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ABSTRACT

Public Long-Term Care Insurance and Retirement Intentions of Urban Workers: Evidence from China*

The Chinese government announced the pilot of public long-term care insurance (LTCI) policy in 2016. While most studies focus on LTCI's effects on labor supply and retirement behavior, its effect on retirement intentions, which offer certain advantages over actual behavior, remains unclear. This study applies the difference-in-differences design to estimate the effect of LTCI on urban workers' retirement intentions based on the Chinese Longitudinal Healthy Longevity Survey. The results indicate that LTCI significantly increases the probability of intentions to delay retirement and intended retirement age, especially for the LTCI providing both service and cash benefits. Moreover, the effects are larger and more significant among subgroups, including women, self-employed workers and workers' family members with LTCI eligibility, as these sub-samples are more likely to be caregivers and caregivers' effect is larger. Mechanism analysis reveals that LTCI reduces time support within the family and improves mental health, both of which contribute to delayed retirement intentions. The negative effect of mitigating precautionary saving motives caused by LTCI also exists but subtler. Overall, these empirical evidences support that LTCI helps shape workers' retirement intentions.

JEL Classification: H55, I28, J14, J26

Keywords: long-term care insurance, retirement intentions, difference-in-differences, China

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1. Introduction

Population aging has become a global phenomenon as a result of the combined effect of declining fertility and increasing life expectancy, which make the government concern that the growing need for long-term care (LTC) may impose financial and time burdens on family. The working age population is on the demise and a subsequent social issue has emerged regarding the lack of caregivers. China has 52.71 million disabled elderly people in 2020. Health insurance-covered medical care has been used to supplement insufficient LTC. However, frequent overuse of expensive tertiary hospitals[1] due to the poor quality of primary health care continues to weigh heavily on families with elderly members (Yip et al., 2019). Therefore, the Chinese government decided to pilot the public long-term care insurance (LTCI) policy in 15 cities in 2016, expanding it to 49 cities by 2020.

The effect of LTCI on labor supply behaviors is widely investigated. Studies in countries such as the United States, Japan, and Germany have found significant positive spillover effects of LTCI on caregivers' labor participation (Coe et al., 2023; Fu et al., 2017; Geyer & Korfhage, 2015). Chinese studies have also confirmed the positive effects of LTCI on caregivers' labor supply (Han et al., 2023; Pei et al., 2024). However, Ai et al., (2024) found negative labor supply effect and retirement effect of LTCI on older people. In summary, existing literature suggests that LTCI may influence labor supply and retirement through three potential mechanisms. First, crowding-out effect provides evidence that LTCI can reduce the caregiving burden (Arntz & Thomsen, 2011; Coe et al., 2023; Pei et al., 2024), which encourages people participate in labor market. Most literatures about caregivers' effect of LTCI use this mechanism to support their

[1] All medical institutions in China are divided into three levels and six grades based on indicators such as medical services and management, medical quality and safety, technological level and efficiency. Tertiary hospital, positioned at the apex of this system, signify its capability to deliver advanced, specialized medical and health services.

findings. Moreover, alleviating caregiving responsibilities and increasing disposable income could improve people's health to increase their labor supply (Arai & Zarit, 2011; Luo et al., 2024). Finally, LTCI could discourage labor supply through mitigating the precautionary saving motives against LTC (Han et al., 2023).

Few studies have examined the relationship between LTCI and workers' retirement intentions, while most focus on its effect on actual labor participation and retirement behavior. Subjective retirement intentions offer certain advantages over observed behaviors. First, retirement decisions involve long-term and dynamic optimization processes (Heyma, 2004), meaning that actual behaviors may not respond immediately to policy changes, whereas retirement intentions may adjust quickly. Empirical methods can better capture immediate policy effect. Second, retirement intentions can predict the long-term effect of LTCI and reflect future retirement plans of younger cohorts, as they often align with future retirement behaviors (Benítez-Silva & Dwyer, 2005). These insights can enable policymakers to anticipate changes and make decisions in advance. Lastly, intentions provide insights into voluntary or involuntary retirement, which can affect retirees' well-being and potential returns to work (Maestas, 2010). In urban China, workers must go through the retirement process and receive a pension upon reaching the statutory retirement age. While some can continue working informally, the majority retire at this age due to limited formal employment opportunities thereafter.

The effect of LTCI on retirement intentions and actual retirement decisions may differ. Retirement intentions may apply to more broad population; indeed, the study sample in Ai et al. (2024) ranges from the statutory retirement age to age 75, while our study focuses on workers aged 45 to below the statutory retirement age, and this sample difference could be an important factor behind the difference effect of LTCI on retirement intentions and actual retirement.

LTCI may positively influence retirement intentions, as working-age individuals being younger and with lower motives of precautionary saving (Kennickell & Lusardi, 2004). The positive caregivers' effect on intergenerational support and health may be more evident when forming intentions. However, retirement planning is dynamic and these considerations undergo shifts as individuals age. Caregivers' positive effect of LTCI diminishes over age (Fu et al., 2017), while precautionary saving motives grow stronger (Choi et al., 2017; Kennickell & Lusardi, 2004). Older individuals, being more risk-averse, increasingly prioritize precautionary savings when deciding on retirement. Moreover, statutory retirement policy often results in involuntary retirement. Many people have to retire at the statutory retirement age because of institutional constraints and lack of job opportunities (Feng et al., 2020), limiting the effect of LTCI on actual retirement. Therefore, the positive effect of LTCI on retirement intentions may weaken or even turn negative for actual retirement decisions (Ai et al., 2024).

Therefore, this study explores the casual effect of LTCI on workers' retirement intentions. We limit the sample to urban workers who aged 45 to below the statutory retirement age. To identify the effect of LTCI, we apply DID and PSM-DID methods based on the variation in the timing of LTCI pilots across different cities. Using the China Health and Retirement Longitudinal Study (CHARLS) from 2011 to 2020, we find that LTCI leads to 7.7 (DID) and 8.8 (PSM-DID) percentage points increase in the probability of intentions to delay retirement, and the intended retirement age increases by 0.822 (DID) and 1.132 (PSM-DID) years. Moreover, LTCI that provide both service and cash benefits has a larger effect than that only provide service benefit. LTCI has heterogeneous effect among the workers with different gender, type and LTCI eligibility. In particular, the effects for those who are female, self-employed, and whose family members with LTCI eligibility, are larger and more significant.

We also demonstrate LTCI can affect workers' retirement intentions through three potential mechanisms form the perspectives of caregivers and potential beneficiaries. First, we find that LTCI has a negative effect on the probability of providing informal care and living with or near children. This suggests that LTCI reduces caregiving burdens and time support received from children, thereby making workers intent to delay retirement. Second, our analysis reveals that improved mental health, induced by LTCI, is another mechanism affecting workers' retirement intentions. Third, we show that LTCI policy discourages retirement by mitigating precautionary saving motives against LTC costs. We find workers with higher household savings and poorer health exhibit stronger precautionary saving motives, indicating the role of LTCI in addressing these concerns and reducing the need for such savings.

Our study also contributes to the literature in other aspects. First, we examine the effects of LTCI considering workers as both caregivers and potential beneficiaries because individuals aged 45 to 59 often have both elderly parents and children. Most studies focusing on younger individuals only considered the caregivers' perspective (Coe et al., 2023; Fu et al., 2017; Pei et al., 2024), while Ai et al. (2024) focused on older individuals and more emphasized the perspective as potential beneficiaries. Second, a wider range analysis of mechanisms is included in our study. Our analysis expands the scope to include intergenerational support, health, and precautionary saving motives, whereas Ai et al. (2024) focuses on bankruptcy risk and wealth effect, and other studies typically focus on caregiving burden.

The rest of the paper is organized as follows: Section 2 is background and conceptual framework, Section 3 describes data and empirical strategy, Sections 4 and 5 are main results and mechanism analysis, Section 6 is conclusion and discussion.

2. Background and Conceptual Framework

2.1 Public LTCI policy in China

In July 2016, the Chinese government announced the launch of public LTCI policy in 15 pilot cities spanning across 14 provinces, with Jilin and Shandong provinces as the key contact provinces. LTCI was introduced to address the growing demand for LTC and was designed with appropriate variations across the pilot cities. In 2020, the Chinese government expanded the pilot program to include more cities, such as Hohhot and Tianjin. Theoretically, all people covered by the national medical insurance and residing in the pilot areas are eligible for LTCI. As of the end of June 2023, the number of people insured in the 49 LTCI pilot cities had reached 170 million, with over 2 million people having received benefits and a total expenditure of about 65 billion yuan from the program (National Healthcare Security Administration of China, 2023).

National health insurance coverage is a prerequisite for LTCI eligibility in China, including the Urban Employees Basic Medical Insurance (UEBMI, targets urban employee) and the Urban and Rural Residents Basic Medical Insurance (URRBMI, targets others excluded by UEBMI). All cities cover individuals who are enrolled in UEBMI and part of cities additionally cover individuals who are enrolled in URRBMI. People who covered by the national health insurance program and from polit cities are eligible for LTCI. Therefore, the funds for LTCI mostly come from health insurance pooling fund, and also from individual payments, the welfare fund and financial subsidies. Individual payments are made by policyholders who can afford the premiums. In some cases, the government provides financial subsidies to low-income households to help them pay for their insurance premiums.

LTCI is designed primarily for those who are unable to care for themselves due to having lost some or all of their functions as a result of old age, disease, disability, or other causes. Eligible people can claim LTCI benefit if they are identified by

professionals as having a certain degree of disability. The insurance encompasses two main types of benefits: services and cash. Care services under LTCI encompass home care, institutional care, and hospital care, which together deliver formal and expert care services to disabled elderly. Cash subsidies are directly provided to the disabled elderly and their families, affording them the flexibility to utilize the funds for formal care or informal care provided by others chosen by themselves, including relatives, friends and nurse.

Due to limited micro data, our analysis can only include pilot cities that implemented LTCI in and before July 2020. We include 28 pilot cities in our study based on CHARLS data. There are sourced from official pilot documents and piloted by local governments. Table A1 in the Appendix presents the details of pilot cities used in this study, including their name, pilot year, coverage and benefit type. Specifically, Qingdao city took the lead in implementing the nationwide policy pilot in 2012, while Weifang city launched the pilot before the official government document was issued. The remaining 26 cities adopted LTCI following the official announcement of the pilot cities in 2016.

2.2 Conceptual framework

While LTCI are designed to assist people with limited functional ability, their effect on the welfare of the whole family, including both caregivers and potential beneficiaries, should be concerned. Therefore, we analyze three mechanisms through which LTCI may influence retirement intentions, considering workers both as caregivers and potential beneficiaries.

The first mechanism is intergenerational support. Crowding-out theory posits that when social care services meet the needs of disabled individuals, formal care can effectively substitute for informal care and reduce the burden on family caregivers (Arntz & Thomsen, 2011). From the perspective of caregivers, previous literatures have

found that LTCI can reduce financial and time burden on family caregivers (Arai & Zarit, 2011; Pei et al., 2024). From the perspective of potential beneficiaries, Becker (1974) proposed that social security reduced upward intergenerational support from children to parents. Moreover, simply purchasing LTCI can diminish time support received from their children (Coe et al., 2023; Zweifel & Strüwe, 1998). In summary, LTCI could reduce caregiving burden and time support received from family. Reduced caregiving burden may encourage people to participant in work (Geyer & Korfhage, 2015; Han et al., 2023). Szinovacz et al. (2001) also pointed out that people could resort to work to compensate for the absence of time support from children. The effect of financial transfer is complicated, as it depends on the amounts of transfers provided and received, as well as future LTCI reimbursements.

