The Characteristic Study on the Impact of Digital Financial Inclusion on Income Gap under the Goal of Common Prosperity

Xu Di

School of Finance, Qilu University of Technology (Shandong Academy of Sciences), Jinan, China
m15053102196_1@163.com

Abstract: *With the rapid development of our country's economy and society, digital finance has become an important entry point into the construction of new pattern of our country's economic and social development. This paper will theoretically explore the impact of the development of Digital Financial Inclusion on residents' income level, and take 31 provinces and cities from 2012 to 2021 as samples to conduct empirical research to test the impact of Digital Financial Inclusion on residents' income, and analyze and find that the rapid development of Digital Financial Inclusion can increase the income gap of residents. However, the development of digitization has a nonlinear relationship with income. Therefore, based on the realization of the goal of common prosperity, the use of Digital Financial Inclusion is of great practical significance to promote the healthy development of the income gap among provinces and regions*

Keywords: *Digital Financial Inclusion(DFI); income gap; nonlinear*

1. Introduction

The most essential feature of socialist modernization is to achieve common prosperity. The development we are pursuing is not simply to increase material wealth, but to continuously meet the people's needs for a better life and promote well-rounded human development through development. The prosperity we pursue does not only mean the accumulation of economic wealth, but also the improvement of people's living standards through sustained development and the realization of the goal of sharing the fruits of reform and development with all people. The current series of reforms in our country focus on the impact of economic and social development. To achieve common prosperity for all our people is our common goal and the direction of our efforts. We are committed to continuously meeting the growing needs of the people for a better life, and the happiness of the people is the top priority of our work. All this is not only to rally people's hearts, but also to promote the great rejuvenation of the Chinese nation and consolidate the long-term governance foundation of the Party.

At present, the world is rapidly advancing a new round of scientific and technological revolution represented by big data, the Internet of Things, artificial intelligence and 3D printing. In this new scientific and technological revolution, digital transformation has become an important direction of production mode and production system reform, and this trend will profoundly affect the development of the financial industry. In recent years, the extensive application of technologies such as the Internet, big data and artificial intelligence is rapidly promoting the development process of the financial industry to digitization, networking and intelligence. The Global Partnership for Financial Inclusion (GPFI) has made it clear that Digital Financial Inclusion has great scope for development, providing new ways to address core issues in financial inclusion development and achieving significant results. According to the "China Financial Technology and Inclusive Finance Development Report (2023)" pointed out that in the context of "broadband to the countryside", 5G base stations and other infrastructure projects, the continuous iteration and innovation of digital technology have accelerated the rapid development of Digital Financial Inclusion, and prompted it to initially form a complete digital inclusive financial ecosystem. According to data from the China Banking and Insurance Regulatory Commission, at the end of 2021, the outstanding RMB loans of financial institutions increased by 11.6 percent compared with the same period last year, reaching 192.69 trillion yuan. For the whole year, RMB credit increased by 19.95 trillion yuan, an increase of 315 billion yuan year-on-year. This encouraging development shows that the continued development of Digital Financial Inclusion has broadened the reach of digital finance.

From the macro perspective, this paper aims at the characteristics and characteristics of Digital Financial Inclusion in the current development stage of China, and puts forward corresponding policy suggestions through in-depth analysis of the current situation of Chinese residents' income under the goal of Digital Financial Inclusion and common prosperity, in order to provide theoretical basis and practical reference for further improving China's urban and rural income distribution pattern.

