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IMPACT OF NEW RURAL COOPERATIVE MEDICAL SCHEME ON MEDICAL SERVICE UTILIZATION IN RURAL CHINA

This article examines the impact of the New Rural Cooperative Medical Scheme on medical service utilization in rural China using an econometric approach accounting for selection and censoring problems in data. The results show that the New Rural Cooperative Medical Scheme significantly increases the number and medical cost of outpatient visits per capita. Furthermore, the results provide evidence on the potential inference errors that could occur without taking into account the sample selection issues in the estimation procedures.

Keywords: *New Rural Cooperative Medical Scheme; outpatient visits; outpatient medical cost; rural China.*

JEL: H75; I18; R58.

Ліжан Квін, Чень-ганг Ванг

ВПЛИВ НОВОЇ СХЕМИ СІЛЬСЬКОЇ КООПЕРАТИВНОЇ ОХОРОНИ ЗДОРОВ'Я НА КОРИСТУВАННЯ МЕДИЧНИМИ ПОСЛУГАМИ В СЕЛАХ КНР

У статті досліджено вплив Нової схеми сільської кооперативної охорони здоров'я на користування медичними послугами в селах КНР. Використання економетричних підходів дозволило врахувати похибку на фактор цензури при аналізі даних. Результати аналізу довели, що Нова схема суттєво збільшила кількість звертань до лікарів в селах, а також витрати на медицину. При подальших розрахунках у даній сфері необхідно враховувати, що кількість похибок и помилок у розрахунках багато в чому визначається якістю вибірки.

Ключові слова: *Нова схема сільської кооперативної охорони здоров'я; амбулаторне лікування; медичні витрати; сільські регіони КНР.*

Табл. 4. Форм. 3. Літ. 17.

Лижан Квин, Чень-ганг Ванг

ВЛИЯНИЕ НОВОЙ СХЕМЫ СЕЛЬСКОГО КООПЕРАТИВНОГО ЗДРАВООХРАНЕНИЯ НА ПОЛЬЗОВАНИЕ МЕДИЦИНСКИМИ УСЛУГАМИ В СЁЛАХ КНР

В статье исследовано влияние Новой схемы сельского кооперативного здравоохранения на пользование медицинскими услугами в сёлах КНР. Использование эконометрических подходов позволило сделать поправку на фактор цензуры при анализе данных. Результаты анализа доказали, что Новая схема существенно увеличила количество обращений к врачам в сёлах, а также расходы на медицину. При дальнейших расчётах в данной сфере необходимо учитывать, что объём погрешности будет во многом зависеть от качества выборки.

Ключевые слова: *Новая схема сельского кооперативного здравоохранения; амбулаторное лечение; медицинские расходы; сельские регионы КНР.*

1. Introduction

In the 1950s, Chinese government established the Cooperative Medical System (CMS), a government-provided medical insurance program for rural residents organized at the village level and managed by a government-appointed Committee. However, the CMS collapsed rapidly in most rural areas following the rural econom-

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ic reforms of the early 1980s. The coverage rate of CMS decreased from 90% to 5% between 1979 and 1984 (You and Kobayashi, 2009). According to the Ministry of Health of China (2004), 46% of the rural residents could not afford to see a doctor when they needed to. Not surprisingly, the World Health Organization (WHO) ranked China 188th (out of 191) in terms of medical and health fair evaluation (WHO, 2000).

Chinese Central Government has tried twice to re-establish the CMS in the late 1980s and early 1990s. However, both attempts failed due to the lack of funding. At the beginning of 2004, the Central Government initiated a New Rural Cooperative Medical Scheme (NRCMS). There are 2 significant differences between NRCMS and CMS. First, in CMS rural residents and their village collectives are fully responsible for medical insurance funds, while under NRCMS central and local government each pledges 10 RMB Yuan (1 USD = 6.3 RBM Yuan) for every participant. Second, participation in NRCMS is voluntary. The governmental subsidy greatly stimulated the participation in NRCMS nationwide. By the end of 2012, 2729 out of 2861 counties have adopted NRCMS with the total 814 mln rural participants.

The effectiveness of NRCMS in improving rural health service is controversial. Some studies show a positive impact of NRCMS on farmers' health (Yip and Hsiao, 2009; Wagstaff et al., 2009; Dai et al., 2012; Liu et al., 2013). The Evaluation Group of China New Rural Cooperative Medical Scheme (2006) finds that NRCMS reduces by 10.78% the number of farmers who did not go to see a doctor when they were sick. However, other studies did not support this finding (Han et al., 2009; Lei, Lin, 2009; Babiarz et al., 2012; Jiang, 2013). Based on several case studies, Han et al. (2009) find that NRCMS does not provide any incentive for farmers to use medical service due to low reimbursement. Using the data of China Health and Nutrition Survey, the study shows that NRCMS does not reduce medical costs of participants (Lei, Lin, 2009).

