ВЫЗОВЫ XXI ВЕКА И СТРАТЕГИЯ УСТОЙЧИВОГО РАЗВИТИЯ

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THE VALUE OF HEALTH CAPITAL AND ITS DETERMINANTS: A REVIEW BASED ON HEALTH DEMAND MODEL

Health, as an important aspect of social development evaluation, has a profound impact on the evolution process of human society. Based on the current health status of China's population and the integration of the intrinsic and instrumental value of health capital, this paper constructs an econometric model of health capital demand using Grossman's model. The study examines the determinants of health capital from four perspectives: labor market, income distribution, environmental quality, and public services. In addition, the author reviews the existing gaps in China's academic research in this area and proposes constructive and feasible policy recommendations. This paper provides a theoretical framework for better understanding of the value of health capital and its determinants, and contributes to the sustainable development of society.

Keywords: health capital; health demand model; determinants; health of Chinese residents.

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1. Introduction. Health, one of the important pursuits of human social development, has also become one of the important dimensions for assessing social development because of its own profound intrinsic value, and is an important social issue of common concern to governments around the world. According to human capital theories, human capital stock is mainly composed of elements such as health, knowledge, skills, and work experience. Although individuals can increase their personal productivity, that is, their ability to earn monetary income and produce non-monetary goods, through the accumulation of all these elements, only the health capital stock determines the total amount

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of time that an individual can spend on all market and non-market activities. Since 1990, the Human Development Report (HDR), issued annually by the United Nations Development Programme (UNDP), has suggested that human well-being is the true purpose of development [1]. At the same time, health affects other dimensions of human development, such as economic development and education, to varying degrees, and health, in turn, is influenced by the level of economic development, education, public governance, environment, and other factors. On the route to obtaining the ultimate well-being of human social development, quality national health is a source of sustainable social development amidst the wave of globalization, and studying the value of health capital and its influencing factors is undoubtedly of great theoretical and practical significance.

Along with the expansion of the world market, the economies of countries around the globe are rapidly integrating into the wave of economic globalization, and the process of globalization has not only brought about impacts on the politics, economies, and cultures of various countries but also brought about impacts on public health that cannot be ignored. Take China as an example. Since the reform and opening, China's economic prosperity has attracted worldwide attention, especially since China's accession to the World Trade Organization (WTO) in 2001. The scale of imports and exports in China's international trade has expanded dramatically, and as of 2023, China's per capita Gross National Income (GNI) reaches US$13,400, which has jumped up to an upper-middle-income country*. Meanwhile, we have also noticed that the health of the Chinese population has gradually become a social concern (Figure 1).

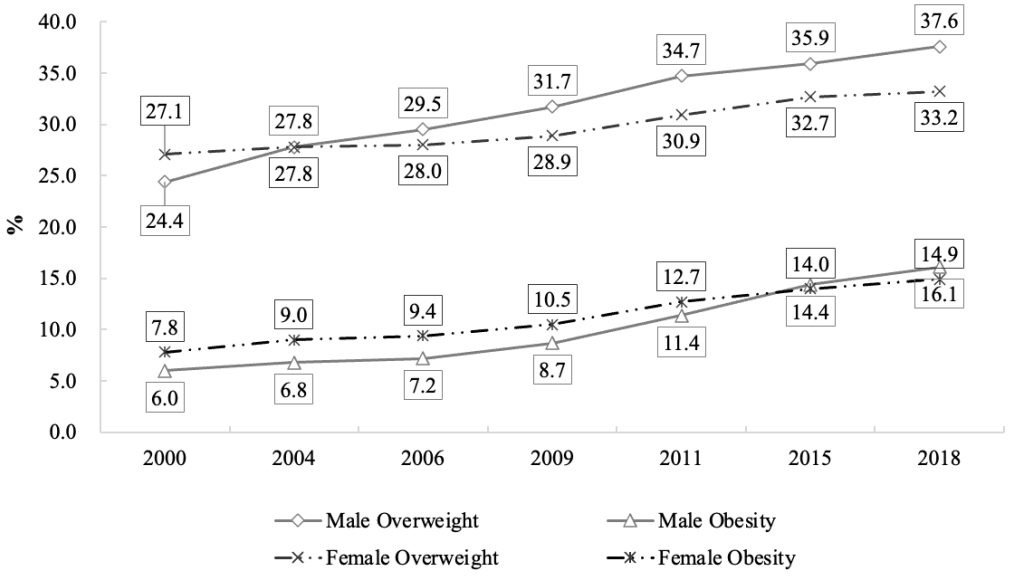

Figure 1. Trends in overweight and obesity rates among adults of different genders in China (2000–2018)

Source: Compiled by the authors**.

