Health System Reforms in China: What is needed for a next step?

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Abstract

Along with the economic reforms started in the late 1970s, the health system changed considerably in China. The health system deteriorated in the 1980s and the 1990s since the government did not direct much attention to the health sector. The government finally initiated the health system reforms in the late 1990s. The medical insurance system was re-established in both urban and rural areas by the early 2000s, and the insurance coverage has dramatically increased in recent years. However, there remain further challenges in China's health sector. This study attempts to provide an analysis of remaining challenges in the health sector of China. The empirical analysis using provincial panel-data indicates that scaling up the insurance fund level is necessary to improve the health outcome, i.e., maternity mortality, at the provincial level. In addition, improving the availability of health services is also important to improve local heath in rural China. This study also presents an overview of related studies particularly using micro-data, and summarizes the publicly opened micro-panel data of China for further studies.

1. Introduction

The health system has changed significantly in China after the economic reforms. During the 1980s and the 1990s, the government did not direct much attention to the health sector. The health system hence was deteriorated, which hindered people from accessing needed health care services. The availability and affordability of health care services were highly limited over the period.

The government eventually initiated health system reforms in the late 1990s. The Urban Employee Basic Medical Insurance (UEBMI) was established in 1998, which covered urban formal employees. Following this, the new Cooperative Medical Scheme (the new CMS) was established in 2003, which aimed at reforming the rural health system. The UEBMI covers urban employees but not their dependent family members. To include those urban people who are ineligible to enroll in the UEBMI, a pilot program of the Urban Resident Basic Medical Insurance (URBMI) was started in 2007. In addition, more comprehensive health system reform plan was launched in 2009. The government has intensified the health system reforms in recent years.

However, there remain challenges to improve physical and financial accessibility to needed health care services in China. For instance, expanding the medical insurance benefits is needed to improve the effectiveness of the insurance. In addition, the issue of health equity is a serious challenge for China. In this context, this study attempts to provide an analysis for further reforms in China's health system. Next section reviews transition of the health systems in China and traces changes in the health outputs. Taking the maternal mortality rate as a health outcome index, section 3 examines impacts of medical insurance conditions on the health outcome by using provincial panel-data. In addition, section 4 reviews other studies which examine China's health issues as well by using micro-data. This section also summarizes the publicly opened micro-panel data of China for future studies. The last section presents conclusion.

2. Recent Progress of Health System Reforms in China

2.1 Transition of the health systems

Along with the economic reforms started in the late 1970s, the health system also changed significantly in China. During the era of the planned economy, health services were provided through the Labor Insurance System (LIS) and Public Insurance System (PIS) for the urban population (World Bank 1997, Wong et al. 2006). The former system was basically financed by state owned enterprises (SOEs), and covered employees and

retirees of SOEs. The latter system was financed publicly, and covered personnel and retirees of public institutions. Both systems provided the members with health services that were basically free of charge. While, the health service provision was based on the Cooperative Medical Scheme (CMS) for the rural population before the economic reforms started. Its financial and administrative foundation was based on the people's communes (World Bank 1997, Li 2004). Unlike the LIS or PIS, the members of the CMS were required paying contributions to the CMS fund and co-payments for receiving the services. In this sense, characteristics of the CMS were similar to a community-based insurance. Although insurance benefits of the CMS were much lower than those of LIS or PIS, the health systems controlled financial risks associated with health matters in both urban and rural areas.

The economic reforms changed socio-economic systems, which had a critical impact on the health systems in both urban and rural areas. As the economy transited from a planned to a market economy, many of the SOEs came to suffer from the deficits, and their financial responsibilities for health service provision came to be heavy burdens (Nakagane 1999, Zhu 2004, Li 2004). The SOEs eventually became to be unable to finance health service provision for their employees or retirees (Liu 2002, Wong et al. 2006). Consequently, the conventional health system became to malfunction for the urban population. In addition, other types of the enterprise than SOEs increased due to the transition to a market economy. It also caused the malfunction of the conventional health system, because the employees of those types of enterprise were not covered by the conventional health system. The economic reforms significantly changed the socio-economic conditions in rural areas as well. Economic reforms in rural areas changed the production base of agricultural products from the people's communes to each household, which weakened the function of the people's communes (Kojima 1988). It accordingly caused the malfunction of the CMS (World Bank 1997, Li 2004, Zhu 2004).

The government needed to reform the health systems, and instead of SOEs or people's communes, it was required to take financial responsibilities for health service provision. However, the government did not direct much attention to the health sector until the late 1990s. The availability and affordability of health services hence was deteriorated considerably in the 1980s and the 1990s.