The second mechanism is subjective health. Caregivers often face the risk of experiencing both physical and mental health issues (Arai & Zarit, 2011; Do et al., 2015). Therefore, from the perspective of caregivers, a reduction in the caregiving responsibilities can lead to an improvement in their health (Arai & Zarit, 2011; Luo et al., 2024). From the perspective of potential beneficiaries, LTCI may reduce anticipated life stress and future risks, resulting in improved self-reported health. In addition, LTCI can also increase family disposable income and encourage individuals to consume more to improve health and quality of life (Luo et al., 2024; Wang et al., 2023). Several studies have shown that LTCI positively affects the health of caregivers and beneficiaries (Lei et al., 2022; Sohn et al., 2020; Wang et al., 2023). Health is a major factor affecting retirement and extending people's working lives (Blau & Goodstein, 2010; Nivalainen, 2020). In addition, individuals in poor health and with shorter expected lifespans may not need to work so long to accumulate pension wealth for retirement (French & Jones, 2017).

The last mechanism is precautionary saving motives against LTC costs. Most people have to work for having precautionary savings as a form of self-insurance against future LTC or other risk for themselves and their family members (Bueren, 2023). By providing financial protection against LTC costs, LTCI reduces the financial risks associated with aging and potential future care needs. This reduced financial certainty may lead people to feel more financially secure and mitigate precautionary saving motives. Ameriks et al. (2016) and Liu et al. (2023) demonstrated how LTCI could alleviate the motives for precautionary saving. This reduced motives for precautionary saving can decrease their incentives and intentions to prolong their careers (Anderson et al., 2017; Magnani, 2024).

Figure 1 shows the relationships of LTCI, mechanisms and outcome variables. Based on these theories it is hypothesized that LTCI would likely increase workers' intentions to delay retirement and intended retirement age if the decrease in time support and improved health offset the negative effect of mitigating precautionary saving motives against LTC costs.

[Insert Figure 1 here]

3. Data and empirical strategy

3.1 Data

The primary data source for this study is the China Health and Retirement Longitudinal Study (CHARLS). It is a large-scale, national representative micro-data survey that collects information on health, work, and old-age care of middle-aged and elderly individuals over the age of 45 years and their spouses. The survey was conducted using a stratified random sampling method and is harmonized to the Health and Retirement Study (HRS) in the United States. The questionnaire consists of key modules: demographics; family composition and transfer; health condition and

functioning; health care and insurance; employment; retirement and so on. CHARLS initiated its pilot survey in 2008, and carried out its first nationwide survey in 2011, followed by a further four follow-up surveys in 2013, 2015, 2018 and 2020. This study uses all five waves of the survey available now, including the baseline national wave and the four follow-up polls.

To discuss the retirement intentions of workers and reduce the sample selection bias, we focus on urban workers[2] aged 45 to below statutory retirement age in this study, which is 60 for male workers, 55 for female white-collar workers and 50 for female blue-collar workers[3]. The sample age is from 45 to 59 years old. The reasons for restricting urban workers mostly because LTCI policy is more developed and the statutory retirement policy places greater restrictions on them. In addition, we also limited our samples to workers whose families with at least one person enrolled in the basic medical insurance program (UEBMI and URRBMI), as only these families are eligible for LTCI. Answer "as long as possible" for age planning to stop working which form our dependent variables are also excluded because it is impossible to ascertain any precise information regarding their retirement plans.

Finally, 4,695 individual samples were collected after deleting missing values, those from 103 cities, with 3,406 in control group from 75 cities, and 1,289 in treated group from 28 cities. Table A2 in the Appendix examines the correlation between missing of intended retirement age, attrition and LTCI coverage across cities. The results suggest that there are no significant differences in missing and attrition rate between treated cities and control cities.

[2] We focus exclusively on urban workers and exclude urban residents from our sample. Only 26 urban residents responded to the question about retirement intentions. Therefore, we excluded these samples.

[3] According to relevant documents, in this paper, white-collar workers refer to cadres and managers in party and government organizations, mass organizations, enterprises and institutions, as well as self-employed workers. The retirement age of self-employed workers is determined based on their pension age. Blue-collar workers refer to workers in state-owned enterprises, institutions, and party and government organizations, as well as mass organizations, who do not fall under the white-collar category.

3.2 Variable definitions

To create dependent variables for intended retirement decisions, we used the survey question " At what age do you plan to stop working"[4] from CHARLS to create a binary variable, Delayed Retirement, by comparing the intended age to stop working with China's statutory retirement age. If male intends to retire after 60 years old, female white-collar intends to retire after 55 years old, or female blue-collar intends to retire after 50 years old, the value is 1; otherwise, the value is 0. Between 2011 and 2020, China had been striving to formulate an appropriate delayed retirement policy. We generated another variable (Delayed Retirement (+5)) based on one of the proposed plans (Wang, 2013; Xing, 2018), which equals 1 if male intends to retire after 65 years old, white-collar female intends to retire after 60 years old or blue-collar female intends to retire after 55 years old; otherwise, the value is 0. Retirement age is recorded as a continuous variable by directly using the answer to this question.

The key independent variable is LTCI treatment status of urban workers, determined by whether the worker is from a pilot city. In our study sample, 28 out of 103 prefectural-level cities had implemented LTCI . This means that urban workers in these 28 cities are considered the treated group, including 19 cities in the officially-announced pilot list that implemented LTCI during 2012-2018 and 9 cities where the local governments had launched LTCI during 2017–2019. Those workers not covered by LTCI in the remaining 75 cities are designated as the control group. And then we construct an indicator of whether the urban worker was covered by LTCI, according to the pilot timing at the city level.

Our empirical analysis also controls for a comprehensive set of variables that capture the workers' individual, family, and work characteristics. Specifically, we

[4] The related problem is "At what age do you plan to stop working? Stopping work in this context shall refer to having stopped all income-related activities, unpaid family business and having no intention of engaging in anything more serious than small pastime work".

control for the following workers' details: gender (1=male); education level (use below primary school level as the reference group to 4 dummy variables: primary school (1=yes), junior high school (1=yes), senior high school (1=yes), and bachelor or above (1=yes)); age; registered residence (1=rural); marital status (1=married). Other control variables include the number of living children, living parents (1=yes), and work type (1=employed). Some city characteristics also included in the model. Such as the logarithm of fiscal revenue, the number of medical institutions, per capita GDP, average wages, and the service industries' share of GDP.

Table 1 shows the summary statistics for datasets; the statistics are reported separately according to the workers in the treatment or control group. The mean values and standard deviations of the key dependent and control variables are shown in it. We observe that 50.6% of urban workers intend to delay retirement under the current statutory retirement age, and 15.9% intend to delay retirement five years after reaching the statutory retirement age. The average intended retirement age is 59.87 years, 61.03 for men and 57.17 for women, which is older than statutory retirement age in China. However, the difference test reveals only a small significant difference in Delayed retirement (+5) between the treated and control groups.

[Insert Table 1 here]

3.3 Empirical strategy

Using the variation in the timing of implementation in 28 pilot cities, we apply a two-way fixed effect (TWFE) DID design to assess the effect of LTCI on retirement intentions. We only use city fixed effects rather than individual fixed effects to focus on city-level policy effect and to avoid a significant loss of sample size due to the unbalanced panel. We based on the following equation (1) to investigate the effect of LTCI within a standard difference-in-differences (DID) framework.

$$Retirement_{ict}=\beta_0+\beta_1\times LTCI_{ict}+\beta\times X_{ict}+City_c+Province_c\times Year_t+\mu_{ict} \quad (1)$$

$Retirement_{ict}$ denotes the intended retirement decisions for individual i from city c in year t, including Delayed retirement, Delayed retirement (+5) and Retirement age. $LTCI_{ict}$ is equals to $Treat_{ic}\times Post_{ct}$. $Treat_{ic}$ is a treated dummy indicating whether urban worker i is from pilot city c or treated group. $Post_{ct}$ is a period dummy indicating the years after the implementation of LTCI. X_{ict} is a vector of time-varying characteristics as discussed previously. $City_c$ is a set of city fixed effects, which absorbs time-invariant differences in observable and unobservable characteristics. $Year_t$ is a set of year fixed effects and $Province_c$ is a set of province fixed effect. $Province_c\times Year_t$ could capture time-varying characteristics that are specific to each province. μ_{ict} is the error term. The point estimate β_1 denotes the effect of public LTCI implementation. Standard errors are clustered at the city level.

To ensure greater similarity in observables between the treatment and control groups, we also employed the PSM-DID method to achieve "double robustness". First, we utilized six nearest-neighbors matching to obtain the propensity scores based on a set of baseline city characteristics in 2011, including the logarithm of fiscal revenue, the number of medical institutions, per capita GDP, average wages, and the service industries' share of GDP. 45 cities successfully matched with 28 treated cities. We then performed DID analyses on individuals within the common support, ensuring that both groups have similar probabilities of being covered by LTCI. All observable characteristics are well balanced (see Table A3 in the Appendix).

4. Results

4.1 Basic regression results

Table 2 reports the results from Equation (1), which provides the estimated effects on the probability of intentions to delay retirement and intended retirement age.

Columns (1) to (3) are the results of dependent variable: Delayed retirement. Columns (4) to (6) are the results of dependent variable: Delayed retirement (+5). Columns (7) to (9) are the results of dependent variable: Retirement age. Meanwhile, Columns (1), (4), and (7) are the results for OLS, which do not control for any covariates or fixed effects; Columns (2), (5), and (8) are the results for DID, which control all covariates and fixed effects; Columns (3), (6), and (9) are the results for PSM-DID.

Our results show that LTCI increases urban workers' intentions to delay retirement and their intended retirement age. Columns (1) to (3) in Table 2 show that LTCI has no significant effect on urban workers' probability of delayed retirement intentions. However, LTCI significantly increases workers' probability of intentions to retire 5 years after reaching the statutory retirement age when controlling for all covariates and fixed effects. The regression results in Columns (5) to (6) show that LTCI increases urban workers' probability of intentions to delay retirement by 7.7 or 8.8 percentage points. Two model specifications also demonstrate that LTCI significantly increases the intended retirement age of urban workers. The regression results of Columns (8) and (9) show that LTCI policy raises workers' intended retirement age by 0.822 years or 1.132 years.

The aforementioned results for the probability of intentions to delay retirement suggest that LTCI may not contribute to an increase in the intended retirement age among older workers transitioning from pre- to post- statutory retirement age. Nevertheless, it influences those already planning to retire beyond the statutory retirement age, encouraging later retirement—a significant finding given that over 50% of the samples expressed willingness to retire beyond this age. Additionally, the event study (see Figure A1 in the Appendix) confirms a lagged effect of LTCI on the probability of delayed retirement, showing a significant increase in delayed retirement intentions in the first, second, and third periods after LTCI implementation, particularly

among the matching sample. This means while LTCI may not immediately affect their delayed retirement, it shows a positive effect over time.

