



Determinants of Medical and Health Care Expenditure Growth for Urban Residents in China: A Systematic Review Article

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Abstract

In recent years, medical and health care consumption has risen, making health risk an important determinant of household spending and welfare. We aimed to examine the determinants of medical and health care expenditure to help policy-makers in the improvement of China's health care system, benefiting the country, society and every household. This paper employs panel data from China's provinces from 2001 to 2011 with all possible economic variations and studies the determinants of medical and healthcare expenditure for urban residents. CPI (consumer price index) of medical services and the resident consumption level of urban residents have positive influence on medical and health care expenditures for urban residents, while the local medical budget, the number of health institutions, the incidence of infectious diseases, the year-end population and the savings of urban residents will not have effect on medical and health care expenditure for urban residents. This paper proposed three relevant policy suggestions for Chinese governments based on the findings of the research.

Keywords: Medical care expenditure, Health risk, Government policy, Urban residents

Introduction

In recent years, China's medical and health care expenditures have increased. Medical and health care for urban residents reached CNY 1.25907 trillion in 2011, accounting for 10.1% of the total disposable income of urban residents. Medical and health care are now the 4th largest consumer goods among the Chinese (1), following food, living and transportation, and communication, which poses greater pressure on society and each household. Against the backdrop of China's medical and health care reform, it is of great practical significance to study the medical and health care expenditures of urban residents.

Scholars at home and abroad have conducted a large quantity of research on medical and health care expenditures from the supply and demand perspective. From the demand side, economic growth, resident income and an increase in the demand for health care have resulted in an increased demand for medical and health care consumption (2-7). In addition, with a large aging population, the prevalence of diseases and medical expenditures are on the rise (8). Moreover, as living standards improve, people have higher requirements and consciousness for health, which also increase the demand for medical and health

care products (9-12). From the supply side, the inelasticity or low elasticity of medical service prices, the higher salaries of medical staff, and the advanced medical technologies lead to higher medical costs (13-18).

From both the supply and demand sides, many factors contribute to higher health care expenditures.

What drives medical and health care expenditure? Many scholars have conducted relevant research and propose many findings concerning this question, but there is still no convincing answer. This is because most researchers used a multiple regression model, influenced by multicollinearity and random variable selection. What's more, due to the introduction of other explanatory variables, some highly relevant variables become irrelevant variables, reducing the reliability of these methods. An Extreme Bounds Analysis model has better performance in examining the interference-resistant robustness. This paper employs panel data from China's provinces between 2001 and 2011 and conducts an empirical analysis of the determinants of medical and health care expenditure based on an EBA model. These interference-resistant "robust" determinants can provide experience and reference for medical reform policy-making.

Analysis of the Potential Determinants of China's Medical and Health Care Expenditures

In recent years, during economic transformation, medical and health care consumption has risen, making health risk an important determinant of household spending and welfare. Examining the determinants of medical and health care expenditure helps policy-makers in the improvement of China's health care system, benefiting the country, society and every household.

Per capita GDP

As a type of consumption, medical and health care expenditure is closely linked with per capita GDP. Newhouse first proposed that income is an important determinant of medical expenditure growth. This conclusion has been proven by many

follow-up studies. There is a strong correlation between medical expenditure and per capita GDP.

Per capita disposable income

Based on the Grossman model, as per capita disposable income increases, the marginal return of health care investments rise and people have a greater demand for health care products. With more disposable income, consumers have higher spending power, leading to higher health care expenditure.

Price index of medical and health care service

Based on the supply-demand model, higher prices of medical and health care services move the supply curve to the right. With an inelastic price, the demand curve also moves to the right, resulting in higher medical and health care expenditure. This is a passive increase.

Government spending on medical and health care

Along with China's medical system, most of the medical expenditures fall on the population. Government spending on medical and health care is shrinking, while the population's medical expenditure is increasing. The relations between local medical and health care spending and personal health care consumption are complicated.

Aging

According to China's 4th national medical service survey, as industrialization, urbanization, and aging are speeding up, people have greater demands for medical and health care. In particular, the prevalence of chronic diseases, which are both time and money consuming, raises medical expenditures.

Awareness of medical and health care

Since the reform and opening up, people's awareness of the necessity and urgency of health is stronger, and has reached a new height in the past decade. In the past, people ignored ailments, endured illness, and dreaded serious illness. Now people tend to see a doctor when they become sick and even pay attention to health care when

they are healthy. High enthusiasm about health is one reason that drives up medical expenditures.

