How Does Long-term Care Insurance Policy Affect Entrepreneurship? Evidence from China

Abstract

This paper examines the relationship between Long-Term Care Insurance (LTCI) policies and entrepreneurship in China. Using a staggered difference-in-difference model, we find a significant 5.6% increase in local business registrations following the implementation of LTCI. The findings show that LTCI policies contribute to an increased labor supply, reduced labor costs, and subsequently, lower entry barries for potential entrepreneurs. The heterogeneity tests demonstrates that cities with a larger aging population, strongerConfucian culture influence, or those located in urban agglomeration regions, experience a more substantial increase in entrepreneurship post-LTCI implementation. Lastly, the study highlights a notable increase in female entrepreneurship following LTCI implementation, underlining the policy's gender-specific impact. Taken together, our paper sheds light on the contribution of LTCI to the sustainable development of local economies and societies, extending beyond healthcare outcomes.

Keywords: Long-term care insurance, entrepreneurship, labor participation

1. Introduction

The global population is aging at an unprecedented rate, creating significant socio-economic challenges for countries worldwide.[1] This demographic shift has underscored the urgent need for long-term care solutions. While caring for the elderly is both an obligation for children and a continuation of traditional values, it also imposes a significant burden on families. Long-term care insurance (LTCI) emerges as a crucial policy mechanism to address this challenge, alleviating pressure on medical resources and reducing family care responsibilities.

Despite the considerable attention LTCI has received in recent years, existing research has predominantly focused on its impact within the healthcare sector. Studies have extensively explored how LTCI improves access to healthcare services, mitigates the financial burden of care, and influences the quality of life for beneficiaries. However, there remains a gap regarding the broader socioeconomic impact of LTCI, particularly its effects on local economies. Understanding these economic implications is critical, as the success of LTCI policies should not be measured solely by their healthcare outcomes but also by their contribution to the sustainable development of local economies and societies.

In this study, we shed light on this issue by examining the relationship between LTCI policies and entrepreneurship. This exploration is crucial not only for researchers but also for policymakers, as entrepreneurship plays a vital role in employment, innovation, and economic growth (Decker, Haltiwanger, Jarmin, and Miranda, 2014). On the one hand, as the aging population intensifies, there is a growing number of young caregivers who face the dual pressures of employment and caregiving responsibilities (Toossi and Torpey 2017). Many surveys indicate that a significant number of individuals experience disruptions in their work due to the demands of caregiving responsibilities, with some even having to resign from their jobs (AARP and National Alliance for Caregiving, 2020; Harrington and McInturff, 2021; Lerner, 2022; Maestas et al., 2024). On the other hand, the employment interruptions of caregivers also result in significant economic losses for their employers. When caregivers can no longer balance work and caregiving responsibilities, employers face the costs of losing valuable, experienced workers and the expenses associated with hiring new employees. Therefore, the availability of LTCI has the potential to alleviate the burden on families and thus

[1] According to the World Health Organization, in 2020, the number of people aged 60 years and older outnumbered children younger than 5 years. Between 2015 and 2050, the proportion of the global population aged 60 and older is expected to nearly double, increasing from 12% to 22%.

free up labor resources, which are crucial drivers of active entrepreneurship.

We focus on the Chinese market for the following two reasons: First, China is experiencing an unprecedented pace and scale of aging. According to data released by the National Bureau of Statistics of China, by the end of 2023, the population aged 65 and above in China reached 216.76 million, accounting for 15.4% of the total population. In terms of quantity, China currently has the largest elderly population in the world. In terms of proportion, China has officially entered a moderately aged society. At the current rate of aging, it is projected that China will enter a super-aged society with a proportion exceeding 20% around 2030. This not only significantly increases the demand for public services such as healthcare, elderly care, and social security but also leads to a decrease in labor supply and an increase in production costs. Second, to address the challenges posed by aging, China officially launched staggered LTCI pilots in 15 cities in 2016, expanding to 49 cities in 2020. In addition, some regions have independently initiated pilot programs for long-term care insurance policies. These cities are located in various parts of China, including both coastal and inland cities with different levels of economic development. This provides an ideal quasi-natural experimental setting for our research. Specifically, by employing a staggered difference-in-difference (DiD) model, we provide cleaner evidence on the causal relationship between LTCI policy and entrepreneurship.

To comprehensively depict the entrepreneurial landscape of the city, we utilize new firm registration data sourced from the State Administration for Industry and Commerce of China. This data set spans all records of new firm registrations dating back to 1985, totaling more than 280 million registrations. Our baseline DiD regression model indicates a positive causal effect of the LTCI policy on entrepreneurial activity. This result is not only statistically significant but also economically meaningful. On average, cities experience a 5.6% increase in local business registration after the LTCI implementation compared to those without. We conduct a series of tests to facilitate the causal interpretation of the results. First, we assess the validity of the parallel trend assumption underlying our DID estimation. Second, we conduct a placebo test showing that spurious time trends do not drive our results by randomizing treatment cities. Third, we conduct propensity score matching to find comparable control cities and rerun the DID analyses. Our results are generally robust to these alternative research designs.

Next, we turn to analyze the underlying economic mechanisms that lead to the LTCI implementation positively impacting local entrepreneurship. We propose that the LTCI policy increases the supply of the labor force, reduces labor costs, and, therefore, lowers the entry costs for potential entrepreneurs. We use the number of employees in the total population of a

city to proxy labor supply and the average wage in a city to measure labor cost. We indeed find that cities with LTCI policies experience increasing labor supply and declining labor cost. Further, when examining the policy's impact on local entrepreneurship by sectors, we find that the effect is more pronounced in manufacturing firms and labor-intensive firms compared to firms in capital-intensive or technology-intensive industries. We also observe that the effect is stronger in non-high-tech industries than in high-tech industries. This evidence not only demonstrates that the impact of LTCI policies varies across different industries, but also confirms that this variation is closely linked to the degree of labor dependency in each industry, reinforcing the analysis of the underlying economic mechanisms.

To explore the heterogeneity of the effect of LTCI policy on local entrepreneurship, we examine it from the perspectives of population aging, Confucian culture, and urban agglomerations. First, we show that cities with a larger fraction of the aging population experience a greater increase in entrepreneurship after the policy's implementation. As the degree of population aging increases in a region, so does the magnitude of long-term care pressure it faces. Hence, it is not surprising that the LTCI policies have a stronger impact oonn entrepreneurial activities in regions with a greater aging population. Moreover, we find that the positive impact of the long-term care insurance policy on local entrepreneurship is not limited to the silver economy (businesses that cater to the needs of the aging population). It also stimulates business formation across other sectors of the economy.

Second, we show the LTCI policy has a greater impact on entrepreneurship in cities with higher levels of Confucian culture. Confucian culture places a strong emphasis on filial piety, where individuals are expected to take care of elderly family members. This cultural obligation often leads to a significant caregiving burden, especially for potential entrepreneurs, who may be less inclined to start businesses due to family responsibilities. The introduction of long-term care insurance helps alleviate this pressure, allowing individuals to focus more on their careers and business ventures.

Third, we find that the positive relationship between LTCI policy and entrepreneurship is stronger in urban agglomeration areas than in non-urban agglomeration areas. City clusters typically have better access to financial, human, and technological resources. Entrepreneurs in these areas can leverage these resources more efficiently when long-term care insurance policies reduce financial uncertainties associated with caregiving for the elderly. This support allows individuals more flexibility to pursue entrepreneurial activities.

Finally, we focus on the policy's impact on local female entrepreneurship. Women are traditionally more likely to assume caregiving responsibilities for elderly family members.

Long-term care insurance helps alleviate some of this caregiving burden by providing financial support for professional care, allowing women more freedom to pursue entrepreneurial activities. Our analysis reveals that long-term care insurance (LTCI) policies significantly enhance the entrepreneurial spirit of female entrepreneurs in self-employment. However, these policies do not appear to have a significant impact on women becoming private business owners. We argue that self-employment, characterized by individual businesses, generally requires lower initial capital and operational resources compared to establishing a private enterprise. Women, who may have limited access to financial resources due to structural and societal barriers, might find self-employment a more viable option. LTCI policies can indirectly support this by freeing up time and mental energy, which women can then channel into self-employment. In contrast, becoming a private business owner entails greater financial risks, higher capital investment, and often requires a more substantial time commitment compared to self-employment. Even with the implementation of LTCI policies, women may continue to face significant challenges in accessing capital, navigating regulatory environments, and managing the more demanding aspects of running a private enterprise. Thus, LTCI policies alone may not sufficiently address the broader, more complex barriers that women encounter in becoming private business owners.

Our paper mainly contributes to two strands of literature. First, we build on the literature on the factors that determine entry into entrepreneurship (Kerr, Nanda, and Rhodes-Kropf, 2014) and the government's role in promoting entrepreneurship (Bayar, Chemmanur, and Liu, 2019; Hall and Lerner, 2010; Howell, 2022; Lerner, 2020). Previous literature has been focusing mostly on how financial constraints might discourage entrepreneurship (Hurst and Lursardi, 2004; Kerr and Nanda, 2009; Adelino, Schoar, and Severino, 2015; Schmalz, Sraer, and Thesmar, 2017). Less attention is paid to the non-financial factors, including social insurance programs, that can limit or spur entry into entrepreneurship.Hombert, Schoar, Sraer, and Thesmar (2020) shows that providing unemployment insurance to unemployed workers increased firm entry. Gottlieb, Townsend, and Xu (2022), who show that job-protected maternity leave increases entrepreneurship using a Canadian reform. By examining the impact of long-term care insurance provision on entrepreneurship and the underlying economic mechanisms through labor market cost, we shed light on a previously underexplored aspect of non-financial barriers to entrepreneurship.

Second, we speak to the literature analyzing the effects of long-term care insurance on the economy (Brown and Finkelstein, 2011). Existing literature focuses mostly on studying the supply and demand for LTCI (Mellor, 2011; Brown et al., 2012; Mommaerts, Forthcoming),

but little research has shown its impact on entrepreneurship. Other papers have examined the effects of the provision of employer-based healthcare insurance on entrepreneurship and the "entrepreneurship lock" (DeCicca, 2010; Fairlie et al., 2011; Lee and Winters, 2022). However, no research has focused on how insurance could free up labor forces that also bear the responsibility of family care. Our paper advances the existing body of literature by providing empirical evidence on the broader economic impact of LTCI. Specifically, we demonstrate that the availability of LTCI can alleviate family caregiving responsibilities, freeing up labor, and in turn stimulating entrepreneurial activity. Our findings suggest that LTCI not only has the potential to enhance individual well-being but also serves as a catalyst for local economic growth by fostering greater entry into entrepreneurship.

Finally, Our paper also contributes to the broader literature on women's careers and firms. Prior studies highlight gender disparities across various sectors and occupations and how providing non-wage benefits to employees could affect women's career outcome (Lagaras, Marchica, Simintzi, and Tsoutsoura, 2022; Sapienza, Zingales, and Maestripieri, 2009; Tate and Yang, 2015; Simintzi, Xu, and Xu, 2024; Cong, Liu, Yang, and Zhang, 2022). This gender gap is especially striking among entrepreneurs and scholars have been examining factors that discourage potential female entrepreneurs(Hebert, 2023; Zandberg, 2021; Core, 2024; Morazzoni and Sy, 2022). We contribute to this line of literature by showing that providing non-wage programs that support family care could have a stronger effect on potential female entrepreneurs, who often bear a disproportionate share of caregiving duties.

2. Institutional Background

Since the 1960s, many developed countries, confronted with an aging population, initiated the establishment of the Long-Term Care Insurance (LTCI) systems to alleviate the burden of elderly care and the accompanying financial pressures. LTCI primarily involves pooling funds through mutual assistance to provide services or financial support for the basic living care and closely related medical assistance of long-term disabled individuals. The system aims to safeguard elderly individuals who face difficulties in performing daily activities or even lose their ability to self-care. It is an essential public service system for societies entering an era characterized by aging, elderly, and super-elderly demographics. Countries such as the Netherlands, Germany, Japan, and the United States, tailored to their respective economic and social conditions, have developed relatively uniform and standardized LTCI systems. These nations have demonstrated the positive impact of LTCI systems in addressing long-term care

issues within the elderly population. In contrast, China's development of the LTCI system started later and is currently in the pilot phase.

In recent years, China's elderly population has continued to grow, with the trend of population aging accelerating, and the proportion of the population with disabilities among older people is on the rise. According to a report presented by the State Council in August 2022, China has over 190 million older people suffering from chronic diseases, and around 40 million are either partially or fully disabled. Simultaneously, with the ongoing urbanization process, the phenomenon of smaller family sizes, lower birth rates, and empty-nest elderly individuals in urban areas is becoming more pronounced, making the long-term care of disabled individuals a pressing social issue. In the current backdrop of an imperfect elderly care and medical security system, the phrase "one person disabled, the whole family imbalanced" resonates with many Chinese households. The 2010 national census data reveals that the disabled and partially disabled population in China has exceeded 40 million, making it imperative to address the challenges of an aging population promptly. Therefore, the gradual aging of the population, changing family structures, and factors related to individual modernity have collectively contributed to the emergence of caregiving for disabled, elderly individuals as a societal issue. In response to this, the Long-Term Care Insurance (LTCI) system has been introduced.

Since the "13th Five-Year Plan" period, China has prioritized the establishment of an independent LTCI policy, laying the foundation for the construction of related policies. Given the sharply rising demand for elderly care, it is crucial to explore and establish an LTCI system suitable for China's economic and social conditions. This is not only an essential requirement for meeting the long-term care service needs of the aging population and enhancing their quality of life but also a vital approach to improving the entire social service security system.

In March 2016, the Central Committee of the Communist Party of China and the State Council proposed in the "13th Five-Year Plan for National Economic and Social Development" to improve the national medical security system, explore the establishment of an LTCI system, and initiate LTCI trials. In June of the same year, the Ministry of Human Resources and Social Security issued the "Guiding Opinions on Carrying Out Pilot Programs for Long-Term Care Insurance Systems," marking the official implementation of the LTCI system in China. The "opinion" stated that LTCI trials would be launched in 15 cities, including Chengde City in Hebei Province, Changchun City in Jilin Province, Qiqihar City in Heilongjiang Province, and others.