[Insert Table 2 here]

The DID specification requires the key assumption that the selection of pilot cities is unrelated to other determinants of intended retirement decisions. A common trend test is typically used to address this problem as it can empirically determine the same time trends of the dependent variables between the treated and control groups over time. This study follows Huang & Zhang (2021) to conduct common trend test. In Figure 2, we compare the pre-trends differences between treated group and control group on some key city characteristics, including local fiscal revenue, number of medical institutions, per capita GDP, service industries' share of GDP, and average wage. Among them, fiscal revenue and medical institutions are considered crucial indicators for eligible in LTCI . We find the time trends are fairly parallel between treated cities and control cities on city characteristics for all sample and matching sample, which indicate that there are no significant trend differences regardless of whether LTCI was implemented. We also conducted F-tests to examine parallel trends. The F-statistic and corresponding p-values are reported in each figure. The p-values are 1.00 for local fiscal revenue and number of medical institutions, suggesting that treated and control group have parallel trends. Cities did not preemptively anticipate the pilot status or invest in infrastructure to compete for pilot status.

[Insert Figure 2 here]

4.2 Component effect of the LTCI

There are two types of LTCI benefits in pilot cities: service benefit and cash benefit. The vast majority of cities adopt service benefit to implement LTCI. A minority

of cities have implemented both service and cash benefits to implement LTCI . Benefit type is crucial as it influences the flexibility and accessibility of LTC for disabled individuals when LTCI fund remains similar in every pilot (Han et al., 2023; Wang et al., 2021). Existing literature explored the impact of cash benefit in encouraging familial care at home (Fu et al., 2017; Geyer & Korfhage, 2015; Han et al., 2023). Cash benefit entails direct cash subsidies to elderly people or their caregivers, empowering participants to utilize benefits according to their specific needs, such as hiring caregivers (including relatives, friends and even nurse) or searching formal institutions through themselves.

Out of the 28 pilot cities, only 7 have implemented both service and cash benefits. Table 3 examines the differences in policy effect between these two types of LTCI benefits in one model. Columns (1), (3), and (5) present regression results using DID method. In contrast, Columns (2), (4), and (6) present regression results using PSM-DID method.

The results in Table 3 demonstrate that workers' delayed retirement intentions have increased more in those pilot cities where LTCI was implemented with both service and cash benefits. All models show that the coefficients of LTCI with service and cash benefits are larger and more significant than the coefficients of LTCI that only provide service benefit. More flexible and diverse types of insurance benefits have a more positive effect on improving the willingness of older urban workers to continue working. These results are similar with Han et al. (2023). Two reasons could explain this conclusion. First, traditional ideology in China towards receiving care from strangers or living in formal LTC institutions hinders the efficiency of service benefit (Zhang & Li, 2020). Second, LTCI offering cash benefit allows elderly individuals to pay for care services provided by relatives, neighbors and nurse, substituting for informal family care and encouraging intentions to delay retirement (Han et al., 2023).

While cash subsidies enable insured individuals to select their caregivers, these caregivers are more likely professionals since they must undergo training to ensure adequate long-term care skills.

[Insert Table 3 here]

4.3 Heterogeneous analysis

This section explores the heterogeneous effects of LTCI on the intentions to delay retirement and intended retirement age using DID method[5]. We examine these heterogeneous effects from three perspectives: gender, worker type and their LTCI eligibility.

4.3.1 Gender

Whether in the family or in formal care facilities in China, females are the major care providers for the disabled elderly. LTCI may partially substitute the informal care provided by other family members (mainly female family members), and significantly increasing the intentions of female workers to work and delay retirement (Klimaviciute et al., 2019). This implies that LTCI could have more effect on both encouraging females' intentions to delay retirement and raising their retirement age from the perspective of caregivers, including reducing females' care burden and thus improve their health.

Panel A of Table 4 lists the outcomes of separate regressions using subsamples of male and female workers. We find that the effects on delayed retirement intentions are particularly larger amongst female workers, which is consistent with conjectures. Panel A shows that women have 17.4 percentage points increase in the probability of intentions to delay retirement and a 2.487-year increase in their intended retirement age,

[5] PSM-DID results are very similar to DID results. Therefore, due to space limitations, in subsequent regressions, including heterogeneity, robustness and mechanism analysis, we mainly report the regression results of DID.

compared with men who have 3.7 percentage points increase in the probability of delayed retirement and a 0.328-year increase in the intended retirement age.

4.3.2 Workers' type

Similarly, LTCI may have different effects on retirement intentions, depending on workers' type. Urban self-employed workers are mainly independent contractors or freelancers, whereas urban employed workers have formal jobs and some work in businesses and government institutions. On the one hand, self-employed workers may have more freedom in their retirement decision than employed workers, and they lack early retirement incentives available to their salaried counterparts. At the same time, the choice of self-employed and employed work is linked to informal care. Self-employed workers may take on more informal care responsibilities due to their more flexible work schedules, plus the fact that workers who must care for others are more likely to choose self-employed work (Connelly, 1992). Therefore, LTCI may increase the intentions of self-employed workers to delay retirement and their intended retirement age from the perspective of caregivers.

We use a subsample of self-employed workers and employed workers to explore the heterogeneity effect of LTCI. Panel B shows that the effect on the intention to delay retirement is especially noticeable among self-employed workers. They have 8.2 percentage points increase in the probability of intentions to delay retirement and a 1.380-year increase in intended retirement age, compared to employed workers, who show 5.5 percentage points increase in the probability of delayed retirement and a 0.552-years increase in the probability of increasing the retirement age.

4.3.3 LTCI eligibility

At last, LTCI may have different effects on retirement intentions, depending on whether the workers themselves have LTCI eligibility or if their family members have LTCI eligibility. On the one hand, individuals with LTCI eligibility are more likely to

focus on the direct effect of LTCI from the perspective of potential beneficiaries. This can primarily affect their retirement intentions through three aspects: intergenerational support from their children, health effect, and preventive savings for themselves. On the other hand, family members with LTCI eligibility are more likely to focus on the spillover effect of LTCI and consider individual more as a caregiver. The effect on their retirement intentions is likely influenced by the caregiving responsibilities, the subsequent health improvements resulting from reduced caregiving burdens, and preventive savings for their family members.

We use subsamples of workers with their own LTCI eligibility and those with family members' LTCI eligibility to explore LTCI's heterogeneous effect. Given that some workers and their family members are both eligible for LTCI, we further incorporate family members' disability into the classification[6]. Specifically, workers with LTCI eligibility refer to worker is eligible while family members are not, or both are eligible but no family members are disabled. Family members with LTCI eligibility refer to worker is ineligible but family members are eligible, or both are eligible and there are disabled family members. Panel C shows the results of the three dependent variables and find family members with LTCI eligibility have a larger effect on workers' retirement intentions. They have 12.4 percentage points and a 1.373-year increase in the probability of intentions to delay retirement and intended retirement age, compared to workers with LTCI eligibility, who only show 7.2 percentage points and a 0.082-year increase in counterparts. This means the caregivers' effect of LTCI could be larger than its potential beneficiaries' effect on retirement intentions.

[Insert Table 4 here]

[6] We do not consider the workers' own disability status, as they are young with less than 4% having mild disabilities and are unlikely to directly benefit from LTCI.

4.4 Robustness checks

4.4.1 Placebo test

Placebo test based on false treatment status. We conduct a placebo test that randomly selects appropriate cities to serve as the virtual treated group, that is, randomly selects the treated status of each city. These cities are assumed to have the same period of policy implementation as the initial treated cities. Specifically, our regression sample comprises 28 LTCI cities out of 103 cities. Of those 103 cities, we chose 28 cities at random to replace these treated cities and the remaining cities being non-LTCI cities. Finally, we construct a false LTCI variable. The randomization ensures that this newly constructed regressor of interest should have no effect on retirement decision-making, and any significant results would point to the misspecification of our estimation equation. To prevent contamination from any rare events, we repeat this random data generation process 500 times.

Since the regression results of Delayed retirement are not significant, Figure 3 only plots the distribution of estimated coefficients and probability density function for other two dependent variables. The distributions center around zero and most estimates are distributed around zero. Meanwhile, the placebo test clearly shows that our true estimates (vertical dashed line, respectively in Figure 2 (a) and (b)) are outliers. When taken together, these findings show that the estimated results in this study are not driven by unobservable factors, which means that the increase in the probability of intentions to delay retirement and intended retirement age of urban workers in the treated group could be attributed to LTCI.

[Insert Figure 3 here]

4.4.2 Other robustness checks

Alternative PSM methods. In the basic regression analysis, we perform matching based on city characteristics in 2011. In this part, we provide robustness checks for PSM-DID method by alternative matching methods. First, we performed year-by-year matching using city characteristics for each year, then conducted PSM-DID. Second, we matched both individual and city characteristics year-by-year, then conducted PSM-DID. Panel A of Table 5 shows the results of two match methods, which show that LTCI still significantly increases people's intensions to delay retirement and intended retirement age. The results are similar to the basic regression results.

Alternative regression methods. A concern with using TWFE regressions in a DID design is the problem of negative weights, as treated observations may serve as controls. The linear regression coefficient might appear negative even if all the average treatment effects are positive because of negative weights. Therefore, we conduct robustness checks and obtain alternative estimators robust to heterogeneous treatment effects based on the DID method provided by Sun & Abraham (2021). In addition, to eliminate the potential sample selection bias for only using workers sample, we use Heckman two-stage method to perform another robustness check. Panel B of Table 5 demonstrates that LTCI still significantly increase workers' intentions to delay retirement and their intended retirement age. These results are consistent with the basic regression results.

Deleting the samples from Shandong Province and Jilin Province. Jilin Province and Shandong Province are the key contact provinces of LTCI policy in China. The implementation timing and design of LTCI in each city within these two provinces are mainly determined by local economic, demographic, and other contextual factors, allowing for flexibility. This means that treatment status may be influenced by unobservable factors within these cities. Furthermore, when a city in a key contact

province implements LTCI, residents of nearby cities are more likely to anticipate changes to their own city's policy and react preemptively, potentially underestimating the policy's impact. As a result, we deleted the observations in the Jilin Province and Shandong Province. Panel C of Table 5 indicates that LTCI significantly increases people's intensions to delay retirement and their intended retirement age, which are similar to basic regression results.

Including linear trends. And then, we included linear trends of baseline city characteristics in 2011 to mitigate potential biases in our analysis. These trends, including the logarithm of fiscal revenues, medical institutions, per capita GDP, average wages, and service industries' share of GDP, can capture the evolving socio-economic context of each city. By controlling for these factors, we could eliminate the effect of underlying regional dynamics that may influence both the implementation of LTCI and retirement intentions. The regression results are shown in Panel D of Table 5. We find that LTCI significantly increases workers' intentions to delay retirement and intended retirement age.

Alternative definition of female blue-collar and white-collar. We addressed potential issues from imprecise classification between female white-collar and blue-collar workers. Following Feng et al. (2020), we conducted a robustness check by setting the statutory retirement age for both groups at either 50 or 55 years. Panel E of Table 5 shows that LTCI still significantly increases workers' delayed retirement intentions. Additionally, considering the correlation between occupation and education (Connelly et al., 2014), we classified workers with a high school education or below as female blue-collar workers, and those with a college education or above, as well as self-employed female workers, as female white-collar workers (Ai et al., 2024; Feng et al., 2020). The results, presented in Panel A of Table A4 in the Appendix, confirm the same conclusion.

