

The Impact of Government Health Expenditure on Economic Growth

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Abstract. At present, China is in an important strategic opportunity to promote the construction of Healthy China, and it is of great practical significance to study the economic growth effect of China's government health expenditure in this context. Based on the Cobb-Douglas production function, this paper explores the impact of government health expenditure on economic growth by using a two-way fixed effects model with panel data from 30 provincial regions in China between 2011 to 2020. The full-sample estimation results show that government health expenditure has a significant positive effect on economic growth. Further analysis finds that the economic growth effect of government health expenditure can be realized by increasing residential consumption expenditure. Taking different approaches to regional division, it is found that the effect of government health expenditure on economic growth is differentiated in different regions, specifically, the more obvious the driving effect is as the level of economic development increases. With the emergence of new problems and challenges that restrict the development of the health field, government departments should accelerate the improvement of China's public health care policy.

Keywords: Health expenditure; economic growth; consumption; regional differences.

1. Introduction

On October 25, 2016, the Central Committee of the Communist Party of China and the State Council issued the the Plan of Healthy China 2030, which is the first medium and long-term strategic plan in the field of health proposed at the national level since the founding of the country. Since the reform and opening up, China's health field reform and development have made remarkable achievements, the medical and health service system is increasingly sound and the people's health level and physical quality continue to improve. However, industrialization, urbanization and population aging have brought a series of new challenges to the maintenance and promotion of health. At the same time, the contradiction between the overall shortage of health service supply and the growing demand is still prominent, and the coordination between the development of the health field and economic and social development needs to be enhanced. In the future, we need to solve major and long-term issues related to health from the national strategic level, and China is currently in an important strategic opportunity period to promote the construction of Healthy China. Therefore, we should pay attention to: What kind of contribution does government health expenditure make to the growth of the national economy? As a country with a wide range of regional economic development levels, how does the impact of government health expenditure on economic growth differ from region to region? By studying these questions, it is important for government to grasp the scale of health expenditure, improve the medical security system and optimize the structure of health financial expenditure.

As for the theoretical analysis, this paper analyzes the effect of government health expenditure on economic growth based on the neoclassical growth model and the endogenous growth model, as well as the mechanism principle and heterogeneity of this effect. In terms of the empirical analysis, this paper selects panel data of 30 provincial regions in China from 2011 to 2020 to study the relationship between government health expenditure and economic growth and uses mechanism tests to further verify the effect of government health expenditure on economic growth by increasing residential consumption expenditure. At the same time, the variability of the impact of government health expenditure on economic growth in different regions is analyzed through heterogeneity.

This paper is structured as follows: First, a theoretical analysis, including a review of relevant literature and a theoretical model. Second, a two-way fixed-effects model for the basic regression, mechanism testing, and heterogeneity analysis. Third, verification of the robustness and endogeneity of the results. Finally, research conclusions and related recommendations.

2. Review of the Literature

2.1 Review of Foreign Literature

Research on the relationship between health expenditures and economic growth first originated in the 1970s with Kleiman (1974) and Newhouse (1977). In response to early studies questioning the smoothness between health expenditures and GDP, Jewell et al (2003) reexamined the smoothness of health expenditures and GDP in a panel context and found that both health expenditures and GDP were smooth in the one or two level break case through models that were able to identify structural mutations. Aísa and Pueyo (2006) found that public health expenditures have a positive effect on life expectancy, savings, and economic growth, and that if the effect is strong enough, it can offset the negative impact of investment in resource utilization. Wang (2011) further obtained from panel regression analysis and quantile regression analysis that health expenditures stimulate economic growth, based on health expenditure data for 31 countries from 1986 to 2007, and the impact of expenditure growth on economic growth is positive in countries with medium and high levels of economic growth. Amiri and Ventelou (2012) used a modified version of Toda-Yamamoto's Granger causality test to examine the causal relationship between GDP and health care expenditure in OECD countries, and the results of the study showed that bidirectional Granger causality dominates.