The majority of these studies mentioned above uses the household survey data and focuses mainly on the effect of NRCMS on developing regions (Central and Western China); no study has looked at the developed areas. From the technical standpoint, the typical approach used in these literature estimates a participation function as well as medical care expenditure function but ignores the censoring problems inherent in the survey: participating in NRCMS makes it possible for farmers to see a doctor due to hospital visits afforded and, consequently, this affects the range of the number of visits and medical payments. Failure to account for censoring in the data may affect the consistency and efficiency of the impact parameter estimates and, consequently, the inferences about the household-level impacts of NRCMS.

The objective of this article is to determine the ex-post impact of NRCMS adoption in rural Beijing using an econometric approach that explicitly accounts for censoring in NRCMS data. In particular, we estimate the effects of NRCMS on the frequency and costs of participants' outpatient visits, while addressing the potential selection, simultaneity, and censoring problems in the estimation.

Hence, this article contributes to literature in two ways. First, we add to the empirical understanding of the economic impact of NRCMS by analyzing the economic behavior of rural residents in suburban areas (rural Beijing) that has not been studied before. Second, we contribute by pointing out the importance of address-

ing censoring in impact estimation and showing potential inference errors that could occur when censoring is not accounted for in the impact analysis of NRCMS. This could help make researchers/analysts aware of the importance of addressing censoring problems in future studies that examine the economic impacts of NRCMS.

2. Data and methods

2.1. Data and empirical specification. The data used in the study comes from the sample of 570 household surveys in Chaoyang District, Beijing, China in 2008. Chaoyang District lies in the Eastern part of Beijing. Its per capita income was 15090 Yuan in the year 2008, which is 3.2 times as much as the national average (4761 Yuan in 2008). Governmental subsidy for NRCMS in Chaoyang District is 315 Yuan per capita, which is 6.3 times as much as the national average. So Chaoyang District is a developed area in China. 19 townships in Chaoyang District implemented different NRCMS policies in terms of deductible, ceiling, reimbursement rates and farmer enrolling payments.

An equidistance random sampling approach was adopted in the survey. A sample distribution of the variables used in the study is provided in Table 1. The dependent variables of interest are the dummy for NRCMS participation, the number of outpatient visits per capita, and outpatient medical expenditures per capita. The former one is used to evaluate the factors affecting NRCMS participation, and the latter two variables are used to measure the efficiency of NRCMS program.

Table 1. **Summary and definition of variables**

Variables	Definition of Variables	Means	Std. Error	Min	Max
PREM	Premium per person, 50 RMB yuan = 0, 100 RMB yuan = 1.	82.01	24.02	50	100
DEDU	Deductible, 0 RMB yuan = 0, 200 RMB yuan = 1.	27.50	89.76	0	200
AGEL	Age of household leader.	50.41	12.25	18	90
NUMB	Number of family members.	3.38	1.33	1	10
INCO	Income per capita in one family.	11795	6308	3714	60000
MARR	Marriage status of household leader, married = 0, devoiced or widowed = 1.	0.12	0.32	0	1
EDUC	Education status of household leader, below high school = 0, high school or above = 1.	0.21	0.41	0	1
MUTU	Mutually help status of people, average and worse = 0, better = 1.	0.47	0.05	0	1
CHRO	Whether has chronic disease member in one family, no chronic disease person = 0, at least one chronic disease person = 1.	0.53	0.50	0	1
CORR	Whether farmer worries about NRCMS funds would be corrupted, not worried = 0, worried = 1.	0.93	0.26	0	1
KNOW	Farmer knowledge about NRCMS designated hospital and clinics, referenced group: know = 0.				
KNOS	Know some of them = 1, otherwise = 0.	0.20	0.40	0	1
KNON	Do not know = 1, otherwise = 0.	0.02	0.14	0	1
PART	Whether the farmer enrolls in NRCMS, non-participation = 0, participation = 1.	0.97	0.18	0	1
OPVP	The number of outpatient visits per capita in one family.	2.63	4.31	0	40
OPCP	Outpatient medical cost per capita in one family.	813	1973	0	27333

Source: Authors.

In order to estimate the impacts of NRCMS a large number of factors need to be taken into account. To properly estimate the impact of NRCMS on outpatient visits and expenditure per capita, the control covariates used in the study are: (1) resource variables (income per capita; knowledge of the hospital or clinic; illness history in the family); (2) family demographic variables (education, age, and marriage status of household head; number of family members), and (3) participation costs (premium, deductible for reimbursement, and worrying about corruption). Those variables are observable characteristics that serve as the control variables to account for the factors that may affect the efficiency of NRCMS program.

