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-RESEARCH ARTICLE-

THE INFLUENCE OF HEALTH INSURANCE ON LABOR MARKET OUTCOMES：A COMPARATIVE STUDY USING HEALTH ECONOMICS AND LABOR ECONOMICS

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—Abstract—

In recent years, health economics and labor economics have not only risen rapidly in the international academic circles. This paper constructs a dynamic programming model including health risks and health insurance, and conducts numerical simulation based on the iterative method of Bellman equation value function to study the impact of commercial health insurance on labor participation rate. The empirical results show that the commercial health insurance purchased by workers themselves can increase their labor participation rate, while the commercial health insurance purchased by employers will reduce the labor participation rate of workers, and the impact of commercial health insurance on labor participation is heterogeneous. On the basis of introducing the frontier research on output evaluation system and method based on preference theory and feasibility theory in recent years, this paper focuses on summarizing and analyzing the development and application of choice modeling and its experimental methods and tools. It provides a basis and reference for comprehensive and in-depth health economics evaluation research in the future.

Keywords: Health insurance, labor markets, health economics, labor economics, labor participation

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1. INTRODUCTION

In traditional concepts, people usually equate health with no disease (Evans & Stoddart, 1990). Although health and disease are closely related, they cannot be equated. This is a relatively narrow understanding of health. Disease is a disease that appears in medicine, and it is a form of health. In addition to "visible health", whether there are hidden dangers in a human body that are not conducive to body activities, and whether various tissues and organs can function properly. These are closely related to health, but this is only explained from the physical level. Mental cognitive judgment ability, subjective feeling and adaptability to the surrounding environment are also a basis for explanation (Charles & DeCicca, 2008; Rust & Phelan, 1997).

Undoubtedly, health is the first precious wealth in life, and it is more important than other wealth. In economics, it is regarded as a special consumer product. In addition to its intrinsic value, health also has its instrumental value (Fuchs, 2011). The intrinsic value of health is reflected in a person's good self-feeling, which can directly increase his pleasure or utility satisfaction; while its instrumental value is reflected in the fact that he can earn more work income under good physical health, thus using currency Wage income is used to purchase and consume various commodities to obtain utility, which indirectly increases utility satisfaction. In other words, if health is lacking, the realization of many other feasible abilities will be affected, and health is undoubtedly the most important of many feasible abilities (Remme, Martinez-Alvarez, & Vassall, 2017). In recent years, the connotative development theory proposed in the common literature emphasizes that technological progress is the main source of a country's sustainable economic development (Kadar & Reicher, 2020). The output obtained by simply relying on the increase of production factors (such as capital) (which can be called the desperate effect) is relatively small, but the output obtained by technological progress (which can be called the knowledge promotion effect) is relatively large (Azmat & Petrongolo, 2014; Charness & Kuhn, 2011). Some economic studies have emphasized that one of the main forces driving technological progress is the growth of human capital, because the creation and invention of technological progress are all inspired by the human brain (David, 2013). Because technological progress has the characteristic of increasing returns to scale, its impact on social and economic development will make the development gap between developing countries and developed countries more and more wide (Lin, Yao, & Zhao, 2014). Under the concept of connotative development theory, health, as an important factor of human capital, will have a more prominent impact on social and economic development. Starting from investing in health is an important way to shorten the gap between the rich and the poor in social and economic development among countries (Wang et al., 2021).

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From an economic perspective, health is different from general commodities. As a special commodity, health not only has intrinsic value, that is, its own value, but also has the value of a tool to increase the utility of other activities. There is no doubt that health is the greatest wealth that people possess (Oreopoulos, 2011). We can divide the concept of labor economics into two parts, namely "labor" and "economics". The former specifies the research object of labor economics, while the latter specifies the category of labor economics (Pavlin, 2014). Generally speaking, labor economics belongs to the category of economics and is an important branch of economics. Its research object is mainly the law of labor relations and its development (Currie & Almond, 2011). At the same time, the theoretical basis of labor economics does not only come from the theoretical system of economics, but also sociology, psychology, anthropology, ethics, political science and other disciplines also provide theoretical support for the study of labor economics, which can It is said that labor economics is also an interdisciplinary subject, and it is precisely because of this feature that labor economics can maintain the comprehensiveness and comprehensiveness of research in complex social and economic environments.

Combing the literature related to labor force and health insurance shows that: in terms of health insurance, the research is mainly related to the relevant factors affecting demand and the interaction with social medical insurance (Ahonen et al., 2018). In the research on labor force, domestic and foreign scholars regard labor capital as an input variable to study its impact on economic output or labor efficiency, on the other hand, labor is used as an output variable to study the impact of other factors on labor (Evans & Stoddart, 1990). Health is inseparable from disease and injury, and health insurance has a certain relationship with these diseases, so there is research on the relationship between labor force and health insurance (Autor, Dorn, & Hanson, 2016; Kluve, 2010). Domestic research is mainly distributed on social medical insurance, and the research conclusions also have their own characteristics, while the content related to health insurance is less and reduce unhealthy habits such as smoking and drinking to improve healthy human capital (Aissaoui, 2022; Lin et al., 2023). Some are based on a misunderstanding or one-sided view of economics, while others are unwilling to accept the widespread problem of resource shortages and the need to set priorities. But there is also a criticism related to the developing world, which concerns the suitability of the literature, much of which originates in the rich world, to the situation in poorer countries (Mills, 2014).