Accompanied by rapid socio-economic development and huge changes in residents' lifestyles, the proportion of overweight and obese people among

* Data source: https://www.gov.cn/yaowen/liebiao/202409/content_6977573.htm.

** Data source: China Health and Nutrition Survey. https://www.cpc.unc.edu/projects/china.

Chinese residents is rapidly increasing*. The data show that the overweight and obesity rates of both urban and rural residents in China were on the rise from 2000 to 2018. Among them, the rate of obesity rose faster than the growth of the overweight rate; the increase of overweight and obesity rates in rural populations was higher than that in urban populations (Figure 1). At the same time, further statistics on the morbidity rates of different groups in urban and rural areas of China based on data from the China Health and Nutrition Survey show that the morbidity rates of urban and rural residents in various regions have begun to show a consistently high trend (Figure 2).

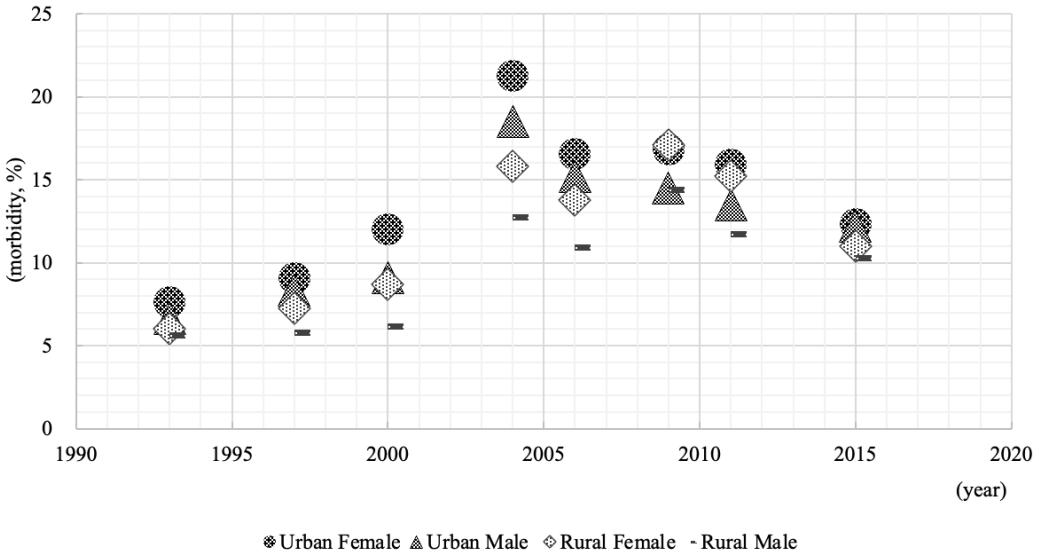

Figure 2. Gender and household differences in morbidity among Chinese residents

Source: Compiled by the authors**.

As a form of social welfare, public health has always been an important social issue of great concern to the Chinese government. The report of the 19th National Congress proposed the implementation of the "Healthy China" strategy, listing public health as "an important symbol of national prosperity and national strength." The Action for a Healthy China (2019–2030) explicitly proposes that by 2030, China will significantly improve the level of national health literacy, enter the ranks of high-income countries in terms of the level of major health indicators, and basically realize health equity. In view of this, this paper will use the data from the China Health and Nutrition Survey to try to analyze the current health status of Chinese urban and rural residents and further sort out and summarize the value of health capital and its influencing factors to provide a basis for the sustainable development of health capital and better promote the process of sustainable development of human beings.

