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The Impact of Government Health Spending on Household Consumption: An AI-Driven Empirical Study

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Abstract

The downward pressure on China's economy is great, and the growth pace tends to be slow. In this context, how to effectively promote economic development and actively promote residents' consumption while ensuring the health of people's livelihood has become an important problem to be solved urgently in China. This study collected relevant data from 2000 to 2022 and used regression analysis method to deeply explore the internal relationship between government health expenditure, per capita disposable income of residents and consumer price index and consumer expenditure. The results show that there is a negative correlation between government health expenditure and household consumption expenditure, while per capita disposable income and consumer price index are positively correlated with household consumption expenditure. Further analysis of the reasons behind it shows that the increase of government health expenditure often leads to the corresponding decrease of public expenditure in other fields, especially when the government's financial resources are limited, the redistribution of such resources will affect key areas such as education and infrastructure construction, and then indirectly affect residents' consumption. In addition, a higher amount of government health expenditure may be passed on to residents by raising taxes or public service fees, thus inhibiting residents' consumption. On the other hand, with the increase of the per capita disposable income of residents, the disposable funds in the hands of residents are more abundant and their spending power is enhanced. The consumer price index can reflect the level of inflation to a certain extent, and moderate inflation can stimulate residents' willingness to consume, thus increasing the demand for all kinds of goods and services.— Based on the above conclusions, in order to effectively promote consumption and promote sound economic development, the following suggestions are put forward: adhere to the leading position of the government, allocate health expenditure scientifically and reasonably, build a sound health evaluation system, and continuously optimize the health system, so as to help consumption upgrade and realize the coordinated development of economy and people's livelihood security.

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Keywords

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1 Introduction

In recent years, with the gradual transformation of China's economic structure and the sustainable development of society, residents have paid more attention to health, and the position of medical and health field in national economy and social life has become more critical, which makes the relationship between government health expenditure and residents' consumption an important research topic.

After a long period of high-speed growth, China's economy is in a critical period of transition to high-quality development, and the basic role of consumption in economic growth is constantly highlighted. However, residents' consumption behavior is restricted and influenced by many complex factors, among which the uncertainty of medical expenditure is particularly prominent. On the one hand, the rising medical expenses and the medical security system need to be improved, which makes residents often need to reserve funds for the high medical expenses they may face, and the precautionary saving motivation is strong, thus inhibiting the consumption expenditure in other fields to some extent.

At the same time, as the core financial support of the medical and health system, the changes in the scale and structure of government health expenditure have a far-reaching indirect impact on residents' consumption. Especially during the period of dealing with major public health events, the government greatly increased health expenditure to ensure people's health and public health safety. Although this effectively controlled the spread of the disease in a short period of time, it also changed the distribution pattern of financial resources to some extent. In the case of relatively limited financial resources, the increase of health expenditure may lead to the adjustment of investment in other public

areas, such as education and infrastructure construction, and then have a complex chain reaction to residents' consumption through various channels such as affecting residents' long-term income expectations, employment opportunities and living environment.

In addition, the acceleration of China's population aging process, the rapid change of disease spectrum and the improvement of residents' requirements for the quality and accessibility of medical services all put forward higher challenges and requirements for government health expenditure. In-depth study on the impact of government health expenditure on residents' consumption will help to rationally optimize the allocation of financial resources, accurately formulate policies and measures, effectively promote the upgrading of residents' consumption, promote sustainable and stable economic growth, and realize the benign interaction and coordination between economic development and social and people's livelihood security.

2 LITERATURE REVIEW

In the process of global economic and social development, the relationship between government health expenditure and household consumption has attracted much attention in academic circles. Although the early Keynesian theory did not focus on health expenditure alone, it laid the foundation for the study of government intervention affecting consumption.[1]

Many studies show that the relationship between them is complicated. Some studies have found that it has a promoting effect. Some scholars, through cross-border data research, have found that in high-welfare countries, government health expenditure reduces the uncertainty of residents' medical burden, releases consumption potential, promotes growth in non-medical fields and optimizes consumption structure.[2] Some scholars' research on time series data in specific regions of China shows that health infrastructure investment can improve residents' health level and labor productivity, increase household income and consumer confidence, and drive consumption. However, there are also many studies on contrary conclusions or complex relationships. Some scholars point out that when the fiscal revenue is fixed, the increase in health expenditure may squeeze the investment in public services such as education and social security.[3] Limited education affects residents' future income expectations, and the weakening of social security increases the motivation of preventive saving, which leads to the decrease of residents' consumption. Some scholars use the dynamic general equilibrium model to analyze and find that the financing mode of health expenditure has a significant impact, and debt financing may trigger inflation or tax increase expectations so that residents can reduce their current consumption.[4]

