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Public Medical Insurance System Reform and Determinants of Participation in Public Medical Insurance Systems in an Aging China*

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Using the 2011 data of the China Health and Retirement Longitudinal Study (CHARLS), we conduct an empirical analysis to test four hypotheses and verify the determinants of participation in public medical insurance systems in China. Several major conclusions emerge. First, we find differences in participation probability between rural and urban groups, and the formal and informal employment sectors. Thus, the establishment and implementation of public medical insurance programs are segmented by rural and urban registration systems as well as employment sectors. Second, the liquidity constraints hypothesis is rejected, whereas the adverse selection hypothesis is supported. Third, education, gender, and drinking behavior also affect participation probabilities; however, the effects are different for the rural and urban groups.

JEL classifications: I13, I14, I38
Keywords: public medical insurance; liquidity constraints hypothesis; adverse selection hypothesis; China

1. Introduction

With the implementation of the population control policy (namely, the one-child policy) since the 1980s, China has been witnessing a decline in birth rate and an increase in the aging population. Thus, the implementation of social security systems has become an important issue for the Chinese government. Along with the transition from a planned economy to a market economy, the country's social security systems are being transformed, and its public medical insurance systems have also been undergoing reforms since the 1990s.

Currently, a variety of medical insurance programs are being implemented in China. For

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example, the Urban Employee Basic Medical Insurance (UEBMI), which covers workers in urban regions, is being implemented since 1998; the Urban Resident Basic Medical Insurance (URBMI), which covers non-workers with urban registrations, was introduced in 2007; and the New Cooperative Medical Scheme (NCMS), initiated since 2003, provides coverage to individuals with a rural registration. In addition, since the 1990s, Private Medical Insurance (PMI) and Enterprise Medical Insurance (EMI), which is purchased by an enterprise as part of its welfare system for its employees, have been implemented to complement the public medical insurance systems. Moreover, the Medical Aid (MA) system has been implemented to assist low-income groups since the 1950s. Currently, these public and private medical insurance systems cover the entire population in the rural and urban China. Therefore, it can be said that "Universal Medical Insurance" has been implemented in an aging China.

However, the implementation of these public medical insurance systems faces some problems. This study focuses on two such problems. First, the extent of participation and offerings differ by the type of medical insurance system. For instance, the public medical insurance systems vary in the urban and rural regions. Although individuals working in urban firms are eligible to participate in the UEBMI, the enrollment rate of rural–urban migrants in this scheme is low. One of the reasons is that the firms that employ the migrants do not prefer to pay for their medical insurance premiums. Thus, there is a disparity in medical insurance participation between the rural and urban registration systems. Moreover, the implementation of medical insurance systems varies by employment sectors. For example, the regulations of the UEBMI mandate that employers must pay the medical insurance premiums (amounting to 6% of the wage bill) for their employees. However, as pointed out by Nakagane (2000) and Ma (2014, 2015), compared with the public sector, the possibilities of firms not paying for employees' medical insurance premiums might be higher in the private sector as it seeks to gain more profits. Consequently, participation in the public insurance medical system might differ by the individual's sector of employment.

Second, the growth in income inequality is accompanied by disparity in medical insurance participation. In order to rectify the health care disparities caused by income inequality, the public medical insurance system in developed countries such as the U.S. and Japan is implemented as a means of income redistribution, and covers the low-income groups as well. However, in China, the main purpose of the public medical insurance system reforms, which have been instituted since the 1990s, is to reduce the funding burden on the government and state-owned enterprises (SOEs), and most of the private medical insurance companies focus only on the middle- and high-income groups. Thus, it is possible that income inequality in China has given rise to the disparity in medical insurance system participation.

Does the participation in each kind of medical insurance system differ by rural and urban regions, or by the ownership type of the work sectors? Does income affect an individual's participation in the public medical insurance systems? This study attempts to answer these

questions through an empirical analysis using micro-data. We use the data of the China Health and Retirement Longitudinal Study conducted in 2011 (CHARLS2011).

This paper is structured as follows. Section 2 reviews the public medical insurance reforms in China and previous empirical studies. Section 3 describes the data, models, and analytical methods. Section 4 analyzes the participation in China's medical insurance systems via statistical analysis. Section 5 presents the results of the quantitative analysis. Section 6 concludes.

2. Background and Literature Review

2.1 Economic Transition and Public Medical Insurance System Reforms in China

During its planned economy period, the Chinese government promoted the establishment and implementation of a social security system based on socialist principles. Specifically, in the urban regions, the Labor Medical Insurance (LMI), which covered the workers in SOEs or Collective-owned Enterprises (COEs), and the Government Medical Insurance (GMI), which covered the workers in government or public organizations (*Shiye Danwei*; e.g., schools, hospitals, and research institutes), were introduced in the 1950s. These medical insurance systems also covered employees' family members. In addition, in the rural regions, the Cooperative Medical System (CMS), a community mutual assistance system, was promoted along with the dissemination of People's Communes—an administrative level of the Communist Party in the rural regions—in the 1960s, which operated and managed the CMS. Because the LMI, GMI, and CMS covered the entire population in China, it can be said that the universal health care system was established in the planned economy period.

Since 1978, however, the Chinese government has been transforming itself from a closed centralized planned economy to an open market economy. China's public medical insurance systems underwent significant changes as part of this transition. First, in order to reduce the financial burden on the government and public sector, the public medical insurance systems were reformed in the urban regions. Specifically, the LMI was abolished, and the UEBMI was introduced by the government in 1998. Based on the regulations of the UEBMI, the participants included employees who worked in either the public or the private sector, including individual firms. Because the UEBMI does not cover non-workers, a section of unemployed individuals with urban registrations did not fall under the ambit of the public medical insurance system in the urban regions. To deal with this problem, the URBMI was promulgated in 2007.

