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The Impact of Delayed Retirement on China's Employment Rate is based on Three Pilot Cities: Shanghai, Nanjing and Jinan

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Abstract: This document analyzes the impact of delayed retirement policies on employment rates in China, based on empirical studies in three pilot cities: Shanghai, Nanjing, and Jinan. As China's population gets older and there are fewer and fewer people in the labour force, the Chinese government has come up with a great idea: a delayed retirement policy to help ease the pressure brought by an ageing population. In this paper, we used a special model called the differential-differential model (DID) to evaluate how a delayed retirement policy affects the employment rate. The results show that delayed retirement has a significant positive impact on the employment rate, especially in industries and cities with high labor demand. What's more, this paper also discusses how different industries are affected by delayed retirement. It finds that the policy has the most obvious effect on the employment rate of the primary industry. It also suggests that when implementing the delayed retirement policy, we should think about the different regions in China and the health of the elderly labour force. We should also improve the relevant supporting policies and security systems during implementation. This will help us make sure that the delayed retirement policy works well in different economic backgrounds.

Keywords: Delayed Retirement Policy; Employment Rate; Labor Market; Regional Differences.

1. Introduction

In recent years, China's population problem has attracted the attention of all countries, and the problem of population aging is a serious challenge for China. According to the data of the Chinese government in 2022, the proportion of elderly people aged 65 and above will reach 14.9%, and the elderly dependency ratio will also reach 21.8% (The data on the birth rate and old age dependency ratio is from China Statistical Yearbook 2023 published by the National Bureau of Statistics of the People's Republic of China, https:// www. stats. gov. cn/ sj/ndsj/2023/indexch.htm). At the same time, China is also experiencing negative population growth as the birth rate is lower than the death rate. As the birth rate continues to decline, the elderly population continues to increase, the labor supply continues to decrease, and the proportion of working population declines, which not only increases the burden of old-age care, but also poses a certain threat to China's economic development.

At present, the statutory retirement age in most regions of China is 60 for men, and 55 for women officials and 50 for women workers, depending on the type of job. The retirement policy set in this way has adapted to the needs of economic development and demographic structure in the past, but with the increasingly serious problem of population aging, this policy can no longer meet the needs of current social development. A large number of workers have stopped paying pensions after retirement, and the number of pensioners has increased rapidly, increasing the pressure on government fiscal expenditure. In order to cope with this dilemma, the Chinese government has made reference to the experience of developed countries and gradually promoted the delayed retirement policy, with a view to achieving sustainable economic and social development in the near future.

In order to break this dilemma, the Chinese government draws on the experience of developed countries to explore how to effectively implement the delayed retirement policy in China. In 2013, the Chinese government proposed to adopt a "gradual" retirement delay policy and improve the social security system. Considering the different economic development status and urban construction of each city in China, the Chinese government chose Nanjing, Jinan and Shanghai as pilot cities. The Chinese government selected cities with different economic development and demographics to determine the likely impact of delayed retirement.

The implementation of late retirement policies may have implications in many ways. First, delayed retirement directly affects the supply of labor, which can have a knock-on effect on overall employment, wage levels, and socioeconomic development. To explore how these potential effects might manifest, the Chinese government has chosen Nanjing, Jinan and Shanghai as pilot cities for the delayed retirement policy. These cities differ not only in terms of economic development, but also in terms of population structure and labor market performance. Therefore, this paper can provide a representative empirical basis for the comprehensive promotion of delayed retirement policies.

The main purpose of this study is to evaluate the practical effects of delayed retirement policies in China through data analysis of pilot cities, and to explore its impact on employment rates. The empirical analysis in this paper is based on data from 17 Chinese cities between 2008 and 2023, focusing on changes in employment rates before and after the implementation of delayed retirement policies. Therefore, this paper adopts the Difference-in-Differences (DID) model to analyze the impact of policy shocks on employment rate, but before doing DID, it needs to pass the parallel trend test. Robustness test, placebo test and heterogeneity analysis were performed by Propensity Score Matching (PSM).

Through this study, we hope to answer the following key questions: Does the delayed retirement policy have a

significant impact on the employment rate in Shanghai, Nanjing and Jinan? Does the effect vary across industries? Are the effects of delayed retirement policies pervasive and robust, taking into account control variables? The research in this paper not only helps to evaluate the effectiveness of delayed retirement policies, but also provides data support for policy makers, and provides theoretical basis and practical experience for promoting delayed retirement policies in a larger scope in the future.

The structure of this paper is as follows: the first part is the introduction, introducing the research background, research problems and methods, and clarifying the significance and framework of the research; The second part is a literature review, which reviews the research progress on the relationship between delayed retirement and employment rate at home and abroad, and analyzes the shortcomings of existing research. The third part is the research design, which explains the empirical model, data source and variable selection in detail. The fourth part is empirical analysis, showing the effect of delayed retirement policy on employment rate, and discussing the results of baseline regression, robustness test and heterogeneity analysis. The fifth part is the policy suggestion, based on the empirical results, put forward the optimization suggestion of the delayed retirement policy; The sixth part is the conclusion, which summarizes the main research findings of this paper and points out the direction of future research.

