Paired Assistance: Policy Rationale and Economic Performance as Illustrated by Xizang and Xinjiang

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Abstract: *This study highlights the changing priorities of China's paired assistance throughout the past decades, as well as its theoretical implications and economic growth effects for recipient regions. Using panel data from 32 prefecture-level cities from 1990 to 2020, this study uses the multiperiod difference-in-differences approach to examine how paired assistance has contributed to economic growth in Xizang Autonomous Region and Xinjiang Uygur Autonomous Region. The findings indicate that, first, the implementation of the paired assistance policy has boosted economic growth in Xizang and Xinjiang. Second, paired assistance has stimulated economic growth in recipient communities by improving infrastructure. Third, paired assistance has contributed to economic growth in recipient communities by providing improved public services such as education and healthcare. Improvements to public services have a relatively smaller indirect effect in short term than infrastructure development on economic growth. Yet both education and healthcare are crucial to people's quality of life in recipient communities. This paper has refined and broadened research on the effects of paired assistance, providing preference for future policymaking.*

Keywords: *Chinese characteristics, paired assistance, multiperiod difference-in-differences, assessment of policy effects*

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1. Introduction

China has established the paired assistance policy, which designates rich cities and regions to help less developed ones. The successful implementation of this policy initiative demonstrates the strength of socialism with Chinese characteristics and serves as an institutional solution to meet the collective interests of the country during its modernization journey (Zhao, 2011; Zhong, 2013; Li, 2015; Li, 2019). It represents a harmonious integration of the interests of the Chinese national community with the institutional supply of socialism with Chinese characteristics.

Since the founding of the People's Republic of China in 1949, the CPC Central Committee has prioritized socio-economic development in ethnic regions such as Xizang and Xinjiang. Chinese

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policymakers have spent decades working to create a comprehensive framework for paired assistance to support socio-economic development in Xizang Autonomous Region and Xinjiang Uygur Autonomous Region (Xizang and Xinjiang for short thereafter). China has deployed national resources to support recipient communities under this policy strategy. This initiative is unprecedented in its duration, extent, and investment. The first stage of implementing paired assistance was initiated by the CPC Central Committee at the Third National Symposium on Work in Xizang in July 1994[1], which established the policy approach of "division of responsibilities among regions for paired assistance with periodical rotations". A large-scale aid campaign for Xinjiang was formally launched in March 1996 after the Central Politburo Standing Committee convened a meeting on socio-economic stability in the region and released the *Highlights of the CPC Central Committee's Meeting on Stability in Xinjiang* (No. 7 Document) (Hu, 2014). At the Seventh National Symposium on Work in Xizang, General Secretary Xi Jinping expounded the Party's strategy for the governance of Xizang in the new era, and raised the following expectations: "The CPC Central Committee has followed a consistent policy to mobilize resources across the nation to support Xizang, and we must adhere to this policy on a long-term basis and conscientiously summarize experiences to bring about a new situation in the assistance to Xizang".[2] At the Third National Symposium on Work in Xinjiang, General Secretary Xi Jinping stated, "We must adhere to paired assistance to Xinjiang on a long-term basis and improve the overall results".[3] At the 20th CPC National Congress, General Secretary Xi Jinping remarked, "We should strive to realize people's expectations for a better life as the very purpose of our modernization drive, maintain and promote social equality and justice, promote common prosperity for all, and prevent the wealth gap".[4] In the new era, paired assistance to Xizang and Xinjiang should serve the goal of common prosperity once a moderately prosperity society has been built in all aspects. There have been several practical experiences and theoretical research outcomes on paired research as a public policy, but no systematic and in-depth analysis has been conducted to investigate the method and mechanism for the paired assistance policy to achieve the desired effects.

2. Evolving Rationale for the Paired Assistance Policy

For millennia, the Chinese people have established a cultural and civilizational community, confronting natural calamities with a distinctive philosophy of mutual aid that has ingrained itself in the Chinese national character. Extensive exploration and theoretical research have led to a wealth of Chinese practices involving paired assistance.

2.1 Period of Socialist Revolution and Construction: Initial Exploration of Paired Assistance

Upon the founding of the People's Republic of China in 1949, the Chinese government adopted a planned economic system for nationwide resource allocation and a highly centralized mode of poverty assistance to address the issues of livelihoods and stability for border regions. According to the situation following the completion of socialist transformation in China, the Eighth CPC National Congress modified its assessment of China's principal social contradiction to "that China's underdeveloped social production was unable to meet the ever-growing material and cultural needs of the people". Back then, the principal task for people across the country was to develop social productive forces, achieve

[1] In 1994, the CPC Central Committee and the State Council held the Third Symposium on Work in Xizang in Beijing. See the Party Literature Research Office of the CPC Central Committee and the CPC Committee of the Xizang Autonomous Region (2005).

[2] Xi Jinping's speech at the Seventh National Symposium on Work in Xizang: Comprehensively Implementing the Party's Tibetan Governance Strategy and Building a United, Prosperous, Civilized, Harmonious and Beautiful Socialist Modern New Xizang, https://theory.gmw.cn/2020-09/10/content_34174885.htm.

[3] Xi Jinping's speech at the Third National Symposium on Work in Xinjiang, https://www.gov.cn/xinwen/2020-09/26/content_5547383.htm.

[4] Xi Jinping: Raising High the Great Banner of Socialism with Chinese Characteristics and Striving to Build Socialist Modernization in All Respects: Report to the 20th CPC National Congress, https://www.gov.cn/xinwen/2022-10/25/content_5721685.htm.

national industrialization, and take steps to meet people's growing material and cultural needs[5]. Under this principal social contradiction, the central government called upon all sectors to support agriculture, which marks the inception of paired assistance at the local level. Some localities have developed a paired assistance mode characterized by a "combination of industry and agriculture, mutual assistance between urban and rural areas, and collaboration between industrial counties and communes". In an editorial subsequently published on March 20, 1960, *Shanxi Daily* fully recognized the contract-based relationship of paired assistance between Shanxi Jingwei Textiles Machinery Factory and Zhangqing Shuguang Commune for the supplies of agricultural machinery, implements, and technicians, as well as the construction of factories since the late 1950s. This marks the first time that paired assistance was put into practice[6]. Paired assistance to Xizang has focused on the improvement of living conditions through the implementation of a series of policy preferences, the provision of fiscal subsidies, special allowances, and infrastructure investment to Xizang, as well as human, material, financial, and technological support from various departments and prosperous provinces and municipalities. The subsequent socio-economic development in Xizang has been made possible by the construction of the Qinghai-Xizang and Kanding-Xizang highways, Dangxiong Airport, and other infrastructure projects, as well as the development of banks, telecom and postal services, trade, and other economic sectors. In 1962, Minister of the former Agriculture and Land Reclamation Ministry, Wang Zhen, and the Shanghai municipal government appealed to Shanghai's educated youth to assist Xinjiang's development, thereby facilitating the transfer of talent to Xinjiang (Yi, 2019). Moreover, the central government relocated some enterprises and industries from prosperous regions in eastern and southern China to Xinjiang, which to some extent transformed Xinjiang's backward status (Hu, 2014).

