



Does return migration with government support drive county economic convergence? Evidence from migrant workers returning to hometown for entrepreneurship in China

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Abstract

This paper employs a quasi-natural experiment of “Migrant Workers Returning to Hometown for Entrepreneurship” policy in China to investigate the impacts of the return migration with government support on economic convergence among China’s counties. Using a county-level dataset from 2001–2020 in China, we found that China’s counties exhibit absolute and conditional β -convergence, and return migration with government support plays a significant role in accelerating this process. Moreover, the heterogeneity test results indicate that such positive effects differ for counties in terms of locations, economic status, industry structure and population mobility characteristics. A credible mechanism derived from this paper suggests that enhancing local employment, facilitating financial development, and promoting innovation level are effective influencing paths through which the return migration reform accelerates the inter-county economic convergence.

Keywords Return migration · County economic convergence · Migrant workers returning to hometown for entrepreneurship

1 Introduction

Ramifications of regional economic inequality have been extensively deliberated in the literature (Fan et al. 2011; Gong 2020; Bhattacharai and Qin 2022), sparking widespread interest in the issue of regional economic convergence (Chen and Fleisher 1996; Patel et al. 2021; Bhattacharai and Qin 2022). The neoclassical growth model claims that given access to the

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same technologies, backward regions could catch up developed ones (Solow 1956). But the data tells a different story. Starting with Barro et al. (1991) seminal work and reinforced by a series of follow-up findings argued that the backward regions fail to grow faster than their richer counterparts, particularly in several developing countries (Ghosh 2008; Gong 2020). These contradictory views have engendered a great deal of papers that emphasized the necessity of government interventions in promoting regional coordinated development (Fan et al. 2011).

Since the reform and opening-up in 1978, a significant number of farmers in China have migrated from their hometowns to seek employment opportunities (Zhao 2002; Démurger and Xu 2011; Zhang et al. 2021). This labor mobility is expected to facilitate the diffusion of technology and promote economic convergence across regions (Zhang et al. 2021). However, the persistent unidirectional flow of labor from backward regions to developed ones exacerbates regional disparities (Zhan et al. 2021). Recent literature focuses on the effects of return migration on less developed regions (e.g., see Peng and Swider 2017; Hao et al. 2020; Zhan et al. 2021). Return migrants, having accumulated wealth, broadened their horizons, and enhanced their skills while working elsewhere, have become key drivers of local economic growth (Peng and Swider 2017; Huang et al. 2022). In this context, many countries have increasingly implemented public policies such as financial rewards and tax incentives to encourage return migration for entrepreneurship as a strategy to boost economic development of underdeveloped regions (Zhang et al. 2021). In China, the government has selected 341 counties across the eastern, central, and western regions for a phased implementation of a pilot policy designed to incentivize migrant workers to return and start business. This policy aims to mitigate regional disparities by supporting economic development in underdeveloped rural areas, thereby promoting coordinated regional development nationwide.

In this paper, we investigate the impact of return migration with government support on inter-county economic convergence in China. Using county-level data from the China County Social and Economic Statistical Yearbook and manually collecting information on the implementation of the “migrant workers returning to their hometown for entrepreneurship” policy from Chinese government documents, we compile a county panel dataset spanning 2001 to 2020. We employ a time-varying difference-in-differences (DID) approach to analyze the effects of this policy. Specifically, we include an interaction term into the convergence regression model based on the work of Barro and Sala-i-Martin (1992) combining the logarithm of counties’ initial per capita GDP with the policy dummy variable. A negative coefficient for this interaction term suggests that the failure to implement the return migration reform diminishes the likelihood of inter-county economic convergence. We find the coefficient is indeed negative. Our empirical methodology is similar to Aghion et al. (2005), who identified a negative interaction term between financial development and countries’ initial per capita GDP, concluding that the likelihood a country converging to the frontier growth rate increases with its level of financial development. In addition, we conducted a series of robustness tests, including propensity score matching DID (PSM-DID), varying the sample period, and excluding contemporaneous policy effects. The results of these robustness tests confirm the robustness of our baseline regression findings.

A substantial body of literature explores the impact of labor migration on regional economic convergence, yet no consensus has been reached. On one hand, labor outmigration from less developed areas can alleviate local pressures on land and employment, increase farmers’ income, and help mitigate the persistent widening of income disparities between these regions and more developed ones (Peng and Swider 2017; Huang et al. 2022). Additionally, labor migration can reduce absolute differences in factor endowments across

regions by adjusting demand structure (Li and Fan 2003; Hao et al. 2020). Consequently, the positive effects of labor outmigration on the economic growth of less developed regions outweigh the adverse effects, thus promoting regional economic convergence (Peng and Swider 2017; Hao et al. 2020). In contrast, prominent economists such as Krugman argue that labor migration contributes to the geographic concentration of economic activities, thereby exacerbating regional disparities (Krugman 1993). Supporting this perspective, Ha et al. (2016) utilized a panel dataset spanning from 1997 to 2011, covering over 100 villages in China, and found that labor migration has increased income inequality. This view is further corroborated by Zhan et al. (2021) and Wei (2022). The severe spatial imbalance in human capital distribution caused by labor migration is considered the fundamental driver of widening regional economic disparities (Zhan et al. 2021), particularly due to the migration of high-skilled labor from less developed to more developed regions (Démurger and Xu 2011).

While existing theories and empirical studies have extensively explored the economic consequences of labor outmigration in underdeveloped regions, there has been comparatively limited focus on the effects of return migration on regional economic convergence. Return migration is a crucial source of human capital that can significantly influence local economic development (Zhang et al. 2021; Huang et al. 2022). By introducing advanced management practices and technical skills, they hold the potential to enhance local industrial structures (Zhang et al. 2021) and improve product competitiveness (Huang et al. 2022). These contributions can lead to increased per capita income and facilitate catch-up development with more developed regions (Démurger and Xu 2011).

This paper constitutes a novel step in three aspects. First, to the best of our knowledge, it is the first to investigate the effects of return migration on county-level economic convergence in the context of China. Taking the return migration reform as a quasi-natural experiment, we find that the return migration with government support accelerates the convergence rate of per capita GDP among Chinese counties. We identify that the improvement of county-level employment, innovation, and financial development are effective mechanisms through which this reform enhances economic convergence. Although existing literature has addressed various aspects of return migration, such as influencing factors (Naito and Zhao 2020), environmental effects (Han and Deng 2023), and economic consequences (Kunuroglu et al. 2015), comprehensive research on its role in fostering coordinated regional development limited. This paper fills this gap by providing a nationwide evaluation of the effects of return migration with government support on county economic convergence, thereby offering a thorough understanding of its role in promoting coordinated regional development.

Second, this paper enhances the literature on regional economic convergence by focusing on county-level dynamics, an area that has been less explored compared to national or provincial levels (see Song 2013; Cavusoglu and Dincer 2015). County-level economies are fundamental to the national and regional economic system (Cai et al. 2022). Coordinated economic development across counties is crucial for upholding social equity, promoting sustainability, and enhancing overall economic and societal well-being (Song 2013). As Luttmer (2005) suggests, jealousy is more likely to be directed at neighbors rather than geographically dispersed compatriots. Therefore, economic convergence across smaller administrative regions, such as counties, is equally as important as convergence at the national level (Glaeser et al. 2009). Our research focuses on economic convergence between counties rather than within individual county, shedding light on the effects of return migration at the inter-county level. This contributes valuable insights to the broader discourse on regional economic convergence and development strategies.

Third, this paper provides much-needed evidence on the impact of government-supported return migration on coordinated regional development in a developing economy. As return migration increasingly becomes a strategic tool for regional development, its implications extend beyond China's borders. The experiences and insights from this study offer valuable guidance for other developing nations grappling with similar challenges related to regional disparities and uneven economic growth. Policymakers globally can draw on these insights to better leverage return migration as a means to address regional disparities and promote more coordinated economic development.