2.2 Review of Domestic Literature

The vast majority of early foreign analyses of health expenditures have focused on the impact of total health expenditures on economic growth while ignoring the different situations of the three components of total health expenditures. Based on this, domestic scholars have further studied government health expenditures among them. Ping Jiang and Chengshi Tian (2009) analyzed the panel data of 30 provincial-level regions from 1997 to 2012 and showed that government input in the health sector has a significant impact on economic growth and has obvious geographical characteristics, i.e., the scale of government input is lower in central and western regions compared with eastern regions. By constructing a fixed-effects model for three regions in the east and west of China, Bonai Fan and Diandian Zhang (2014) concluded that there were significant spatial and temporal differences in government health care fiscal expenditures on economic growth. Based on the geographical division of regions, Xiaomin Zhong and Liumei Yang (2016) divided 30 provincial regions into four regions with different levels of development according to the level of economic development and found that the contribution of health care expenditures to economic growth differed significantly among regions. In terms of mechanism, Chunhai Tao and Yuxiao Wang (2018) show that by increasing spending on health care, the government promotes an increase in residents' income balance, which in turn leads to an increase in consumer spending and stimulates domestic consumption demand, thus promoting economic growth.

In summary, the study examines the positive impact of government health expenditure on economic growth based on the impact of mechanisms such as consumption, income, savings, and life expectancy, as well as the heterogeneity of the impact of government health expenditure on regional economic growth. In addition, considering that there are large differences among regions in China, other control variables need to be introduced to eliminate interference when constructing the framework of the effect of government health expenditure on economic growth. In this paper, control variables are selected from the labor force level, population structure level, urban-rural gap level and urbanization level.

2.3 Research Hypothesis

In the last decade, the government has increased health expenditure year by year, and at the same time, China's economy has shown a steady upward trend. Combined with the above literature review, it is clear that government health expenditure has an influential relationship on economic growth. Therefore, this paper introduces government health expenditure into the Cobb-Douglas production function, on which the economic growth effect of government health expenditure is studied. Therefore, research Hypothesis One is proposed.

Hypothesis One: Government health expenditure has a positive contribution to economic growth.

Scholars at home and abroad have explored the mechanism of government health expenditure to promote economic growth in various aspects, but the current research mainly focuses on government health expenditure to promote economic growth by improving the health level of residents and improving the quality of labor force. In this paper, we refer to Yuan Hong (2009) to study the transmission mechanism from the perspective of residents' consumption, that is, government health expenditure belongs to the government's consumption expenditure on people's livelihood, and the increase of government health expenditure can reduce residents' expectation of "large rigid expenditure" in a certain period in the future, improve their optimism of future consumption, stimulate their consumption demand and increase immediate consumption expenditure. Therefore, research Hypothesis Two is proposed.

Hypothesis Two: Government health expenditure drives economic growth by increasing residential consumption.

The vast size of China, the differences in the degree of development of resources and the efficiency of resource utilization in different regions have led to serious imbalances in economic development in each region, so the impact of government health expenditure on economic growth will also show regional differences. According to Hong Fan and Pan Chen (2016), government health expenditure can significantly promote economic growth, but with obvious regional differences, showing the strongest situation in the East, followed by the central region and the weakest in the West. At present, most scholars mainly use the traditional division method of East, Central and West for heterogeneity analysis, but this simple geographical location division cannot accurately portray the actual situation of economic development level. Therefore, this paper refers to Xiaomin Zhong and Liumei Yang (2016) for regional division from the perspective of regional development. Therefore, research Hypothesis Three is proposed.

Hypothesis Three: There is significant regional variability in the impact of government health expenditure on economic growth.

3. Research Design

3.1 Data Sources

Based on the availability of data, this paper selects the data of 30 provincial regions in China from 2011 to 2020 (some data are excluded because of missing data in Tibet). The data used in this paper are obtained from CSMAR, the China Statistical Yearbook and provincial statistical yearbooks, and all continuous variables are winsorize on 1% and 99%.

