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Research on the reverse selection effect of basic medical insurance for flexibly employed people—from the perspective of health risk cognitive bias

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Abstract: With the rapid development of the Internet economy, flexible workers play an increasingly important role in the labor market. However, the low participation rate of flexible employees not only restricts the improvement of fairness and sustainability of medical insurance system, but also hinders the healthy development of this group and new business and new economy, which has become a social problem worthy of attention. Based on this, this study analyzes the health insurance choice behavior of flexible employees from the perspective of cognitive bias by using probit model and using the data of china household follow-up survey in 2020. The study found that the more blindly optimistic individuals are more reluctant to buy health insurance; conversely, the more pessimistic individuals are more willing to buy health insurance.

1. Introduction

According to the 2023 All-China Federation of Trade Unions' "Ninth National Workforce Survey Report", the number of new employment workers has reached 84 million, accounting for about 20.9% of the total number of 402 million employees in the country, and has become a huge group of employees. The report of the 20th National Congress of the Communist Party of China clearly called for "strengthening the protection of the rights and interests of workers in flexible employment and new forms of employment", supporting and regulating the development of new forms of employment, and protecting the rights and interests of flexible workers. According to the design of China's basic medical insurance system: the basic medical insurance for urban and rural residents implements voluntary participation in the place of household registration, and the basic medical insurance for employees implements compulsory participation for formal employees; However, the implementation of voluntary insurance for informal employment and flexible employment has led to the flexible employment group being in the gap between the two medical insurance systems, and is not protected by the basic medical insurance for urban and rural residents and the medical insurance for employees. However, this group tends to have a higher vulnerability to poverty [1], and in the absence of insurance contributions, the probability of not receiving medical treatment and poverty

due to illness is greatly increased, which further leads to problems such as increasing income disparity, distorted competitive environment, and intensifying social class contradictions. Therefore, exploring how to include flexible workers in the medical insurance system is not only in line with the principle of comprehensiveness and fairness of social security, but also helps to improve the health level and economic efficiency of the whole society, which is an important measure to build a harmonious society and promote sustainable development.

Through the "14th Five-Year Medical Insurance Plan", government has clearly stated that it is necessary to liberalize the restrictions on the nationality of flexibly employed persons and allow them to participate in basic medical insurance for workers and urban and rural residents in their permanent residence or place of employment. In the "Several Opinions of the State Council on Supporting and Regulating the Development of New Business Entities", freelancers are also encouraged and supported to participate in basic medical insurance and other social insurance. Although the government has introduced a series of policies and measures to encourage and support flexibly employed people to participate in basic medical insurance, the actual enrollment rate is still facing challenges. Tan Zhonghe's research found that about 13.1% of people in our country's basic medical insurance should be uninsured, and 7.8% of people are repeatedly insured. Due diligence is not only a key prerequisite to ensure the sustainable development of the medical insurance system, but also an inevitable requirement to promote social equity.

The purpose of this paper is to explore the reverse selection effect of flexible employment in participating in basic medical insurance, and to study it from the perspective of health cognitive bias. The reverse selection effect refers to the phenomenon that in the insurance market, relatively healthy individuals are more inclined to choose insurance products with low premiums or high deductibles, while relatively unhealthy individuals are more inclined to choose insurance products with high premiums or low deductibles. Among flexibly employed people, their occupational characteristics and work patterns may cause their perception of personal health risks to be biased, and this bias may affect their decision-making and behavior in participating in medical insurance. Through theoretical analysis and empirical research on reverse selection, this paper aims to reveal the behavioral characteristics and decision-making patterns of flexible workers in the participation of medical insurance, explore its impact on social security policies, and put forward relevant policy suggestions. In particular, this article will focus on the insurance selection behavior of flexible workers under the bias of health cognition, analyze its potential impact on the sustainability and efficiency of the medical insurance system, and provide theoretical support and empirical basis for improving social security policies.