2. Literature Review

At present, the policy of postponing retirement is regarded as a macro-control policy to effectively deal with population aging (David E. Bloom, David Canning, Gunther Fink 2010). It has been widely concerned by various countries, and scholars in various countries have conducted research on delayed retirement. By extending the working hours of the workforce, it can alleviate the shortage of labor supply due to the aging population and the financial burden of paying for pensions. This paper will be sorted out from the existing international research and the existing research in China.

2.1. Review of International Research

Developed countries have experienced the problem of population aging in earlier years, and have improved the problem of population aging by implementing late retirement policies. From the existing international literature, the research of international scholars on the delayed retirement policy is relatively comprehensive. This part will sort out the positive and negative effects of delayed retirement.

In the opinion of most scholars, the policy of postponing retirement will bring about positive effects on society. The positive effects of delayed retirement policies mainly focus on labor supply, economic growth and government fiscal burden. According to the report of the Organization for Economic Co-operation and Developmen(OECD, 2017), delaying retirement is the main method to cope with the aging population, and many countries have adopted the means of delaying retirement. To ease the financial pressure brought about by an aging population and maintain stable economic growth in various countries. Blundell and MaCurdy (1999) put forward that postponing retirement can directly improve the total labor supply by extending the working time of the elderly labor force. This would make up for the shrinking Labour supply caused by an ageing population. At the same time, Gruber and Wise(2004) selected 12 developed countries for comparison and concluded that under a relatively perfect social security system, delayed retirement can improve the working time of the labor force and alleviate the problem of reduced labor supply in the labor market. Lindh and Malmberg (1999) proposed that the delayed retirement policy could increase labor supply and ensure the growth of productivity, thus maintaining sustained economic growth. At the same time, Diamond and Orszag (2004), based on the data of the United States, pointed out that delaying retirement can reduce the pressure on the government to pay pensions. Moreover, studies have found that Sweden and Germany have successfully alleviated the pressure on pension payments by implementing macro policies to delay retirement (Borsch-Supan & Coile, 2018). At the same time, by implementing the policy of postponing retirement and improving related supporting policies, Japan has increased the supply of labor force, and promoted the re-employment of labor force and the upgrading of skills (Takayama, 2007).

But delaying retirement still has some negative effects. Gruber and Wise (2010) point out that in countries where the demand for labor is not so high, delayed retirement will have a negative impact on youth employment. Meanwhile, Case and Deaton (2005) pointed out that low-income people engaged in physical labor and high-income people engaged in high mental work have different health states, which makes low-income people unable to benefit from delayed retirement, thus deepening the state of social imbalance. Hagen (2018) also points out that delayed retirement may exacerbate socioeconomic inequality. By studying the delayed retirement policies of Nordic countries, he found that high-income groups benefit from delayed retirement by maintaining high productivity through flexible work arrangements, while low-income groups are more likely to suffer from deteriorating health and reduced work efficiency under delayed retirement policies, which ultimately aggravate income and health inequalities. Based on British data, Banks et al.(2016) found that delayed retirement makes elderly workers forced to continue working, and their psychological pressure keeps increasing, which may affect their health and productivity.

After research, many scholars have found that improving related supporting policies will bring better results when implementing the delayed retirement policy. Based on Australian data, Atalay and Barrett (2015) found that although delaying retirement can increase the labor force participation rate and reduce the pension burden, the long-term effect of the policy may not be ideal if there is no supporting re-employment and health protection measures. In addition, Eichhorst and Rinne (2015) compared the implementation effect of delayed retirement in different countries in their study. They point out that the effectiveness of policies depends on the structure of a country's labor market and the soundness of its social security system. In Northern European countries, where the social security system is more complete, delayed retirement has less negative impact on the labor market, while in southern European countries, delayed retirement policies have a greater impact on youth employment due to the poor flexibility of the labor market. At the same time, Schulz and Blossfeld (2006) also show that countries with relatively sound social security systems are more likely to achieve social balance through delayed retirement policies, while countries with less sound social security systems are more likely to see the exacerbation of social inequality.

2.2. Review of Chinese Studies

In recent years, China's aging population has become more and more serious, and the policy of postponing retirement has become the focus of academic attention. In the process of research, Chinese scholars not only discussed the possible positive impact of delayed retirement, but also analyzed the potential negative impact of delayed retirement. The literature review in this part will be reviewed from both positive and negative aspects.