2.2 New Era of Reform, Opening up and Socialist Modernization: Development of Paired Assistance

In the post-reform era, the Party was faced with the principal task of continuously exploring a correct path of Chinese socialism and liberating and developing social productive forces in order for the people to escape poverty and achieve prosperity, thereby creating vibrant institutional assurances and material conditions for the great rejuvenation of the Chinese nation[7]. The CPC Central Committee has adopted the basic principle of "adhering to economic development as the central task", establishing the goal of building a moderately prosperous society in all respects. In October 1984, Comrade Deng Xiaoping noted at the Third Plenum of the Advisory Committee of the CPC Central Committee that "when people's living standards reach moderately prosperous levels, their attitude will be different. Material life is the foundation, and when people's material living standards improve and their level of education increases, their attitude will change a lot".[8] The masses started to call for a higher level of satisfaction amid industrial development and an increasing material abundance in the reform and opening-up era. The Sixth Plenum of the 11th CPC Central Committee made a new assessment of the principal social contradiction as the one between the "ever-growing material and cultural needs of the people versus backward social production". The central government took steps to institutionalize paired assistance after initial experiments. In July 1979, the report delivered at the National Frontier Protection Conference by Ulanfu, endorsed by the CPC Central Committee, unequivocally called for paired assistance to ethnic border regions[9]. Under the principal social contradiction, the paired assistance policy became officially

[5] Resolution of the CPC Central Committee on the Major Achievements and Historical Experience of the Party over the Past Century, http://www.gov.cn/xinwen/2021-11/16/content_5651269.htm.

[6] "Factory-commune assistance: On the new situation of industrial support to agricultural technological renovation", Shanxi Daily, March 20, 1960.

[7] Resolution of the CPC Central Committee on the Major Achievements and Historical Experience of the Party over the Past Century, http://www.gov.cn/xinwen/2021-11/16/content_5651269.htm.

[8] Selection of Important Documents since the 12th CPC National Congress (Vol.2), page 80.

[9] Selected Ethnic Policy Documents of the State Ethnic Affairs Commission (1979-1984), page 242-243.

established at the national level, giving rise to a new paradigm of multitiered, extensive, and in-depth cooperation. Since the 1990s, the central government has made new arrangements to broaden assistance to Xizang and Xinjiang from the economic sector to the cultural, educational, healthcare, and other social sectors. In particular, the central government announced 43 projects and 62 projects to celebrate the 20th and 30th anniversaries of the Xizang Autonomous Region, which include not only infrastructure projects such as roads and communications but also culture and tourism projects, the latter of which accounted for 65%. These projects have increased Xizang's tourism capacity and significantly improved education and healthcare for the local people (Li, 2000). In addition, Xinjiang has also made public welfare the top priority for paired assistance (Yang, 2011; Xin and Zheng, 2023).

2.3 New Era for Socialism with Chinese Characteristics: Broadening and Deepening Paired Assistance

The 18th CPC National Congress has unveiled a new era for socialism with Chinese characteristics. After accomplishing the first centennial goal, the Party set out on a new journey towards the second centennial goal and the great rejuvenation of the Chinese nation. According to the *Resolutions of the CPC Central Committee on the Major Achievements and Historical Experiences of the Party over the Past Century*, the principal social contradiction for China in the new era has become the one between people's growing needs for a better life and unbalanced and inadequate development. We must adhere to the development philosophy of putting people first, establishing whole-process democracy, advancing people's all-round development, and striving for more substantive progress in delivering common prosperity for all[10]. In this shift of principal contradiction for Chinese society, we must respect and give greater play to the initiative of people in leading the masses to meet their needs for a better life (Gao and Hu, 2018). In this period, paired assistance has evolved into extensive two-way exchanges in various domains and at various levels. Given the distribution of natural resources and the reality of unbalanced and insufficient socio-economic development across regions, the paired assistance policy has played an important role in stimulating socio-economic development in recipient localities, enhancing local development capabilities, reducing institutional dependence, and meeting people's needs for sustainable development. The shift of financial and project priorities to public welfare and social programs, agriculture, livestock, and infrastructure has ensured that the great endeavor towards common prosperity continues to drive people's all-round development following China's completion of building a moderately prosperous society in all respects.

3. Literature Review, Theoretical Analysis and Research Hypothesis

3.1 Literature Review

Paired assistance is both a practical and theoretical question. Scholars have covered all the in-depth research on paired assistance and come up with different definitions. Some defined paired assistance in the sense of international aid (Jin, 2010), while others defined it as a political bequeathment (Li, 2015) and a new intergovernmental relationship (Yang and Li, 2018). Paired assistance is carried out in the form of horizontal transfer payments (Xu and Liu, 2018) and represents a policy mode with Chinese characteristics (Huang et al., 2022; Wang, 2022). Some scholars classified paired assistance into fiscal assistance, project assistance, and talent assistance (Jin, 2010), while others classified it into five types, including comprehensive assistance for special ethnic regions, compensatory assistance to regions of major project implementation, developmental assistance for poor regions, special assistance to regions with less-developed public services, and emergency assistance to disaster-hit areas (Li, 2019).

[10] Resolution of the CPC Central Committee on the Major Achievements and Historical Experience of the Party over the Past Century, http://www.gov.cn/xinwen/2021-11/16/content_5651269.htm.

