Research on the Effectiveness of E-Commerce in Poverty Alleviation in the Context of Precise Poverty Alleviation--Taking Gansu Province as an Example

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Abstract: Thanks to the rapid development of modern networking and digitalization, e-commerce has come into being. In recent years, under the guidance and call of the national strategy of precise poverty alleviation, the e-commerce business segment has gradually expanded and extended to poor areas, providing new development opportunities for regional economic growth, accelerating the transformation and upgrading of local industries, and driving farmers to generate income and increase their income. By analyzing the mechanism of the role of e-commerce in poverty alleviation from multiple dimensions, this paper empirically analyzes the influencing factors of e-commerce in poverty alleviation in Gansu Province using regression models, and proposes initiatives to further consolidate the effectiveness of poverty alleviation based on the research results, so as to lay a solid foundation for the implementation of rural revitalization strategy.

1. Introduction

As the main battlefield of the national poverty alleviation campaign, the removal of poverty in all 75 poor counties in Gansu Province in 2020 marks the high scientific, practical and effective basic strategy of the Party Central Committee for precise poverty alleviation, and is another important milestone on the journey of the great rejuvenation of the Chinese nation. Review of Gansu Province, this poverty alleviation and poverty reduction results, the contribution of e-commerce can not be ignored. In recent years, thanks to the rapid changes in network information technology, poverty alleviation means increasingly diverse and the emergence of new business models, new business models, e-commerce emerged, rapid development, driving the economy of Gansu Province to the ranks of high-quality development, the digital economy "acceleration" running, leading people out of poverty, on the road to wealth .

To further explore the effectiveness of e-commerce poverty alleviation model, improve the theoretical framework of poverty alleviation, maintain the sustainability of poverty alleviation results, and lay the foundation for the implementation of strategies such as rural revitalization, this paper selects Gansu Province, a very representative poverty-stricken region, as the research object, and adopts a combination of theoretical construction and empirical research to explore the impact of e-commerce on the effectiveness of poverty alleviation in the region under the leadership of the central government's precise poverty alleviation policy. Specifically, firstly, we provide an overview of the existing literature in the fields of "precise poverty alleviation" and "e-commerce" at home and abroad, and analyze the mechanism of the role of e-commerce in poverty alleviation; secondly, we extensively collect data on population, GDP, and e-commerce in Gansu Province from 2012 to 2019, and conduct an empirical study. Secondly, we collect data on population, GDP and e-commerce in Gansu Province from 2012 to 2019, conduct an empirical study, draw empirical results through relevant analysis of the data, and finally elaborate the findings of the study and propose relevant initiatives to consolidate the effectiveness of poverty alleviation.

2. Literature Review

2.1 Domestic Literature Review

Li Wancheng et al. (2015) defined precise poverty alleviation as the process of realizing the effectiveness of poverty alleviation by adopting a site-specific approach, implementing linkage assistance, flexible access and exit criteria, and precise assessment under the premise of scientific and effective and precise identification of poverty targets [1]. Huang Chengwei and Qin Zhimin (2015) proposed that precise targeting of poverty and precise allocation of poverty alleviation resources are important components of precise poverty alleviation, the core of which is to achieve "real poverty alleviation and real poverty alleviation" and promote long-term and stable reduction of poverty and gradual enrichment of the poor [2]. According to Liu Zhanyong (2016), the core of precise poverty alleviation is the accurate positioning of poverty alleviation elements, that is, precise poverty alleviation is based on the working principles and methods of scientific precision of poverty target identification and resource allocation, reasonable and efficient allocation of social group forces and sustainability of poverty alleviation results, aiming to achieve the ultimate goal of comprehensive poverty alleviation, comprehensive well-off and comprehensive development in the new era of poverty alleviation [3].

Based on the industry perspective, Li Luyun et al. (2015) proposed that e-commerce poverty alleviation is not constrained by various aspects and has significant breakthroughs in terms of market scope extension and sustainability [4]. Zheng Ruiqiang (2016) discussed the benefits of e-commerce in poverty alleviation from two perspectives: first, analyzing from the industry perspective, he argued that e-commerce helps emerging products emerge, market share expansion and industrial transformation and upgrading; second, from the poverty target, he argued that it plays a key role in stimulating the endogenous motivation of poor households, cultivating their sense of independent creativity and enhancing their development potential [5]. Ye Shifan (2018) argues that e-commerce poverty alleviation is a subversive initiative to the traditional way of defining and allocating resources, which can better drive the poor people with file cards out of poverty and increase their income to become rich [6]. Yang Jinlong (2018) believes that the good development of rural e-commerce in the context of the "Internet+" era has the potential to attract e-commerce giants to sink the rural market, expand the poverty alleviation "mountain goods" into the city and "net goods The two-way logistics circulation mode of "mountain goods" into the city and "net goods" into the village, as well as the great potential of stabilizing and consolidating the results of poverty eradication [7].

