Myopic** Agents)

when the agents are **Myopic**. The solved attitude level $\overline{A}^{m}$ equals to 0.054620 when agents make their decisions based on current utility. When we compare $\overline{A}^{pf}$ and $\overline{A}^{m}$, we can find that the **Myopic** agents are less tolerant of Policy II. In this paper, we discuss the "**Perfectly Foresighted**" and "**Myopic**" situations separately. In the real word, the **Perfectly Fore-**

**sighted** and **Myopic** agents coexist in the population. Then, the real $\overline{A}$ should be located within the range $[0.054620, 0.308175]$.

Under Policy II, agents need to pay a premium $\tau_{SHI}$ to join the insurance pool. This premium can also be treated as a tax because it is compulsory. Then the government or the state-owned health insurance company will cover the expenses of all medical services for the whole population. In Figure 7, the orange line represents the government revenue along the horizontal axis $\tau_{SHI}$. Ideally, the government plans to have zero revenue. Therefore, $\tau_{SHI}$ solved by our model is equal to 16.4%. In reality, the social health insurance premium applied in Germany is 15.9%, which is very close to what we calibrated.

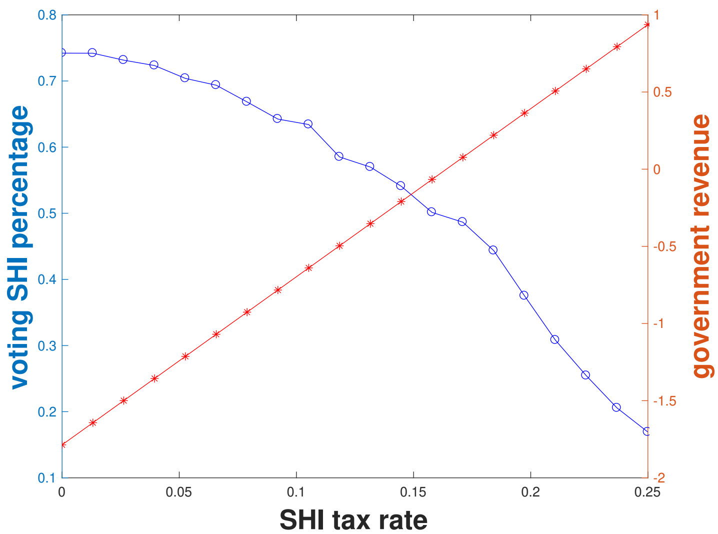


Figure 7: Fraction of Supporters for Policy II with SHI and Government Revenue to Different SHI Premiums

The blue line in Figure 7 shows the movement of the public views on the SHI policy with the increase of $\tau_{SHI}$. Logically, the higher the insurance premium is, the less attractive the policy is.

### 3.2 The Effects of Key Factors

In the introductory section we proposed two hypotheses as the possible key factors in explaining the reasons for the existence of different health insurance systems among similarly developed countries: i) in the elections, the enthusiasm for participating and the voting proportion among the poorer groups are much lower than among the rich ones; ii) The role of different attitudes towards the size of the government is another proposed explanation. Based on our analysis, we point to a third possible factor: the minimum consumption level $\underline{c}$.

First, we believe that the different attitudes towards the government's size and towards the compulsory policies will also strongly affect the households' view in the elections. Agents, who have a negative image about the government, suffer a utility loss under Policy II with SHI. The more intense their negative attitudes are, the lower the current utility or expected life-long utility the agents gain; therefore, they are less willing to vote for the policy with fully covered social health insurance.

For both **Perfect Foresight** (Figure 5) and **Myopic** individuals (Figure 6), the proportion of supporters of Policy II decreases with the rise of negative attitude. In other words, when the public shows lower levels of trust in their government, it will be harder for the politicians to promote the reform of the health insurance system. In Figure 8, we obtain the same results under all weight (participation rate) levels.

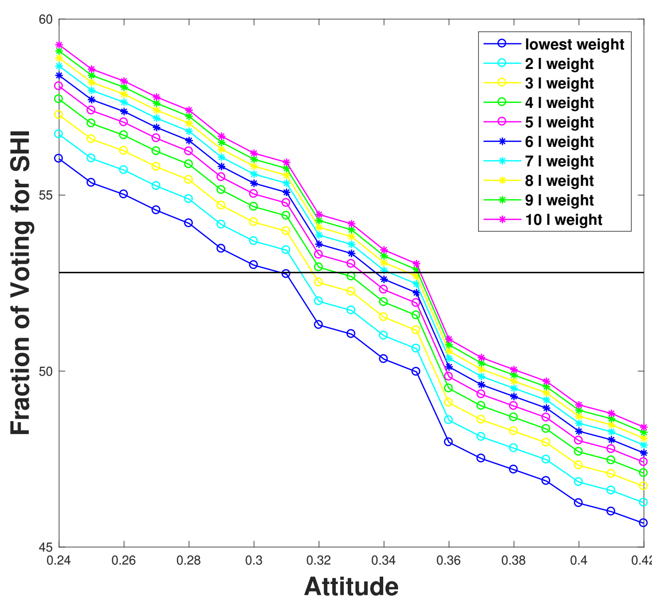


Figure 8: Fraction of Supporters for Policy II with SHI given Different Attitudes and Different Voting Participation Rate