In September 2020, the National Healthcare Security Administration and the Ministry of

Finance issued the "Guiding Opinions on Expanding Pilot Programs for Long-Term Care Insurance Systems," proposing to expand the trial scope, with the list of cities conducting LTCI trials increasing to 49. In addition, some regions have learned from the advanced experiences and practices of the national pilot cities, actively promoting LTCI system trials in their localities. In September 2021, the General Office of the State Council issued the "Notice on the '14th Five-Year Plan' for National Medical Security," once again emphasizing the need to adapt to the level of economic and social development and the trend of aging, build the policy framework for the LTCI system, and coordinate the construction of the LTC service system.

The pilot programs of the long-term care insurance system have growed rapidly, with the total number of service institutions in pilot areas reaching 7,600, four times the original number, and the number of care personnel increasing from over 30,000 to 330,000. By the end of 2022, the number of participants in LTCI reached 169 million, with a cumulative 1.95 million people enjoying benefits. The total fund expenditure reached 62.4 billion yuan, with an annual per capita expenditure of 14,000 yuan. Taking the pilot city of Shangrao in Jiangxi Province as an example, for LTCI beneficiaries, an annual contribution of only 50 yuan allows them to receive a monthly cash subsidy of 450 yuan and a 300-yuan home care service package, effectively reducing the financial burden on families.[2]

Figures 1-3 illustrate the implementation of the LTCI system in China during the sample period. From the perspective of trial practices, China's LTCI system was implemented relatively late, with imbalances in the regions covered by the system and limited policy coverage. The system is still in its early stages. However, to date, trial efforts have achieved phased results, and the number of counties covered by policy implementation has steadily increased. Considering the current population aging situation, economic development level, and the demand for care services, China can further advance the implementation of the LTCI system. Encouraging local areas to strengthen the establishment and improvement of the care service system based on their actual conditions will maximize the benefits of the LTCI system.

[Insert Figure 1-3 about here]

[2] In 2023, the per capita disposable income of urban residents in Shangrao City is 47,001 yuan. This means that the subsidies received by local residents through LTCI account for 19.14% of their income.

3. Data and Summary Statistics

3.1 Sample Selection

Our data set mainly consists of three parts: LTCI policy implementation information, business registration information data, and city-level characteristics. The LTCI policy information is obtained from the official website of the Chinese government. It includes 406 counties in 57 cities, and the sample period is from 2012-2021[3]. Following the existing literature (Kong and Qin, 2021; Shi et al.,2021; Tian and Xu, 2022), the business registration information data is obtained from the State Administration for Industry and Commerce (SAIC) of China, which contains individual businesses (*i.e.,* Sole proprietorship;个体工商户) and private enterprises (私营企业). The data set provides information on each firm's address, registered date, entrepreneur's gender, and industry attributes. The city-level characteristics are obtained from the China City Statistical Yearbook. After matching the LTCI policy implementation data, business registration information data, and other data, we get the final matched sample consisting of 51,290 enterprise type-county-year observations. To alleviate the concern that our results could be driven by outliers, we winsorize all variables at the 1st and 99th percentiles.

3.2 Variable Construction

3.2.1 Measuring Entrepreneurship

The outcome variable is entrepreneurship (*ES*), measured as the ratio of the number of newly registered enterprises to the total number of surviving enterprises in the previous year. We multiply this number by 100 to facilitate the interpretation of the results.

3.2.2 Measuring LTCI Policy

The key explanatory variable is a dummy variable representing the LTCI policy. If the LTCI policy is in place in a county in a year, the variable takes the value of one; otherwise, it equals zero. Given that the LTCI policy may not have an immediate impact, if county *i* implemented LTCI policy in the first half of year *t*, the LTCI variable is set to one after year *t*; if county *i* implemented LTCI policy in the second half of year *t*, the LTCI variable is set to one after year *t+1*.

[3] The research period begins in 2010, two years prior to the introduction of China's Long-Term Care Insurance (LTCI) policy in 2012, and concludes in 2021, the most recent year for which macroeconomic data are available.

3.2.3 Control Variables

Following the existing literature (Boudreaux et al., 2021; Tian and Xu, 2022), we control for a vector of city characteristics that could affect the implementation of LTCI policy and entrepreneurship, including the growth rate of the GDP per capita at the city level (*GDPGrowth)*; local fiscal spending (*Fiscal*), measured as the proportion of fiscal expenditure in GDP at the city level; the proportion of second industry (*SecInd*), measured as the proportion of GDP attributable to the secondary industry at the city level; medical service level (*MedSev*), measured as the proportion of the number of doctors in the population at the city level; population density (*PD*), measured as the proportion of population in land area of the administrative region at the city level; enterprise type (*Type*) is a dummy variable, if enterprise is a private enterprise, the value of *Type* is 1, and if the enterprise is an individual business, the value of *Type* is 0. Appendix 1 provides detailed definition of the variables used in our tests.

3.3 Summary Statistics

Table 1 reports summary statistics of variables in the paper.
The mean and median values of the local entrepreneurship measure (ES) are 22.373 and 21.009, respectively, which are higher than the corresponding GDP growth rates during the same period (with a mean of 0.094 and a median of 0.089).The standard deviation of ES is 10.141,showing that entrepreneurial activities vary significantly across regions in China. The mean of *LTCI* is 0.043, indicating that 4.3% of the county-year observations in the sample have implemented the LTCI policy.

[Insert Table 1 about here]

4. Empirical Setting and Main Results: LTCI Policy and Local Entrepreneurship

In this section, we examine how social security policies affect entrepreneurship by analyzing the staggered implementation of the LTCI policy across cities in China.

4.1 Empirical Setting

Using the implementation of the LTCI policy in China as a quasi-experiment shock, we implement a staggered difference-in-difference (DID) model to identify the relationship between LTCI policy and entrepreneurship. The DID estimation equation was specified as follows:

$$ES_{i,t+1} = \alpha + \beta LTCI_{i,t} + \gamma Control_{i,t} + \sum FE + \varepsilon_{i,t} \quad (1)$$

where *i* indexes county, *t* indexes year. The definitions of LTCI policy (*LTCI*) and entrepreneurship (*ES*) are discussed in details in the previous sections. Control variables include a vector of city characteristics that could affect the implementation of LTCI policy and entrepreneurship following the existing literature. In all regressions, to exclude the interference of other possible confounding factors, we include county and year fixed effects and cluster standard errors at the county-year level.

The coefficient estimate on *LTCI* in Equation (1) is the DID estimator measuring the effect of the implementation of LTCI policy on entrepreneurship. If implementing the LTCI policy promotes entrepreneurship, we should observe a positive and significant coefficient estimate on LTCI. Note that we only include *LTCI* but not the treatment dummy variable and time dummy variable in the regressions because fixed effects absorb the two dummy variables.

4.2 Baseline Results

Table 2 Panel A reports the estimation results of how the LTCI policy affects entrepreneurship. The key independent variable of interest in this paper is *LTCI*. In Column (1), we only include fixed effects, and the result shows that the coefficient estimate on *LTCI* is positive and statistically significant at a 5% significance level. In Column (2), we further control for a vector of city characteristics. The positive and statistically significant coefficient estimates on *LTCI* also suggest that LTCI policy has positively influenced local entrepreneurship. The economic magnitude of the effect is sizable: Counties experience a 5.6% (1.255/22.373×100%=5.6%) increase in local entrepreneurship after the implementation of the LTCI policy, compared to counties that never have an LTCI policy in place.

The coefficient estimates on other control variables are generally in line with our expectations. The coefficient on *GDPGrowth* is positive and statistically significant, which implies that local economic growth is positively associated with entrepreneurship. By contrast, local fiscal spending (*Fiscal)* is negatively correlated with entrepreneurship, which could be due to the fact that regions with less financial expenditure are also those with a lower level of economic development and firm dynamics. The estimated coefficients of *MedSev* are positive and significant at the 10 percent level, which may be due to more entrepreneurial opportunities in regions with faster economic development and better medical service levels, which are important factors in cultivating an entrepreneurial spirit.

[Insert Table 2 about here]

When analyzing the impact of LTCI policy on local entrepreneurship, it is crucial to

distinguish between individual businesses and private enterprises. Individual businesses (e.g., self-employed, sole proprietorships) are typically smaller and more flexible in decision-making, while private enterprises are larger, with more complex structures involving multiple shareholders or investors. These differences suggest that LTCI policy may affect them differently, shaping their responses to economic incentives, market demand, or labor costs. This distinction enables a more nuanced analysis of the policy's impact, offering clearer insights into how different types of entrepreneurs adapt to policy changes.

We further divide the sample by types of companies and conduct a heterogeneity test. Regression results are reported in the Panel B of Table 2. We find that the LTCI policy had a positive effect on the creation of both types of firms. Compared to private enterprises, the LTCI policy has a stronger positive impact on local entrepreneurship in individual businesses (*i.e.,* sole proprietorships) , which are economically more important. After the implementation of the LTCI policy, local entrepreneurship among individual businesses increased by 6.28% (1.406/22.373 × 100% = 6.28%), while local entrepreneurship among private enterprises increased by 4.93% (1.104/22.373 × 100% = 4.93%).

[Insert Table 3 about here]

4.2 Additional Tests

This section reports an extensive set of robustness checks we undertake to strengthen our baseline findings.

4.2.1 Parallel Trend Assumption

The DID model requires the parallel trend assumption that absent the shock, the control group, non-LTCI counties, and the treatment group, LTCI counties, should have the same trend in local entrepreneurship. Even though the parallel trend is not testable, we provide supportive evidence that the assumption holds in our context. Specifically, we estimate the following equation:

$$ES_{i,t+1} = \alpha + \beta_1 pre3_{i,t} + \beta_2 pre2_{i,t} + \beta_3 pre1_{i,t} + \beta_4 current_{i,t} + \beta_5 post1_{i,t} + \beta_6 post2_{i,t} + \beta_7 post3_{i,t} + \gamma Control_{i,t} + \sum FE + \varepsilon_{i,t} \quad (2)$$

where *pre3* denotes years prior or equal to three years before the LTCI policy implementation; *pre1* and *pre2* denote the years one or two years prior to the LTCI policy implementation; *current* is the year when county *i* implements the LTCI policy; *post1* and *post2*

denotes one or two years after the LTCI policy implementation; *post3* denotes three years and more after implementation. To avoid multicollinearity problems, we drop the dummy variable, *pre1*, in the regressions. The rest of the variable definitions and model settings are consistent with equation (1).

Panel A of Table 3 reports the estimation result of the parallel trend test. In addition, we plot all coefficient estimates of β in Figure 4. The solid line shows the estimated coefficient, which depicts the marginal effect of LTCI policy on entrepreneurship. The vertical lines denote the 90% confidence intervals of β estimates. One can observe that prior to the implementation of the LTCI policy, all estimated coefficients' 90% confidence intervals cover zero, suggesting that there is no significant difference in the trend in local entrepreneurship between the treated counties and control counties. After the implementation of the LTCI policy, confidence intervals are above zero and there appears to be an upward trend,, suggesting that the marginal effect of LTCI policy on entrepreneurship gradually increases over time. The figure provide suggestive evidence that the parallel trend assumption holds in our context.

[Insert Table 3 about here]

[Insert Figure 4 about here]

4.2.2 Alternative Measures for Entrepreneurship

We also use alternative definitions of local entrepreneurship and rerun the tests. Specifically we use the ratio of the number of newly registered enterprises to the administrative land area (*ES1*) and the raw number of newly registered enterprises (*ES2*) to re-measure entrepreneurship. Panel B of Table 3 reports the estimation results, which indicate that the coefficients of the key independent variables are still positively significant, confirming that the LTCI policy has played a crucial role in promoting entrepreneurship.

4.2.3 Alternative Measures for Independent Variable

To enhance the credibility of the baseline results in Table 2, we test the robustness of our findings against additional LTCI policy variables. First, if the county *i* implemented LTCI policy in year *t*, the value of *LTCI1* in year (t) and all subsequent year is 1; otherwise, it is 0. Second, if the county *i* implemented LTCI policy in year *t*, the value of *LTCI2* in year (t+1) and all subsequent year is 1; otherwise, it is 0. The regression results according to the benchmark regression model and method after using alternative measures for *LTCI* are shown in Panel D

of Table 3, where the estimated coefficients of the LTCI1 and LTCI2 are still significantly positive. The results indicate that the positive relationship between the LTCI policy and entrepreneurship remains robust when alternative measures for independent variables are employed.

4.2.5 Alternative Sample

To avoid the effects of obvious regional differences in the political and economic aspects of different grade cities, we exclude the sample of municipalities directly under the central government and municipalities under separate planning. The estimation result is reported in Panel D of Table 3. Overall, we continue to observe positive and significant coefficient estimates of LTCI policy.

4.2.6 Alternative Cluster-Robust Standard Errors

When selecting cluster-robust standard errors, this study employed double clustering at both the individual and time levels in the baseline regression. Furthermore, to ensure the robustness of the results, separate clustering adjustments are made at the individual and time levels. The estimation result is reported in Panel E of Table 3. The results indicate that after using alternative cluster-robust standard errors, the positive promotional relationship between the implementation of long-term care insurance policies and entrepreneurial spirit remains significant.

4.2.7 Heterogeneous Treatment Effects

Given that heterogeneity in treatment effects might introduce potential biases in estimating the two-way fixed effects model, this study employs a more robust estimator proposed by Sun and Abraham (2021) to calculate group-time average treatment effects. The outcomes are illustrated in Figure 5. The estimation outcomes confirm that local entrepreneurial acitivites indeed surge after the implementation of LTCI policies.

[Insert Figure 5 about here]

4.2.8 DID Approach with Propensity Score Matching

While the staggered DID approach provides support that the implementation of the LTCI policy has a positive effect on entrepreneurship, there still exist concerns that the treated counties may not be comparable to control counties in some dimensions. In other words, the results could be driven by the differences in these counties' local conditions rather than the implementation of

LTCI policy.

To eliminate the possibility that our results are driven by differences in other characteristics between treatment and control counties, we match counties in the treatment and control groups using the propensity score matching algorithm. However, PSM is appropriate for cross-sectional data, whereas the DID framework necessitates panel data. Most existing studies address this issue by treating the panel data as cross-sectional data and matching directly, which leads to another concern of time mismatch. Performing a phase-by-phase matching on each cross-section of panel data can solve the problem of time mismatch, but the control group is unstable. Due to the reasons above, we just take PSM-DID as robustness tests and conduct both cross-sectional and phase-by-phase matching.