Advanced medical technology

With the fast development of science and technology, advanced technology and materials are widely used in clinical practice, reforming traditional diagnostics and treatment methods. On the one hand, this improves the level of diagnosis and treatment, prolongs lives, and improves the quality of life. On the other hand, it drives up medical costs. Viewed from the demand-supply model, with inelastic or less elastic medical prices, higher medical costs will cause medical and health care expenditures to increase.

Medical insurance

Insurance influences medical demands via relative price. A premium is paid by the third party. This means that consumers pay less for medical insurance. If medical service complies with economic principles, medical insurance will increase public usage of medical services. This leads to higher medical demands and medical expenditures and thus the price of medical services will increase.

Research Design

Model

Levine and Renelt proposed a MLR (multiple linear regression) model that evaluates the correlation between different explanatory variations and the robustness of economic growth. The model is called an EBA (the extreme bounds analysis) model.

$$\Delta Y = c + \beta_i I + \beta_m M + \beta_z Z + u [1]$$

In the above formula, ΔY is the GDP growth rate of a country or a region (or investment to GDP ratio). I is a set of core variations, which are directly relevant to economic growth. M is a target variation. The target variations we study include economic policies and economic systems. Z is a set of conditional variables, which have an underlying correlation with economic growth. The reason why Z is introduced is to determine the range of values for the coefficient β_m of M . The selection

of I and Z is based on previous literature and prior research findings. Levine and Renelt's study in 1992 arrives at the following conclusion: changes to I and Z do not influence the conclusion of the model analysis.

Selection of variables

When analyzing the determinants of medical and health care expenditures, we selected the per capita medical and health care expenditure (CPM) of urban residents as a dependent variable.

Based on the above analysis and data availability, this paper selects nine possible determinants of medical and health care expenditures for the empirical study.

1) *Per capita disposable income of urban residents (CPDI)*

This is the portion of total income that can be used in daily living consumption. PDI is the total income less income tax and social security and subsidy charges.

2) *Consumer price index (CPI)*

The CPI is an important indicator for inflation, which reflects the price changes of consumer goods and services. In addition, a critical factor influences economic growth. Generally speaking, similar to the MPI (medical price index), the CPI and economic growth move in the same direction.

3) *Consumption level of urban residents (CC)*

It is the per capita spending of permanent urban residents, including goods and services, to meet the demands of living, development and entertainment. It reflects the quantity and quality of goods and service consumption. The level of consumption is positively correlated with economic growth. Level of consumption (CNY/person) = resident consumption in GDP within the reported period/total population within the reported period.

4) *Local government medical budget (GMB)*

According to the "2012 Government Revenue and Expenditure Classification", there are 210 groups of "medical and health care expenditures". These 210 groups fall into seven categories, including administrative spending on medical and health care, public hospitals, grass-root medical and health care institutions, public health, medical insurance, TCM (traditional Chinese medicine), and food and drug administration.

5) *Number of health institutions (NHI)*

Medical and health care institutions are institutions established for disease diagnosis and treatment in accordance with the law, including medical institutions, centers for disease control and prevention (CDC), blood transfusion centers, health supervision and inspection agencies, medical research and training institutions, institutes of health education, sanatoriums, out-patient departments, clinics, health centers, and first-aid stations.

6) *Incidence of infectious diseases (IID)*

According to the “Law on the Prevention and Control of Infectious Diseases”, infectious diseases are categorized into A, B, and C groups based on the pattern, speed and seriousness.

7) *Year-end population (P)*

These data are the year-end population of different regions. Larger populations, especially larger aging population, will increase medical and health care expenditure (19, 20).

8) *Urban residents RMB saving (CSK)*

As a proxy variable of saving, CSK refers to the sum of RMB and foreign currency deposits in banks and other financial institutions by urban residents at a specific time. It includes both RMB deposits and other foreign currency deposits.

Data sources and processing

This paper employs the panel data of 30 Chinese provinces (not including Tibet) between 2001 and 2011. Sources of data include the “China Health Statistics Yearbook”(21), the “China Statistics Yearbook”(1), the provincial statistics yearbooks(1), the China POPIN (CPDRC, China Population and Development Research Center), the OECD website, and the CEInet database. To discount price factors, per capita GDP, CIP and other data involving the value form are calculated at a constant price using 2001 as the base period.

Variable selection

1) *Explained variables*

CPM per urban household.

2) *Core variables*

Per capita GDP (GDPP). This paper employs the GDPP after discounting inflation factors.

3) *Target variable set*

CPDI, CPI, MPI, CC, GMB, NHI, IID, P, CSK.