Then, we examine the general effects of the participation rate on the final voting outcomes. The participation rate can be treated as the weight to which an income class influences the election outcomes. The lower the participation rate is, the less their voices can be heard, therefore, the less their voting outcomes weigh in the final results. In order to show the effects, we simulated ten sets of participant rates corresponding to ten distinct income groups. The lowest weight level is the participation rate we used in the benchmark model: 27.35%, 33.68%, 34.32%, 38.35%, 44.93%, 46.71%, 52.75%, 58.01%, 60.93% and 63.37% respectively from the lowest income group to the highest. The highest weight group comprises 100%, representing a scenario where all agents participate. Then, for a given wealth class, we set the simulated weights increase by the same amount each time. For example, for the poorest group, the 10 different weights applied in the simulations are 27.35%, 35.42%, 43.49%, 51.57%, 59.64%, 67.71%, 75.78%, 83.86%, 91.93% and 100% respectively.

The simulated voting results are shown in Figure 8. Each line represents the voting results (fraction of supporters) against the negative public attitudes level given the simulated weights for the 10 income groups. For a fixed attitude level, we can compare the election results under the different weights. We can see from the figure that with the increase of the weights, the fraction of supporters of Policy II curve moves upwards. Therefore, with the increase of the participation rate overall (especially in the poor and in the middle class), the SHI policy has a better chance to be approved.

For the public, making decisions in the election is boils down to comparing the benefits (or losses) under different policies. Therefore, the factor which can affect Policy I (without any social health insurance), will also exercise influence on voting behaviour. In this paper, the minimum consumption level $\underline{c}$ plays a significant role under Policy I. Therefore, we also take $\underline{c}$ as a key factor into account.

Figure 9 illustrates the simulation results for the age-one agents' life time expected utility against the log income with distinct consumption floor levels $\underline{c}$ under Policy I. The third lowest $\underline{c}$ is the parameter we solved in our benchmark model. Based on that, we generate the remaining nine values with the same growth rate (5%).

We can see from the figure that the increases in the minimum consumption level $\underline{c}$ push

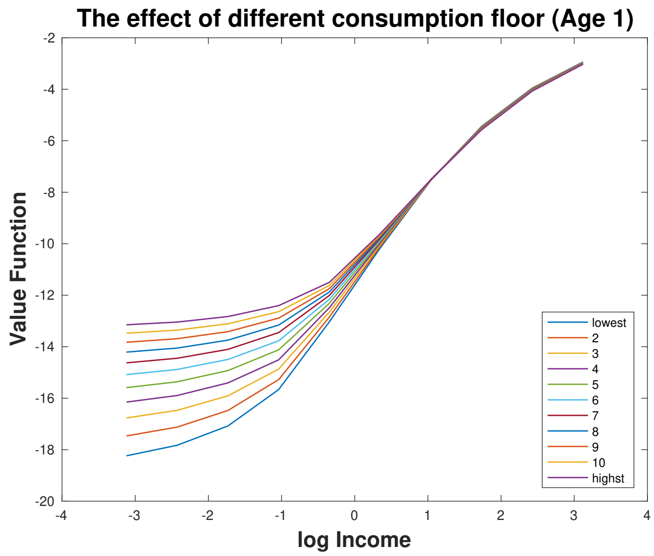


Figure 9: The Expected Utility of Age 1 Agents with Different Minimum Consumption Levels

up the value of expected utility for the agents endowed with relatively lower income. When the government raises the poverty line, the fraction of agents who take subsidies increases. Meanwhile, the minimum consumption level and the subsidized amount will increase as well. In other words, higher $\underline{c}$ will result in a better situation for the poor. However, there are no obvious differences for the agents with the highest income.

With the higher expected utility level under Policy I without SHI, Policy II, which aims at co-exposure and provides protection for the vulnerable groups from miserable living conditions, becomes a less attractive option for the poor. Therefore, when the minimum consumption level increases, the fraction of supporters for Policy II with SHI goes down, resulting a less favourable voting behaviour.