To sum up, the existing literature mainly conducts research from the perspective of social medical insurance, but few studies focus on the labor supply effect of health insurance, and most of the research methods are based on empirical analysis. Based on the above situation, this paper combines theoretical models and empirical analysis to study the impact of health insurance on labor participation, hoping to supplement existing research.

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2. THEORETICAL FOUNDATIONS

2.1 Theories Related to labor supply

The neoclassical school started from the assumption that the information in the labor market is perfect, the flow is unimpeded, and the cost of obtaining information is low or even zero, and combined with other assumptions, it laid the foundation for its school. In their eyes, no A description of the hunt. However, McKenna believes that in reality, the information in the labor market is asymmetric, and there is a cost to collecting information, and the wage rate is not given, which is uncertain. Therefore, starting from the modification of the assumptions of the neoclassical school, the related theories of the neoclassical school were further improved, and the labor market search theory was established (Bieleń & Kubiczek, 2020; Kluve et al., 2017; Radulescu et al., 2020). After the 1930s, the New History School, the Welfare Economics School, and the Keynesian School advocated that social security has a positive effect on economic development and employment.

Since labor demand is a derived demand, firms hire labor because they can create a useful product or service (Piore, 2018; Smaldone et al., 2022). Therefore, enterprises determine the number of workers according to the principle of profit maximization, and the neoclassical school believes that as long as the marginal revenue yield of each additional labor force is equal to its marginal cost or wage level (Conrad, 2022), the size of the enterprise's labor force is already in an optimal state. Let the production function of the enterprise be $Q=f(K, L)$, K represents the amount of capital input, L represents the amount of labor input and Q represents the output, which is expressed by the formula $W=MRP$L where W is the wage and MRPL is the marginal revenue yield of labor, as shown in Figure 1.

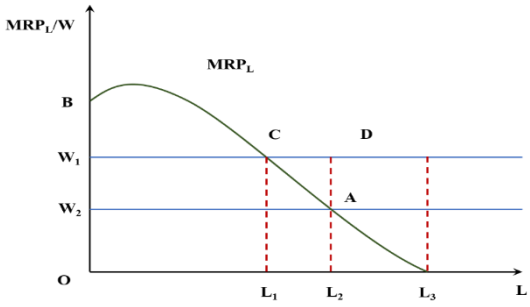

Figure 1: Relationship between marginal revenue yield and labor force size

In the assumption that the enterprise has only two input factors, capital, and labor, the capital factor has little elasticity of change in the short run. Thus, the firm can only adjust the quantity of labor demand. However, in the long run, both the capital and labor

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factors are variable, in which the wage often shows a rising trend, and the firm can change both capital and labor inputs in order to maximize profit, as shown in Figure 2.

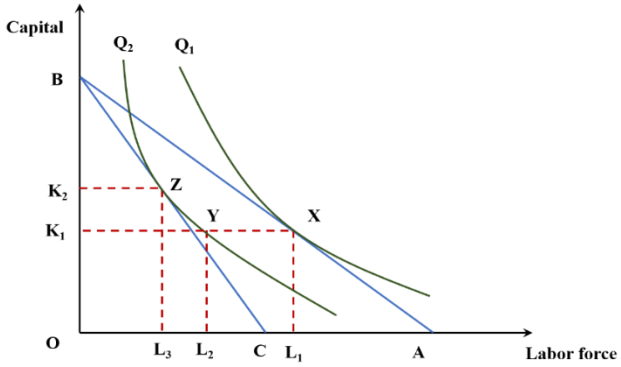

Figure 2: Capital-labor relations

As a result of higher labor costs, firms need to reconsider the equilibrium level, as in Figure 3, where an increase in the wage level raises the firm's costs, shifting the marginal cost curve MC1 to MC_2 to the left. such that the output level falls to Q_2. As a direct result of the wage increase, the equal output curve in Figure 3 slips from Q_1 to Q_2, and the demand for labor falls from L_1 to L_2, with L_2 corresponding to point Y on the equal output curve. As a result, the level of hiring falls.

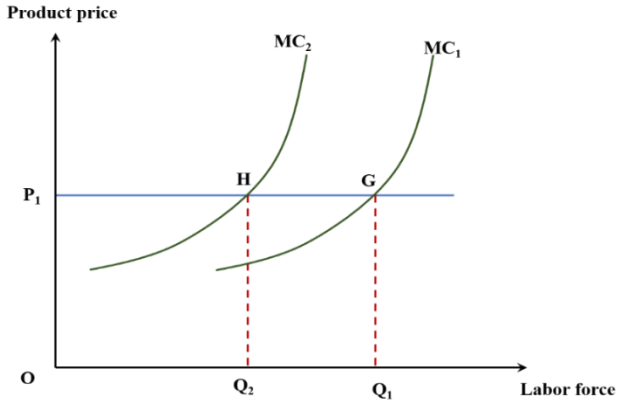

Figure 3: Production and product price relationship

In addition, since the number of employees in some national plans is linked to the total wage control index, the increase or decrease of enterprise personnel is directly related to the change in wage quantity, and the personnel and wage index is controlled by the government. Once an enterprise has a labor index and recruits workers, these workers are solidified and settled

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in the enterprise, and can only enter but not leave. Unusable labor cannot be dismissed, so top-down planning is often greater than the real labor demand of enterprises, making the existence of redundant workers a regular phenomenon. As in Figure 4, the horizontal axis represents the quantity of labor force L, the vertical axis represents the marginal revenue yield of labor MRP_L or wage W, and W_0W_1 is the demand curve of the labor force. Since employment is arranged by the planning department and the wage is inelastic to the quantity of labor supply, the demand curve of the labor force in the figure is a straight line intersecting W_1 parallel to the L axis. It intersects with MRPL at W_0 when L_0 is the optimal hiring size, and accordingly, the supply of labor is inelastic with respect to wages, so the supply curve of labor is a straight line W_L perpendicular to the L axis. However, under the traditional way of labor allocation, since firms always attempt to hire more labor, the labor supply curve of firms must be a straight line W_1L_1, which intersects with MRPL at point B At this point, the marginal revenue yield of labor is negative, and it is obvious that the size of the hired labor, L_1, not only does not increase profits but also offsets them.