Despite an abundance of research results on the concept, origins, and explanations of paired assistance, academia has yet to provide a science-based and in-depth analysis and evaluation of the effectiveness of paired assistance. Some scholars have summarized the remarkable poverty reduction achievements of paired assistance under the Chinese mode in the new era (Wang, 2022; Wang, 2021a), while others have demonstrated the health-improving and poverty-reducing effects of paired assistance for healthcare (Wang, 2021) and the poverty-reducing effects of paired assistance for education (Zhang, 2018) and technology (Li, 2020). As for the methodology for evaluating the effectiveness of paired assistance, some scholars evaluated paired assistance from Jiangsu Province to localities under the Yili Prefecture from the perspective of intergovernmental relations theory (Ji et al., 2012) based on individual case studies. Regarding empirical research, Wang (2021b) tested the economic effect of paired assistance to Xizang using the difference-in-differences (DID) method and conducted a heterogenous analysis for localities with uneven development levels across Xizang. Through an analysis of the mechanism of paired assistance, Zhao et al. (2020) evaluated the policy effect of paired assistance using the two-way fixed effect model with interprovincial panel data from 1996–2017. Other scholars evaluated the effect of paired assistance from a healthcare perspective (Ge et al., 2014; Chen et al., 2009). Xie (2013) conducted a qualitative assessment of the current status, problems, and countermeasures of paired assistance for higher education. Using a two-way fixed-effect model, Cao and Ha (2022) estimated the effects of paired assistance on recipient institutions' faculty development, R&D, and social service capabilities. Based on the case study approach, Xie and He (2020) conducted an analytical comparison of Changdu and Linzhi to examine the policy efficacy of paired assistance to Xizang from the perspective of public policy implementation.

Based on the above analysis, previous research has focused and developed extensive research findings on what paired assistance is and why. There has been an abundance of research findings on the conceptual implications, origin, and explanation of paired assistance. What is missing, however, is a scientifically sound and thorough analysis and evaluation. Scholars have come to realize the importance of policy evaluation for paired assistance and have carried out research on its effects. Most methodologies for evaluating the paired assistance policy focused on dissecting case studies. Some quantitative research using the one-way analysis of variance (ANOVA) method has compared the economic performance of recipient localities before and after policy implementation, but strict empirical analysis has yet to be carried out for a science-based assessment of causality between paired assistance and socio-economic development in recipient localities. Some scholars have investigated paired assistance to Xizang or Xinjiang using the DID method without dissecting the process and transmission mechanism of policy effects. Hence, this paper systematically reveals the historical background and evolving rationale of paired assistance in China, identifies the historic missions of paired assistance over different periods of time, and uncovers the theoretical implications and mechanism by which paired assistance promotes economic growth in recipient localities. On this basis, we proceed to investigate the relationship of causality between China's paired assistance policy and economic growth performance in Xizang and Xinjiang, using a multiperiod DID method.

3.2 Theoretical Analysis and Research Hypothesis

In this paper, we provide a further analysis of the theoretical mechanism by which paired assistance contributes to economic growth in Xizang and Xinjiang. Since the adoption of the paired assistance policy, designated localities have influenced socio-economic development in Xizang and Xinjiang under direct and indirect effects through aid in infrastructure, education, and healthcare, as well as the input of human, physical, and financial resources (see Figure 1). The direct effects are manifested in the economic growth boosted by the input of production factors such as human resources, capital, and technology. The indirect effects refer to the improvements in infrastructure, education, and healthcare under paired assistance schemes, which contribute to economic growth in recipient localities.

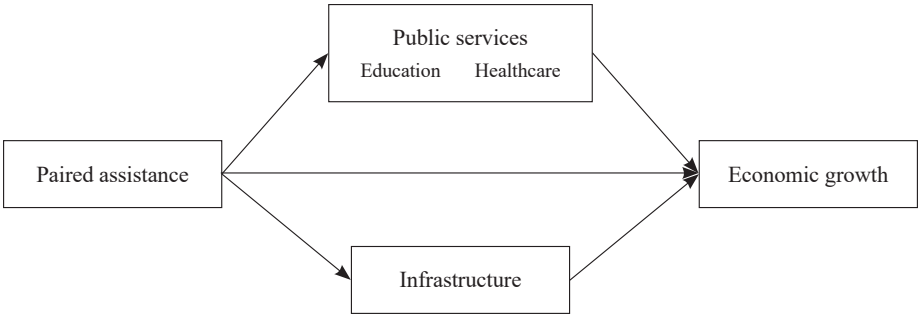

Figure 1: Mechanism by Which Paired Assistance Contributes to Economic Growth

On one hand, paired assistance increases productivity and economic growth in Xizang and Xinjiang by optimizing the allocation of production factors such as labor, capital, technology, and management. On the other hand, paired assistance contributes to economic growth by improving the economic environment and business climate in Xizang and Xinjiang, thereby lowering the cost of transactions for economic entities and inspiring corporate dynamism. From the three aspects of talent support, financial aid, and economic projects, Yang (2011) analyzed the policy effects of paired assistance to Xinjiang from the three aspects of talent support, financial aid, and economic projects, pointing to the consequent improvement of local governance and the increase of essential public services and infrastructure that drive economic growth and endogenous development potential in ethnic regions. Based on a case study of Jiangxi Province, Zheng (2012) found that paired assistance had increased the self-development capabilities of ethnic regions while supporting local economic growth. According to Liu and Xu (2017), investments in public and industrial infrastructure in Xinjiang from 19 provinces and autonomous regions in China's central and eastern regions may boost economic growth through investment in the short run and raise labor productivity through economies of agglomeration to boost incomes, add jobs, and speed up economic growth in the long run. In this sense, paired assistance generates significant economic growth effects. Xu (2022) conducted a comparative study on interprovincial paired assistance and central government transfer payments, demonstrating the regional productivity gains from fiscal transfer payments. Hence, we propose Hypothesis 1.

Hypothesis 1: Paired assistance policy is conducive to economic growth in recipient localities.

The economic growth effects of transportation infrastructure have been extensively researched in economics. Jin (2022) considered that a complete and advanced transportation network consisting of highways, railways, civil aviation, communications, and other infrastructure is essential to secure safe and smooth economic performance and national wealth growth. The completion of 43 and 62 paired assistance projects in Xizang in two waves has uplifted people's living standards through better transportation, communications, and infrastructure. Transportation and information infrastructures are the foundation of economic development and prerequisites for people to benefit from agriculture, industry, and services. Scholars have covered all in-depth research and arrived at similar views on the importance of transportation and information infrastructures to economic development (Huang et al., 2020; Zhao and Cha, 2015). Based on the above analysis, paired assistance projects have helped improve infrastructure and facilitated transportation and information connectivity between Xizang and Xinjiang and the rest of China, which is indispensable to the formation of a unified national market and economic development in Xizang and Xinjiang. Hence, we propose Hypothesis 2.

Hypothesis 2: Paired assistance policy is conducive to economic growth in recipient localities through infrastructure development.

