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The Impact of Digital Inclusive Finance on Economic Growth in Xinjiang Uygur Autonomous Region, China

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Abstract: The emergence of digital inclusive finance has been significantly influenced by the progress in digital technology and comprehensive research into inclusive finance. This innovation in finance has been driven forward by leveraging digital technology to lower the costs and eliminate the obstacles associated with financial services. Specifically, in the Xinjiang Uygur Autonomous Region, which is challenged by its isolated location, digital inclusive finance has successfully addressed these geographical limitations. This research paper examines how digital inclusive finance contributes to the economic development of Xinjiang. By employing a dynamic panel GMM model and analyzing panel data from 2011 to 2019 specific to the Xinjiang Uygur Autonomous Region, the study demonstrates the beneficial impact of digital inclusive finance on the area's economic prosperity.

Keywords: Digital Inclusive Finance Index, Economic Growth, GMM Model

1. Research Background and Significance

The advent of digital inclusive finance has been a direct consequence of advancements in digital technologies paired with deep explorations into the realm of inclusive finance. The integration of digital solutions has significantly diminished financial service costs and hurdles, paving the way for increased financial accessibility among underserved populations. This, in turn, has spurred the progression of digital inclusive finance. In the domain of research concerning the influence of inclusive finance on economic growth, a consensus prevails among international scholars that inclusive finance plays a beneficial role in bolstering economic growth. Scholars such as Asli Demirgüç-Kunt and Ross Levine have posited that inclusive finance widens economic horizons and mitigates social inequities [1]. Aditi Kapoor has put forward the idea that inclusive finance acts as a leveling force, thereby fostering economic expansion that benefits the populace at large, particularly those in vulnerable positions [2]. Kim J H, through detailed empirical scrutiny, has established that inclusive finance lessens income disparities and forges a link with economic prosperity, effectively converting the traditionally negative association between income inequality and economic growth

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into a positive dynamic via the expansion of inclusive finance [3]. On the national front, scholar Yang Yan asserts that while inclusive finance catalyzes economic growth, economic expansion does not significantly reciprocate the development of inclusive finance. Despite the progressive ascension of inclusive finance levels in China, disparities in its development across various regions remain a concern [4]. In their analytical work, Du Qiang and Pan Yi have discovered that the connection between inclusive finance and regional economic advancement typically assumes an inverted U-shape [5]. Consequently, the interplay between digital inclusive finance and economic growth has sparked considerable scholarly debate. Amidst a backdrop of extensive theoretical and empirical investigations by both domestic and international academics, the specific focus on Xinjiang has been scant. Building on the foundation laid by prior studies, this manuscript singles out Xinjiang as its focal point, employing a GMM model to dissect the influence of digital inclusive finance on the economic vitality of Xinjiang.

2. Overview of Inclusive Finance in Xinjiang

Back in 2011, the measure of digital inclusive finance within Xinjiang lagged behind the national average significantly. However, it has since seen swift progress. Urban centers such as Urumqi and Karamay have emerged as leaders in digital finance within the western territories of China. Other areas, including Hami City, the Changji Hui Autonomous Prefecture, the Bayingol Mongolian Autonomous Prefecture, and the Tarim basin, have experienced growth rates in their digital inclusive finance indices surpassing the national average. The extensive reach of the internet across Xinjiang has laid a solid foundation for the flourishing of digital finance. There's a notable parallelism between the digital inclusive finance index and the region's economic magnitude. A broader observation suggests that areas with a higher index of digital inclusive finance tend to showcase more robust economic health.

3. Research Data

This research utilizes the natural logarithm of Xinjiang's per capita Gross Domestic Product (lnrgdp) as the pivotal outcome variable to gauge economic growth. The principal explanatory variable incorporated is derived from the "Peking University Digital Inclusive Finance Index (2011-2020)", unveiled by the Peking University Digital Finance Research Center in April 2021, focusing on the Xinjiang Uygur Autonomous Region. Additional variables, deemed influential on economic expansion, are incorporated as controls to provide a comprehensive analysis. The empirical scrutiny is conducted using panel data spanning from 2011 to 2019, aiming to elucidate the impact of digital inclusive finance on economic growth.

Dependent Variable: The regional Gross Domestic Product (GDP) is one of the crucial indicators for assessing the economic level of a region. Therefore, this study selects the natural logarithm of per capita Gross Domestic Product (lnrgdp) in Xinjiang as the indicator for economic growth.