2. Literature review

2.1. In the foreign research status.

The research on adverse selection originated early in foreign scholars. This part sorts out the corresponding achievements from two aspects: research origin and influencing factors. Arrow (1963) was the first to study the adverse selection behavior based on information asymmetry. He took insurance market as the research object of information asymmetry theory and pointed out that information asymmetry is the main reason for insurance market failure, especially in the field of medical insurance[2]. Since then, the study of information asymmetry has begun to enrich. Among them, Akerlof (1970) made a prominent contribution[3]. He took the used car market in the United States as an example and found that in the asymmetric information market, the seller has more sufficient vehicle information than the seller, so that the buyer is only willing to pay the price matching the average quality to buy the car, which will lead to the phenomenon that the quality products are squeezed out of the product market, which will eventually lead to market failure. Then

Rothschild & Stiglitz(1976) introduced the theory of adverse selection in insurance market for the first time, and showed that even a small amount of asymmetric information may have a significant impact on the competitive market[4]. They put forward the most classical equilibrium R-S theory in insurance market research theoretically, that is, the law that "the higher the risk, the higher the degree of insurance". Based on the outstanding contributions of Arrow(1963), Akerlof(1970) and Stiglitz(1976), the theoretical community formed the basic analysis framework of information asymmetry in the 1970s, namely the traditional information asymmetry theory. Since then, most of the related literatures have been based on R-S theory, and have made great progress in testing adverse selection problems with empirical methods, and have shown the research idea of "theoretical analysis-empirical analysis-applied research".

Study on factors affecting adverse selection Foreign scholars 'analysis of the influencing factors of adverse selection behavior in insurance market mainly focuses on risk preference, health status and so on. In terms of risk appetite: Hemenway first analyzed the impact of risk appetite on insurance contract selection and market operation. Individual risk appetite also affects the operation mode of the entire insurance market. Groups with strong risk aversion consciousness are more inclined to buy insurance. Under market competition, insurance companies may adjust their products and pricing strategies to meet the needs of customers with different risk preferences. Hemenway's research results provide a theoretical basis for further research on the behavior and market structure of insurance markets[5]. By constructing a health insurance market model with wealth heterogeneity, scholars have confirmed that the positive correlation between risk and security will be weakened under the influence of wealth heterogeneity, and also verified that adverse selection may occur in the insurance market[6]. After gradually controlling the factors leading to positive selection (individual risk characteristics, insurance contract attributes, etc.), some scholars found that the negative correlation would gradually weaken and eventually become a positive correlation[7], further verifying Hemenway's research results. However, some scholars believe that Hemenway's research design does not consider the impact of market supply on equilibrium, so positive selection does not necessarily mean that risk and insurance are negatively correlated [8]; only if there is no moral hazard, positive selection means that risk and insurance are negatively correlated. Some scholars have drawn the conclusion that risk preference has no significant effect on market choice by using the data of American Medical Insurance Benefit Group Survey (MCBS) and Health and Retirement Survey (HRS), and analyzing the influence of heterogeneous factors such as risk preference, wealth, cognition and education level [9]. Therefore, whether risk preference affects individual insurance behavior choice is still controversial, and it needs to be further verified in empirical analysis by considering different influencing factors comprehensively. In terms of health levels: Manning used economic models for the first time to explain adverse selection in the health insurance market. His research shows that relatively healthy individuals tend to choose lower-cost health insurance plans, while relatively unhealthy individuals tend to choose more comprehensive plans, leading to imbalances in the health insurance market[10]. This study is the first to verify how individual health affects adverse selection behavior from a health perspective and lays the foundation for subsequent related research. Later, scholars proved that the demand for health insurance of sick individuals will increase significantly by studying individual diseases, further indicating that health status has an impact on individual insurance choice behavior, and may lead to adverse selection. Later scholars have reached the same conclusion by using different types of data and research methods.

2.2. Domestic research status

Although the research on inverse theory started late in our country, the research on information asymmetry theory is extensive, and the related research results mainly focus on empirical test.

Most studies show that adverse selection exists in social insurance market, especially in pension insurance and medical insurance. In terms of pension insurance. Through empirical analysis of social insurance in Haidian District of Beijing City, scholars found that the reason for serious adverse selection problems in endowment insurance, unemployment insurance and medical insurance in Haidian District is information asymmetry, and this conclusion may be applicable to other regions of the country[11]. Subsequent studies have further confirmed the existence of adverse selection in social pension insurance markets by using different types of data and research methods. By using the national baseline survey data of China Health and Pension Follow-up Survey (CHARLS) in 2011, scholars demonstrated the adverse selection problem existing in the new rural social pension insurance by using Logit model and quantile regression [12]; and this adverse selection will seriously affect the construction of China's pension insurance system [13]. Due to the particularity of variables, most studies use Probit and Logit models; although these two models can intuitively explain the correlation between the degree of security and individual health risk, they may also have endogenousness caused by bidirectional causality, which makes the estimation results appear certain bias. Therefore, this method is often used as a benchmark empirical model in empirical research, and then other empirical methods can be supplemented to obtain robust conclusions[14].