Second, in the rural regions, the CMS enrollment rates decreased dramatically (from 90% in 1981 to merely 5% in the 1990s) alongside the implementation of the "Household Contract Production System" (*Jiating Liangchan Chengbao Zerenzhi*). This was caused by the dramatic reduction in the number of People's Communes (Liu *et al*. 1995, Wagstaff and Linedelow 2008, Cheng *et al*. 2015). Moreover, since the 1990s, the Chinese government has been enforcing major

health care reforms by converting Chinese health care service systems from the planned economy system to the market economy system. Thus, the total health care and out-of-pocket health care expenditures have increased substantially. As a result, there is a possibility of people with serious illnesses falling into poverty—not only do these patients have to pay for themselves but they also need to pay more for health care. Therefore, the inequality in health care utilization caused by income gap became a serious problem in the rural regions. To address this social problem, the Chinese government introduced a new public health insurance scheme—the NCMS—in the rural regions in 2003. The NCMS covers the entire population with rural registrations. Although enrollment into the NCMS is voluntary, participation in the scheme was promoted by the central and local governments.

Third, to reduce the disparity in public medical insurance systems between the rural and urban regions, since 2006, the government has promoted a new medical insurance system, which is a combination of the URBMI and the NCMS. This system is called the Urban and Rural Resident Basic Medical Insurance (URRBMI) system. However, its coverage rate is currently low.

In addition, along with the SOE ownership reforms, public insurance companies were permitted to establish PMI as a new good. At the same time, the private insurance companies have been maturing since the 1990s. Participation in the PMI is voluntary.

The public medical insurance system reforms mean that the population with urban registrations is covered by either the UEBMI or the URBMI, and that with rural registrations is covered by the NCMS. Thus, it is can be said that "Universal Medical Insurance" was a reality in China during the economic transition period. However, it should be noted that participation in the URBMI or the NCMS is voluntary, whereas enrollment in the UEBMI is compulsory. In addition, although these public medical insurance programs are funded by the government, the participants have to pay a portion of the medical insurance premiums. The medical insurance premiums, payment systems, and insurance funds differ among the UEBMI, URBMI, and NCMS (see Table 1). Because the insurance funds are insufficient for the NCMS and the URBMI, the proportion of payment accounts is lower for them compared to the UEBMI and the GMI. Moreover, even though the patients participate in the NCMS and the URBMI, the majority of health care expenditures are paid for by the patients themselves. Thus, it is assumed that the lower proportion of payments (or the higher proportion of out-of-pocket health care expenditures) for the URBMI and the NCMS might affect their participation probabilities.

Table 1 Medical Insurance System Types under the Economic Transition Period in China

Panel A: Medical Insurance Sytem Classifications in the Planned Economy Period (1949-1977)

	Classifications	Participants	Premiums	Promulgated Year
Public Medical Insurance	LMI	the workers and their family members with the urban registration	• Premiums purchased by the firm: 6% of total wage bills • All of the other fees were purchased by the government	1956
	GMI			1960s
	NCMS	the individuals with the rural registration	• funds by the people's communes	1960s
Others	Medical Aids	the low-income group	Exemption system	1950s

Panel B: Medical Insurance Sytem Classifications in the Economic Transition Period (from 1978 until now)

	Classifications	Participants	Premiums	Promulgated Year
Public Medical Insurance	UEBMI	the workers in firms	• Fixed-rate system • Social medical insurance fund and individual account system • Premiums purcharged by the firm: 7% of total wage bills • Premiums purcharged by the individual: 3% of the individual basic wage	1998
	GMI	the workers in public organizations	• Fees purcharged by the government: operating cost and management fee	1960s
	ERBMI	the non-workers with the urban registration	• Premium purchased by the government: different by the local governments • Premium purchased by the individual: different by the provinces	2007
	NCMS	the families with the rural registration	• premium purcharged by the central government: per capita 380 Yuan yearly in 2015 • premium purcharged by the individual: per capita 120Yuan yearly in 2015	2003
Private Medical Insurance	Commercial Medical Insurance	all populations	Proportional-rate system	1990s
Others	• Medical Aids	the low- income group	Exemption system	1950s
	• Enterprise Replenishment Medical Insurance	the workers in firms	by the firms	1980s

Source: Summaried by the author.

2.2 Literature Review

First, we review previous studies on the determinants of participation in medical insurance from the demand side perspective.[1] We specifically refer to the adverse selection and liquidity constraints hypotheses. Regarding the adverse selection hypothesis based on microeconomic theory, there exists an information asymmetry problem in the insurance market. For example, the insured individual often has relatively more information about his health status than the insurer. When an individual in poor health guesses that he will have to pay more toward his health care expenditure in the future, he tries to avoid the risk by participating in medical insurance. As a result, the probability of participation in medical insurance is relatively higher for groups in poor health than for those in good health. As per the liquidity constraints hypothesis, because the insurance premium needs to be after confirming participation in medical insurance, the possibility that the individual cannot purchase the insurance premium is higher for the low-income group than the high-income group, and thus, the probability of participation in medical insurance is lower for the low-income group.

However, the estimated results for these two hypothesis are not consistent. For example, some empirical studies on the U.S., such as Wolfe and Goddeeris (1991) and Shaefer et al. (2011), analyzed the probability of changing from private medical insurance to public medical insurance. They showed that the probability of such a change is higher for groups with low income and poor health, and indicated that the estimated results support both the liquidity constraints and adverse selection hypotheses. However, Madden et al. (1995), Drehr et al. (1996), Bograd et al. (1997), Swartz and Garnick (2000), and Long and Marquis (2002) found that the health status does not affect the participation probability in the U.S. and that the adverse selection hypothesis is rejected.

Second, we review studies on developing countries, excluding China. Kimani et al. (2012) conducted an empirical study on Kenya's public medical insurance reforms and found that the probability of participation in public medical insurance is higher for regular workers than for those working in the informal sector. Their results indicate the existence of the liquidity constraints problem in Kenya. Hofter (2006) and Pardo and Schott (2012) analyzed the case of Chile and demonstrated that the probability of participation in public medical insurance is higher for the poor, healthy, low-income, less educated, and self-employed worker groups. Moreover, the adverse selection and liquidity constraints hypotheses are both supported in this case.