## 3.3 Multiple Cut-off Point

In the previous analysis about the minimum consumption level $\underline{c}$ in Figure 9 we can observe an interesting phenomenon: the value function curve is firstly convex and after a certain point, changes to concave for Policy I. However, in the literature, with an increasing income, the expected value function should monotonically increase with a decreasing rate (concave)

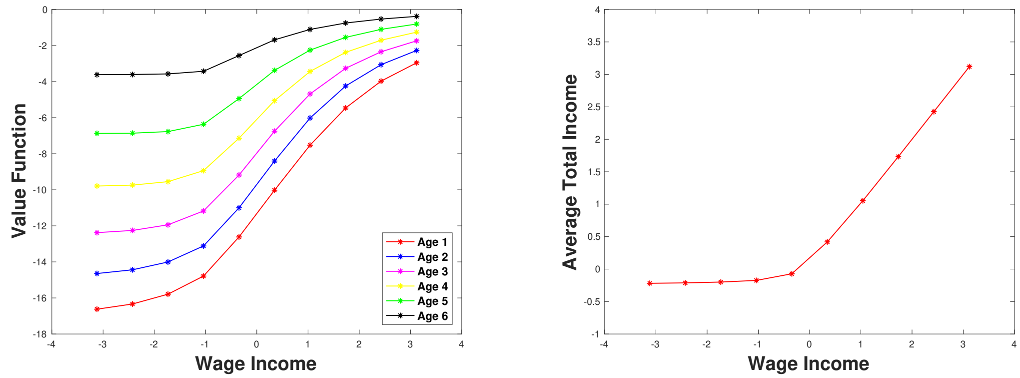


Figure 10: The Shape of Value Function Changes from Convex to Concave along the Wage Income.

globally. The left panel of Figure 10 illustrates the value function curves for the agents from every age group (age 1 to age 6). All these lines exhibit the same pattern. Our finding, while contradictory at first glance, can be explained if we consider the differences between log wage in come and log total income of the poor.

In our benchmark model, under Policy I, the poorest 14.8% of the agents will receive subsidies from the government. In order to make sure everyone can consume at least at the minimum consumption level $\underline{c}$, based on the optimal choice of poor agents, the government will transfer certain amount and top up the consumption to $\underline{c}$. In that case, the total inflow for the poorest 14.8% agents is not only their labor income but also the subsidies received from government.

Seen from the right panel of Figure 10, even though the log wage income keeps increasing, the average log total income (total inflows) for the poorest groups does not change much. After which, the slope of the red line turns to 45 degrees. This means that the log wage income matches the average log total income.

Then, we suspect that the difference between the log wage income and the log total income for the poorest proportions is the reason for the changes of the value function curve from convex to concave (the left panels in Figure 10 and in Figure 11). In the right subfigure of Figure 11, we draw the expected value function curves against the average log total income instead of the log wage income. Consequently, we obtain the concave curves (monotonically

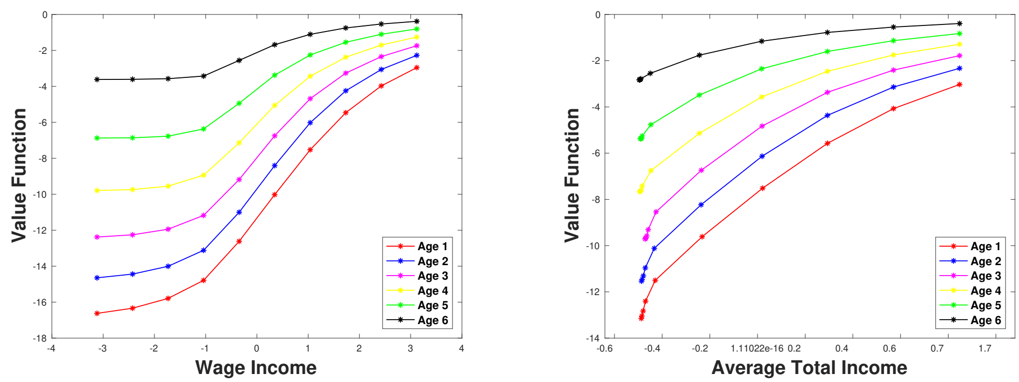


Figure 11: Comparison of Value Functions along Wage Income and along Average Total Log Income

increase with a decreasing rate) for all age groups. This means that, if we treat the total inflow as the income for agents, the expected value function remains concave. This matches the previous findings reported in the literature.

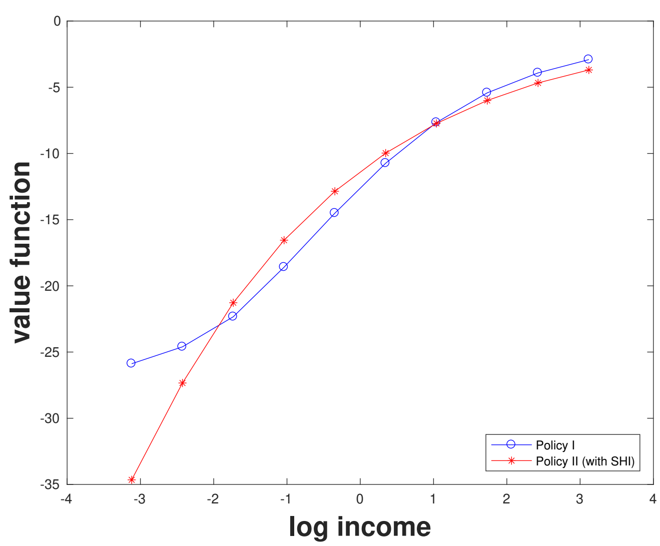


Figure 12: Multiple Cut-Off Point for Policies with and without SHI

As the expected utility under Policy I does not have a single concavity, there exists a chance that the two value function curves under the two policies might have two cut-off points. In Figure 12, the blue line and the red line are the value function curves under policies without or with SHI respectively. Since there is no subsidy under Policy II to only support the poor (there is no restriction of the minimum consumption level $\underline{c}$), the red line is concave. These two lines cut at two points where the log income equals to $-1.9358$ and $0.9450$. The first intersection locates at the 3rd quantile and the second one is at the 73rd quantile.