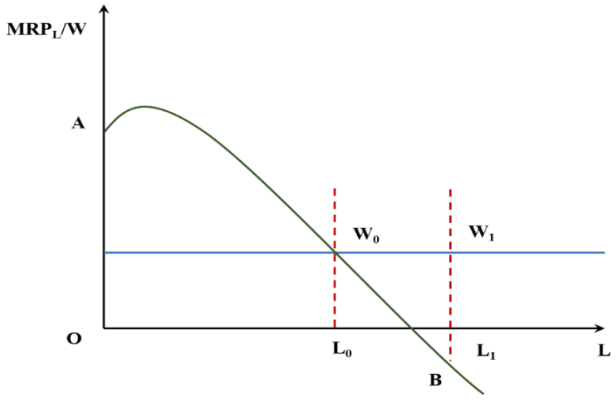

Figure 4: Change in the number of labor force

Second, the existence of a large number of redundant workers leads to inefficient labor. Redundancy inevitably leads to the same amount of people using fewer means of production and creating less wealth, which manifests itself in low labor productivity. Due to the planned economic system, rigid wage system, fixed-worker system, and evenly distributed welfare system, the size and increment of their personal economic welfare are completely regulated, and individuals have no economic human characteristics and lack profit motive and motivation, so their maximization behavior is expressed as the pursuit of on-the-job idleness. On the other hand, the fixed-worker system lacks the competition mechanism and the worry of unemployment, which reduces the degree of individual work effort and makes the pursuit of on-the-job leisure lack of institutional constraints, as in Figure 5.

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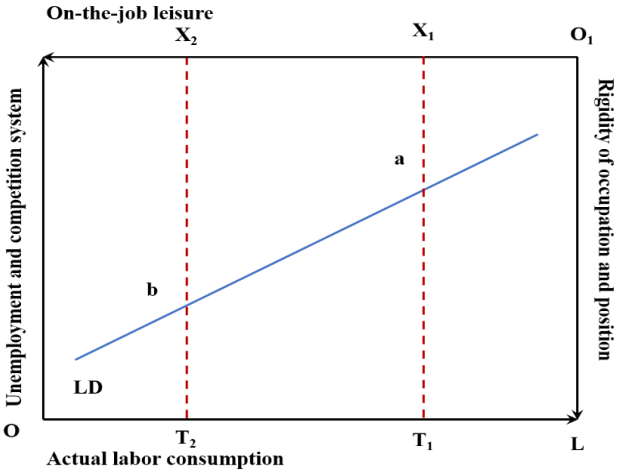

Figure 5: Labor behavior change

LD is the behavior curve of the labor force. It can be seen that the actual consumption of labor increases with the degree of unemployment and competition and decreases with the degree of occupational and job rigidity, on the contrary, on-the-job idleness decreases with the degree of unemployment and competition and increases with the degree of occupational and job rigidity. Under the traditional approach to labor allocation, the labor force behaves at point b.

2.2 History of Health Economics

As an independent discipline, the development history and topics of concern of health economics have changed with the times, reflecting the characteristics of stages. This study compares the main development history of health economics, which is shown in Table 1.

Table 1: Key developments in health economics

Year	Stages	Representative person	Important Results
1676	Origin of Health Economics	Petty	First to introduce the concept and measurement of human capital
1909	U.S. National Health Report	Fisher	Estimated U.S. health capital stock of $250 billion in 1900
1940	Health economics terms emerge		
1963	Birth of Health Economics	Arrow	Uncertainty and the Welfare Economics of Health Care
1972	Birth of Health Needs Theory	Grossman	The concepts of health capital and health needs
1987	Experimental Health Economics	Manning	RAND Health Insurance Experiment

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Due to the different socioeconomic conditions, the development of health economics in developing countries has its special characteristics: health policy directions and trends have a profound impact on the development of health economies, and international organizations and multilateral institutions play an important role in promoting the development of health economies in their countries.1 The main areas of interest in health economics in developing countries are the development of cost-benefit and cost effectiveness analysis, health financing, health care provision, and systems analysis, Health care provision and systems analysis are the four main areas of concern in developing countries, as shown in Figure 6.