In terms of health insurance. Domestic scholars have studied adverse selection in the field of medical insurance sufficiently and extensively. Through theoretical and empirical studies, some scholars have shown that there is adverse selection problem in the new rural cooperative medical system in China, which is manifested in that the older the people are, the more willing they are to participate in cooperative medical system, and the farmers with low income and low educational background and those who do not work outside are more willing to participate in cooperative medical system [15]. Based on CHARLS micro data, some scholars use single-level and two-level Logistic models to further study and show that individuals are not only affected by their own factors, but also affected by macro environment (whether medical resources are sufficient) when making insurance decisions [16]. However, some scholars believe that this kind of adverse selection behavior is not obvious in the selection of insured grades. For example, Zhong Xiaomin et al. empirically analyzed the adverse selection effect in urban and rural residents 'medical insurance based on the real outpatient data of a 3A hospital in Hangzhou City. They used OLS, Logit and other regression models to test the adverse selection effect in urban and rural residents' medical insurance. They found that the adverse selection effect was not significant when making decisions on insurance grades [17]; and positive selection and adverse selection may coexist in the decision-making process. Although most of the literature indicates that adverse selection problems are common in the medical insurance market. However, most of the existing literatures use self-evaluation health indicators or medical service utilization to measure health. The former has certain subjectivity, while the latter often contains interference information such as economic factors, so it has certain limitations in use. Some scholars use China Labor Force Dynamic Survey Data (CLDS) to select five angles such as self-rated health and physiological health to construct an indicator system, and then use principal component analysis to measure health level. Empirical research shows that flexible employment personnel have significant adverse selection effect. This method overcomes the subjectivity of self-evaluation and makes the results more objective and robust.

3. Research methods

3.1. Data source

This paper uses data from the China Family Panel Studies (CFPS) in 2020, which was conducted by the China Social Science Survey Center (ISSS) of Peking University, with a sample size of 16,000 households in 25 provinces/municipalities/autonomous regions, and all family members in the sample

household. In order to obtain a sample of flexible employees, this paper screens flexible employees through the following rules: first, keep a sample of working age between 16 and 55 years old (women) or 16 to 60 years old (men); second, the samples without work and those who work at home are excluded, and the samples with formal labor contracts with the employer are excluded from the samples with jobs; Third, the sample of students working in state-owned enterprises, public institutions, and government departments should be excluded; Samples with missing values for some variables are eliminated. The rest are flexible workers, and the final model sample is 6181.

3.2. Variable settings

The variables of interest in this study are shown in Table 1. The dependent variable is the individual's insurance status, corresponding to the questionnaire question "What medical insurance do you enjoy", excluding supplementary medical insurance and public medical insurance, and assigning 1 to the remaining insurance, and 0 to the one who does not participate. Independent variables included subjective health risk, objective health risk and health perception bias. Subjective health risk is an individual's subjective judgment of their own health status, corresponding to the question "How do you think your health status is?" in the questionnaire. The five grades "very healthy, very healthy, relatively healthy, fair, unhealthy" were assigned 1, 2, 3, 4, and 5 in descending order. Objective health risk is hospitalization, corresponding to the question "whether hospitalization due to illness in the past 12 months" in the questionnaire, hospitalization is assigned 1, otherwise 0. Control variables included sex, age, marital status, residence status, education level, wage income, smoking and drinking, and chronic disease.

3.3. Model

In this paper, we use binary Probit model to estimate whether there is adverse selection problem in basic medical insurance for urban and rural residents. The basic regression equation is as follows: P(Di=1)=Φ(δ +r1Healthi+r2Xki+ σ i)

where i represents individual flexible employment, and the explained variable Di represents whether to participate in medical insurance, which is a 0-1 variable. The key explanatory variable was adverse selection related health factors$i\ H\ e\ a\ l\ t$ In addition, the econometric model contains a series of control variables Xki. The influence of health risk perception bias on medical insurance purchase behavior may be endogenous, because individuals may pay more attention to health after purchasing medical insurance, thus changing risk perception. To solve this problem, instrumental variable method is adopted in this paper. The community mean of health risk perception bias is highly correlated with individual perception bias, but not with other explanatory variables and error terms in the model. Therefore, the community mean of health risk perception bias is selected as an instrumental variable to alleviate the endogenousness problem of the model.