The agents make their voting decisions only based on the comparison of the current utility or the life-time expected utility level. Therefore, when a certain value function curve is above another one, the curve denotes a policy that is more appreciated by that income class. Specifically, in Figure 12, at first the curve for Policy I is higher (blue line), then the red line (Policy II) surpasses it, and eventually Policy I ends up higher than Policy II again. In other words, in the benchmark model, in the case of the **Perfectly Foresighted** agents, who have incomes below the 3rd quantile or above the 73rd quantile, will vote for Policy I with subsidies rather than Policy II with the fully covered compulsory social health insurance system. Both the poorest and the richest agents prefer the American style and only the middle class wants a the European-style health insurance policy to be applied.

These two cut-off points divide the households into three groups: the poorest 3% of the agents, the richest 27% and the rest in between. Unlike normal commercial insurances which provide risk management to units of similar exposure, the social health insurance supply the cover to the whole population. Its premium is not based on the risk level, but on a proportion of the income. It means that the more capable ones will take more responsibilities in the system.

Based on that, the mechanism which drives the voting choices made by the poorest and the richest agents can be inferred. The poorest have very low income. Although under Policy II they only need to pay a very low premium compared to the medical costs they need to pay under Policy I, the subsidy from the government in Policy I is high enough to turn out a higher utility level. Therefore, they will disapprove the SHI policy. As for the richest, since they obtain high wage income, given the same premium rate $\tau_{SHI}$, the amount contributed by them to the insurance pool is much more than the average. If they only take the current utility or value function into account, they prefer to take the risk of medical expenses shocks under Policy I since the estimated medical costs will be lower than the premium that they

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.412 | 0.439 | 0.138 | 0.010 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0.097 | 0.390 | 0.404 | 0.102 | 0.006 | 0 | 0 | 0 | 0 | 0 |
| 0.009 | 0.125 | 0.429 | 0.360 | 0.074 | 0.004 | 0 | 0 | 0 | 0 |
| 0 | 0.014 | 0.165 | 0.457 | 0.311 | 0.051 | 0 | 0 | 0 | 0 |
| 0 | 0.001 | 0.023 | 0.210 | 0.471 | 0.260 | 0.035 | 0.001 | 0 | 0 |
| 0 | 0 | 0.001 | 0.035 | 0.260 | 0.471 | 0.210 | 0.023 | 0.001 | 0 |
| 0 | 0 | 0 | 0.002 | 0.051 | 0.311 | 0.457 | 0.165 | 0.014 | 0 |
| 0 | 0 | 0 | 0 | 0.004 | 0.074 | 0.360 | 0.429 | 0.125 | 0.009 |
| 0 | 0 | 0 | 0 | 0 | 0.006 | 0.102 | 0.404 | 0.390 | 0.097 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0.010 | 0.138 | 0.439 | 0.412 |

Table 6: The Income Transition Matrix

must pay under Policy II.

However, there exists a group of agents who are recipients of benefits under Policy I as well but still vote for Policy II. Under Policy I, 14.8% of households will receive subsidies but only around 20% of those households supports this policy option. We can infer the reason behind this from the income transition matrix (Table 6).

The table shows the income dynamics. There are 10 income groups ($10 \times 10$ matrix). The rows represent the current income classes to which the agents belong and the columns denote the agents' situation in the next period. All numbers located in the diagonal imply the proportions of agents with unchanged income classes. For example, the number 0.412 in the square of the first column and the first row denotes the probability of the group 1 income agents at present remaining in group 1. Similarly, the chance for an agent who originally takes the lowest income to jump to the second lowest income class is 43.9% (first row, second column).

For the low income households (group 1-4), they will have a good chance to receive a higher payment in the next period. Under the case of Policy I, the increased amount will be cancelled out by the decrease of subsidies. However, under Policy II, even though they need to pay a higher premium, they do not need to worry about their medical cost shocks.

| | $\underline{C}$ | Attitude | Weight |
|---|---|---|---|
| **Myopic** | $77.36\%$ | $66.25\%$ | $53.09\%$ |
| vs Baseline (52.8% ) | $+46.50\%$ | +25.47% | +0.56% |
| **Perfect Foresight** | $94.63\%$ | $78.61\%$ | $55.98\%$ |
| vs Baseline (52.8% ) | $+79.23\%$ | +48.89% | +6.02% |

Table 7: The Counterfactual Analysis Results

The increased premium is proportional, but the decreased subsidy is a full amount. With the expectation of higher income, the relatively poor agents will vote for the social health insurance policy.