Third, the number of empirical studies on this issue for China is scarce. Zhou (2002) analyzed the determinants of voluntary participation in the UEBMI (e.g., she considered the self-employed workers, and free-workers who can adjust their work hours by themselves and do not employed by firms and organizations). She utilized data from the Social Change Basic Survey (SCBS) conducted

1) Regarding the behavior of participation in medical insurance, it is necessary to consider the factors influencing both the supply side (government, companies, and insurance companies) and the demand side (individuals). Owing to data limitations, this study focuses on the demand side only.

by the Development Center at Zhongshan University in 2000, and found that the participation probabilities are lower for the poor, healthy, younger generation, and unemployed workers. Further, she pointed out that both the adverse selection and liquidity constraints hypotheses are supported. Lin et al. (2009) analyzed the probability of participation in the URBMI using the data of a survey conducted by Peking University in 2008. Their findings show that the relationship between income and participation probability is U-shaped (this means that compared to the middle-income group, the participation probability is relatively higher for the low- and high-income groups) and that the participation probability is higher for the group that suffered from a chronic disease in the past year. Thus, they showed that the adverse hypothesis is supported, and the liquidity constraints hypothesis is partly supported. Ma (2014) performed an empirical study on the determinants of participation of local urban residents in the UEBMI and the PMI using data from the Chinese Household Income Project Survey (CHIPs) conducted in 2008, and found that both the adverse selection and liquidity constraints hypotheses are supported. In addition, she pointed out that compared with the public sector, the probability of participation in the UEBMI was lower for the private sector, COEs, private enterprises, self-employed workers, and non-workers in 2007.

Currently, the lack of empirical evidence on the determinants of participation in public medical insurance in China for the urban and rural regions prevents us from comprehending the mechanism of participation behavior. Particularly, the significant income inequality between the rural and urban regions, and differences in the lifestyles, medical facilities, and public medical insurance programs make it likely that the determinants of participation in medical insurance systems will vary by region. In addition, the implementation of public medical insurance systems might vary by employment sectors, and thus, it is assumed that the determinants of participation in public medical insurance systems also vary by employment sectors. However, none of the empirical studies focus on these comparisons between rural and urban China, and between employment sectors. This study aims to fill this gap to a certain extent using the latest survey data.

Based on previous studies and China's special situation, this study tests the following four hypotheses (H1, H2, H3, and H4):

H1: Participation in public medical insurance systems differs by rural and urban registrations (segmentation by registration systems hypothesis).

H2: Participation in public medical insurance systems differs by the ownership types of the work sectors (segmentation by work sectors hypothesis).

H3: Participation in public medical insurance systems differs by income groups (liquidity constraints hypothesis).

H4: The adverse selection problem exists when the individual decides to participate in public medical insurance systems (adverse selection hypothesis).

The estimated results of H1 and H2 are particularly applicable for China; these results are useful for an in-depth understanding of the problems related to the social security system in the country.

The results of the analyses for H3 and H4 can be compared with those of previous studies on this issue for developed and other developing countries.

3. Methodology and Data

3.1 Model

Probit regression models, expressed as equations (1)~(3), are utilized to measure the probability of participation in the medical insurance system.

$$Y_i^* = a + \beta X_i + u_i \tag{1}$$

$$Y_i^* = \begin{cases} 1 & if \quad Y_i^* \geq 0 \\ 0 & if \quad Y_i^* < 0 \end{cases} \tag{2}$$

$$P(Y_i = 1) = P(1 - a - \beta X_i > u_i) \tag{3}$$

In equations (1)~(3), i denotes individuals, $P(Y_i = 1)$ indicates the dependent variable (which is equal to 1 if the individual subscribes to public or private medical insurance, and 0 otherwise), Y_i^* is a continuous but unobservable latent variable (we only observe the actual variable, as expressed in equation (3)), α is a constant, and u_i is the random error term. X refers to the factors affecting participation behavior, and the index variables of H1~H4 in X are utilized to test these hypotheses. β refers to the estimated parameters. If β of the hypothesis index is statistically significant, the hypothesis is supported.

3.2 Data

As stated previously, data from CHARLS2011 are utilized for the analysis. The survey was conducted by the China Center for Economic Research, Peking University, in August 2011. It covers individuals aged 45 years and over and their family members in rural and urban regions. The total sample comprises 17,670 individuals. The survey data include information on participation in the medical insurance systems, health status, household income and consumption, demographic factors, health behavior, and employment status. Nationwide samples and subsamples, namely, the rural group (the group with rural registrations) and the urban group (the group with urban registrations), are utilized in the analysis. The objects of the analysis in this study are individuals aged 40 and over, including workers and non-workers in the urban and rural regions.

In the participation probability function, the dependent variable is the binary variable (equal to 1 if the individual has participated in any medical insurance system, and 0 otherwise).

Based on CHARLS2011, the medical insurance systems are classified into ten categories. They are: 1. UEBMI (Urban Employee Basic Medical Insurance), 2. URBMI (Urban Resident Basic Medical Insurance), 3. NCMS (New Cooperative Medical Scheme), 4. URRMI (Urban and Rural Resident Basic Medical Insurance), 5. GMI (Government Medical Insurance), 6. MA (Medical Aid), 7. PMI-1 (Private Medical Insurance purchased by firms), 8. PMI-2 (Private Medical Insurance purchased by individuals), 9. Others (other medical insurance not listed above), and 10. No insurance (i.e., the individual has not subscribed to any medical insurance).

To test H1~H4, the independent variables are constructed as follows. First, the local urban registration dummy is constructed based on two questions: "What is your current *Hukou* (registration) status?" and "What is the location of your current *Hukou*?" This dummy variable takes 1 when the answers are "non-agriculture" and "province or city," and 0 otherwise.2 Holding the other factors (individual characteristics) constant, when the coefficients of the urban dummies are statistically significant, participation probabilities differ between the urban and rural registration groups, and thus, H1 (segmentation by registration systems hypothesis) is supported.[2)]

Second, we introduce the following work sector dummies: 1. Government organization, Public organization (*Shiye danwei*), 3. SOEs (including 100% SOEs and state-controlled enterprises), 4. COEs (including 100% collective-owned firms and collective-controlled firms), 5. Private enterprises (including 100% private enterprises, private-controlled enterprises, 100% foreign-owned enterprises, joint venture enterprises, and other joint-ownership enterprises), 6. Individual enterprises,[3)] and 7. Others.