Paired assistance for education has contributed to human capital development in Xizang and

Xinjiang. By establishing and supporting educational systems, the educational assistance projects have helped improve the quality of education in Xizang and Xinjiang, thus contributing to local economic growth. In the early 1960s, T. W. Schultz pointed out the importance of education for economic growth. After the 1980s, Romer and Lucas demonstrated the economic growth effect of education from the perspective of endogenous growth. According to Min (2017), the role of education in economic growth is manifested in the following four aspects under China's unique socio-economic conditions: First, education promotes economic growth by improving the quality of human capital and total factor productivity (Zhang et al., 2022); second, education promotes economic growth by creating industrial workers with adequate knowledge and skills and thereby advancing industrial upgrade (Wu et al., 2022); third, education promotes economic growth by increasing labor productivity through the improvement of knowledge and skills, thereby facilitating labor flow between primary, secondary and tertiary industries and accelerating new-type urbanization with people at the core (Cai, 2019); and fourth, education promotes economic growth by changing consumer behaviors and increasing household consumption (Min et al., 2021; Liu et al., 2019). As a major strategic decision adopted by the CPC Central Committee and the State Council, paired educational assistance to Xizang and Xinjiang has led to a policy support system encompassing programs for ethnic minority students in high schools, junior middle schools, vocational secondary schools, and prep schools, as well as programs for backbone talent cultivation hosted in assistance-giving provinces and municipalities (Li and Huang, 2022). By mobilizing faculty and staff to support education in Xizang and Xinjiang, these assistance programs have resulted in continuous improvements in the quality of education for local people. Hence, we propose Hypothesis 3.

Hypothesis 3: Paired assistance policy promotes economic growth in recipient localities by improving the quality of education.

Paired medical assistance is conducive to economic growth in Xizang and Xinjiang by creating and supporting local healthcare systems and raising the level of healthcare services. According to its press release on August 26, 2022, the National Health Commission has dispatched over 2,500 medical professionals to Xizang and Xinjiang, assisted over 1,000 local medical teams and some 5,800 medical personnel, and trained over 10,000 key medical personnel since the initiation of the medical assistance program. Moreover, over 4,000 medical staff received training at designated hospitals. As a result, the overall competence of medical personnel has improved significantly[11]. Liu et al. (2004) identified four mechanisms by which health impacts economic growth by directly or indirectly affecting the production function. First, healthy individuals are more productive because of their stamina and skills (Zhang and Xia, 2020; Wang et al., 2015). Second, healthy individuals may expect to live longer and be more capable of long-term planning and investing in their own human capital. As shown by an abundance of research on human capital investment, healthiness may boost labor productivity and income (Long and Tao, 2017; Jacobs et al., 2015). Third, people's expectations to live longer further reinforce individual savings, which provide additional monetary capital for economic investment that drives income and economic growth (Yang, 2014; Yin et al., 2011). A healthier workforce also attracts more external capital. Fourth, a healthier workforce means a lower mortality rate (Long and Tao, 2017) and a higher median age of the population. Such a demographic change will further increase the ratio of the working-age population, which serves as a key factor in average income and economic growth. The dispatches of medical professionals to assist Xizang and Xinjiang have steadily improved local healthcare services, medical education, and management, contributing to a sense of well-being for the local people. Hence, we put forth Hypothesis 4.

Hypothesis 4: Paired assistance promotes economic growth in recipient localities by improving the level of healthcare.

[11] Transcript of the National Health Commission's press conference on August 26, 2022, http://www.nhc.gov.cn/xcs/s3574/202208/6e43034143524a7f8c01da47d567f38c.shtml.

4. Research Design

4.1 Model Specification

4.1.1 Multiperiod DID model

As explained in the preceding section, precise classification paves the way for a clear understanding and research on paired assistance. Paired assistance to Xizang and Xinjiang is comprehensive assistance for special ethnic regions (Li, 2019). In 1994, the Third National Symposium on Work in Xizang adopted the Tibetan assistance working mechanism of "allocation of responsibilities by regions, paired assistance, and periodical rotation", opening up a new chapter of paired assistance to Xizang. In 1996, the central government made the strategic decision to provide paired assistance to Xinjiang. In regard to this, this paper designates the comprehensive paired assistance for special ethnic regions carried out in Xinjiang as a quasi-natural policy experiment and evaluates the policy effects of such paired assistance using the DID method. Specifically, prefecture-level administrative regions in Xizang and Xinjiang receiving paired assistance between 1990 and 2020 are designated as the treatment group. Meanwhile, the prefecture-level administrative regions in other provinces of the western region are designated as the control group given their similarities with the recipient localities in terms of economic conditions, industrial structure, and national policies to evaluate the economic growth effects of paired assistance to Xizang and Xinjiang. The model specification is as follows:

$$Y_{it}=\alpha_0+\alpha_1 Treat_{it}+\sum_k \alpha_k Control_{it}+\delta_i+\eta_t+\varepsilon_{it} \quad (1)$$

In equation (1), the explained variable Y_{it} is the level of economic development of city (prefecture or region) i in year t. The core explanatory variable $Treat_{it}$ is the dummy variable under treatment. If city i received paired assistance in year t, $Treat_{it}$ is 1; otherwise, it is 0. Coefficient α_1 is the focus of our attention, and denotes the average treatment effect for economic growth in Xizang and Xinjiang. If α_1 is significantly greater than 0, the implication is that the paired assistance policy has effectively boosted economic growth in various prefecture-level cities (prefectures or regions) of Xizang and Xinjiang. $Control_{it}$ indicates a set of control variables that may affect economic growth, including industrial structure and the level of public consumption. δ_i and η_t respectively denote the individual fixed effect of prefecture-level cities (prefectures for regions) and the time fixed effect. ε_{it} is the stochastic disturbance term.

4.1.2 Mediating effect model

Infrastructure and public services are the two major aspects and priorities of paired assistance. In order to uncover how paired assistance contributes to economic growth in recipient localities, this paper creates a mediating effect model on the basis of the multiperiod DID model to test the existence of the mediating effect with respect to infrastructure and public services. The model specification is as follows:

$$Y_{it}=\alpha_0+\alpha_1 Treat_{it}+\sum_k \alpha_k Control_{it}+\delta_i+\eta_t+\varepsilon_{it} \quad (2)$$

$$M_{it}=\beta_0+\beta_1 Treat_{it}+\sum_k \beta_k Control_{it}+\delta_i+\eta_t+\xi_{it} \quad (3)$$

$$Y_{it}=\gamma_0+\gamma_1 Treat_{it}+\gamma_2 M_{it}+\gamma_3\sum_k \gamma_k Control_{it}+\delta_i+\eta_t+\lambda_{it} \quad (4)$$

In the above equations, M_{it} is the mediator, α_1 is the aggregate policy effect, γ_1 is the direct policy effect, and $\beta_1\gamma_2$ is the mediating effect of the mediator. The mediating effect is significant if α_1 in equation (2) is significantly different from 0, β_1 in equation (3) is significantly different from 0, and γ_2 in equation (4) is significantly different from 0. γ_1 in equation (4) being significantly different from 0 signifies a partial mediating effect; otherwise, it signifies a complete mediating effect. In this paper, we test the significance of the mediating factor using the Sobel-Goodman test.