Based on China's national conditions, Lin, Wan, and Morgan(2016) concluded that older workers can use their existing experience and skills to improve labor productivity when working longer hours. The transfer of experience and skills can not only promote the improvement of productivity, but also ensure the sustainable growth of the economy. On the other hand, from the perspective of government fiscal expenditure, delaying retirement is proposed to reduce the number of retirees and increase the number of working years. At the same time, the number of pension contributions to be paid by the government decreases, and the pension received by the government increases. It alleviates the pressure of pension payment (Wang, Beland, and Zhang,2014).

Although delayed retirement brings many positive effects, the negative effects of delayed retirement cannot be ignored. Based on empirical research, An, Wang, and Zhang (2022) found that the delayed retirement policy would make the elderly labor force continue to occupy their jobs, resulting in few employment opportunities for young labor force and a decline in the employment rate of young labor force. With so many jobs taken up in the labor market, the opportunities for young people could be severely limited. In addition, delayed retirement may exacerbate gender inequality. As Chinese women have to balance family and career, their physical condition is worse than that of men. In the context of delayed retirement, women's competitiveness will be weakened and inequality will be accelerated (Ren and Treiman, 2015). Under the background of delayed retirement, the labor competitiveness of female workers is weakened, which makes female workers at a disadvantage in the workplace.

According to the existing literature, although some progress has been made in the research on the impact of delayed retirement on the employment rate in China, most studies focus more on the macro impact of delayed retirement on the whole country, and there are few analyses on the differences between cities. But every city in China has different levels of economic development, industrial structure and labor market. Due to the difference of economic development stage and population structure, the implementation effect of delayed retirement policy may be different in different cities.

By controlling the fixed effects of different cities, this paper reveals the effect of local policy implementation better. Hope to fill the gap of regional difference research. In addition, this paper also hopes to analyze the different effects of the delayed retirement policy on the employment rate in these industries by subdividing the primary, secondary and tertiary industries, and help understand the different effects of the policy on different industries.

3. Model Design

3.1. Model Selection

This paper uses a Difference-in-Differences (DID) model to assess the impact of delayed retirement policies on employment. DID model is a classical quasi-experimental method. The effect of the policy was compared by comparing the results of an experimental group affected by the policy (the area where the policy was implemented) and a control group not affected by the policy (the area where the policy was not implemented) (Angrist, & Pischke, 2009). In other words, the core of this experimental method is to identify the net effect of the delayed retirement policy by comparing the employment rate changes in the affected areas and the unaffected areas before and after the implementation of the delayed retirement policy. In this study, the control group is the cities affected by the policy, namely Shanghai, Nanjing and Jinan. The control group was 14 other cities that were not affected by the policy. However, a key prerequisite for the use of DID in the evaluation of causal effects is to satisfy the parallel trend hypothesis, that is, the trend of the outcome variables in the experimental group and the control group should be the same before the policy is implemented. If the parallel trend test is passed, the DID model can accurately reveal the causal effects of delayed retirement policies.

In the empirical study of this paper, 2013 is regarded as the key time point of the delayed retirement policy, because from this year, some regions in China began to gradually implement the delayed retirement policy and improve the relevant social security system. As a result, 2013 is seen as the beginning of a policy shock. On this basis, this paper constructs the following differential regression model:

$$\mathrm{Employ}_{it} = \alpha_0 + \alpha_1 \mathrm{time} \times \mathrm{treat}_{it} + \alpha_2 \mathrm{Col}_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

Where i and t represent individuals and years respectively, the explained variable represents the employment rate, is the dummy variable of whether the region is affected by the policy, the value is 1 in the region where the policy is implemented, 0 in the region where the policy is not implemented, is the dummy variable of the time when the region is affected by the policy, and the year before the implementation of the delayed retirement policy (before 2013) is assigned to 0. The years following the implementation of the delayed retirement policy (2013 and after) are assigned a value of 1. α_0 represents the random disturbance term, Col represents a series of control variables, μ_i and δ_t the individual and time fixed effects, ε_{it} represents the random disturbance term.

3.2. Variable Selection

When selecting variables, we should not only consider the theoretical basis, but also consider whether the empirical research data of this paper is available. Therefore, in order to comprehensively evaluate the impact of delayed retirement policies on employment rate, the following variables are selected in this paper.

3.2.1. Explained Variables

Employment rate (Employ**)** is the core dependent variable of this study. The employment rate is an important indicator to measure the labor market activity in a region (ILO, 2003). By extending the working time of the elderly, the delayed retirement policy may have a crowding out effect or substitution effect on the labor market, and the final result is directly reflected in the change of the employment rate.

3.2.2. Control Variables

Per capita (GDP) as a representative variable to measure the level of regional economic development, per capita Gdp

is included in the model. The higher the level of economic development, the more job opportunities, the higher the employment rate in the area. Taking per capita GDP as a control variable can eliminate the influence of economic development level on employment rate. At the same time, in order to reduce heteroscedasticity, logarithmic processing of GDP is more suitable for regression analysis.