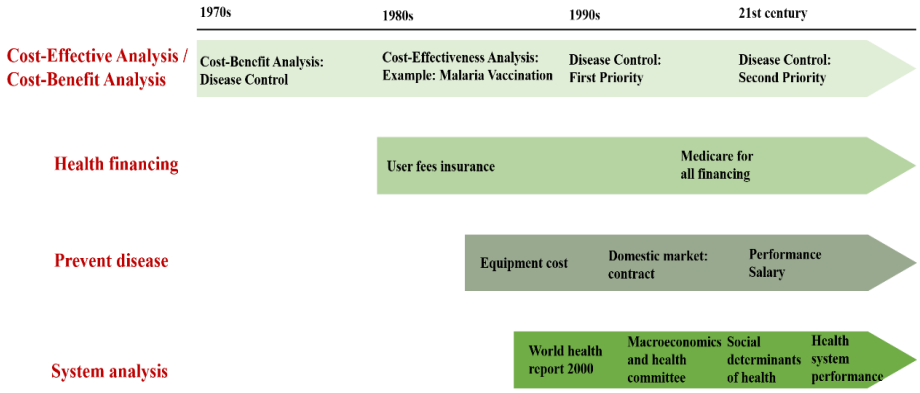

Figure 6: The evolution of health economics in developing countries

Cost-benefit analysis (CBA) was initially developed as a systematic method of assessing the costs and benefits of public sector investments, where market tests (profitability) could not be applied. In the 1970s, it was a popular tool for making the economic case for disease control investments. However, it is increasingly recognized that the traditional approach to measuring the value of well-being, the human capital approach mentioned earlier, is a very one-sided measure of the value of life. Health is valued not only because it helps people to be more productive and has value as an instrument, but also because it has intrinsic value and is part of overall well-being. Cost-effectiveness analysis (CEA) became the preferred technique, assessing benefits only in terms of health, rather than in terms of money, as CEA does. Since the 1970s and 1980s, there has been a rapid expansion of the literature on the cost-effectiveness of a variety of interventions, mainly in relation to infectious diseases, childhood illnesses, and immunization.1 In addition, there has been an increase in the number of interventions that are cost-effective, and in the number of interventions that are cost-effective. For example, to help mobilize resources to support the resumption of malaria control in the late 1990s, WHO commissioned cost-effectiveness studies of key malaria control tools. The results suggest that prevention (e.g., insecticide-treated nets) and treatment are as cost-effective as many other low-cost interventions to reduce child mortality (Mills, 2014).

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2.3 Health theory under the concept of economics

Economics views health from both a holistic and individual perspective. On the whole, the role of health in socio-economic development is labor and capital, which are the most important production factors in the socio-economic system (Bilgaev et al., 2022; Cui et al., 2022; Hasan, 2021). The Production function of a country as a whole can be simplified as Q=F (L, K), where Q represents output, L represents labor production factors, and K represents capital production factors. In the case where production factors can be replaced, the principle for manufacturers to choose the most suitable combination of production factors is cost minimization, and the combination of production factors with cost minimization must meet the requirement that the ratio of relative prices of factors is equal to the ratio of marginal production of factors. From this simplified overall production function, we can see the power and source of a country's economic growth. Before the Industrial Revolution, it was mainly the growth of population (labor force), and after the Industrial Revolution, it was mainly the accumulation of capital. Traditional economists emphasize that capital is physical capital (Acs, Audretsch, & Lehmann, 2013; Nielsen, Holm, & Lorenz, 2021).

Traditionally, the capital emphasized by economists is the physical capital. However, since the early 1960s, several economists have successively introduced the concept of human capital, where labor is not homogeneous and workers, like capital factors of production, can be improved with the help of investments to improve the quality of labor and thus productivity.

The general form of the health production function: is $H= f(M, IS, T)$, where H represents the health of the consumer, LS represents the lifestyle chosen by the consumer, and T represents the time invested by the consumer in producing health. If the goal of health policy is to produce (promote) health, then under the concept of the health production function, to achieve the same level of health output, the cost expenditure for producing health can be reduced by substituting different health production factors.

Health capital, like other types of capital, is subject to depreciation, and Dr. Michael Grossman argues that consumers can "produce" health in a way that replenishes the health stock. The main productive factor in the production of health by consumers is healthcare services (Bhattacharya, Hyde, & Tu, 2014). In addition, lifestyle, environment, and education are also major inputs to consumer health (Martínez-Rodríguez et al., 2022). Thus, economics expresses the health production function as $H= f(M, LS, E, S)$. The policy implication of the health production function is that, under the concept of the health production function, consumers do not purchase health services for the purpose of needing health services per se, but for the purpose of needing

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"health" (Bayati, Akbarian, & Kavosi, 2013). Health services are simply inputs that consumers use to produce health. Thus, economics views the demand for health care as a "derived demand" from the consumer's demand for health. In other words, the provision of medical services is only the "means"; achieving health is the "goal" (Folland, Goodman, & Stano, 2016; Santana et al., 2023). In the health production function, there is substitutability between the various factors of production. Therefore, the government can induce consumers to choose the lowest-cost combination of factors of production by changing the relative prices of the factors of production.

3. THE IMPACT OF HEALTH ON LABOR MARKET PERFORMANCE

3.1 Model Construction

Drawing on McCall and Sargent &. Ljungqvis, this paper constructs a dynamic programming model that introduces health risk and health insurance in order to find the effects of each factor of health risk and health insurance on the labor force participation rate. This paper assumes that health risk affects workers' human capital and thus has the potential to lead to wage loss. A worker, he or she can choose to accept a job with a wage distribution F(w) in each period and receive a wage of w in each subsequent period, or not accept a job and receive unemployment insurance of c and wait until he or she finds a job with the same wage in the next period.

To address the core concern of this paper, according to Grossman's health demand theory and literature review, it can be found that the interaction mechanism between health, working hours, and income is manifested as follows: healthy people have the more physical and mental energy and can work longer hours, so this directly increases their labor productivity and thus their income level, while higher income makes it relatively easier to obtain good The higher the income, the easier it is to obtain good nutrition and quality medical services, which indirectly improves people's ability to invest in health and increases the stock of health capital.