3.2 Models and Variables

In this paper, the Cobb-Douglas production function is used as the basic model for the study, and its general form is shown in (1):

$$Y = AK^{\alpha}L^{\beta} \quad (1)$$

Where Y represents output; A represents the level of technology; K represents the amount of input of capital; L represents the amount of input of labor; α represents the output elasticity of capital; β represents the output elasticity of labor and assumes constant payoffs to scale, i.e., $\alpha + \beta = 1$.

In the study of this paper, government health expenditure (Health) will be introduced and linearized by taking the natural logarithm on both sides of the equation. The extended production function model is shown below:

$$\ln Y = \ln A + \alpha \ln K + \beta \ln L + \delta \ln \text{Health} + \varepsilon \quad (2)$$

Where α , β , and δ represent the output elasticities of capital, labor, and government health expenditures, respectively; ε is the residual of the regression equation.

$$\ln \text{GDP}_{it} = \beta_0 + \beta_1 \ln \text{Health}_{it} + \beta_2 \ln \text{Employment}_{it} + \beta_3 \text{Oldratio}_{it} + \beta_4 \text{ChildrenRatio}_{it} + \beta_5 \text{IncomeGap}_{it} + \beta_6 \text{UrbanRatio}_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (3)$$

In the above model, the explained variable is the gross domestic product of each region ($\ln \text{GDP}$), which is used as a proxy variable for economic growth. The explanatory variable is government health expenditure ($\ln \text{Health}$), which is explained in the China Statistical Yearbook as: government expenditure at all levels on various undertakings such as medical and health services, medical insurance subsidies, health and medical insurance administration, and expenditure on population and family planning affairs. The control variables are divided into labor force level: number of employed persons ($\ln \text{Employment}$), population structure level: Old-age dependency ratio (OldRatio) and child-age dependency ratio (ChildrenRatio), urban-rural gap level: urban-rural income gap (IncomeGap), and urbanization level: urbanization rate (UrbanRatio). The variables are explained in the following table:

Table 1 Variable definitions and calculation methods

	Meaning	Variable Name	Variable Definition
Explained variables	Gross regional product	$\ln \text{GDP}$	Logarithm of Gross Domestic Product by Region
Explanatory variables	Government health expenditure	$\ln \text{Health}$	Logarithm of government health expenditure by district
	Number of employed persons	$\ln \text{Employment}$	Log of employed persons
	Old-age dependency ratio	OldRatio	Ratio of the number of elderly people to the number of working-age people by region
Control variables	Child-age dependency ratio	ChildrenRatio	Ratio of the number of children and adolescents to the number of working-age population by region
	Urban-rural income gap	IncomeGap	Ratio of per capita disposable income of urban residents to per capita disposable income of rural residents
	Urbanization rate	UrbanRatio	Share of urban population at the end of the year

4. Empirical Results

4.1 Descriptive Statistics

The small standard deviation of $\ln \text{GDP}$ and $\ln \text{Health}$ from 2011 to 2020 indicates that the dispersion of these two variables is low and the fluctuations are not large. As can be seen from Fig. 1 and 2, the respective trends of the two variables from 2009-2020 are not exactly the same, but the overall trends are relatively similar. During this decade, China's GDP showed a steady upward trend and economic development steadily advanced. China's government health expenditure also showed an upward trend, rising most significantly between 2019 to 2020. In 2020, the Chinese government health expenditure was nearly 2.2 trillion yuan, up 21.8% from 2019, reaching the peak growth rate of the past decade. This situation is due to the significant increase in government expenditure on

epidemic prevention in 2020. The development goal of "the proportion of personal health expenditure to total health expenditure will drop to about 28% in 2020" was achieved.