The structure of this paper is as follows. The second section will explore the importance of health capital and its role in promoting other dimensions of sustainable social development from two perspectives: the intrinsic and instrumental value of health. The third section conducts a comparative static

* Note: Overweight is defined as a body mass index (BMI) of 24.0–27.9 kg/m2, and obesity is defined as a body mass index (BMI) of more than 28 kg/m2.

** Data source: China Health and Nutrition Survey. https://www.cpc.unc.edu/projects/china.

analysis of health needs based on the Grossman health model and constructs an empirical analytical model of health capital, and based on the econometric model, it further analyzes and organizes in detail health capital's determinants, including labor market-related factors, income distribution, environmental quality, and public services; the fourth part is conclusions and policy recommendations.

2. The value of health capital. Health, as one of the important human capital stocks, has a direct impact on the economic growth of the country, and at the same time, it is one of the primary goals of individuals engaged in economic activities. The American psychologist Maslow classified people's needs into five levels, and there is no doubt that health needs are an important element of the needs for survival and security, as well as an important basis for higher-level needs. Anand (2002) suggests that health not only possesses an instrumental value that cannot be ignored, but also, more importantly, health is a direct constituent of personal well-being, and it is a commonly recognized need to value goal; it is the true goal of development [2]. At the same time, improving people's health can fundamentally contribute to the viability of the individual, thus enabling the individual to choose a life that he or she finds valuable (Sen, 1987, 2002) [3; 4].

In addition to its own intrinsic value, health capital has varying degrees of instrumental value for other dimensions of human development. Empirical studies have shown that the instrumental value of health is manifested in the promotion of other areas of society, including economic growth, increased labor productivity, increased personal income and personal educational opportunities, and impacts on social fertility rates. Considering the wide range of domains that health capital affects, this paper will focus on organizing the instrumental value of health in terms of increasing labor productivity and personal income and promoting economic growth.

To begin with, health status is multidimensional*, which means that different dimensions of health have different impacts on labor productivity and earnings. Common indicators of health in research include nutritional intake, anthropometric measurements, disease, and functional impairment. For example, Leibenstein (1957) hypothesized that workers who consume more calories have higher productivity compared to those who are undernourished, and that better nutritional intake is positively associated with higher labor productivity compared to those with low nutritional intake [5]. Subsequently, Wolgemuth et al. (1982) found that calorie supplementation had a positive effect on the amount of soil dug per hour by workers in a randomized experiment with 47 road construction workers [6].

Other scholars have explored the impact of health on wages through BMI (medium-term nutrition) and height (long-term nutrition). For example, Thomas et al. (1997) empirically analyzed the effects of height, BMI, calorie and protein intake on the income of urban workers in Brazil using cross-sectional data from the Brazilian Urban Household Budget Survey, and used the instrumental variables approach to address endogeneity in their study; they found that all four health dimensions had a significant effect on the income of urban workers, and among them, the effect of height on wages was large and significant [7].

In addition to its impact on labor productivity and earnings, the instrumental value of health for economic growth has been confirmed by a wealth of research. Earlier, Fogel (1993) introduced indicators such as population health and nutritional status into the historical development process of the European economy. Among other things, health status is both an indicator of population welfare and a determinant of economic growth rates. They found that one of the reasons

* Note: The World Health Organization (WHO) stated in 1948 that health is not only the absence of disease and infirmity but also a good state of physical, mental, and social adjustment. In 1990, the WHO added an ethical health component.

for the high annual growth rate of per capita income of 1.15 % in the United Kingdom during the 200-year period 1780–1979 was the improvement in health and nutritional status, and they concluded that about one-third of the economic growth in the United Kingdom during this 200-year period should be attributed to the improvement in nutritional and health status (Fogel, 1991, 1997) [8; 9]. Subsequent empirical studies have further supported this important instrumental value of health for economic growth (Bloom et al., 2001; Jamison et al., 2005) [10; 11], and although the paths of health effects on economic growth are not the same for countries at different income levels, they all demonstrate a positive impact of health on economic growth (Bhargava et al., 2001) [12].