The article proceeds as follows: Sect. 2 outlines the institutional background and theoretical hypothesis. Section 3 details the data and empirical strategy employed in this study. Section 4 presents the estimated effects of return migration with government support on county-level economic convergence. Section 5 concludes.

2 Institutional background and theoretical hypothesis

2.1 Institutional background

In the mid to late 1980s, as China's reform and opening-up policies deepened, increasing numbers of farmers migrated from underdeveloped central and western areas to the more prosperous coastal ones, sparking a profound "migration for work" phenomenon (Zhao 2002; Zhang et al. 2021). This migration reshaped China's economic landscape while widening regional economic disparities. Data from China's seventh national population census reveal a severe imbalance in labor migration at the county level, with a notable population decline in central and western counties and an aggregation in developed eastern regions. Between 2010 and 2020, counties in Anhui, Shanxi, and Gansu saw population decrease of 3.03 million, 2.64 million, and 1.65 million, respectively, while Zhejiang's eastern counties gained 3.04 million.¹ This trend highlights a clear pattern of population convergence towards developed regions.

The severe spatial imbalance in human capital distribution resulting from labor migration is considered the root cause of widening regional economic disparities (Zhan et al. 2021). Addressing how to incentivize the return of migrant workers and foster comprehensive industrial development in central and western regions has become a critical challenge for the Chinese government in its efforts to promote coordinated regional development. The 2008 global financial crisis led to a precipitous contraction in foreign market demand, severely impacting China's labor-intensive manufacturing sector (Huang et al. 2022). Consequently, domestic economic growth slowed, accompanied by significant reductions in corporate investments. In this context, eastern regions experienced a structural shift from labor-intensive to mechanized production processes, reducing employment opportunities for low-skilled workers, lowering migrant workers' wages, and exacerbating the employment challenges faced by surplus rural labor (Huang et al. 2022).

Conversely, industrial development in China's central and western regions is flourishing (Zhang et al. 2021). Encouraging migrant workers to return home for entrepreneurship has become a crucial strategy for alleviating employment pressures in the eastern regions, while also supporting economic transformation efforts (Huang et al. 2022). To facilitate this, the

¹ Data source: Yangtze Industrial Economic Institute.
(Website: <https://idei.nju.edu.cn/aa/e2/c26392a633570/page.htm>).

Chinese National Development and Reform Commission, in collaboration with ten other ministries, issued the “Notice on Approving Pilot Programs Supporting Migrant Workers to Return to Hometowns for Entrepreneurship in 90 Counties, Including Weixian County, Hebei Province” in February 2016. Two additional rounds of pilot program documents were subsequently released in January 2017 and October 2017, further advancing the return migration reform.²

The reform objectives across all three phases of the pilot programs are clearly defined, with a focus on fostering economic growth in underdeveloped counties and addressing key challenges encountered by return migrants engaging in entrepreneurship. These challenges include a lack of suitable venues, inadequate infrastructure, insufficient public services, financing difficulties, and bureaucratic obstacles in licensing procedures. Local authorities are encouraged to align these objectives with the specific conditions of the pilot counties, develop specialized industrial clusters, and explore innovative strategies for poverty alleviation through entrepreneurship. Additionally, they are tasked with facilitating economic transformation, promoting urban–rural integration, and supporting regional growth. The selection criteria for pilot counties have remain consistent across all phases, prioritizing regions with substantial needs for new urbanization and significant labor outflows.

From a reform perspective, while differences exist among provinces, there is a general consistency in focusing on enhancing policy support systems, such as tax incentives and financial subsidies; improving the return migration landscape by promoting e-commerce development and industry integration; and reinforcing infrastructure construction, including entrepreneurial training and the construction of entrepreneurial parks. For instance, in response to national directives, Kaifeng City in Henan Province has implemented seven categories of preferential policies for returnees engaging in entrepreneurship. These policies include subsidies, financial assistance, tax reductions, venue support, and entrepreneurial security.³ In December 2019, the Henan provincial government issued detailed policies for supporting returning migrant entrepreneurs. One provision specifies that Kaifeng City provides subsidies for entrepreneurial training, with 1500 yuan allocated per person-200 yuan for awareness training, 300 yuan for practical training, and 1000 yuan for star-up enterprise training.

“First experimenting and then spreading” is the core thinking of the Chinese government in implementing different policies. By the end of 2020, a total of 341 pilot counties had been established for the return migration reform, as shown in Fig. 1. Figure 2 presents the geographic distribution of these pilot counties, with darker shading indicating regions that have implemented the return migration policy. This map effectively illustrates the widespread implementation of the reform throughout the nation and underscores its importance as a strategic initiative to promote coordinated regional development.

² The details and list of the first batch of pilot counties can be found in the following report: “Notice on Approving Pilot Programs Supporting Migrant Workers to Return to Hometowns for Entrepreneurship in 90 Counties, Including Weixian County, Hebei Province.”.

(Website: https://www.ndrc.gov.cn/xxgk/zcfb/tz/201706/t20170628_963593.html?code=&state=123).

The details and list of the second batch of pilot counties can be found in the following report: “Notice on Approving Pilot Programs Supporting Migrant Workers to Return to Hometowns for Entrepreneurship in 116 Counties, Including Fucheng County, Hebei Province.”.

(Website: https://www.ndrc.gov.cn/xxgk/zcfb/tz/201701/t20170105_962855.html?code=&state=123).

The details and list of the third batch of pilot counties can be found in the following report: “Notice on Approving Pilot Programs Supporting Migrant Workers to Return to Hometowns for Entrepreneurship in 135 Counties, Including Daming County, Hebei Province.”.

(Website: https://www.ndrc.gov.cn/xxgk/zcfb/tz/201711/t20171102_962582.html?code=&state=123).

³ The specific policy regulations can be found on the website: <https://www.henan.gov.cn/2019/12-06/1075076.html>