In summary, domestic scholars have conducted extensive research in the field of poverty eradication and e-commerce poverty alleviation, but less attention has been paid to research on specific regions or application mechanisms. Based on this, this paper mainly takes Gansu Province as an example to explore the effectiveness of its e-commerce poverty alleviation implementation, point out potential problems, and provide rationalized development strategies.

2.2 Review of Foreign Literature

Based on the vicious circle theory of poverty, Narkes (1953) addressed the current situation of the constant cycle of poverty in developing countries at both the supply and demand levels and concluded that capital scarcity is the root cause of chronic poverty in economic operation [8]. In the theory of low-level equilibrium trap, Nelson (1969) pointed out that the high rate of population growth in underdeveloped countries would limit the growth rate of their per capita income, while the large-scale capital injection would drive the growth rate of investment and output to exceed the population growth rate, and finally achieve the high growth rate of per capita income level and national economy to successfully cross the trap [9].

Bill Pool (2001) argues that the extension of supply chains to rural markets is a good catalyst for accelerating the flow of information factors allocated between urban and rural markets and solving information asymmetry problems. Thus, rural e-commerce will help to promote broad producer participation and the realization of broader, transparent transactions [10].Elia, Lefebvre (2007) conducted a study on the impact of rural e-commerce from an industrial retailing perspective and concluded that e-commerce can stimulate market dynamics, stimulate consumption, and improve

profitability by increasing sales and reducing inquiry and transaction cost costs [11].

In summary, the existing foreign literature has mainly studied the causes of poverty, low-level income trap formation and continuous cycle in developing countries, and there is a lack of research in the field of precise poverty alleviation and e-commerce.

3. The Role Mechanism of e-Commerce in Poverty Alleviation

E-commerce empowers rural revitalization and promotes the realization of high-quality resources.E-commerce for poverty alleviation helps groups in poor areas understand and master the ability to use e-commerce in a timely manner and develop regional special economies. Through the creation of information technology platform, poor areas are expected to break the information and technology barriers, obtain the latest market trends and real-time direction, symmetrical supply and demand information; the emergence of e-commerce can fully explore and play the regional advantages, the use of its high-quality products, tourism resources, to create regional characteristics, to fully serve the fight against poverty, so that poor subjects share the fruits of e-commerce development, to achieve " The goal of transforming "blood transfusion" poverty alleviation to "blood creation" poverty alleviation.

3.1 Stimulate the Vitality of Agricultural Products on the Market and Optimize the Supply and Marketing Model

The main difficulties of agricultural products on the market are the low standardization of products and slow transportation timeframe, while the emergence of e-commerce provides an opportunity for their development. E-commerce operations firstly ensure quality sources and promote standardized production by tracking and disclosing the source of product production and cultivation, while acting as a channel for attracting traffic and branding marketing with its traffic advantages. In addition, the construction of logistics and distribution outlets and other facilities during the construction of e-commerce, as well as the emergence of new e-commerce models such as micro-business and live broadcast, also promote the integration of online and offline sales, effectively alleviating the pressure of product stagnation and difficulty in selling, helping to create a new retail business of agricultural products and cultivating new economic growth points.

3.2 Boosting the Transformation and Upgrading of Traditional Industries and the Integration of Industrial Chains

The e-commerce poverty alleviation model instills "Internet+" thinking into traditional industries, and promotes the combination of agriculture and service industries to form new industrial patterns. Through the integration of big data and e-commerce go hand in hand to promote the enterprise, scale and brand development of products, create a new industrial model of "vertical e-commerce + product optimization + technology poverty alleviation", form an industrial chain centered on special products, promote the brand cultivation process, and transform the regional economic ecology.

3.3 Stimulate the Entrepreneurial Vitality of Farmers and Enhance Their Confidence to Get Rich

E-commerce helps farmers to detect the dynamics of industrial operation, explore entrepreneurial opportunities, break away from conservative concepts, follow the trend of the times, participate in market activities with enthusiasm, and create more wealth with their hard work and wisdom. With the support of the state and governments at all levels for the development of e-commerce, e-commerce skills training courses and services such as e-commerce rich leaders to drive entrepreneurship also bring rich e-commerce knowledge to farmers who have the will to start their own businesses, broaden their learning avenues and connect them to the road of e-commerce richness with low-threshold entrepreneurship.