To be specific, we use the control variables in equation (1) as matching variables, and we screen the samples using the propensity score matching (PSM) method. We employ the radius matching method, with a radius set at 0.01. Then, we construct the dataset in the two ways described below: (i) We treat panel data directly as cross-sectional data for propensity score matching (PSM) analysis; (ii) We conduct period-specific matching on each cross-section of panel data, followed by vertical integration of the matching results for each period. Third, we test the two sets of matching data for balance and analyze the matching effect.[4] Fourth, we re-estimate the impact of the implementation of the LTCI policy on entrepreneurship.

The regression results of the PSM-DID model are presented in Panel F of Table 3. In Column (1), the result from employing the propensity score matching (PSM) method with cross-sectional matching reveals a positive and statistically significant coefficient for the key independent variable at the 5% significance level. In Column (2), the result from employing the propensity score matching (PSM) method with phase-by-phase matching unveils a positive and statistically significant coefficient for the key independent variable at the 10% significance level. The regression results all show that, after fully considering the sample selection bias, LTCI policy still significantly improves entrepreneurship.

[Insert Panel F of Table 3 about here]

4.2.9 Placebo Test

To validate whether spurious time trends drive our regression results, we undertake a placebo test. Specifically, we randomly assign fictitious treatment groups and fictitious event times while maintaining the same distribution of the actual treatment group and event times.

4 See appendix 3 for balance test charts and analysis of matching effects.

Following the standard practice in the literature, we repeat the randomization process 1,000 times. Figure 6 plots the distributions of the coefficient estimates using a sample of randomized treatment and event times. The figure shows that the vast majority of coefficient estimates using pseudo treatment and event times are insignificant, demonstrating that spurious time trends are unlikely to have driven our results.

[Insert Figure 6 about here]

Overall, the results of the robustness tests confirm our key finding that there is a positive relationship between the implementation of the LTCI policy and entrepreneurship.

5. Mechanism Tests

Thus far, we have demonstrated the positive impact of the LTCI policy on entrepreneurship. We now delve into the underlying mechanisms through which the LTCI policy fosters entrepreneurial activity.

5.1 LTCI, Labor Supply, and Labor Costs

One hypothesis posits that the LTCI policy may stimulate entrepreneurship by bolstering the labor force supply, lowering labor costs, and, consequently, both increasing the number of entrepreneurs directly and lowering the cost of opening a new business, hence promoting local entrepreneurship indirectly. The mechanism regression model is as follows:

$$LaborNum(LaborCost)_{i,t+1} = \alpha + \beta LTCI_{i,t} + \beta Control_{i,t} + \sum FE + \varepsilon_{i,t} \quad (3)$$

where *i* indexes city, *t* indexes year. We use the proportion of the number of employees in the total population at the city level as a proxy variable for the quantity of labor force (*LaborNum*). Additionally, we use the average wage of employees in each region to measure the cost of labor (*LaborCost*). For data processing, we divide the average wage by the region's 2010 employee wage to better capture regional wage variations. The setting of control variables and fixed effects is consistent with that in equation (1).

Panel A of Table 4 presents the impact of the LTCI policy on both the quantity and cost of the labor force. When the quantity of the labor force (*LaborNum*) is considered as the outcome variable, the LTCI policy exhibits a significantly positive association with *LaborNum*, suggesting that its implementation fosters an increase in labor supply. Conversely, when the cost of the labor force (*LaborCost*) is taken as the outcome variable, the LTCI policy shows a significantly negative correlation with *LaborCost*, indicating that its implementation reduces labor costs. In essence, the LTCI policy can robustly support the enhancement of

entrepreneurial endeavors by augmenting labor supply and diminishing labor costs.

[Insert Table 4 about here]

5.2 Further Mechanism Tests

In light of the LTCI policy's potential to augment labor numbers and decrease labor costs, we proceed to conduct further testing on the aforementioned mechanisms.

First, we divide the manufacturing sample into labor-intensive, capital-intensive, and technology-intensive samples. According to national statistical standards and considering the relative intensity of labor, capital, and technology in the manufacturing sector, this study classifies industries into three primary types: labor-intensive, capital-intensive, and technology-intensive, utilizing the "Industrial Classification of National Economy" (GB/T 4754-2017). Labor-intensive industries primarily rely on a large workforce for production, with comparatively lower dependence on technology and equipment. Capital-intensive industries have a higher proportion of capital costs in unit product costs, requiring a greater amount of fixed and working capital per laborer. Technology-intensive industries lie between labor-intensive and capital-intensive sectors, characterized by a higher capital intensity per unit of labor compared to labor-intensive industries but lower than capital-intensive industries. Appendix 5 provides detailed definition of the labor-intensive samples, capital-intensive industries and technology-intensive samples.

Panel B of Table 4 reports the regression results. The findings indicate that the implementation of long-term care insurance policies significantly fosters entrepreneurial activities in both labor-intensive and capital-intensive enterprises, with the largest magnitude observed in labor-intensive firms. The results offer additional validation of the economic mechanism proposed earlier. From the perspective of labor force quantity, the implementation of long-term care insurance policies is poised to augment the supply within the labor market. Specifically, for labor-intensive enterprises, such policies may incentivize greater labor force participation, thus providing these enterprises with a more extensive pool of labor resources. Regardinglabor cost, the implementation of long-term care insurance policies is expected to decrease labor expenses, thereby reducing firms' expenditure in hiring labor. This reduction in labor costs enables labor-intensive enterprises to employ more workers at reduced expenses, thereby enhancing production capacity and fostering entrepreneurship. Similarly, for capital-intensive enterprises, the decrease in labor costs translates to lower production expenses, thereby lowering the entry costs and ultimately nurturing entrepreneurial spirit. Therefore, in comparison to technology-intensive enterprises, the implementation of long-term care

insurance policies is more effective in significantly fostering entrepreneurial spirit within both labor-intensive and capital-intensive enterprises by means of augmenting labor force quantity and reducing labor costs.

Second, we divide the sample into high-tech enterprises and Non-high-tech enterprises. Specifically, high-tech industries refer to sectors of the national economy characterized by a relatively high intensity of R&D investment. According to national statistical standards, we categorize the sample into high-tech enterprises and non-high-tech enterprises based on the "Industrial Classification of National Economy" (GB/T 4754-2017). Appendix 5 provides detailed definition of the high-tech enterprise samples and Non-high-tech enterprise samples.

Panel C of Table 4 reports the regression results. We observe that the effect of the LTCI policy on local entrepreneurial activities are stronger in the non-high-tech firms, compared to high-tech firms, despite that the estimates in both sectors are statistically significant. This conclusion again provides supporting evidence for the labor channel that the implementation of LTCI policy plays a pivotal role in increasing labor market supply and reducing labor costs, hence, promoting local entrepreneurship. The results is particularly strong for non-high-tech enterprises since labor expenses typically constitute a substantial portion of their production costs. By alleviating these costs, enterprises can engage additional labor at a lower financial burden, thus bolstering production capacity and entrepreneurial activities. In contrast, high-tech enterprises often prioritize technological and capital inputs over human resources, thereby the policy has smaller impact of labor costs on their creation.

6. Cross-Sectional Heterogeneity

In this section, we conduct cross-sectional heterogeneity tests that make use of variations in several characteristics of the region to shed light on our main findings. To be specific, we examine the effect of LTCI policy on entrepreneurship with population aging, Confucian culture, and city clustering.

6.1 The Moderating Effect of Population Aging

Population aging leads to an increase in the proportion of elderly individuals, directly resulting in a rising demand for long-term care services. As the elderly population grows, the implementation of long-term care insurance policies becomes increasingly critical. In regions with higher levels of aging, the need for long-term care insurance is more urgent and evident,

particularly concerning its impact on the local economic environment, social welfare systems, and healthcare resources. Consequently, we expect that the implementation of long-term care insurance can effectively alleviate the pressure on long-term care in aging regions, thereby encouraging greater participation in entrepreneurial activities.

There is significant regional variation in the degree of population aging across China. According to data from the 2020 Seventh National Population Census, the proportion of individuals aged 65 and above is as high as 17.4% in Liaoning Province, compared to just 8.6% in Guangdong Province. This provides an opportunity for examining the proposed ideas. Specifically, to examine the moderating effect of the aging population, we calculate two measures at the province level: the percentage of the elderly population (*Age1*), measured as the percentage of the population aged 65 and over in the total population at the province level and the percentage of the elderly population dependency (*Age2*), measured as the percentage of the population aged 65 and over in the population aged between 15 and 64 at the province level. We use the average value from 2009 to 2011, which is the period before the LTCI policy's implementation, to define the population aging variable. We also include the interaction term of LTCI policy (LTCI) and the continuous variable for the level of population aging of the province (*Age1*, *Age2*). Panel A of Table 5 reports the regression results. The results show that the positive relation between LTCI policy and entrepreneurship is stronger in regions with a higher population aging.

[Insert Table 5 about here]

Given the moderating effect of population aging, some might ask whether LTCI only promoted the startup of new businesses that meet the needs of elderly people. To answer this question, we divided the sample into the silver economy sample and the non-silver economy sample. This process followed the standards of the "Elderly Care Industry Statistical Classification (2020) " published by the National Bureau of Statistics. We first identified the elderly care industry and its corresponding national economic industry classification codes and names, based on the 2017 classification system. Since the industry codes provided in the "Elderly Care Industry Statistical Classification (2020)" are four-digit codes, and the data we used only contain two-digit industry codes, we adopted an indirect method to determine the classification of the elderly care industry. Specifically, we inferred the corresponding two-digit industry classification based on the four-digit industry codes. On this basis, we further defined the silver economy industry: if a two-digit industry classification includes at least one elderly care industry, we classified it as a silver economy industry; conversely, if the classification does not include any elderly care industry, it is defined as a non-silver economy industry.

Panel B of Table 5 reports the regression results. The results show that the implementation of the long-term care insurance policy has had a significant positive impact not only in the silver economy sector, promoting entrepreneurship among related enterprises, but also extending this positive effect to the non-silver economy sector, thereby encouraging entrepreneurship there as well. This cross-sector positive impact indicates that the implementation of the long-term care insurance policy has stimulated market vitality and boosted enterprises' confidence in the elderly care services market by providing necessary support and security. This has not only created development opportunities for enterprises related to the silver economy but also opened new growth points for enterprises in the non-silver economy sector, promoting diversification and balanced development of the entire economic system.

6.2 The Moderating Effect of Confucian Culture

In China, influenced by traditional Confucian culture, the concept of "raising children for old age" is deeply ingrained. Family-based eldercare has been the traditional mode of elderly support, with the majority of disabled elderly individuals relying on family members, particularly children, for informal care at home. However, with the sustained increase in the number of disabled elderly individuals, the demand for caregiving and assistance among the elderly has continuously risen. Nevertheless, the absence of traditional social insurance nursing services has resulted in a significant burden of elderly care falling upon most families. The long-term care insurance policy, as a product challenging traditional Confucian cultural norms regarding familial responsibilities, can mitigate the caregiving burden on the elderly population by providing subsidies for formal caregiving and employing various other measures. This facilitates the transition from informal family caregiving to formal societal caregiving, consequently enhancing individuals' motivation to engage in entrepreneurial activities. Based on this rationale, this study anticipates that the implementation of the long-term care insurance policy will have a more pronounced effect on fostering entrepreneurial spirit in regions with a stronger presence of Confucian culture.

Referring to the previous research (Du, 2015; Gu et al.,2023), we define a city as a high-Confucian-culture city if the number of *Jinshi* during the Ming and Qing Dynasties, Confucian temples, Confucian academies, county schools and prefectural schools at the city level is equal or greater than the median of all cities, and define it as a low Confucian culture city otherwise. In the empirical specification, a dummy variable (*Confucian1*, *Confucian2*, *Confucian3*, *Confucian4*) is used to represent the Confucian culture level and is equal to one for the high

Confucian culture city and zero for the low Confucian culture city. Similarly, we include the interaction term of LTCI policy (*LTCI*) and the dummy variable for the level of Confucian culture of the city *(Confucian1*, *Confucian2*, *Confucian3*, *Confucian4*). Panel C of Table 5 reports the regression results. We argue that compared to cities with lower levels of Confucian culture, the LTCI policy has a greater impact on entrepreneurship in cities with higher levels of Confucian culture.

6.3 The Moderating Effect of Urban Agglomeration

In comparison to non-urban agglomeration areas, urban agglomerations exhibit a higher level of economic development and offer relatively more entrepreneurial opportunities. In such an environment, entrepreneurs tend to pursue autonomous entrepreneurship. Therefore, this study anticipates that in urban agglomeration areas, the implementation of long-term care insurance policies will significantly foster entrepreneurial spirit. This is attributed to the richer resources and broader markets available in urban agglomerations, where entrepreneurs are more likely to receive greater support and opportunities.

In the empirical specification, we define a dummy variable, *CityGroup*, which equals one if the city belongs to an urban agglomeration and 0 otherwise.[5] We include an interaction term of LTCI policy and *CityGroup*. The result is presented in Panel D of Table 5, and the estimated coefficient of the interaction term is significantly positive at the 1% level. The result shows that the positive relationship between LTCI policy and entrepreneurship is stronger in urban agglomeration areas than in non-urban agglomeration areas.

7 The effect of LTCI on Female Entrepreneurship

The analysis in the preceding sections has confirmed that LTCI policy has significantly promoted entrepreneurship and has validated the robustness of this conclusion. Next, we will explore it from the perspective of female entrepreneurship.

In China, the profound influence of traditional Confucian culture has entrenched the notion of filial piety and the familial responsibility of caring for older people, resulting in households shouldering the informal caregiving burden for older people over an extended period. At the same time, influenced by the traditional ideology of "men as breadwinners and women as homemakers," female family members have long borne the primary responsibility for caregiving, inevitably sacrificing their opportunities and benefits in labor market

5 See appendix 4 for the list of urban agglomeration.

participation. However, with the implementation of long-term care insurance policies, women are gradually liberated from their traditional family caregiving responsibilities, gaining greater autonomy and opportunities. They possess the capability to engage in more entrepreneurial activities, which not only fosters the flourishing of female entrepreneurial spirit but also contributes to the transformation of traditional gender role divisions.