Domestic related research is also increasingly rich. Some scholars have found that the efficiency of government health expenditure is different in different regions of China, and residents in high-efficiency regions enjoy high-quality and low-cost medical services to promote consumption; The waste and unreasonable allocation of resources in inefficient areas may increase the burden on residents and curb consumption. Some scholars analyze from the perspective of urban-rural differences.[5] In cities, government health expenditure mostly promotes high-end consumption by promoting healthy

human capital, while in rural areas, it focuses on reducing the risk of poverty caused by illness and stabilizing basic consumption.[6]

The existing research results are fruitful, but due to the differences in national conditions, research methods and data, the conclusions are different.[7] With the aging of the population, the application of emerging medical technology and the adjustment of macroeconomic policies, this field still needs to be explored in depth to accurately reveal the complex relationship between government health expenditure and household consumption in China, provide scientific basis for policy making, promote the coordinated development of economy and people's livelihood, enable the government to better weigh the impact on household consumption when making health expenditure decisions, and promote the overall social welfare promotion and stable economic growth.[8]

3 DATA PROCESSING

3.1 The source of the data

All the data in this paper is from the website of the National Bureau of Statistics. Considering the availability of data, the relevant data from 2000 to 2022 are selected for empirical analysis, and the missing data are supplemented by linear interpolation.

After completing the correlation analysis, it is found that the consumption level of residents is significantly correlated with the scale of government health expenditure, industrial structure layout, income level of residents, price index and other factors. To further analyze the influencing factors of residents' consumption level, this study takes the scale of government health expenditure, industrial structure layout, urban structure form, consumer goods price fluctuation and residents' income level as follow-up research.

3.2 Selection of variables

According to previous scholars' research, this paper selects the following variables for research, and the results are shown in Table 1

Consumption level(consume): the explained variable, which reflects the quality of life and economic welfare level of residents, is also one of the important indicators to measure a country's economic development and social progress. This paper selects the per capita consumption expenditure of residents to measure.

Government health expenditure (health): the core explanatory variable, which reflects the government's attention and support for residents' health protection and reflects the level of public health resources investment in a country. This paper selects the proportion of government health expenditure in GDP to measure.

Industrial structure (control₁): Control variable, which reflects a country's economic development level and resource allocation. This paper selects the added value of the tertiary industry/the added value of the secondary industry to measure it.

Urban structure (control₂): Control variable, which reflects the characteristics of urban development scale, functional orientation and development direction. This paper selects the proportion of urban population at the end of the year to measure it.

Consumer price (control₃): Control variable, which directly affects consumers' purchasing power and consumption decision, and

Table 1: Variable Selection Results

Variable category	variable symbol	variable	measurement method
Explained variable	consume	Consumption level of residents	Per capita consumption expenditure of residents(yuan)
Explanatory variable	health	Degree of government health expenditure	Government health expenditure /GDP (%)
Control variable	$control_1$	industrial structure	Tertiary industry/secondary industry (%)
	$control_2$	Urban structure	Proportion of urban population at the end of year (%)
	$control_3$	Consumer goods price	consumer price index (CPI)
	$control_4$	Income of residents	Per capita disposable income of residents (yuan)

Table 2: Descriptive statistical results of variables

variable	average	standard deviation	minimum value	maximum	Number of observations
consume	11888.66	7212.382	2914	24538.2	23
health	8850.974	7612.625	709.52	24040.89	23
$control_1$	1.086612	0.206358	0.87376	1.439071	23
$control_2$	51.40391	9.33359	36.22	65.22	23
$control_3$	558.187	93.06131	433.5	706.6	23
$control_4$	16656.6	10855.77	3721.34	36883.3	23

is also an important signal reflecting the relationship between market supply and demand and economic operation. This paper selects consumer price index to measure it.

Residents' income ($control_4$): an important indicator to measure residents' economic situation and living standards. This paper selects the per capita disposable income of residents to measure.

3.3 Data processing

To deeply explore the variation differences of residents' consumption level, government health expenditure, industrial structure, urban structure, residents' income status and consumer goods prices, this study calculated the key statistics such as the average value and standard deviation of each index in detail, and the relevant results are listed in Table 2. This data will provide a strong data base and quantitative basis for further analysis and help to accurately grasp the characteristics such as the dispersion degree and concentration trend of each index, so as to understand their variation laws and trends in different periods and situations more deeply.

By drawing the scatter diagram of government health expenditure and per capita consumption of residents (the result is shown in Figure 1), it can be clearly observed that at first, government health expenditure and per capita consumption expenditure showed an upward trend. However, in the subsequent development process, there has been a downward trend. This phenomenon may be due to the high proportion of government health expenditure in the total expenditure, which triggered the crowding-out effect, which led to the decrease of residents' consumption expenditure. Finally, there was a parabolic curve relationship between the two, which intuitively reflected their complex correlation and changing characteristics at different stages.

