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Assessing Fund Performance of China's Basic Medical Insurance for Urban Employees: A Model and an Empirical Test

Ying Zhang
Center for Social Security Studies, Wuhan University
Faculty of Applied Economics, Antwerp University
E-mail: fslys7@yahoo.cn

Xiaowei Zhang
Center for Social Security Studies, Wuhan University
Wuhan, P.R.China
E-mail: zhangxiaowei1983@gmai.com

***Abstract*—At present 33.81% China's employees do not enjoy basic medical insurance when they are at work. This paper mainly discuss 4 key factors, the growth rates of penetration, density, involved degree and structure-aging degree, which influence fund balance performance of China's basic medical insurance for urban employees via fund growth model and explore the possibility for involving more populations into this package. Our findings are as followed. On one hand, GDP and average premium increase would improve fund balance growth. On the other hand, involved and aging degrees have negative impacts on fund balance. The conclusion also prove adverse selection and moral hazard has reduced the efficiency of current basic medical insurance fund performance for urban employees.**

Keywords- China's basic medical insurance for urban employees; fund growth model; involved rate; fund balance

I. INTRODUCTION

By the end of 2008, there are 30,210 million populations who work in China's cities and towns, while 19,999 million of which have involve in basic medical insurance for urban employees. From Table I, both quantities and involved rate of employees in basic medical insurance system has increased rapidly during past 10 years. However, there are still approximately 33.81% employees do not enjoy basic medical insurance when they are at work.

TABLE I. INVOLVED RATE OF CHINA'S BASIC MEDICAL INSURANCE FOR URBAN EMPLOYEES

(1998-2008, Unit: Million, Percentage)

Year	Urban Employees	Employees Involved in Basic Medical Insurance System	Involved Rate	Involved Growth Rate
1998	21.616	1.878	8.687	/
1999	22.412	2.065	9.215	0.528
2000	23.151	3.787	16.358	7.143
2001	23.940	7.286	30.434	14.076
2002	24.780	9.401	37.939	7.505
2003	25.639	10.902	42.520	4.581
2004	26.476	12.404	46.848	4.328
2005	27.331	13.783	50.430	3.582
2006	28.310	15.732	55.570	5.14
2007	29.350	18.020	61.397	5.827
2008	30.210	19.996	66.189	4.792

Data Resource from China Statistical Yearbook, 2008

In this paper, we extend the analysis into following 4 questions. What's the current fund performance of China's basic medical insurance for urban employees? Which factors have influenced its balance and how much each weights? Is it possible to involve more workers into this package under 2%+6% rate? To solve these problems, several factors as insurance density, insurance penetration, involved degree and structure-aging degree would be introduced into our model.

II. LITERATURE REVIEW

Since 1998, China's basic medical insurance for urban employees has been calculated from employers and employees respectively. Employers' contribution rate is required as 6% of total wages, while employees contribute approximate 2%. There are three comparatively opposite attitudes towards this issue.

Some scholar considers 8% (2%+6%) is appropriate rate for fund sustainable in a long term [1]. Jia (2010) constructed the optimum premium rate model by national income redistribution system and labor force demand and supply system. His conclusion is 8% would be moderate during period of 2001-2050 which is also well situated with international experience. However, some paper believes current rate is not a relatively low level for China's social medical insurance system [2]. Liu (2002) approached the problem under two basic hypotheses. Firstly, they only calculate acute and critical illness in the system. Secondly, there are no limits for insurance indemnity. Therefore, appropriate level of social medical insurance rate should be settled at 2.66% of total wages. Nevertheless, some other scholars measure it from different aspects. He (2010) considered that the "structure-aging" trend of social medical insurance system will increase the fund risk and then affect its development [3]. They use life and non-life actuarial science model to calculate the vertical balanced rate of the social medical insurance system based on the long-term fund balance and tests it via urban employees' data in Hangzhou city. The final result is when premium rate and ROI reach 9.13% and 5% per year respectively, 25-year group could realize long-term fund balance.

We assume that two crucial criterions toward assessing optimum premium rate and coverage, efficiency and equity [4], should be employed in measuring China's basic medical insurance fund performance for urban employees. Efficiency means current premium rate and coverage could keep fund balance and be able to invite more workers to join. Equity, the most remarkable characteristic of social insurance, means the impact of information asymmetry should be reduced into

a relatively low level on the system. This paper will mainly work on the former.

III. DATA DYNAMIC ANALYSIS

With pervious literature analysis, five elements would be invited to assess current fund performance in this paper, fund balance, insurance density, insurance penetration, involved degree as well as structure-aging degree. We firstly focus on each index calculation method and its dynamic analysis.