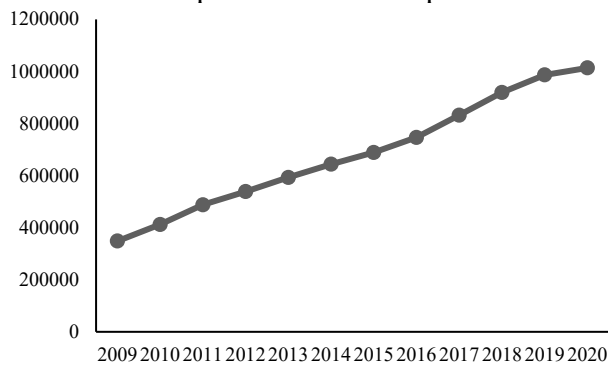


Fig. 1 Trend of GDP (Billion)

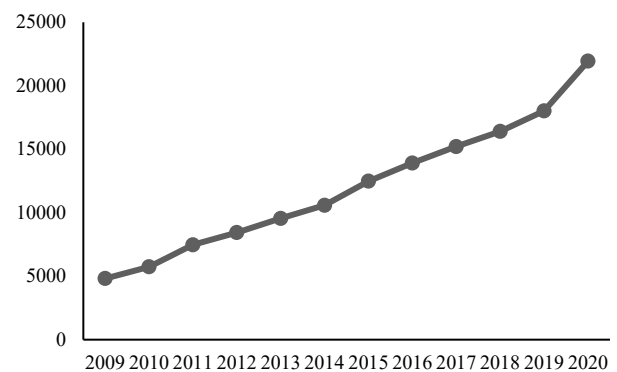


Fig. 2 Trend of government health expenditure (Billion)

As for the control variables, the standard deviation of *lnEmployment* and *IncomeGap* are small and fluctuate little. The standard deviation of *OldRatio* and *ChildrenRatio* are larger, which indicates that the age structure of China's population is different, and a larger dependency ratio means a serious dependency burden on the labor force. The standard deviation data of *UrbanRatio* indicates that urbanization level of different provinces varies greatly, and the urbanization level of developed regions is significantly higher than that of other regions, with a large proportion of urban population.

Table 2 Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Median	Max
<i>lnGDP</i>	300	19.044	0.852	16.861	19.084	20.75
<i>lnHealth</i>	300	15.082	0.662	13.158	15.11707	16.479
<i>lnEmployment</i>	300	7.603	0.773	5.74	7.692171	8.848
<i>OldRatio</i>	300	14.55	3.645	8.601	14.095	24.365
<i>ChildrenRatio</i>	300	22.819	6.233	10.628	23.093	36.502
<i>IncomeGap</i>	300	2.589	0.378	1.852	2.545	3.646
<i>UrbanRatio</i>	300	59.011	12.204	36.577	57.27	89.3

4.2 Basic Regression

This paper conducts basic regression on the economic growth effect of government health expenditure through mixed regression and panel fixed effects regression respectively, as shown in Model I and Model II. Using Stata16 econometric software, the regression results are shown in Table 3.

From the regression results of the explanatory variables, both Model I and Model II show that government health expenditure promotes economic growth at the 1% level of significance. Model II indicates that every 100% increase in government health expenditure will drive economic growth by 40.5%, so Hypothesis One is confirmed. From the regression results of the control variables, Model II shows that the number of employed persons and urbanization rate both positively and significantly affect economic growth at the 1% level. Possible explanations for this result are the higher the number of employed persons, the higher the social productivity, which provides the necessary labor support for economic growth; the increasing level of urbanization, the transfer of rural population to urban areas, expanding urban consumer groups and consumer demand, leading to further economic growth.

Table 3 Basic regression

	(1) Model I	(2) Model II
lnHealth	0.249*** (7.45)	0.405*** (3.19)
lnEmployment	0.823*** (27.58)	0.971*** (3.51)
OldRatio	0.001 (0.32)	-0.005 (-0.87)
ChildrenRatio	0.002 (1.09)	0.006 (0.88)
IncomeGap	-0.136*** (-4.71)	0.079 (0.37)
UrbanRatio	0.028*** (17.57)	0.024*** (3.17)
Cons	7.649*** (33.25)	3.840 (1.53)
Fixed time	No	Yes
Individual fixation	No	Yes
Obs	300	300
R ²	0.973	0.891
N		30

Note: ①Standard deviation of the regression is in parentheses; ②*, ** and *** indicate significance at 10%, 5% and 1% significance levels, respectively.