Wage growth rate (Sgro) is the rate of wage growth is the change in a worker's wage level over a period of time. Higher wage growth can attract more workers into the market. Therefore, we say that the wage growth rate affects the supply and demand relationship in the labor market. Controlling wage growth can eliminate the disturbance caused by wage changes to the employment rate.

GDP growth rate (Ggro) is used to measure the growth rate of the regional economy and is an important indicator of economic vitality. A higher GDP growth rate in a region usually brings more job opportunities to the region, so GDP growth rate is included as a control variable in the model.

Science education expenditure (Expen) refers to the government's financial investment in education and research. Expenditure on science education may affect the supply-side structure of the labor market. This is because higher investment in education will enhance the competitiveness of workers and thus increase the employment rate (Hanushek and Woessmann, 2008). It is therefore incorporated into the model as a control variable.

3.3. Discussion on Endogeneity

In the context of China's social security system and policies, the question of labor mobility and sample selection, in particular whether residents of Shanghai are required to be included in the sample, will be explained in detail below.

China's social security system consists of several parts, including pension, medical insurance, unemployment insurance and so on. Both employers and employees must contribute to the social security system, and the place of payment is linked to the place of work. According to China's labor law, employers are obliged to pay social insurance for workers as long as they work locally, regardless of whether they have local household registration. For example, if the labor force is employed in a unit in Shanghai, its social insurance contribution is made in Shanghai. Even if these people return to their places of residence at night, they are still considered part of Shanghai's labor market. The sample selection in this paper is based on social insurance payment records, so the sample of labor force already includes labor force registered outside the place of work. To ensure the accuracy and representativeness of the research results.

3.4. Data Sources

The research data in this paper is based on the China City Statistical Yearbook, China Science and Technology Statistical Yearbook and the National Economic and Social Development Statistical Bulletin of prefecture-level cities, and contains detailed statistical data of 17 Chinese cities from 2008 to 2023 (The data on the birth rate and old age dependency ratio is from China Statistical Yearbook 2023 published by the National Bureau of Statistics of the People's Republic of China, https:// www. stats. gov. cn/ sj/ ndsj/ 2023/ indexch.htm). The data were selected on the basis of their comprehensiveness, consistency over time and authority, ensuring an accurate representation of the impact of delayed retirement policies on employment rates. At the same time, the data from these sources are relatively comparable and representative, including both economically developed cities and less developed cities. By analyzing long-term data for these cities, this study was able to reveal the actual effects of delayed retirement policies in different economic contexts and ensure the robustness and interpretability of the conclusions. Finally, descriptive statistical analysis is carried out on the explanatory variables, explained variables and control variables mentioned above. In order to eliminate the influence of heteroscedasticity, logarithmic processing is performed on some data to show the mean value, standard deviation, maximum value and minimum value of each variable. Descriptive statistics are shown in Table 1.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Employ	228	0.957	0.026	0.843	0.992
Did	272	0.121	0.327	0	1
Gdp	261	10.136	4.725	1.803	46.775
Sgro	250	0.104	0.041	-0.065	0.318
Ggro	261	0.093	0.218	-0.68	2.795
Expen	255	12.965	1.305	10.019	15.529

4. Empirical Analysis

4.1. Benchmark Regression Results Analysis

In this paper, the impact of the delayed retirement policy is analyzed by using the difference in difference method (DID). The model R-squared off the benchmark regression result is 0.711 and 0.727 respectively, indicating that the research model in this paper has strong explanatory power in explaining the change of employment rate. The baseline regression results are shown in Table 2, and the effect of delayed retirement policy on employment rate is statistically significant positive.

First, column (1) shows the regression results without adding control variables. The regression coefficient of the delayed retirement policy is 0.019, which is significant at the significance level of 1%, indicating that the delayed retirement policy has a significant positive impact on the urban employment rate without considering other factors.

Second, a series of control variables are included in column (2), including GDP, per capita wage growth rate, GDP growth rate, and expenditure on science and education. The results show that the regression coefficient of delayed retirement policy is still 0.018, which is also significant at the significance level of 1%, indicating that the positive impact of delayed retirement policy on employment rate still exists even after controlling these variables. This result shows that the delayed retirement policy has the effect of promoting urban employment rate, and its positive effect is not due to other economic factors, but the effect of the policy itself. For the regression results of control variables, the effect of wage growth rate (Sgro) and expenditure on science and education

(Expen) on employment rate is not significant, indicating that these two control variables have limited impact on employment rate. The effect of GDP per capita on employment is positive at a significant level of 10%, indicating that higher GDP per capita is associated with higher employment.