As stated earlier, the regulations of the UEBMI mandate that firms need to pay a portion of the public medical insurance premiums for their employees. Thus, there should be no disparities between employment sectors with different ownership. If other factors composed of individual characteristics are held constant, when the coefficients of ownership dummies are statistically significant, the participation probabilities vary by the ownership type, which might cause disparities among the work sectors. Therefore, H2 (segmentation by work sectors hypothesis) is supported.

Third, to test H3 (liquidity constraints hypothesis), the index of liquidity constraints should be calculated. The data of CHARLS2011 provide information on both household income and household consumption for the previous year. Considering the permanent income effect, household consumption is a better index than temporary income (information on a single year's household income can be obtained from the survey). Therefore, the total household consumption, excluding health expenditures, is utilized as the index of liquidity constraints. The household consumption variables are divided into five groups, one each for the first to the fifth quintile. The first quintile

2) In China, the registration system is mainly divided into two types: urban registration and rural registration. Most of the individuals with rural registrations live and work in rural regions (villages or the countryside). Workers with rural registrations working in urban regions (provinces or cities) are called "migrants."

3) Based on the firm classification rules published by the Chinese government, "individual firms" (the self-employed sector) are defined as small firms with less than eight employees or firms made up entirely of self-employed workers and unpaid family members.

group is the lowest income group, and the fifth, the highest. When the liquidity constraints problem exists, the participation probability is higher for the high-income group than for the low-income group. Thus, the estimated results of household income are positively significant.

Fourth, to analyze H4 (adverse selection hypothesis), two indices are used. The first index is chronic disease in the past year's dummy variables[4] (equals 1 when the individual suffers from a chronic disease, and 0 otherwise). The chronic diseases considered in this study are: 1. Hypertension, 2. Dyslipidemia (elevation of low-density lipoprotein, triglycerides (TGs), and total cholesterol, or a low high-density lipoprotein level), 3. Diabetes or high blood sugar, 4. Cancer or malignant tumors (excluding minor skin cancers), 5. Chronic lung diseases such as chronic bronchitis and emphysema (excluding tumors and cancer), 6. Liver disease (except fatty liver, tumors, and cancer), 7. Heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems, 8. Stroke, 9. Kidney disease (except for tumors or cancer), 10. Stomach or other digestive diseases (except for tumors or cancer), 11. Emotional, nervous, or psychiatric problems, 12. Memory-related disease, 13. Arthritis or rheumatism, and 14. Asthma. The second one is age category (age 40-49, age 50-59, age 60-69, age 70-79, age 80 and over) dummy variables.

Fifth, it is thought that other factors, such as education and individual characteristics, might affect the participation behavior. Thus, we construct dummies for education, married respondents, children, and male. In addition, because behaviors such as smoking and drinking can affect health status, they might influence participation in the medical insurance system. Thus, we introduce smoking status dummy (1. Has not smoked in the past, 2. Has smoked in the past but not in the survey year, and 3. Is smoking in the survey year) and drinking frequency dummy (1. Has not drunk alcohol in the past, 2. Has drunk alcohol once a month in the survey year, and 3. Has drunk alcohol more than once a month in survey year).

Table 2 shows sample statistical descriptions by country, urban region, and rural region. Excluding the missing values, the total sample utilized for the econometric analysis has 16,778 observations, 3,763 for the urban group and 13,015 for the rural group.

4. Results: Participation in Medical Insurance Systems in China

4.1 Overall Rate of Participation in Medical Insurance Systems

The rates of participation in medical insurance systems for the whole of China, the rural group, and the urban group are shown in Table 3.

4) Previous studies have used both chronic disease and self-reported health status as indexes of adverse selection. Chronic disease dummies are used in this study for two reasons. First, the number of respondents who answered the questions on self-reported health status is smaller than those who responded to the questions on chronic disease. Second, the analysis is also performed using the self-reported health status, and the results are similar to those estimated using the chronic disease dummy variables.