The government eventually initiated the health system reforms in the late 1990s. The Urban Employee Basic Medical Insurance (UEBMI) was established in 1998 (Ministry of Labour and Social Security 1998). The UEBMI covers formal employees who have urban registry (urban *hukou*), and the enrollment unit is an individual

employee. Therefore, rural migrants who emigrate from rural areas to urban areas are originally not eligible to enroll in the UEBMI[1], and the dependent family members of urban employees are ineligible to enroll in it either. In this sense, the population coverage of the UEBMI was very limited. The employers and employees are required to contribute the premium to the insurance fund, and the insurance benefits basically cover both in-patient and out-patient services. Each UEBMI scheme is organized at the city level; therefore, practical schemes may differ between different cities. To include the dependent family members in the insurance system, the government started a pilot program in 2007, i.e., the Urban Resident Basic Medical Insurance (URBMI) (Ministry of Labour and Social Security 2007). The URBMI covers the dependent family members of urban formal employees as well as other urban population who are not eligible to enroll in the UEBMI, such as the informal urban workers or the self-employed[2]. The members of URBMI are required to contribute the premium to the insurance fund. In addition, governments provide subsidies for the insurance fund. However, the insurance fund of URBMI is still limited; therefore, generally only in-patient services are covered by the insurance. Each insurance scheme of URBMI is organized at the city level. In this sense, the actual scheme of the URBMI may also differ between cities.

To reform the rural health system, the new CMS was established in 2003 (Ministry of Health 2003). Unlike the UEBMI, the enrollment unit of the new CMS is the household. All family members, including dependent family members, are required to enroll in the new CMS en mass. Both central and local governments subsidize the new CMS in order to expand the insurance coverage. In particular, the central government concentrates its subsidy in central-western provinces, considering their lower economic levels than other regions'. However, the insurance fund level of the new CMS is still low compared with that of the UEBMI. The insurance benefits hence are quite limited. The benefits generally cover only in-patient services. Each new CMS is organized at the county level; therefore, practical schemes may vary among counties.

From the late 1990s to the early 2000s, the government focused on reforming the medical insurance system. In recent, the insurance coverage has dramatically increased in both urban and rural areas. As we will observe the details below, the coverage has reached more than 90% in rural areas and 80% in urban areas by 2009.

[1] In recent, the government has initiated some attempts to include rural migrants in the urban insurance system.

[2] Originally, the rural migrants who have rural registry (rural hukou) are not covered by the URBMI but the new CMS. However, as in the footnote 1, the government attempts to include them in the urban insurance system recently.

Moreover the government attempts to reform the health system comprehensively in recent years, which includes not only issues of the medical insurance but also issues of health service provision and price control. To deal with those issues practically, the government launched a comprehensive reform plan of the health system in 2009 (National Development and Reform Commission 2009). The government plans to schedule CNY 850 billion (US$ 125 billion) for the three-year reform plan (Alcon and Bao 2011, Yip and Hsiao 2009). The plan lists the five targets, i.e., the medical insurance system, basic public health services, health service provision at the grass-root levels, the national essential medicine system, and public hospital reforms (National Development and Reform Commission 2009). The purpose of the plan is to improve financial and physical accessibility to and availability of health care services, and to provide qualified services for those in need.

2.2 Transition of the health outputs

As reviewed, the health system considerably changed in China along with the economic reforms. Those changes had a significant impact on the health outputs, in particular, on the conditions of health financing.

Table 1 Medical Insurance in Urban Areas: UEBMI and URBMI

	Enrollment population (10,000 persons)			% Coverage
	UEBMI	URBMI	Total	Total
2005	13,783			
2006	15,732			
2007	18,020	4,291	22,311	51.8
2008	19,996	11,826	31,822	72.4
2009	21,961	18,100	40,061	89.0

Note: Author's compilation based on data from *Health Statistical Yearbook of China 2010* (Ministry of Health, China). The data of non-agricultural population is used to calculate the insurance coverage (%).

Table 1 summarizes the progress of the urban medical insurance coverage. Since we have only data of the urban population as a whole, we cannot calculate the

insurance coverage for the UEBMI and the URBMI respectively, but for the whole urban population. The figures that show the insurance coverage has expanded significantly in recent years (Table 1).

Table 2 Medical Insurance in Rural Areas: the New CMS

	Enrollment population (100 million persons)	Coverage (%)	Insurance fund by per member (CNY)
2005	1.8	20.0	42.1
2006	4.1	46.0	52.1
2007	7.3	82.7	58.9
2008	8.2	92.4	96.3
2009	8.3	94.3	113.4
Data of 2009	(10,000 persons)		
East Region	23,863		136.6
Central Region	33,551		103.2
Western Region	25,895		105.1

Note: Author's compilation based on data from *Health Statistical Yearbook of China 2010* (Ministry of Health, China). The data of agricultural population is used to calculate the insurance coverage (%).

The coverage of the new CMS has also dramatically expanded since 2007, and the level of insurance fund has increased significantly since 2008 (Table 2). Those figures confirm that the government has intensified recent efforts to improve medical insurance conditions in rural areas. Looking at the regional figures, the level of insurance fund is substantially higher in Eastern region than in Central or Western regions. It indicates that the insurance benefits may considerably differ between those regions. It is an important challenge to improve the situation in pooper regions and ameliorate the disparity in health between regions.