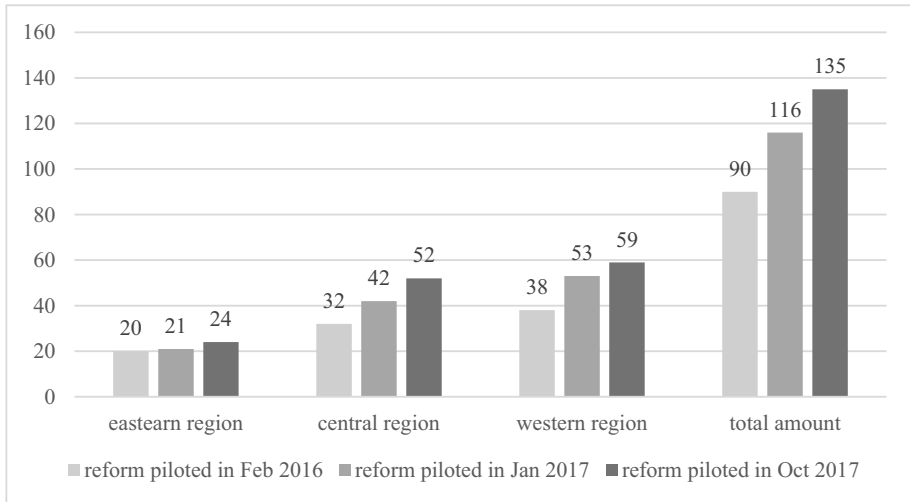


Fig. 1 The changing trend of quantities of the policy piloted counties

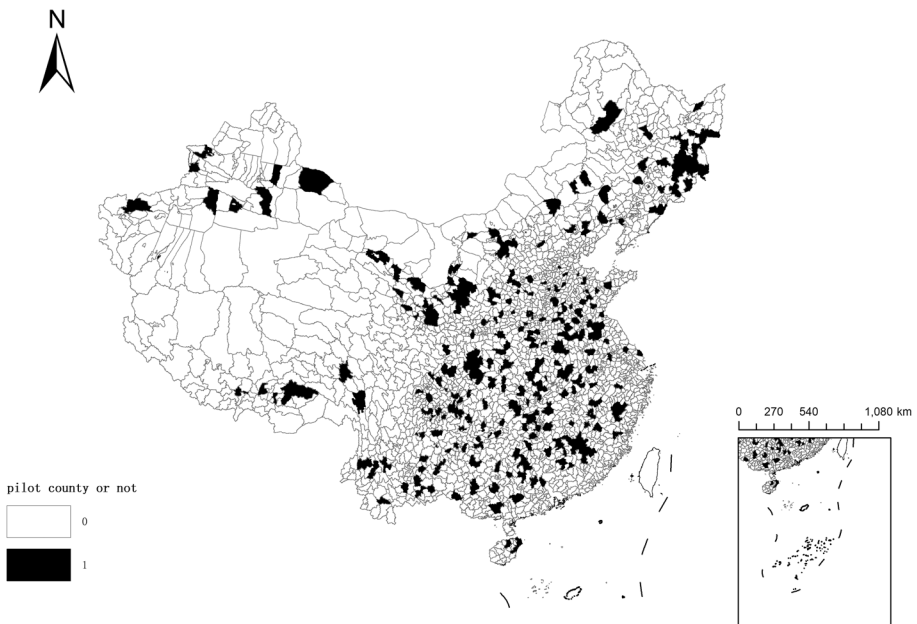


Fig. 2 Geographic distribution of pilot counties of the return migration reform in 2020

2.2 Theoretical hypothesis

The new economic geography theory suggests that economies of scale in core regions boost productivity and wages, attracting labor inflows, while peripheral regions, lacking such advantages, experience population outflows and declining incomes, exacerbating regional economic disparities (Krugman 1993; Kubis and Schneider 2016). Furthermore,

skilled labor intensifies these regional disparities, as highly educated and skilled workers gravitated toward developed regions, while low-skilled laborer, limited by migration costs, has restricted mobility, widening regional disparities (Zhan et al. 2021). This persistent unidirectional labor flow from less developed regions to more developed ones raise output levels in the latter. As a result of cumulative causation, the rich get richer and the poor get poorer, further intensifying regional disparities.

Return migration is accompanied by the re-aggregation of crucial production factors, such as capital and technology, reshaping regional economic landscape and narrowing economic disparities (Kubis and Schneider 2016). In China's dual economic structure, rural migrant workers face various challenges like land scarcity, financial constraints, and inadequate public services. The return migration reform addresses these issues by providing financial assistance to alleviate the startup pressures for return migration. Additionally, it also includes initiatives to improve rural infrastructure and public services, enhancing quality of life. By upgrading transportation, education, and healthcare sectors, the government creates better working and living conditions for rural entrepreneurs, boosting their willingness and capacity to establish businesses locally.

Returning migrants, who acquire advanced skills and management experience during their outside period, can drive the diversified development of local industries and lead to the establishment of numerous small and medium-sized enterprises and individual businesses (Zhang et al. 2021; Huang et al. 2022). The growth in market entities generates significant employment positions, absorbing surplus labor and contributing to local employment (Démurger and Xu 2011). Meanwhile, full employment and stable income growth fundamentally strengthen consumption capacity of farmers. This increased demand complements the domestic supply of mid-to-low-end products, facilitating the absorption of surplus low-end production capacity and driving economic development in underdeveloped areas. Since the implementation of the return migration policy in 2016, China's return-to-hometown entrepreneurship has flourished, with notable impacts on employment. By the end of 2020, over 8.5 million return migrants were engaged in entrepreneurship nationwide, creating jobs for more than 34 million people and emerging as a crucial drivers of local economic growth.⁴

The enhancement of local financial development is another crucial factor influencing the coordinated development of regional economies (Liang 2006). The rising demand for entrepreneurial financing has prompted local financial institutions to focus on supporting small and micro-enterprises. In response, these institutions may innovate by introducing new financial products, such as microloans and startup loans, to support a diverse range of financial services. Additionally, some entrepreneurial projects may attract venture capital, fostering the growth of local venture capital markets and promoting high-tech and high-value-added industries. Simultaneously, local governments may implement financial support policies, including interest subsidies and guarantee services, to assist migrant workers in entrepreneurship. Strengthened financial support enables enterprises within pilot counties to access funds, technology, and market resources more effectively, enhancing their competitiveness and accelerating the catch-up development of these regions.

The return migration policy also significantly facilitates innovation levels in piloted counties. Entrepreneurs who return to their hometowns bring advanced technology and

⁴ Data source: The "Promoting High-Quality Development of Return-to-Hometown Entrepreneurship" themed forum organized by the National Development and Reform Commission (NDRC) in 2020. (Website: <http://gongyi.cctv.com/shuangchuang2020/fgw/fxcy/index.shtml>).

management expertise, which supports the upgrading of local industries (Huang et al. 2022). This knowledge transfer not only improves production efficiency of local enterprises but also stimulates technological and managerial innovations (Hao et al. 2020). Additionally, the diverse entrepreneurial projects initiated by return migration promote innovation and diversification within the local economic structure, ultimately enhancing the resilience of the economy (Zhang et al. 2021). Another advantage of return migration is their familiarity with local market demands and resource endowments, which aids in driving innovation activities based on the actual circumstances of the locality. Government support policies, including financial support, tax incentives, and administrative facilitation, play a crucial role in ensuring that return migration positively impacts county-level innovation. Such public actions reduce barriers to entrepreneurship and stimulate innovative vitality. Based on analysis above, the following hypotheses are proposed:

Hypothesis 1: The return migration reform has positive impacts on county-level economic convergence.

Hypothesis 2: This return migration reform facilitate inter-county economic convergence by enhancing local employment, financial development, and innovation.

3 Methodology

3.1 Economic convergence model

In research on economic convergence in China, Chen and Fleisher (1996) were pioneers in utilizing per capita output data to investigate income convergence among Chinese provinces. Subsequent studies have expanded this inquiry to per capita GDP, energy intensity, and labor productivity across various regions in China (Herrerías and Monfort 2015; Bhattarai and Qin 2022). However, conflicting literature suggests that regional disparities continue to widen (Fan et al. 2011; Gong 2020). For instance, Fan et al. (2011) highlighted significant income disparities between China's coastal and inland regions in 2007, noting that the per capita GDP in inland areas was less than half of that in coastal regions. While previous studies have largely concentrated on regional or provincial levels, Cai et al. (2022) emphasized the pivotal role of county-level economies as the foundational units of the national or regional economic system. Analyzing economic convergence at the county level provides a more nuanced view of local economic diversity compared to provincial or city-level analyses. This perspective aids government officials and policymakers in understanding local economic intricacies and developing more targeted policies.

In the literature on economic convergence, Barro and Sala-i-Martin (1992) introduced two primary approaches to investigate the catch-up process among various economies: σ -convergence and β -convergence. σ -convergence focuses on the dispersion of economic growth rates over time. A decreasing standard deviation in growth rates indicates σ -convergence, while an increasing standard deviation suggests divergence. β -convergence refers to the inverse relationship between the growth rate of per capita income and its initial level. If less developed economies experience higher growth rates, β -convergence is observed. β -convergence can be further classified into absolute β -convergence and conditional β -convergence. Absolute β -convergence assumes that all economies are subject to identical conditions, except for initial capital. In contrast, conditional β -convergence acknowledges that economies experience different rates of technological progress or have varying levels of per capita output. Thus, economic growth is influenced

not only by the initial income level but also by other factors such as saving rates, population growth, and environmental policies.

Both σ - and β -convergence methods are widely used in economic research (see Chen and Fleisher 1996; Gong 2020; Patel et al. 2021). In this study, we employ β -convergence to examine the impact of the return migration reform on economic convergence among counties in China. The specific rationales are as follows. First, the β -convergence method focuses on the negative correlation between county economic growth rates and initial levels. This approach provides a more straightforward insight, indicating that counties with lower initial economic levels tend to experience relatively faster economic growth rates when influenced by the return migration reform, thereby demonstrating a catch-up trend. Second, by incorporating control variables such as human capital, investment levels, and population, the conditional β -convergence approach effectively accounts for regional heterogeneity. This method allows regions to converge towards their own specific equilibrium levels rather than assuming a single, uniform equilibrium for all regions' economic growth. Consequently, the model offers a more realistic and better explains variations in growth rates across regions, even under similar conditions.