2. Theoretical analysis and research hypothesis

On the view that financial development promotes economic growth, there are different views in academic circles, and there is no consensus on whether financial development will lead to the convergence or expansion of the income gap between urban and rural residents. Therefore, as an organic unity of the development of "Internet + inclusive finance", Digital Financial Inclusion must have the characteristics associated with financial development to adapt to diverse academic views and social needs. Financial development has an important impact on a country's income distribution pattern. According to the research results of Johnson and Arnold (2012)[1], rural residents do not have access to digital financial services due to the lack of digital technology in remote areas where economic development is relatively lagging behind. In addition, the lack of basic financial literacy among rural residents further exacerbates their demand for Digital Financial Inclusion, which widens the gap between digital technology and rural residents. Wang Yongjing and Li Jing (2021)[2] found that the development of Digital Financial Inclusion has a significant convergence effect on promoting new-type urbanization, but the two have not formed a good integration, so the income gap between urban and rural residents cannot be effectively narrowed. Wang Ning and Hu Leming (2022)[3] found through literature review that, on the one hand, digital economy achieves economies of scale at lower marginal costs by reducing search costs, replication costs and transportation costs, thus promoting globalization and urban-rural integration. Promote employment and income growth in emerging industries, thereby improving the optimization of income distribution. On the other hand, due to lack of knowledge, excess information, monopoly and privacy leakage and other reasons, in the digital economy, basic work has been replaced, the urban-rural income gap has widened, and the skills bias has exacerbated the income gap. Corrado(2017)[4] believes that inclusive finance is highly inclusive and can effectively solve the problem of high threshold for rural financial loans. It can save costs and promote rural financial development by participating in residents' consumption and investment guarantee services without requiring a lot of social resources.

Based on this, this paper proposes:

Hypothesis 1: Digital Financial Inclusion may further widen the income gap between urban and rural residents.

According to the theoretical framework of "preferring the rich to the poor", people have doubts about whether financial development can promote the income gap between urban and rural residents. Greenwood and Jovanovic(1990)[5] pointed out in their research that the development of financial level would aggravate the income gap between urban and rural residents to a certain extent, and showed an inverted U-shaped curve relationship. In addition, Townsend et al. (2006)[6] found that financial development would exacerbate individual income gap and lead to more social inequality. Ye Zhiqiang et al. (2011) 's[7] research results on China show that the rapid development of the financial industry has limited impact on the income level of farmers, but may further widen the income gap. These results show that there are certain risks and uncertainties in the impact of financial development on the income difference between urban and rural residents. Xiong Deping (2020)[8] believes that in the later stage of the development of Digital Financial Inclusion, the excessive improvement of digital level may lead to the worsening of urban and rural income inequality. The reason is that the digital level of Digital Financial Inclusion is too high, resulting in the existence of "digital divide". Under the digital economy, some regions or groups have unfair phenomena in information access, skill training, financial services and so on. According to Kim (2016)[9], through analyzing the economic development data of 40 countries, they are divided into high-income and low-income categories according to per capital GDP, and the results show that the impact of financial development on the urban-rural income gap is different at different levels of economic development. Compared with high-income countries, the impact of finance on reducing the income gap between urban and rural residents in low-income countries is not obvious. In the context of the dual differentiation of urban and rural financial markets such as China, the study of the mechanism of financial development on the income gap between urban and rural residents can provide rich reference materials. Tao Ran et al. (2003)[10] put forward the "paradox of Chinese practice", which has important representative significance in the research. According to their division, China's financial development history can be divided into two stages from 1978 to 1988 and 1989 to 1998. In the early

stage of reform and opening up from 1978 to 1988, agricultural production was liberated and the rural economy developed significantly, which helped reduce the income gap between urban and rural residents. During the period of urban construction as the central strategy from 1989 to 1998, the urban economy developed rapidly, which further widened the income gap between urban and rural residents. According to the study of Li Na (2021)[11], through empirical research on the panel data of 31 provinces and municipalities directly under the central government, the conclusion is that Digital Financial Inclusion can significantly reduce urban-rural income inequality in all regions, but its effect is different. According to the research conducted by Yang Yi et al. (2022)[12] based on the panel data of 30 provinces and cities in China, the coverage breadth and digitization degree of Digital Financial Inclusion can reduce the income gap between urban and rural residents. Based on this, this paper proposes:

Hypothesis 2: The development of Digital Financial Inclusion has a certain threshold for increasing the urban-rural income gap.

3. Model construction and data source

3.1. Model construction

According to hypothesis 1, first of all, we need to explore the impact of Digital Financial Inclusion on the income of urban and rural residents, and build a basic linear regression model based on the panel data of 31 provinces in China from 2012 to 2021:

$$\text{gap}_{it} = \alpha_0 + \alpha_1 \text{dfi}_{it} + \alpha_2 C_{it} + \vartheta_{it} + \varepsilon_{it} \tag{1}$$

In the formula (1), i=1,2..., t= 1, 2..., i stands for region, t stands for time, gap_{it} stands for income gap of residents of Phase t of Region i, dfi_{it} stands for Digital Financial Inclusion, and C stands for control variable. The emphasis of this paper lies in the solution. The focus of this paper is to decode the coefficient of the variable $\alpha 1$. If $\alpha_1 > 0$, it indicates that Digital Financial Inclusion has a positive impact on income gap. Hypothesis 1 is valid.