Table 3 Maternity Insurance

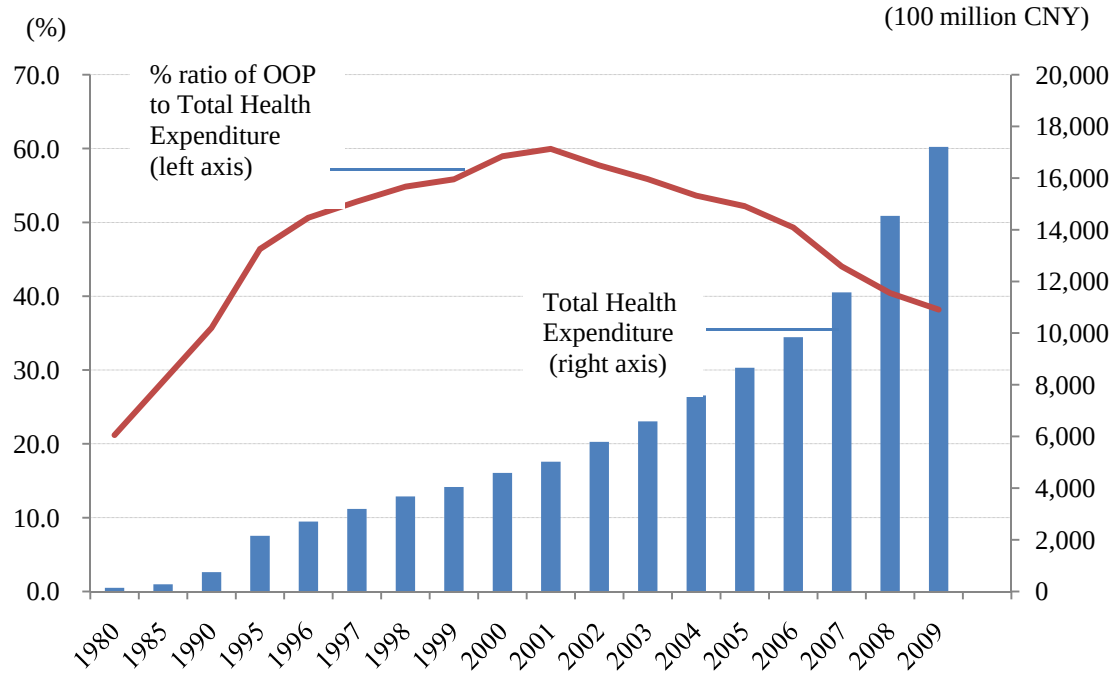
	Enrollment population	Beneficiaries	Insurance fund

	(10,000 population)		Total (100 million CNY)	Per member (CNY)
2006	6,459	108	62	96
2007	7,775	113	84	107
2008	9,254	140	114	123
2009	10,860	174	132	122
Data of 20009				
Eastern region	5,599	92	78	140
Central region	2,029	22	16	81
Western region	1,626	25	19	117

Note: Author's compilation based on data from *Health Statistical Yearbook of China 2010* (Ministry of Health, China).

The maternity insurance has also expanded significantly in recent years (Table 3). Since it is difficult to capture the number of the targeted population, we cannot calculate the coverage percentage of the maternity insurance. The level of insurance fund on average (per member) is close to that of the new CMS. The insurance fund differs between regions also for the case of maternity insurance. The fund level is higher in Eastern region than other regions, and it is significantly low in Central region. It indicates that in addition to increasing the coverage, scaling up the fund level is also needed to improve the health conditions in poorer regions.

Figure 1 Total Health Expenditure and Out of Pocket Payment



Note: Author's compilation based on data from *Health Statistical Yearbook of China 2010* (Ministry of Health, China).

Figure 1 presents total health expenditures (THE) and percentage ratio of out-of-pocket payment to THE. Total health expenditures have expanded considerably after the 2000s.[3] The OOP ratio (%), which was around 20% in 1978, increased acceleratory in the 1980s and the 1990s, and reached 61% in 2001. Such level is substantially high even if it is compared with other developing countries (Uchimura 2009). As reviewed above, the heath systems were deteriorated in the 1980s and the 1990s in China. Figure 1 confirms that people needed to bear heavy financial burdens to access health care services over the period.

Table 4 Health Expenditure: Urban and Rural Areas

	Health expenditure per capita (CNY)		
	Total	Urban	Rural
1978	12		
1980	15		

[3] The figure is in the nominal term; therefore, it also reflects changes in the price level.

1985	26		
1990	65	159	39
1995	178	401	113
2000	362	814	215
2001	394	841	245
2002	451	987	259
2003	510	1,109	275
2004	584	1,262	302
2005	662	1,126	316
2006	749	1,248	362
2007	876	1,516	358
2008	1,095	1,862	455
2009	1,289		

Note: Author's compilation based on data from *Health Statistical Yearbook of China 2010* (Ministry of Health, China).

Table 4 summarizes health expenditures *per capita* in urban areas and rural areas respectively. Health expenditures have increased in both urban and rural areas. Moreover, the difference in the health expenditures between urban and rural areas is critical. As observed above, the insurance coverage has dramatically expanded and reached to more than 90% in rural areas. However, the financial difference in the health sector between urban and rural areas is significant, which would link to the difference in the health outcomes between urban and rural areas.

3. Empirical Analysis

The health system reforms have progressed significantly in the last decade in China. As observed in the previous section, the medical insurance coverage has expanded dramatically in recent years. However, it does not necessarily improve peoples' accessibility to needed health care services significantly. A major bottleneck is the low-level of insurance benefits. Insurance benefits may differ between different localities in China, because each insurance scheme is organized at the city level in urban areas and at the county level in rural areas. Insurance benefits are closely related to the scale of insurance funds; therefore, the fund scale might have an important impact on local health outputs or outcomes.