4.2 Data Source and Sample Explanation

In this paper, we evaluate the policy effects of paired assistance to Xizang and Xinjiang using the panel data of 32 prefecture-level cities (prefectures and regions) of China's western region between 1990 and 2020. The sources of data include the *China Statistical Yearbook of Cities*, the *Statistical Yearbook* of various prefecture-level cities (prefectures and regions), as well as the *Statistical Communique of National Economic and Social Development* of various prefecture-level cities (prefectures and regions). Our treatment group samples include six prefecture-level cities in Xizang, i.e. Lhasa, Shigatse, Qamdo, Nyingchi, Lhoka, and Nagqu, excluding Ngari Prefecture due to lack of data. Xinjiang contains nine prefecture-level cities (prefectures and regions): Turpan, Hami, Aksu, Kashgar, Hotan, Changji Hui Autonomous Prefecture, Bortala Mongolian Autonomous Prefecture, Bayangol Mongolian Autonomous Prefecture, and Kizilsu Kirgiz Autonomous Prefecture. In order to better satisfy the parallel trend hypothesis, we designate a control group of regions having received no comprehensive paired assistance in the nine provinces from the western region except Chongqing (Li, 2019), alongside prefecture-level cities with the level of economic development, industrial structure, natural resources, geographical environment, and national policy status similar to those of various samples in the treatment group. In the end, 17 prefecture-level cities are included in the control group. Moreover, we no longer conduct propensity scoring matches between the treatment group and the control group in order to ensure that the sample size may support the subsequent analysis of economic growth effects.

4.3 Variable Specification and Descriptive Statistics

4.3.1 Explained variable and core explanatory variable

The explained variable is the level of economic development in various prefecture-level cities. In this paper, the GDP deflator of each province (with 1990 as the base period) is used to substitute the GDP deflator of prefecture-level cities (prefectures and regions) and calculate the real GDP of various prefecture-level cities (prefectures and regions) in various years.

With a multiperiod DID method, we use a treatment variable for the paired assistance policy that changes with time and region as the core explanatory variable to substitute the common interaction term in the DID model.

4.3.2 Control variables

Referencing relevant research, we select the following control variables to control for the economic growth effects of other factors: industrial structure (*Ind*), expressed by value-added in the secondary industry as a share of GDP, to control for the economic growth effect of industrial structure; and the level of social consumption (*Cons*), expressed by the aggregate consumer goods sales volume, to control for the economic growth effect of consumption. Other socio-economic indicators: Demographic indicators such as permanent population and natural population growth rate are not included into control variables due to differences in the statistical scope and indicators for various prefecture-level cities in Xizang and Xinjiang in earlier years. At the economic level, the indicators of fixed-asset investment and local fiscal spending are susceptible to paired assistance and horizontal central transfer payments, and the inclusion of both into the model as control variables will not increase the model's R^2. As such, the inclusion of such control variables may lead to bias in the coefficient estimation of core explanatory variables. Moreover, our DID model has controlled for the individual fixed effect and time effect to address the potential endogeneity problem, which may to some extent mitigate the endogeneity of variables. That is why the two factors of "industrial structure" and "level of social consumption" are chosen as control variables.

4.3.3 Mediating variables

Based on the theoretical analysis in the preceding section, infrastructure and public services are the two major aspects and priorities of paired assistance. As such, the two mediating variables of infrastructure and public services are chosen. Infrastructure and public service indicators already established in the existing research have been well recognized. Referencing Zhao et al. (2020b) and taking into account the consistency of statistical scope and indicators for Xinjiang and Xizang between 1990 and 2020, we adopt road length (*Road*) and aggregate post and telecom business volume (*Post*) as proxy variables. Regarding public services, we adopt the number of full-time teachers at ordinary middle schools (*Mid*), the number of full-time teachers at ordinary primary schools (*Pri*), the number of sick beds at healthcare institutions (*Bed*), and the number of healthcare technicians (*Tech*) as proxy variables according to relevant paired assistance policies. In conducting empirical analysis, we have carried out a logarithmic treatment of all absolute-value variables to reduce heteroscedasticity interference from data in the model. Refer to Table 1 for key variables and definitions.

Table 1: Key Variables and Definitions

Variable	Definition and measurement unit
GDP	Real GDP (10,000 yuan)
PGDP	Per capita real GDP (yuan)
Ind	Value-added of the secondary industry as a share of GDP (%)
Cons	Aggregate retail sales volume of social consumer goods (10,000 yuan)
Post	Aggregate post and telecom business volume (10,000 yuan)
Road	Road length (km)
Mid	Number of full-time teachers at ordinary middle schools (persons)
Pri	Number of full-time teachers at ordinary primary schools (persons)
Bed	Number of sick beds at healthcare institutions (beds)
Tech	Number of health technicians (persons)

5. Empirical Results and Analysis

5.1 Baseline Regression Results and Analysis

Table 2 reports the average treatment effect of paired assistance for economic growth in various prefecture-level cities (prefectures and regions) in Xizang and Xinjiang. Models (1) and (2) present the estimated results when the explained variables is Ln*GDP* without and with control variables, respectively, and Model (3) provides the estimated results when the explained variable is Ln*PGDP*. The coefficient of treatment variable *Treat* is the focus of attention in our study. Judging by the baseline regression results in Table 2, the coefficient of the treatment variable *Treat* remains positive and significant at 0.01 after the inclusion of the control variables and the substitution of the explained variable by per capita real GDP. Since the paired assistance policy was implemented, various prefecture-level cities (prefectures and regions) have seen their real GDP increase by 58.04% and per capita real GDP increase by 49.21%, compared with prefecture-level cities (prefectures and regions) in the control group. That is to say, paired assistance has boosted economic development and substantially raised living standards in Xizang and Xinjiang. By injecting capital, talent and technology, paired assistance has created conditions for Xizang and Xinjiang to thrive economically and close their gaps with prosperous regions. As fully demonstrated by the above results, paired assistance is conducive to economic growth in recipient localities, verifying hypothesis 1.