A. *Fund Balance Measure*

We measure fund balance performance via balance growth rate, which equation as followed.

$$\text{Balance Growth Rate} = \frac{\text{Balance at year}_t\text{end} - \text{Balance at year}_{t-1}\text{end}}{\text{Balance at year}_{t-1}\text{end}} * 100\% \quad (1)$$

From Fig. I, we could find revenue, expenses, and balance's total amount of China's basic medical insurance fund for urban employees has grown gradually since 1998, while their growth rates have experienced a frustrated period, especially the balance at year-end in Fig. II.

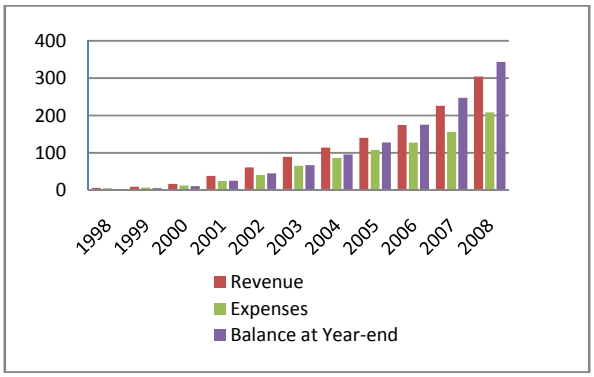

Figure I. Revenue, Expenses and Balance of China's Basic Medical Insurance for Urban Employees (1998-2008, Unit: Billion RMB)

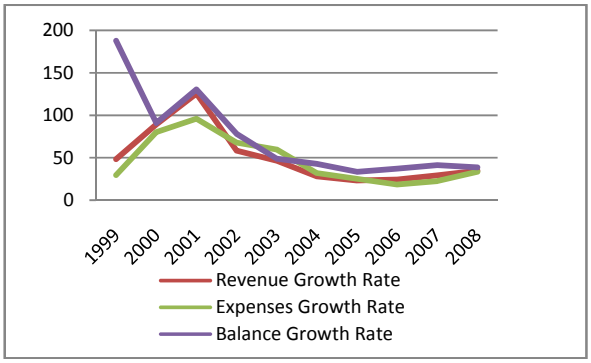

Figure II. Revenue, Expenses and Balance Growth Rate of Basic Medical Insurance for Urban Employees (1999-2008, Unit: Percentage)

B. *Insurance Penetration & Density Measure*

Insurance penetration and density are two basic concepts in assessing the importance of insurance industry and the development of average premium rate in one nation's economy. We introduce these two indexes in our model for measuring the relationship among economic development level, fund revenue and urban employees' population of this package. Equations are as followed.

$$\text{Penetration Growth Rate (PR)} = \left(\frac{\text{Fund Revenue}_t}{\text{GDP}_t} - \frac{\text{Fund Revenue}_{t-1}}{\text{GDP}_{t-1}}\right) / \left(\frac{\text{Fund Revenue}_{t-1}}{\text{GDP}_{t-1}}\right) * 100\% \quad (2)$$

$$\text{\& Density Growth Rate (SR)} = \left(\frac{\text{Fund Revenue}_t}{\text{Urban Employees No.}_t} - \frac{\text{Fund Revenue}_{t-1}}{\text{Urban Employees No.}_{t-1}}\right) / \left(\frac{\text{Fund Revenue}_{t-1}}{\text{Urban Employees No.}_{t-1}}\right) * 100\% \quad (3)$$

C. *Involved Degree Measure*

Involved rate is utilized to measure social medical insurance system's coverage and its change, which is the key factor for assessing the possibility of inviting more individuals to join this package. During past 10 years, the population of urban employees has increased 39.76% to 30.21million, while the number involved also enjoyed a rocket growth from 1.877 million in 1998 to 19.996 million at the end of 2008.

$$\text{Involved Growth Rate (IR)} = \left(\frac{\text{Urban Employees Inv.}_t}{\text{Urban Employees No.}_t} - \frac{\text{Urban Employees Inv.}_{t-1}}{\text{Urban Employees No.}_{t-1}}\right) / \left(\frac{\text{Urban Employees Inv.}_{t-1}}{\text{Urban Employees No.}_{t-1}}\right) * 100\% \quad (4)$$

D. *Structure-Aging Measure*

Structure-aging is a huge potential problem for current social security system [5]. Almost all the components, both pay-as-you-go and fully-funded system have faced with its threat. Right now, China has already moved into aging society, for the amount above 65-age occupied 8.3% of total population at the end of 2008, the increasing percentage of which would seriously influence current social medical insurance fund's long-term performance. We use the index of aging growth rate to measure its relationship with balance growth.

$$\text{Aging Growth Rate (AR)} = \left(\frac{\text{Age above 65 No.}_t}{\text{All Population}_t} - \frac{\text{Age above 65 No.}_{t-1}}{\text{All Population}_{t-1}}\right) / \left(\frac{\text{Age above 65 No.}_{t-1}}{\text{All Population}_{t-1}}\right) * 100\% \quad (5)$$

From table II, we could find five catalogues of data respectively. GDP, fund revenue and its balance has been adjusted by GDP index (1978) and inflation index.