On the contrary, the relatively rich agents have a high probability to face an income drop in the next period but not to the point that they would fall into the poorest subsidized groups. They can not enjoy the benefits from Policy I, but can expect a lower premium in the future. Therefore, they are the ones who also strongly support Policy II.

# 4 Counterfactual and Sensitivity Analysis

In this subsection, we try to analyse the importance magnitude of the three proposed key factors: the minimum consumption level $\underline{c}$; the negative attitude towards bigger government and the compulsory insurance policy $A^{m,pf}$; and the lower representations of poorer voters $w_y$. We shut down each factor in turn to test how the final voting results would change.

We also did the sensitivity analysis for two parameters: the poverty fraction and the voting results, which were used to solve the key factors $\underline{c}$ and $A^{m,pf}$.

## 4.1 Counterfactual Analysis

The first counterfactual exercise we do is to control the consumption floor $\underline{c}$ and set it equal to zero under Policy I. Next, we shut down the public attitude towards the size of the government. Then we waive the influence of the lower representation of the poor.

When we remove the protection for agents to consume at a survival level, some agents who draw an extremely low income and high medical expenses will suffer negative consumption. In the case of these agents, we set them to consume at a very low positive level which is close to zero. Then their utility, which follows a CAAR form, will converge to negative infinity.

Table 7 shows that these three factors, $\underline{c}$, Attitude $A^{m,pf}$ and the weight $w_y$ indeed affect the election results. For the **Myopic** agents, when we shut down these factors separately, the fractions of the agents who approve the social health insurance policy rises to 77.36%, 66.25% and 53.09% respectively. Compared to the voting result (52.8%) we used in the benchmark model, the three counterfactual exercises raise the results by $+46.50\%$, +25.47% and +0.56%. Similarly, for the **Perfect Foresight** case, the increases caused by the three factors are $+79.23\%$ ($\underline{c}$), +48.89% ($A^{pf}$) and +6.02% ($w_y$) and further push the supporters among the population up to $94.63\%$, 78.61% and 55.98% respectively.

The change in minimum consumption level affects the voting results the most and it is followed by the attitude towards bigger governments. The voting participation rate plays the most insignificant role in influencing the voting outcomes. Compared to the **Myopic** agents, the **Perfectly Foresighted** agents would be affected to a higher degree by all three factors.

There exists a surprisingly high value of 94.63% in the results. If the agents have **Perfect Foresight**, and when we remove the restriction of minimum consumption, almost the whole population prefer to have fully covered social health insurance. We can infer from Figure 13 that when we shut down the consumption floor, the expected utility curve no longer changes from convex to concave but remains concave all along. Without protection from the government, the poor households have to face the extreme conditions themselves and gain negative utility converging to negative infinity. Furthermore, no matter which income level the agents belong to, they make their decisions based on expectations. The risk of falling into the miserable state makes Policy I less attractive for almost all agents.

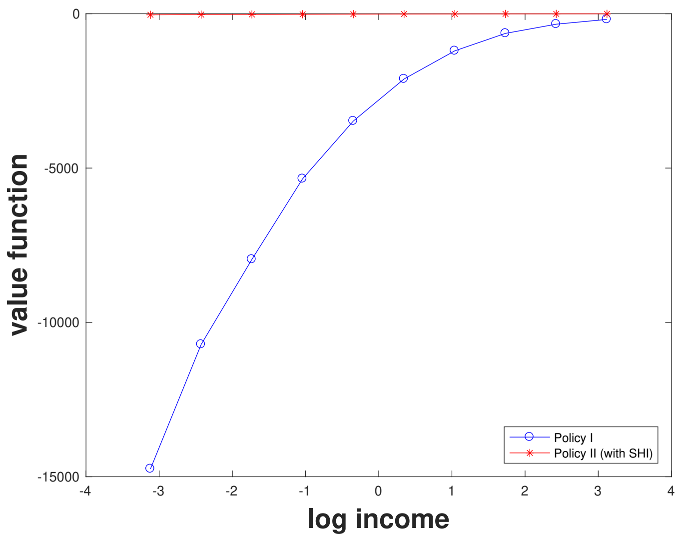


Figure 13: Comparison of Value Functions under the Two Policies in the Counterfactual Analysis (Control $\underline{c}$)

| Poverty | $\underline{c}$ | Income Tax | $A^m$ | $A^{pf}$ |
|---|---|---|---|---|
| 10.0% | 0.036140 | 3.97% | 0.213008 | 0.618295 |
| 14.8% | 0.113250 | 4.88% | 0.054620 | 0.309995 |
| 20.0% | 0.205310 | 5.99% | -8.9418e-04 | 0.137045 |

Table 8: Sensitivity Analysis I: Parameters Solved at Different Poverty Rates

## 4.2 Sensitivity Analysis

In the baseline model, the poverty fraction is used to calibrate the minimum consumption level $\underline{c}$. With a lower (higher) poverty level, the model generates a smaller (larger) minimum consumption constrain $\underline{c}$. We change the poverty fraction $p^p$ to 10% and 20% instead of 14.8% to test the sensitivity. This is followed by another sensitivity analysis about the voting result, which was applied to solve the attitude level $A^{m,pf}$. We change the voting results to 60% and to 40% instead of 52.8% to examine whether our main findings hold.