However, on the other hand, a poor working environment or long overtime work will lead to health impairment of the labor force and reduce labor supply time or even withdrawal from the labor market, while health deterioration will reduce unit wage level and cause income reduction.

The causal relationship between labor force health, working hours, and income is shown in Figure 7.

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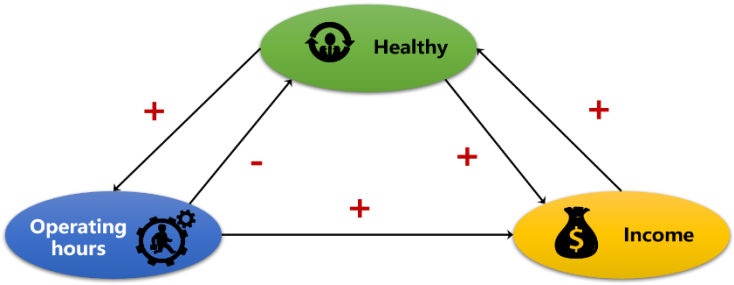

Figure 7: Health, working hours, and income interrelationships and expected direction of impact

The Probit model is a type of generalized linear model, which is applicable to nonlinear regression. The explanatory variables used in this study are "health assessment", "hospitalization", "happiness" and "trust". The above four variables are all set as binary (0,1) variables. Because these variables are discrete and discontinuous, the general linear regression model cannot be used for analysis. The function form of the probit model is as follows:

$$F(X)=\Phi(X)=\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{X}e^{-t^2/2}dt \tag{1}$$

$$Probit(p)=P(y_i|x)=\Phi(x_i'\beta)=\int_{-\infty}^{x_i'\beta}\varphi(t)dt \tag{2}$$

The core explanatory variable in this study is "commercial health insurance". For the binary (0,1) variables mentioned above, the Probit model calculates the probability of the impact of the core variable on the dependent variable by controlling for other factors. The database named CHIP contains household survey data conducted in 1988, 1995, 2002, 2007 and 2008. This database is known as the most authoritative basic data source in the field of income distribution and labor market research in China so far.This study combines the content of the CHIP database and the definition of the World Health Organization, and on the basis of existing research, selects the "health assessment", "hospitalization", "well-being" and "social adaptation", "happiness" and "trust" Four indicators are used as proxy variables of healthy human capital.

3.2 Results Analysis

In this study, the Probit model was established in STATA 14.0 software. Since the coefficients of the Probit model cannot represent the degree of influence of variables, this study calculated the average marginal effect, and Table 2 reports the regression results.

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Table 2: Regression results for the total sample

Variables	Health	Evaluation	Hospitalization	Well-being Trust
Commercial Health Insurance	0.145**	0.051	0.0233*	0.123*
	(0.088)	(0.061)	(0.021)	(0.052)
Gender	0.217**	-0.08**	-0.019	0.156**
	(0.031)	(0.033)	(0.019)	(0.017)
Age	-0.035**	0.018**	0.001**	-0.011**
	(0.002)	(0.001)	(0.0003)	(0.0008)
Education level	0.246**	-0.056*	0.022**	0.088**
	(0.012)	(0.009)	(0.005)	(0.005)
Marital Status	0.306***	-0.061*	0.115***	-0.013
	(0.043)	(0.036)	(0.021)	(0.023)
Working situation	0.451**	-0.375**	0.001	0.069**
	(0.028)	(0.025)	(0.016)	(0.017)
Urban and rural distribution	-0.292**	0.186***	0.01*	0.028
	(0.032)	(0.027)	(0.016)	(0.017)
Household consumption per capita	0.305**	0.435***	0.064**	0.052**
	(0.038)	(0.033)	(0.02)	(0.021)
Liabilities	-0.079*	0.027***	-0.014*	-0.005**
	(0.006)	(0.005)	(0.003)	(0.003)
Regional Variables	Controlled	Controlled	Controlled	Controlled

*, **, and *** represent 10%, 5%, and 1% significance levels, respectively, with standard deviations in parentheses.

For the indicator of "health evaluation", although it is obtained by subjective evaluation, it is a more comprehensive indicator of health manpower because it integrates all kinds of relevant information from respondents. The effect of "commercial health insurance" on "health evaluation" passes the 5% significance level hypothesis, which indicates that commercial health insurance has an effect on health human capital, and its marginal effect coefficient is 0.146, indicating that having commercial health insurance can increase the probability of being healthy by 14.6%. probability of being healthy by 14.6%. In this regression, the control variables all passed the hypothesis of 1% significance level. The marginal effect coefficient of "age", "urban and rural distribution", and "debt situation" is negative, indicating that these three indicators have a negative impact on the "Health

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assessment", that is, the older the age, the lower the probability of health in rural areas when carrying debt, This may be because older age represents faster depreciation of healthy human capital. Compared to urban areas, medical conditions in rural areas are relatively backward, and carrying debt can bring economic pressure to individuals and families, making it difficult to improve living conditions, thereby increasing health vulnerability.

There are two perspectives for understanding the indicator of 'hospitalization'. The first type of indicator can be considered as an objective measure of health human capital, as once hospitalized, it indicates that health human capital has been hit by health risks, leading to a decline in the stock of health human capital. The other type is that the indicator of "hospitalization" reflects the utilization rate of medical services. In this regression, the indicator of "hospitalization" did not pass the hypothesis test at the 10% significance level, indicating that the presence or absence of commercial health insurance does not affect individual hospitalization behavior. A positive indicator coefficient indicates that the indicator may focus more on the utilization rate of medical services.