4. Results

Variable Descriptive Statistics Are Shown In Table 1. The Medical Insu

4.1. Descriptive statistics

Table 1 shows variable descriptive statistics. The medical insurance coverage rate is 87%, indicating that there are still some flexible employees who are not insured. The mean deviation of health risk perception was-0.12, indicating that there were more blind pessimism bias in the sample; there was little difference between male and female samples, 83% of respondents had spouses,

generally had low education level, and most lived in rural areas.

Table 1: Descriptive statistics

Variable name	Observations	Mean	Variance	Min	Median	Max
Medical insurance	6181	0.87	0.332	0	1	1
Subjective health risks	6181	2.8	1.146	1	3	5
Objective health risks	6181	0.07	0.249	0	0	1
Health risk cognitive bias	6181	-0.12	1.084	-4.50964	0.24926	1.837183
Gender	6181	0.51	0.5	0	1	1
Age	6181	40.21	11.212	16	40	60
Account	6181	0.25	0.433	0	0	1
Marriage	6181	0.83	0.378	0	1	1
Education	6181	8.92	3.889	0	9	19
Income	6181	2.76	1.011	1	3	5
Chronic disease	6181	0.1	0.303	0	0	1
Smoke	6181	0.31	0.461	0	0	1
Drink	6181	0.14	0.342	0	0	1

4.2. Empirical results

Table 2: The impact of health risk cognitive bias on basic medical insurance enrollment

Variable name	Probit	Probit	IV	IV
	Model1	Model2	Model3	Model4
Health risk cognitive bias	-0.054***	-0.055***	-2.118***	-2.115***
	-0.02	-0.02	-0.748	-0.748
Gender	0.077*	0.117**	-0.057	-0.013
	-0.043	-0.057	-0.087	-0.105
Age	0.019***	0.019***	0.049***	0.047***
	-0.002	-0.002	-0.011	-0.011
Account	-0.315***	-0.313***	-0.123	-0.119
	-0.052	-0.052	-0.112	-0.112
Marriage	0.428***	0.427***	0.396***	0.407***
	-0.054	-0.054	-0.098	-0.097
Education	0.032***	0.032***	0.037***	0.036***
	-0.006	-0.006	-0.01	-0.01
Income	0.059***	0.060***	-0.254**	-0.246**
	-0.023	-0.023	-0.119	-0.116
Chronic disease		0.036		0.301*
		-0.076		-0.156
Smoke		-0.067		-0.049
		-0.061		-0.099
Drinking		-0.007		-0.032
		-0.068		-0.112
_cons	-0.337**	-0.326**	-0.915***	-0.901***
	-0.136	-0.137	-0.303	-0.303
Endogenous test	——	——	20.70***	20.55***
Weak tool variable test	——	——	8.02***	7.99***

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The results of the test on the influence of health risk perception bias on health insurance choice of

flexible employees are shown in Table 2. Column 1 shows regression results for uncontrolled health risks; column 2 shows controlled results. The results show that health risk perception bias negatively affects health insurance decision making of flexible employees, specifically: blind optimistic individuals are less willing to buy health insurance than those without perception bias; conversely, blind pessimistic individuals are more willing to buy health insurance. Therefore, the hypothesis of this paper is true. Columns 3 and 4 show regression results for instrumental variables. The Wald chi-square value indicates that the exogenous hypothesis of the original model is significantly rejected, and the instrumental variable needs to be used. The F value of the first stage indicates that the community mean of health risk perception bias passes the weak instrumental variable test and is a valid instrumental variable. After mitigation of endogenesis, the coefficient of health risk perception bias is still negative under 1% significance, indicating that the more blindly optimistic about health risk, the less likely to buy medical insurance, the more blindly pessimistic, the more willing to buy medical insurance, the hypothesis still holds.