4. Variables, Models and Data

4.1 Variable Settings

Selection of explanatory variables

This study mainly takes Gansu Province as an example to explore the effect of e-commerce on poverty alleviation, selects poverty incidence as an observable indicator of e-commerce poverty alleviation, and analyzes the effects of industrial growth, e-commerce development, and economic growth on poverty incidence.

Agricultural income growth rate (AIG): In recent years, the development of Gansu Province's e-commerce poverty alleviation situation has gained momentum, for the development of agricultural products, the province has also carried out more initiatives, so this paper adds the factor of agricultural income growth in the study to measure the effect of e-commerce poverty alleviation. Theoretically, when the two are combined, e-commerce poverty alleviation and agricultural products, the Internet era can promote the sale of agricultural products through shopping platforms and live broadcast platforms, which in turn promote industrial development, improve the income of residents, reduce the poverty rate in Gansu Province, and help fight poverty. Therefore, the greater the growth rate of agricultural income, the more significant the efficiency of poverty alleviation. Its calculation CG = (the current year's agricultural income - the previous year's agricultural income) / the previous year's agricultural income.

E-commerce development index (aEDI): The development of e-commerce has an important impact on the effect of poverty alleviation, and the most authoritative index to measure e-commerce development is currently the e-commerce development index. In this paper, we refer to the calculation method in Ali Research Institute's "China County E-commerce Development Index Report", and conduct research from both the demand side and supply side, which is calculated in Table 1.

Table 1 e-Commerce Development Index Calculation Formula

E-commerce Development Index (0.5* E-commerce Transaction Index + 0.5* Consumer Expenditure Index)	E-commerce Transaction Index	E-commerce transaction index = E-commerce transaction value/GDP
	Consumer Expenditure Index	Consumer spending index = online shopping consumption / per capita disposable income

The development index covers the consumer expenditure index, which reflects the demand of residents; the e-commerce transaction index, which reflects the regional supply. Analyzed from both demand and supply, it can comprehensively and reasonably measure the level of e-commerce development in Gansu Province.

Economic growth (EG): This study mainly explores the effect of poverty alleviation and focuses on economic income at the individual level, so GDP per capita is chosen as a measure to reflect the living standard of the residents, and the data analysis is more reasonable. The growth of GDP per capita reflects the good prospect of the provincial economy and the steady improvement of people's living standard, calculated as EG = Gross regional product (GDP) / total regional population at the end of the year.

4.2 Measure of the Explanatory Variable (Incidence of Poverty)

Poverty incidence (PI): There are many ways to measure the effect of e-commerce on poverty alleviation, and this study mainly adopts poverty incidence as an indicator to measure it. Poverty incidence refers to the proportion of the population below the poverty line to the total population, which is clearer than the total population out of poverty and can reflect the poverty level of the region more directly. The lower the incidence of poverty, the lower the poverty level of the region, and vice versa. It is calculated as POV = number of poor people/number of people counted.

1) Model Setting

Based on the above variables, a multiple linear regression was performed using SPSS software to construct the model as follows:

$$PI_t = \beta_0 + \beta_1 AIG_t + \beta_2 IM_t + \beta_3 aEDI_t + \beta_4 EG_t + u_t$$

Where PIt denotes the poverty incidence in Gansu Province in year t, AIGt denotes the agricultural income growth level indicator in year t, and IMt denotes the e-commerce transaction index in year t.

aEDIt is the e-commerce development index of Gansu Province in year t. EGt is the economic development indicator, and this paper uses the GDP per capita indicator of Gansu Province to measure.

2) Data source

E-commerce poverty alleviation was first proposed by Wang Xiangdong since 2012, and was formally incorporated into the poverty alleviation system in 2015. The sample of this paper is selected from the data of Gansu Province for the period of 2012-2019. The data come from the Gansu Provincial Statistical Yearbook, the Ministry of Commerce's China E-Commerce Report, Gansu Provincial Bureau of Statistics, Alibaba Research Institute, etc.

Different evaluation indicators often have different scales and units, and such a situation can affect the results of data analysis. In order to eliminate the influence of the scale between indicators, data standardization is needed to address the comparability between data indicators. One of the most typical is the normalization of data, so this study normalizes the variables, and the data analysis operations below are based on the processed data. The normalization formula is: y=(xi-min)/(max-min).