The indicator passed the hypothesis test at a 10% significance level, indicating that health insurance has a significant impact on "happiness". A coefficient of 0.023 indicates that individuals with commercial health insurance have an increased likelihood of feeling happy by about 2.3%. This may be because commercial health insurance can reduce the medical burden faced by residents after accidental injury or illness, thus reducing people's Psychological stress on unknown risks, increasing the sense of security, and maintaining the stability of the family.

For the "trust degree" indicator, the impact coefficient of "health insurance" on this indicator is positive, and it passes the hypothesis test at the 1% significance level, indicating that individuals who purchase health insurance will have an increased probability of trust in strangers around them in society, and will have better social adaptability and be able to communicate better with others around them. This may be because commercial health insurance is a social mutual trust behavior. After purchasing commercial health insurance and paying premiums, policyholders receive risk protection and other value-added services provided by insurance companies, increasing consumers' sense of gain, thereby strengthening this local social trust, and ultimately driving the improvement of the overall trust ability of society.

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4. A STUDY OF THE LABOR SUPPLY EFFECTS OF HEALTH INSURANCE

4.1 Theoretical model

Drawing on McCall and Sargent &. Ljungqvis, this paper constructs a dynamic programming model that introduces health risk and health insurance in order to find the effects of each factor of health risk and health insurance on the labor force participation rate.

This paper assumes that health risk affects workers' human capital and thus has the potential to lead to wage loss. A worker, he or she can choose to accept a job with a wage distribution F(w) in each period and receive a wage of w in each subsequent period, or not accept a job and receive unemployment insurance of c and wait until he or she finds a job with the same wage in the next period.

The health risk affects the worker's wage, the loss occurs with exogenous probability p1, the loss occurs at a rate h that causes the wage to fall, and the worker receives a wage of:

$$w_r = (1-p_1)w + p_1 w(1-h) \tag{3}$$

In this paper, health insurance is divided into two categories: health insurance purchased by oneself and health insurance purchased by the employer. When a loss occurs, the probability that the loss is covered by the insurance liability of the health insurance purchased by the employer is p2, and the worker can receive a payout in proportion to the degree of insurance coverage m. Then the worker receives a wage income of:

$$w_{rm} = (1-p_1)w + p_1 w[(1-p_2)(1-h) + p_2(1-h+hm)] - p_2 \mu m p_1 hw \tag{4}$$

In this case, the premium for health insurance purchased by oneself is p2μmp1hw, μ is the market power of the health insurance company, mp1hw is the actuarially fair premium, 2μmp1hw is the premium after taking into account the market power of the insurance company, and p2μmp1hw is premium at this time taking into account the case of being insured by the insurance company. Equation (4) shows that in the case of health risk and no health risk, the wage is a weighted average based on the probability of occurrence, on which the premium is deducted, and in the case of health risk, the wage can be further decomposed into a weighted average based on the probability of coverage in the case of non-coverage of health insurance purchased by the employer and the case of coverage.

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In the case of employer-purchased health insurance, the worker receives a wage income of:

$$w_{rm} = (1-p_1)w + p_1 w[(1-p_2)(1-h) + p_2(1-h+hm)] - p_2\eta w \tag{5}$$

In this case, the employer's cost of health insurance for its employees is deducted in proportion to the employee's wage η. Eq. (5) shows that in the case of occurrence and non-occurrence of health risks, the wage is a weighted average based on the probability of occurrence, to which the necessary deductions for the employer to provide health insurance for the employee are subtracted. In the case of the occurrence of health risks, the wage can be further decomposed into a weighted average based on the probability of coverage in the case of non-coverage and coverage of health insurance purchased by the employer.

Let $v(w_{rm})$ be the expected lifetime earnings of the worker, and the corresponding Bellman equation be:

$$v(w_{rm}) = \max\left\{\frac{w_{rm}}{1-\beta}, c + \beta\int v(w'_{rm})dF(w'_{rm})\right\} \tag{6}$$

β is the discount factor, and the Bellman equation states that the worker chooses to accept the job and receive the same wage in each period, or refuses to work to receive the large job insurance c, and gets the job opportunity with the wage obeying $F(w_{rm})$ in the next period. Equation (7) can calculate the worker's reservation wage $\bar{w}_{rm}$:

$$\frac{\bar{w}_{rm}}{1-\beta} = c + \beta\int v(w'_{rm})dF(w'_{rm}) \tag{7}$$

From the concept of reservation wage, it is clear that if the wage exceeds the reservation wage, the worker will accept the job,w... The lower it is, the higher the probability of accepting the job and the higher the labor force participation rate, w... The higher the probability of accepting a job, the lower the labor force participation rate. Therefore, numerical simulation of the dynamic programming of the Bellman equation can be used to derive the change in the labor force participation rate under the influence of the probability of occurrence, degree of loss, market power, degree of coverage, and coverage of self-bought and employer-bought health insurance.

4.2 Numerical simulation

Figure 8 shows that as the probability of occurrence increases by p_1, the retained wage line that only introduces health risks is a horizontal straight line, that is, p_1 has no effect on it.