3. Determinants of health capital.

3.1. Health Demand Model. According to the theory of health human capital, health status depends on health investments [13]. Grossman (1972) further clarified the concept of health capital by constructing a theoretical model for analyzing health needs based on the characteristics of health, which defines health as a durable capital stock capable of yielding a healthy life time, distinguishing health from other forms of human capital [14]. It is assumed that the utility function of a typical consumer in all periods of his life is:

$$U = U(\varphi_t H_t, O_t), \ t = 0, 1, ..., n. \quad (1)$$

In equation (1), φ_t is the return per unit of health capital, H_t is the stock of health capital in period t or at age t, $h_t = H_t\varphi_t$ which is the total consumption of health in period t, and O_t is the total consumption of goods other than health in period t. The initial health capital is assumed to be H_0 and exogenous; H_t in each subsequent period is determined by consumer choice and is endogenous. From this, it is not difficult to obtain the incremental health capital:

$$H_{t+1} - H_t = I_t - \delta_t H_t. \quad (2)$$

As shown in equation (2), δ_t is the depreciation rate of health in period t. The depreciation rate is exogenous and varies with period or age, and I_t is the total investment in health capital in period t. In general, I_t and O_t are determined by the following functions:

$$I_t = I_t(M_t, TH_t; \ E); \quad (3)$$

$$O_t = O_t(S_t, T_t; \ E). \quad (4)$$

Where M_t is the set of goods that are available in the market for health-friendly capital, such as health services and medical services, as inputs to produce I_t; S_t is the set of goods that favor the output O_t; TH_t and T_t are the time taken to produce I_t and O_t; and E is the human capital other than health capital.

In Figure 3, the intersection of the health benefit curve and the cost curve $(r + \delta_t)$ determines the individual's optimal demand for health H_t^*. An increase in the cost of health investment will lead to a decrease in the individual's demand for health capital. At the same time, studies have been conducted to focus on the changes in the depreciation rate of health capital δ_t. In general, the accompanying increase in age will lead to an increase in the depreciation rate δ_t. For example, when the depreciation rate increases from δ_t to δ_t^*, the demand for health capital will decrease from H_t^* to H_t^{*a}.

In addition, other determinants will affect the movement of health capital, leading to an overall outward or inward shift of the health return curve, which is explained by the "education" variable in this paper, considering that education is also one of the most important human capitals of great concern. Research has long demonstrated the complementary nature of the two human capitals, education and

health, and an increase in the level of education will, to some extent, increase the productivity of health capital, which will lower the shadow price of health capital and lead to an outward shift in the health return curve, thus leading to an increase in the demand for health capital from H^*_t to H^{*b}_t (Figure 3).

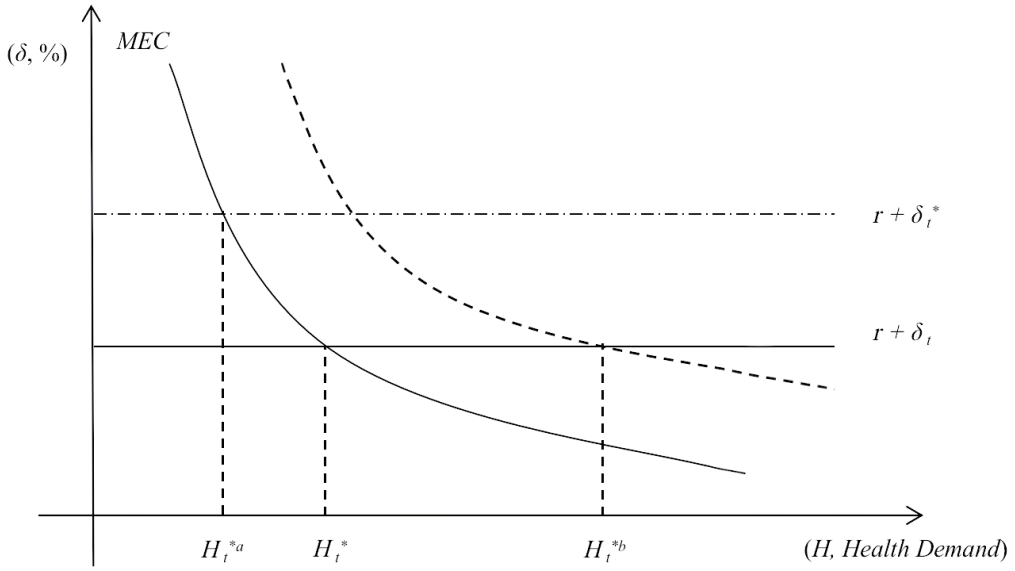

Figure 3. Comparative static analysis of health needs

Source: Compiled by the authors based on Grossman's health demand model*.