Therefore, referring the idea of Barro and Sala-i-Martin (1992), our convergence model is set as follows:

$$growth_{it} = \beta_0 + \beta_1 \times y_{i,t-1} + a_i + a_t + \Gamma' X_{it} + \varepsilon_{it} \quad (1)$$

In the equation, i represents county and t represents year. The variable $growth$ denotes the per capita GDP growth rate of county i in year t . The variable $y_{i,t-1}$ represents the logarithm of per capita GDP of county i in year $t-1$ (the initial economic level). Additionally, β_0 is the constant term, X_{it} represents other control variables reflecting county characteristics, and ε_{it} is the error term. According to Barro and Sala-i-Martin (1992), if the β_1 is significantly negative, it implies that the lower initial levels of per capita GDP are associated with higher economic growth rate. In other words, counties with lower per capita GDP grow faster than their rich counterparties, indicating the presence of inter-county β economic convergence. a_i and a_t represent the fixed effect of county and year, respectively.

Constructing interaction terms is a pivotal method for discussing the issue of economic convergence. A seminal work in this regard is by Aghion et al. (2005), where they investigated the impact of financial development on economic convergence among countries by introducing an interaction term between the level of financial development and initial per capita GDP of countries. Their conclusions and methodology were further validated by Bun and Harrison (2019). Following the widespread adoption of the DID model, this approach has also been extensively applied to estimate policy treatment effects within the DID framework. A notable example is presented by Chen (2017), who constructed an interaction term between the abolition of agricultural taxes and a continuous variable representing government revenue loss (measured by the difference in the ratio of agricultural tax revenue and transfer payments to total government revenue before and after the reform). This interaction term was utilized to examine the impact of tax abolition on the tax enforcement incentives of different county-level governments.

To investigate the effect of the return migration reform on economic convergence at the county level, this paper introduces an interaction term between the return migration policy and the initial per capita GDP of counties into Model (1), constructing a time-varying DID model with both time and individual fixed effects. The baseline model is specified as follows:

$$growth_{it} = \beta_0 + \beta_1 \times reform_{it} + \beta_2 \times y_{i,t-1} + \beta_3 \times reform_{it} \times y_{i,t-1} + a_i + a_t + \Gamma' X_{it} + \varepsilon_{it} \quad (2)$$

where, $reform_{it}$ represents the dummy variable. Specifically, $reform_{it}=1$ if county i is a piloted county under the return migration policy in year t ; otherwise, $reform_{it}=0$. The interaction term in the model captures the differential effect of initial per capita GDP on growth between piloted and non-piloted counties. If the estimated coefficient of this interaction term is significantly negative, it suggests that piloted counties experience a higher rate of economic convergence compared to non-piloted counties. This supports hypothesis that the return migration reform effectively promotes economic convergence in piloted counties.

3.2 Propensity score matching

The stochastic experimental sample is a crucial requirement for the validity of time-varying DID estimates. However, obtaining a completely random sample is challenging, which may lead to potential “selection bias” in Model (2). To address these biases and adhere to the DID model’s requirements, this study employs Rosenbaum and Rubin’s (1983) PSM strategy to control for confounding factors between the treatment and control groups.⁵ The estimation model is outlined as follows:

Step 1: Estimating propensity score. The Probit model is used to estimate the propensity score, defined by the following equation:

$$P_i = \text{probit}(Reform_i = 1 | X_i) = \Phi(X_i) \quad (3)$$

where, P_i represents the propensity score for county i . $Reform_i$ is a dummy variable indicating whether the county i is the piloted county under the return migration reform. X_i is the set of selected county characteristic variables. $\Phi(\bullet)$ denotes a normal distribution function. Equation 3 provides the predicted value of the propensity score.

Step 2: Nearest neighbor matching. For each piloted county i , a non-piloted county j is selected with replacement such that their propensity scores are as similar as possible. This matching is performed according to:

$$j(i) = \underset{j}{\text{argmin}} \left| \hat{P}_j - \hat{P}_i \right|, \forall j \quad (4)$$

This procedure helps maintain similarity between groups and controls for differences in sample characteristics over time. Consequently, the estimated results derived from the samples after PSM will mitigate “selection bias” and “confounding bias” in the time-varying DID Model (2).

3.3 Parallel trend test

Our identification strategy of Model (2) is critically dependent on the parallel trend assumption. This assumption posits that, prior to the policy intervention, the initial economic conditions of counties in the treatment group and the control group exhibit similar trends in their per capita GDP growth rate. Divergence in these trends after the implementation of the return migration reform suggests that observed difference may be attributed to the policy itself rather than pre-existing systematic differences. If the

⁵ The study follows the methodology outlined by Beck et al. (2010), where the treatment group refers to the counties where the return migration policy was piloted, while the control group comprises other counties in the sample.

time-varying DID model satisfies this parallel trend assumption, our estimated results will reflect the effect of the return migration reform on economic convergence among counties.

To test this parallel trend assumption, this paper follows methodologies of Beck et al. (2010) and Chen (2017) by incorporating a series of time-varying dummy variables into Model (2). The model is specified as follows:

$$\begin{aligned} growth_{it} = & \tilde{\beta}_0 + \sum_{T=-6}^{T=-2} \tilde{\beta}_1 \times Reform_i \times d(T) + \sum_{T=0}^{T=4} \tilde{\beta}_1 \times Reform_i \times d(T) \\ & + \tilde{\beta}_0 \times \gamma_{i,t-1} + \sum_{t=-6}^{-2} \tilde{\beta}_{-T} \times Reform_i \times \gamma_{i,t-1} \times d(T) + \sum_{T=0}^6 \tilde{\beta}_{+T} \\ & \times Reform_i \times \gamma_{i,t-1} \times d(T) + a_i + a_t + \Gamma'X_{it} + \varepsilon_{it} \end{aligned} \quad (5)$$

where $Reform_i$ denotes whether the county i is piloted county of the return migration policy. If it is a piloted county, $Reform_i$ equals 1, otherwise equals 0. The parameter $\tilde{\beta}_{-T}$ and $\tilde{\beta}_{+T}$ represent the estimated coefficients for T periods prior to and following the beginning year of the return migration reform, respectively. We exclude the policy lag of one year and estimate the dynamic effects of the return migration policy on county economic convergence for the years specified in Model (3).

4 Empirical results and analysis

4.1 Variables definition

Table 1 provides a comprehensive overview of the variables used in this study, outlining the variable names, corresponding symbols, and their definitions. The variables are classified into dependent, independent, and control variables to reflect their roles in the empirical model.

4.2 Data sources

Our dataset comprises unbalanced panel data covering 2,721 counties over the period from 2001 to 2020. The county-level data used in this study are sourced from the China County Social and Economic Statistical Yearbook (2002–2021), published by the National Bureau of Statistics of China. This comprehensive dataset provides detailed economic information on various county-level administrative units, including GDP, fiscal expenditures, population figures, public services, and the balance of loans from financial institutions.

In addition, data related to the return migration reform were manually collected from official local government web portals. This dataset captures changes in the scope of the policy, along with specific details regarding their implementation periods. The Chinese National Development and Reform Commission issued documents in three distinct batches: February 2016, January 2017, and October 2017, gradually expanding and clarifying the scope of pilot counties involved in the return migration policy.