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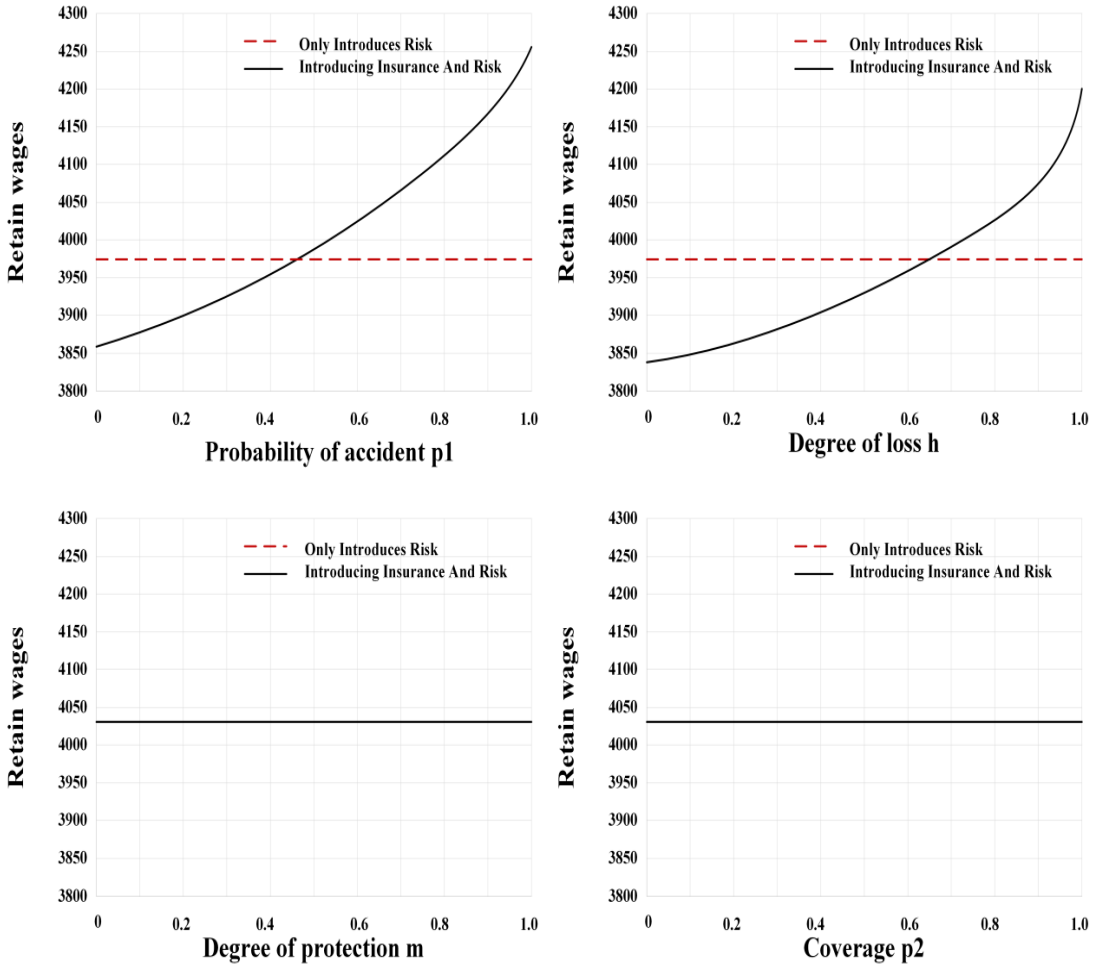

Figure 8: Impact of self-purchased health Insurance on labor force participation

As the probability of accident p_1 increases, the labor participation rate decreases, indicating that an increase in accident probability has the effect of reducing labor participation rate. As the degree of loss h increases, the retained wage line that only introduces health risks is a horizontal straight line, that is, h has no impact on it. At the same time, the retained wage line that introduces health risks and self purchased health insurance has a positive slope and intersects with the retained wage line that only introduces health risks.

Figure 9 shows that as the probability of accident p1 increases, the retained wage line that only introduces health risks is a horizontal straight line, meaning p1 has no effect on it.

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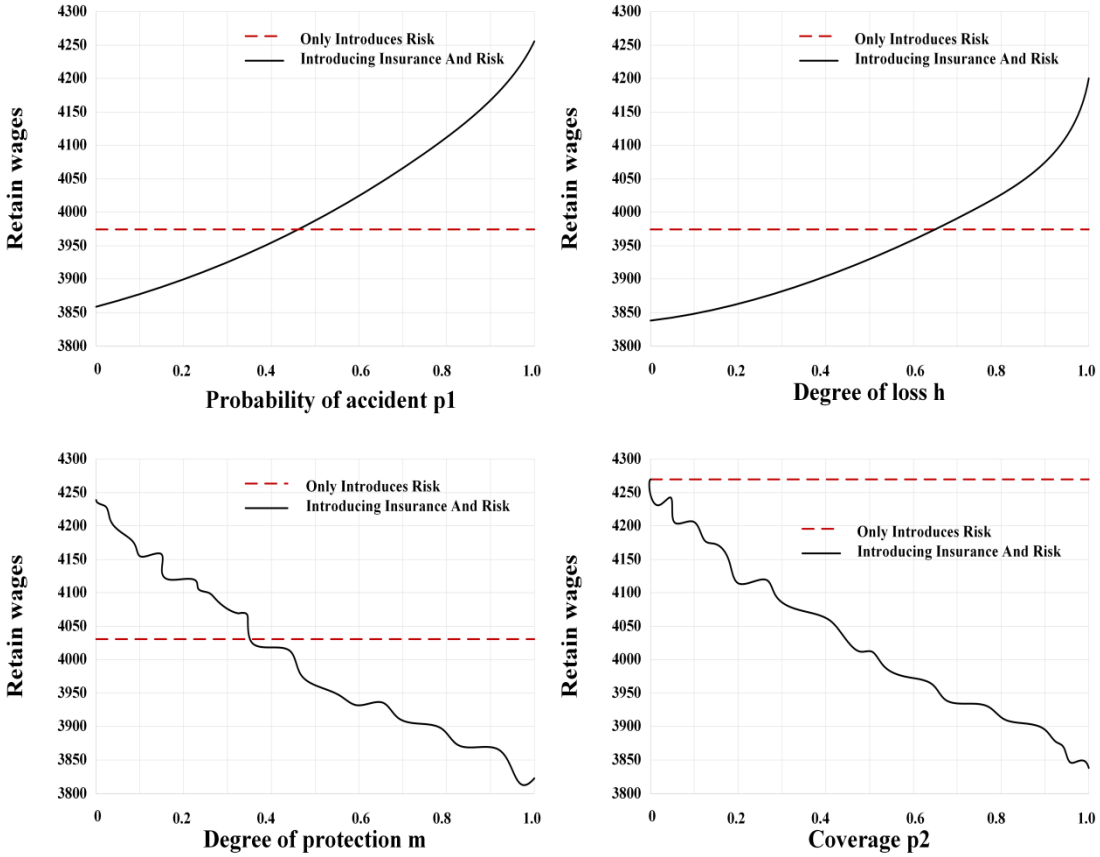