4.3 Mechanism Test

Several scholars have discussed that government health spending can have a significant impact on consumption (Yuan Hong, 2009; Yong Yu, 2009; Chunhai Tao and Yuxiao Wang, 2018), and this paper further examines the impact of government health expenditure on resident consumption. Table 4 shows the regression analysis of government health expenditure on per capita consumption expenditure of the residents.

This article is based on Ting Jiang (2022) suggested method for mechanism testing. lnConsume is the logarithm of per capita consumption expenditure of residents in each region. As shown in Table 4(2), government health expenditure has a significant positive effect on per capita consumption expenditure of residents at the 10% level, i.e., government health expenditure promotes an increase in residents' consumption expenditure. This is consistent with our theoretical analysis that an increase in government health expenditure reduces residents' precautionary saving motive, improves their current consumption confidence, and increases their consumption expenditure. The significant positive effect of residential consumption on economic growth has also been argued by several scholars. Zhanfeng Li and Zhiying Yuan (2009), by building a joint cubic equation model and impulse response function, reveal that the latest dynamic impact of residential consumption on economic growth is the largest, and the growth of residential consumption will become the most effective means to promote economic growth. Using cointegration theory, Feng Xu and Keqin Jin (2009) investigate the relationship between China's economic growth and domestic residential consumption since the reform and opening up and find that consumption has a long-term and stable role in promoting economic growth. Based on the above two-step analysis, it is found that government health expenditure can stimulate consumer demand by increasing residential consumption expenditure, thus boosting economic growth, so Hypothesis Two is proved.

Table 4 Mechanism test

	(1) lnGDP	(2) lnConsume
lnHealth	0.405*** (3.19)	0.108* (1.76)
lnEmployment	0.971*** (3.51)	-0.021 (-0.28)
OldRatio	-0.005 (-0.87)	-0.005* (-1.70)
ChildrenRatio	0.006 (0.88)	0.002 (0.71)
IncomeGap	0.079 (0.37)	0.147* (1.98)
UrbanRatio	0.024*** (3.17)	0.003 (1.14)
Cons	3.840 (1.53)	-1.284 (-1.47)
Fixed time	Yes	Yes
Individual fixation	Yes	Yes
Obs	300	300
R ²	0.891	0.970
N	30	30

Note:①Standard deviation of the regression is in parentheses;②*, ** and *** indicate significance at 10%, 5% and 1% significance levels, respectively.

4.4 Heterogeneity Test

4.4.1 According to the geographical scope

In order to study the differences in the impact of government health expenditure in different geographical regions, this paper refers to Ping Jiang and Chengshi Tian (2009) and divides the 30 provinces, autonomous regions and municipalities directly under the central government into 3 major regions: (1) Eastern region includes: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan 11 provinces and municipalities; (2) Central region includes: Heilongjiang, Jilin, Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan 8 provinces; (3) Western region includes: Chongqing, Sichuan, Guizhou, Yunnan, Guangxi, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Inner Mongolia 11 provinces, autonomous regions and municipalities. Regression analyses were conducted using fixed-effects models for different regions. The regression results are shown in Table 5.

Table 5 Heterogeneity test: East-Middle-West

	(1) East	(2) Middle	(3) West
lnHealth	0.585*** (3.50)	0.190 (1.11)	-0.314 (-1.01)
lnEmployment	1.031** (2.78)	0.152 (0.47)	2.767*** (3.79)
OldRatio	-0.012* (-1.85)	-0.011 (-1.01)	0.004 (0.46)
ChildrenRatio	0.014* (1.94)	0.026** (2.72)	-0.012* (-1.85)
IncomeGap	0.555 (1.45)	0.873* (2.13)	-0.610*** (-4.43)
UrbanRatio	0.013 (1.68)	0.085** (3.39)	0.052** (2.42)
Cons	0.335 (0.11)	8.038*** (4.38)	2.342 (0.31)
Fixed time	Yes	Yes	Yes
Individual fixation	Yes	Yes	Yes
Obs	110	80	110
R ²	0.930	0.910	0.940
N	11	8	11

Note:①Standard deviation of the regression is in parentheses;②*, ** and *** indicate significance at 10%, 5% and 1% significance levels, respectively.