The sample from the Tibet Autonomous Region is eliminated from this paper due to excessive missing data. Referring to Cai et al. (2022), we winsorize continuous variables at the 1% and 99% level to mitigate the influence of outliers. Additionally, to enhance the

Table 1 Main variables definitions

	Variable name	Symbol	Definition
Dependent variable	Economic growth rate	growth	$(\text{per capital GDP} - P \text{per capital GDP}_{t-1}) / \text{per capital GDP}_{t-1}$
Independent variable	Initial economic level	y	$\ln(\text{per capital GDP}_{t-1})$
	the return migration reform	reform	1 = piloted counties of the return migration reform; 0 = other counties
Control variable	Population growth	n	$(\text{population}_t - \text{population}_{t-1}) / \text{population}_{t-1}$
	Initial population	ln pop	$\ln(\text{population})$
	Saving rate	s	$(\text{resident savings}_t - \text{resident savings}_{t-1}) / \text{country GDP}$
	Ratio of primary student	pri _ stu	the number of primary student / populations
	Ratio of middle school student	mid _ stu	the number of middleschool student / population
	Public medical level	hos	$\ln(\text{number of hospital beds})$
	Fiscal expenditure	fis	government general budget expenditure/country GDP
	Ratio of primary industry	first	first=value-added of primary industry/country GDP
	Ratio of secondary industry	second	second=value-added of secondary industry/country GDP

Table 2 Descriptive statistics

Variables	Symbol	Observations	Mean	Standard deviation	Min	Median	Max
Economic growth rate	<i>growth</i>	37466	0.134	0.130	-0.269	0.126	0.636
Initial economic level	<i>y</i>	37466	9.531	0.998	7.451	9.545	12
The return migration policy	<i>reform</i>	37466	0.030	0.170	0	0	1
Population growth	<i>n</i>	37466	0.001	0.048	-0.224	0	0.244
Initial population	<i>In pop</i>	37466	12.783	0.859	9.903	12.874	14.273
Saving rate	<i>s</i>	37466	0.684	0.332	0.106	0.627	2.009
Ratio of primary student	<i>pri _ stu</i>	37466	0.080	0.027	0.028	0.076	0.160
Ratio of middle school student	<i>mid _ stu</i>	37466	0.054	0.017	0.012	0.053	0.102
Public medical level	<i>hos</i>	37466	6.831	0.928	3.829	6.873	8.879
Fiscal expenditure	<i>fis</i>	37466	0.239	0.220	0.032	0.170	1.364
Ratio of primary industry	<i>first</i>	37466	0.240	0.133	0.002	0.225	0.613
Ratio of secondary industry	<i>second</i>	37466	0.405	0.157	0.080	0.401	0.794

robustness of the results obtained from Model (2), centralization was applied to continuous variable *y* when constructing interaction terms.⁶ The descriptive statistics of these variables used in this paper are presented in Table 2, summarizing the mean, standard deviation, minimum, and maximum values of the dataset.

4.3 Baseline results

Table 3 presents the results of Model (1) in Panel A and Model (2) in Panel B. In Panel A, columns (1) and (2) report the results for the baseline convergence model. The coefficient of γ is significantly different from zero at 1% confidence level, indicating a clear convergence trend in term of per capita GDP across Chinese counties. These results confirm the existence of both absolute and conditional β -convergence among counties in China.

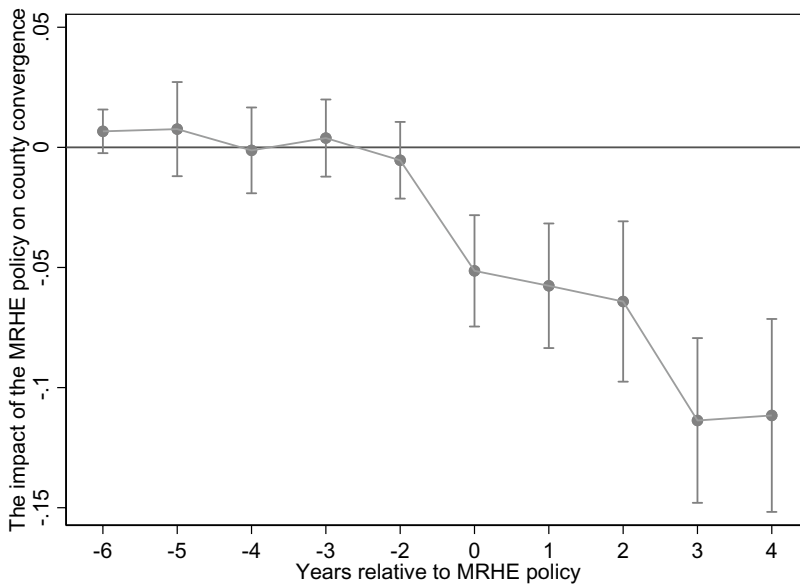
In Panel B, the results of the extended model that includes the interaction term between the return migration policy and initial per capita GDP are reported. In column (1) of Panel B, which excludes control variables, the coefficient of *reform* $\times$ *y* is -9.82%, significantly different from zero at 1% confidence level. This suggests that counties with lower per capita GDP experience faster economic growth due to the return migration policy, pointing towards an accelerated convergence trend. In column (2) of Panel B, after including control variables to address potential confounding factors, the coefficient for the interaction term becomes -7.46%, still significant different from zero at the 1% confidence level. These results indicate that even after controlling for various county-level characteristics, the return migration policy plays a substantial role in promoting inter-county economic convergence, supporting our hypothesis 1.

⁶ Centralization involves subtracting the mean of a continuous variable from each individual value of that variable, resulting in a new variable with a mean of zero. This technique is commonly used to address multicollinearity and simplify the interpretation of interaction terms in regression analysis.

Table 3 The impact of the return migration on economic convergence among counties

	Panel A: Results of Model (1)		Panel B: Results of Model (2)	
	(1)	(2)	(3)	(4)
<i>y</i>	-0.1177*** (0.0038)	-0.3188*** (0.0070)	-0.1162*** (0.0039)	-0.3183*** (0.0070)
<i>reform</i>			0.0978*** (0.0129)	0.0721*** (0.0081)
<i>reform x y</i>			-0.0982*** (0.0118)	-0.0746*** (0.0091)
Control variables	No	Yes	No	Yes
Constant	1.2571*** (0.0367)	6.7539*** (0.2161)	1.2420*** (0.0368)	6.7259*** (0.2167)
<i>N</i>	37466	37466	37466	37466
adj. <i>R</i> ²	0.1935	0.5501	0.1973	0.5523
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

**Fig. 3** Results of parallel trend test based on Model (5)

4.4 Parallel tread test

The dynamic effect of the return migration policy are assessed using Model (5), with the results reported in Fig. 3. This figure illustrates that the estimates of $yx_d(T)$ over time. Before the implementation of the return migration reform, the estimates of $yx_d(T)$

are nonsignificant, indicating no discernible difference in growth trends between piloted and non-piloted counties. However, following the policy intervention, the estimates of $yxd(T)$ becomes significantly negative. The observed opposite trends before and after the policy intervention support the parallel trend assumption, which is a critical requirement for the validity of the time-varying DID method employed in this study.

4.5 Robust checks

4.5.1 PSM-DID estimation

The return migration reform is an exogeneity public policy initiated by China's central or provincial government, and its pilot implementation was not controlled by local governments. However, during the selection process of piloted counties, various factor may have influenced which counties were chosen, leading to potential "selection bias" and "confounding bias" in the time-varying DID model. Such biases can undermine the accurate estimation of the policy's treatment effects (Zhu et al. 2023). To address this concern, we use the PSM method to examine the robustness of baseline results.

After conducting balanced testing and verifying the common support assumption, we perform regression analysis using the matched dataset. Panel A of the Table 4 presents the regression results based on matched dataset. Even after introducing control variables, the coefficients of $reform \times y$ remains significantly different from zero at 1% confidence level. This indicates that the return migration reform continues to promote economic convergence among counties, even after controlling for selection bias. The PSM-DID estimation reaffirms the robustness of our findings.