Figure 9: The Impact of employer-purchased health insurance on labor force participation

In summary, the increase in the probability of occurrence, degree of loss, and market power of the health insurance purchased by oneself will reduce the labor participation rate. Compared to the benchmark situation where only health risks are introduced, the probability of occurrence and degree of loss of the health insurance purchased by oneself will increase the labor participation rate when they are low, and lower the labor participation rate when they are high. The increase in market power of the health insurance purchased by oneself will reduce the labor participation rate. The level and coverage of health insurance do not affect the labor participation rate.

According to the premium formula of the health insurance purchased by oneself, if the increase in premium comes from the increase in probability of occurrence, degree of loss, and market power, it will reduce the labor participation rate; If there are changes in the level of protection and coverage, it will not affect the labor participation rate. The increase in the probability of occurrence, degree of loss, and salary deduction ratio of

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health insurance purchased by employers will all reduce the labor participation rate. Compared to the baseline scenario where only health risks are introduced, the probability of occurrence, degree of loss, and wage deduction ratio of health insurance purchased by employers are lower, which will increase labor participation rate, while higher ones will reduce labor participation rate.

4.3 Results Analysis

When building the theoretical model, this paper introduces health risk and health insurance into the Dynamic programming model at the same time, and finds out the impact of health risk and health insurance on the labor participation rate. The regression results are shown in Table 3.

It can be seen that in a healthy state, the commercial health insurance purchased by oneself has no significant impact on the labor force participation rate. The regression coefficient for employers to purchase health insurance is -8.835, which is significant at the 5% level, indicating that employers' purchase of health insurance will reduce the labor force participation rate in a healthy state. Influence. That is to say, whether it is the health insurance purchased by oneself or the health insurance purchased by the employer, health insurance will have a significant impact on the labor force participation rate only when the individual is in a healthy state. Among them, the purchase of health insurance by oneself will increase the labor participation rate, and the employer's purchase of health insurance will reduce the labor participation rate.

Table 3: Examining the impact of health insurance on labor force participation by health status subgroup

Variables	(1)	(2)	(3)	(4)
	Health	Unhealthy	Health	Unhealthy
Buy your own health insurance	7.721***	-2.544		
(=1)	(1.136)	(9.781)		
Employer purchase of health insurance			-8.835**	-2.253
(=1)			(4.190)	(11.61)
Observed values	4968	812	5126	793

To sum up, the increase in the probability of occurrence, loss degree, and market power of the health insurance purchased by oneself will reduce the labor participation rate. Compared with the baseline situation where only health risks are introduced, the health insurance purchased by employers will increase the labor force participation rate when

the probability of accident, loss degree and wage ratio are low, and will reduce the labor force participation rate when it is high. Employer-purchased health insurance increases labor force participation with greater levels of protection and coverage. Compared with the baseline situation where only health risks are introduced, the health insurance purchased by employers will reduce the labor participation rate when the protection degree is low, and increase the labor participation rate when the coverage is high; the expansion of coverage will increase the labor participation rate.

5. CONCLUSION

This paper aims at a comparative study of the impact of health insurance on labor market outcomes. Firstly, health theory under the concept of labor supply and economics is introduced to provide a theoretical basis for subsequent research. Second, we explore the impact of health on labor market performance, including the development of health economics and the impact of health on labor force participation. Then, it focuses on the impact of medical insurance on the health status of the labor force, and constructs the corresponding model for analysis. The results are analyzed in detail by data source and variable setting.

Combined with the research results of this paper, commercial health insurance purchased by employers for employees does not have the effect of increasing labor participation rate, and even reduces labor participation rate. Moreover, the current commercial health insurance purchased by employers has the phenomenon of high risk probability, high loss degree, high proportion of wage deduction and low protection degree. Moreover, employers do not gain more output performance by purchasing commercial health insurance for their employees. Therefore, this paper suggests that insurance companies should design a reasonable and effective commercial health insurance guarantee mechanism based on the immediate needs of employers and employees, and at the same time meet the insurance needs of employers and employees, so as to truly play the positive role of commercial health insurance in labor participation.

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