Additional results of robustness checks are presented in Table A4. We employ various methods, including using alternative measures of Delayed retirement (+5), excluding the effect of overlapping policy, and replacing city fixed effects with individual fixed effects, to confirm that the regression results remain consistent with the basic findings.

[Insert Table 5 here]

4.5 Extended analysis: LTCI and actual retirement

Our basic regression analysis demonstrates a positive effect of LTCI on the retirement intentions of urban workers. However, we cannot determine whether this can translate into their actual retirement behavior. To further explore this problem, we conducted an extended analysis to examine the effect of LTCI on the actual retirement age. We first examine the correlation between actual and intended retirement age using a scatter plot in Figure 4. We find a positive correlation between these two factors, indicating that individuals who intend to delay retire tend to do so in practice. This visual representation supports that retirement intentions are a good predictor of actual retirement behavior (Bentez-Silva & Dwyer, 2005; Nivalainen, 2022).

Next, we explore the direct effect of LTCI on actual retirement age. The results of Panel A in Table 6, however, show that LTCI has an insignificant effect on actual retirement age using DID and PSM-DID methods. Retirement decisions are dynamic, influenced by the interplay of various factors over time. As individuals age, the positive caregivers' effect declines, while the negative effect of precautionary saving motives becomes more evident, potentially leading to an insignificant overall effect on actual retirement. To examine this conjecture, we first assess whether the caregivers' effect declines and the effect of precautionary saving motives increases with age. Given that actual retirement decisions precede the survey and respondents are older than their

actual retirement age, we analyze LTCI's effect on intended retirement age across different age groups. As shown in Panel B of Table 6, the effect of LTCI on intended retirement age of older workers is found to be insignificant, suggesting a reduction in the caregivers' positive effect and an increase in the effect of precautionary saving motives as individuals age. Next, we explore the role of precautionary saving motives in actual retirement. Research suggests that individuals in poor health are more likely to have stronger precautionary saving motives for LTC (Liu et al., 2023). Panel C of Table 6 indicates that LTCI significantly decreases actual retirement age for individuals in poor health, providing empirical support for the effect of precautionary saving motives.

The different effects of LTCI on intended and actual retirement age may stem from the distinction between voluntary and involuntary retirement. Actual retirement age often aligns with statutory retirement age due to social norms or institutional constraints, particularly in public sectors where pension benefits are tied to this age (Feng et al., 2020). While some workers may intend to continue working, they have to work in informal sector, which is less unattractive because of its fewer benefits and securities (Gustman & Steinmeier, 2000). Involuntary retirement often leads to reduced well-being (Bonsang & Klein, 2012; Maestas, 2010). In Panel D of Table 6, we demonstrate the existence of involuntary retirement and its effect on CESD score and well-being. We define involuntary retirement using the gap between intended and actual retirement age: the first measure classifies retirement as involuntary if the ages are not equal; the second measure classifies retirement as involuntary if the age difference beyond 2 years. Our results show that 91.71% and 76.58% of individuals are involuntarily retired. The regression analysis also confirms that involuntary retirement significantly reduces well-being, highlighting its role in the different effects of LTCI on intended and actual retirement age.

[Insert Table 6 here]

5. Mechanism analysis

The findings reveal that LTCI may increase the probability of intentions to delay retirement and intended retirement age of urban workers. This section refers back to the conceptual framework to discuss three possible mechanisms.

5.1 Intergenerational support

First, intergenerational support may be a potential mechanism through which LTCI affects workers' retirement intentions. Reduced time support provided to or received from others can delay retirement intentions, while financial support within the family also significantly impacts retirement intentions (Geyer & Korfhage, 2015; Szinovacz et al., 2001). To verify this mechanism, we examined how LTCI affects the intergenerational support between workers and their family members. Specifically, we estimated equations similar to the above equation (1) but used variables on intergenerational support as dependent variables. The variables used to measure intergenerational support encompass the probability of providing informal care, contacting with parents or children, living with or near children, the probability and amounts of transfer payments provided to or received from family members.

The results presented in Panel A of Table 7 indicate that LTCI can slightly diminish the probability of workers providing informal care to others. Moreover, we observe a significant reduction in the probability of workers living with and near their children. With regards to the effect of LTCI on financial support, as depicted in Panel B of Table 7, we find that, apart from a slight decrease in the probability of workers giving transfer payments to their parents, other results are not significant. In summary, LTCI increases urban workers' intentions to delay retirement and intended retirement age by reducing time support, both provided informal care to others and received from

their children. The diminishing time support within family serves as a mechanism that contributes to increasing delayed retirement intentions.

[Insert Table 7 here]

5.2 Subjective health

Second, health may also be a potential mechanism through which LTCI affects workers' retirement intentions. Good health status may encourage workers to stay in the labor market or delay retirement (Blau & Goodstein, 2010; Nivalainen, 2020). Therefore, we estimated equations similar to the above equation (1) but used health variables as dependent variables instead of retirement intentions to examine the existence of this mechanism. The variables we used include self-reported health, CESD-score, well-being, measurement on depression and hope.

Table 8 presents the findings on how LTCI affects the subjective health assessment of urban workers. Table 8 shows that LTCI significantly decreases workers' CESD score, which means LTCI improves urban workers' mental health. In addition, we find no evidence that LTCI has an effect on self-rated health, well-being, feeling depressed and feeling hopeful for the future in this study. In summary, improving mental health is also a mechanism to increase the probability of intentions to delay retirement and intended retirement age.

[Insert Table 8 here]

5.3 Precautionary saving motives

At last, we utilize two sub-sample analysis to verify the existence of precautionary saving motives against LTC costs. First, many studies have shown that precautionary saving motives can explain most individual and family savings behavior (Caballero, 1991; Choi et al., 2017). Therefore, household savings can serve as a proxy for the

strength of these motives. Workers with higher savings in 2011-2013 likely have stronger precautionary saving motives and may be more sensitive to the reduction of LTC risks caused by LTCI. Therefore, LTCI may have a smaller effect on their retirement intentions. In contrast, workers with lower savings are more likely to delay retirement due to weaker precautionary motives. Panel A of Table 9 examines the heterogeneous effect of LTCI by dividing workers into two groups based on median household savings in 2011-2013: lower and higher savings. The results show a larger and more significant effect on retirement intentions for workers with lower savings, highlighting the role of precautionary saving motives in retirement intentions.

Additionally, precautionary saving motives would be stronger among workers facing higher LTC risks. Poor health can face higher risks of becoming disabled and needing LTC (Liu et al., 2023). Therefore, we explore the heterogeneous effect of LTCI on retirement intentions of urban workers with poor health and with good health in Panel B of Table 9. Poor health is defined as self-reporting health as poor or very poor in 2011-2013, while good health is defined as self-reporting health as fair or good in 2011-2013. We find the effects of LTCI on retirement intentions are negative, although insignificant, among workers with poor health. This also demonstrates the existing of the motive for precautionary savings.

[Insert Table 9 here]

6. Conclusion and discussion

Both developed and developing countries face the challenge of population aging, resulting in a heavy care burden and high demand for formal LTC. To address this problem, the Chinese government officially launched the pilot of public LTCI policy in 2016. Many studies have shown that the effect of LTCI on labor supply and retirement behavior. Few studies, however, focus on the effect of LTCI on retirement intentions

of urban workers and relevant mechanisms. Therefore, we address these questions by using DID and PSM-DID methods based on the variation in the timing of LTCI pilots across different cities to investigate the effect of LTCI on retirement intentions of urban workers.

Our study suggests that LTCI increases the intentions of urban workers to delay retirement, particularly the intentions to retire five years after reaching the statutory retirement age. Specifically, LTCI increases the probability of intentions to delay retirement by 7.7 (DID) and 8.8 (PSM-DID) percentage points and intended retirement age by 0.822 (DID) and 1.132 years (PSM-DID). Our findings contribute to related literature about LTCI and labor market. Moreover, pilots implementing LTCI with both service and cash benefits have a larger effect on workers' retirement intentions in comparison to those with only service benefit. We also find that LTCI has a larger effect on the retirement intentions of women, self-employed workers, and those workers' family members with LTCI eligibility because these sub-samples are more likely to be caregivers and caregivers' effect is larger than potential beneficiaries' effect.

In addition, we explore three potential mechanisms through which LTCI primarily influences the retirement intentions of urban workers. The first mechanism is intergenerational support, which shows that LTCI increases workers' delayed retirement intentions by reducing time support within the family, both provided informal care to others and received from their children. Second, we find that LTCI improves workers' mental health, which further contributes to their intentions to continue working. Finally, our subgroup analyses reveal that LTCI mitigates precautionary savings motives related to LTC, which may reduce workers' intentions to delay retirement and intended retirement age.

Blau & Goodstein (2010) and Feldstein (1974) pointed out that public insurance policies can motivate people to retire early due to the increase in lifetime income.

However, our empirical findings suggest that LTCI does not encourage early retirement[7], as pension insurance does. Instead, it increases individuals' intentions to continue working, which is a positive outcome. The reduction in time support and improved health caused by LTCI may obscure the induced retirement effect of reduced motives for precautionary savings. This suggests that we can actively promote LTCI to fully utilize the resources of the elderly and implement additional measures to accelerate the construction of LTCI, thereby increasing people’s intentions to delay retirement. Furthermore, more cities should include cash benefits in their LTCI policy to enhance its intervention effects. However, LTCI has no significant effect on actual retirement due to the reduced effect of caregivers, the increased effect of precautionary saving motives, and involuntary retirement. Future policies should focus on aligning intended and actual retirement and exploring flexible statutory retirement policies to reduce involuntary retirement.

[7] We examined the effect of LTCI on early retirement intentions using the similar DID and PSM-DID design. The estimated effect is not statistically significant, indicating that LTCI does not increase the intentions of early retirement and supporting our conclusion that LTCI promotes delayed retirement intention rather than inducing early retirement.