Based on Figure 3 and the Grossman health model, this paper selects several aspects that are more closely related to China's current economic development needs to summarize and sort out the existing research, and discusses the influencing factors of health capital in detail, with the model shown in equation (5):

$$Health_{it} = \beta_0 + \beta_1 L_{it} + \beta_2 I_{it} + \beta_3 E_{it} + \beta_4 P_{it} + \beta_5 N_{it} + \varepsilon_{it}. \quad (5)$$

As shown in equation (5), this paper mainly summarizes and combs the existing related studies on the determinants of health capital based on the four directions of labor market: employment rate, absolute income, work intensity, etc., (L), income distribution (I), environmental quality (E), and public services (P), which including healthcare accessibility and public education services.

3.2. Determinants of health capital. Labor Market Related Factors and Health Capital. Based on the summary and organization of existing literature, this part selects three labor market-related factors, namely employment, personal income, and work intensity, to analyze the relationship between them. First, the relationship between employment and health capital. As early as 1974, McMichael et al. proposed the "healthy worker effect". They found that the total mortality rate of certain types of workers is lower than that of the general population [15]. Subsequently, scholars in various countries launched a series of studies on the relationship between work and health. Guo (2016) used ordered probit regression to empirically explore the effects of job characteristics on the health status of Chinese university graduate workers and found that the rate of positive effects of employment on the health of Chinese university graduate workers was

* Source: GROSSMAN, M. (1972). The Demand for Health: A Theoretical and Empirical Investigation. Columbia University Press. https://doi.org/10.7312/gros17900.

lower than the rate of negative effects [16]. Liang (2016) utilized the CSS 2013 data to empirically explore the effects of two different work statuses, working outside the home and working full-time at home, on the mental health of urban married women, and the mental health of working urban married women was significantly better than that of full-time housewives [17]. Of course, there is no shortage of different research findings. For example, Fletcher et al. used data on job characteristics (physical demands and environmental conditions) summed over a five-year period to confirm that job characteristics have a cumulative effect on health and are more detrimental to the health of women and older workers, but that income, one of the job characteristics, partially mitigates the effects of physical demands and poor environmental conditions on workers' health [18]. Karmakar and Breslin found that job characteristics moderated the relationship between education and health and that lower levels of work-related social support and irregular shift work were associated with lower self-rated health [19]. Therefore, the government should make efforts to promote labor market formalization and move workers engaged in informal employment to formal positions. Second, the relationship between work intensity and health capital. According to statistics, the average weekly working hours of employed workers in Chinese enterprises exceed the legal working hours by 4.6 hours. In the context of the increasing normalization of overwork, hot words such as "overworked death" and "overworked fat" continue to appear in reports, and workers gradually realize that overwork is not conducive to their own health development. Many studies have shown that work intensity has a certain impact on physical health (including blood pressure, stroke, overweight, etc.) and mental health (e.g., anxiety) [20–24]. Therefore, the advocacy of moderate labor should be further strengthened to promote workers to improve their health investment, strengthen the attention to workers' work mindset, and establish a flexible and elastic work system, to alleviate the health depletion of the labor force population. Finally, the relationship between personal income and health capital. In health economics, the effect of income on health is referred to as the absolute income hypothesis, which has now been confirmed to varying degrees in several countries. Despite the problems of omitted variables, reverse causation, and sample data bias in the research process, most of the research conclusions still support the absolute income hypothesis, which has achieved a basic consensus in the field of health economics. Meanwhile, most of the relevant studies in China discuss the impact of income and income disparity on health at the same time. In view of this, the article will develop a detailed discussion of Chinese studies in the section on income distribution and health capital.