Core Explanatory Variable: The cornerstone of this study is the natural logarithm of the Digital Inclusive Finance Index in Xinjiang (lndfi), extracted from the "Peking University Digital Inclusive Finance Index (2011-2020)" announced by the Peking University Internet Finance Research Center. This index, a composite reflecting traditional and digital finance indicators, measures the extent, depth, and digital transformation of inclusive finance, offering a nuanced view of digital finance's evolution and accessibility. The index's credibility and relevance stem from its comprehensive methodology and authoritative source, providing a significant lens into digital inclusive finance's role in Xinjiang.

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Control Variables: For a nuanced analysis, the study introduces three control variables, with data sourced from the "China Statistical Yearbook," "China Statistical Abstract," and "Xinjiang Statistical Yearbook." These variables are instrumental in distilling the precise influence of digital inclusive finance on economic progression. The specific control variables are as follows:

1. Industrial Structure (is): Measured as the sum of the value-added of the secondary and tertiary industries as a percentage of the regional GDP. The industrial structure directly influences resource allocation efficiency, and a shift in the focus of industrial structure from the primary industry to the secondary and tertiary industries may optimize resource allocation efficiency, enhancing output capacity and promoting local economic development.

2. Trade Openness (open): An essential indicator measuring the degree of external economic development for a country or region, reflecting the extent of participation in international division of labor.

3. Square of Natural Logarithm of Per Capita GDP ((lnrgdp)2): Considering the possibility of the Kuznets phenomenon, where economic development may exhibit an inverted U-shaped relationship, the square of the natural logarithm of per capita GDP is chosen as a control variable to account for potential non-linear relationships in economic growth.

4. Model Construction

This research employs the Difference Generalized Method of Moments (Diff-GMM) model to analyze the relationship between digital inclusive finance and economic growth in Xinjiang province from 2011 to 2019. Due to potential endogeneity issues in panel data research, which may result in differences between random effects and fixed effects under a static panel, leading to biased regression results, this study opts for the Diff-GMM estimation. Based on the described data indicators, the following model is set to measure the effects of digital inclusive finance on economic development:

$$Lnrgdp_{i,t}=\beta_{0+}\beta_1 lnrgdp_{i,t-1}+\beta_2 lndfi_{i,t}+\beta_3 is_{i,t}+\beta_4 open_{i,t}+\beta_5 inrgdp^2_{i,t}+\mu_{i,t}$$

In the above model, "i" represents the observed unit (city or region), and "t" represents the time year. "β" denotes the regression coefficients, and "μ" represents the error term. "lnrgdp" signifies per capita Gross Domestic Product, "lndfi" represents the natural logarithm of the digital inclusive finance index, "is" is signifies industrial structure, and "open" represents trade openness.

Table 1: Multicollinearity Analysis

variable	VIF	1/VIF
$lnrgdp^2$	1.55	0.646585
is	1.42	0.702271
indfi	1.28	0.783219
open	1.05	0.950973
Mean VIF	1.32	

To address potential endogeneity issues in the explanatory variables, the Durbin-Wu-Hausman test is employed. The null hypothesis assumes no endogeneity problems in the model. The test, conducted using Stata software, yields a p-value significantly less than 0.01, rejecting the null hypothesis and indicating the presence of endogeneity issues. Descriptive statistical analysis of the data is conducted for a more intuitive understanding of the characteristics of each variable, as shown in Table 2. The study sample is based on panel data from Xinjiang Uygur Autonomous Region for the years 2011 to 2019, comprising a total of 135 observations. The results indicate that the natural logarithm of the digital inclusive finance index (lndfi) in Xinjiang ranges from a minimum of 3.013 to a maximum of

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5.685, with a standard deviation of 0.594 and a mean of 4.911, reflecting the overall level of digital inclusive finance development in Xinjiang. The notable gap between the maximum and minimum values suggests rapid development of digital inclusive finance in Xinjiang. Furthermore, the correlation analysis in Table 3 reveals a significant positive correlation between the economic growth indicator and industrial structure.

Table 2: Descriptive Statistical Analysis

VARIABLES	Sample Size (N)	Average (mean)	Standard Deviation (sd)	Minimum (min)	Maximum (max)
inrgdp	135	10.59	0.709	8.728	11.99
indfi	135	4.911	0.594	3.013	5.685
is	135	80.12	12.04	20.38	100
open	135	0.139	0.157	0.00208	0.795
lnrgdp2	135	112.7	14.83	76.17	143.8

Table 3: Correlation analysis

	inrgdp	indfi	is	open	$lnrgdp^2$
inrgdp	1				
indfi	0.431***	1			
is	0.518***	0.336***	1		
open	-0.140*	-0.201**	-0.146*	1	
$lnrgdp^2$	0.999***	0.429***	0.530***	-0.154*	1

Note: *, ** and *** were significant at the significance level of 10%, 5% and 1% respectively