Table 2. Benchmark Regression Results

	(1)	(2)
VARIABLES	Employ	Employ
Did	0.019***	0.018***
	(0.003)	(0.003)
Gdp		0.001*
		(0.001)
Sgro		0.007
		(0.022)
Ggro		-0.014*
		(0.007)
Expen		0.007
		(0.006)
Constant	0.954***	0.855***
	(0.001)	(0.070)
Ind	YES	YES
Year	YES	YES
Observations	228	222
R-squared	0.711	0.727

*Note: *, ** and *** are significance levels of 10%, 5% and 1%, respectively, with robust standard error in brackets.*

For the GDP growth rate (Ggro), the regression coefficient is negative and is negative at the significant level of 10%. Simply put, the rate of change of GDP growth rate, that is, the change of GDP growth rate, is negatively correlated with the employment rate. The possible reasons lie in the following aspects. First, when economic growth is slowing, companies are more cautious about the economic outlook and do not expand their businesses. Ultimately, companies may scale back hiring due to reduced demand and cost pressures, leading to a decline in employment. Second, during periods of rapid economic growth, technological innovation and industrial upgrading often bring new job opportunities. However, when economic growth slows, enterprises and government investment and support for new technologies and new industries decline, resulting in the failure to create more jobs, especially in high-tech and modern services, and this gap will be more obvious, resulting in overall employment decline.

According to the results of baseline regression analysis, the delayed retirement policy has a significant positive impact on the employment rate, indicating that the delayed retirement policy has a significant promoting effect on the employment rate. As the population ages, many industries face labor shortages. And delayed retirement policies keep older workers in their jobs, so overall employment rises, pushing up employment.

4.2. Robustness Tests

In order to verify the robustness of baseline regression results, several robustness tests were conducted, including parallel trend hypothesis test, propensity score matching (PSM) test and placebo test.

4.2.1. Parallel Trend Assumption Test

A key prerequisite for the use of DID in the evaluation of causal effects is to satisfy the parallel trend hypothesis, that is, the trend of outcome variables in the experimental group and the control group should be the same before the policy is implemented. To verify this hypothesis, a parallel trend test was performed in this study, and the test results are shown in Figure 1. The results showed that there was no significant difference in the employment rate between the treatment group and the control group before the implementation of the delayed retirement policy. However, after the implementation of this policy, the employment rate of the treatment group was significantly higher than that of the control group, indicating that the delayed retirement policy has a significant impact on the employment rate. The results meet the requirements of parallel trend test and verify the robustness of the baseline regression results.

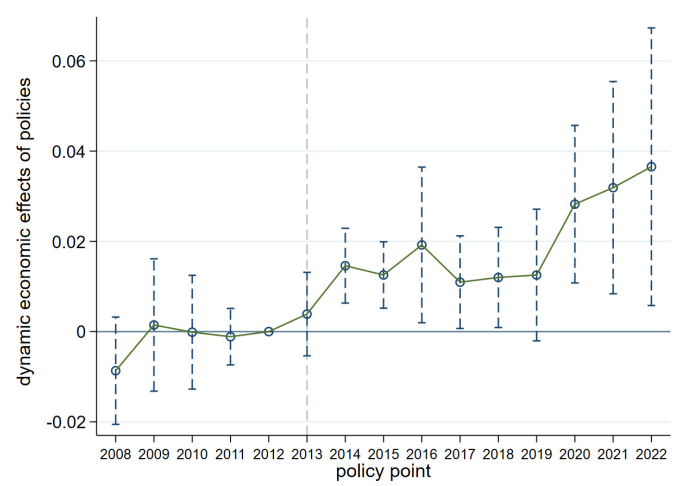


Figure 1. Parallel Trend Assumption Test

4.2.2. Propensity Score Matching

In order to alleviate the problem of sample selection bias caused by differences in economic development level and industrial structure of cities, this paper adopts propensity score matching method (PSM) to conduct sample pairing test. The specific approach is to perform a 1-to-1 neighbor matching (that is, matching cities with similar economic characteristics) within the caliper according to the control variables including Gdp, Sgro, Ggro, Expen and other indicators, and perform regression analysis. The matching regression results in Table 3 show that the effect of delayed retirement policy is still significant after matching, with a regression coefficient of 0.020, which is significant at the significance level of 1%.

Table 3. Propensity Score Matching

	(1)
VARIABLES	Employ
Did	0.020***
	(0.004)
Gdp	0.001
	(0.001)
Sgro	0.006
	(0.030)
Ggro	-0.022
	(0.014)
Expen	0.001
	(0.007)
Constant	0.937***
	(0.093)
Ind	YES
Year	YES
Observations	129
R-squared	0.785

*Note: *, ** and *** are significance levels of 10%, 5% and 1%, respectively, with robust standard error in brackets.*

This means that after eliminating the influence of urban economic differences, the positive promotion effect of delayed retirement policy on the employment rate is still significant, which further verifies the robustness of the baseline regression results. In addition, the regression results after matching show that the control variables have little influence on the employment rate after matching, indicating that the influence of the delayed retirement policy on the employment rate mainly comes from the policy itself, rather than other factors. The findings above still hold true.