5. Empirical Results and Analysis

5.1 Descriptive Statistics

Table 2 Descriptive Statistics Of the Variables

	PI	AIG	IM	aEDI	EG
Min	0.9%	0.0021	0.057	6.830	2.334
Max	33.2%	0.725	0.399	22.740	3.299
Mean	16.0%	0.163	0.254	11.939	2.705
SD	10.7%	0.251	0.130	5.359	0.339

According to Table 2, it can be seen that during the period 2012-2019, the maximum value of PI in Gansu Province is 33.2%, the minimum value is 0.9%, the mean value is 16%, and the standard deviation is 10.7%, indicating that there is a large gap between PI in different years in Gansu Province in recent years, and the incidence of poverty has decreased significantly in recent years. The minimum value of E-commerce development index is 6.83, the maximum value is 22.74, the standard deviation is 5.359. thus, it can be seen that in the past nearly ten years, e-commerce has been greatly developed. the minimum value of EG is 2.334, the maximum value is 3.299, the standard deviation is 0.339, indicating that in recent years there is a large change in per capita GDP, side reflecting the increase in disposable income of residents.

5.2 Correlation Analysis

Before conducting the regression analysis, correlation analysis was conducted for poverty incidence, e-commerce transaction index, e-commerce development index, agricultural income growth level, and economic development indicators. The purpose and results of correlation analysis are to feedback the logic of association between data, verify the closeness of variables, and in some way, to initially verify the hypotheses. The test criteria are: (1) when the confidence level is below 0.01, 0.05 or 0.1, it means that the correlation between the variables is obvious; (2) the larger the absolute value of the value, the greater the correlation between the variables. The correlation coefficients of the variables are shown in Table 3:

Table 3 Correlation Coefficients Of Variables

	PI	AIG	IM	aEDI	EG
PI	1				
AIG	-0.777**	1			
IM	-0.978***	0.663	1		
aEDI	-0.912***	0.946***	0.854***	1	
EG	-0.947***	0.914***	0.887***	0.964***	1

Note: ***, **, * represent 1%, 5%, 10% significance level respectively, the same below.

The correlation coefficient between PI and AIG is negative and significant at the 5% level, indicating that there is a significant negative correlation between poverty incidence and the level of agricultural income growth and e-commerce development index. the correlation coefficients between

PI and IM, aEDI, and EG are also negative and pass the 1% significant level test, so there is a significant negative correlation between PI and IM, aEDI, and EG relationship.

5.3 Regression Analysis

Based on the data of Gansu Province from 2012-2019, the regression results of the model were calculated using spss26.0 as follows:

Test of goodness of fit

The goodness of fit refers to the degree of closeness between the points on the regression line and each observation, and the indicator reflecting the goodness of fit is the coefficient of determination R^2 of the model. In order to avoid overestimating R^2 by adding independent variables, the adjusted R^2 is usually used.

As can be seen from Table 4, the model R^2=0.998 and the adjusted R^2=0.988, which proves that the overall model has a good fit, and the p-value of the test regression coefficient=0.001<0.01, which indicates that the model as a whole has a significant linear relationship between the explanatory variables and the explained variables, and can play a good explanatory role.

Table 4 Model Summary Table

Model Summary	
R2	0.998
AdjustmentR2	0.988
F	150.264
P	0.001

Testing and correction of multicollinearity

In the regression analysis, if there is multicollinearity, it will cause confusion in the regression results and even lead the analysis astray, so it is necessary to diagnose the multicollinearity

Table 5 Table of Preliminary Regression Results

Variable	Coefficient	Std. Error	T	Significance	VIF
c	0.974	0.032	30.412	0.000	0.000
AIG	-1.219	0.520	-2.344	0.101	178.524
IM	-1.329	0.335	-3.972	0.029	88.253
aEDI	1.141	0.509	2.239	0.111	160.827
EG	0.426	0.371	1.147	0.335	92.903

Note: Dependent variable: PI

According to Table 5, we derive the regression equation as follows:

$$PI_t = 0.974 - 1.219AIG_t - 1.329IM_t + 1.141aEDI_t + 0.426EG_t$$

Among them, the coefficients of e-commerce development index and GDP per capita are 1.141 and 0.426 respectively, and the signs are positive, which are contrary to the economic significance, in addition, the variance inflation factors of the independent variables are large, and it is generally considered that if VIF>10, we judge that the explanatory variables and other explanatory variables may have serious co-linearity problems. In summary, there is multicollinearity in the explanatory variables in this model

There are two methods to solve the multicollinearity, stepwise regression and ridge regression. In this study, we use ridge regression to eliminate the multicollinearity among the explanatory variables, which is in essence a modified least squares method, by giving up the unbiased nature of least squares and obtaining a more realistic and reliable regression coefficient at the cost of losing some information and reducing the accuracy.