In the following, we conduct empirical analyses in order to examine further challenges of the health system reforms in China. In the analyses, we particularly focus

on the impacts on the maternal mortality level of the fund scale as well as the coverage level of medical insurance and the availability of local health services. Although the recent progress of health system reforms has been impressive, the disparity in health remains a serious challenge in China. The disparity in insurance benefits and local health service provision may have an important effect on local health outcomes. By conducting the empirical analyses, we attempt to investigate further challenges in China's health systems.

3.1 Model and Data

Estimation Model

The estimation model is as follows.

$$y_{i\,t} = \alpha + \beta_1 X_{i\,t} + \beta_2 C_{i\,t} + \mu_i + u_{i\,t}, \quad (1)$$

where *y* is the dependent variable, i.e., the maternal mortality rate at the provincial level. As noted above, medical insurance is organized at the city level in urban areas and at the county level in rural areas. Therefore, it is desirable to examine impacts of the scale of medical insurance fund on health outcomes at the city/county level. However, the data limitation does not allow us to examine the impact at the city level/county level. Instead, we conduct the estimation at the provincial level. Hence, i denotes province, and t is year. X_i denotes the focal independent variables, i.e., the level of medical insurance coverage or the scale of insurance fund in a province (i). As mentioned above, the insurance coverage has expanded dramatically in recent years. Expanding the insurance coverage would improve the financial accessibility of the insured to needed health services. It is hence expected that this variable has a positive impact on improving the maternity mortality rate, i.e., reducing the mortality rate. Moreover, leveling up the insurance benefits is important to improve effectiveness of the insurance. The level of insurance benefits is related to the scale of insurance fund. Therefore, the variable, i.e., the scale of insurance fund, is also expected to have a positive effect on decreasing the mortality rate.

In addition to the impact of medical insurance, we examine effects of the local health service availability on the maternal mortality rate. Hence, variables, measuring the local health service availability, are also included in the model as independent variables. As details in the below, thoes variables measure physical conditions of health care services. Health service provision is still limited particularly in rural areas. Improving the availability hence is expected to have a positive effect on reducing maternal mortality rate especially for the case of rural population.

C_i denotes a control variable, i.e., the educational level at the provincial level.[4] In general, the educational level is highly related to the mortality rate in developing countries. Higher the educational level, lower the mortality rate. This variable is hence expected to have a positive effect on reducing the maternity mortality rate. u is an error term. We employ a fixed-effects model for our analyses. Therefore, μ_i is the unit-specific residual which varies between units (provinces) but is time-invariant. That is, μ_i captures unit specific characteristics that do not change over time. It thus can be geographical characteristics of a province in the model.

Data and Variables

Rural population

The dependent variable for the case of rural population is the provincial maternal mortality rate in rural areas which is from the *Health Statistical Yearbook of Chin*a. The focal independent variables used are the coverage ratio (%) of the new CMS at the provincial level and the amount of the insurance fund *per capita (per enrollee)*. The provincial coverage ratio is calculated by using the data of the number of enrollees of the new CMS and the number of agricultural population at the provincial level. The amount of the insurance fund *per capita (per enrollee)* is calculated by using the data of total amount of the insurance fund and the number of insurance enrollees at the provincial level. The source of these data is also the *Health Statistical Yearbook of China*.

In addition to the new CMS, we examine the effects on the maternal mortality rate of the maternity insurance conditions at the provincial level. Due to the data limitation, we cannot examine the relationships between the maternal mortality rate and the level of maternity insurance coverage. Instead, we examine the following two variables: the scale of insurance beneficiaries compared with the enrollees and the scale of the insurance fund. The scale of beneficiaries is calculated by using the data of the number of beneficiaries and the number of enrollees of maternity insurance at the provincial level. The scale of insurance fund is measured by the amount of the maternal insurance fund *per capita (per enrollee)* at the provincial level, which is calculated by using the data of the amount of the insurance fund and the number of the insurance enrollees. These data about maternity insurance includes both urban and rural

[4] The local economic level is usually included in models as a control variable because the level of maternal mortality rate is influenced by the economic level in general. However, as in Uchimura (2011), the economic level has a significant effect on the level of medical insurance coverage in China which is included in our models as a focal independent variable. We therefore do not include the local economic level in the estimation models as a control variable.

population.

The health service availability is measured by the following three variables in the model: the number of health institution beds per 1,000 rural population, the number of doctors per 1,000 population in rural areas, and the utilization rate of health institution beds. Among the three variables, the bed utilization in fact captures the effectiveness of health service provision rather than the availability. The data used in the model is the utilization rate at the provincial level which covers both urban and rural areas because the utilization rate for rural population is not available. All these data are from the *Health Statistical Yearbook of China*. The educational level, a control variable, is measured by the illiterate rate over 15-years old population at the provincial level. The data is from *the China Statistical Yearbook*.

The dataset does not include the data of Shanghai because the data of maternal mortality rate for Shanghai is not available. The data of the new CMS are available from 2007 to 2009, whereas the data of the maternity insurance are available from 2006 to 2008.

Urban population

The dependent variable for urban population is the provincial maternal mortality rate in urban areas which is from the *Health Statistical Yearbook of China*.