Subsequently, the Diff-GMM model is constructed. The estimation results in Table 4 show that AR (1) and AR (2) are both greater than 0.1, indicating no serial correlation. The Sargan test value exceeding 0.05 suggests no over-identification problem with the instrumental variables, validating the reasonableness of the model setup. The Diff-GMM estimation reveals that the digital inclusive finance index in Xinjiang province has a significant positive effect on economic growth. The coefficient for the Xinjiang digital inclusive finance is 0.0066, with a significance level of 1%. This implies that for every one percentage point increase in the Xinjiang provincial digital inclusive finance index, the economic development level increases by 0.0066 percentage points. Additionally, the first-order lag of the economic development level is significant, with a coefficient of 0.0078, indicating a time continuity feature in economic development. Furthermore, all control variables show positive and significant estimates, suggesting that optimizing industrial structure (is) and increasing trade openness (open) in the Xinjiang region contribute to promoting economic growth. A one-percentage-point adjustment in the proportion of the secondary and tertiary industries in the industrial structure results in a 0.0000693 percentage point increase in economic development.

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Table 4: Differential GMM Estimation

Explanatory variable	Differential GMM inrgdp
L.inrgdp	0.00780***
	(0.002)
indfi	0.00660***
	(0.001)
is	0.0000693***
	(0.007)
open	0.0112**
	(0.011)
$lnrgdp^2$	0.0464***
	(0.000)
N	105
AR(1)	0.103
AR(2)	0.107
sargan	0.086

Note: *, ** and *** are significant at the significance level of 10%, 5% and 1% respectively, and the values in brackets below the estimated coefficient are standard errors.

5. Research Conclusion

The landscape of digital inclusive finance within Xinjiang province has been characterized by remarkable growth. From a modest figure of 22.34 in 2011, the digital inclusive finance index surged to 308.35 by 2020, reflecting an expansion by over thirteen times within a span of nearly a decade. An analysis employing descriptive statistical techniques on the evolution of digital inclusive finance in Xinjiang underscores a pronounced disparity between the highest and lowest recorded values of the finance index. Such variance underscores the brisk pace at which digital financial inclusion has progressed in the area. This investigation delves into the dynamics between the surge in digital inclusive finance within Xinjiang and its economic advancement, drawing upon data spanning 2011 to 2019 from the region. Utilizing the Diff-GMM estimation approach, the study probes the influence exerted by digital inclusive finance on economic growth. The empirical evidence garnered through this research underscores the pivotal contribution of digital inclusive finance to Xinjiang's economic enhancement. The aggressive promotion of digital inclusive finance emerges as a catalyst for elevating the economic stature of Xinjiang province. Despite the observed ascension in digital inclusive finance levels within Xinjiang in recent times, a noticeable discrepancy remains when juxtaposed with China's eastern territories. In light of this, the following recommendations are proposed:

1. Clarify the Core of National Development Strategy and Establish a Digital Inclusive Finance System: Relevant national departments should intensify efforts to promote the creation and application of technologies such as big data, artificial intelligence, and cloud computing to achieve multiplier effects and drive the construction of a smart living environment. To improve the digital inclusive finance system, it is necessary to explore the cost-efficiency advantages of digital technology deeply. The goal is to establish a inclusive finance system within the context of digital life, truly meeting the needs of relatively vulnerable groups. Collaboration between banks and non-banking institutions should be encouraged to infuse new vitality into traditional enterprises through

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financial technology. 2. Enhance Government Support and Guidance to Promote the Development of Digital Inclusive Finance: Utilize monetary policy effectively. The government should not only reduce the cost of social financing but also actively guide financial institutions to allocate newly added or revitalized credit resources to small and medium-sized enterprises, rural areas, farmers, and agriculture. Simultaneously, the implementation of fiscal policy should be more flexible, playing an active role in fiscal policy functions to facilitate the recovery of labor and production. Establish and improve financial regulatory mechanisms. Strengthen penalties for illegal activities such as "illegal lending," "illegal fundraising," and "illegal business operations." Formulate corresponding standards and enhance the detection of illegal activities. 3. Address Information Management Issues in Digital Inclusive Finance: Address information management issues within digital inclusive finance through legislation. Legally protect the personal data and privacy of financial consumers under digital inclusive finance. Promptly enact the "Financial Consumer Privacy Protection Regulations." Emphasize the confidentiality and security of the identity recognition system and continue to advance institutional arrangements for protecting the rights of financial consumers.

These policy recommendations aim to create an environment conducive to the sustained and balanced development of digital inclusive finance in Xinjiang province, contributing to the overall economic growth and well-being of the region.

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