[Insert Table 6 about here]

We measure female entrepreneurship using the ratio of the number of newly registered enterprises by women to the number of newly registered enterprises by men (*ES_female1*) and the ratio of the number of newly registered enterprises by women to the number of newly registered firms (*ES_female2*). To enhance the readability of the results, we multiplied these measure by. The larger the *ES_female1* and *ES_female2* values, the more active the female entrepreneurial spirit in the region. Then, we divided the samples into individual businesses and private enterprises for subsample regression. Table 6 reports the regression results. The results show that compared to private firms, the positive relation between LTCI policy and female entrepreneurship is stronger in individual businesses. The explanation is that individual businesses offer more flexible time arrangements compared to private enterprises, enabling female entrepreneurs to balance family and career responsibilities better and allocate more time to entrepreneurial activities. Second, individual businesses have lower entry barriers relative to private enterprises, facilitating easier market entry for female entrepreneurs and initiating their entrepreneurial journey without encountering excessively high startup hurdles. Third, individual businesses entail lower entrepreneurial risks, which are attributed primarily to their smaller scale and adaptable operational methods. Consequently, individual businesses provide a safer entrepreneurial environment for female entrepreneurs. In conclusion, the implementation of long-term care insurance policies has created a more favorable environment and conditions for female entrepreneurs in individual businesses, thereby significantly promoting the development of female entrepreneurship.

8 Conclusion

This paper examines the relationship between long-term care insurance policies and entrepreneurship in China, focusing on the staggered implementation of LTCI across cities. Our analysis, employing a staggered difference-in-difference (DID) model, shows a significant and positive impact of LTCI policy on local entrepreneurship. On average, cities experience a notable 5.6% increase in local business registration following the implementation of the LTCI.

A battery of tests and robustness checks support the causal interpretation of these findings. In terms of the underlying economic mechanism, our analyses suggest that LTCI policies increase labor force supply, reduce labor costs, and, subsequently, lower entry costs for potential entrepreneurs.

Furthermore, we explore the heterogeneity of this effect, demonstrating that cities with a greater fraction of the aging population, higher levels of Confucian culture, or located within an urban agglomeration region experience a more substantial increase in entrepreneurship post-LTCI implementation. Additionally, we show that the policy had a significant positive impact on local female entrepreneurship particularly.

Our findings highlight the multi-faceted benefits of long-term care insurance policies, demonstrating their potential to not only address the challenges posed by an aging population but also to foster a dynamic and innovative local economy. By promoting entrepreneurship and reducing entry barriers for new businesses, LTCI policies can contribute to economic growth, job creation, and societal well-being. This is particularly relevant as societies worldwide face increasing demographic pressures and seek strategies to maintain economic vitality. Understanding and leveraging the positive externalities of LTCI policies, as demonstrated by our findings in China, is crucial for shaping a sustainable and inclusive future for aging societies.

References

Adelino, M., Schoar, A., & Severino, F. (2015). House prices, collateral, and self-employment. *Journal of Financial Economics*, 117(2), 288-306.

Bayar, O., Chemmanur, T. J., & Liu, M. H. (2019). How to motivate fundamental innovation: Optimal interactions between entrepreneurs, venture capitalists, and the government. *Available at SSRN 2799490.*

Boudreaux, C. J., Jha, A., & Escaleras, M. (2022). Weathering the storm: How foreign aid and institutions affect entrepreneurship activity following natural disasters. *Entrepreneurship Theory and Practice*, 46(6), 1843-1868.

Brown, J. R., & Finkelstein, A. (2011). Insuring long-term care in the United States. *Journal of Economic Perspectives*, 25(4), 119-142.

Brown, J. R., Goda, G. S., & McGarry, K. (2012). Long-term care insurance demand limited by beliefs about needs, concerns about insurers, and care available from family. *Health Affairs*, 31(6), 1294-1302.

Cong, L. W., Liu, B., Yang, X., & Zhang, X. (2022). Bridging the Gender Gap in Entrepreneurship and Empowering Women via Digital Technologies.

Core, F. (2024). Female innovative entrepreneurship and maternity risk. *Review of Finance*, rfae014.

DeCicca, P. (2010). Health insurance availability and entrepreneurship. *Available at SSRN 1660435.*

Decker, R., Haltiwanger, J., Jarmin, R., & Miranda, J. (2014). The role of entrepreneurship in US job creation and economic dynamism. *Journal of Economic Perspectives*, 28(3), 3-24.

Denes, M., Howell, S. T., Mezzanotti, F., Wang, X., & Xu, T. (2023). Investor tax credits and entrepreneurship: Evidence from us states. *The Journal of Finance*, 78(5), 2621-2671.Du, X. (2015). Does Confucianism reduce minority shareholder expropriation? Evidence from China. *Journal of Business Ethics*, 132(4), 661-716.

Fairlie, R. W., Kapur, K., & Gates, S. (2011). Is employer-based health insurance a barrier to entrepreneurship?. *Journal of Health Economics*, 30(1), 146-162.

Gottlieb, J. D., Townsend, R. R., & Xu, T. (2022). Does career risk deter potential entrepreneurs?. *The Review of Financial Studies*, 35(9), 3973-4015.

Gu, Z. H., Sun, W., & Zhou, F. S. (2023). Cultural origin and minority shareholder expropriation: Historical evidence. *Journal of Accounting Research*, 62(1), 181-228.

Hall, B. H., & Lerner, J. (2010). The financing of R&D and innovation. *In Handbook of The Economics of Innovation* (Vol. 1, pp. 609-639). North-Holland.

Hebert, C. (2023). Gender Stereotypes and Entrepreneur Financing.

Hombert, J., Schoar, A., Sraer, D., & Thesmar, D. (2020). Can unemployment insurance spur entrepreneurial activity? Evidence from France. *The Journal of Finance*, *75*(3), 1247-1285.

Howell, S. T. (2017). Financing innovation: Evidence from R&D grants. *American Economic Review*, 107(4), 1136-1164.

Hurst, E., & Lusardi, A. (2004). Liquidity constraints, household wealth, and entrepreneurship. *Journal of Political Economy*, 112(2), 319-347.

Kerr, W. R., & Nanda, R. (2009). Democratizing entry: Banking deregulations, financing constraints, and entrepreneurship. *Journal of Financial Economics*, 94(1), 124-149.

Kerr, W. R., Nanda, R., & Rhodes-Kropf, M. (2014). Entrepreneurship as experimentation. *Journal of Economic Perspectives*, 28(3), 25-48.

Kong, D., & Qin, N. (2021). China's anticorruption campaign and entrepreneurship. *Journal of Law and Economics*, 64.

Lagaras, S., Marchica, M. T., Simintzi, E., & Tsoutsoura, M. (2022). Women in the financial sector. *Available at SSRN 4098229*.

Lee, J. Y., & Winters, J. V. (2022). State medicaid expansion and the self-employed. *Small*

Business Economics, 59(3), 925-954.
Lerner, J. (2020). Government incentives for entrepreneurship (No. c14426). National Bureau of Economic Research.
Maestas, N., Messel, M., & Truskinovsky, Y. (2024). Caregiving and Labor Supply: New Evidence from Administrative Data. *Journal of Labor Economics*, *42*(S1), S183-S218.
Mellor, J. M. (2001). Long-term care and nursing home coverage: Are adult children substitutes for insurance policies?. *Journal of Health Economics*, 20(4), 527-547.
Mommaerts, C. (Forthcoming). Long-term care insurance and the family. *Journal of Political Economy*.
Morazzoni, M., & Sy, A. (2022). Female entrepreneurship, financial frictions and capital misallocation in the US. *Journal of Monetary Economics*, *129*, 93-118.
Sapienza, P., Zingales, L., & Maestripieri, D. (2009). Gender differences in financial risk aversion and career choices are affected by testosterone. *Proceedings of the National Academy of Sciences*, *106*(36), 15268-15273.
Schmalz, M. C., Sraer, D. A., & Thesmar, D. (2017). Housing collateral and entrepreneurship. *The Journal of Finance*, 72(1), 99-132.
Simintzi, E., Xu, S. J., & Xu, T. (2024). The Effect of Childcare Access on Women's Careers and Firm Performance. *Kenan Institute of Private Enterprise Research Paper*, (4162092).
Shi, X., Xi, T., Zhang, X., & Zhang, Y. (2021). Moving umbrella: Bureaucratic transfers and the comovement of interregional investments in China. *Journal of Development Economics*, 153, 102717.
Sun, L., & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2), 175-199.
Tate, G., & Yang, L. (2015). Female leadership and gender equity: Evidence from plant closure. *Journal of Financial Economics*, *117*(1), 77-97.
Tian, X., & Xu, J. (2022). Do place-based policies promote local innovation and entrepreneurship?. *Review of Finance*, 26(3), 595-635.
Toossi, M., & Torpey, E. (2017). Older workers labor force trends and career options. Bureau of Labor and Statistics.
Zandberg, J. (2021). Family comes first: Reproductive health and the gender gap in entrepreneurship. *Journal of Financial Economics*, *140*(3), 838-864.

Figure 1. LTCI in China and Regional Older Population Fraction

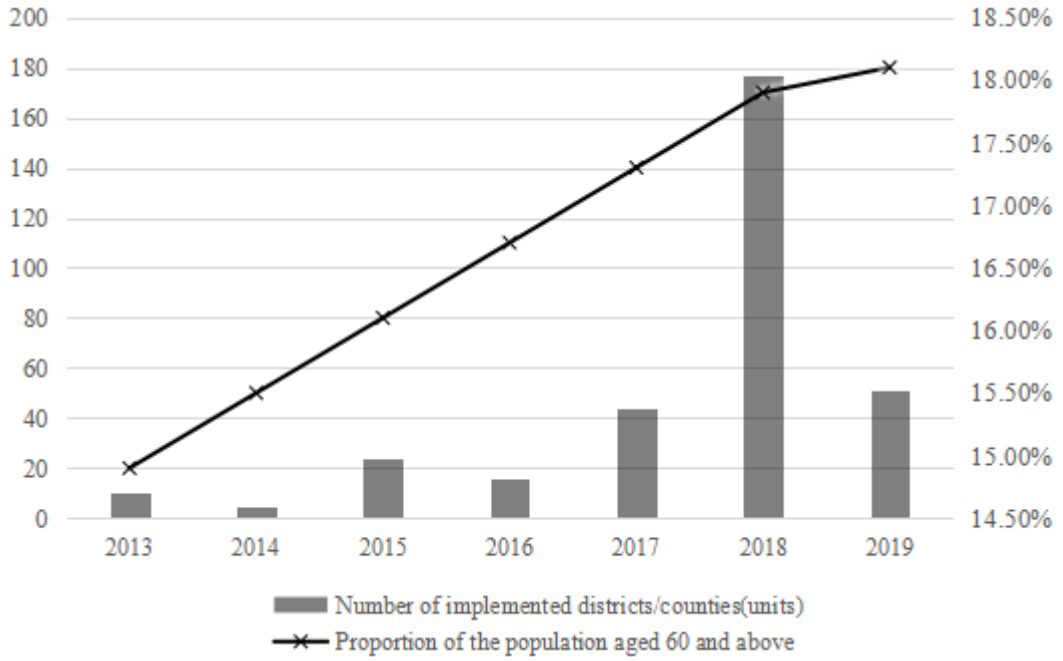


Figure 2. Implementation Status of China's LTCI System By Year

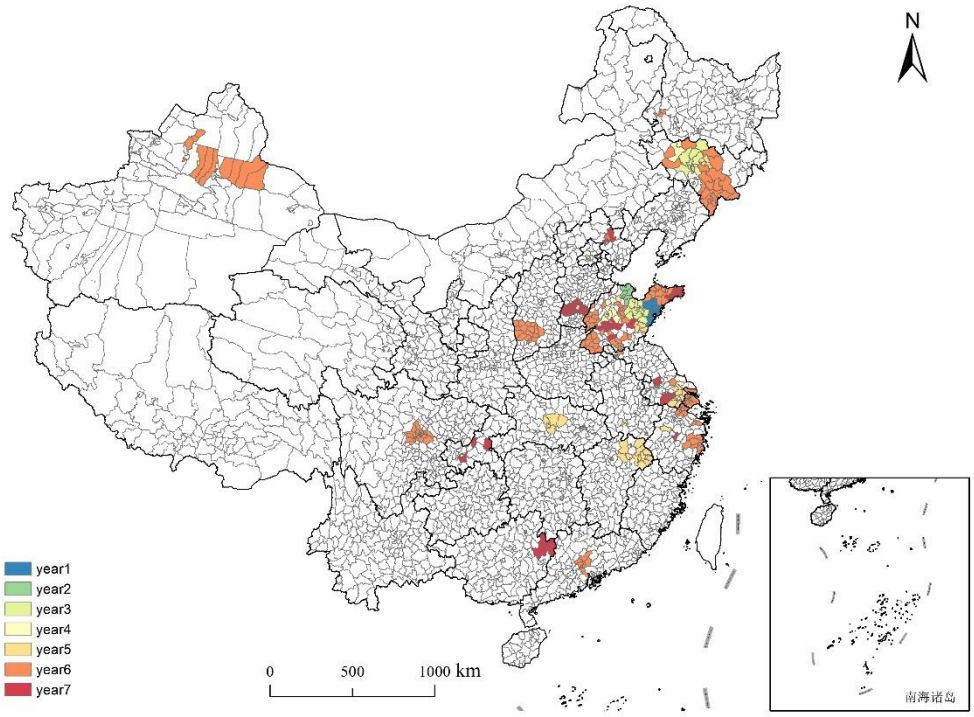


Figure 3. Implementation Status of China's LTCI System - Distinguishing National Pilot Programs

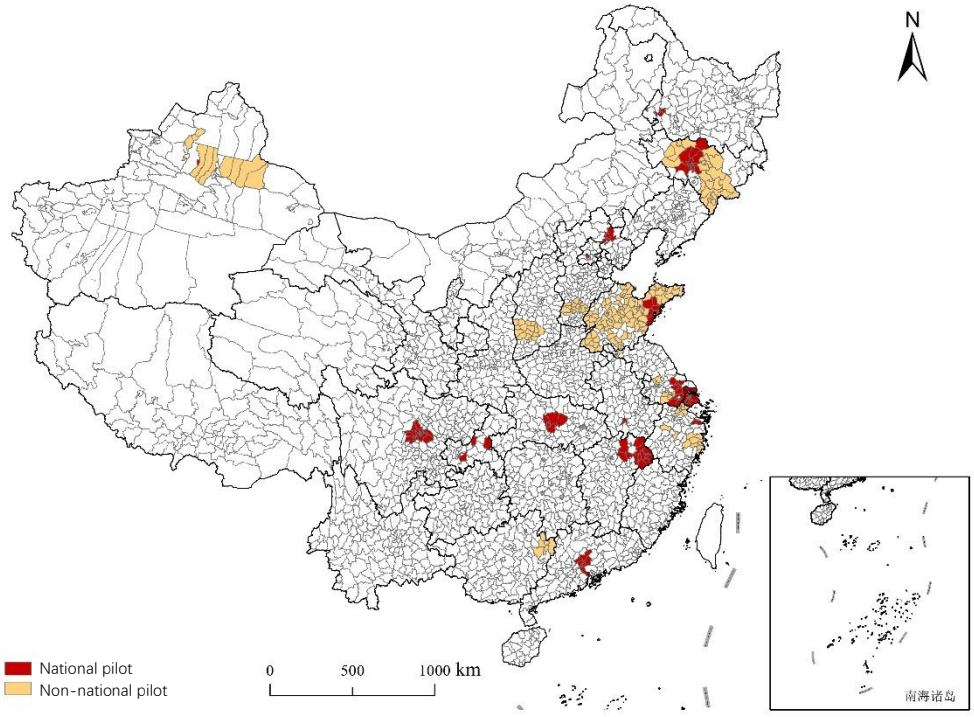


Figure 4 Plots of the results of the parallel trend tests

The regression model includes county and year fixed effects, and T-statistics computed with robust standard errors clustered at the county and year level. The confidence interval is at the 90% level.