The number of enrollees of UEBMI and that of URBMI are available; however, the number of targeted population of UEBMI or URBMI is not available. That is to say, the data of denominator is not available to calculate the insurance coverage ratio of UEBMI or URBMI respectively. Alternatively, we calculate the insurance coverage ratio for total urban population, which includes both of UEBMI and URBMI, by using the data of the number of enrollees of UEBMI and URBMI and the number of non-agricultural population at the provincial level.

The same as the case of rural population, we examine effects on the maternal mortality level of the scale of maternity insurance fund and the scale of the insurance beneficiaries compared with the enrollees. As mentioned above, the data regarding the maternity insurance is the provincial data including both urban and rural population. Thus, the data used to calculate the scale of the maternity insurance fund and the scale of maternity insurance beneficiaries are the same as the above mentioned data.

The availability of health services is measured by the following variables in the model for urban population: the number of health institution beds per 1,000 population in urban areas of a province, the number of doctors per 1,000 population in urban areas of a province, and the utilization rate of health institution beds. As mentioned above, the

data of bed utilization is the provincial level data which includes both of urban and rural areas. Also the same as the case for rural population, the educational level at the provincial level, measured by the illiterate rate for population over 15 years old, is included in the model as a control variable.

The data of UEBMI and URBMI is limited compared with that of the new CMS. As mentioned, we can only calculate the insurance coverage for whole urban population which includes UEBMI and URBMI. In addition, the data of UEBMI and URBMI are available only for a two-year period, i.e., 2007 and 2008. We therefore conduct the estimation regarding UEBMI and URBMI only for reference. The dataset of the estimation about UEBMI and URBMI covers 31 provinces and a two-year period. The dataset of the estimation about the maternity insurance covers 31 provinces and a three-year period (2006 – 2008).

3.2 Result

Table 5 summarizes results of the estimation. The coefficient of the insurance coverage level is negative and statistically significant, and that of the insurance fund scale is also negative and statistically significant (Table 5 (1)). It means that the maternal mortality rate is lower at a province in which the insurance coverage or the insurance fund scale is relatively higher. Regarding the control variable, i.e., the educational level (illiterate rate), the coefficient is positive and statistically significant. It means that the maternal mortality rate is higher in a province in which the educational level is lower.

Regarding impacts of the health service availability, the coefficient of the number of health institution beds or that of the utilization rate is negative and statistically significant, whereas that of the number of doctors is negative but not significant statistically (Table 5 (2)). These results indicate that a certain type of health services (health outputs) has an important impact on the maternal mortality. In rural areas, improving the availability of health beds or the utilization of health beds is important to reduce the maternal mortality rate. Delivering at a health institution is a critical factor to reduce the maternal mortality particularly in less developed areas. In this sense, the result suggests that the physical condition at health institutions is still limited in rural China and strengthening the physical condition of local heath institutions is important to improve rural health.

Table 5 Estimation Results: the case of rural population

(1) The new CMS

Dependent variable	Maternal mortality rate at the provincial level			
	(a)		(b)	
Independent variables				
the new CMS				
Insurance coverage	-39.12	(2.14)**		
Scale of insurance fund			-0.65	(2.11)**
Education level				
Illiterate rate	3.65	(3.31)**	3.78	(0.00)**
No. observation	90		90	
R2	0.737		0.691	

(2) Health service availability

Dependent variable	Maternal mortality rate at the provincial level							
	(c)		(d)		(e)		(f)	
Independent variables								
Health ser. availability								
No. health beds	-45.19	(4.95)**					-31.04	(2.67)**
No. doctors			-4.21	(.060)				
Utilization of health beds					-1.10	(4.47)**	-0.578	(1.90)*
Education level								
Illiterate rate	2.45	(2.58)**	4.80	(4.79)**	2.06	(1.95)*	1.69	(1.68)*
No. observation	90		90		90		90	
R2	0.412		0.710		0.687		0.438	

(3) The new CMS and health service availability

Dependent variable	Maternal mortality rate at the provincial level							
	(g)		(h)		(i)		(j)	
Independent variables								
the new CMS								
Insurance coverage	17.82	(0.86)			-9.96	(0.55)		
Scale of insurance fund			-0.03	(0.93)			-0.03	(0.09)

Health ser. availability								
No. health beds	-51.45	(4.40)**	-41.80	(4.25)**				
No. doctors								
Utilization of health beds					-1.03	(3.88)**	-1.08	(3.85)**
Education level								
Illiterate rate	2.71	(2.71)**	2.08	(2.01)**	1.87	(1.71)*	2.03	(1.90)*
No. observation	90		90		90		90	
R2	0.383		0.361		0.662		0.677	

(4) Maternity insurance and health service availability

Dependent variable	Maternal mortality rate at the provincial level							
	(k)		(l)		(m)		(n)	
Independent variables								
Maternity insurance								
Scale of insurance fund	-2669.1	(4.14)**			-2060.8	(2.90)**	-1905.5	(2.77)**
Scale of beneficiaries			-192.86	(0.67)				
Health ser. availability								
No. health beds					-29.27	(1.86)*		
No. doctors								
Utilization of health beds							-0.74	(2.49)**
Education level								
Illiterate rate	7.26	(6.21)**	10.10	(9.54)**	6.49	(5.34)**	5.58	(4.27)**
No. observation	89		88		89		89	
R2	0.539		0.467		0.49		0.56	

Notes: Numbers in parentheses are the t-statistics. * indicates significance at the 10% level. ** indicates significance at the 5% level.