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Figures and Tables

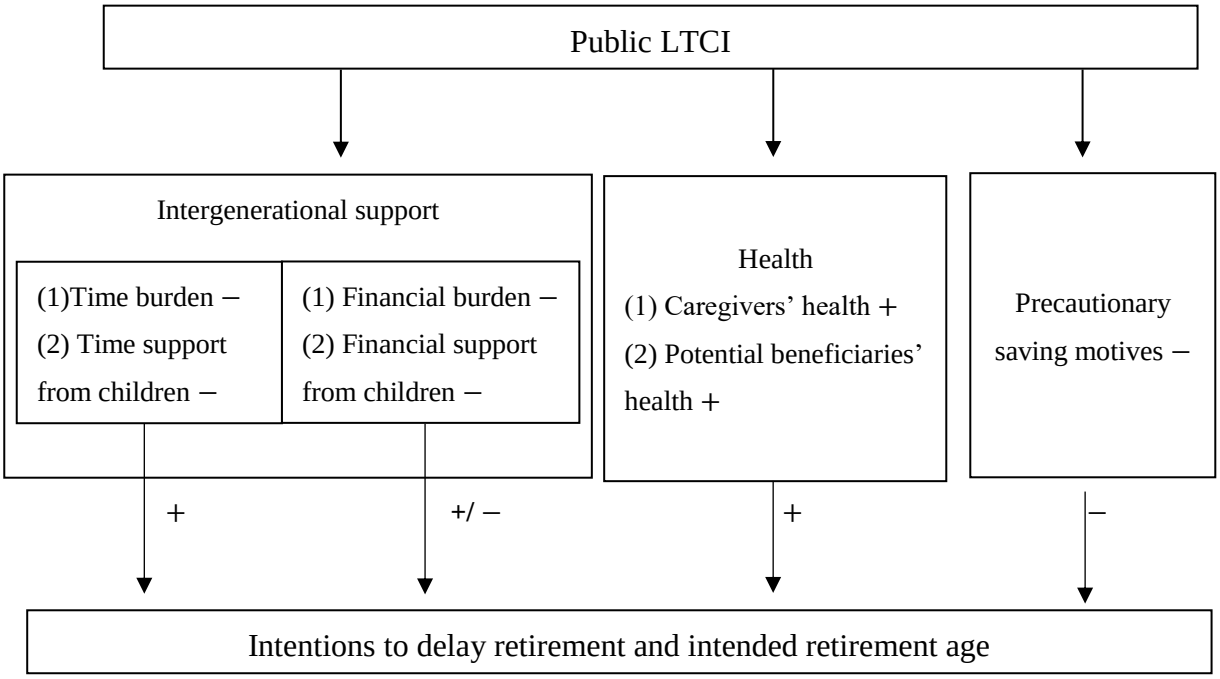
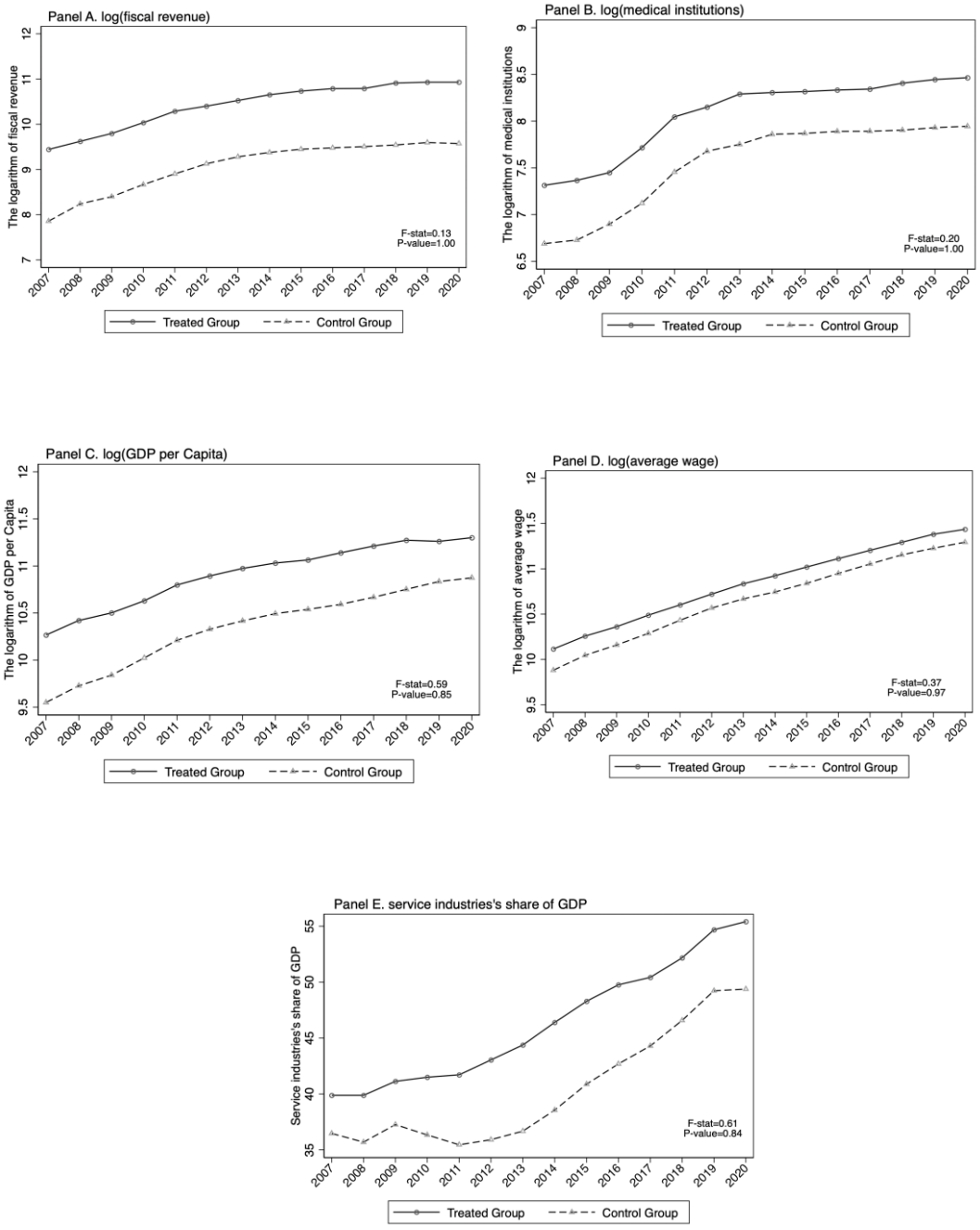
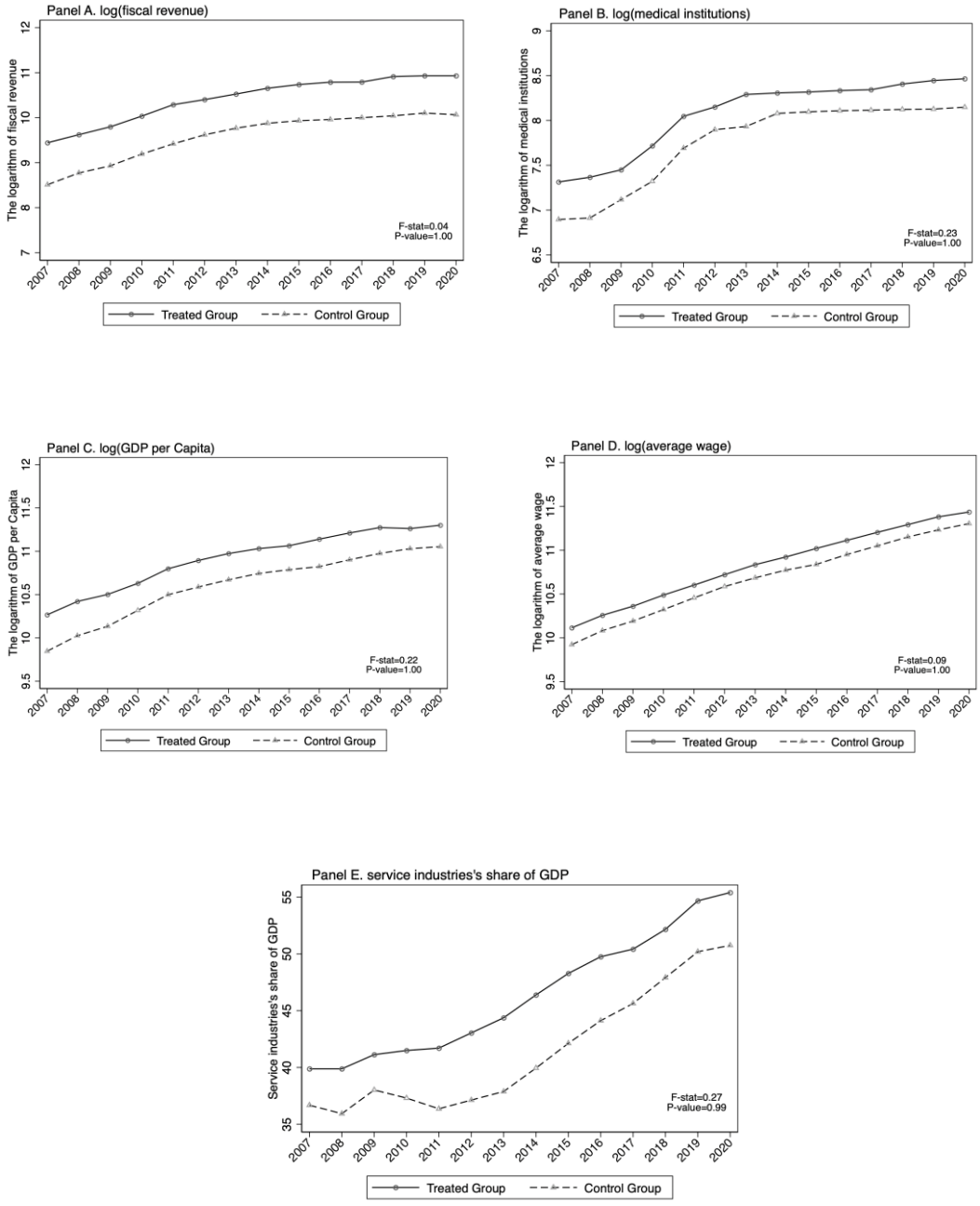


FIGURE 1 Conceptual framework. *Note*: The symbols associated with the mechanism variables represent the direction of the effect of LTCI on these variables. The symbols adjacent to the arrows denote the direction of the effect of the mechanism variables' changes on the outcome variables.

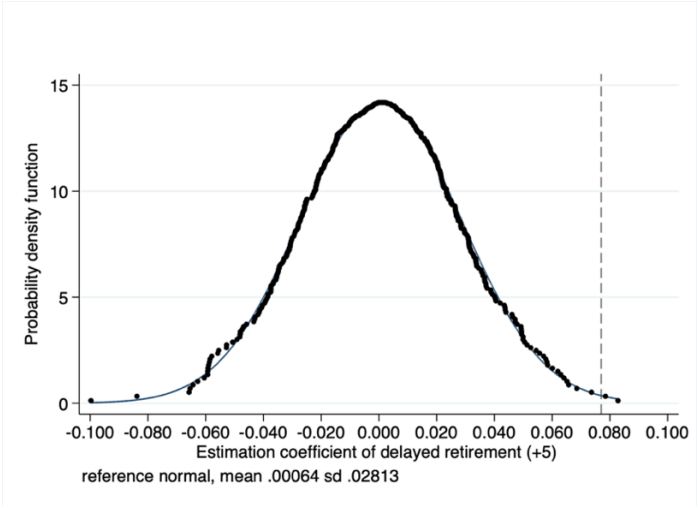

Panel A. log(fiscal revenue)
The logarithm of fiscal revenue
F-stat=0.13
P-value=1.00
Panel B. log(medical institutions)
The logarithm of medical institutions
F-stat=0.20
P-value=1.00
Panel C. log(GDP per Capita)
The logarithm of GDP per Capita
F-stat=0.59
P-value=0.85
Panel D. log(average wage)
The logarithm of average wage
F-stat=0.37
P-value=0.97
Panel E. service industries's share of GDP
Service industries's share of GDP
F-stat=0.61
P-value=0.84
Treated Group
Control Group

(a) All sample

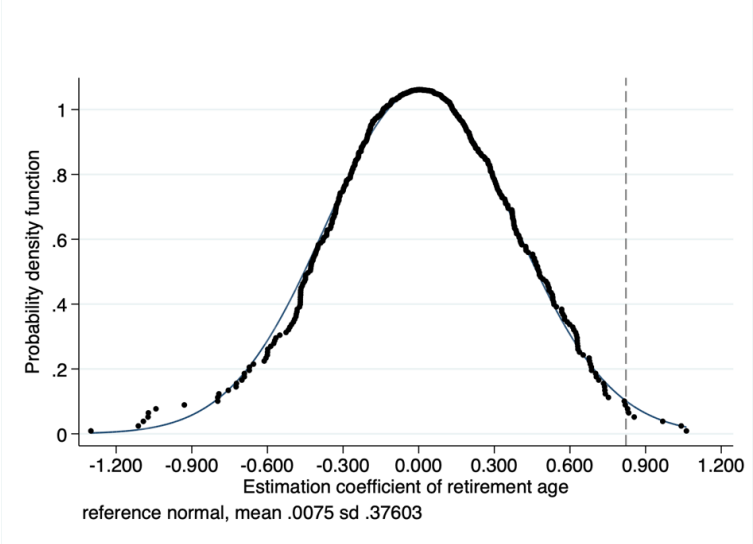


(b) Matching sample

FIGURE 2 City characteristics between treated and control cities. *Note*: This figure compares the average differences between treated and control cities on some key city characteristics, including local fiscal revenue, number of medical institutions, per capita GDP, service industries' share of GDP, and average wage from 2007 to 2020. The F-statistic and p-values are based on the null hypothesis of having parallel trends between treatment and control group (Huang & Zhang, 2021).