Drawing on the research results of Xiong Deping et al. (2020), in order to explain the impact of the development of Digital Financial Inclusion on the urban-rural income gap, we will take the degree of digitization as the threshold regression variable and further optimize the model based on it to explore the threshold effect of the urban-rural income gap affected by the degree of digitization. The final setting is as follows:

$$\text{gap}_{it} = \beta_0 + I(\text{dfi}_{it} \leq \theta_1)\beta_1 ind_{it} + I(\theta_2 \geq \text{dfi}_{it} > \theta_1)\beta_2 ind + ... + I(\theta_n \geq \text{dfi}_{it} > \theta_{n-1})\beta_n ind + \beta_2 C_{it} + \vartheta_{it} + \varepsilon_{it} \tag{2}$$

In the formula (2), gap_{it} represents the income gap of residents in the phase t of region i, dfi_{it} represents Digital Financial Inclusion, C represents control variables, β_1, β_2, ... β_n represents the estimated coefficients, θ_1, θ_2, ... θ_n represents the threshold value, ϑ_{it} represents the controlled individual, and ε_{it} represents the random disturbance term such as the introduced unobserved random factor. I(·) is the indicator variable for which the indicative function takes the value of 1 or 0, and takes the value of 1 when the corresponding condition is true, otherwise it takes the value of 0.

3.2. Data source

Table 1: Description of the variable

Variable type	Variable name	Measuring standard	Symbol
Explained variable	Resident income gap	Urban per capita disposable income/rural per capita disposable income	gap
Explanatory variable	Digital Financial Inclusion Index	Peking University Digital Financial Inclusion General Index	ind
Control variable	urbanization	urban population by region/total regional population	urb
	Educational level	Local government expenditure on education (billion yuan)/GDP	edu
	Unemployment rate	Urban registered unemployment rate	une
Threshold variable	Degree of digitization	Peking University Digital Financial Inclusion digital degree index	dig

This study uses the panel data of 31 provincial administrative regions in China from 2012 to 2021 as the research sample, but does not include Hong Kong, Macao and Taiwan.Based on "the report of Peking University Digital inclusive Financial Development Index (2011-2021)",this paper analyzes the digital inclusive financial development index and its various dimensional indicators. In addition, the data of other variables come from the China Statistical Yearbook and the statistical yearbooks of various provinces and cities.Table 1 illustrates the variables.

3.3. Descriptive statistics

According to the data in Table 2, we can see that in the observations from 2012 to 2021, there are 310 samples from 31 provinces and municipalities (excluding Hong Kong, Macao and Taiwan). From the perspective of the income gap of the explained variables, the median value is 10.86, the maximum value is 12.142, and the minimum value is 9.849, indicating that the income gap between urban and rural residents in different regions of China is large. The Digital Financial Inclusion Index (ind) as the core explanatory variable has a mean of 5.444, a maximum of 6.129, and a minimum of 4.119. It shows that Digital Financial Inclusion still needs to be further improved and developed in China. Similarly, the mean, maximum and minimum values of Digitization Degree indicator (dig) also show a lot of room for growth. In terms of control variables, the maximum value of urbanization level index (urb) is 0.896 and the minimum value is 0.128, which indicates the unbalanced urbanization progress in different regions of China. The unemployment rate index (une) has a maximum value of 4.6 and a minimum value of 1.2, which is nearly four times the difference, indicating that there is a large gap in the employment situation in different regions. The maximum value of education expenditure level index (edu) is 0.168, and the minimum value is 0.022, which shows that there are great differences in education expenditure in different regions.