The models in Table 5 (3), i.e., model (g), (h), (i), (j), include variables of the new CMS as well as the health service availability. In these models, the coefficient of the insurance coverage or the insurance fund scale is not statistically significant. In addition, the r-squared (the coefficient of determination) indicates that the fitness of models in Table 5 (3) is lower than that of models in Table 5 (1). It suggests that the variables are correlated in the models of Table 5 (3). In fact, the health service availability might influence the willingness to join the medical insurance. The variables

of health service availability may hence collate with the variables of the new CMS.

The results regarding the maternity insurance are summarized in Table 5 (4). The coefficient of the insurance fund scale is negative and statistically significant, whereas that of the insurance beneficiary scale is negative but not significant statistically. The coefficient of the insurance fund scale is also negative and statistically significant in the models which include variables of the health service availability. The same as the case of the new CMS, the scale of insurance funds has an important effect on improving the maternal mortality, while the scale of insurance beneficiaries does not have a strong relationship with the maternal mortality. Regarding the health service availability, the coefficient of the number of health beds or the utilization rate of health beds is negative and statistically significant.

As expected, both the level of insurance coverage and the scale of insurance fund are important to improve the maternal mortality in rural China. In addition, improving the physical condition of local health institutions; that is, increasing the number of health beds and improving the utilization of health beds are also necessary to reduce the maternal mortality. These results are suggestive for further reforms in the health system. The government has intensively worked for expanding the insurance coverage in recent years in China. Based on the analyses, expanding the insurance coverage has a positive effect on improving the health outcomes in rural China. In addition, expanding the insurance fund scale as well as strengthening the physical condition of local health institutions will be a next challenge to improve health in rural areas.

Table 6 Estimation Results: the case of urban population

(1) Maternity insurance (A)

Dependent variable	Maternal mortality rate at the provincial level					
	(a)		(b)		(c)	
Independent variables						
Maternity insurance						
Scale of insurance fund	-3932.88	(4.17)**				
Scale of beneficiaries			-190.42	(1.02)		
Education level						
Illiterate rate	-1.01	(0.59)	3.81	(5.01)**	0.34	(0.25)
No. observation	93		93		93	
R2	0.267		0.310		0.01	

(2) Health service availability (A)

Dependent variable	Maternal mortality rate at the provincial level		
	(d)	(e)	(f)
Independent variables			
Health ser. availability			
No. health beds	-55.60 (5.87)**		
No. doctors		19.91 (1.17)	
Utilization of health beds			-1.48 (3.71)**
Education level			
Illiterate rate	-3.43 (2.76)*	0.51 (0.38)	-2.99 (1.99)*
No. observation	93	93	93
R2	0.365	0.023	0.367

(3) Maternity insurance (B), Health service availability (B)

Dependent variable	Maternal mortality rate at the provincial level			
	(g)	(h)	(i)	(j)
Independent variables				
Maternity insurance				
Scale of insurance fund	-3631.49 (4.62)**			
Scale of beneficiaries		-185.88 (0.84)		
Health ser. availability				
No. health beds			-42.12 (4.93)**	
No. doctors				
Utilization of health beds				-1.01 (3.07)**
No. observation	93	93	93	93
R2	0.262	0.01	0.285	0.134

(4) Maternity insurance and health service availability

Dependent variable	Maternal mortality rate at the provincial level	
	(k)	(l)
Independent variables		
Maternity insurance		
Scale of insurance fund	-1687.03 (1.49)	-3062.56 (2.98)**
Scale of beneficiaries		

Health ser. availability				
No. health beds	-28.48	(2.32)**		
No. doctors				
Utilization of health beds			-0.34	(0.86)
No. observation	93		93	
R2	0.324		0.272	

(5) UEBMI + URBMI

Dependent variable	Maternal mortality rate at the provincial level			
	(m)		(n)	
Independent variables				
UEBMI+URMBI				
Insurance coverage	-91.60	(2.87)**		
Scale of beneficiaries			556.15	(2.87)**
Education level				
Illiterate rate	-10.85	(2.31)**	-2.04	(0.52)
No. observation	62		62	
R2	0.236		0.235	

Notes: Numbers in parentheses are the t-statistics. * indicates significance at the 10% level. ** indicates significance at the 5% level.

Table 6 summarizes the estimation results for the case of urban population. The coefficient of the maternity insurance fund scale is negative and statistically significant, whereas that of the insurance beneficiary scale is negative but not significant statistically (Table 6 (1)). Regarding the health service availability, the coefficient of the number of health beds or the utilization rate of health beds is negative and statistically significant, whereas that of the number of doctors is positive and not significant statistically (Table 6 (2)). These results are the same as the case of the rural population. It indicates that expanding the scale of maternity insurance fund or improving the availability of health beds and their utilization rate is important to improve the maternal mortality also for the urban population.