When $p^p$ drops to 10%, $\underline{c}$ decreases to 0.036140 and the income tax goes down to 3.97% (seen in Table 8). But in order to match the voting outcome of 52.8%, attitudes solved by the model for both **Myopic** and **Perfectly Foresighted** agents become higher (0.213008 for $A^m$

| $p^p = 10\%$ | $\underline{c}$ | Attitude | Weight |
|---|---|---|---|
| **Myopic** | $80.01\%$ | $75.83\%$ | $54.00\%$ |
| vs Baseline (52.8% ) | $+51.53\%$ | +43.63% | +2.27% |
| **Perfect Foresight** | $92.86\%$ | $81.24\%$ | $56.74\%$ |
| vs Baseline (52.8% ) | $+75.86\%$ | +53.87% | +7.46% |

Table 9: Results with Controlled Key Factors given Poverty Rate 10%

| $p^p = 20\%$ | $\underline{c}$ | Attitude | Weight |
|---|---|---|---|
| **Myopic** | $78.67\%$ | $52.54\%$ | $52.21\%$ |
| vs Baseline (52.8% ) | $+49.00\%$ | -0.48% | -1.30% |
| **Perfect Foresight** | $96.60\%$ | $72.56\%$ | $53.89\%$ |
| vs Baseline (52.8% ) | $+82.96\%$ | +37.41% | +2.07% |

Table 10: Results with Controlled Key Factors given Poverty Rate 20%

and 0.618295 for $A^{pf}$).

In contrast, a higher poverty fraction (20%) leads to an increase both in the consumption floor (to 0.205310) and in the income tax (to 5.99%). Meanwhile, the negative attitude must be lower than the results solved in the benchmark model to maintain the same voting result (52.8%). Especially for the **Myopic** agents, $A^m$ becomes as low as almost zero (-8.9418e-04).

Table 9 and Table 10 show the effects of those three key factors given poverty rate equal to 10% and 20% respectively. Similar to the counterfactual analysis, we shut down the minimum consumption $\underline{c}$, the negative attitude $A^{m,pf}$ and the participant rate $w_y$ correspondingly for both the**Myopic** and **Perfectly Foresighted** agents.

Although the poverty rates are different, the ranking of the effects among those key factors remain unchanged. Shutting down the consumption restriction under Policy I causes the largest change in the final voting result. The negative attitude towards government size and the compulsory social health insurance also plays an important role, especially for the **Perfectly Foresighted** agents. The participation rates of low income households have the

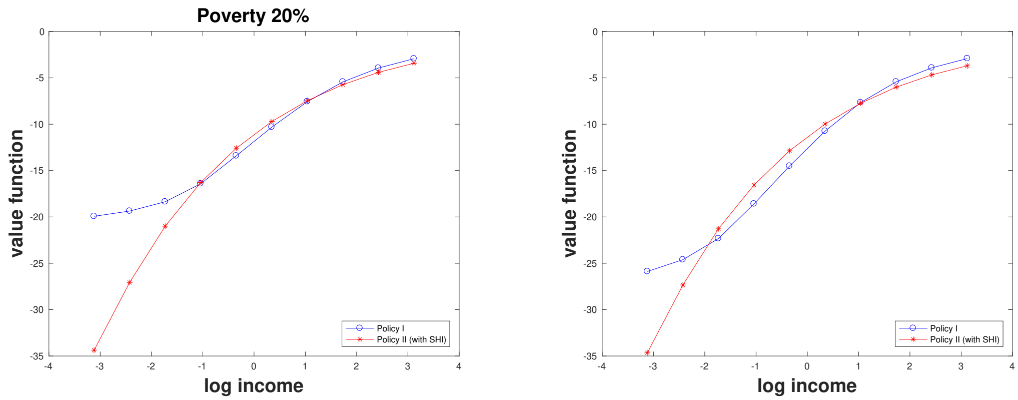


Figure 14: Comparison of Value Functions along Wage Income under Poverty Fractions of 20% and 14.8% (Benchmark Model)

minimal effect. For the **Myopic** agents case, given $p^p = 20$, there even exists a decrease in the voting result.

From Figure 14, we can illustrate reason why there is a negative effect of the poverty rate to the **Myopic** agents. These two panels exhibit the expected utility curves under the poverty fraction of 20% (left panel) and 14.8% (right panel). Compared to the benchmark, a larger proportion of poor agents prefer Policy I with subsidies from the government. Therefore, when the voting weight of all agents increases up to 100%, the voices scaled up the most are from those income groups, as the poor agents are underrepresented in benchmark model. Therefore, the ratio of supporters for Policy I increases and agents who approve the social health insurance policy decreases.