Table 2 Statistical Descriptions

	National		Urban		Rural	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Urban	22.4%	41.7%				
Chronic Diseases						
Hypertension	24.6%	43.1%	32.0%	46.7%	22.4%	41.7%
Dyslipidemia	9.2%	28.9%	17.2%	37.8%	6.9%	25.3%
Diabetes or high blood sugar	5.7%	23.2%	10.0%	30.0%	4.5%	20.6%
Cancer or malignant tumor	1.0%	10.0%	1.3%	11.5%	0.9%	9.6%
Chronic lung diseases	10.2%	30.2%	9.9%	29.9%	10.2%	30.3%
Liver disease	3.9%	19.4%	4.3%	20.4%	3.8%	19.1%
Heart disease	12.1%	32.6%	18.4%	38.8%	10.2%	30.3%
Stroke	2.3%	15.1%	3.2%	17.7%	2.1%	14.2%
Kidney disease	6.4%	24.4%	6.5%	24.6%	6.3%	24.4%
Stomach or other digestive disease	22.3%	41.7%	17.7%	38.1%	23.7%	42.5%
Emotional, nervous, or psychiatric problems	1.3%	11.3%	1.1%	10.4%	1.4%	11.6%
Memory-related disease	1.5%	12.0%	2.2%	14.6%	1.3%	11.2%
Arthritis or rheumatism	33.2%	47.1%	25.8%	43.7%	35.4%	47.8%
Asthma	3.6%	18.6%	3.5%	18.3%	3.6%	18.7%
Age Categories						
Age40-49	21.4%	41.0%	19.6%	39.7%	21.9%	41.3%
Age50-59	34.5%	47.5%	32.7%	46.9%	35.0%	47.7%
Age60-69	27.3%	44.6%	27.8%	44.8%	27.2%	44.5%
Age70-79	13.0%	33.6%	15.8%	36.5%	12.1%	32.7%
Age80 and over	3.8%	19.2%	4.0%	19.6%	3.8%	19.0%
Income Categories						
First quintile	19.5%	39.6%	18.5%	38.8%	19.8%	39.8%
Second quintile	19.8%	39.9%	17.9%	38.3%	20.4%	40.3%
Third quintile	20.5%	40.3%	11.8%	32.3%	23.0%	42.1%
Fourth quintile	20.5%	40.4%	26.3%	44.0%	18.8%	39.1%
Fifth quintile	19.7%	39.8%	25.5%	43.6%	18.1%	38.5%
Education Categories						
No formal education illiterate	27.7%	44.8%	9.5%	29.4%	33.0%	47.0%
Did not finish primary school	17.9%	38.3%	9.6%	29.5%	20.3%	40.2%
Primary school	21.4%	41.0%	17.2%	37.8%	22.6%	41.8%
Junior high school	20.4%	40.3%	27.9%	44.8%	18.3%	38.6%
senior high school	10.1%	30.2%	25.8%	43.7%	5.6%	23.0%
College and over	2.4%	15.4%	9.9%	29.9%	0.3%	5.1%
Individiual Characteristics						
Married	87.1%	33.5%	88.1%	32.4%	86.9%	33.8%
Male	46.3%	49.9%	50.2%	50.0%	45.3%	49.8%
Child numbers	0.68	1.28	0.60	1.13	0.71	1.33
Health Behaviour						
No smoking	62.7%	48.4%	63.8%	48.1%	62.3%	48.5%
Smoking in the past	8.4%	27.8%	10.7%	30.9%	7.8%	26.8%
Smoking now	28.9%	45.3%	25.5%	43.6%	29.9%	45.8%
No drinking	68.1%	46.6%	68.0%	46.7%	68.2%	46.6%
Drinking once a month	7.7%	26.6%	8.2%	27.5%	7.5%	26.3%
Drink more than once a month	24.2%	42.8%	23.8%	42.6%	24.3%	42.9%
No. of observations	16,778		3,763		13,015	

Source: Calculated based on CHARLS2011.

Table 3 Overall Rate of Participation in Medical Insurance Systems in China

	Nation		Urban		Rural	
Medical Insurance Categories	Num.	%	Num.	%	Num.	%
1.UEBMI	1,772	10.2	1,690	43.7	82	0.6
2.URBMI	740	4.3	647	16.7	93	0.7
3.NCMS	12,568	72.3	471	12.2	12,097	89.5
4.URRBMI	212	1.2	93	2.4	119	0.9
5.GMI	352	2.0	324	8.4	28	0.2
6.MA	14	0.1	7	0.2	7	0.1
7.PMI(1)	117	0.7	75	1.9	42	0.3
8.PMI(2)	314	1.8	122	3.2	192	1.4
9. Others	130	0.7	46	1.2	84	0.6
10.No insurance	1,162	6.7	396	10.2	766	5.7
Total	17,381	100.0	3,871	100.0	13,510	100.0

Source: Calculated based on CHARLS2011.
Note: UEBMI: Urban Employee Basic Medical Insurance
URBMI: Urban Resident Basic Medical Insurance
NCMS: New Cooperative Medical Scheme
URRBMI: Urban and Rural Resident Basic Medical Insurance
GMI: Government Medical Insurance
MA: Medical Aid
PMI(1): Private Medical Insurance (purchased by firms)
PMI(2): Private Medical Insurance (purchased by individuals)
Others: Other medical insurance

First, the overall rate of participation in public medical insurance (including participation in the UEBMI, URBMI, NCMS, GMI, or MA) is 90%, and the proportion of non-participation (i.e., the respondents subscribe to none of the above-mentioned medical insurance systems) is only 6.7%. Thus, it can be said that China achieved almost universal medical insurance participation in 2011 (the survey year).

Moreover, the rate of participation in the NCMS is the highest (72.3%) for the whole of China owing to the high proportion of the population with a rural registration. It should be noted that although the percentage of population in urban region was nearly 50% in 2011, the participation rate in the NCMS was 72.3%, which is higher than the percentage of population in rural region. This indicates that a section of the rural–urban migrants[5] have not been covered by the urban public medical insurance systems (e.g., UEBMI and URBMI), and that the public medical insurance systems are segmented by the urban and rural registration systems.

Second, the participation rate in public medical insurance differs between the urban and rural regions; specifically, the proportion of participation in the NCMS (89.5%) is the highest for the group with rural registrations, whereas that in the UEBMI (43.7%) is the highest for the group with urban registrations.

5) Here, "migrant" is defined as a worker who owns a rural registration and works in an urban region in China.

4.2 Rate of Participation in Public Medical Insurance Systems by Groups

The participation rate in the medical insurance systems by groups appears in Table 4.

First, we analyze the participation rate by income groups. For the urban group, the participation rate in the public medical insurance systems is greater for the high-income subgroup (UEBMI: 51.3%, URBMI: 15.9%). In contrast, in the rural group, the participation rate in the public medical insurance (NCMS) is marginally lower for the high-income subgroup (87.5%) compared to the low-income subgroup (89.0%) and middle-income subgroup (90.7%). These results indicate that the effects of household income on participation differ by the rural and urban groups.

Second, we consider the effect of health status on participation in public medical insurance systems. In both the urban and rural groups, the participation rate is greater for groups that indicated their health status as being "Fair" than for those who answered "Good" and "Poor." For example, in the urban regions, the participation rate in the UEBMI is 47.8% for the "Fair" group, which is greater than that for the "Good" group (23.5%). Moreover, the participation rate in the NCMS is 89.2% for the "Fair" group, which exceeds that for the "Good" group (82.7%).[6)]

Third, compared to the relatively younger group (groups aged 40–49 and 50–59), the participation rate in public medical insurance (UEBMI or NCMS) is greater for the elderly group (aged 60 and over). For example, the participation rate in the UEBMI is 46.1% for the elderly group, which exceeds that for the younger group in the urban regions, while the participation rate in the UEBMI is 90.8% for the elderly group, which is greater than that for the younger groups in the rural regions.