Table 4 Results of robust tests

	Panel A: Results of PSM-DID		Panel B: Results of period replacement	
	(1)	(2)	(3)	(4)
y	-0.1157*** (0.0039)	-0.3184*** (0.0070)	-0.1352*** (0.0068)	-0.4100*** (0.0112)
$reform$	0.0980*** (0.0129)	0.0721*** (0.0081)	0.0978*** (0.0125)	0.0767*** (0.0077)
$reform \times y$	-0.0981*** (0.0118)	-0.0745*** (0.0091)	-0.1015*** (0.0112)	-0.0792*** (0.0088)
Control variables	No	Yes	No	Yes
Constant	1.2377*** (0.0369)	6.7332*** (0.2158)	1.4823*** (0.0687)	9.4016*** (0.3609)
N	37445	37445	21949	21949
adj. R^2	0.1978	0.5522	0.2007	0.6536
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.5.2 Replacement of sample period

As previously analyzed, the 2008 global financial crisis significantly impacted China's economic landscape, especially affecting labor market and manufacturing sectors (Huang et al. 2022). Labor-intensive industries experienced significant setbacks, and increased automation led to challenges for migrant workers seeking employment. These shifts makes it essential to investigate whether the return migration policy has different effects on inter-county economic convergence under these altered economic conditions.

We restricted our sample to post-crisis data, excluding the pre-crisis period. This adjustment provides a more precise evaluation of whether the policy had a stronger influence on inter-county economic convergence during this stable post-crisis phase. The results are presented in Table 4. In Panel B, the interaction term (*reform* $\times$ *y*) remains significantly negative, demonstrating that the return migration policy continued to accelerate inter-county economic convergence in the post-crisis period. Additionally, the policy's effect is notably more pronounced in this sample compared to the baseline period. The enhanced effect is likely attributed to the stabilization of the economic environment following the crisis. During the financial crisis, factors such as sharp declines in market demand, reduced corporate investment, and rising unemployment may have muted the policy's influence. In contrast, the post-crisis period characterized by a more stable economic environment allows for a clearer manifestation of the return migration policy's influence, thereby making its effects on inter-county economic convergence more evident.

4.5.3 Excluding policy interference during the same period

Multiple policies can simultaneously affect county-level economies and their convergence. To ensure the independent impact of the return migration reform on county-level economic convergence, we account for the influence of other contemporaneous policies that could potentially affect the convergence process (Chen 2017; Huang et al. 2022). Specifically, we introduce interaction terms between the initial per capita GDP (*y*) and contemporaneous policies (*policy*) into Model (2). If the coefficient of the core independent variable (*reform* $\times$ *y*) remains significantly negative, it suggests that the return migration reform plays a key role in accelerating economic convergence among counties, independent of the effects of other policies.

One major contemporaneous policy considered is the Incremental Rewards for Agricultural Lending (IRAL), introduced by the Chinese Ministry of Finance in 2009. This policy aims to incentive county-level financial institutions to increase agricultural lending and direct social capital towards supporting agricultural development. The policy stipulates that starting from 2009, county-level financial institutions that achieve a year-end agricultural loan balance growth rate exceeding 15%, without a corresponding increase in the non-performing loan ratio, would receive a reward from the Ministry of Finance. Both RIAL and the return migration policy aim to enhance rural economic development and promote coordinated regional development. Therefore, excluding the influence of the RIAL policy is of significant importance when assessing the effects of the return migration reform on economic convergence. As shown in Panel A of Table 5, even after introducing interaction terms between the initial per capita GDP (*y*) and contemporaneous policies (*policy*), the coefficient of *reform* $\times$ *y* remains significantly different from zero at 1% confidence level. This indicates that the positive effect of the return migration reform on county-level economies is not confounded by the influence of the RIAL policy.

Table 5 Results of excluding other policy interference

	Panel A: IRAL		Panel B: WHPSC		Panel C: NRFIs	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>y</i>	-0.0901*** (0.0043)	-0.2957*** (0.0072)	-0.3555*** (0.0110)	-0.3441*** (0.0096)	-0.0973*** (0.0101)	-0.4689*** (0.0266)
<i>reform</i>	0.0765*** (0.0129)	0.0585*** (0.0082)	0.0367*** (0.0122)	0.0943*** (0.0122)	0.1375*** (0.0263)	0.0848*** (0.0165)
<i>reform x y</i>	-0.0757*** (0.0119)	-0.0605*** (0.0093)	-0.0637*** (0.0210)	-0.0768*** (0.0118)	-0.1286*** (0.0229)	-0.0782*** (0.0157)
<i>policy x y</i>	-0.0504*** (0.0026)	-0.0571*** (0.0029)			-0.0758*** (0.0104)	0.0056 (0.0121)
Control variables	No	Yes	Yes	Yes	No	Yes
Constant	1.0078*** (0.0407)	6.6255*** (0.2273)	7.8086*** (0.3725)	7.1031*** (0.2776)	1.1782*** (0.1072)	10.9763*** (0.7920)
<i>N</i>	37466	37466	14504	22962	5995	5995
adj. <i>R</i> ²	0.2126	0.5680	0.5538	0.5913	0.2109	0.7073
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In the mid-1980s, the Chinese government initiated large-scale poverty alleviation programs, identifying 258 national-level poverty-stricken counties in 1986. By 2014, the list was updated to include 832 counties, with a focus on reducing regional disparities through fiscal transfers, policy incentives, and project support. These efforts, referred to “Wearing the Hat of Poverty-Stricken Counties” (WHPSC), provided targeted assistance to under-developed areas. To examine the potential influence of WHPSC on the return migration reform’s impact, this study categorizes the sample into poverty-stricken counties (*policy*) and non-poverty-stricken counties (*policy*=0). Columns (1) and (2) of Panel B in Table 5 report the respective effects of the return migration reform on economic convergence for these two categories. The results indicate that the return migration reform has a more pronounced effect on promoting economic convergence in non-poverty-stricken counties. This difference could be attributed to the fact that poverty-stricken counties already receive extensive support through government programs, making them less sensitive to additional policies like the return migration reforms. Non-poverty-stricken counties, on the other hand, benefit more directly from the return migration policy due to the absence of comparable levels of support from other poverty alleviation initiatives.

Since 2006, China has gradually eased its rural financial market access policies, leading to the establishment of new-type rural financial institutions (NRFIs), which have played an increasingly important role in improving financial services at the county level.⁷ One of the key pathways through which the return migration policy promotes economic convergence among counties is fostering county-level financial development. Therefore, to mitigate the potential

⁷ On June 29, 2021, the People’s Bank of China issued the “Opinions on Financial Support to Consolidate and Expand the Achievements of Poverty Alleviation and Promote Rural Revitalization”. (Website: <http://www.pbc.gov.cn/zhengwugongkai/4081330/4406346/4693549/4315049/index.html>).

influence of NRFIs when evaluating the policy's impact, we manually collected data on the establishment dates and locations of NRFIs from 2000 to 2020.⁸ By incorporating the interaction term between the establishment of NRFIs and the initial per capita GDP into the Model (2), we assess whether the presence of these institutions alters the effects of the return migration reform on inter-county economic convergence. Results, shown in Panel C of Table 5, indicate that after controlling the establishment of NRFIs and introducing control variables, the coefficient of the key independent variable (*reform* $\times$ *y*) remains significantly negative at the 1% confidence level. This finding suggests that the promotion effect of the return migration policy on county-level economic convergence is not disrupted by the establishment of NRFIs.

4.6 Who benefits from the return migration policy?

4.6.1 Regional heterogeneity

China exhibits significant regional disparities, with different regions featuring distinct economic, social, and geographic characteristics (Gong 2020; Cai et al. 2022). County-level units in eastern, central, and western regions may vary in terms of the applicability and implementation of policies (Wang et al. 2012). Through regional heterogeneity tests, we can determine whether the effects of the return migration policy are consistent across China's these regions or if there are regional differences.