Table 5 shows that the corresponding elasticities of contribution are 0.585%, 0.190% and -0.314% in the eastern, central, and western regions respectively. In the eastern region, the effect of government health expenditure on economic growth is significant and positive; in the central and western regions, there is an insignificant effect. Thus, it is found that there is a significant regional difference in the effect of government health expenditure on economic growth.

The study concluded that the eastern region has relatively high medical financial allocation, sound health infrastructure, and more complete health service system, and the highest economic effect of government health expenditure with higher marginal contribution rate than the central and western regions. The central and western regions, on the other hand, due to the level of economic development, geographical location, natural environment and transportation conditions, have relatively low financial expenditures on health care, insufficient size of health technicians, relatively weak health infrastructure, and a higher cost of health service supply, resulting in the economic effect of government health expenditures not being fully realized, and the limited government health investment is difficult to play the scale effect. At the same time, local residents' basic needs for health care are not high, and improving the basic material level is still an area of greater concern to residents; increasing government health expenditure will, to a certain extent, crowd out government financial expenditure in other areas and reduce the overall efficiency of public expenditure. Since health expenditures are generally consumption expenditures rather than production expenditures, which to a certain extent are not conducive to the accumulation of physical capital, the effect of increasing government health expenditures on economic growth is not obvious in central and western China.

4.4.2 According to the degree of development

The previous paper uses the traditional division method of East, Central and West for heterogeneity testing, but this division criterion in a purely geographic sense does not accurately reflect the differences in regional economic development levels. Therefore, this paper refers to the division method of Xiaomin Zhong and Liumei Yang (2016) and adjusts it accordingly to further divide the country into four categories of regions, namely, developed regions, comparatively developed regions,

moderately developed regions, and underdeveloped regions, using the GDP per capita of each region (Explanatory variable: AGDP) as the criterion, and depicts the histogram of GDP per capita, and the results are shown in Figure 3.