(a) Delayed retirement (+5)



(b) Retirement age

FIGIRE 3 Placebo test based on false treatment status. *Note*: The vertical dashed line represents the coefficient size of LTCI effect in the basic regression results. All control variables, year fixed effect and city fixed effect are added. Control variables included workers' gender, education level, age, registered residence, marital status, the number of living children, living parents and work type.

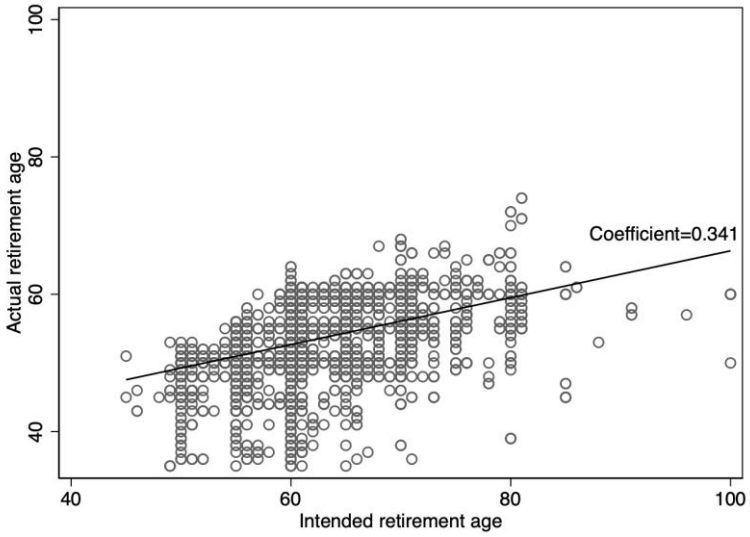


FIGURE 4 The correlation between actual retirement and intended retirement. *Note*: The data used is CHARLS 2011, 2013, 2015, 2018, and 2020. N=2,993. The X-axis represents the intended retirement age. The Y-axis represents the actual retirement age. The diagonal line represents the linear regression line between the actual retirement age and intended retirement age, with a slope coefficient of 0.341.

TABLE 1 Descriptive Statistics.

	Total sample	Control group	Treated group	Difference
Delay retirement (1=yes)	0.506	0.505	0.510	0.005
	[0.500]	[0.500]	[0.500]	(0.016)
Delay retirement (+5, 1=yes)	0.159	0.164	0.144	-0.020*
	[0.366]	[0.371]	[0.352]	(0.012)
Retirement age	59.872	59.885	59.837	-0.048
	[4.951]	[4.977]	[4.883]	(0.162)
Long-term care insurance (LTCI)	0.046	0.000	0.168	0.168***
	[0.210]	[0.000]	[0.374]	(0.006)
Gender (1=male)	0.700	0.688	0.732	0.043***
	[0.458]	[0.4623	[0.443]	(0.015)
Age	50.850	50.758	51.092	0.333***
	[3.924]	[3.916]	[3.937]	(0.128)
Under primary school (1=yes)	0.092	0.095	0.083	-0.012
	[0.288]	[0.293]	[0.276]	(0.009)
Primary school (1=yes)	0.290	0.292	0.285	-0.007
	[0.454]	[0.455]	[0.451]	(0.015)
Junior high school (1=yes)	0.265	0.252	0.300	0.049***
	[0.441]	[0.434]	[0.459]	(0.014)
High school (1=yes)	0.243	0.244	0.243	-0.001
	[0.429]	[0.429]	[0.429]	(0.014)
Bachelor above (1=yes)	0.110	0.118	0.089	-0.029**
	[0.313]	[0.323]	[0.285]	(0.014)
Married (1=yes)	0.909	0.904	0.924	0.020**
	[0.287]	[0.295]	[0.265]	(0.009)
Registered residence (1=rural)	0.418	0.407	0.448	0.041**
	[0.493]	[0.491]	[0.498]	(0.016)
Living children	1.653	1.719	1.476	-0.243***
	[0.854]	[0.883]	[0.745]	(0.028)
Living parents (1=yes)	0.622	0.624	0.614	-0.011
	[0.485]	[0.484]	[0.487]	(0.016)
Employment status (1=employed)	0.656	0.632	0.720	0.088***
	[0.475]	[0.482]	[0.449]	(0.015)
log (fiscal revenue, million yuan)	9.811	9.458	10.745	1.288***
	[1.179]	[1.016]	[1.064]	(0.034)
log (medical institution)	8.004	7.877	8.338	0.461***
	[0.699]	[0.667]	[0.668]	(0.022)
log (GDP per capita, yuan)	10.783	10.638	11.164	0.525***
	[0.550]	[0.514]	[0.450]	(0.016)
log (average wage, yuan)	10.966	10.919	11.089	0.170***
	[0.363]	[0.352]	[0.363]	(0.012)
Service industries' share of GDP	44.234	42.166	49.699	7.532***
	[10.443]	[9.673]	[10.437]	(0.323)
Observations	4,695	3,406	1,289	

Note: This table shows mean values and standard deviations of the key variables by workers' treatment status. The standard deviations are reported in brackets and the standard errors are reported in parentheses. The difference is the difference in mean value between treated group and control group. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 2 Effect of LTCI on the intended retirement decisions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Delayed retirement			Delayed retirement (+5)			Retirement age		
	OLS	DID	PSM-DID	OLS	DID	PSM-DID	OLS	DID	PSM-DID
LTCI	-0.044	0.035	0.065	-0.006	0.077***	0.088***	0.434	0.822**	1.132***
	(0.028)	(0.045)	(0.049)	(0.021)	(0.021)	(0.025)	(0.331)	(0.337)	(0.357)
Control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
City fixed effect	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Province × year fixed effect	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Mean of Y	0.506	0.506	0.496	0.159	0.159	0.143	59.872	59.872	59.688
Observations	4,695	4,695	3,328	4,695	4,695	3,328	4,695	4,695	3,328
R-squared	0.001	0.182	0.173	0.000	0.168	0.163	0.001	0.304	0.332

Note: Delayed retirement equals to 1 indicating that workers intend to retire after their statutory retirement age. Delayed retirement (+5) equals to 1 indicating that workers intend to retire 5 years or more after their statutory retirement age. OLS model does not add any control variables or fixed effects. DID and PSM-DID add control variables, city fixed effects, and the interaction of province and year fixed effects. Control variables include workers' gender, age, education level, age, marital status, registered residence, the number of living children, living parents, work type and some city characteristics. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 3 Different LTCI benefits' effect

	(1)	(2)	(3)	(4)	(5)	(6)
	Delayed retirement		Delayed retirement (+5)		Retirement age	
	DID	PSM-DID	DID	PSM-DID	DID	PSM-DID
LTCI with only service benefit	0.009	0.042	0.059***	0.071***	0.677	1.108**
	(0.063)	(0.068)	(0.022)	(0.024)	(0.429)	(0.437)
LTCI with service and cash benefits	0.086	0.109*	0.112***	0.121**	1.113***	1.179**
	(0.054)	(0.057)	(0.042)	(0.048)	(0.404)	(0.493)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Province × year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Y	0.506	0.496	0.159	0.143	59.872	59.688
Observations	4,695	3,328	4,695	3,328	4,695	3,328
R-squared	0.182	0.173	0.169	0.163	0.304	0.332

Note: LTCI is divided into two categories based on the benefit model: one type uses only the service benefit, while the other uses both service and cash benefits. We only report DID and PSM-DID results in this table. C All control variables, city fixed effects, the interaction of province and year fixed effects are controlled. Control variables are the same with basic regression. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 4 Heterogeneous analysis.

	Delayed retirement		Delayed retirement (+5)		Retirement age	
	Panel A: Workers' gender					
	Male	Female	Male	Female	Male	Female
LTCI	0.047	0.051	0.037	0.174***	0.328	2.487***
	(0.051)	(0.075)	(0.029)	(0.0361)	(0.383)	(0.706)
Mean of Y	0.423	0.700	0.099	0.299	61.028	57.171
Observations	3,286	1,399	3,286	1,399	3,286	1,399
R-squared	0.147	0.256	0.127	0.218	0.168	0.407
	Panel B: Workers' type					
	Employed	Self-employed	Employed	Self-employed	Employed	Self-employed
LTCI	0.031	0.043	0.055*	0.082**	0.552	1.380***
	(0.060)	(0.070)	(0.032)	(0.040)	(0.436)	(0.650)
Mean of Y	0.456	0.601	0.119	0.235	59.358	60.854
Observations	3,079	1,603	3,079	1,603	3,079	1,603
R-squared	0.170	0.277	0.195	0.219	0.403	0.288
	Panel C: LTCI's eligibility					
	Workers with LTCI	Family members with LTCI	Workers with LTCI	Family members with LTCI	Workers with LTCI	Family members with LTCI
LTCI	0.052	0.079	0.072**	0.124**	0.082	1.373***
	(0.073)	(0.057)	(0.030)	(0.053)	(0.642)	(0.413)
Mean of Y	0.495	0.532	0.148	0.185	59.571	60.610
Observations	3,335	1,360	3,335	1,360	3,335	1,360
R-squared	0.189	0.301	0.184	0.278	0.344	0.351

Note: Panel A runs separate regressions for the subsamples of male and female workers. Panel B runs separate regressions for the subsamples of self-employed and employed workers. Panel C runs separate regressions for the subsamples of workers with LTCI eligibility and their family members with LTCI eligibility. Control variables, city fixed effects, the interaction of province and year fixed effects are controlled. Control variables are the same with basic regression. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 5 Robustness check.