2.2. Estimation procedures. Following McBride and El-Osta (2002), an extended three-step Heckman's technique is used in this study. First, we use a Probit model to estimate NRCMS participation equation. Second, the predicted probabilities of NRCMS participation and the Inverse Mill Ratio (IMR) are calculated. Finally, the probabilities and IMR are used as additional regressors to estimate the number of per capita outpatient visits and per capita medical expenditure equations.

Based on the first step, estimated parameters are used to estimate a random variable λ, known as the IMR as in the following:

$$\hat{\lambda} = \frac{\varphi(\hat{Z})}{\phi(\hat{Z})}, \text{ if the household is in the NRCMS program;} \quad (1)$$

$$\hat{\lambda} = \frac{\varphi(\hat{Z})}{1-\phi(\hat{Z})}, \text{ if the household is not in the NRCMS program.}$$

$\varphi(Z)$ is the standard normal density function, $\phi(Z)$ is the corresponding cumulative distribution function.

In the third step, the predicted probability (P_i) of the NRCMS program participation and the IMR (λ) are used in the following simultaneous equations:

$$Y_{1i} = \alpha_0 + \alpha X_i + \alpha_1 \hat{P}_i + \alpha_2 \hat{\lambda}_i + \varepsilon_{1i}, \quad (2)$$

$$Y_{2i} = \beta_0 + \beta X_i + \beta_1 \hat{P}_i + \beta_2 \hat{\lambda}_i + \varepsilon_{2i}, \quad (3)$$

where Y_{1i}, Y_{2i} are household outpatient visits per capita and outpatient medical cost per capita respectively; X includes all the factors affecting household outpatient visits and medical cost except P_i and λ. We use the seemingly unrelated regression (SUR) method to account for possibly correlated error terms in equations (2) and (3).

3. Results

3.1. Probit model. Table 2 presents the parameter estimates of the Probit model. The statistically significant variables that affect NRCMS participation including the insurance premium per capita, whether there are any family members with chronic diseases, the age of the household head, the attitude to corruption in the village government, and the knowledge of the hospital and clinic designated for treatment. The negative sign of the estimated parameter on premium per capita suggests that the participation rate decreases as the premium increases, which is consistent with the literature (Wang et el., 2006; Yip, Hsiao, 2009; Liu et al., 2013). Moreover, this result shows that it is difficult to enhance the premium even in developed rural areas of China. Meng (2008) and Liu et al. (2013) encourage the farmer pay about 1% of their annually income to join NRCMS. In the surveyed villages,

the premium is no more than 100 RMB Yuan per person. However, the highest premium per person in the sample is 100 RMB Yuan. The results indicate there are some shortcomings in the policies design. Yip and Hsiao (2009) and Jiang (2013) suggested that a lump sum payment for the whole family is one of the hurdles to farmers joining NRCMS.

Table 2. **The results of the determinants of participation in NRCMS (Probit procedure)**

Variables	Parameter
Intercept	0.2
	(1.04)
PREM	- 1.15 **
	(0.54)
DEDU	-0.12
	(0.37)
INCO	0.2
	(0.38)
CHRO	1.18***
	(0.46)
AGEL	0.05 ***
	(0.02)
MARR	-0.53
	(0.62)
EDUC	0.61
	(0.43)
MUTU	-0.09
	(0.32)
CORR	0.81*
	(0.45)
KNOS	-0.98***
	(0.35)
KNON	-1.74 ***
	(0.67)
Log Likelihood	-39.52

Notes: (1) ***, ** and * stand for 1%, 5% and 10% statistical significance respectively; (2) Standard errors are in parentheses.
Source: Authors.

The farmer's knowledge about the reference hospital and clinic does affect the decision on participation, supporting the findings of Zhang (2005), Zhang and Song (2007) and Wagstaff et al. (2009). The family's chronic disease history and the age of the household head have to do with high medical expenditures (You, Kobayashi, 2009; Liu et al., 2013). Participation also depends on the dummy variable representing whether the family is concerned with corruption, suggesting that participation in NRCMS is related with the confidence of managers in the village level, as shown in literature (Zhang, 2005; Jiang, 2013).

3.2. NRCMS effects on outpatient visits and outpatient medical costs. Table 3 presents the results for the impact of NRCMS on outpatient visits and outpatient medical cost per capita. In addition, the parameter estimates for the Heckman, Tobit, and SUR models are presented in Table 3. This paper mainly explains the

results of SUR model. The results of the Heckman and Tobit model's show the stability and significance of the parameters. Significances of lamda (λ) in both outpatient visits and outpatient medical cost indicate that the sample selection is indeed an issue here. The probability of NRCMS participation is the variable we are interested in. The SUR and Heckman models provide relative larger parameters than Tobit type model. We calculated the elasticities of outpatient visits per capita and outpatient medical cost per capita with respect to the probability of NRCMS adoption (Table 4). The elasticity of the frequency of outpatient visits per capita is 1.86 based in the SUR and Heckman model and 1.27 in the Tobit. The elasticity of outpatient medical cost per capita is 2.73 in the SUR and Heckman model and 1.53 in the Tobit. These imply that outpatient visits and medical cost will increase 1.86% and 2.73% respectively when the participation probability was enhanced 1%.