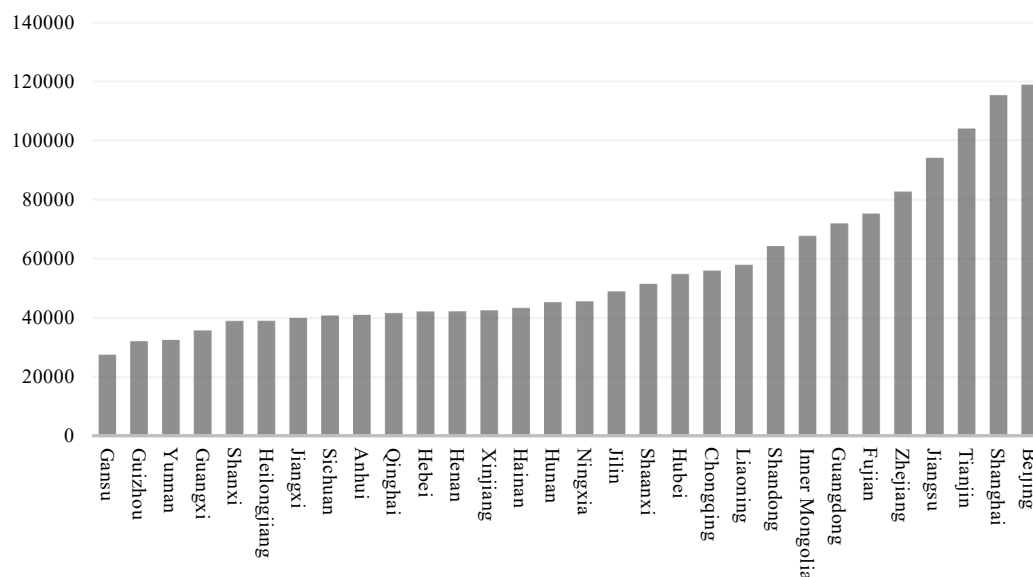


Fig. 3 Histogram of GDP per capita

Figure 3 visualizes the degree of development of each region, and the 30 regions are now divided as follows: (1) developed regions: Beijing, Shanghai and Tianjin 3 municipalities; (2) comparatively developed regions: Jiangsu, Zhejiang, Fujian, Guangdong, Inner Mongolia, Shandong and Liaoning 7 provinces and autonomous regions; (3) moderately developed regions: Chongqing, Hubei, Shaanxi, Jilin, Ningxia, Hunan, Hainan, and Xinjiang 8 provinces, autonomous regions and autonomous regions; (4) underdeveloped regions: Henan, Hebei, Qinghai, Anhui, Sichuan, Jiangxi, Heilongjiang, Shanxi, Guangxi, Yunnan, Guizhou, Gansu 12 provinces and autonomous regions.

Table 6 shows that the corresponding elasticities of contribution are 0.959%, 0.543%, 0.319% and -0.217% for developed, comparatively developed, moderately developed and underdeveloped regions respectively. In the developed regions, government health expenditures contribute the most to economic growth, followed by the comparatively developed regions and then the moderately developed regions. In the underdeveloped regions, the impact of government health expenditure on economic growth is not significant. Combined with the previous analysis of the geographical division method, it is found that all the developed regions are located in the east; all the comparatively developed regions are located in the east except Inner Mongolia; all the medium developed regions are located in the central and west except Hainan; half of the underdeveloped regions are located in the west. It can be seen that the results obtained by the two methods of classification are generally consistent, that is, as the level of economic development increases, the more obvious the role of regional government health expenditure in promoting economic growth, so Hypothesis Three is confirmed again.

Table 6 Heterogeneity test: degree of development

	(1) Developed regions	(2) Comparatively developed regions	(3) Medium developed regions	(4) Underdeveloped regions
lnHealth	0.959* (3.77)	0.543* (2.31)	0.319* (1.93)	-0.217 (-0.69)
lnEmployment	0.244 (0.40)	1.522** (2.81)	0.485 (1.07)	0.524 (1.22)
OldRatio	-0.017 (-0.99)	-0.012 (-1.03)	-0.000 (-0.03)	-0.006 (-0.50)
ChildrenRatio	0.037 (1.83)	0.003 (0.34)	0.013 (1.43)	-0.014 (-1.18)
IncomeGap	0.260 (0.15)	0.221 (1.32)	-0.281 (-1.01)	-0.280 (-0.91)
UrbanRatio	-0.017 (-0.20)	0.064*** (4.69)	0.039 (1.66)	0.064*** (4.68)
Cons	3.962 (0.22)	-5.249 (-1.36)	8.688 (1.81)	16.071** (3.05)
Fixed time	Yes	Yes	Yes	Yes
Individual fixation	Yes	Yes	Yes	Yes
Obs	30	70	80	120
R ²	0.948	0.936	0.941	0.897
N	3	7	8	12

Note:①Standard deviation of the regression is in parentheses;②*, ** and *** indicate significance at 10%, 5% and 1% significance levels, respectively.

4.5 Robustness Test

This paper uses two methods for robustness testing: refer to Xiaomin Zhong and Liumei Yang (2016) who replace GDP per capita with GDP to examine the robustness of the model. Table 7 (1) shows that the coefficient estimates of the explanatory variables remain significant, and the positive and negative signs do not change. To further verify the robustness of the model, Table 7(2) runs a fixed effects regression on the panel data for 2009-2020 (some data are missing for 2009) and again finds that the significance of the coefficients of the explanatory variables and the positive and negative signs do not change. Both of these methods indicate that the model is robust, and the results are convincing.

Table 7 Robustness test

	(1)	(2)
	lnAGDP	2009-2020
lnHealth	0.421*** (4.02)	0.450*** (4.39)
lnEmployment	0.697*** (2.83)	0.673*** (3.74)
OldRatio	0.002 (0.40)	-0.006 (-0.84)
ChildrenRatio	0.003 (0.63)	0.001 (0.17)
IncomeGap	-0.008 (-0.04)	0.089 (0.56)
UrbanRatio	0.022*** (3.00)	0.024*** (3.34)
Cons	-11.393*** (-4.66)	5.501*** (2.85)
Fixed time	Yes	Yes
Individual fixation	Yes	Yes
Obs	300	342
R ²	0.888	0.933
N	30	30

Note:①Standard deviation of the regression is in parentheses;②*, ** and *** indicate significance at 10%, 5% and 1% significance levels, respectively.