The effect of the educational level (illiterate rate) on the mortality however is not clear for the case of the urban population. Therefore, the model (c) focuses on the effect of the educational level, and the result indicates that the effect is not significant for the case of the urban population. The illiterate rate appears not to be a critical factor influencing the maternal mortality for the urban population. We therefore estimate the models which do not include the variable of the educational level (Table 6 (3)). The

results confirm that the insurance fund scale and the health service availability have a positive effect on improving maternal mortality rate.

The empirical analysis indicates that the expanding the insurance coverage is conducive to improving maternal mortality rate in both rural and urban China. In fact, the insurance coverage has increased dramatically especially in recent years, which is an important achievement of the health system reforms in China. In addition, the estimation results suggest that expanding the scale of insurance fund will be a next challenge to improve the local health status further in China. The availability of local health services will be an essential factor also in improving local health.

4. For Future Studies

The micro data, which includes the information not only on medical insurance but also on individual characteristics, enables us to examine the detailed relationships between medical insurance/health system conditions and health outputs/outcomes. Moreover, the micro-panel data is needed to estimate the relationships more precisely. This is an important issue for future studies.

In this section, we attempt to provide ideas for future empirical studies on China's health systems. We firstly review studies which examine issues of the health system, particularly medical insurance, in China by using micro data. In addition, we review a publicly opened micro-panel data of China which contain the information of health status and individual/household characteristics.

Studies using China's micro data

Several studies focus on the new CMS, and examine the relationships between the design of the new CMS and health outputs It is found that those studies use one of the following four types of micro-data. One is the household survey data consisting of 50 households in each of 30 counties in Anhui and Jiangsu provinces. This survey was conducted in 2006 by the National Bureau of Statistics in China in collaboration with the Institute for Population and Labor Economics at the Chinese Academy of Social Science and Nanjing Agricultural University (the 2006 survey data). Since this data was collected in 2006 when the coverage of the new CMS was still around 50% on average, this survey data includes both counties operating and not operating the new CMS. Hence, this data enables us to examine factors that affect the willingness to join the insurance system or differences in the health-care seeking behavior between the insured

and the uninsured.

For example, Brown and Theoharides (2009) examine the determinants of health-seeking behavior by using the 2006 survey data. They focused not only on the design of the new CMS but also the characteristics of each household, and investigated factors that affect health-seeking behavior and hospital choice. They found that the following factors, i.e., age, the ratio of food consumption to total household expenditure, the presence of other sick family members and the disability, have significant effects on people's health-seeking behavior. The first three factors negatively affect the health-seeking behavior, while the last factor has a positive effect. In addition, it is found that the reimbursement schemes of the new CMS or the average daily expense with hospitalization has a considerable impact on the hospital choice. Brown and Huff (2011) use the survey data of Anhui province which is based on the 2006 survey data. The data consists of 50 households in each of 20 counties in Anhui provinces. This study also shed light on differences in practical schemes of the new CMS between different localities as well as the characteristics of each household, and examined the determinants of the willingness to pay for the new CMS. They found that a household, which is wealthier or has at least one family member who has been hospitalized, tends to pay more for the new CMS. While, a household, which has other insurance, has a lower willingness to pay for the new CMS. In addition, they indicate that increasing contribution of the insured (premium) will not affect much on the participation rate. As mentioned in the previous section, it is an important challenge to expand the fund scale of the new CMS. The finding of Brown and Huff (2011) would support the idea of increasing the premium in order to expand the fund scale of the new CMS. Another study by Brown, Brauw and Du (2009) also used the 2006 survey data including both of Anhui and Jiangsu provinces. This study focused on the differences in the schemes of the new CMS as well, and examined the conditions which improve satisfaction of the insured. This study found that making rural migrants eligible for the coverage and lowering deducted costs from the reimbursement coverage relate to the higher satisfaction. In addition, they indicate that OOP (out-of-pocket payment) appears to be still too high to improve the accessibility of the rural poor to needed health care services.

Another survey data was conducted by the Chinese Academy of Sciences' Center for Chinese Agriculture Policy Beijing in collaboration with Stanford University and MIT. They conducted two rounds of survey in 2005 and 2008. The first survey consists of 100 rural villages in 6 provinces, i.e., Jiangsu, Sichuan, Shaanxi, Jilin, and Hebei. To be a true panel, they conducted the second survey consisting of the same

households in the same villages. Since the data is a true panel data, they can apply a more sophisticated econometoric technique to the estimation. The above mentioned studies, using the 2006 survey data that is micro but not panel data, cannot control unobservable unit specific characteristics or endogeneity, etc. By using the panel data, for instance, Yi *et al*. (2009) examine progress of the new CMS and strengthen/weakness of the new CMS. Since they conducted the survey in 2005 and 2008, their survey data contain the information of 2004 and 2007. As in the section 2, the new CMS was established in 2003. In this sense, they could compare the differences in the situation of the new CMS between 2004 (the very early stage) and 2007 (the mid-term achievement). They found that the coverage of the new CMS expanded significantly, but there remained a critical challenge. The insurance did not control financial risks associated with catastrophic illnesses. They found that the insurance covered only 15% of expenditures of the patient even in 2007. In addition, the study indicated that a limited funding of the insurance was a major factor for the low benefits, which supports the results of our analyses.