4.2.3. Placebo Test

In order to prevent the missing variables that are difficult to observe from interfering with the accuracy of the baseline regression results, the placebo test was conducted by changing the experimental group. The specific approach is to randomly select samples from the total sample and assume the experimental group, and the remaining sample enterprises are classified as the control group. Through empirical test, the impact of the delayed retirement policy implemented by regional placebo on the employment rate can be obtained. Further, the above operation is repeated 500 times to obtain a total of 500 regression coefficient estimates and their corresponding P-values. The kernel density distribution is plotted according to the above 500 regression results, and the results are shown in Figure 3. The regression coefficients were normally distributed and mainly clustered around 0, while most regression results were not significant at the significance level of 10%. Therefore, the accuracy of the benchmark regression results in this paper is not affected by unobservable factors.

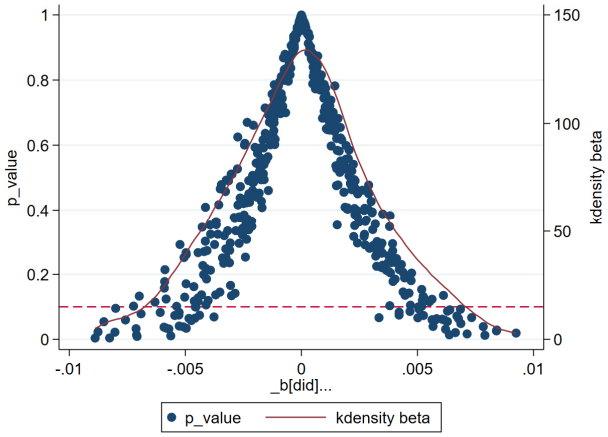


Figure 2. Placebo Test

4.3. Heterogeneity Analysis

4.3.1. Industry Heterogeneity

On the basis of baseline regression, this paper further conducts a heterogeneity test to explore the differential effects of delayed retirement policies on employment rates in different industries. In order to reveal the specific effects of policies in different industries, this paper conducts a regression analysis of the employment rate of the primary industry, the secondary industry and the tertiary industry by industry, and the results are shown in Table 4.

In the primary industry, which is mainly agriculture, the effect of delayed retirement policy is more significant in the regression results, and the regression coefficient is 0.058, which is significant at the significance level of 5%. This result indicates that the delayed retirement policy has a significant positive promoting effect on the employment rate in the primary industry. Since the primary industry is usually labor-intensive, the implementation of the delayed retirement policy may extend the working life of the elderly labor force, reduce the loss of labor force, and thus have a significant improvement effect on the employment rate of the industry.

The secondary industry is mainly manufacturing and industry, among which the regression results show that the delayed retirement policy also has a significant impact on the employment rate of this industry, with a regression coefficient of 0.025, which is significant at the significance level of 1%. Compared with the primary industry, although the regression coefficient is smaller, the delayed retirement policy also has a significant positive impact on the employment rate in the secondary industry. The labor demand in manufacturing and industry is usually biased towards skilled workers, and the delayed retirement policy allows older workers with rich experience to stay in their jobs, which helps to alleviate the demand pressure for highly skilled labor in the secondary industry and improve the production efficiency of the industry.

The tertiary industry is the service industry, which is the fastest growing part of China's economy. The effect of the delayed retirement policy on this industry is also significant, with a regression coefficient of 0.024, which is significant at the significance level of 1%. Since many jobs in the service industry are less physically demanding, older workers can

more easily adapt to the work needs of this industry, and the delayed retirement policy allows the service industry to continue to absorb more older workers, thereby increasing the employment rate of this industry in general. In addition, the expansion of the service industry is strong, which can provide more employment opportunities for older workers, which is one of the reasons why the delayed retirement policy has a significant effect in the tertiary industry.

Overall, the heterogeneity test results show that the delayed retirement policy has a significant positive impact on the employment rate in the three major industries, and the impact is most obvious in the primary industry, followed by the secondary industry and the tertiary industry. The high impact of the primary industry may be related to its labor-intensive and low labor substitution. In the secondary industry and the tertiary industry, although the impact is also significant, the increase in employment rate brought by the policy is relatively small. This difference indicates that there are significant differences in the sensitivity of different industries to delayed retirement policies, and the effects of policies are reflected in different ways in different industries.