Table 2: Economic Growth Effects of Paired Assistance to Various Prefecture-level Cities (Prefectures and Regions) of Xizang and Xinjiang

Variable	Ln*GDP*		Ln*PGDP*
	(1)	(2)	(3)
Treat	0.6314*** (14.44)	0.5804*** (14.14)	0.4921*** (12.17)
Control variable	No	Yes	Yes
Individual fixed effect	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes
Constant term	11.4689*** (227.77)	7.6925*** (22.75)	4.4872*** (13.47)
Sample size	992	992	992
R^2	0.932	0.9414	0.9303

Note: Numbers in parenthesis are the values of t statistic; ***, ** and * denote significance at 1%, 5% and 10% levels, respectively. The same below.

5.2 Parallel Trend Test and Counterfactual Test

5.2.1 Parallel trend test

The parallel trend assumption is a reliable premise for both the standard DID model and the multiperiod DID model. In this paper, our parallel trend assumption is that no significant difference should exist in the economic growth trend between the treatment group and the control group in the absence of external shocks from paired assistance to Xizang and Xinjiang. In this paper, we use the treatment variable *Treat* to create a dummy variable of 33 periods before and after policy implementation, as well as a two-way fixed effect dynamic change trend model, to observe whether paired assistance is consistent with the parallel trend hypothesis. The model specification is as follows:

$$Y_{it}=\alpha_0+\sum_j \alpha_j xh_j+\sum_k \alpha_k Control_{it}+\delta_i+\eta_t+\varepsilon_{it} \quad (5)$$

In the equation (5), we use xh_1 to denote seven years prior to the implementation of paired assistance, xh_8 to denote the current period of policy implementation, xh_{33} to denote 25 years after the policy implementation, and so on and so forth. Judging by the two parallel trend charts of Figure 2 and Figure 3, the coefficients of *xh* dummy variable for the treatment group and the control group prior to policy implementation are both insignificant at the 99% confidence interval; after the implementation of paired assistance, the regression coefficients of *xh* dummy variable with real GDP as the explained variable are all significantly positive, and the regression coefficients of *xh* dummy variable with per capita real GDP as the explained variable are positive in the final two periods, but insignificant most probably due to the external shocks of COVID-19. Overall, the treatment group and the control group are generally consistent with the parallel trend hypothesis with respect to the paired assistance policy, and the average economic growth effect of paired assistance is significant over a long period after the policy implementation.

5.2.2 Counterfactual test

Counterfactual test is often performed in the existing literature using a placebo test of the random policy shock. The basic approach is to select treatment group samples by random sampling from the treatment and control group samples and policy implementation time point before conducting regression estimation of the baseline regression model for 1,000 times and finally displaying the p-values of the regression coefficients of the random policy shock of paired assistance with respect to economic growth.

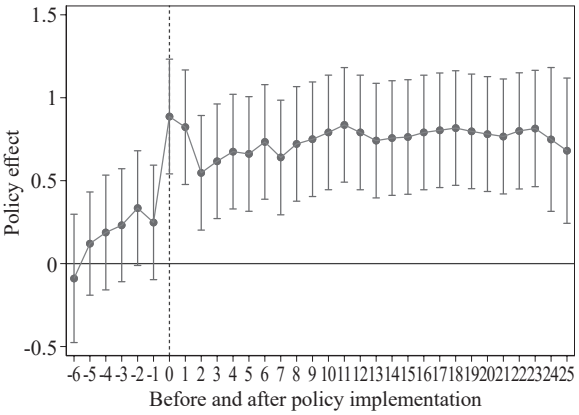

Figure 2: Parallel Trend Chart for Real GDP

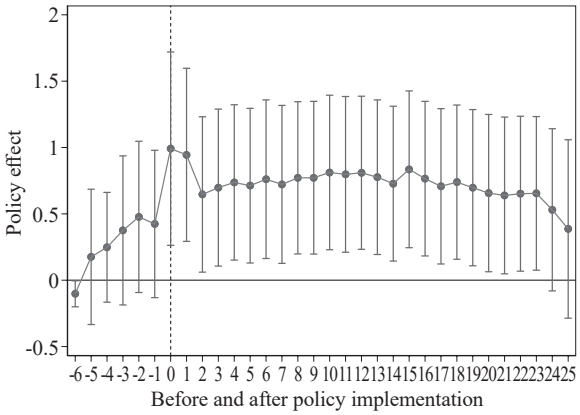

Figure 3: Parallel Trend Chart for Real Per Capita GDP

Figure 4 presents the principal test result of the random policy shock of paired assistance, and the p-values of the estimated coefficients are greater than 0.1 in most instances. The dotted line to the right of the chart is the regression coefficient of *Treat* in the baseline regression model, which is not included in the core density curve of the estimated coefficients. It can be thus verified that the random policy shock of paired assistance has an insignificant impact, i.e. the research findings in the previous section are reliable. The significant average effect of paired assistance on economic growth in recipient localities is not attributable to other random factors.

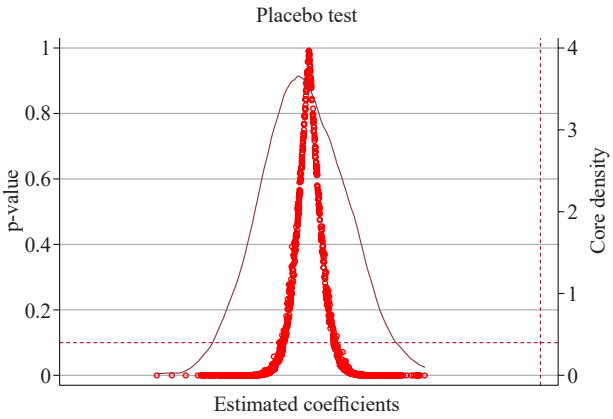

Figure 4: Placebo Test of the Random Policy Shock

5.3 Robustness Test

In order to ensure the robustness of the models, we have performed robustness tests to control for the non-parallel trend and competition policy interference and exclude outliers, and the results have all passed the tests.

5.4 Mediating Effects of Infrastructure and Public Services

From the initial project-based and talent assistance to the subsequent comprehensive assistance, paired assistance in China has focused on infrastructure development and public services as the two policy priorities. Based on the theoretical analysis in the preceding section, we use the proxy variables of infrastructure and public services as mediating variables to investigate the two paths of influence, i.e. paired assistance leads to infrastructure development that contributes to economic growth, and paired assistance improves public services such as education and healthcare that also contribute to economic growth. In the following section, we create a mediating effect model on the basis of the DID model to test these two paths of influence.