Table 2: Descriptive statistics

Variable	Observed value	Mean value	variance	Minimum value	Maximum value
Resident income gap	310	10.86	0.436	9.849	12.142
Digital Financial Inclusion Index	310	5.444	0.413	4.119	6.129
Degree of digitization	310	5.738	0.344	4.673	6.136
urbanization	310	0.593	0.128	0.229	0.896
Educational level	310	0.045	0.023	0.022	0.168
Unemployment rate	310	3.203	0.636	1.2	4.6

3.4. Stationary test

In order to prevent the pseudo-regression phenomenon of panel data from affecting the accuracy of the regression results in this paper, before the regression analysis, we first used the LLC test method to test the stationarity of the variables in this paper. Based on the results in the following table 3, we can see the test statistics and corresponding p-values of each variable. The results show that all variables reject the null hypothesis of the existence of a unit root, meaning that all variables are stationary. The result shows that the conclusion of this paper is valid.

Table 3: Stationary test

Variable	Test value	P-value	conclusion
Resident income gap	-7.0020	0.000	Stationary
Digital Financial Inclusion Index	-12.4563	0.000	Stationary
Degree of digitization	-18.3297	0.000	Stationary
urbanization	-6.5224	0.000	Stationary
Educational level	-7.9324	0.000	Stationary
Unemployment rate	-1.9715	0.0243	Stationary

In this paper, the variance expansion factor of each variable is further calculated to determine whether there is multiple collinearity among the variables. Some viewpoints believe that there is no collinearity

if the correlation coefficient is less than 0.8, but in reality, there is more or less multicollinearity of pair variables, and then we need to test it. That is, the measurement of variance inflation factor, as long as it is not more than 10, we believe that there is no collinear problem. In the table 4, we can see that the maximum value of VIF is 2.05, and the urbanization level of the control variable is much lower than 10. Therefore, we can conclude that there is no collinearity problem in these variables.

Table 4: VIF test

Variable	VIF	1/VIF
urbanization	2.05	0.488231
Educational level	1.75	0.572948
Digital Financial Inclusion Index	1.35	0.742739
Unemployment rate	1.10	0.906889
Mean VIF	1.56	

3.5. Effect test

In this paper, F-test and Hausman test were used to observe the optimal effect model. By comparing the two models, the significance test showed that the fixed effect model was statistically significantly better than the mixed OLS model and the random effect model. Therefore, this paper chooses fixed effect as the optimal effect model. The results are shown in Table 5.

Table 5: Effect test

test	P-value	Conclusion
F test	0.000	The fixed effect model is superior to the mixed OLS model
Hausman test	0.000	The fixed effects model is superior to the random effects model

4. Empirical analysis

4.1. Baseline regression

In Table 6 formula (1) shows the impact of Digital Financial Inclusion on income gap without adding control variables, while the results of formula (2) after adding control variables show that the results based on the fixed-effect model show that the estimated coefficient of Digital Financial Inclusion composite index is 0.2370, which is statistically significant at 1% significance level. This shows that the development of Digital Financial Inclusion can help widen the income gap between urban and rural residents. Specifically, every time the total digital financial inclusion index increases by one unit, the income gap between urban and rural residents wide Digital Financial Inclusionns by 0.2370 units. Therefore, Digital Financial Inclusion can raise the service threshold of inclusive finance to a certain extent, so that more people can benefit from digital financial services. The development of Digital Financial Inclusion is not conducive to alleviating the income imbalance caused by the threshold effect, but may increase the income gap between urban and rural residents.

From the perspective of control variables, urbanization level plays a positive role in promoting the income gap, with a coefficient of 2.9424 and a P value of 0.0000, passing the significance test of 1% level. In other words, the higher the degree of urbanization, the greater the income gap will be.This is probably because the country's fiscal and financial policies have always favored industry and cities, and all funds have been invested in the construction and development of cities. Although the number of farmers moving into cities is increasing with the increasing degree of urbanization, most of them have only the average basic salary, and the level of bank lending to rural areas and farmers has been low, and the urbanization orientation of financial intermediaries in lending has continuously distorted the income gap between urban and rural areas.

Education (edu) has a significant negative impact on the income gap of residents, that is to say, the higher the degree of education, the more it can reduce the income gap. First of all, the government will invest more educational resources in rural areas, especially in rural basic education, and the gap between urban and rural education level will change from expanding to gradually narrowing. Second, the government has increased subsidies for education, especially in rural areas, which has stimulated enthusiasm for setting up schools. By increasing the investment in rural education and improving the

quality of education, the imbalance between urban and rural areas can be reduced. The coefficient of unemployment rate is 0.0042, but the income gap in China is not significant. The possible reason is that China is a big agricultural country and a big manufacturing country, and labor employment is more concentrated in labor-intensive industries, while capital and technology-intensive industries that require higher technical level and knowledge reserve do not attract labor employment. So the income gap has not been effectively improved.