Table 4. Heterogeneity Analysis

	(1)	(2)	(3)
VARIABLES	Industry_1	Industry_2	Industry_3
Did	0.058**	0.025***	0.024***
	(0.024)	(0.007)	(0.005)
Gdp	-0.001	0.001	0.001
	(0.004)	(0.001)	(0.001)
Sgro	0.032	-0.011	-0.002
	(0.126)	(0.046)	(0.043)
Ggro	-0.017	-0.014	-0.016
	(0.051)	(0.015)	(0.017)
Expen	0.020	0.039***	0.005
	(0.019)	(0.012)	(0.012)
Constant	-0.153	0.408***	0.844***
	(0.235)	(0.145)	(0.144)
Ind	YES	YES	YES
Year	YES	YES	YES
Observations	204	204	204
R-squared	0.609	0.762	0.714

*Note: *, ** and *** are significance levels of 10%, 5% and 1%, respectively, with robust standard error in brackets*

5. Conclusion

With the rapid development of China's economy and the implementation of the family planning policy for many years, China's population aging is increasing, and the problem of labor supply is becoming increasingly severe. The policy of postponing retirement has gradually become an important reform measure to cope with the aging population. The policy aims to increase labor supply by extending the working life of workers, reduce the pressure on pension payments, and promote sustainable economic development. However, the practical impact of delayed retirement policies, particularly on employment rates and specific effects on different industries, remains a central concern for academics and policymakers.

In order to further study the effect of the delayed retirement policy, this paper selected three pilot cities of Shanghai, Nanjing and Jinan to conduct empirical analysis through the difference difference model (DID), combined with the robustness test and heterogeneity analysis, to study the impact of this policy on the employment rate.

5.1. Discovery

The baseline regression results of this study show that the delayed retirement policy has a significant positive impact on the overall employment rate. No matter whether economic variables such as GDP, per capita wage growth rate and GDP growth rate are controlled or not, the delayed retirement policy has a significant positive promoting effect on the employment rate. Delaying retirement significantly increases the supply of the labor market by extending the working life of older workers, especially in cities with a high degree of aging, and this policy significantly improves the employment rate.

Through the difference model (DID), the employment rate changes before and after the implementation of the policy and between different cities are compared. It is found that the elderly workers continue to participate in the labor market after delaying retirement, which makes up for the labor shortage caused by aging, thus increasing the employment rate. These results clearly show that delayed retirement policies are well suited to cities with high levels of aging and labor shortages. In addition, the delayed retirement policy still shows an independent positive effect when controlling for economic factors. This finding suggests that delaying retirement not only works at the initial design level of the policy itself, but also its subsequent promotion and implementation effectively increases the labor supply and thus the overall employment rate.

This study further finds that there is a negative correlation between changes in GDP growth rate and employment rate. This result illustrates the close relationship between economic growth and the labor market, indicating that firms tend to increase labor supply during periods of accelerating economic growth, while firms tend to reduce hiring during periods of slowing economic growth, resulting in lower employment. Although the slowdown in economic growth has had a negative impact on employment, the delayed retirement policy has mitigated this negative effect to some extent. By increasing the supply of workers, the late retirement policy has helped companies maintain some productive jobs, softening the impact of the economic slowdown on the job market. This shows that in the case of unstable economic cycle, the delayed retirement policy can still have a certain positive effect on stable employment.

The delayed retirement policy has a significant heterogeneous effect in different industries. According to the research of this paper, the policy has the most significant

positive effect on the primary industry, followed by the secondary industry, while the tertiary industry also benefits from the delayed retirement policy but has a slightly smaller impact.

The primary industry, since it is usually labor-intensive, is agriculture. The delayed retirement policy directly increases the labor supply of the industry by extending the working life of older workers. The primary industry requires less experience and physical strength, and older workers can continue to work under the delayed retirement policy, reducing labor turnover and thus significantly increasing the employment rate.

In the secondary sector, the demand for highly skilled labor is high in manufacturing and industry. Delayed retirement policies allow older workers with more experience to continue working, easing the pressure on companies to demand skilled workers. Especially in technology-intensive industries, the continued employment of older workers can pass on experience and skills to other workers, and also help ensure production stability. Although the policy impact of this industry is slightly smaller than that of the primary industry, it still shows a significant positive effect.

The tertiary industry is the service industry, and the delayed retirement policy also has a significant impact on the employment rate. Especially in some positions with lower physical requirements, older workers can adapt to work needs more easily. Delaying retirement boosts the service sector by increasing the supply of workers.

5.2. Discussion

Although the delayed retirement policy has achieved remarkable results in improving the overall employment rate in China, especially in different industries showing different positive effects, there are still some controversies and potential problems in the promotion and implementation process of the policy. Hence, the discussion of potential issues will continue below.

Although the delayed retirement policy has effectively increased the working life of China's elderly workers and increased the overall employment rate in the short term, this policy may also cause a crowding out effect of China's young labor force. As older workers remain in the workforce, there may be less demand for new jobs, especially in industries with low labor demand or limited job supply, which may reduce opportunities for young people to enter the workforce and face greater employment pressure. Although existing research has not shown a significant decline in youth employment, this potential risk cannot be ignored. In the long run, the delayed retirement policy may inhibit the renewal of the labor market, cannot guarantee the vitality of China's economic development, and ultimately affect China's economic development.