4 Empirical analysis

4.1 Model building

To accurately verify the internal relationship between government health expenditure and per capita consumption of residents, this study selects the relevant data from 2000 to 2022 and builds an analysis model based on this. By using the data of this long period of time, this paper aims to analyze more comprehensively and deeply how the change of government health expenditure affects the trend of per capita consumption of residents in different economic cycles and social development stages, thus providing strong support for the quantitative study of the relationship between them, further revealing the potential economic laws and logical connections behind them, and providing valuable reference for the formulation and optimization of relevant policies. This paper uses data from 2000 to 2022 to build a model (1):

$$consume_i = \alpha + \beta_1 health_i + \beta_2 health_i^2 + \sum_{n=1}^4 \varphi_n control_{ni} + \varepsilon_i \quad (1)$$

Among them, $consume_i$ refers to the per capita consumption expenditure of residents in the i th year, $health_i$ refers to the government health expenditure in the i th year, ε_i refers to the random error term, and $control_{ni}$ refers to the sample of the i th year in the n th controlled variable.

4.2 Empirical analysis

To strictly test whether there is heteroscedasticity in the data, this paper uses White test to test the relevant data in detail. After calculation, the P value corresponding to chi-square test is 0.402. According to the statistical correlation criterion, the p value indicates that the variables selected in this paper are not affected by

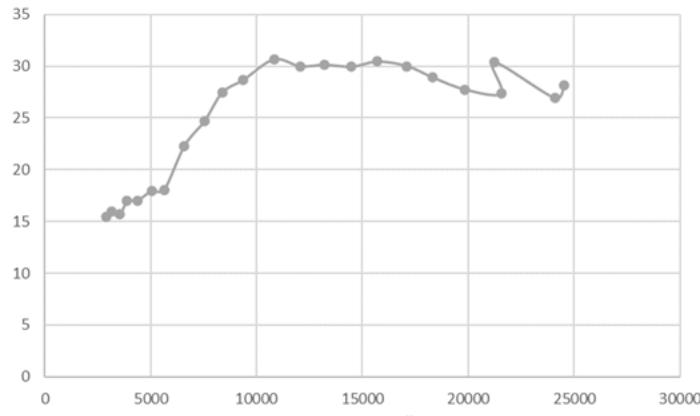


Figure 1: Scatter chart of government health expenditure and per capita consumption of residents

Table 3: Regression results

variable	coefficient of regression	Standard error
<i>health</i>	-0.10139720	0.0505065
<i>health</i> ²	-0.00000492***	0.0000011
<i>control</i> ₁	-1309.71000000	569.2588000
<i>control</i> ₂	27.08653000	21.7068700
<i>control</i> ₃	-11.02908000*	3.8079310
<i>control</i> ₄	0.85721510***	0.0317263

Note: *** p<0.1, ** p<0.05, * p<0.1, all of which are two-tailed tests.

heteroscedasticity, which also confirms the reliability and stability of the data from the side, and can ensure that the relevant research results reflect the actual situation more scientifically and accurately.

4.2.1 Multiple linear regression. Considering that the data selected in this paper comes from many fields, the data units are different. Based on this, this paper chooses to use standardized multiple linear regression and solves the regression results by using OLS. The regression results are shown in Table 3. The adjusted $R^2 = 0.9998$ is obtained by using STATA software, which fully shows that the curve fitting is excellent, and the built model can accurately reflect the relationship between variables. However, there may be multiple collinearity problems hidden behind the high fitting degree, and this potential risk needs to be properly handled in the follow-up study.

In addition, the joint significance test is carried out for the data, and $F(6, 16) = 21817.63$, is calculated, and the corresponding $P = 0.000$. This means that at the significance level of 0.1, the regression model presents a joint significance feature, that is, the independent variables in the model have significant explanatory power to the dependent variables.

Further observation of Table 3 shows that at the significance level of 0.05, the coefficients of government health expenditure and per capita disposable income of residents are significantly different from zero. This result strongly proves that government health expenditure does have a certain degree of influence on residents' per capita consumption expenditure, which provides a key empirical

Table 4: :VIF values

	VIFVALUE
<i>health</i>	372.07
<i>health</i> ²	82.96
<i>control</i> ₁	34.73
<i>control</i> ₂	103.31
<i>control</i> ₃	316.06
<i>control</i> ₄	298.55

basis and data support for in-depth analysis of the mechanism and policy orientation between the two.