Table 6: Baseline regression

		(1)	(2)
		y	y
Digital Financial Inclusion Index		0.5272***	0.2370***
		(44.0700)	(9.5200)
urbanization		——	2.9424***
			(11.8019)
Educational level		——	-5.1868***
			(-5.9060)
Unemployment rate		——	0.0042
			(0.3774)
_cons		7.9893***	8.0442***
		(122.3405)	(84.0137)
N		310	310
adj. R^2	0.861	0.913	

t statistics in parentheses* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.2. Threshold effect regression

Threshold represents the threshold or threshold value. We take the Digital Financial Inclusion Index (ind) as the self-variable, the urban-rural income gap (gap) as the dependent variable, and the digitization degree (dig) as the threshold variable. The threshold effect regression was performed when the control variables remained unchanged. Table 7 Results of threshold validity test show that the P-value of the single threshold is 0.0000, and the P-value of the double threshold is 0.1800, that is, the single threshold test rejects the null hypothesis, indicating that the digitization degree of Digital Financial Inclusion in China has a single threshold effect on the urban-rural income gap. bootstrap represents the number of bootstraps. Theoretically, the more the better, but in order to improve the execution efficiency of this paper, it is set to 300.

Table 7: Threshold effect

Threshold effect test (bootstrap = 300 300 300):							
Threshold	RSS	MSE	Fstat	Prob	Crit10	Crit5	Crit1
Single	0.9239	0.0031	90.83	0.0000	37.6833	43.9367	50.7862
Double	0.8300	0.0028	33.91	0.1800	23.2650	44.5945	78.3230

Table 8: Threshold estimates (level = 95%):

model	Threshold	Lower	Upper
Th-1	5.0968	4.9971	5.4032

According to the estimation results of threshold values in Table 8, there is a threshold for digitalization degree. th-1 represents the value of a single threshold period, when the threshold value is 5.0968, and the threshold value in this paper has passed the 95% level significantly.

To verify the accuracy of the estimation results of threshold values. This paper further explains the double threshold for studying the impact of Digital Financial Inclusion on income gap. 0b._cat#c.x and 1._cat#c.x respectively indicate the significance level when the digitization degree is less than the first threshold value and greater than or equal to the threshold value. From Table 9, it can be concluded that when the digitization degree is less than 5.0968, The impact of Digital Financial Inclusion Index on residents' income gap is positive and significant at the 1% level, which is also consistent with our research hypothesis. When the degree of digitization is greater than the threshold value, the coefficient of income gap is 0.465, which also passes the significance level. This means that Digital Financial Inclusion, while improving the digital level, will also widen the income difference between residents, mainly due to the

imperfect infrastructure, poor education level, low popularity of digital products, or insensitive acceptance of digital products. Therefore, the corresponding measures taken by relevant departments did not bring too much benefit to the regional poor, but further widened the income gap between urban and rural areas.

Table 9: Threshold significance test and robustness test

	(1)	(2)
Variables	Income gap	Income inequality lags by one stage
Digital Financial Inclusion Index	——	1.5418***
		(11.0771)
urbanization	1.461*	1.5264***
	(1.73)	(11.4047)
Educational level	-5.486***	1.3573**
	(-2.87)	(2.4118)
Unemployment rate	0.005	-0.0171
	(0.28)	(-0.9949)
0b._cat#c.x	0.504***	——
	(4.53)	
1._cat#c.x	0.465***	——
	(4.46)	
Constant	7.677***	2.7215***
	(42.11)	(4.3304)
year	control	control
Observations	310	279
Number of id	31	31
R-squared	0.941	0.856