We also need to take into account the physical health of China's older workforce. While the delayed retirement policy has alleviated China's labor shortage in the short term, older workers' health may deteriorate as they age, leading to a decline in their ability to work and productivity, especially in industries that require manual labor or intensive work. Although the delayed retirement policy has extended the working life of China's older workers, the health problems of China's older workers may have a negative impact on overall labor productivity and work quality. Have policy implementers designed their retirement delay policies with consideration of the health challenges that older workers may face, especially in industries that require high levels of physical strength and efficiency? How to ensure that elderly workers maintain good health and work ability after delayed retirement has become an important issue for the Chinese government in the implementation of policies.

Delaying retirement, while stabilizing labor supply as China's economy slows, could still have a negative impact on employment. When China's economic growth is accelerating, the society needs more labor force. The policy of postponing retirement ensures that the elderly labor force can still work in their jobs and exert a stronger labor supply effect to help meet the market demand and promote economic growth. However, in the period of China's economic growth decline, the society no longer needs so many labor forces, and the continued work of elderly workers may exacerbate the employment pressure of young people, especially in emerging industries, the employment opportunities of young people may be squeezed, making it more difficult for young people to find employment. From a critical point of view, the effect of the Chinese government's delayed retirement policy on the acceleration or deceleration of economic growth is different. In the period of economic expansion, the demand of the labor market is strong, which can better absorb the elderly workers, but in the period of economic downturn, extending the working life may lead to the imbalance of the job market and aggravate the employment difficulties of young people.

5.3. Policy Implications

Based on the research and discussion in this paper, it is found that in order for the Chinese government to maximize the effect of the delayed retirement policy under different economic and social backgrounds, policy implementers need to consider more comprehensively when implementing the delayed retirement policy.

The implementation of the retirement delay policy should take into account that different regions in China have different levels of economic development, population structure and different industrial structures. For areas with serious aging and labor shortage, the policy of postponing retirement can be promoted as a priority measure, while in areas with relatively sufficient labor supply and high youth unemployment rate, the policy should be implemented more cautiously to avoid crowding out the employment opportunities of young labor. For example, in the economically developed regions of China, the tertiary industry accounts for a relatively high proportion and has a high demand for labor force. Therefore, the policy of delaying retirement can effectively alleviate labor shortage. In the less developed areas with surplus labor force and high youth unemployment rate, the implementation of the policy should be combined with other employment promotion measures to avoid adverse effects on youth employment.

We will strengthen health protection and vocational training for older workers. As older workers age, their health and ability to work may gradually decline, especially in high-intensity or physically demanding industries. Therefore, it is necessary for the Chinese government to strengthen the health protection of the elderly labor force when implementing the delayed retirement. For example, the Chinese government and enterprises should provide regular medical check-ups and health insurance for older workers to ensure that they can maintain good working condition during their extended working years. At the same time, with the continuous development of economy and technology, the vocational skills of elderly workers may have been unable to meet the

needs of The Times. Therefore, the government should provide retraining opportunities for older workers to help them learn and adapt to new skills and jobs, which can effectively improve their labor productivity and enhance their competitiveness in the labor market. For example, Japan has successfully implemented delayed retirement through a series of retraining and health support programs, which has eased labor market pressures (Takayama, 2007). The Chinese government can learn from this practice and provide more support for older workers so that they can continue to contribute to the social economy in the context of delayed retirement.

When implementing the retirement delay policy, it is necessary to balance the interests of China's old workers and young workers. While delaying retirement can alleviate the aging population and labor shortage, it may have a crowding out effect on the employment opportunities of young workers, especially in areas with limited job supply. Therefore, when implementing the delayed retirement policy, the Chinese government must take simultaneous measures to ensure that the young labor force will not be affected by the negative impact of delayed retirement when they enter the workplace. The Chinese government can balance the demand and supply of young and older workers in the labor market by providing more employment opportunities for young people, developing innovative industries, and promoting entrepreneurship policies. In addition, policies can encourage older workers to pass on their experience to younger workers, ensuring that skills and experience are passed on.

For different economic growth periods, the Chinese government should flexibly implement different retirement delay policies. When the economic growth rate is accelerating, the implementation of the retirement delay policy should be vigorously promoted. At this time, the labor market demand is strong, and the delayed retirement policy can better exert the supply effect, increase the employment rate and alleviate the labor shortage. However, when the economic growth rate slows down, the continued work of older workers may exacerbate the employment pressure of the young labor force, and the implementation of the delayed retirement policy should be more flexible to avoid negative effects on the supply and demand balance of the labor market.

The Chinese government should strengthen its assessment of the effect of its policies. The implementation of the delayed retirement policy is long-term and complex, and its effects may vary in different periods, industries and regions. Therefore, the government should establish a sound policy evaluation mechanism to evaluate the implementation of policies on a regular basis. Through the evaluation and analysis of the implementation effect of the policy, the problems and deficiencies in the policy are found in time, and the adjustment and optimization are made according to the actual situation. This can not only ensure the effectiveness of policies, but also improve the government's policy implementation and public trust.

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