5. Results of the Econometric Analysis

Tables 5 and 6 present the probabilities of participation in the UEBMI, the NCMS and URBMI, respectively. The results of the hypotheses tests are summarized in Table 7.

We use the results of the urban and work sector dummies from Table 5 to test H1 and H2. In addition, because participation in the NCMS and URBMI is voluntary, the results seen in Table 6 are used to test H3 and H4.

First, the probability of participation in public medical insurance systems differs by rural and urban groups; specifically, the participation probabilities in the UEBMI (Table 5) are 28.8~59.9% higher for the urban group. Thus, H1 (segmentation by registration systems hypothesis) is supported.

Second, compared with the government group, the probability of participation in the UEBMI

6) Although the total CHARLS2011 sample comprises 17,670 observations, only 8,866 respondents answered the questions on self-reported health. Thus, the percentage of people reporting "No insurance" for the urban group is not consistent with the calculated results shown in Table 3. In response to the sample bias problem, the chronic disease dummy is utilized as the index of health status to test the hypotheses in the following analysis.

Table 4 Rate of Participation in Medical Insurance Systems by Groups

Panel A : by income groups unit: %

	Urban			Rural		
Medical Insurance Categories	Low	Middle	High	Low	Middle	High
1.UEBMI	48.6	44.5	51.3	0.9	0.7	0.9
2.URBMI	14.9	14.9	15.9	0.5	0.4	0.7
3.NCMS	9.8	8.6	7.4	89.0	90.7	87.5
4.URRBMI	1.5	1.8	1.7	1.1	1.5	1.3
5.GMI	5.9	9.7	6.4	0.2	0.4	0.1
6.MA	0.3	0.2	0.0	0.1	0.1	0.0
7.PMI(1)	5.1	2.0	0.5	0.6	0.4	0.1
8.PMI(2)	4.4	3.8	3.6	1.1	0.7	1.5
9.Others	0.5	1.4	1.0	1.1	0.4	0.7
10.No insurance	9.0	13.1	12.4	5.6	4.9	7.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated based on CHARLS2011.

Panel B : by self-health status groups unit: %

	Urban			Rural		
Medical Insurance Categories	Good	Fair	Poor	Good	Fair	Poor
1.UEBMI	23.5	47.8	7.5	4.0	0.8	6.1
2.URBMI	9.1	15.4	5.0	1.5	0.7	3.7
3.NCMS	45.5	13.3	75.6	82.7	89.2	79.3
4.URRBMI	1.4	1.5	1.6	0.7	1.1	1.4
5.GMI	5.4	7.5	1.2	0.9	0.1	1.1
6.MA	0.1	0.0	0.1	0.1	0.0	0.1
7.PMI(1)	2.2	1.2	0.6	1.1	0.3	0.5
8.PMI(2)	2.6	3.3	1.5	1.8	1.5	1.4
9.Others	1.0	1.3	0.8	0.6	0.5	0.7
10.No insurance	9.1	8.7	6.2	6.8	5.7	5.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated based on CHARLS2011.

Panel C : by age groups unit: %

	Urban			Rural		
Medical Insurance Categories	40~49	50~59	60 and over	40~49	50~59	60 and over
1.UEBMI	39.7	42.6	46.1	0.6	0.6	0.6
2.URBMI	17.7	17.8	15.6	0.6	0.8	0.7
3.NCMS	14.5	13.7	10.2	87.9	89.1	90.8
4.URRBMI	2.2	2.5	2.4	0.8	0.8	1.0
5.GMI	3.5	6.2	11.9	0.1	0.3	0.2
6.MA	0.0	0.2	0.3	0.1	0.0	0.1
7.PMI(1)	2.0	1.7	2.1	0.6	0.3	0.2
8.PMI(2)	6.8	3.5	1.4	2.9	1.8	0.3
9.Others	0.9	0.9	1.5	0.7	0.8	0.4
10.No insurance	12.7	11.0	8.7	5.7	5.6	5.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Calculated based on CHARLS2011.