5.4.1 Test of influence path in which paired assistance contributes to economic growth by improving infrastructure

Table 3 presents the test results of paired assistance promoting economic growth in recipient

localities via infrastructure. When the mediating variable is the length of roads, the mediating effect is significant, as illustrated in Models (1)(2), and (3) of Table 3; the aggregate effect is 0.5804 and significant at the 0.01 level; Model (2) uses the length of highways as the explained variable; and the coefficient value of the treatment variable *Treat* is 2.4731 and significant at the 0.01 level. That is, with other conditions held constant, the length of highways in prefecture-level cities (prefectures and regions) receiving paired assistance would increase by 247.31% relative to the non-recipients. After Model (3) introduces the mediating variable of highway length, the coefficient of highway length is 0.0946, i.e. with other conditions held constant, an increase in highway length by each percentage point will drive up real GDP by 0.0946 percentage points, and the direct effect is 0.3464 and significant. Hence, the mediating effect of highway length is a partial mediating effect. The p-value of the Sobel test is smaller than 0.01, i.e. the mediating effect with highway length as the mediating variable is highly significant, and the magnitude of the mediating effect is 0.2340, accounting for 40.32%.

When the mediating variable is the aggregate post and telecom business volume, the mediating effect is significant, as illustrated in Models (1)(4), and (5) of Table 3; the aggregate effect is 0.5804 and significant at the 0.01 level. Model (4) defines the aggregate post and telecom business volume as the explained variable, and the coefficient value of the treatment variable is 0.2167 and significant at the 0.05 level, i.e. with other conditions held constant, prefecture-level cities (prefectures and regions) receiving paired assistance recorded a 21.67% increase in their aggregate post and telecom business volume. When the mediating variable of aggregate post and telecom business volume is introduced into Model (5), the coefficient of aggregate post and telecom business volume is 0.1135, i.e. with other conditions held constant, an increase in the aggregate post and telecom business volume by each percentage point will drive up real GDP by an average of 0.1135 percentage points, while the direct effect is 0.5559 and significant. As such, the mediating effect of the aggregate post and telecom business volume is a partial intermediate effect. The p-value of the Sobel test is 0.0161, which is smaller than 0.05, i.e. the mediating effect with the aggregate post and telecom business volume as the mediating variable is significant, and the magnitude of the mediating effect is 0.0246, accounting for 4.24%.

This fully explains that there exists a transmission mechanism in which paired assistance leads to infrastructure development that stimulates economic growth, thus verifying Hypothesis 2. It can also be observed that the mediating effect of the aggregate post and telecom business volume accounts for a modest share, which means that ICT infrastructure has an insignificant economic growth effect for the treatment group compared with the control group. Overall, the mediating effect from infrastructure accounts for 44.56%, which means paired assistance promotes economic growth in recipient localities largely via infrastructure development.

Table 3: List of Test Results of Infrastructure's Mediating Effect

Variable		Highway length		Aggregate post and telecom business volume	
	(1)	(2)	(3)	(4)	(5)
	Ln*GDP*	Ln*Road*	Ln*GDP*	Ln*Post*	Ln*GDP*
Ln*Road*			0.0946*** (7.51)		
Ln*Post*					0.1135*** (7.36)
Treat	0.5804*** (14.14)	2.4731*** (23.80)	0.3464*** (6.84)	0.2167** (2.55)	0.5559*** (13.87)
Control variable	Yes	Yes	Yes	Yes	Yes
Individual fixed effect	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes

Table 3 Continued

Variable		Highway length		Aggregate post and telecom business volume	
	(1)	(2)	(3)	(4)	(5)
	Ln*GDP*	Ln*Road*	Ln*GDP*	Ln*Post*	Ln*GDP*
Constant term	7.6925*** (22.75)	7.8363*** (8.95)	6.5784*** (18.79)	0.2309 (.32)	7.2938*** (21.68)
Sobel test		0.000 (7.16)		0.0161 (2.407)	
Magnitude of mediating effect		0.2340		0.0246	
Share of mediating effect		0.4032		0.0424	
Sample size	992	992	992	992	992
R^2	0.9653	0.7851	0.9673	0.9291	0.9672

5.4.2 Test of the influence path in which paired assistance contributes to economic growth by improving public services such as education and healthcare

Test results of paired assistance promoting economic growth in recipient localities via public services (education and healthcare) are shown in Tables 4 and 5. As illustrated by Models (1)(2)(3)(4), and (5) of Table 4, when the mediating variables are the number of full-time teachers at ordinary high schools and the number of full-time teachers at ordinary primary schools, the mediating effect of the number of full-time teachers at ordinary middle schools is insignificant according to the Sobel test result, and the mediating effect of the number of full-time teachers at ordinary primary schools is significant. As can be seen from Models (2) and (4), various prefecture-level cities (prefectures and regions) of Xizang and Xinjiang in the control group reported an increase in the number of full-time teachers at ordinary middle schools by 48.08% and an increase in the number of full-time teachers at ordinary primary schools by 64.15%, which are more significant than the increases for the control group. In other words, paired assistance has significantly raised the level of education in recipient localities. However, the mediating effect is significant only when the mediating variable is the number of full-time teachers at ordinary primary schools. Hence, the economic growth effect via the level of education was not fully materialized in the short run.

When the mediating variables are the number of sick beds and the number of healthcare technicians at medical institutions, the mediating effects are significant, according to the Sobel test result. As illustrated by Models (1)(2)(3)(4), and (5) of Table 5, various prefecture-level cities (prefectures and regions) in Xizang and Xinjiang as the treatment group reported a 7.55% increase in the number of sick beds at medical institutions and a 6.82% increase in the number of health personnel, which are more significant than the increases for the control group. Paired assistance has narrowed the gaps between recipient prefecture-level cities (prefectures and regions) in Xizang and Xinjiang and other provinces in West China. The degree of healthcare improvement pales in comparison with that of education.

Compared with the mediating effect of infrastructure, which accounts for 44.56%, those of education and healthcare represent modest shares at 8.17% and 5.3%, respectively. Compared with infrastructure, paired assistance for education and healthcare has weaker indirect short-term effects on economic growth in recipient localities. In a nutshell, the transmission mechanism by which paired assistance boosts economic growth via public services such as education and healthcare is proven to exist, hence verifying Hypotheses 3 and 4. Despite the modest indirect short-term effects, there is a lag in the economic growth effect of education and healthcare, and the long-term economic performance warrants more attention (Zhang and He, 2011).