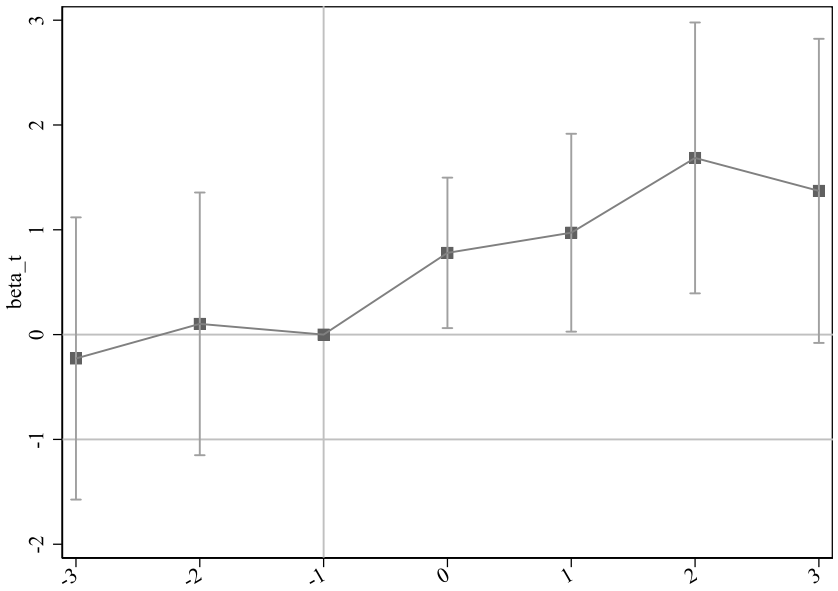
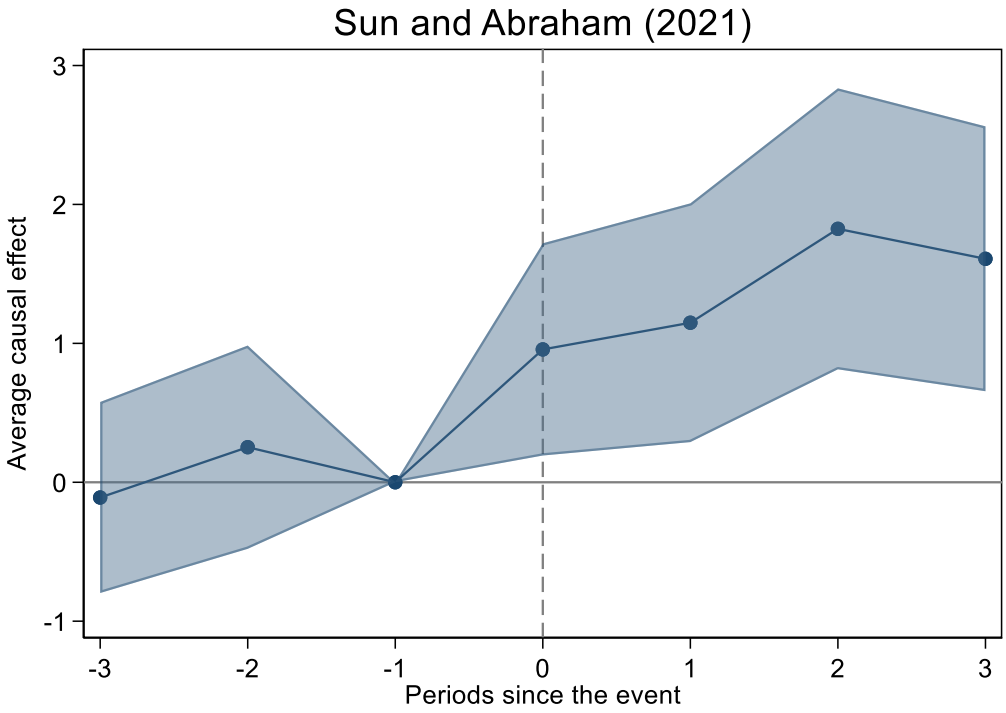


Figure 5 Heterogeneous Treatment Effects

Given that heterogeneity in treatment effects might introduce potential biases in estimating the two-way fixed effects model, this study employs a more robust estimator proposed by Sun and Abraham (2021) to calculate group-time average treatment effects.

The confidence interval is at the 90% level.



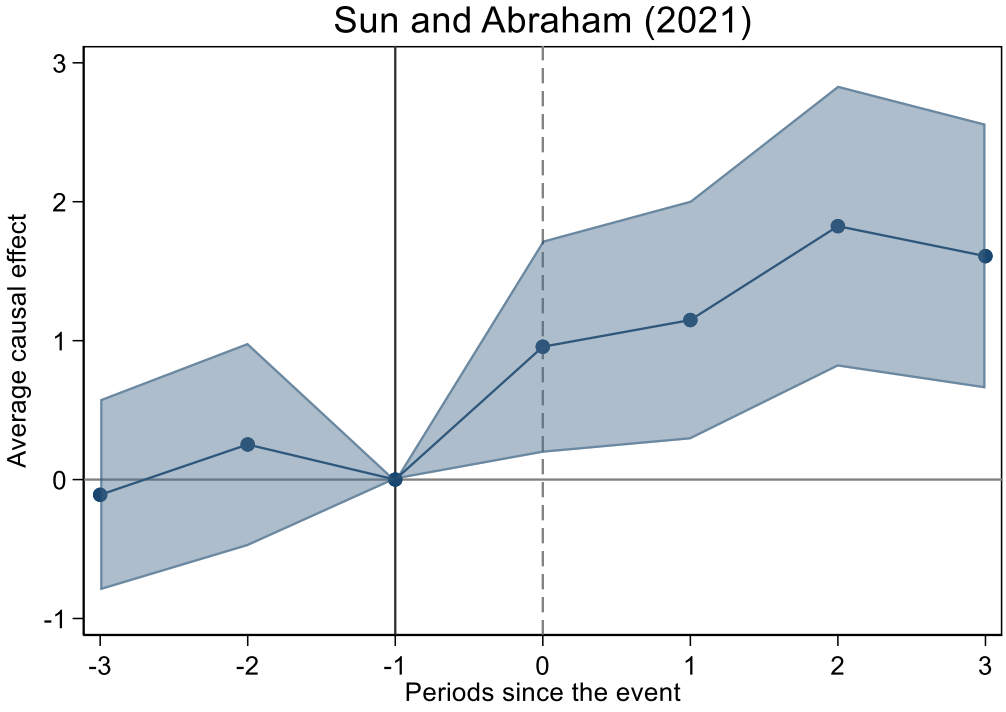


Figure 6 Plots of the results of placebo tests for the coefficient estimates on randomized LTCI

The regression model includes county and year fixed effects, and T-statistics computed with robust standard errors clustered at the county and year level.

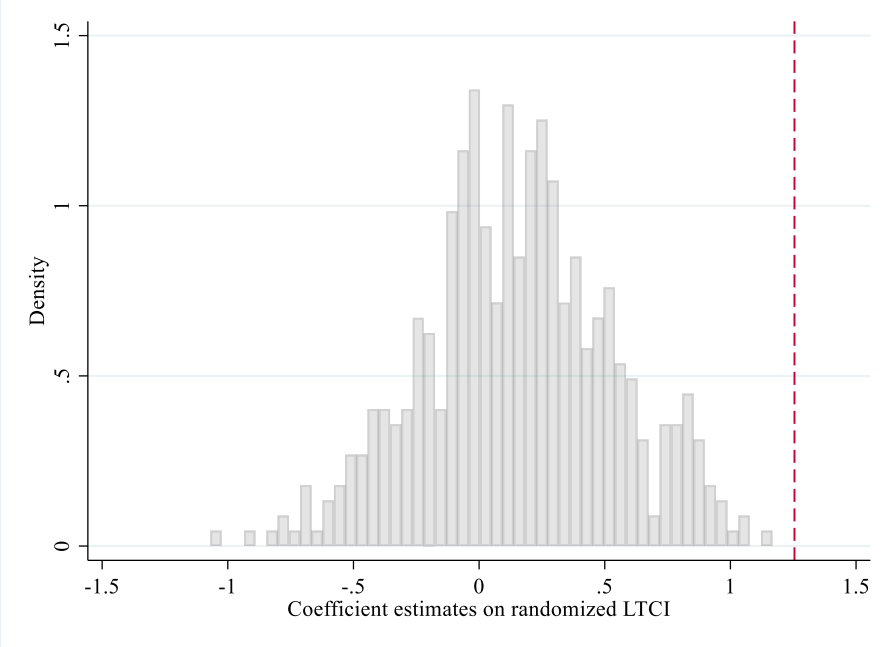


Table 1 Summary statistics

This table summarizes the main variables of the sample with the definition of variables listed in Appendix 1. The sample period is from 2010 to 2021. The unit of observation is a county-year.

Variables	N	Mean	SD	Min	P10	P25	Median	P75	P90	Max
ES	51290	22.373	10.141	1.521	11.277	16.102	21.009	27.134	34.635	72.573
ES1	38216	2.989	9.212	0.007	0.094	0.224	0.623	1.794	5.155	101.722
ES2	51290	1951.636	2782.613	28	198	430	1029	2329	4600	32553
LTCI	51290	0.043	0.202	0	0	0	0	0	0	1
GDPGrowth	51290	0.094	0.086	-0.288	0.011	0.052	0.089	0.134	0.203	0.399
Fiscal	51290	0.202	0.097	0.064	0.109	0.135	0.178	0.236	0.332	0.731
SecInd	51290	0.451	0.103	0.121	0.321	0.39	0.454	0.518	0.577	0.74
MedSev	51290	2.353	1.132	0.672	1.259	1.574	2.094	2.786	3.813	8.462
PD	51290	0.438	0.331	0.007	0.1	0.187	0.375	0.634	0.859	2.617
Type	51290	0.5	0.5	0	0	0	0.5	1	1	1
Age1	51290	0.092	0.014	0.056	0.076	0.083	0.087	0.103	0.112	0.119
Age2	51290	0.124	0.02	0.078	0.098	0.11	0.122	0.136	0.149	0.168
Conf1	51290	0.669	0.471	0	0	0	1	1	1	1
Conf2	51290	0.584	0.493	0	0	0	1	1	1	1
Conf3	51290	0.644	0.479	0	0	0	1	1	1	1
Conf4	51290	0.704	0.457	0	0	0	1	1	1	1
LaborNum	35738	0.217	0.214	0.019	0.056	0.076	0.114	0.256	0.597	1.181
LaborCost	25694	1.648	0.525	1.025	1.147	1.261	1.467	1.928	2.447	5.622
CityGroup	51290	0.593	0.491	0	0	0	1	1	1	1

Table 2 LTIC policy and entrepreneurship

This table explores the effects of the LTCI policy on entrepreneurship. The unit of observation is the county-year. The dependent variable is the number of newly registered enterprises ×100/number of previous year's surviving enterprises. Panel A presents the baseline results where we examine all types of business formed. In Panel B, we further examine the LTCI's impact on different types of business formation. The sample period is 2010-2021. Control variables are measured at year t. All variables are defined in Appendix 1. T-statistics computed with robust standard errors clustered at the county-year level are reported in parentheses. All models include fixed effects as indicated in the table. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Baseline Regression

	(1)	(2)
	ES	*ES*
LTCI	1.243**	1.255**
	(2.58)	(2.49)
GDPGrowth		5.239**
		(2.22)
Fiscal		-7.338*
		(-1.77)
SecInd		-3.403
		(-0.66)
MedSev		0.426*
		(1.82)
PD		-0.493
		(-0.33)
Type		1.359
		(1.19)
constant	22.320***	23.377***
	(1207.53)	(8.41)
County FE	Yes	Yes
Year FE	Yes	Yes
N	51290	51290
Adj. R^2	0.377	0.384

Panel B: Subsample Regression Based on Firm Type

	(1)	(2)
	individual business	*private enterprise*
	ES	*ES*
LTCI	1.406*	1.104**
	(1.86)	(2.20)
GDPGrowth	3.151	7.326***
	(1.39)	(2.67)
Fiscal	-7.684*	-6.992
	(-1.78)	(-1.27)
SecInd	-2.322	-4.483
	(-0.34)	(-0.93)
MedSev	0.488*	0.365
	(1.80)	(1.04)
PD	2.535	-3.521**
	(1.49)	(-1.98)
Type	0.000***	0.000**
	(4.00)	(2.00)
constant	21.679***	26.435***
	(5.66)	(10.50)
County FE	Yes	Yes
Year FE	Yes	Yes
N	25645	25645
Adj. R^2	0.467	0.485

Table 3 Robustness tests

This table presents a battery of robust tests on the effects of the LTCI policy on entrepreneurship. The unit of observation is the county-year. The sample period is 2010-2021. Control variables are measured at year t. All variables are defined in the Appendix 1. T-statistics computed with robust standard errors clustered at the county-year level are reported in parentheses. All models include fixed effects as indicated on the table. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Parallel Trend Assumption