Table 5 Results of Participation Probabilities in the UEBMI

	Estimation(1)			Estimation(2)		
	coef.	z-value	df/dx	coef.	z-value	df/dx
Urban	1.678 ***	22.26	0.599	1.179 ***	5.58	0.288
Chronic Diseases						
Hypertension	0.142 *	1.93	0.052	-0.063	-0.29	-0.010
Dyslipidemia	0.375 ***	3.77	0.130	1.030 **	2.34	0.095
Diabetes or high blood sugar	0.170	1.42	0.061	1.021	1.54	0.085
Cancer or malignant tumor	0.639 *	1.76	0.198	0.661	0.54	0.066
Chronic lung diseases	-0.046	-0.41	-0.017	0.156	0.43	0.022
Liver disease	0.171	1.08	0.061	-0.347	-0.76	-0.068
Heart disease	0.091	0.97	0.033	-0.009	-0.03	-0.001
Stroke	0.156	0.80	0.056	(omitted)		
Kidney disease	0.170	1.25	0.061	-0.066	-0.17	-0.011
Stomach or other digestive disease	-0.014	-0.17	-0.005	0.470 *	1.88	0.059
Emotional, nervous, or psychiatric problems	-0.475	-1.58	-0.185	(omitted)		
Memory-related disease	-0.011	-0.05	-0.004	-0.999	-0.75	-0.272
Arthritis or rheumatism	-0.216 ***	-3.00	-0.081	-0.557 ***	-2.60	-0.112
Asthma	-0.185	-1.09	-0.070	0.867	0.85	0.076
Age Categories (Age40-49)						
Age50-59	0.214 **	2.56	0.078	-0.009	-0.05	-0.001
Age60-69	0.564 ***	5.87	0.194	-0.176	-0.60	-0.031
Age70-79	0.839 ***	7.03	0.263	-0.228	-0.43	-0.042
Age 80and over	0.683 ***	3.61	0.211	-0.078	-0.07	-0.013
Income Categories (First quintile)						
Second quintile	-0.054	-0.57	-0.020	-0.318	-1.14	-0.058
Third quintile	-0.138	-1.26	-0.052	-0.198	-0.67	-0.035
Fourth quintile	-0.148	-1.57	-0.056	-0.321	-1.19	-0.057
Fifth quintile	-0.129	-1.37	-0.048	-0.233	-0.85	-0.040
Ownership Categories (Government organization)						
Public organization				0.237	0.60	0.035
State-owned enterprise				-0.249	-0.65	-0.044
Collective-owned enterprise				-0.007	-0.01	-0.001
Private firm				-0.220	-0.56	-0.039
Self-emloyment				-1.730 ***	-4.60	-0.490
Others				-1.352 ***	-3.34	-0.387
Education Categories (No formal education illiterate)						
Did not finish primary school	0.414 ***	3.27	0.141	0.816 *	1.61	0.078
Primary school	0.650 ***	5.50	0.214	0.478	1.04	0.058
Junior high school	1.169 ***	9.91	0.361	1.179 ***	2.72	0.133
Senior high school	1.440 ***	11.46	0.410	1.409 ***	3.16	0.186
College and over	2.082 ***	11.01	0.410	1.374 ***	2.79	0.134
Individiual Characteristics						
Married	0.390 ***	3.56	0.150	0.517	1.51	0.110
Male	0.029	0.34	0.011	-0.135	-0.61	-0.021
Child numbers	0.019	0.60	0.007	0.296 **	2.48	0.047
Health Behaviour						
Smoking (no smoking)						
Smoking now	-0.093	-1.05	-0.035	-0.238	-1.05	-0.040
Smoking in the past	-0.078	-0.65	-0.029	-0.027	-0.08	-0.004
Drinking (no drinking)						
Drinking once a month	0.197 *	1.63	0.070	0.098	0.37	0.015
Drink more than once a month	0.304 ***	3.61	0.109	0.610 ***	2.83	0.087
Constants	-2.578 ***	-14.29		-0.955	-1.49	
No. of observations	2940			715		
Log likelihood	-1098.122			-171.456		
Pseudo R2	0.437			0.521		

Source: Calculated based on CHARLS2011.
Note: *,**,*** :statistical significant in 10%,5%,1% level.

Table 6 Results of Participation Probabilities in the NCMS and URBMI

	NCMS			URBMI		
	coef.	z-value	df/dx	coef.	z-value	df/dx
Chronic Diseases						
Hypertension	0.090 *	1.87	0.010	0.176 *	1.82	0.065
Dyslipidemia	0.132	1.54	0.013	0.263 **	1.97	0.095
Diabetes or high blood sugar	0.034	0.35	0.004	0.018	0.11	0.007
Cancer or malignant tumor	0.519 *	1.84	0.038	0.352	0.75	0.122
Chronic lung diseases	-0.014	-0.21	-0.002	0.019	0.13	0.007
Liver disease	0.032	0.32	0.003	0.200	0.90	0.072
Heart disease	-0.014	-0.23	-0.002	0.282 **	2.33	0.102
Stroke	-0.081	-0.64	-0.010	0.117	0.45	0.043
Kidney disease	0.114	1.37	0.012	0.207	1.22	0.075
Stomach or other digestive disease	0.103 **	2.23	0.011	0.033	0.30	0.012
Emotional, nervous, or psychiatric problems	0.061	0.37	0.006	-0.520	-1.47	-0.204
Memory-related disease	0.006	0.04	0.001	-0.135	-0.45	-0.052
Arthritis or rheumatism	0.028	0.69	0.003	0.050	0.54	0.019
Asthma	-0.111	-1.14	-0.013	-0.246	-1.07	-0.095
Age Categories (Age40-49)						
Age50-59	0.039	0.77	0.004	0.093	0.83	0.035
Age60-69	0.181 ***	3.12	0.019	0.200	1.55	0.073
Age70-79	-0.014	-0.20	-0.002	0.108	0.67	0.040
Age 80and over	0.040	0.39	0.004	0.267	1.12	0.095
Income Categories (First quintile)						
Second quintile	0.029	0.49	0.003	0.019	0.14	0.007
Third quintile	0.109 *	1.86	0.012	0.157	0.96	0.058
Fourth quintile	0.043	0.69	0.005	0.063	0.49	0.023
Fifth quintile	-0.064	-1.09	-0.007	0.056	0.42	0.021
Education Categories						
(No formal education illiterate)						
Did not finish primary school	0.020	0.36	0.002	0.031	0.20	0.011
Primary school	0.005	0.09	0.001	0.133	0.92	0.049
Junior high school	0.101	1.56	0.011	0.234 *	1.64	0.086
Senior high school	0.033	0.36	0.004	0.221	1.44	0.080
College and over	0.162	0.34	0.016	0.138	0.49	0.050
Individiual Characteristics						
Married	0.400 ***	6.37	0.056	0.032	0.24	0.012
Male	0.003	0.06	0.000	-0.314 ***	-2.64	-0.118
Child numbers	0.014	0.83	0.002	-0.032	-0.75	-0.012
Health Behaviour						
Smoking (no smoking)						
Smoking now	0.025	0.46	0.003	-0.038	-0.31	-0.014
Smoking in the past	-0.033	-0.43	-0.004	0.140	0.85	0.051
Drinking (no drinking)						
Drinking once a month	-0.008	-0.11	-0.001	0.318 *	1.86	0.112
Drink more than once a month	-0.013	-0.26	-0.001	0.351 ***	2.92	0.125
Constants	1.058 ***	11.37		-0.107	-0.48	
No. of observations	12593			1041		
Log likelihood	-2716.170			-654.409		
Pseudo R2	0.022			0.044		

Source: Calculated based on CHARLS2011.
Note: *,**,*** :statistical significant in 10%,5%,1% level.