The third one is based on one of the most major health survey data; that is, the China Health and Nutrition Survey (CHNS). The CHNS provides micro-panel data including the social, economic, and health information of households and individuals. You and Kobayashi (2011) used this survey data. They used the data of 2004 consisting of 9 provinces (Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Liaoning, and Shandong) and 4,400 households. They examined the determinants of people's out-of-pocket payment (OOP). Among the various factors, they found that perceived severity of illness and the self-reported health status have the most significant impacts on the OOP. Aging is also an important factor determining the OOP. Moreover, they found that some types of insurance, in particular labor insurance, tend to increase the OOP. It suggests that insurance does not control financial risks but expand individual's expenditure further. Since it is the critical issue for the function of insurance, further studies are needed to examine the function of insurance by using updated micro-panel data. Liu, Gao, and Rizzo (2011) also used the CHNS. They used the longitudinal data from the CNHS, i.e., data of 2000, 2004, and 2006. The data, consisting of the above mentioned 9 provinces, contains 119 rural communities in 2000, 140 in 2004, 145 in 2006. The data includes the adult samples: 6,584 in 2000, 6,289 in 2004, and 6,427 in 2006, and the child samples: 1,738 in 2000, 1,426 in 2004, and 1,232 in 2006. They examined the relationship between the enrollment of the new CMS and the purchase of private health insurance. They found that the new CMS did not crowd out private insurance for the adult. It is also found that risk preferences and the

socio-economic status, such as income and education level, have an important positive impact on purchasing private insurance.

The last one is the National Health Service Survey (NHSS), administrated by the Center for Health Statistics and Information (CHSI) of the Ministry of Health. The data includes 10 counties operating the new CMS and 5 counties not operating the new CMS. The first survey was conducted in 2003 covered about 54,000 households in 900 villages across 31 provinces. A follow-up survey was conducted in 2005, and it successfully re-interviewed about 94% of households and about 87% of individuals of the 2003 survey. By using the survey data, Wagstaff et al. (2009) examined the impacts of the new CMS on the utilization of health care services and on the OOP. They found that operating the new CMS increased the utilization of outpatient and inpatient services, but it does not necessarily reduce the OOP per outpatient visit or inpatient spell. This result suggests that the new CMS improves people's utilization of health care services but it does not control well the financial risks associated with the illness. Reducing the OOP is one of the most important purposes of establishing the new CMS. In this sense, the schemes of the insurance needs to be reformed to practically improve people's financial accessibility to needed health care services.

China's publicly opened micro-data

By using micro data, particularly micro-panel data, we can examine impacts of health system reforms on health outputs/outcomes precisely. However, the accessibility to the micro data is limited in general. In the following, we briefly summarize a publicly opened micro data which contains health related information as well as socio-economic information of households/individuals in China.

The data is the China Health and Nutrition Survey (CHNS). This survey is conducted as an international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. This survey data is the micro-panel data including the data of 1989, 1991, 1993, 1997, 2000, 2004, 2006, and 2009. The survey has been conducted in the following nine provinces: Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Liaoning, and Shandong. It had 190 primary sampling units in the survey of 1989, 1991, and 1993. Each survey includes more than 3,500 households and 12,000 individuals. In the 1997 survey, new communities and new households were added to replace those which no longer participate in the survey. Heilongjiang replaced Liaoning province also in the

1997, but Liaoning was back to the survey 2000.

The survey consists of the following sub-survey: Household survey, Adult survey, Child survey, Health and Nutrition survey, and Community survey. The household survey includes the detailed demographic information and socio-economic information. The purpose of the adult survey is to investigate the energy-expenditure-related dimensions of an adult, which includes questions about physical activities relating to the work (occupation). The child survey attempts to collect the data of physical activities and inactivity. The health and nutrition survey has the following individual data: dietary in-taken, body composition, blood pressure, health history, and health-related behavior. The community survey includes the data of community infrastructure, services (family planning, health facilities, and retail outlets, etc.), population, and prevailing wages. Although this survey only include 9 provinces, the survey is designed carefully to capture the socio-economic information, health related information, and community information. In addition, as mentioned, it is the longitudinal survey data. We hence can examine the detailed relationships between health related policies and health outcomes or between the individuals' socio-economic conditions and their health related behavior, etc., precisely.

5. Conclusion

Along with the economic reforms started in the late 1970s, the socio-economic conditions changed significantly in China. Those changes had a critical impact on the health system function, and the conventional health system was deteriorated in the 1980s and the 1990s. It was the late 1990s that the government finally initiated the health system reforms in China. Firstly, the government focused on reforming the medical insurance system in both urban and rural areas. In recent, the insurance coverage has increased dramatically, which has been conducive to lessening people's financial burdens to access health care services. However, there remain challenges to improve health further in China.

The empirical analysis confirms that the expansion of the medical insurance coverage contributes to improve health outcomes at the provincial level. In addition, the analysis indicates that expanding the insurance fund level needs to improve local health further, and improving the availability of health services is also necessary to improve rural health.

We can examine precisely the detailed relationships between health system reforms and health outcomes or between household characteristics and their health conditions by using micro-panel data. Although the accessibility to micro-data is still

limited, some micro-panel data about China's health are publicly opened. Examining those issues using micro-panel data will be an important issue for future studies.

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