	Delayed retirement	Delayed retirement (+5)	Retirement age	Delayed retirement	Delayed retirement (+5)	Retirement age
	Panel A. Oher PSM-DID methods					
	Match by year			Match based on individual and city		
LTCI	0.064	0.077***	0.979**	0.058	0.091***	0.971**
	(0.026)	(0.028)	(0.428)	(0.052)	(0.028)	(0.433)
Observations	3,319	3,319	3,319	3,032	3,032	3,032
R-squared	0.165	0.161	0.320	0.179	0.177	0.325
	Panel B. Another regression method					
	Alternative robust estimators			Heckman two-stage model		
LTCI	0.042	0.078***	0.884***	0.043	0.079***	0.755**
	(0.046)	(0.022)	(0.325)	(0.046)	(0.021)	(0.349)
Inverse Mills ratio				2.572	0.596	-21.650
				(2.088)	(1.557)	(20.397)
Observations	4,695	4,695	4,695	4,695	4,695	4,695
R-squared	0.182	0.162	0.304	0.182	0.168	0.304
	Panel C: Deleting Shandong and Jilin			Panel D: Including linear trend		
LTCI	0.069	0.081***	1.097***	0.045	0.073***	0.709*
	(0.052)	(0.024)	(0.348)	(0.052)	(0.027)	(0.380)
Observations	4,165	4,165	4,165	4,695	4,695	4,695
R-squared	0.182	0.171	0.303	0.180	0.169	0.309
	Panel E. Alternative definition for female blue-collar and white-collar					
	Set all females at 50 years old			Set all females at 55 years old		
LTCI	0.048	0.047*	0.805**	0.041	0.069***	0.710**
	(0.047)	(0.027)	(0.397)	(0.046)	(0.018)	(0.316)
Observations	4,303	4,303	4,303	5,004	5,004	5,004
R-squared	0.222	0.276	0.332	0.167	0.152	0.307

Note: Matching by year refers to conducting a year-by-year match based on city-level variables. Matching based on both individual and city means conducting a year-by-year match based on both individual and city-level variables. The sample for the first stage of Heckman two-stage model includes both workers and non-working residents. The exclusion variable in the first stage is the average employment rate in the community where individual resides. Sample reduction in Panel A results from excluding unmatched samples, and in Panel C results from deleting samples from two provinces. The sample changes in Panel E are due to the modification of the statutory retirement age, which alters the sample range. Event studies of estimators robust to heterogeneous treatment effects based on the method of Sun & Abraham (2021) for three outcome variables are shown in Figure A2. Control variables, city fixed effects, the interaction of province and year fixed effects are controlled. Control variables are the same with basic regression. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 6 The effect of LTCI on actual retirement.

	Panel A: Effect on actual retirement age				Panel B: Effect on intended retirement age among different age groups			
	All sample		Sample in this study		DID		PSM-DID	
	DID	PSM-DID	DID	PSM-DID	Younger	Older	Younger	Older
LTCI	-0.003	0.067	0.235	0.655	0.769*	-0.138	1.429***	-0.332
	(0.027)	(0.224)	(0.876)	(0.910)	(0.453)	(0.572)	(0.476)	(0.683)
Observations	9,077	7,231	1,586	1,219	2,626	2,059	1,854	1,462
R-squared	0.414	0.420	0.728	0.731	0.314	0.267	0.355	0.281
	Panel C: Effect on actual retirement age among different health groups				Panel D: Effect of involuntary retirement on CESD and well-being			
	DID		PSM-DID		Difference=0		|Difference|<=2	
	Good	Poor	Good	Poor	CESD score	Well-being	CESD score	Well-being
LTCI / Involuntary retirement	0.186	-1.262*	0.321	-1.961**	0.235	-0.117**	0.183	-0.064*
	(0.262)	(0.642)	(0.237)	(0.829)	(0.351)	(0.057)	(0.232)	(0.038)
Mean of X (%)					91.71	91.71	76.58	76.58
Observations	7,567	1,493	6,041	1,173	2,776	2,787	2,776	2,787
R-squared	0.435	0.454	0.445	0.447	0.163	0.227	0.163	0.226

Note: All sample refers to retired samples in CHARLS with actual retirement age. The sample in this study refers to the retired sample that can match with the sample used in the basic study. The age groups are based on the age of males and females, with younger referring to males aged 45-52 and females aged 45-49, and older referring to males aged 53-59 and females aged 50-54. The health groups are based on the health status in 2011-2013. Good health refers to workers reporting their health fair or good; poor health refers to workers reporting their health fair or good. Missing health data in 2011-2013 were imputed using the corresponding year's data. We only report PSM results in Panel D and PSM-DID results are also similar. Control variables, city fixed effects, the interaction of province and year fixed effects are controlled. Control variables are the same with basic regression. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 7 Mechanism: intergenerational support.

	Panel A. Time support					
	Informal care to parents	Informal care to all	Contact with parents	Contact with children	Live with children	Live near children
LTCI	0.032	-0.087*	0.064	-0.030	-0.160***	-0.142***
	(0.093)	(0.046)	(0.060)	(0.025)	(0.042)	(0.042)
Observations	1,415	3,633	2,750	4,069	4,156	3,656
R-squared	0.196	0.266	0.165	0.111	0.206	0.255
	Panel B: Financial support					
	Transfer from children		Transfer to parents		Total transfer payments	
	Probability	Log (Net received)	Probability	Log (Net given)	Log (received)	Log (Net received)
LTCI	0.018	-0.042	-0.076*	-0.468	0.542	0.057
	(0.05))	(0.501)	(0.041)	(0.349)	(0.509)	(0.195)
Observations	4,519	4,513	2,684	2,674	3,365	3,295
R-squared	0.282	0.148	0.191	0.236	0.249	0.273

Note: Due to the lack of interaction information with parents in 2020, all variables related to parents only used data from 2011 to 2018. The amount-related variables all take natural logarithms. The amount of transfer payments received from children equals the transfer payment from children - transfer payment to children; the amount of transfer payments to parents equals the transfer payment to parents - transfer payment from parents; the amount of total transfer payments received equals the transfers from children + transfers from parents + transfers from others; the amount of net transfer payments received equals the transfers from all people - transfers to all people. Control variables, city fixed effects, the interaction of province and year fixed effects are controlled. Control variables are the same with basic regression. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 8 Mechanism: subjective health assessment.

	Self-reported Health	CESD score	Well-being	Feeling depressed	Feeling hopeful for the future
LTCI	0.176	-0.715**	0.114	-0.192	0.028
	(0.165)	(0.332)	(0.212)	(0.137)	(0.213)
Control Variables	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes
Province × year fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	4,393	4,299	4,274	4,300	4,262
R-squared/Pseudo R-squared	0.085	0.207	0.097	0.062	0.048

Note: A 5-item scale is used to assess self-reported health. The Center for Epidemiological Survey, Depression Scale, or CESD score, is a 10-item summary of depression. A 5-item scale is used to assess self-reported well-being, feeling depressed and feeling hopeful for the future. The deeper the degree, the larger the corresponding values of all scales. Categorical variables using ordered-logit model to perform regression analysis. Control variables, city fixed effects, the interaction of province and year fixed effects are controlled. Control variables are the same with the basic regression. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE 9 Mechanism: precautionary saving motives

	Delayed retirement		Delayed retirement (+5)		Retirement age	
	Panel A: Household savings in 2011-2013					
	Lower	Higher	Lower	Higher	Lower	Higher
LTCI	0.065	0.024	0.129**	0.051	1.278**	0.730
	(0.075)	(0.052)	(0.050)	(0.041)	(0.607)	(0.638)
Observations	2,181	2,503	2,181	2,503	2,181	2,503
R-squared	0.221	0.224	0.199	0.209	0.334	0.338
	Panel B: Health status in 2011-2013					
	Good	Poor	Good	Poor	Good	Poor
LTCI	0.061	-0.187	0.117***	-0.146	1.174***	-1.379
	(0.045)	(0.213)	(0.026)	(0.140)	(0.376)	(1.890)
Observations	3,994	416	3,994	416	3,994	416
R-squared	0.188	0.396	0.180	0.396	0.319	0.452

Note: In panel A, we classified the workers into two subsamples based on median household savings in 2011-2013: lower savings and higher savings. In panel B, we classified the workers into two subsamples based on their self-reported health. Good health refers to workers reporting their health fair or good in 2011-2013; poor health refers to workers reporting their health fair or good in 2011-2013. Missing health data in 2011-2013 were imputed using the corresponding year's data. Control variables, city fixed effects, the interaction of province and year fixed effects are controlled. Control variables are the same with basic regression. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

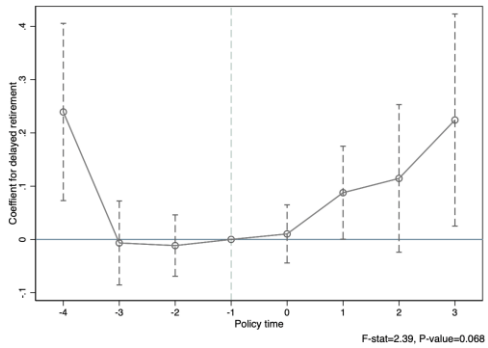
Appendix: China's retirement policy

In the urban sector in China, workers face statutory retirement and receive pension benefits at these ages. Official documents of China in 1978 set the statutory retirement age and pension age to 60 for males, 55 for white-collar employees (civil servants, managers in party and government organizations, mass organizations, enterprises and institutions, and so on) and 50 for blue-collar employees. This retirement policy continues to be in effect, despite China's statutory retirement age being significantly lower than that of other countries. However, the retirement ages for individual laborers, including self-employed workers and freelancers, were not specified initially. In 2001, the Chinese government clarified that self-employed individuals and other workers in urban informal sectors could apply for retirement and receive a basic pension at 60 for men and 55 for women.

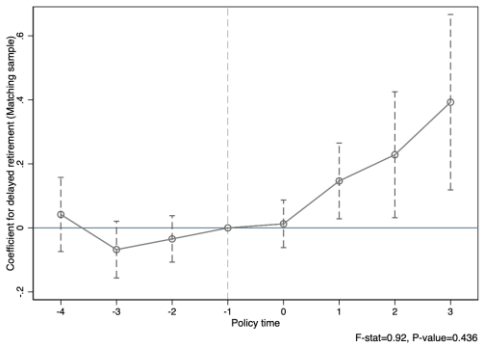
In the formal sector, including public institutions, administrative institutions, and enterprises, China's legal retirement age limits are strictly enforced. Conversely, the informal sector, encompassing self-employed individuals, unpaid workers, and informal workers, does not have an established statutory retirement age in the strict sense. However, pension eligibility ages significantly influence retirement behavior among self-employed workers in the informal sector by providing financial incentives.

Upon reaching statutory retirement age, individuals must undergo the retirement process, cease formal employment, and start receiving pension benefits. They only can stay in labor market informally and work chances also decrease significantly. For self-employed workers, reaching the statutory retirement age means they can apply for retirement and become eligible for pension benefits. Consequently, most people adhere to the retirement-age policy and retire at the statutory retirement age. However, some people also choose not to comply with the retirement policy. They may be re-appointed by the same workplace on a contractual basis or seek new employment opportunities, either in the private sector or through self-employment.