4.3. Heterogeneity analysis

Table 3: Analysis of heterogeneity of age and education level

	Model1	Model2	Model3	Model4	Model5	Model6
Health risk cognitive bias	-0.009**	-0.013*	-0.026**	-0.003	-0.003	-0.014**
	-0.004	-0.008	-0.011	-0.008	-0.007	-0.006
Gender	0.016	0.002	0.04	0.017	0.008	0.021
	-0.013	-0.019	-0.027	-0.02	-0.021	-0.019
Age	0.005***	0.005***	0.009**	0.003	0.009***	-0.001
	-0.001	-0.001	-0.004	-0.003	-0.003	-0.003
Account	-0.066***	-0.062***	-0.093***	-0.095***	-0.043**	-0.029
	-0.014	-0.018	-0.029	-0.024	-0.02	-0.018
Marriage	0.008***	-0.005	0.009***	0.003	0.006***	0.005**
	-0.002	-0.005	-0.003	-0.003	-0.002	-0.002
Education	0.008	0.031***	0.040***	0.005	0.006	0.007
	-0.005	-0.009	-0.012	-0.009	-0.008	-0.007
Income	0.009	-0.044	0.057	0.003	-0.041	0.021
	-0.015	-0.03	-0.051	-0.034	-0.026	-0.018
Chronic disease	-0.005	-0.052**	-0.031	-0.016	0.01	-0.026
	-0.013	-0.022	-0.03	-0.021	-0.02	-0.019
Smoke	-0.005	0.012	-0.059	0.001	0.019	0.011
	-0.015	-0.026	-0.041	-0.023	-0.02	-0.022
Drinking			0.103***	0.103***	0.065**	0.081**
			-0.027	-0.032	-0.032	-0.033
_cons	0.595***	0.712***	0.298***	0.651***	0.362***	0.839***
	-0.034	-0.085	-0.101	-0.107	-0.137	-0.157
N	4300	1881	1441	1759	1530	1451
adj. R^2	0.027	0.035	0.052	0.017	0.016	0.016

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The analysis of the heterogeneity of age and education is shown in Table 3.Because of the differences in health insurance choices among different ages and educational levels, the influence of

health risk perception bias on health insurance participation behavior may be heterogeneous. In order to further explore the impact of health risk perception bias on serious illness insurance participation behavior in different age groups and education level groups, the sample age is divided into four groups according to relevant research. Since China adopts nine-year compulsory education system, the sample is divided into low education level (education years <9) and high education level (education years ≥9) according to individual education years. See Table 3 for regression results. The regression results showed that the influence of health risk perception bias on major illness insurance participation behavior was lower in the group with low education level, but stronger in the group with high education level. The reason may be that individuals with higher education levels generally have a higher awareness of their health status and a more accurate ability to assess risk. They may think they don't need health insurance to deal with health problems and are more likely to opt out or opt for commercial health insurance. Age, 41-50 age group compared with other age groups, adverse selection behavior is more obvious, significantly stronger. The reason may be that these people are the main labor force in the family and pay more attention to their own health protection.

5. Conclusions and recommendations

This paper analyzes the influence of health risk perception bias on adverse selection behavior of health insurance among flexible employees by probit model using data from China household tracking survey in 2020. The results show that there is adverse selection in the health insurance behavior of flexible employees. The greater the health risk perception bias, the less willing to participate in insurance, and the smaller the health risk perception bias, the more willing to participate in insurance. At the same time, marriage, age, education, income and so on have significant impact on the behavior of serious illness insurance, after alleviating the endogenesis and robustness problems, the above conclusions are still valid. Although the coverage rate of medical insurance in China is relatively high in recent years, there are still some people who are not included in the scope of medical insurance. Because poverty has long-term and recurrent characteristics, "difficult to see a doctor, expensive to see a doctor" is still the main problem plaguing most families, so the problem of "returning to poverty due to illness" still cannot be ignored. In order to solve the impact of major diseases on family economy and strengthen the precision poverty alleviation, all parties should take certain measures to promote the full coverage of medical insurance according to their own conditions. According to the above conclusions, this paper puts forward the following suggestions:

First, actively guide flexible employment personnel to participate in medical insurance and make rational use of medical resources. Because flexible employment personnel have the characteristics of high poverty vulnerability, poor health literacy and consciousness, relevant departments should strengthen the propaganda of health policy, guide flexible employment personnel to participate in insurance, and promote their rational use of medical resources, so as to ensure the health of the insured and realize the sustainable development of medical insurance funds. Secondly, the adverse selection of middle-aged and old-age flexible employment personnel will lead to the decrease of medical insurance fund income and affect the sustainability of the fund. It is suggested that certain compulsory measures should be taken for the participation of low-age groups to realize universal coverage of medical insurance through compulsory universal participation. Finally, everyone will face health risks. Individuals should broaden information channels to obtain more scientific health information, strengthen their own health management on the basis of rational cognition of themselves and the environment, rationally analyze health information, reasonably assess their own health risks, and not be blindly optimistic or pessimistic. At the same time, we should cooperate with and support the health knowledge propaganda and poverty alleviation work of the government and insurance companies, enhance cognitive ability, and reduce overconfidence and cognitive bias.

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