TABLE II. FIVE INDEXES' GROWTH RATES DATA IN MODEL (1998-2008, UNIT: PERCENTAGE)

Year	Balance Growth Rate	Penetration Growth Rate	Density Growth Rate	Involved Growth Rate	Aging Growth Rate
1999	187.813	32.54	39.55	0.528	0.2
2000	90.83	68.67	70.96	7.143	0.1
2001	130.362	101.96	104.2	14.076	0.1
2002	78.142	39.73	44.4	7.505	0.2
2003	48.786	27.92	29.74	4.581	0.2
2004	42.842	12.4	8.87	4.328	0.1
2005	33.427	7.38	7.51	3.582	0.1
2006	37.108	7.38	7.48	5.14	0.2
2007	41.345	10.06	6.4	5.827	0.2
2008	38.548	20.16	15.1	4.792	0.2

Data Resource from China Statistical Yearbook, 2008

IV. Model and Empirical Results

A. Model Specification

To test relationship between fund balance growth and other four factors above, we develop following model.

$$\ln\widehat{BR}_t = \beta_0 + \beta_1 \ln PR_t + \beta_2 \ln SR_t + \beta_3 \ln IR_t + \beta_4 \ln AR_t + \mu_1 \quad (6)$$

For data's natural logarithm transformation does not change their original cointegration, which could make trend linear and eliminate time series' heteroskedasticity. We use their natural logarithm form $\ln\widehat{BR}_t$ for fund balance growth rate, $\ln PR_t$ for penetration growth rate, $\ln SR_t$ for density growth rate, $\ln IR_t$ for involved growth rate, $\ln AR_t$ for structure aging growth rate, $\mu_1 \sim N(0, \sigma^2)$, instead of $\widehat{BR}_t$, PR_t, SR_t, IR_t, AR_t in our model.

B. The Fund Growth Model

Our estimated equation for fund growth is as followed.

$$\ln\widehat{BR}_t = 2.742 + 0.356 \ln PR_t + 0.207 \ln SR_t - 0.337 \ln IR_t - 0.073 \ln AR_t$$
$$(4.606) \quad (0.561) \quad (0.373) \quad (-2.497) \quad (-0.250)$$
$$R^2=0.866, \ D.W=2.218 \quad (7)$$

An examination of the regression results using China's data for the period 1999-2008 suggest that $\ln\widehat{BR}_t$ has positive coefficients with $\ln PR_t$ and $\ln SR_t$, negative coefficients with $\ln IR_t$ and $\ln AR_t$ and are significant at least at the 5% level. The results of the diagnostic tests indicate no obvious model inadequacy.

C. Empirical Results

From the equation above, we find two results in accordance with China's current social medical insurance fund performance.

(1) Balance performance at year end would be better when penetration and density growth rate have mounted up. That is to say, the increase of GDP and average premium per person would improve the fund balance of China's basic medical insurance for urban employees. This result is supported by China's current situation. We could also forecast its performance would get stronger when national economic circumstance keep on turning to better account.

(2) Balance performance at year end would be worse when the growth rate of involved degree and structure-aging degree have risen. The argument that structure-aging has negative impacts on the fund balance performance of both pension and medical insurance is proved by many literatures before. However, the significant result found by us demonstrate that involved rate almost perform in the same shoes.

D. Further Explanation

In theoretically, this finding doesn't follow the law of large number's arrangement, which requires when more population involves, the actual loss would be closer to expected result with an unlimited number of units. However, it reaches an interesting question we have discussed on pervious paper [6].

In China's practice, one third of total amount's absence could be divided into two catalogues. On one hand, poor people who have strong intention to join the package are unable to do so. Lower income means lower premium while poorer health means higher benefits, but their absence partly because they do not have enough money to pay for premium every month and partly because their employers are tend to escape from 6% responsibility as well.

On the other hand, rich people's absence is also due to two reasons. First, they earn more salary and enjoy less health risk on average, therefore it's unnecessary for them to buy social insurance with more premium contribution and less insurance payment. Second, social insurance is less attractive and competitive compared with commercial insurance who could offer more personalized products with various prices levels.

V. Concluding Remarks

The issue of basic social medical insurance fund assessment has been one of the important research areas in social welfare for the past decades. The paper is attempt to apply four relevant measurements, insurance density, insurance penetration, involved degree and structure-aging degree to examine empirically assumptions of the real growth variable in fund growth equation.

With our empirical findings, we could finally answer the last question at paper's beginning. It would be a bit difficult to push down 8% insurance rate to cover more low-income employees without the participation of high-income group. Further works need to be done in mechanism design when market failure is occurred in public good supply system.

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