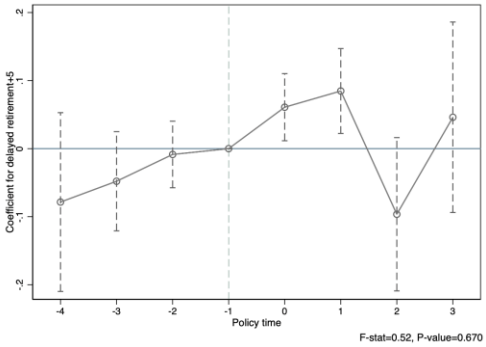
Appendix Figures and Tables



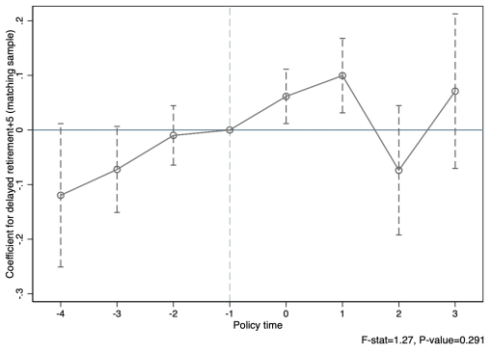
(a) Delayed retirement (all sample)



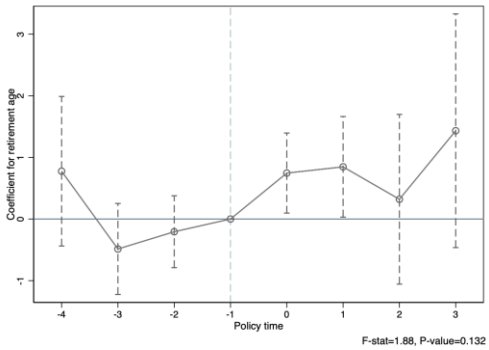
(b) Delayed retirement (matching sample)



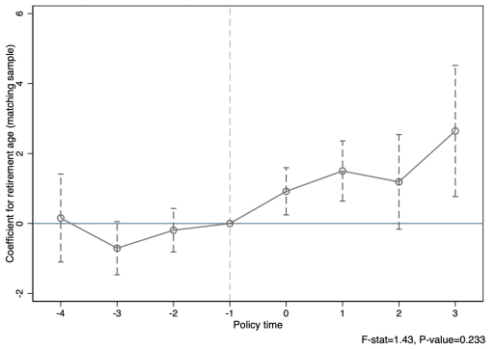
(c) Delayed retirement (+5) (all sample)



(d) Delayed retirement (+5) (matching sample)

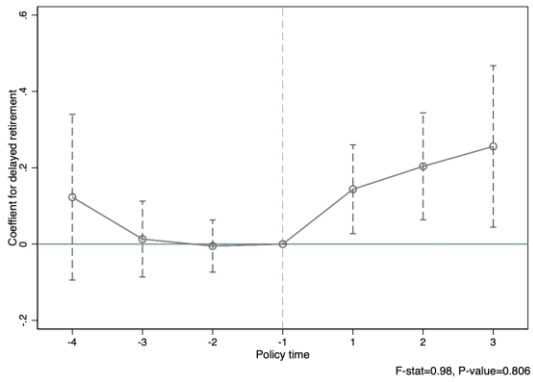


(e) Retirement age (all sample)

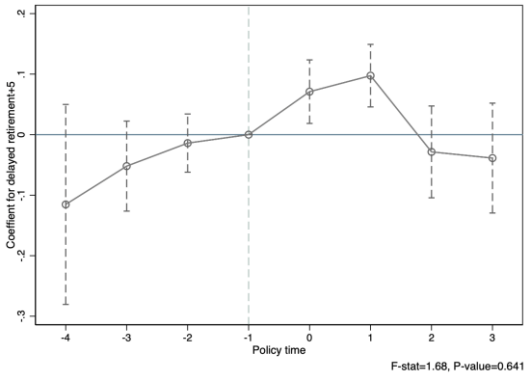


(f) Retirement age (matching sample)

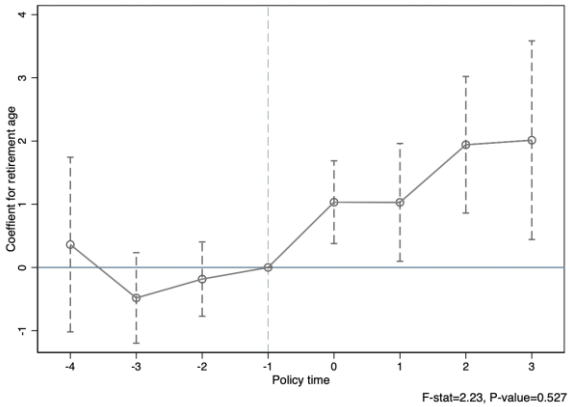
FIGURE A1 Event study. *Note*: X-axis represents a specific period in comparison to the benchmark period. LTCI was implemented in period 0. Covariates include all control variables and fixed effects. Standard errors are clustered at the city level. All sample refers to the non-matched sample and has 4,695 observations. Matching sample refers to the sample after matching and has 3,328 observations. The dashed lines represent 90% confidence intervals.



(a) Delayed retirement



(b) Delayed retirement (+5)



(c) Retirement age

FIGURE A2 Event study based on Sun & Abraham (2021). *Note*: The X-axis represents a specific period in comparison to the benchmark period. The LTCI was implemented in period 0. Covariates include all control variables and fixed effects. Standard errors are clustered at the city level. These Figure (a)-(c) depicts the effect trend of Delayed retirement, Delayed retirement (+5) and Retirement age in all sample, respectively. The dashed lines represent 90% confidence intervals.

TABLE A1 Summary of pilot cities in this study.

City	Implementation year	Coverage	Benefit type
Qindao, Shandong	2012	UEBMI and URRBMI	Service
Weifang, Shandong	2015	UEBMI	Service
Jilin, Jilin	2016	UEBMI and URRBMI	Service
Jinan, Shandong	2016	UEBMI	Service
Jingmen, Hubei	2016	UEBMI and URRBMI	Service
Shangrao, Jiangxi	2016	UEBMI	Service and cash
Chengdu, Sichuan	2017	UEBMI	Service and cash
Chongqing	2017	UEBMI	Service
Guangzhou, Guangdong	2017	UEBMI	Service
Hangzhou, Zhejiang	2017	UEBMI and URRBMI	Service
Jiaxing, Zhejiang	2017	UEBMI and URRBMI	Service
Liaocheng, Shandong	2017	UEBMI	Service
Linfen, Shanxi	2017	UEBMI and URRBMI	Service
Linyi, Shandong	2017	UEBMI	Service
Ningbo, Zhejiang	2017	UEBMI	Service
Qiqihar, Heilongjiang	2017	UEBMI	Service
Shanghai	2017	UEBMI and URRBMI	Service
Suzhou, Jiangsu	2017	UEBMI and URRBMI	Service
Xuzhou, Jiangsu	2017	UEBMI and URRBMI	Service and cash
Beijing	2018	UEBMI and URRBMI	Service and cash
Dezhou, Shandong	2018	UEBMI	Service and cash
Changsha, Hunan	2018	UEBMI	Service
Taizhou, Zhejiang	2018	UEBMI and URRBMI	Service
Weihai, Shandong	2018	UEBMI	Service
Yangzhou, Jiangsu	2018	UEBMI	Service and cash
Zaozhuang, Shandong	2018	UEBMI	Service
Shijiazhuang, Hebei	2019	UEBMI and URRBMI	Service and cash
Taizhou, Jiangsu	2019	UEBMI and URRBMI	Service

Notes: The determination of the implement year is based on policy documents. UEBMI is the Urban Employees Basic Medical Insurance (targets urban employee), refers to insured people of UEBMI. URRBMI is the Urban and Rural Residents Basic Medical Insurance (targets others excluded by UEBMI), refers to insured people of URRBMI.

TABLE A2 The correlation between missing of dependent variable, attrition and LTCI coverage.

	(1)	(2)	(3)	(4)
	Retirement age missing		Attrition	
	All	Matching	All	Matching
LTCI coverage	0.015	0.018	-0.002	0.001
	(0.012)	(0.013)	(0.026)	(0.026)
Control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Province fixed effect	Yes	Yes	Yes	Yes
Observations	9,507	6,827	4,695	3,328
R-squared	0.177	0.172	0.095	0.100

Note: Retirement age missing equals to 1, indicating someone's intended retirement age is missing. Attrition equals to 1, indicating there exists sample attrition in other years. Control variables, year fixed effects and province fixed effects are controlled. Control variables are the same with main regression. Standard errors are clustered at city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.

TABLE A3 Balance test results after matching.

		Mean			%reduct	t-test	
		Treatment	Control	%bias	|bias|	t value	p value
log (fiscal revenue, million yuan)	Unmatched	10.288	9.903	127.3		5.99	0.000
	Matched	10.288	10.017	24.9	80.4	0.95	0.346
log (medical institution)	Unmatched	8.046	7.455	73		3.25	0.002
	Matched	8.046	7.767	34.4	52.9	1.49	0.142
log (GDP per capita)	Unmatched	10.799	10.210	111.1		4.85	0.000
	Matched	10.799	10.765	6.4	94.2	0.27	0.786
log (average wage, yuan)	Unmatched	10.602	10.432	75.2		3.79	0.000
	Matched	10.602	10.536	29.3	61.1	1.04	0.305
Service industries' share of GDP	Unmatched	41.710	35.464	68.3		3.34	0.001
	Matched	41.710	39.548	23.6	65.4	0.87	0.386

Note: We use the city characteristics used in the basic regression analysis to perform six nearest-neighbors matching, including the logarithm of fiscal revenue, the number of medical institutions, per capita GDP, average wages, and the service industries' share of GDP.

TABLE A4 More robustness checks.

	Panel A: Use education to classify female blue-collar and white-collar			Panel B: Alternative definition to Delayed retirement (+5)		
				Male at 65, female at 60	Male and female at 65	
LTCI	0.030	0.068***	0.819**	0.077***	0.060**	
	(0.043)	(0.021)	(0.338)	(0.020)	(0.025)	
Observations	4,680	4,680	4,680	4,695	4,695	
R-squared	0.186	0.174	0.311	0.158	0.126	
	Panel C. Eliminating the effect other overlap policy			Panel D. Alternative fixed effect		
LTCI	0.041	0.073***	0.834**	0.006	0.056*	0.790**
	(0.051)	(0.023)	(0.367)	(0.059)	(0.028)	(0.388)
Observations	4,345	4,345	4,345	3,035	3,035	3,035
R-squared	0.184	0.17	0.292	0.661	0.637	0.708
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
City/Individual fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Province × year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Note: We classified workers with a high school education or below as female blue-collar and those with a college education or above, as well as self-employed female workers, as female white-collar (Ai et al., 2024) in Panel A. We redefined Delayed Retirement (+5) in Panel B based on previously proposed delayed retirement schemes, including 60 for both white-collar and blue-collar female workers and 65 for male workers, or having both male and female workers at 65. Panel C delete Shandong province because of delayed retirement policy was implemented in Shandong province in 2020. In Panel C, we replaced city fixed effect to individual fixed effect. Standard errors are clustered at the city level. ***, **, and * denote the significance at the 1%, 5%, and 10% level, respectively.