	(1)	(2)
	ES	*ES*
pre3	-0.171	-0.228
	(-0.23)	(-0.31)
pre2	0.207	0.103
	(0.30)	(0.15)
current	0.912**	0.780*
	(2.09)	(1.97)
post1	1.064**	0.972*
	(2.14)	(1.87)
post2	1.619**	1.686**
	(2.51)	(2.36)
post3	1.342	1.372
	(1.64)	(1.71)
GDPGrowth		5.214**
		(2.21)
Fiscal		-7.340
		(-1.77)
SecInd		-3.223
		(-0.61)
MedSev		0.429
		(1.81)
PD		-0.576
		(-0.38)
Type		1.359
		(1.19)
constant	22.312***	23.326***
	(615.65)	(8.26)
County FE	Yes	Yes
Year FE	Yes	Yes
N	51290	51290
Adj. R^2	0.377	0.384

(Table 3 Cont'd)

Panel B: Alternative Measures for Entrepreneurship

	(1)	(2)
	ES1	*ES2*
LTCI	1.507*	1042.349***
	(1.87)	(3.47)
GDPGrowth	2.186	277.538
	(1.53)	(0.48)
Fiscal	-7.649***	-4.5e+03***
	(-4.25)	(-5.24)
SecInd	-6.810*	997.703
	(-1.87)	(0.84)
MedSev	0.648***	370.322***
	(3.84)	(4.43)
PD	8.219**	4393.021***
	(2.05)	(4.57)
Type	-0.973***	-1.0e+03***
	(-4.77)	(-6.62)
constant	3.048*	71.573
	(1.70)	(0.10)
County FE	Yes	Yes
Year FE	Yes	Yes
N	38216	51290
Adj. R^2	0.797	0.663

(Table 3 Cont'd)

Panel C: Alternative Measures for Independent Variable

	(1) *ES*	(2) *ES*
LTCI1	1.339**	
	(2.60)	
LTCI2		1.197**
		(2.35)
GDPGrowth	5.335**	5.226**
	(2.29)	(2.20)
Fiscal	-7.164*	-7.305*
	(-1.71)	(-1.76)
SecInd	-3.295	-3.423
	(-0.64)	(-0.66)
MedSev	0.418*	0.438*
	(1.77)	(1.87)
PD	-0.502	-0.369
	(-0.33)	(-0.25)
Type	1.359	1.359
	(1.19)	(1.19)
constant	23.292***	23.311***
	(8.33)	(8.40)
County FE	Yes	Yes
Year FE	Yes	Yes
N	51290	51290
Adj. R^2	0.384	0.384

Panel D: Alternative Sample

	(1) *ES*
LTCI	1.346**
	(2.54)
GDPGrowth	5.401**
	(2.26)
Fiscal	-7.929*
	(-1.87)
SecInd	-2.763
	(-0.55)
MedSev	0.360*
	(1.65)
PD	5.136***
	(3.22)
Type	1.222
	(1.03)
constant	21.336***
	(8.19)
County FE	Yes
Year FE	Yes
N	48408
Adj. R^2	0.376

(Table 3 Cont'd)

Panel E: Alternative Cluster-Robust Standard Errors

	(1)	(2)
	ES	*ES*
Clustering at	County	Year
LTCI	1.255***	1.255**
	(4.14)	(2.76)
GDPGrowth	5.239***	5.239**
	(8.09)	(2.19)
Fiscal	-7.338***	-7.338*
	(-4.12)	(-1.84)
SecInd	-3.403*	-3.403
	(-1.76)	(-0.67)
MedSev	0.426***	0.426*
	(3.52)	(1.93)
PD	-0.493	-0.493
	(-0.45)	(-0.41)
Type	1.359***	1.359
	(11.49)	(1.16)
constant	23.377***	23.377***
	(19.01)	(8.82)
County FE	Yes	Yes
Year FE	Yes	Yes
N	51290	51290
Adj. R^2	0.384	0.384

Panel F: DID Approach with Propensity Score Matching

	(1)	(2)
	ES	*ES*
LTCI	1.184**	0.876
	(2.44)	(1.73)
GDPGrowth	5.403**	5.143*
	(2.31)	(1.95)
Fiscal	-8.240	-5.729
	(-1.81)	(-1.41)
SecInd	-2.429	-0.509
	(-0.45)	(-0.09)
MedSev	0.374	0.305
	(1.77)	(1.45)
PD	0.452	0.698
	(0.37)	(0.38)
Type	1.259	1.173
	(1.09)	(1.08)
constant	22.770***	21.221***
	(7.73)	(7.15)
County FE	Yes	Yes
Year FE	Yes	Yes
N	49944	43266
Adj. R^2	0.380	0.387

Table 4 Mechanism Tests

This table explores the mechanism for the effects of the LTCI policy on entrepreneurship. The unit of observation is the county-year. The dependent variable is the proportion of number of employees in total population at the city level (*LaborNum*) and the ratio of the average wage of current year employees to the average wage of employees in base period (2010) at the city level (*LaborCost*). The sample period is 2010-2021. Control variables are measured at year t. All variables are defined in the Appendix 1. T-statistics computed with robust standard errors clustered at the county -year level are reported in parentheses. All models include fixed effects as indicated in the table. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: LTCI, Labor Supply, and Labor Costs

	(1)	(2)
	LaborNum	*LaborCost*
LTCI	0.119***	-0.150***
	(5.90)	(-3.27)
GDPGrowth	0.000	0.197
	(0.00)	(1.17)
Fiscal	-0.812***	0.186
	(-3.90)	(0.50)
SecInd	-0.081	1.286**
	(-0.54)	(3.07)
MedSev	0.008	-0.006
	(1.28)	(-0.28)
PD	-0.015	-0.029
	(-0.30)	(-0.72)
Type	-0.000	-0.000
	(-0.00)	(-0.01)
constant	0.397***	1.012***
	(4.28)	(3.82)
County FE	Yes	Yes
Year FE	Yes	Yes
N	35738	25694
Adj. R^2	0.657	0.938

(Table 4 Cont'd)

Panel B: Entrepreneurship by Sectors

	(1) *manufacturing sample*	(2) *labor-intensive*	(3) *capital-intensive*	(4) *technology-intensive*
	ES	*ES*	*ES*	*ES*
LTCI	2.427***	3.747***	1.851***	1.401
	(4.54)	(4.67)	(2.96)	(1.18)
GDPGrowth	3.948**	6.702*	2.256	3.302
	(2.15)	(1.96)	(1.65)	(1.50)
Fiscal	-12.322**	-20.049**	-12.319***	-1.243
	(-2.37)	(-2.28)	(-2.78)	(-0.19)
SecInd	-2.213	-5.118	-5.626	4.839
	(-0.36)	(-0.54)	(-0.96)	(1.00)
MedSev	-0.174	0.180	-0.289	-0.608
	(-0.49)	(0.37)	(-0.70)	(-1.45)
PD	1.094	3.811	0.940	-1.902
	(0.21)	(0.56)	(0.18)	(-0.37)
Type	-7.905**	-9.521***	-5.714**	-8.080*
	(-2.49)	(-3.15)	(-2.13)	(-1.69)
constant	28.549***	33.714***	27.645***	23.701***
	(5.83)	(4.85)	(5.73)	(6.31)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	1280661	438389	471781	370491
Adj. R^2	0.068	0.074	0.065	0.080

Panel C Further mechanism test 2

	(1) Full sample	(2) high-tech	(3) Non-high-tech
	ES	ES	ES
LTCI	2.390***	1.562***	2.475***
	(5.27)	(2.79)	(5.25)
GDPGrowth	3.355	2.802	3.410
	(1.37)	(1.08)	(1.36)
Fiscal	-15.516***	1.552	-17.222***
	(-3.09)	(0.24)	(-3.36)
SecInd	-1.720	12.333**	-3.251
	(-0.31)	(2.57)	(-0.55)
MedSev	0.292	0.686*	0.249
	(1.07)	(2.00)	(0.88)
PD	-1.175	-5.792	-0.690
	(-0.28)	(-1.41)	(-0.16)
Type	-4.159	0.704	-4.672*
	(-1.63)	(0.34)	(-1.75)
_cons	32.116***	18.473***	33.583***
	(8.44)	(5.67)	(8.28)
County FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	3414826	347934	3066892
Adj. R^2	0.044	0.049	0.045

Table 5 Cross-Sectional tests

This table explores a battery of cross-sectional tests for the effects of the LTCI policy on entrepreneurship. The unit of observation is the county-year. The sample period is 2010-2021. Control variables are measured at year t. All variables are defined in the Appendix 1. T-statistics computed with robust standard errors clustered at the county-year level are reported in parentheses. All models include fixed effects as indicated in the table. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: The Moderating Effect of Population Aging

	(1)	(2)
	ES	*ES*
LTCI×Age1	73.683**	
	(2.49)	
LTCI×Age2		64.513**
		(2.46)
LTCI	-5.898*	-7.086*
	(-2.10)	(-2.10)
GDPGrowth	5.300**	5.296**
	(2.27)	(2.26)
Fiscal	-6.832	-6.568
	(-1.63)	(-1.57)
SecInd	-3.455	-3.409
	(-0.67)	(-0.67)
MedSev	0.416	0.419
	(1.77)	(1.78)
PD	-0.686	-0.537
	(-0.44)	(-0.35)
Type	1.359	1.359
	(1.19)	(1.19)
constant	23.402***	23.256***
	(8.39)	(8.36)
County FE	Yes	Yes
Year FE	Yes	Yes
N	51290	51290
Adj. R^2	0.384	0.384

(Table 5 Cont'd)

Panel B Further mechanism test 3

	(1) Full sample ES	(2) silver economy ES	(3) Non-silver economy ES
LTCI	2.390***	1.643**	3.123***
	(5.27)	(2.51)	(7.89)
GDPGrowth	3.355	3.023	3.630
	(1.37)	(1.04)	(1.62)
Fiscal	-15.516**	-16.874**	-14.594**
	(-3.09)	(-2.96)	(-2.78)
SecInd	-1.720	-3.767	0.220
	(-0.31)	(-0.60)	(0.04)
MedSev	0.292	0.185	0.402
	(1.07)	(0.70)	(1.24)
PD	-1.175	-2.909	0.835
	(-0.28)	(-0.59)	(0.19)
Type	-4.159	-1.355	-6.768***
	(-1.63)	(-0.42)	(-3.42)
_cons	32.116***	36.454***	27.851***
	(8.44)	(9.72)	(6.84)
County FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	3414826	1672805	1742021
Adj. R^2	0.044	0.051	0.044

Panel C: The moderating effect of Confucian culture

	(1) *ES*	(2) *ES*	(3) *ES*	(4) *ES*
LTCI×Conf1	3.922**			
	(2.63)			
LTCI×Conf2		2.704**		
		(2.52)		
LTCI×Conf3			2.761***	
			(3.42)	
LTCI×Conf4				3.138***
				(3.62)
LTCI	-1.829	-0.738	-0.765	-1.117
	(-1.38)	(-0.68)	(-0.99)	(-1.40)
GDPGrowth	5.260**	5.237**	5.147*	5.177**
	(2.24)	(2.23)	(2.16)	(2.17)
Fiscal	-6.715	-6.960	-6.705	-6.671
	(-1.59)	(-1.64)	(-1.59)	(-1.58)
SecInd	-3.516	-3.692	-3.488	-3.580
	(-0.70)	(-0.72)	(-0.68)	(-0.70)
MedSev	0.418	0.406*	0.420*	0.412*
	(1.80)	(1.75)	(1.80)	(1.77)
PD	0.434	-0.728	-0.811	-0.816
	(0.29)	(-0.47)	(-0.52)	(-0.53)
Type	1.359	1.359	1.359	1.359
	(1.19)	(1.19)	(1.19)	(1.19)
constant	22.917***	23.582***	23.452***	23.504***
	(8.46)	(8.43)	(8.44)	(8.46)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	51290	51290	51290	51290
Adj. R^2	0.385	0.384	0.384	0.384

Panel D: The moderating effect of urban agglomeration

	(1) *ES*
LTCI× *CityGroup*	3.765***
	(4.72)
LTCI	-1.426*
	(-1.72)
GDPGrowth	5.122**
	(2.14)
Fiscal	-6.464
	(-1.51)
SecInd	-3.538
	(-0.69)
MedSev	0.398
	(1.71)
PD	-0.913
	(-0.59)
Type	1.359
	(1.19)
constant	23.520***
	(8.52)
County FE	Yes
Year FE	Yes
N	51290
Adj. R^2	0.385

Table 6 Further analysis

This table explores the relation between LTCI policy and entrepreneurship from the perspective of female entrepreneurship. The unit of observation is the county-year. The sample period is 2010-2020. Control variables are measured at year t. All variables are defined in Appendix 1. T-statistics computed with robust standard errors clustered at the county-year level are reported in parentheses. All models include fixed effects as indicated in the table. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) *individual business* *ES_female1*	(2) *private enterprise* *ES_female1*	(3) *individual business* *ES_female2*	(4) *private enterprise* *ES_female2*
LTCI	1.743***	0.013	0.656***	-0.070
	(2.97)	(0.05)	(2.68)	(-0.44)
GDPGrowth	1.420	0.249	0.597	0.148
	(0.43)	(0.14)	(0.48)	(0.15)
Fiscal	-9.429***	4.172	-3.748**	2.809
	(-2.69)	(1.12)	(-2.58)	(1.42)
SecInd	0.456	-2.944	-0.327	-1.358
	(0.11)	(-1.56)	(-0.20)	(-1.41)
MedSev	0.179	-0.317**	0.083	-0.205**
	(1.17)	(-2.35)	(1.38)	(-2.64)
PD	14.961***	1.053	6.969***	0.194
	(4.69)	(1.25)	(4.82)	(0.46)
constant	50.421***	34.030***	33.035***	25.148***
	(22.21)	(27.70)	(36.65)	(41.52)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	24087	24093	24087	24093
Adj. R^2	0.653	0.530	0.662	0.544

Appendix 1: Definitions of Variables

Name of Variable	Symbol of Variable	Definition of Variable
Entrepreneurship	*ES*	Number of newly registered enterprises ×100/number of previous year's surviving enterprises
LTCI Policy	*LTCI*	If the county i implemented LTCI policy in year t, the value of LTCI after year t is 1; otherwise, it is 0.
Economic Development Rate	*GDPGrowth*	Growth rate of the GDP per capita at the city level
Fiscal Expenditure Level	*Fiscal*	Proportion of fiscal expenditure in GDP at the city level
Proportion of Second Industry	*SecInd*	Proportion of GDP attributable to secondary industry at the city level
Medical Service Level	*MedSev*	Proportion of number of doctors in population at the city level
Population Density	*PD*	Proportion of population in land area of the administrative region at the city level
Enterprise Type	*Type*	If enterprise is a private enterprise, the value of Type is 1, and if enterprise is a individual business, the value of Type is 0.