4.2.2 Multiple collinearity test. To rigorously test whether there is multicollinearity problem in the model, the variance expansion factor (VIF) of each variable is solved with the help of STATA software, and the specific results are shown in Table 4. VIF value can effectively reflect whether there is multicollinearity relationship between independent variables. By analyzing this value, we can further judge the reliability of the model and the real relationship between variables and provide an important basis for optimizing the model and accurately interpreting the research results. According to the data presented in Table 4, it can be clearly found that the VIF values of the above variables all greatly exceed 10, and the maximum value is as high as 372.07. Such remarkable numerical characteristics fully show that the model selected in this

Table 5: Backward Stepwise Regression Results

variable	coefficient of regression	Standard error
$health^2$	-0.00000732	0.00000061
$control_3$	-5.44313200	2.21041800
$control_4$	0.81956410	0.02642410

paper does have serious multicollinearity problems. In view of this, to ensure the accuracy and effectiveness of the model, it is extremely necessary to carry out further revision of the model, so as to eliminate the interference of multiple collinearities the model more accurately reflects the real internal relationship and action mechanism among variables.

4.2.3 Stepwise regression. In order to effectively alleviate the multicollinearity problem in the model, this paper decided to adopt the method of backward stepwise regression to modify the initially constructed regression model. The specific operation is to eliminate those variables that have the least influence on the dependent variables in turn at the significance level of 0.05, to optimize the model structure and reduce the collinear influence between variables. The corresponding regression results are shown in Table 5. As can be seen from the contents shown in Table 5, the variables in the original model were screened by stepwise regression, and the three variables of government health proportion, industrial structure and urban population proportion were eliminated. The quadratic term of government health expenditure, per capita disposable income of residents and consumer price index of residents are retained.

4.3 Research conclusions

4.3.1 Correlation changes between government health expenditure and residents' consumption. Combining Table 3, Table 5 and Figure 1, it can be found that there is a positive correlation between household consumption and government health expenditure when the proportion of government health expenditure is at a low level. However, at this stage, its growth rate has shown a gradual decline. When the proportion of government health expenditure reaches a critical point, crowding-out effect will occur. Currently, the relationship between residents' consumption and government health expenditure turns into a negative relationship, and the growth rate under the negative relationship is increasing. The relationship between them shows a downward curve, which reflects the dynamic change process and characteristics of different stages of the impact on residents' consumption with the change of the proportion of government health expenditure.

4.3.2 Influence of other factors on residents' consumption. From Table 5, the per capita disposable income of residents has a positive impact on the consumption expenditure of residents. Specifically, whenever the per capita disposable income of residents increases by 1 yuan, the per capita consumption of residents will increase by about 0.82 yuan, which clearly reflects the close positive correlation between them, which means that the improvement of residents' income level can effectively drive the growth of consumption expenditure.

At the same time, the consumer price index also has an impact on the consumer expenditure. Every time it increases 1 yuan, the consumer expenditure will increase by about 9.6 yuan. The reason for this situation is that the rising consumer price makes the prices of various commodities such as daily necessities increase, which causes residents to spend more money when purchasing goods and services, thus increasing their consumption expenditure. This also highlights the important role of price changes in residents' decision-making and actual consumption expenditure.

5 SUGGESTIONS AND COUNTERMEASURES

Based on the above research conclusions, to effectively promote consumption and promote steady economic development, the following suggestions are put forward:

5.1 Adhere to the principle of government-led, scientific planning of health expenditure allocation

At present, with the sustained prosperity and progress of social economy, the Chinese government's investment in the field of health is on the rise steadily. However, it should be noted that the expansion of government health expenditure may lead to the corresponding reduction of residents' consumption expenditure under certain circumstances. Therefore, the government should closely conform to the dynamic changes of social development process and national reality, continuously optimize the structure and proportion of health expenditure, effectively ensure the steady rise of residents' consumption expenditure while effectively meeting the growing health demands of the people, and realize the benign balance and coordinated development between the two.

5.2 Focus on building a complete health evaluation system

In the process of social continuous evolution, the government must comprehensively consider the comprehensive impact of multiple social development factors when formulating health expenditure policies, such as the changing trend of urban population proportion, the actual level of per capita disposable income of residents, the overall situation of domestic macro-economy and other related factors, so as to comprehensively improve the efficiency and benefit of the use of health funds, ensure that every investment can be made accurately, and lay a solid foundation for the overall health and well-being of society and stable economic growth.

5.3 Deeply optimize the health system architecture

Actively rely on modern frontier scientific and technological forces, such as cloud computing, quantum information and other advanced technical means to accurately record and track the flow and use details of health funds. According to the uniqueness and differentiation characteristics of different regions, formulate and implement appropriate health policies according to local conditions. In-depth insight and accurate grasp of the internal laws of social development, carefully construct relevant analysis models, conduct comprehensive and in-depth pre-evaluation of the policies to be implemented, and prospectively predict the multiple impacts on economic operation and household consumption after implementation, and extensively absorb opinions and suggestions from all walks of life, and continuously refine and improve the health system, so that it can play a more powerful and lasting supporting role in promoting consumption and helping high-quality economic development.

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