We divided the sample into counties from the eastern, central, and western regions and performed regression analysis based on Model (2).⁹ The results, presented in Table 6, show that coefficients of *reform* $\times$ *y* for all three groups are negative and statistically significant. This indicates that the return migration reform has a significant positive effect on promoting county-level economic convergence in all regions in China. Notably, the central region exhibits a more pronounced impact, followed by the eastern and western regions. This phenomenon may be attributed to the geographical proximity of the central region to the eastern region, which could incentivize migrant workers from the east to return to the central region for entrepreneurial activities, thereby accelerating economic convergence in the area. Furthermore, the resource endowment of Chinese central region, characterized by abundant land and water resources, may align more favorably with the entrepreneurial needs of migrant workers compared to more challenging natural environment of the western region.

4.6.2 Economic status heterogeneity

The initial economic conditions of regions can potentially influence the impact of public policy (Cavusoglu and Dincer 2015). Some scholars contend that rich regions tend to experience faster economic development, as they attract more resources and opportunities,

⁸ NRFIs mainly includes village banks, small loan companies, and rural mutual cooperatives.

⁹ List of provinces in the eastern region of China: Shandong Province, Jiangsu Province, Fujian Province, Guangdong Province, Hebei Province, Guangxi Zhuang Autonomous Region, and Liaoning Province.

List of provinces in the central region of China: Henan Province, Hubei Province, Hunan Province, Anhui Province, Jiangxi Province, Shanxi Province, Inner Mongolia Autonomous Region, Jilin Province, and Heilongjiang Province.

List of provinces in the western region of China: Shaanxi Province, Gansu Province, Qinghai Province, Ningxia Province, Sichuan Province, Yunnan Province, Guizhou Province, and Xinjiang Uyghur Autonomous Region.

Table 6 Results of regional heterogeneity

	Panel A: Eastern region		Panel B: Central region		Panel C: Western region	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>y</i>	-0.3769*** (0.0153)	-0.3765*** (0.0153)	-0.3505*** (0.0124)	-0.3505*** (0.0123)	-0.3154*** (0.0105)	-0.3153*** (0.0105)
<i>reform</i>		0.0574*** (0.0139)		0.1120*** (0.0129)		0.0321*** (0.0121)
<i>reform x y</i>		-0.0495*** (0.0149)		-0.1223*** (0.0135)		-0.0344** (0.0146)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	8.2933*** (0.5271)	8.3081*** (0.5280)	7.9301*** (0.3885)	7.9200*** (0.3882)	6.2119*** (0.3113)	6.1925*** (0.3118)
<i>N</i>	10786	10786	13377	13377	13303	13303
adj. <i>R</i> ²	0.6203	0.6212	0.5737	0.5795	0.5477	0.5481
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

leading to club convergence among these prosperous areas (Tian et al. 2016). Nevertheless, in the context of coordinated regional development, it is crucial to prioritize the needs of less-developed regions (Mendoza-Velázquez et al. 2020).

To explore the differential effects of the return migration reform based on initial economic conditions, we divided the sample into two groups: high per capita GDP counties and low per capita GDP counties, using the median of per capita GDP as the cutoff. Based on Model (2), we obtained regression results as presented in Table 7. Panel A and B present the effects of the return migration reform on economic convergence in high per capita GDP and low per capita GDP counties, respectively. The findings indicate that in both types of counties, the return migration policy has a significant accelerating effect on inter-county per capita GDP convergence, as demonstrated in columns (2) and (4) of Table 7. Notably, this positive effect is more pronounced in low per capita GDP counties. Several factors may explain this phenomenon. Low per capita GDP counties typically have more developmental potential and resource gaps. The return migration reform helps address these deficiencies by providing targeted support to local entrepreneurs. Additionally, the introduction of new entrepreneurial activities fosters the transfer of advanced management practices and production technologies, which boosts overall productivity and facilitates rapid catch-up growth (Zhan et al. 2021; Wei 2022). Low per capita GDP counties are more likely to benefit from the technological spillover effects stimulated by the return migration reform (Huang et al. 2022).

4.6.3 Industry structure heterogeneity

Industry structure is one of the critical factors influencing economic development (Fan et al. 2011; Huang et al. 2022), and disparities in industry structure across counties can influence the effectiveness of the return migration reform. We utilize the ratio of the value added of the tertiary sector to that of the secondary sector at the county level to measure industrial upgrading. Counties are categorized into two groups: those with a higher degree of industrial upgrading (above the mean) and those with a lower degree of industrial upgrading (below the mean).

Table 7 Results of economic status heterogeneity

	Panel A: High-per capita GDP		Panel B: Low-per capita GDP	
	(1)	(2)	(3)	(4)
<i>y</i>	-0.4180*** (0.0121)	-0.4170*** (0.0120)	-0.3836*** (0.0110)	-0.3835*** (0.0110)
<i>reform</i>		0.0801*** (0.0113)		-0.0288 (0.0184)
<i>reform x y</i>		-0.0687*** (0.0000)		-0.2658*** (0.0000)
Control variables	Yes	Yes	Yes	Yes
Constant	8.6227*** (0.3565)	8.5853*** (0.3558)	7.9239*** (0.4843)	7.9043*** (0.4843)
<i>N</i>	19184	19184	18203	18203
adj. <i>R</i> ²	0.6789	0.6805	0.5295	0.5302
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8 presents the effects of the return migration reform on economic convergence in these two groups. Panel A focuses on counties with higher degrees of industrial upgrading, while Panel B examines those with lower degrees. The results show that the return migration policy significantly promotes per capita GDP convergence in both groups. However, the promotion effect is more pronounced in counties with higher levels of industrial upgrading. This heightened effect may stem from the more diverse industrial structure and higher technological content in counties with greater industrial upgrading. These counties are better equipped to attract highly educated and skilled talent, whose contributions enhance local

Table 8 Results of industry structure heterogeneity

	Panel A: Exceeding the mean		Panel B: Below the mean	
	(1)	(2)	(3)	(4)
<i>y</i>	-0.3521*** (0.0116)	-0.3510*** (0.0116)	-0.3524*** (0.0094)	-0.3524*** (0.0094)
<i>reform</i>		0.0614*** (0.0141)		0.0790*** (0.0110)
<i>reform x y</i>		-0.1005*** (0.0169)		-0.0628*** (0.0115)
Control variables	Yes	Yes	Yes	Yes
Constant	7.0474*** (0.3400)	7.0048*** (0.3391)	7.5401*** (0.2928)	7.5111*** (0.2931)
<i>N</i>	12453	12453	24823	24823
adj. <i>R</i> ²	0.5897	0.5920	0.5744	0.5761
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

competitiveness and innovation capabilities. This influx of talent enables the region to leverage its industrial strengths and pursue catch-up growth relative to high-income counties.

4.6.4 Migration direction heterogeneity

Counties with net population inflows and outflows may exhibit different economic characteristics and development statuses (Krugman 1993; Kubis and Schneider 2016). For instance, counties experiencing net population outflows often grapple with issues such as population aging and decline (Zhan et al. 2021), while counties with net population inflows may face challenges related to rapid population growth and urbanization (Ha et al. 2016). Consequently, the return migration reform may have varying effects on the economic convergence depending on the county's population flow dynamics.

In this study, net population flow is measured by the difference between a county's year-end registered population and its year-end total population. A negative value indicates net population inflow, while a positive value signals net population outflow. Table 9 presents the impact of the return migration reform on economic convergence across counties with net population inflows (Panel A) and outflows (Panel B). The results show that the key independent variable (*reform* $\times$ *y*) is negative and significant at the 1% level for both groups, indicating policy's positive effects on county-level economic convergence. Notably, the accelerating effect is more pronounced in counties with net population outflows. This is attributed to the fact that these counties often face challenges such as talent loss and population aging, leading to relatively scarce human resources. The return of labor helps to address these shortages, improve the quality of the local workforce, and thereby promote catch-up development relative to more developed counties.