Appendix 2: Considering the overall effect

Further, this paper considers the overall effect of the LTCI policy and entrepreneurship. Specifically, we matched and merged the entrepreneurship data of each county for each year with the LTCI policy data of each county for each year and the control variables and then we get 25,622 enterprise county-year observations. The table below reports the results of the test considering the overall effect. The results show that the positive relation between LTCI policy and entrepreneurship is robust after considering the overall effect.

The unit of observation is the county-year. The dependent variable is the number of newly registered enterprises ×100/number of previous year's surviving enterprises. The sample period is 2010-2021. Control variables are measured at year t. All variables are defined in the Appendix 1. T-statistics computed with robust standard errors clustered at the county-year level are reported in parentheses. All models include fixed effects as indicated on the table. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)
VARIABLES	*ES*
LTCI	1.241**
	(2.14)
GDPGrowth	5.115**
	(2.14)
Fiscal	-7.604*
	(-1.88)
SecInd	-4.818
	(-0.78)
MedSev	0.537**
	(2.41)
PD	-0.774
	(-0.41)
Constant	24.037***
	(7.73)
Observations	25,622
County FE	Yes
Year FE	Yes
Cluster	County Year
Adjusted R^2	0.505

Appendix 3: Balance test charts and analysis of matching effects

1. PSM-DID by cross-section

The matching data balance test is shown in the Figure A1. It shows that the standardized mean deviation of all matched variables after matching was less than 10%, satisfying the requirements of the balance test condition. The Figure A2 shows that the vast majority of samples in both the experimental and control groups fell within the common range of values, with only some samples in the control group not falling within the common range, and those not within the common range tended to score more extreme values, concentrated around 0.

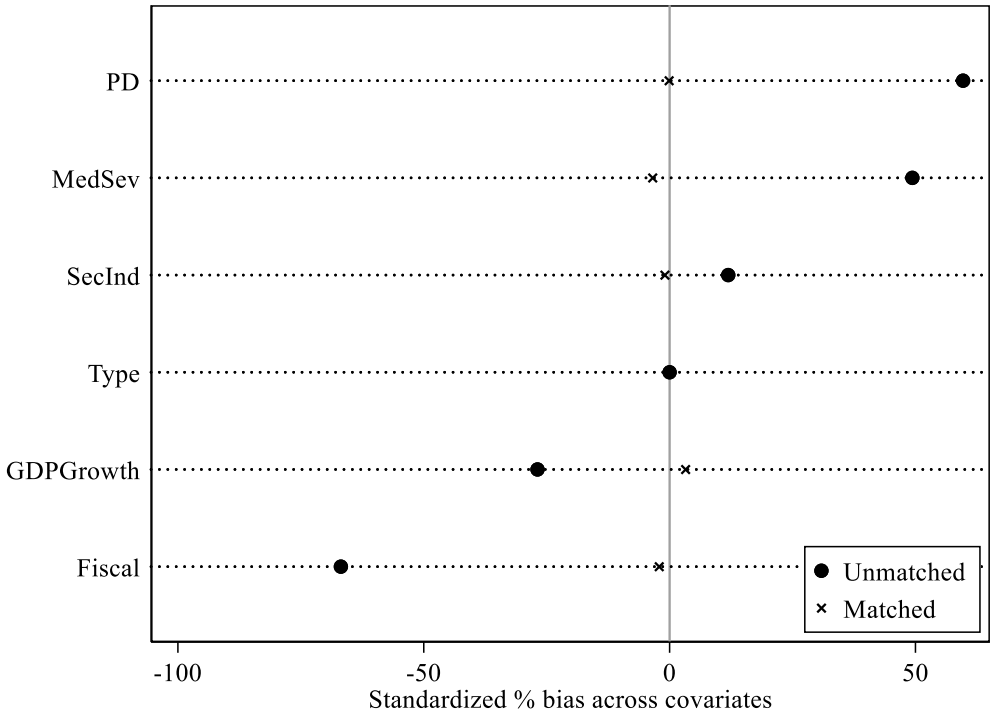


Figure A1: Balance test of PSM by cross section

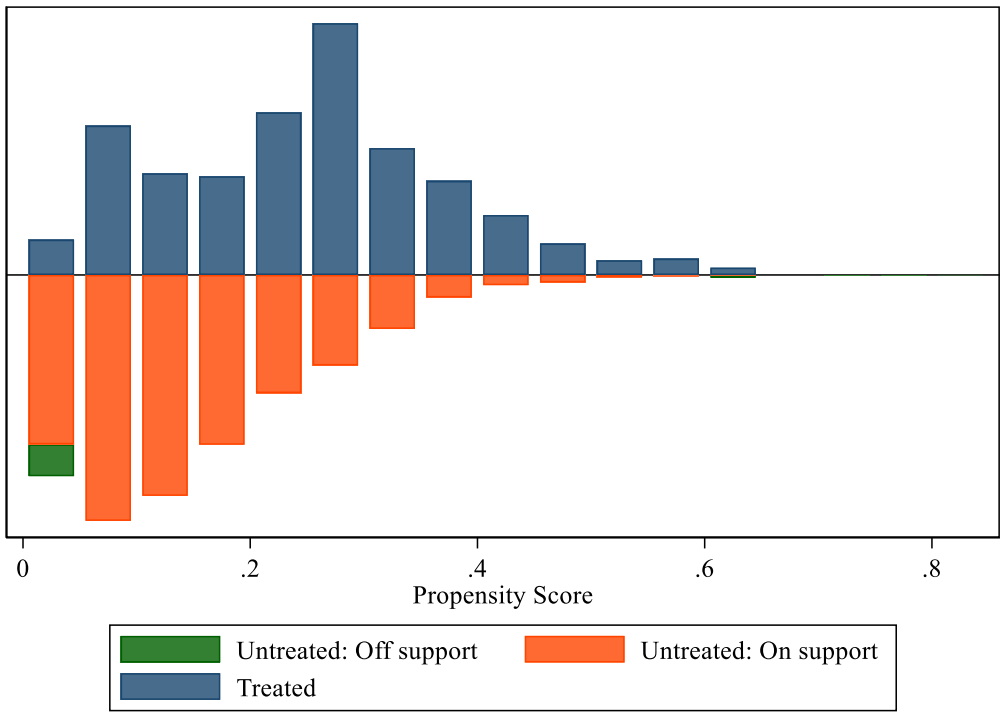


Figure A2: PSM common value range

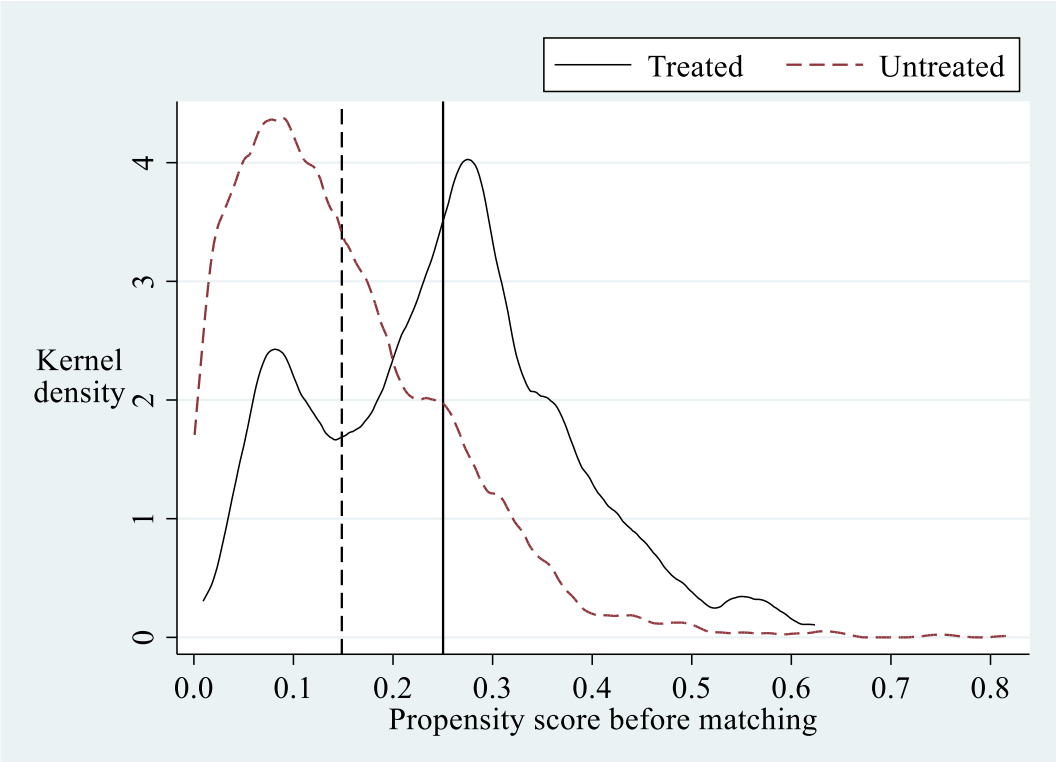


Figure A3: Kernel density distribution before PSM by cross section

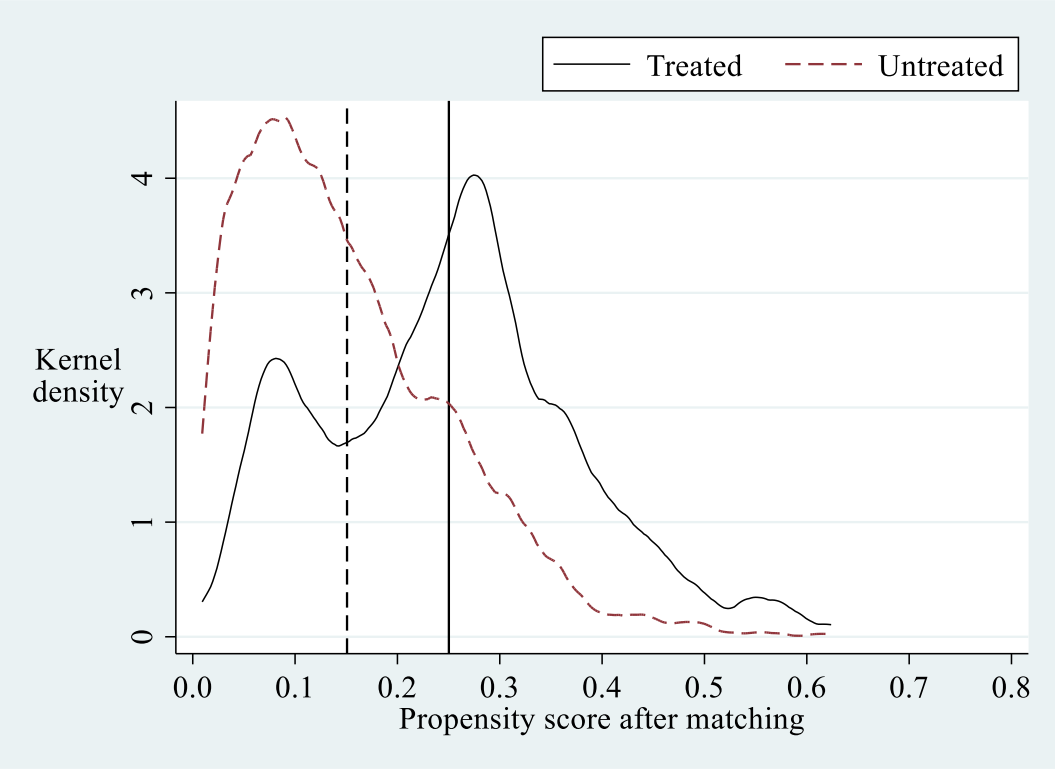


Figure A4: Kernel density distribution after PSM by cross section

2. PSM-DID by year

Since the PSM is conducted within each year, comparing the presence of systematic bias in each matched variable between the two groups can only be done in the same year. We did this by comparing logit regression results across years before and after matching. Specifically, if the coefficient values of each matched variable decrease, become insignificant and the pseudo-R2 significantly decreases after matching, this indicates that there is no systematic bias in the matched variables between the two groups in different years.