Income distribution and health capital. It has been found that the health effect of income is decreasing, which leads to the assumption that the degree of social inequality affects the average health of a society [25]. Firstly, Rodgers (1979) empirically analyzed the relationship between income distribution and health capital using cross-sectional data from 56 rich and poor countries with Gini coefficient, life expectancy, and infant mortality rate, and found that income inequality has a significant negative effect on life expectancy [26]. Flegg (1982), using the data from 59 developed and developing countries, similarly found that income inequality significantly increased infant mortality [27]. Since then, a large number of studies have emerged to support these findings [28–31]. Along with China's sustained and rapid economic growth, people's income and living standards have been rising, and the health status of the population has been greatly improved. In 2021, China's per capita GDP reached US$12,500, exceeding the world's per capita level, and data from the same year show that the life expectancy of the Chinese population increased to 78.2 years, which gradually attracted attention from scholars about the relationship between income, income distribution, and health. For example, Qi (2006) utilized micro-panel data from

nine provinces in China to explore the relationship between income and health capital and the relationship between income distribution and health capital, both of which have urban-rural differences, based on China's urban-rural dual economy and social characteristics. First, the relationship between rural residents' income and health is not significant, while urban residents' income can significantly improve their health status. Second, income inequality has a negative effect on rural residents, while it has a positive effect on urban residents [32]. Subsequently, Chen et al. (2010) demonstrated that income and income disparity had a positive and decreasing effect on farmers' health after using instrumental variables to address the endogeneity problem in the study [33]. Feng et al. (2007) first began to consider the mechanism of income disparity on health capital by introducing public service treatment variables in regression analysis, and the results showed that income disparity affects residents' health through the public healthcare channel [34]. In conclusion, in terms of empirical research, the existing studies on income disparity, the relationship between income and health capital, and the mechanism of influence in China still need to be further explored.

Environment and Health Capital. Based on the health production function, the health depreciation rate leads to the decline of health capital stock, and air pollution has a health depreciation effect, which leads to the depletion of health capital. Cropper et al. (1981) were the first to construct a theoretical framework of environment and health capital based on the health demand theory by further incorporating air pollution into the influencing factors of health capital depreciation rate [35]. Since then, numerous studies, both in developed and developing countries, have shown the relationship between environmental pollution and health capital. Currently, relevant studies mainly focus on the health effects of air and water pollution, and the target groups of the studies include infants, young children, adults, and other groups. Chay et al. (2003) and Currie et al. (2005) successively demonstrated the effects of air pollution levels and four criteria pollutants on the physical health of infants and young children: the mortality rate of infants and young children was reduced by 1 % for every 1 % decrease in TSP by 0.35 %, and reductions in CO and PM10 saved more than 1,000 infant lives [36; 37]. The studies from developing countries have shown the same (Tanaka, 2015; Arceo, 2016) [38; 39]. Health economics in China is still in the early stage of its development, and the studies on the relationship between the environment and health capital are still relatively limited, mostly confined to specific regions, but all of them prove that air and water pollution have a negative impact on physical health [40–42].

Public services and health capital. The findings of Grossman (1972) based on his health demand model suggest that both public education services and public health care services contribute to the improvement of health levels [13]. According to Grossman's (1972) demand for health model, along with the increase in the level of education, the efficiency of producing health capital increases, and the shadow price of health decreases, which in turn increases the flow and stock of health capital, and thus improves the level of health and health care services. For example, Sri Lanka, pre-reform and opening-up China, and the Kerala Gang in India have all achieved rapid reductions in mortality rates even during low-growth periods of economic development through further provision of social public services (mainly healthcare and basic education) (Sen, 1998) [43]. Flegg (1982) earlier studied 46 underdeveloped countries between 1968–1972 using OLS regression modeling and found out that a 1 % increase in the number of doctors per 10,000 population resulted in a 0.134 % decrease in infant mortality rate, and a 1 % increase in the number of nurses per 10,000 population resulted in a 0.087 % decrease in infant mortality rate. The study suggested that unless more emphasis is placed on reducing income inequality