4) *Conditional variables*

The fixed investment, dummy variables and fiscal revenue of east, middle and west China, and three linear combinations of three conditional variables (excluding the target variables).

Results

The basic model test

According the principles of an EBA model, the first step is to perform linear regression with the target variables, namely CPDI, CPI, MPI, CC, GMB, NHI, IID, P, and CSK. Next, determine their statistical significance. At first, to ensure the correctness of data selection, this paper performs linear regression of P with per capita GDP. The result is statistically significant. The model of the first step is as follows:

$$\Delta Y = c + \beta_i I + \beta_m M + \mu [2]$$

Where ΔY is the per capita medical expenditure of urban residents; I is the per capita GDP of 30 Chinese provinces, municipalities, and autonomous regions between 2001 and 2011, excluding Tibet; and M is one variable out of the nine target variables. Using Eviews 6.0, we test the statistical significance of the variable M . If the t value of coefficient β_m is statistically significant, M passes the first step; if not, M does not pass the first step and cannot continue into the second step of the EBA or cannot be used as a conditional variable. The test model is as follows:

$$\ln P = \alpha + \beta_i \ln PGDP + \beta_m M + \mu [3]$$

Because this paper utilizes panel data, it is necessary to conduct the Hausman test before the first step of estimation to determine if the regression model is a fixed-effect model or a random-effect model. Table 1 shows the result of the Hausman test. From it, we can see that the regression model of the NHI is a random-effect model while the models of the CPDI, the CPI, the MPI, the CC, the GMB, the IID, the P and the CSK are fixed-effect models.

Based on the result of the Hausman test, the result of the target, core, and conditional variables in

model [3] are shown in Table 2. We can see that seven target variables, not including the CSK and the NHI, pass the first step of the EBA test, indi-

cating that the CPDI, the CPI, the MPI, the CC, the GMB, the IID, and the P have correlations with medical and health care expenditures.

Table 1: The Hausman test results

Target variable	Chi-SP.Statistic	Chi-Sq.d.f.	Prob.	Model
MPI	18.6436	2	0.0001	Fixed
PDI	6.5695	2	0.0374	Fixed
CC	39.8194	2	0.0000	Fixed
P	71.3458	2	0.0000	Fixed
CPI	18.6455	2	0.0001	Fixed
GMB	18.5296	2	0.0001	Fixed
CSK	43.9807	2	0.0000	Fixed
NHI	8.7277	2	0.5273	Random
IID	4.9258	2	0.0852	Fixed

Note: The significance level is 10%.

Table 2: The first step of EBA test

Target Variable	β_m	t-Statistic	Prob.	Pass or failure to pass
MPI	626.4070	5.8957	0.0000	Y
PDI	0.0347	11.3838	0.0000	Y
CC	0.0158	4.2909	0.0001	Y
P	-0.1410	-5.0866	0.0000	Y
CPI	626.3534	5.8951	0.0000	Y
GMB	0.6616	5.2101	0.0000	Y
CSK	-0.0020	-0.6734	0.5012	N
NHI	-0.8641	-2.8535	0.1902	N
IID	3.4600	14.4248	0.0083	Y

Note: The significance level is 5%."Y" means pass, "N" means failure to pass.

The test of "Robustness"

Conduct traversing estimations of the CPDI, the CPI, the MPI, the CC, the GMB, the IID, and the P. The regression model is shown below:

$$\Delta Y = \alpha + \beta_i I + \beta_m M + \beta_z Z + \mu [4]$$

Where ΔY is the per capita medical expenditure of urban residents; I is the population of 30 provinces, municipalities, and autonomous regions between 2001 and 2011; M is one of these seven variables that passed the first step; and Z is the conditional variable set of the linear combinations of three random conditional variables, excluding M . Next, test the "robustness" of the target variable M . For each target variable, if 90% of the t value of β_m is statistically significant, we say the target variable has an interference-resistant "robust" in-

fluence on the growth of health expenditures. Otherwise, the variable fails to pass the second step, which means that it does not have an interference-resistant "robust" influence on the growth of health expenditures.

After several regression tests, we obtain the traversing coefficient β_m , the value of t , and the value of p and the significance distribution of the variables, as shown in Table 3. From it, the per capita disposable income of urban residents passes the EBA "robustness" test with 100% significance, indicating its strong interference-resistant "robust" influence on the growth of health expenditures. The significances of CPI, MPI and CC of urban residents are 97.1%, 95.9% and 91.8%, respectively, indicating their certain interference-

resistant “robust” influence on the growth of health expenditures. The significances of GMB, IID and P are 58.9%, 64.6% and 24.7%, respectively. These three factors fail to pass the Sala-I-

Martin “robustness” test, indicating that they have no interference-resistant “robust” influence on the growth of health expenditure.