In selecting the control group, we have taken into account the similarities in economic conditions, industrial structure, and national policies between most provinces and municipalities in China's western

region. It should also be noted, however, that Beihai, Fangchenggang, and Qinzhou cities in the control group are coastal cities and differ greatly from other samples of prefecture-level cities, prefectures, and regions despite similar national policies. As the capital of Guizhou Province, Guiyang City has taken steps to develop their big data industry according to General Secretary Xi Jinping's important instruction to "seize new opportunities to implement the digital economy strategy". As a result, the city's digital economy is thriving. To further confirm the reliability of our empirical results, we have performed another round of empirical analysis after excluding these control group samples and still arrived at the same conclusions.

Table 4: List of Test Results of the Mediating Effect of Educational Level

Variable		Number of full-time teachers at ordinary schools		Number of full-time teachers at primary schools	
	(1)	(2)	(3)	(4)	(5)
	Ln*GDP*	Ln*Mid*	Ln*GDP*	Ln*Pri*	Ln*GDP*
Ln*Mid*			0.0215 (.93)		
Ln*Pri*					0.0739*** (3.17)
Treat	0.5804*** (14.14)	0.4808*** (8.22)	0.5701*** (13.40)	0.6415*** (11.15)	0.5330*** (12.25)
Control variable	Yes	Yes	Yes	Yes	Yes
Individual fixed effect	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes
Constant term	7.6925*** (22.75)	0.2794 (.57)	7.3140*** (21.14)	1.0213** (2.11)	7.2446*** (21.00)
Sobel test		0.3541 (.9267)		0.0023 (3.048)	
Magnitude of the fixed effect		0.0103		0.0474	
Share of the fixed effect		0.0178		0.0817	
Sample size	992	992	992	992	992
R^2	0.9653	0.8811	0.9653	0.8361	0.9657

Table 5: Test Results of the Mediating Effect of Healthcare

Variable		Number of sick beds at medical institutions		Number of health technicians	
	(1)	(2)	(3)	(4)	(5)
	Ln*GDP*	Ln*Bed*	Ln*GDP*	Ln*Tech*	Ln*GDP*
Ln*Bed*			0.2277*** (5.96)		
Ln*Tech*					0.1991*** (4.93)
Treat	0.5804*** (14.14)	0.0755** (2.18)	0.5632*** (13.94)	0.0682** (2.07)	0.5669*** (13.95)
Control variable	Yes	Yes	Yes	Yes	Yes
Individual fixed effect	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes
Constant term	7.6925*** (22.75)	3.6492*** (12.50)	6.4888*** (17.68)	4.3645*** (15.72)	6.4511*** (16.78)
Sobel test		0.0408 (2.045)		0.0565 (1.907)	
Magnitude of mediating effect		0.0172		0.0136	
Share of mediating effect		0.0296		0.0234	
Sample size	992	992	992	992	992
R^2	0.9653	0.9483	0.9666	0.9471	0.9662

Another question is the potential endogeneity problem and the validity of the mediating effect. Referencing Jiang's (2022) discussion of the mediating effect, there could be a mutual causal relationship between the mediating effect and the outcome variable, i.e. the mediating variable's endogeneity may cause a biased outcome. First, this paper is primarily concerned with economically less-developed prefecture-level cities (prefectures and regions) in Xizang and Xinjiang, to which designated localities from prosperous regions provide assistance in such areas as infrastructure, education, and healthcare to support local economic growth. That is to say, the improvement of infrastructure and public services results from paired assistance rather than economic growth in recipient localities. For instance, Xizang's fiscal self-sufficiency was only 10.49% in 2021. Meanwhile, our analysis of the mediating effect primarily serves an explanatory purpose to shed light on the relationship between the treatment variable and the outcome variable (Jiang, 2022). Given the unique nature of this study, we consider it unlikely for there to be a causal relationship between the outcome variable (economic growth) and the mediating variables (infrastructure and public services).

6. Conclusion and Policy Implications

Using the equilibrium panel data of 32 prefecture-level cities (prefectures and regions) over a period of 31 years between 1990 and 2020, this paper employs the multiperiod DID method for an empirical test of the effect of China's paired assistance policy on various recipient prefecture-level cities (prefectures and regions) in Xizang and Xinjiang and tests the robustness of models through the parallel trend test, the counterfactual test, and a series of robustness tests. In addition, a more in-depth study is carried out to investigate the impact of the mediating effect model on paired assistance on the basis of the multiperiod DID model. Our research results suggest that: (i) Implementation of the paired assistance policy has facilitated economic growth in recipient localities and assisted socio-economic development in various prefecture-level cities (prefectures and regions) of Xizang and Xinjiang, and the regression results of various explained variables and the performance of various tests have demonstrated the reliability of this conclusion; (ii) the paired assistance policy has contributed to economic growth in recipient localities directly and via infrastructure development indirectly, and the economic growth effect of the road infrastructure is greater than that of ICT infrastructure; (iii) the paired assistance policy has promoted economic growth in recipient localities by raising the levels of education and healthcare, but the indirect short-term effect is smaller compared with infrastructure development. Nonetheless, the paired assistance policy may significantly improve education and healthcare and is therefore more conducive to meeting people's expectations for a better life.

Based on the research conclusions, we have arrived at the following policy recommendations:

First, it is vital to foster and attract educators. As revealed in our quantitative analysis, educational assistance has a modest short-term effect on economic development in Xizang and Xinjiang, but it is a fundamental task to lay the groundwork for local economic development in the long run. Greater efforts should be made to train local teachers in Xizang and Xinjiang through the mentorship system. Moreover, college graduates should be attracted through market-based mechanisms to take teaching posts in Xizang and Xinjiang.

Second, it is also important to foster and attract health professionals. Based on a quantitative analysis, it can be concluded that the economic growth effect of healthcare assistance in Xizang and Xinjiang is less than ideal. One reason is the lack of health professionals at the newly-built county hospitals and township health clinics under the policy guidance to assist rural herding areas and improve livelihoods. Many of those health facilities have become iconic buildings in the townships but are understaffed with highly qualified medical personnel, according to visits by one of the authors to Xizang and Xinjiang. On the other hand, there is a lag in the economic growth effect of improving healthcare, and the cultivation of health professionals takes time. It is suggested that future healthcare assistance

should focus on not only infrastructure and equipment but also the cultivation and attraction of health professionals. Desirable remuneration should be offered to attract and retain health professionals in order to maximize the health and socio-economic effects of healthcare assistance.

Lastly, step up support for infrastructure development. As can be found from quantitative analysis, infrastructure assistance has significantly supported economic growth in the recipient localities of Xizang and Xinjiang. Hence, continued investments should be made to increase road density and build ICT infrastructure in Xizang and Xinjiang. Meanwhile, it is also important to invest in new-type infrastructure for digitalization, mobile Internet, and artificial intelligence (AI) to increase local people's sense of gain, happiness, and security.

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