Table 9 Results of migration direction heterogeneity

	Panel A: Net inflow		Panel B: Net outflow	
	(1)	(2)	(3)	(4)
<i>y</i>	-0.3331*** (0.0087)	-0.3329*** (0.0087)	-0.3469*** (0.0104)	-0.3454*** (0.0104)
<i>reform</i>		0.0530*** (0.0138)		0.0789*** (0.0102)
<i>reform</i> $\times$ <i>y</i>		-0.0553*** (0.0144)		-0.0797*** (0.0102)
Control variables	Yes	Yes	Yes	Yes
Constant	5.5901*** (0.3034)	5.5879*** (0.3039)	7.7717*** (0.3486)	7.7132*** (0.3491)
<i>N</i>	23624	23624	13639	13639
adj. <i>R</i> ²	0.5340	0.5347	0.6177	0.6209
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.7 Influencing mechanisms

To clarify the influencing mechanism through which the return migration reform promotes inter-county economic convergence in China, this paper introduces the mediating variables into Model (2). The specific model is specified as follows:

$$factor_{it}^j = \zeta_0 + \zeta_1 \times reform_{it} + a_i + a_t + \Gamma'X_{it}\epsilon_{it} \quad (6)$$

$$growth_{it} = \delta_0 + \delta_1 \times reform_{it} + \delta_2 \times \gamma_{i,t-1} + \delta_3 \times reform_{it} \times \gamma_{i,t-1} + \delta_4 \times factor_{it}^j + a_i + a_t + \Gamma'X_{it} + \epsilon_{it} \quad (7)$$

where $factor_{it}^j$ represents the mediating variable j for county i in year t . The fundamental logic of the influencing mechanism model is that the independent variable will impact dependent variable through several mechanisms, denoted as $factor_{it}^j$. This implies the accelerating convergence effects might be partially or fully mediated by $factor_{it}^j$ resulting from the return migration reform. If the coefficient of $reform_{it}$ in Model (6) is significant and the coefficient of $reform_{it} \times \gamma_{i,t-1}$ becomes insignificant or smaller compared to the coefficient reported in Table 3, it indicates that the mediating variable $factor_{it}^j$ plays a mediating role in the observed effects.

This paper employs the ratio of non-agricultural employees to the total employed population to measure county employment (*emp*). The level of financial development (*finan*) is measured by the year-end per capita loan balance of financial institutions in each county. Additionally, county-level innovation (*inno*) is gauged by the number of domestic invention patents granted per ten thousand people, based on patent data collected from the China National Intellectual Property Administration's website for the period 2001–2020.

Table 10 presents the results of the mediating effects test for employment, financial development, and innovation in Panels A, B, and C, respectively. In columns (1), (3), and (5), the coefficient for *reform* is positive and statistically significant, indicating that the return migration policy effectively promotes county-level employment, financial development, and innovation. In columns (2), (4), and (6), which incorporate the mediating variables, the absolute value of the coefficient for key independent variable (*reform* $\times$ *y*) is reduced compared to the coefficient reported in Table 3. This reduction suggests that the effects of the return migration policy on county-level economic convergence are partially mediated through improvement in employment, financial development, and innovation.

5 Conclusion

How to achieve inter-county economic convergence is a critical issue for economists and policymakers, particularly in developing economies experiencing rapid growth coupled with significant regional disparities. A comprehensive evaluation of the impact of return migration with government support on inter-county economic convergence could provide a beneficial supplement for location-oriented policy assessments in China.

Taking the phased implementation of the “Migrant Workers Returning to Hometown for Entrepreneurship” policy in China as a quasi-natural experiment, and using the panel data from counties spanning the period 2001–2020, this study employs the time-varying DID methodology and PSM-DID model to investigate the effects of return migration with government support on the inter-county economic convergence in China. Additionally, we

Table 10 Results of influencing mechanisms

	Panel A		Panel B		Panel C	
	(1) <i>emp</i>	(2) <i>growth</i>	(3) <i>finan</i>	(4) <i>growth</i>	(5) <i>inno</i>	(6) <i>growth</i>
<i>reform</i>	0.0222** (0.0099)	0.0724*** (0.0121)	0.0406* (0.0225)	0.0702*** (0.0079)	0.0764** (0.0341)	0.0822*** (0.0108)
<i>y</i>		-0.3364*** (0.0094)		-0.3424*** (0.0068)		-0.3627*** (0.0108)
<i>reform x y</i>		-0.0619*** (0.0124)		-0.0744*** (0.0086)		-0.0733*** (0.0123)
<i>emp</i>		0.0583*** (0.0164)				
<i>inno</i>						0.0098*** (0.0025)
<i>finan</i>				0.0489*** (0.0029)		
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.9808*** (0.2438)	6.4371*** (0.3147)	22.3113*** (0.8410)	6.1216*** (0.2179)	-1.0543 (1.2071)	8.3238*** (0.2813)
<i>N</i>	25674	25674	37442	37442	19385	19385
adj. <i>R</i> ²	0.9060	0.5288	0.9300	0.5656	0.5177	0.6168
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

explore how these effects vary across different regions, economic status, industry structures, and population mobility characteristics. Our findings indicate that counties in China exhibit both absolute and conditional β -convergence trends, with the return migration reform accelerating this convergence process. This stimulating effect is more pronounced in piloted counties located in central regions, those with low per capita GDP, counties with higher degree of industrial upgrading, and those experiencing population outflow. Furthermore, our mediation effect analysis reveals that the enhancement of county employment, financial development, and innovation level are effective mechanisms through which the return migration reform fosters the inter-county convergence.

Based on these key findings, we propose the following policy recommendations to enhance the positive impact of the return migration reform on county-level economic convergence. (1) Advancement of the return migration reform. While our results suggest that the “Migrant Workers Returning to Hometown for Entrepreneurship” reform has a positive effect on inter-county economic convergence, further expansion of this initiative should be done cautiously. Pilot programs could be gradually extended to additional counties, with careful monitoring and evaluation of regional contexts. Alongside this, the government should focus on improving the quality of support, including targeted entrepreneurial guidance, funding, and vocational training, to better align with the unique needs of different regions. (2) Regional differentiation. Considering that the central regions appear to benefit most from the return migration policy, targeted support for these areas should be strengthened. However, it is important to tailor this support to

the specific economic structures and development levels of these regions. This could include more refined industry policies and training programs. (3) Targeted support for specific counties. Considering the more pronounced impact of the return migration policy on counties with lower per capita GDP, more advanced industrial planning, and net population outflows, it is recommended that the government implement differentiated policy support for various counties. For instance, in counties with lower per capita GDP, the government could consider increasing financial subsidies and providing more technical assistance. However, it is important to remain mindful of the resource constraints and potential trade-offs that such policies may entail, particularly in the face of evolving economic conditions.

Although this study has yielded important findings, there are several limitations warrant further discussion. First, the constraints of the sample data should be acknowledged. The study utilizes county-level panel data spanning from 2001 to 2020, and while this provides a relatively long time frame, it may not fully capture the long-term effects of the policy. The lagged effects of the return migration policy implementation might only become apparent beyond the data's time range. Moreover, due to data availability issues, some counties' economic, demographic, and industrial data are incomplete, which could affect the precision of the analysis. Future research could address this limitation by extending the study period and collecting more comprehensive data to better assess the policy's long-term impact. Second, there are limitations in the study's perspective. The focus is primarily on the impact of the return migration policy on economic convergence at the county level, using counties as the main unit of analysis, while the complex interactions between urban and rural areas have not been fully accounted for. For instance, the interplay between urbanization and rural labor returning for entrepreneurship, as well as regional differences in industrial structure, may introduce significant heterogeneity in the policy's effects. These unexamined factors could have broader implications for economic convergence and should be explored in future research.

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Authors' Contributions Miss Deng contributes to the conceptualization, data curation, methodology, and funding acquisition. Professor Lyu is responsible for manuscript editing, methodology, and investigation.

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Data Availability The dataset used during the current study available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Competing Interests The authors declare no competing interests.

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