Table 3. **Results of impact NRCMS on outpatient visits and medical cost per capita**

Variable	Outpatient visits per capita			Outpatient medical cost per capita		
	SUR	Heckman	Tobit	SUR	Heckman	Tobit
Intercept	0.52*	- 0.52*	-0.17	4.32***	4.32***	4.20***
	(0.28)	(0.28)	(0.37)	(0.43)	(0.43)	(0.64)
PREM	0.63***	0.63***	0.47***	0.17	0.17	0.06
	(0.13)	(0.13)	(0.08)	(0.20)	(0.21)	(0.14)
DEDU	-0.42***	-0.42***	-0.42***	-0.1	-0.1	-0.06
	(0.10)	(0.10)	(0.10)	(0.15)	(0.15)	(0.15)
PART	1.91**	1.90**	1.31**	2.80**	2.80**	1.57**
	(0.86)	(0.86)	(0.31)	(1.34)	(1.34)	(0.56)
NUMB	-0.15***	-0.15***	-0.15***	-0.08*	-0.08*	-0.08*
	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.04)
INCO	0.06	0.06	0.08	0.1	0.1	0.11
	(0.07)	(0.07)	(0.06)	(0.10)	(0.10)	(0.10)
CHRO	0.47***	0.47***	0.62***	0.83***	0.83***	0.92***
	(0.13)	(0.13)	(0.08)	(0.19)	(0.19)	(0.13)
AGEL	0.01	0.01	0.01*	0.01	0.01	0.01*
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
MARR	-0.03	-0.03	-0.09	-0.13	-0.13	-0.18
	(0.13)	(0.13)	(0.14)	(0.21)	(0.21)	(0.20)
EDUC	0.11	0.11	0.17*	0.31*	0.31*	0.33**
	(0.11)	(0.11)	(0.10)	(0.17)	(0.17)	(0.15)
Lamda(λ)	0.18**	0.18**		0.16**	0.16*	
	(0.09)	(0.09)		(0.14)	(0.14)	
R-Square	0.28	0.28	0.12	0.17	0.17	0.16

Notes: (1) *, **, *** significance at the 10%, 5% and 1% levels, respectively; (2) Standard errors are in parentheses; (3) We use the predicted probability of participation to institute the real enrollment in NRCMS in the variable PART.
Source: Authors.

Table 4. **Elasticity of outpatient visits and medical cost per capita respectively to the predicted probability of participation in NRCMS**

Dependent variable	Outpatient visits per capita			Outpatient medical cost per capita		
Model	SUR	Heckman	Tobit	SUR	Heckman	Tobit
Value of elasticity	1.8581	1.8582	1.2732	2.732	2.732	1.5271

Source: Authors.

These results indicate that the effects of NRCMS tend to be underestimated without considering the sample selection issues. There is no strong consensus in the literature as to the effect of NRCMS on outpatient visits and outpatient medical expenditure. For example, Wagstaff et al. (2009), Yip and Hsiao (2009), Dai et al. (2012) and Liu et al. (2013) suggested that NRCMS improved the healthcare in rural China Han et al. (2009), Lei and Lin (2009), Babiarz et al. (2012) and Jiang (2013) argued that the effect was nil.

Other interesting variables in Table 3 include the premium, the deductible, the number of family members, and chronic disease. Premium per capita significantly increases the number of outpatient visits, while deductible significantly decreases outpatient visits. However, the coefficients of both variables are not statistically significant in the outpatient medical cost equation. The results also show that families associated with chronic disease member have more outpatient visits and outpatient medical cost than those without. The results may be explained by the growth of the per capita income in China. Improvement in living conditions of rich farmers in the recent years has lead to an increase in the consumption of high-protein and high fat food, and a decrease in physical exercise, resulting in the growth of chronic diseases among rural population.

4. Conclusion

This paper estimates the impact of NRCMS on medical service use in Chinese developed areas using econometric procedures accounting for simultaneity, selection, and censoring problems. The results of our analysis suggest that NRCMS has significantly increased the frequency of outpatient visits and outpatient medical costs.

The results have strong policy implications. First, in order to rebuild Chinese healthcare system, policy makers need to take into account such issues as local corruption, transparency in the NRCMS rules, regional income variations, as well as the disease history in a region. Second, the debates of the US healthcare reform to ensure Americans get high-quality, affordable care they need and deserve, Canadian style healthcare system as well as the status quo of the US healthcare system are highly mentioned in literature. Chinese healthcare system is still under development, but some experiences from developed countries may be used in future reforms.

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