Table 6 Table of Ridge Regression Results

K=0.148	Coefficient	Std. Error	Value of T	Significance (P)
c	0.877	0.049	17.987	0.000***
AIG	-0.034	0.07	-0.481	0.043**
IM	-0.434	0.076	-5.706	0.011**
aEDI	-0.165	0.065	-2.534	0.085*
EG	-0.259	0.07	-3.723	0.034**
R^2	0.975			
AdjustmentR^2	0.943			
F	29.726			
P	0.01			

Note: Dependent variable: PI

From the results of the ridge regression, the multicollinearity has been largely eliminated. The regression equation was obtained as:

$$PI_t = 0.877 - 0.034AIG_t - 434IM_t - 0.165aEDI_t - 0.259EG_t$$

AIG is the level of growth of agricultural products, and its coefficient is negative, corresponding to a p-value less than 0.05, indicating that when there is a negative correlation between the level of growth of agricultural products and the incidence of poverty. That is, when the income of agricultural products increases more, the incidence of poverty is lower.

IM is the e-commerce transaction index, which corresponds to a p-value of 0.011 and is significant at the 5% level, i.e., the e-commerce transaction index has a significant effect on the poverty incidence, and an increase in the e-commerce transaction index will reduce the poverty incidence in Gansu Province.

aEDI is the e-commerce development index, and its coefficient is negative with a p-value of 0.085, which is less than 0.1, indicating that the e-commerce development index has a negative effect on the incidence of poverty.

EG is the economic development index with a negative coefficient of -0.259 and a p-value of 0.034, which is less than 0.05, i.e., significant at the 5% level, indicating that the EG economic development index, like the two indicators above, has a significant negative effect on poverty incidence, and when the economic development index increases by 1%, it will make the poverty incidence decrease by about 0.259%.

6. Research Findings and Recommendations

6.1 Research Findings

The rapid development of e-commerce has led to a revitalized consumer market, improved quality and efficiency, and laid a solid foundation for the future implementation of the rural revitalization strategy. Based on the data of e-commerce and related poverty alleviation in Gansu Province from 2012-2019, this paper studies the implementation and work effectiveness of e-commerce poverty alleviation in the area. After empirical analysis, the following conclusions are drawn: the incidence of poverty in Gansu Province is significantly and negatively correlated with the growth level of agricultural income, e-commerce development index, e-commerce transaction index and economic growth, that is, the construction and development of rural e-commerce ecosystem in Gansu Province has achieved phased positive results, which are manifested as: the incidence of poverty in Gansu Province has significantly decreased, the economy has steadily grown, and the quality of life of residents has further improve

6.2 Rationalization Suggestions

In order to effectively consolidate and enhance the effectiveness of poverty alleviation, in view of the current situation of e-commerce development in Gansu Province, this paper puts forward the following optimization recommendations:

(1)Improve the construction of supporting facilities to optimize the environment for the development of e-commerce

Gansu Province should accelerate the construction of 5G base stations, improve network coverage, and strive for accurate signal coverage throughout the region; introduce big data integration technology to solve the problem of information asymmetry, help farmers grasp the latest market dynamics in a timely manner, and achieve efficient matching of supply and demand information; strengthen road traffic and other infrastructure construction, build proximity logistics service outlets, explore new logistics and distribution models, and improve the logistics system, and strive to create an efficient logistics service system in Gansu

(2)Create an integrated industry chain to help standardize the brand

E-commerce enterprises and farmers should focus on market-oriented production and marketing docking, focus on further integration of the industrial chain from the production end to the consumption end, smooth product distribution channels, and stabilize the purchase and sales relationship between the two ends; the government should set strict production standards for agricultural products, urge operators to strictly comply with production regulations, and provide consumers with healthy, high-quality products; on the premise of meeting the needs of the consumption end, producers should combine their unique natural conditions with advanced management techniques and cultivation methods to promote the cultivation and construction of branding of special agricultural products, and promote standardized and large-scale production of products.

(3)Strengthen the construction of talent teams to create a new high ground for e-commerce

The government should encourage e-commerce talents to return to their hometowns for employment through the implementation of tax exemptions, employment allowances and other policy preferences; co-organize an e-commerce talent salon with the resident e-commerce business, invite competent people to teach their experience, broaden the space for entrepreneurial exchange and drive the masses out of poverty; regularly carry out e-commerce business training courses, combine professional teaching with farmers' independent learning, integrate business knowledge with practical operation, jointly explore and grasp development opportunities, and help e-commerce business become an important new growth point for the local economy

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