Table1: balance test by year (before matching)

	(1) 2011b	(2) 2012b	(3) 2013b	(4) 2014b	(5) 2015b	(6) 2016b	(7) 2017b	(8) 2018b	(9) 2019b	(10) 2020b	(11) 2021b
GDPGrowth	-4.050***	-4.637***	-3.987**	-9.688***	-6.137***	-1.964***	2.503***	-3.990***	-7.928***	-8.062***	-4.632***
	(-3.31)	(-4.26)	(-2.41)	(-6.12)	(-4.92)	(-2.64)	(3.04)	(-5.51)	(-7.98)	(-10.64)	(-4.26)
Fiscal	-10.519***	-11.333***	-11.820***	-11.715***	-11.388***	-9.144***	-8.666***	-7.961***	-6.350***	-5.057***	-3.432**
	(-6.89)	(-7.33)	(-8.19)	(-8.47)	(-8.42)	(-7.38)	(-6.40)	(-6.04)	(-5.81)	(-4.96)	(-2.25)
SecInd	1.249**	0.330	-0.011	-1.419**	-1.246*	-1.158*	0.313	0.281	-1.098	-0.440	-0.944
	(2.02)	(0.54)	(-0.02)	(-2.18)	(-1.91)	(-1.69)	(0.38)	(0.35)	(-1.36)	(-0.58)	(-1.05)
MedSev	0.146**	0.079	0.128**	0.152**	0.061	0.141***	0.301***	0.215***	0.225***	0.186***	0.155**
	(2.57)	(1.21)	(2.50)	(2.35)	(1.12)	(2.88)	(5.36)	(3.67)	(3.78)	(3.39)	(2.52)
PD	0.833***	0.847***	0.874***	0.963***	1.153***	1.027***	0.714***	0.947***	0.776***	0.866***	0.759***
	(3.64)	(4.11)	(4.17)	(4.79)	(5.76)	(5.96)	(4.01)	(5.50)	(4.53)	(5.15)	(4.67)
Type	-0.000	-0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	0.000	-0.000	-0.000
	(-0.01)	(-0.03)	(0.02)	(0.02)	(0.00)	(-0.02)	(-0.03)	(-0.00)	(0.01)	(-0.02)	(-0.09)
Pseudo R^2	0.117	0.122	0.119	0.144	0.122	0.111	0.123	0.118	0.114	0.154	0.097

Table2: balance test by year (after matching)

	(1) 2011a	(2) 2012a	(3) 2013a	(4) 2014a	(5) 2015a	(6) 2016a	(7) 2017a	(8) 2018a	(9) 2019a	(10) 2020a	(11) 2021a
GDPGrowth	-4.043***	-4.542***	-3.010*	-13.762***	-4.854***	-0.950	2.391***	-5.643***	-9.293***	-6.783***	-5.096***
	(-3.14)	(-4.17)	(-1.76)	(-7.50)	(-3.54)	(-1.32)	(2.90)	(-7.16)	(-7.45)	(-6.56)	(-4.37)
Fiscal	-9.501***	-9.772***	-6.685***	-10.143***	-8.234***	-5.361***	-5.260***	-6.536***	-3.140**	-2.360**	-2.812

	(-5.20)	(-5.55)	(-4.07)	(-6.11)	(-5.04)	(-4.04)	(-3.62)	(-4.62)	(-2.44)	(-2.11)	(-1.62)
SecInd	1.412**	0.931	1.230*	-1.267*	-0.481	-0.566	2.455***	1.641**	0.796	0.834	-0.013
	(2.21)	(1.48)	(1.88)	(-1.87)	(-0.72)	(-0.81)	(2.90)	(2.08)	(0.93)	(1.10)	(-0.01)
MedSev	0.124**	0.053	0.193***	0.103	0.125**	0.222***	0.313***	0.318***	0.379***	0.297***	0.234***
	(2.17)	(0.79)	(3.89)	(1.52)	(2.32)	(4.38)	(5.36)	(5.65)	(6.39)	(5.22)	(3.71)
PD	0.940***	0.778***	0.894***	1.459***	1.322***	1.090***	0.817***	1.275***	1.029***	1.021***	0.592***
	(4.07)	(3.74)	(4.19)	(6.95)	(6.61)	(6.26)	(4.31)	(7.70)	(6.65)	(4.86)	(3.12)
Type	-0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.000
	(-0.04)	(-0.01)	(-0.03)	(0.02)	(-0.06)	(-0.00)	(-0.03)	(-0.00)	(-0.16)	(-0.03)	(0.04)
Pseudo R^2	0.079	0.081	0.049	0.094	0.064	0.066	0.073	0.116	0.090	0.097	0.083

Fig. 5 and Fig. 6 report the kernel density plots before and after matching the experimental and control groups under the year-by-year PSM approach. The results show that the kernel density curves were more biased before matching, but after matching the distance between the mean lines was shortened and the two curves were closer, so it can be suggested to some extent that the year-by-year PSM produced a treatment effect of reducing sample selectivity bias.

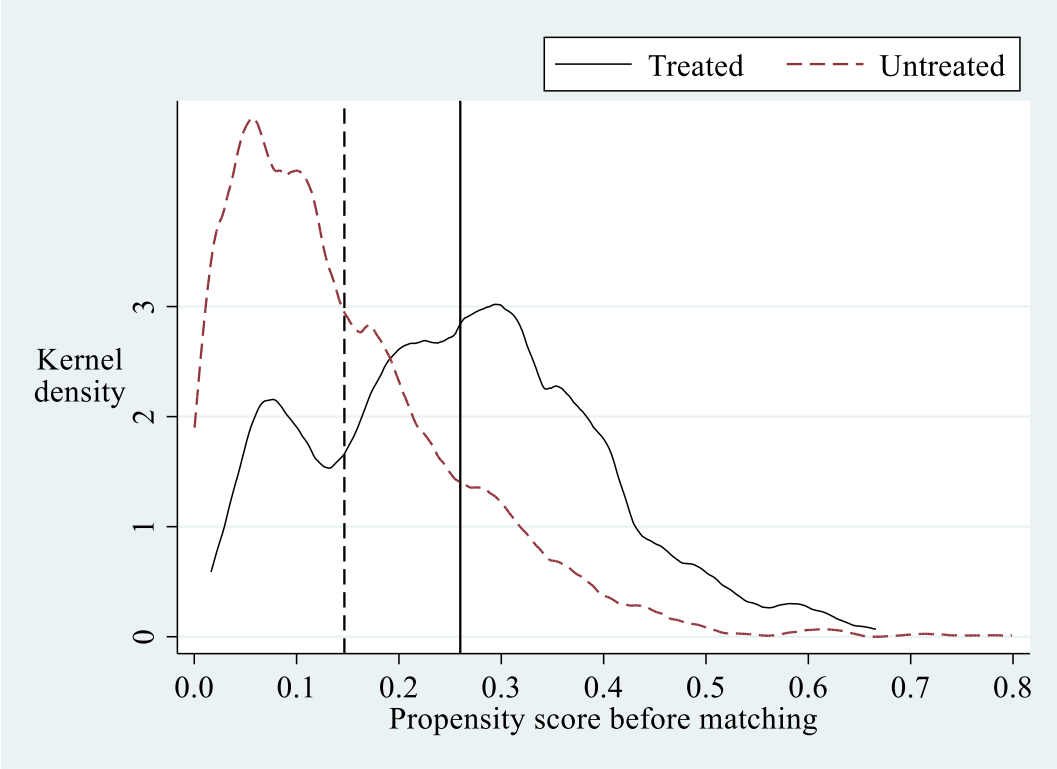


Figure5: Kernel density distribution before PSM by year

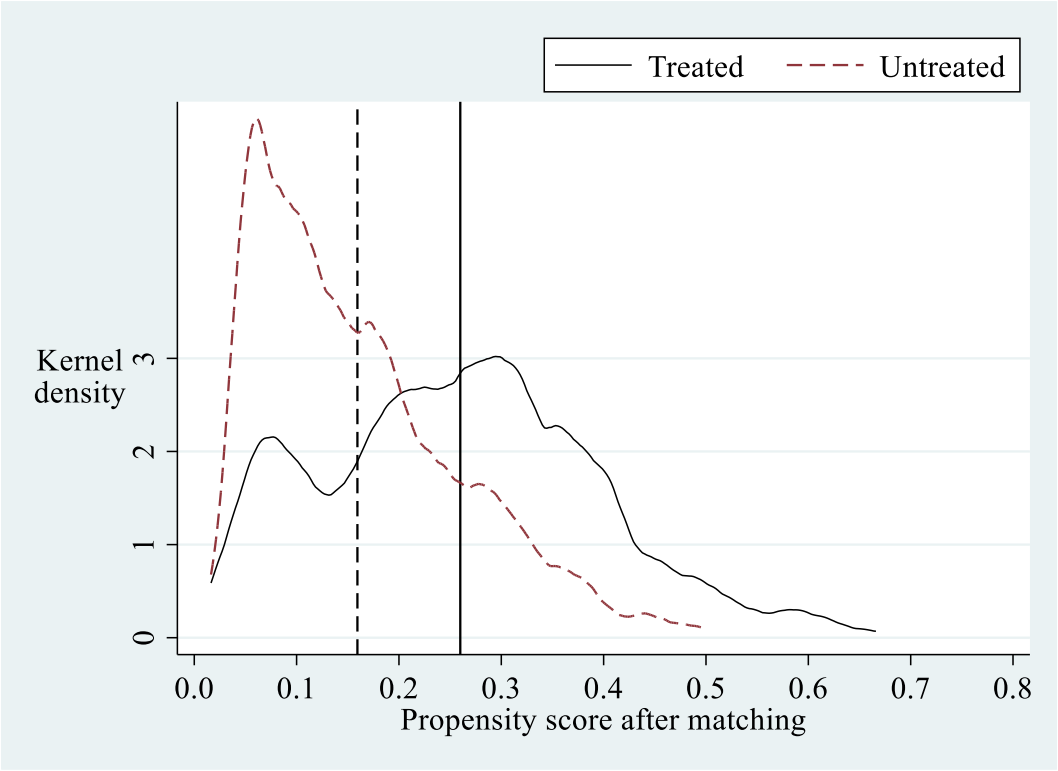


Figure6: Kernel density distribution after PSM by year

Appendix 4: List of urban agglomeration

urban agglomeration	City
Beijing-Tianjin-Hebei Urban Agglomeration	Beijing, Tianjin, Shijiazhuang, Zhangjiakou, Qinhuangdao, Tangshan, Baoding, Langfang, Xingtai, Handan, Hengshui, Cangzhou, Chengde
Yangtze River Delta Urban Agglomerations	Shanghai, Nanjing, Wuxi, Changzhou, Suzhou, Nantong, Yancheng, Yangzhou, Zhenjiang, Taizhou, Hangzhou, Ningbo, Jiaxing, Huzhou, Shaoxing, Jinhua, Zhoushan, Taizhou, Hefei, Wuhu, ''Ma'anshan, Tongling, Anqing, Chuzhou, Chizhou, Xuancheng
Urban Agglomerations of Pearl River Delta	Guangzhou, Shenzhen, Zhuhai, Foshan, Jiangmen, Dongguan, Zhongshan, Huizhou, Zhaoqing
Guanzhong Plain City Group	Yuncheng, Linfen, ''Xi'an, Tongchuan, Baoji, Xianyang, Weinan, Shangluo, Tianshui, Pingliang, Qingyang
Central Plains Urban Agglomeration	Zhengzhou, Kaifeng, Luoyang, Nanyang, Anyang, Shangqiu, Xinxiang, Pingdingshan, Xuchang, Jiaozuo, Zhoukou, Xinyang, Zhumadian, Hebi , Puyang, Luohe, Sanmenxia, Changzhi, Jincheng, Yuncheng, Xingtai, Handan, Liaocheng, Heze, Huaibei, Bengbu, Suzhou, Fuyang, Bozhou
Shandong Peninsula Urban Agglomeration	Jinan, Qingdao, Yantai, Weihai, Weifang, Zibo, Rizhao, Dongying
Liaozhongnan City Groups	Shenyang, Dalian, Anshan, Fushun, Benxi, Dandong, Jinzhou, Yingkou, Fuxin, Liaoyang, Panjin, Tieling, Huludao
Triangle of Central China	Wuhan, Huangshi, Ezhou, Huanggang, Xiaogan, Xianning, Xiangyang, Yichang, Jingzhou, Jingmen, Changsha, Zhuzhou, Xiangtan, Yueyang, Yiyang, Changde, Hengyang, Loudi, Nanchang, Jiujiang, Jingdezhen, Yingtan, Xinyu, Yichun, Pingxiang, Shangrao
Chengdu-Chongqing City Group	Chongqing, Chengdu, Zigong, Luzhou, Deyang, Mianyang, Suining, Neijiang, Leshan, Nanchong, Meishan, Yibin, ''Guang'an, Dazhou, ''Ya'an, Ziyang
Urban Agglomeration on the West Side of the Straits	Fuzhou, Xiamen, Quanzhou, Putian, Zhangzhou, Sanming, Nanping, Ningde, Longyan, Wenzhou, Lishui, Quzhou, Shantou, Chaozhou, Jieyang, Meizhou

Appendix 5: Definition of the samples

	Definition(English)	Definition(Chinese)
labor-intensive	Processing of food from agricultural. products; Manufacture of foods; Manufacture of alcohol, beverages, and refined tea; Manufacture of tobacco; Manufacture of textiles; Manufacture of textiles, clothing; apparel industry; Manufacture of leather, fur, feather and related products; footwear industry; Processing of timber, manufacture of wood, bamboo, rattan, palm, and straw products; Comprehensive use of waste resources; Other manufacturing	农副食品加工业；食品制造业；酒、饮料和精制茶制造业；烟草制品业；纺织业；纺织服装、服饰业；皮革、毛皮、羽毛及其制品和制鞋业；木材加工和木、竹、藤、棕、草制品业；废弃资源综合利用业；其他制造业
capital-intensive	Furniture manufacturing; Manufacture of paper and paper prod; Printing and recorded media; Manufacture of articles for culture, education, art, sports, and entertainment; Processing of petroleum, coking, processing of nuclear fuel; Manufacture of rubber and plastics; Manufacture of non-metallic mineral products; Smelting and processing of ferrous metals; Smelting and processing of non-ferrous metals; Manufacture of metal products; Repair of metal products, machinery and equipment	家具制造业；造纸和纸制品业；印刷和记录媒介复制业；文教、工美、体育和娱乐用品制造业；石油、煤炭及其他燃料加工业；橡胶和塑料制品业；非金属矿物制品业；黑色金属冶炼和压延加工业；有色金属冶炼和压延加工业；金属制品业；金属制品、机械和设备修理业
technology-intensive	Raw chemical materials and chemical products; Medical and pharmaceutical products; Chemical fiber; Manufacture of general purpose machinery; Manufacture of special purpose machinery; Manufacture of automobiles; Manufacture of railway, ships, aerospace and other transportation equipment; Manufacture of electrical machinery and equipment; Manufacture of computers, communication and other electronic equipment; Manufacture of measuring instruments	化学原料和化学制品制造业；医药制造业；化学纤维制造业；通用设备制造业；专用设备制造业；汽车制造业；铁路、船舶、航空航天和其他运输设备制造业；电气机械和器材制造业；计算机、通信和其他电子设备制造业；仪器仪表制造业
high-tech	Manufacture of medical products; Manufacture of railway, ships, aerospace and other transportation equipment; Manufacture of computers, communication and other electronic equipment; Manufacture of measuring instruments; Telecommunications, radio, television, and satellite transmission services; Internet and related services; Software and information technology services; Polytechnic services; Ecological protection and environmental management	医药制造业，铁路、船舶、航空航天和其他运输设备制造业，计算机、通信和其他电子设备制造业，仪器仪表制造业，电信、广播电视和卫星传输服务业，互联网和相关服务业，软件和信息技术服务业，专业技术服务业，生态保护和环境治理业
Non-high-tech	the rest of high-tech	高科技行业之外的行业