In the baseline model, the average result of the ACA voting survey (52.8%) is used to calibrate the agents' attitudes towards the policy with fully covered social health insurance $A^{m,pf}$ for both the cases of Myopic and Perfect Foresight agents. We change the voting results to 60% and to 40% instead of 52.8% to test the sensitivity.

Table 11 shows the negative attitude $A^{m,pf}$ solved by the model given different voting results. From the table we observe that when the voting result is lower (higher), the $A^{m,pf}$ for both the **Myopic** and **Perfectly Foresighted** conditions becomes higher (lower). The mechanism is as follows: given the other situations unchanged, when the $A^{m,pf}$ increases, the agents have worse views on government services and power abuse problems. They are in turn

| Voting Results | $A^m$ | $A^{pf}$ |
|---|---|---|
| $45.0\%$ | 0.086660 | 0.431935 |
| $52.8\%$ | 0.031823 | 0.194727 |
| $60.0\%$ | 0.026376 | 0.149101 |

Table 11: Sensitivity Analysis II: Parameters Solved with Different Voting Results

| Voting=45% | C | Attitude | Weight |
|---|---|---|---|
| **Myopic** | $75.37\%$ | 66.25% | 45.58% |
| vs 45% | $+67.49\%$ | +47.22% | +1.28% |
| **Perfect Foresight** | $93.81\%$ | 78.61% | 47.57% |
| vs 45% | $+108.46\%$ | +74.69% | +5.72% |

Table 12: Results with Controlled Key Factors given the Voting Results 45%

less willing to leave a huge budget of the total health costs in the hands of the government. The reverse is also a reasonable phenomena, where agents put more trust in the government to handle a big budget as $A^{m,pf}$ decreases.

The repeated counterfactual analysis shows similar results (Table 12 and Table 13): the influences of the three factors are ranked as follows: the minimum consumption level, $\underline{C}$; the attitude, $A^{m,pf}$; and the voting participation rate, $w_y$. In other words, even though the changed voting results give different values of attitude calibrated by the model, the main findings remain the same.

| Voting=60% | C | Attitude | Weight |
|---|---|---|---|
| **Myopic** | $77.23\%$ | 66.25% | 59.88% |
| vs 60% | $+28.72\%$ | +10.41% | -0.19% |
| **Perfect Foresight** | $95.89\%$ | 78.61% | 62.73% |
| vs 60% | $+59.82\%$ | +31.02% | +4.55% |

Table 13: Results with Controlled Key Factors given the Voting Results 60%

## 5 Conclusion

In this paper, we build an overlapping generation model to examine the reason why developed countries with similar background have implemented different social health insurance systems. Based on findings reported in the literature, we propose two hypotheses to explain this phenomenon: i) the voice of the poor is less important than the rich, because poor voters are less willing to participate in the elections.; ii) the distinct attitudes towards the size of the government and its power, which can be augmented with a compulsory social health insurance system, affect the voting outcomes.

Agents, who face income shocks and medical cost shocks simultaneously, need to vote for one of the two policies: Policy I without Social Health Insurance (SHI) but with the subsidy for the poor and Policy II with fully covered SHI. By comparing their current utility or their expected life time utility, households will choose one policy.

We find that under the Policy I, the derivative of the changes of expected utility with respect to income is not monotonic. This means that both the poorest and the richest do not favour the social health insurance system. It was an unexpected result at first: since under Policy II, the insurance premium (tax) is a proportion of income but the protection (health-related services) is the same for everyone, those agents who have low income should prefer this policy. However, in our model, there exist the minimum consumption level $\underline{c}$. In the reality, Supplemental Security Income (SSI) is a United States government means-tested welfare program that provides cash assistance and health care coverage (i.e., Medicaid) to people with low-income and limited assets who are either aged 65 or older, blind, or disabled (children included). It is the minimum consumption which doesn't exist in Germany social system. German social security system includes Unemployment Insurance, Health Insurance, Old age pension insurance, Invalidity insurance, Child support, and Social care. With this subsidy, the optimal choice of the poorest has been changed.

With the calibrated parameters, we solve the benchmark and find that the public's attitude towards the size of the government and the lower representation of the poor motivate the election results. The changes in the minimum consumption level under Policy I affect the voting results most, followed by the attitude. Voting Participant rate plays the most insignificant role in the voting outcome.

The sensitivity analysis about the poverty rate and the voting result shows that our main finding are robust to the input parameters.

From the results, we can tell that in order to propel the social health insurance reform, governments should encourage citizens who have relatively low income to participant the election. Meanwhile, governments could also monitor the public attitude and try to change their image among population. Moreover, when governments advance the reform of the social healthcare system, they should also take the subsidy system into account.

# References

**Alesina, Alberto, Edward Glaeser, and Bruce Sacerdote**, "Why doesn't the US have a European-style welfare system?," Technical Report, National bureau of economic research 2001.

**Anderson, Gerard F, Peter S Hussey, Bianca K Frogner, and Hugh R Waters**, "Health spending in the United States and the rest of the industrialized world," *Health Affairs*, 2005, *24* (4), 903–914.