4.6 Endogeneity Test

The endogeneity problem in this paper may stem from two aspects. First, two-way causality. The findings of Amiri and Ventelou (2012) suggest a two-way Granger causality between health expenditure and GDP. Not only does government health spending affect economic growth, but economic growth may also influence the government to increase health spending. Second, the problem of omitted variables. Although this paper controls for some variables, there may still be omitted variables due to the influence of uncontrollable and unobservable factors. In order to solve the endogeneity problem, this paper uses two-stage least squares for econometric analysis to reduce the influence of endogeneity and make the results more reliable. Referring to Minglai Zhu and Qi Hu (2020), this paper uses the 1st order lag of the explanatory variable (L.lnHealth) as the instrumental variable.

The regression results in the first stage of Table (8) show that the selected endogenous variable (lnHealth) is endogenous and the F-value in the first stage is greater than 10, indicating that there is no weak instrumental variables. The regression results in the second stage of Table (8) show that the direction of the sign of the coefficients of the explanatory variables remains consistent and significant at the 1% level. This result suggests that the results of the econometric analysis in this paper still hold robustly after further controlling for potential endogeneity issues.

Table 8 Endogeneity test

	(1) Stage I	(2) Stage II
L.lnHealth	0.563*** (5.35)	
lnHealth		1.142*** (5.54)
lnEmployment	0.404** (2.70)	0.444** (2.11)
OldRatio	0.004 (0.67)	-0.002 (-0.41)
ChildrenRatio	-0.013*** (-2.96)	0.015** (2.15)
IncomeGap	-0.067 (-0.41)	0.125 (0.79)
UrbanRatio	0.005 (0.97)	0.018*** (3.36)
Cons	3.552 (1.67)	-2.986 (-1.25)
Fixed time	Yes	Yes
Individual fixation	Yes	Yes
Obs	270	270
R ²	0.961	0.809
N	30	30

Note:①Standard deviation of the regression is in parentheses;②*, ** and *** indicate significance at 10%, 5% and 1% significance levels, respectively.

5. Conclusion

The empirical results of this paper show that government health expenditure significantly promotes economic growth, and further analysis finds that government health expenditure can stimulate domestic consumption demand by increasing residential consumption expenditure, thus promoting economic growth. When dividing different regions for specific analysis, it is found that there are significant differences in the impact of government health expenditure on economic growth, with the most significant promotion effect in the east, followed by the central region and the weakest in the west, i.e., the more significant the promotion effect is as the level of regional economic development rises. With the emergence of new problems and challenges that constrain the development of the health sector, government departments should accelerate the improvement of China's public health care policies. Based on the above empirical findings, this paper puts forward the following policy recommendations:

1. Pay attention to people's health and increase government health expenditure. Health is an inevitable requirement for the promotion of all-round human development and a basic condition for economic and social development. The government should continue to increase health expenditure, further exert the economic growth effect of government health expenditure, improve people's health, and promote the construction of Healthy China.

2. Improve the medical insurance system to increase residents' current consumption. Accelerating the reform of the medical insurance system enables residents enjoy better quality medical insurance, reduce residents' preventive savings, increase optimism about future expectations, enhance residents' consumption confidence and prompt residents to transform potential consumption demand into real consumption capacity, thus boosting consumption and expanding domestic demand.

3. Focus on equity and optimize the structure of health financial expenditures. Strengthen government financial transfer payments, appropriately increase public health expenditure in western and less developed regions, narrow the differences in medical and health resources between regions,

and give full play to the economic effects of health expenditure. Promote the equalization of basic public services in the field of health, improve the universal medical insurance system, form a public health service system covering all people, and promote the coordination of medical and health development with economic and social development.

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