Table 3: The test results and analysis of “Robustness”

Target Variable	β_{m-max}	t-Statistic	Prob.	β_{m-min}	t-Statistic	Prob.	Significance Distribution(%)	Pass or failure to pass
MPI	0.5632	3.1439	0.0000	-0.4973	-1.6893	0.0345	95.9	Y
PDI	4.2789	7.2343	0.0000	1.0615	5.6588	0.0121	100	Y
CC	0.0047	3.4000	0.0002	-0.0684	-1.3279	0.2303	91.8	Y
P	2.5717	4.8225	0.0000	0.6083	2.2826	0.0003	24.7	N
CPI	0.3061	4.5680	0.0000	-0.7926	1.4568	0.0573	97.1	Y
GMB	1.9864	6.8354	0.0000	0.8536	3.6717	0.0258	59.8	N
IID	3.7379	7.2790	0.0023	-0.4589	-8.4478	0.0000	64.6	N

Note: The significance level is 10%. “Y” means pass, “N” means failure to pass.

Test results analysis and discussion

As can be seen from table 3, there is a positive “robust” correlation between the PDI of urban residents and medical and health care expenditures. According to the theoretical framework of Grossman and the medical demand analysis of Chunhui Y et al.(18), income has two influences on urban residents’ medical and health care expenditures: one is the wealth effect, namely the more people earn, the more their medical and health care expenditures are; the other is the health depreciation effect, which means that people with lower incomes tend to trade their health for income. The faster their health depreciates, the higher their medical and health care expenditures are. Therefore, there are two influencing factors of income on medical and health care expenditures. Compared with rural residents, urban residents, as the study object of the paper, have higher income and are more influenced by the wealth effect. Thus, the PDI of urban residents has a positive “robust” correlation with the medical and health care expenditures of urban residents. This result is unanimous with the findings of Pingping H (8).

Also from table 3, CPI and MPI have a strong interference-resistant “robust” influence on the growth of health expenditure. As CPI rises, especially that of medical services, the price of health

and medical products increase. With inelastic price of medical service, medical and health care expenditure will also rise. This result is consistent with the findings of Xingshen L, Yuan S and Jie P et al. (22, 23).

The consumption level of urban residents has certain interference-resistant “robust” influences on the growth of health expenditures. Because medical and health products are not low-priced goods, when the CPI rises, both the quantity and the ratio of medical and health care expenditures will increase. Moreover, considering the consumption function, the CPI is positively correlated with disposable income: higher disposable income means higher consumption. Therefore, the CPI has similar influences on medical and health care expenditures as disposable income.

Conclusions and Policy Suggestion

Among the nine determinants studied in this paper, PDI, CPI, MPI, CC of urban residents passed the EBA “robustness” test, indicating their interference-resistant influence on medical and health care expenditures for urban residents. The government medical budget, the number of health institutions, the incidence of infectious disease, the year-end population, and the deposits of urban residents failed to pass the EBA “robustness”

test, indicating they have no interference-resistant influence on medical and health care expenditures for urban residents(24). We propose the following policy suggestions based on the previous findings. First, adopt effective macro-economic policy to increase the income of urban and rural residents, improve the health of the labor force, gradually eliminate the income disparity, and increase the marginal propensity of medical and health care consumption. Realize the transformation from living survivability consumption to development consumption and enhance the demand level by means of government subsidies and tax cuts. Meanwhile, strengthen supervision of the price and quality of medical services and products to ensure that hard-working people enjoy better medical and health services.

Second, accelerate medical and health care reform. A basic medical and health care system covering urban residents and an improved medical insurance system should be built in China. In addition, the government must strengthen supervision on and regulation of the price and usage and supply of medicines and promulgate more efficient medical pricing standards. Under the premise of increasing government investment, the government must adjust current medical fees and provide affordable medical and health services for all people, especially people living in middle and west China. Of note, the supply of medical and health care services should adapt to economic growth and the growth of per capita GDP to ensure that people enjoy basic medical and health care services and no excessive consumption of scarce resources occurs.

Third, establish and improve community medical and health care systems. At present, our development of medical and health care services is lagging. Urban residents rush to large hospitals even with minor ailments, causing an over-concentration of medical resources and a monopoly. Community medical and health care systems cover a wider range of services and are highly accessible, curing many common illnesses while reducing the pressure on large hospitals and medical costs and lowering the burden on patients to avoid wasting scarce medical resources.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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