(Table 5) is 49.0% lower for the self-employed worker group, 38.7% lower for the other work sector groups. However, the differentials among government organizations, public organizations (*Shiye danwei*), SOEs, COEs, and private firms are not statistically significant. The results show that although disparities in participation between the ownership types in the formal sector have reduced, they continue to exist between the formal and informal sectors. As a result, H2 (segmentation by employment sectors hypothesis) is supported. In this regard, policies to promote self-employed workers' participation in the UEBMI should be considered by the government.

Third, based on the results shown Table 6 (for the NCMS and the URBMI), the results of household consumption quintiles are statistically insignificant. Therefore, H3 (liquidity constraints hypothesis) is rejected.

The results of the test for H3 for the UEBMI and the NCMS are not consistent with those of Zhou (2002) and Lin *et al*. (2009). This indicates that the increased government assistance in the public medical insurance system and the enforcement of participation in the system by the government helped reduce the disparities in participation caused by income inequality.

Fourth, consider the results of the two indices of H4 (adverse selection hypothesis). Compared with the group without chronic diseases, the participation probabilities in the NCMS are 1.1% higher for the subgroups with stomach or other digestive diseases (except for tumors or cancers). The participation probabilities in the URBMI are 9.5%, 10.2% higher for the subgroups with dyslipidemia (elevation of low-density lipoprotein, TGs, and total cholesterol, or a low high-density lipoprotein level), and heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems.

Further, in most cases, compared with the younger group (aged 40~49), the participation probabilities in medical insurance systems are higher for the elderly groups. For example, the participation probability in the NCMS is 1.9% for the group aged 60~69. All these results support H4 (adverse selection hypothesis). These estimated results are consistent with the findings of previous studies (Zhou 2002, Lin *et al*. 2009, Ma 2014).

Fifth, we consider the effects of individual characteristics. Compared with the group with the lowest education, the participation probabilities in the UEBMI are 13.3~36.1% (junior high school), 18.6~41.0% (senior high school), 13.4~41.0% (college and over) higher for the groups with middle- and high-level education. However, the differentials of the participation probabilities in the NCMS and the URBMI between these education groups are lower (Table 7).

Additionally, compared with the unmarried group, the probabilities of participation in the UEBMI and the NCMS are 15.0% higher and 5.6% higher for the married group, respectively. In contrast, the differentials of participation in the URBMI between the unmarried and married groups are statistically insignificant.

Next, the gender gaps in participation probabilities differ by the type of medical insurance system. For example, the participation probability in the URBMI is 11.8% lower for males than for

Table 7 Summary of Test Results of Hypotheses H1~H4

	H1	H2	H3	H4
UEBMI	○	○	-	-
NCMS	-	-	×	○
URBMI	-	-	×	○

Source: Summaried by the author.
Note: 1. ○: hypothesis is supported, ×: hypothesis is rejected
-: estimated results don't be utilized to test hypothesis
2. H1: segmentation by redistration systems hypothesis
H2: segmentation by work sectors hypothesis
H3: liquidity constraint hypothesis
H4: adverse selection hepothesis

females, whereas the gender gaps in the participation probabilities in the UEBMI and the NCMS are statistically insignificant.

Compared with the group without a child, the probabilities of participation in the UEBMI are higher for the group with children. If the number of children increases by one, the probability of participation in the UEBMI will rise by 4.7%. In contrast, the effect of the number of children on participation in the NCMS and the URBMI are not statistically significant.

The results for all smoking behavior dummies are not statistically significant. However, drinking behavior affects the participation probability.

Specifically, the probability of participation in the UEBMI and the URBMI is 8.7~10.9% higher and 12.5% higher for the group that drank more than once a month, respectively.

6. Conclusions

China's rapidly aging population caused the government to introduce reforms in the public medical insurance system in the 1990s. By the end of the 2000s, the UEBMI, URBMI, and NCMS were implemented, covering the entire population of China. Thus, it can be said that "Universal Medical Insurance" was established in China during the economic transition period. Using CHARLS2011 survey data, we conducted an empirical analysis to test four hypotheses, to verify the determinants of participation in the public medical insurance systems. Several major conclusions emerged.

First, we note differences in participation probabilities between the rural and urban groups, and thus, H1 (segmentation by registration systems hypothesis) is supported. For example, the probability of participation in the UEBMI is 28.8~59.5% higher for the urban group than that for the rural group.

Second, in the case of participation in the UEBMI, compared with the workers with government jobs, the participation probability is lower for the self-employed worker group. However, the differences in participation between government organizations, public organizations (*Shiye danwei*), SOEs, COEs, and private firms are lower. These findings suggest that although the

disparities in system implementation by workplace ownership type in the formal sector are lower, they continue to exist between the formal and informal sectors. Thus, H2 (segmentation by work sectors hypothesis) is supported.

Third, the results of household consumption quantiles are statistically insignificant, and thus, H3 (liquidity constraints hypothesis) is rejected.

Fourth, compared with the group without chronic diseases, the probabilities of participation in public medical insurance systems are higher for the group with chronic diseases. Compared with the younger group, the probabilities of participation in the medical insurance systems are higher for the elderly group. These results support H4 (adverse selection hypothesis).

Finally, education, gender, and drinking behavior also affect the participation probabilities, although these effects vary by the rural and urban groups.

The estimated results indicate that the establishment and implementation of the public medical insurance systems are segmented by the rural and urban registration systems, as well as employment sectors. The following policy implications can be considered. First, compared with the government worker group, the participation probabilities are lower for the self-employed. Policies to promote participation of workers in the informal sector in the UEBMI should be considered by the government.

Second, we revealed differentials in participation probability between the rural and urban groups. This might be caused by the fact that the public medical insurance systems are segmented by the rural and urban registration systems. The proportions of health care expenditures borne by patients themselves are relatively higher for the participants in the NCMS than for those in the UEBMI and the UREMI. This may lead to inequalities in health care service utilization between the rural and urban groups (Ma, 2015, 2016). To address this problem, it is vital that the Chinese government continue to promote participation in the NCMS, UEBMI, and URBMI in the long term.

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