**Benabou, Roland and Efe A Ok**, "Social mobility and the demand for redistribution: the POUM hypothesis," *The Quarterly Journal of Economics*, 2001, *116* (2), 447–487.

**Berwick, Donald M and Andrew D Hackbarth**, "Eliminating waste in US health care," *Jama*, 2012, *307* (14), 1513–1516.

**Blais, Andre, Donald Blake, and Stephane Dion**, "Do parties make a difference? Parties and the size of government in liberal democracies," *American Journal of Political Science*, 1993, pp. 40–62.

**Blakely, Tony A, Bruce P Kennedy, and Ichiro Kawachi**, "Socioeconomic inequality in voting participation and self-rated health.," *American journal of public health*, 2001, *91* (1), 99.

**Blank, Robert, Viola Burau, and Ellen Kuhlmann**, *Comparative health policy*, Macmillan International Higher Education, 2017.

**Doorslaer, Eddy Van, Adam Wagstaff, Hattem Van der Burg, Terkel Christiansen, Diana De Graeve, Inge Duchesne, Ulf-G Gerdtham, Michael Gerfin, José Geurts, Lorna Gross et al.**, "Equity in the delivery of health care in Europe and the US," *Journal of health economics*, 2000, *19* (5), 553–583.

**Duan, Naihua, Willard G Manning, Carl N Morris, and Joseph P Newhouse**, "A comparison of alternative models for the demand for medical care," *Journal of business & economic statistics*, 1983, *1* (2), 115–126.

**Ferguson, Thomas**, *Golden rule: The investment theory of party competition and the logic of money-driven political systems*, University of Chicago Press, 1995.

**Guvenen, Fatih**, "An empirical investigation of labor income processes," *Review of Economic dynamics*, 2009, *12* (1), 58–79.

**Hill, Kim Quaile and Jan E Leighley**, "The policy consequences of class bias in state electorates," *American Journal of Political Science*, 1992, pp. 351–365.

**_ , _ , and Angela Hinton-Andersson**, "Lower-class mobilization and policy linkage in the US states," *American Journal of Political Science*, 1995, pp. 75–86.

**Huber, Manfred**, "Health expenditure trends in OECD countries, 1970-1997," *Health Care Financing Review*, 1999, *21* (2), 99.

**_ and Eva Orosz**, "Health expenditure trends in OECD countries, 1990-2001," *Health care financing review*, 2003, *25* (1), 1.

**Huggett, Mark**, "Wealth distribution in life-cycle economies," *Journal of Monetary Economics*, 1996, *38* (3), 469–494.

**Jacoby, William G**, "Public attitudes toward government spending," *American Journal of Political Science*, 1994, pp. 336–361.

**Kingdon, John W and James A Thurber**, *Agendas, alternatives, and public policies*, Vol. 45, Little, Brown Boston, 1984.

**la Maisonneuve, Christine De and Joaquim Oliveira Martins**, "A projection method for public health and long-term care expenditures," 2013.

**Manning, Willard G, Joseph P Newhouse, Naihua Duan, Emmett B Keeler, and Arleen Leibowitz**, "Health insurance and the demand for medical care: evidence from a randomized experiment," *The American economic review*, 1987, pp. 251–277.

**Marino, Alberto, David Morgan, Luca Lorenzoni, and Chris James**, "Future trends in health care expenditure," 2017.

**Mossialos, Elias, Anna Dixon, Joseph Figueras, and Joe Kutzin**, "Funding health care: options for Europe," 2002.

**Nardi, Mariacristina De and Fang Yang**, "Wealth inequality, family background, and estate taxation," *Journal of Monetary Economics*, 2016, *77*, 130–145.

**_ , Eric French, and John B Jones**, "Why do the elderly save? The role of medical expenses," *Journal of Political Economy*, 2010, *118* (1), 39–75.

**Riker, William H and Peter C Ordeshook**, "A Theory of the Calculus of Voting," *American political science review*, 1968, *62* (1), 25–42.

**Risse-Kappen, Thomas**, "Public opinion, domestic structure, and foreign policy in liberal democracies," *World Politics*, 1991, *43* (4), 479–512.

**Saltman, Richard, Ana Rico, and Wienke Boerma**, *Social health insurance systems in western Europe*, McGraw-Hill Education (UK), 2004.

**Schoen, Cathy, Robin Osborn, David Squires, Michelle M Doty, Roz Pierson, and Sandra Applebaum**, "How health insurance design affects access to care and costs, by income, in eleven countries," *Health affairs*, 2010, *29* (12), 2323–2334.

**Simon, Michael**, *Das Gesundheitssystem in Deutschland*, Vol. 2, Verlag Hans Huber Bern, 2010.

**Verba, Sidney, Kay Lehman Schlozman, and Henry E Brady**, *Voice and equality: Civic voluntarism in American politics*, Harvard University Press, 1995.

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This research was supported by the Deutsche Forschungsgemeinschaft through the IRTG 1792.