and strengthening social infrastructure, infant mortality rates in underdeveloped countries will not decline rapidly [44]. Glewwe et al. (2002) empirically explored the factors influencing children's nutritional status in the time periods 1992–1993 and 1997–1998 using data from the Vietnam Living Standards Survey. After controlling for factors such as children's age, per capita expenditures, religion, ethnicity type, and parental height and education they found that the distance to a private pharmacy had a significant effect on children's nutrition [45]. Most of the Chinese literature on the impact of healthcare services on health has also come to the consistent conclusion that healthcare services have a positive impact on health [46–48]. Compared to the studies on the relationship between medical services and health capital, there are relatively few studies on the impact of educational services on health. However, most of the existing related studies support the conclusion that educational services have a positive impact on health capital. For example, Lu et al. (2013) utilized panel data of 116 countries or regions from 1997 to 2009 and incorporated environmental pollution factors based on the Grossman health production function to empirically study the impacts and differences of environmental pollution on residents' health and the role of public service factors. They found that differences in environmental health risks across countries are largely constrained by the level of public services in that country, and when public services such as education, health, and infrastructure across countries reach their respective thresholds, the impact of environmental pollution on health decreases to some extent [49]. Overall, although there are differences in the existing studies, most of the studies support the conclusion that there is a positive impact of medical services and educational services on health.

In summary, it is easy to find that labor market factors (employment rate, absolute income, work intensity, etc.), income distribution, environmental quality, and public services (healthcare accessibility and public education services P) are all important determinants on health capital (Figure 4).

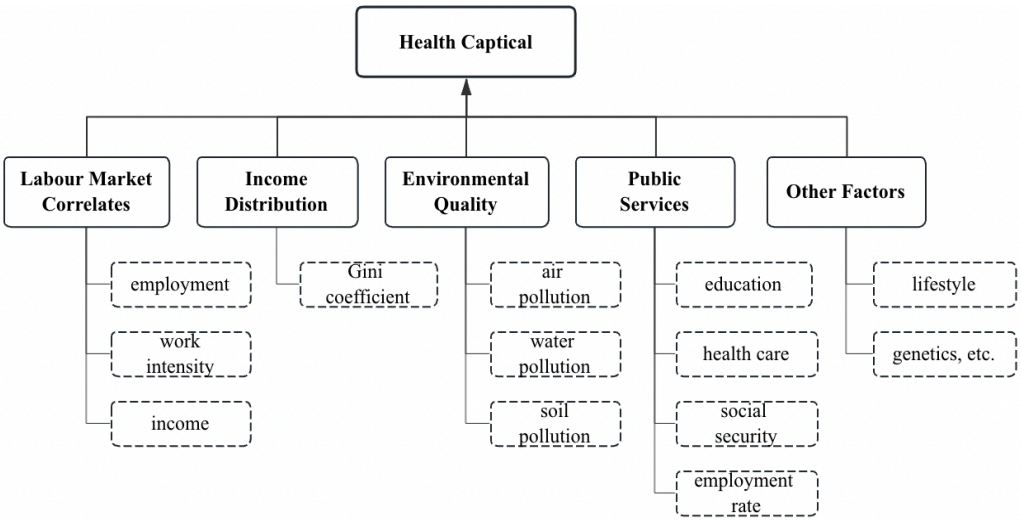

Figure 4. Determinants of health capital

Source: Compiled by the authors.

4. Conclusions and policy recommendations. Health has long been one of the beautiful pursuits for the survival and development of human society. However, there is still relatively little research on the economics of health in mainstream economics studies compared to economic growth. Although we have attempted

to explore the relationship between trade liberalization and health capital both theoretically and empirically [50–51], further clarification on the value of health capital and the theoretical foundations of this area of inquiry is still needed. With the advancement of economic globalization, physical and mental health has become an important goal and foundation for people to engage in economic activities, and health capital has gradually become one of the elements that countries pay close attention to when participating in the globalization process. In the process of economic globalization, how can effective policies be adopted to maximize the health capital of their residents and minimize the health risks they will face? This has become one of the essential issues that countries need to consider.