t statistics in parentheses* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In order to further verify the validity of this paper and prevent the phenomenon of significant results and insignificant conclusions, this paper carries out a plot analysis on the threshold. The LR graph (graphic) analysis of the threshold value in Figure 1 below shows that there is a critical value below the red line, indicating that there is a threshold, which is between 5 and 5.5. So our conclusion is borne out. That is, the impact of the development of Digital Financial Inclusion on the income gap between urban and rural residents presents a non-linear relationship, which is specifically manifested as the difference in the impact of Digital Financial Inclusion within a single threshold interval.
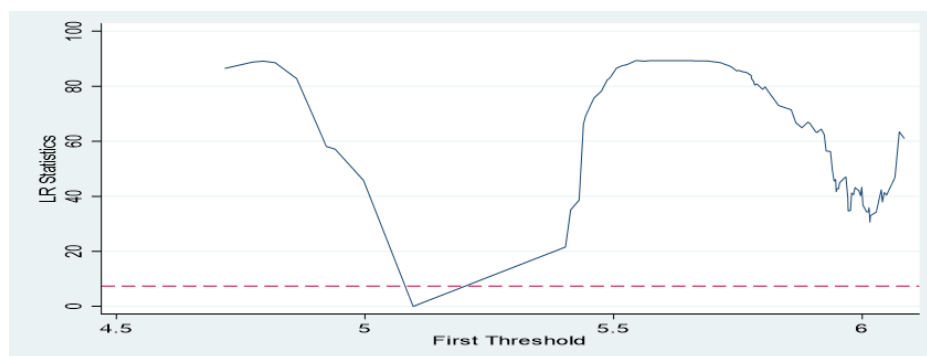

Figure 1: LR graph of threshold value (diagram)

4.3. Robustness test

In order to verify the validity of the conclusions of this paper and prevent the occurrence of endogenous problems such as missing variables, the explained variable, namely the income gap, is delayed by one period to conduct a robustness test. The results are shown in (2) of Table (9). The result of Digital Financial Inclusion lagging one period on the income gap is significantly positive, and the measure index of the explained variable is changed. After regression analysis, it is found that the model results are equally significant, and the direction of influence on the research conclusion is consistent with that of the original model, so the research conclusion is still valid.

5. Conclusion and enlightenment

After the empirical analysis of Digital Financial Inclusion and urban-rural income gap, we will summarize the above research results to reach the research conclusion of this paper. At the same time, based on the results of this study, we will put forward a series of targeted policy recommendations to help relevant policy makers and decision makers to further narrow the urban-rural income gap and promote the realization of the goal of common prosperity.

5.1. Develop Digital Financial Inclusion in light of local conditions

Due to the significant differences in economic nature, human geography and urban and rural planning, the development of Digital Financial Inclusion has not been fully balanced in China, resulting in the income gap between urban and rural residents still needs to be further narrowed. According to the above research results, we can learn that the impact of Digital Financial Inclusionon the urban-rural income gap is diverse due to regional differences. Therefore, relevant policies should be formulated according to the actual situation of China to promote the development of digital universal financial services, so as to reduce the income gap between urban and rural residents.

5.2. Strengthen digital construction

It is crucial to promote innovation in digital inclusive financial products and services in rural areas of western China. At present, the main platform of Digital Financial Inclusion in western rural areas of China is still rural credit cooperatives, whose business scope is relatively narrow and traditional. With the popularization of the Internet business scope and the expansion of digital financial services, rural areas urgently need the participation of more new financial instruments, and constantly enrich and innovate the digital inclusive financial services and products serving the western rural areas,so as to better meet local financial needs and improve the inclusive effect of digital financial services.

5.3. Lower financial barriers

Financial institutions appropriately relax the credit threshold for low- and middle-income people. Using policy-based financial instruments to solve the problems of income inequality and widening gap between the rich and the poor of urban residents. For example, we will expand the coverage of small poverty alleviation loans and student loans, and provide support for entrepreneurship and development for low-income people in urban areas.

5.4. Expand people's income channels actively

In order to increase the proportion of national income distribution, it is necessary to increase the investment in primary distribution and improve the mechanism of distribution according to production factors. In addition, we should also actively explore various ways to increase the factor income of low and middle-income groups, and adopt various ways to increase the property income of urban and rural residents. In addition, in the stock market, China needs to strengthen information disclosure and improve the dividend incentive system to ensure that investors' expectations of asset returns are stable. At the same time, financial knowledge should be popularized to help citizens establish correct financial concepts and financial planning, so as to improve personal financial literacy and financial management ability.

Through the implementation of the above measures, we can better promote the distribution of national income, narrow the income gap between urban and rural residents, achieve a more balanced wealth distribution, and further promote the goal of common prosperity.

Acknowledgements

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