Therefore, based on the above macro human perspective, this paper discusses the value of health capital based on existing studies and further reviews several determinants of health capital based on the health production function. From the summary presented in this paper it is not difficult to make sure that health capital, not only has an important intrinsic value, but also has an important instrumental value for economic growth, labor productivity and income enhancement. At the same time, health capital is also s influenced by other factors such as labor market-related factors, income distribution, environment quality, and public policies. In view of this, the findings of this paper have important policy implications:

Firstly, economic development provides more jobs and opportunities in the labor market, which increases the income of the population, but it is also accompanied by a rise in the intensity of labor, and social phenomena such as ''overworked fat'' and ''stress fat'' are becoming more and more common. According to the health demand model, the rise in absolute income brought about by the labor market will reduce the depreciation rate of health, while the increasing unreasonable intensity of work will increase the depreciation rate of health. Therefore, the Government and relevant departments should make efforts to promote the formalization of the labor market, so that workers engaged in informal employment can move to formal positions. At the same time, they should further strengthen the promotion of moderate work in the labor market, encourage workers to increase their health investments, pay more attention to their work mindset, and encourage enterprises to establish flexible and elastic work systems, to alleviate the depreciation of the health of the labor force.

Secondly, according to the health demand model, environmental pollution will significantly increase the depreciation rate of health. Enterprises should deeply implement the green development concept, promote the green transformation of traditional manufacturing industries, continuously improve the sustainable development of China's economy, and reduce environmental pollution. This is an effective way to improve the health capital of the population and the labor force, and it is also a necessary way to achieve "healthy China".

Finally, the government and relevant departments should further enhance the level of public education and healthcare services. On the one hand, based on the health demand model presented in this study, the improvement of educational capital will lead to increased productivity of health capital, thereby reducing the shadow price of health. This, in turn, will increase the flow and stock of health capital, ultimately improving the overall health of the population. Therefore, it is crucial to steadfastly adhere to the strategy of prioritizing education, continuously promote educational equity, and elevate the quality of public education services. This approach holds significant practical importance for addressing contemporary societal challenges such as public health, the development of a strong human resource base, the decline of the demographic dividend, and issues related to fertility rates and population aging. On the other hand, according to the health demand model, public healthcare services will effectively reduce the depreciation rate of health among the population. It goes without saying that continuously improving the level

of public healthcare services is an essential pathway to promoting public health. It is imperative to deepen reforms in the healthcare system, enhance the quality of public healthcare services, and ensure the equitable distribution of medical resources. This will enable most of the population to achieve "early detection," "early treatment" and "early recovery" rather than facing difficulties and high costs in accessing medical care. As the economy grows and people become more prosperous, it is essential to continuously meet the increasing demand for health services among all ethnic groups, ensuring that the benefits of economic development are reflected in improved health outcomes for all.

It should be acknowledged that this study has certain limitations. First, as a review article, the literature synthesis presented herein may not comprehensively encompass all relevant studies, and there remains room for further refinement and expansion. Second, while this paper provides a theoretical framework for understanding health capital and its determinants, empirical research in this field is still in its early stages and requires further in-depth exploration. Future studies should aim to conduct more rigorous empirical analyses to validate and extend the theoretical insights proposed in this research.

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ЧЖАН ЮЙТИН,
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ЦЕННОСТЬ КАПИТАЛА ЗДОРОВЬЯ И ЕГО ДЕТЕРМИНАНТЫ: ОБЗОР НА ОСНОВЕ МОДЕЛИ СПРОСА НА ЗДРАВООХРАНЕНИЕ

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Здоровье как важный аспект оценки социального развития оказывает глубокое влияние на процесс эволюции человеческого общества. Основываясь на текущем состоянии здоровья населения Китая и интеграции внутренней и инструментальной ценности капитала здоровья, данная работа строит эконометрическую модель спроса на капитал здоровья с использованием модели Гроссмана. В исследовании рассматриваются детерминанты капитала здоровья с четырех позиций: рынка труда, распределения доходов, качества окружающей среды и государственных услуг. Кроме того, в статье обобщаются существующие пробелы в научных исследованиях Китая в данной области и предлагаются конструктивные и осуществимые рекомендации по политике. Настоящая работа предоставляет теоретическую основу для более глубокого понимания ценности капитала здоровья и его определяющих факторов, а также способствует устойчивому развитию общества.

Ключевые слова: капитал здоровья; модель спроса на здравоохранение; детерминанты; здоровье жителей Китая.

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