Regional Differences in the Impact of Internet on Agricultural Economic Growth

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Abstract. In the context of developing the "Internet Plus Agriculture" initiative, this paper investigates the impact of the Internet on China's agricultural economic growth and its regional differences. Through recourse to a panel data model, the paper analyzes regional differences in Internet resources and their impact on the agricultural economic growth in 31 provinces, municipalities and autonomous regions in China. The paper concludes that the impact of the Internet on eastern China is significantly greater than that on the central and western regions. The central and western regions can tap the potential of applying Internet resources in agricultural production by adopting such measures as promoting feature agriculture, strengthening agricultural e-commerce, building online brands, and promoting official websites.

Keywords: Internet Plus, Agricultural Economy, Economic Growth, Regional Economy

1. Introduction

The 19th National Congress of the Communist Party of China described the principal contradiction in China now as one "between the people's ever-growing needs for a better life and unbalanced and inadequate development of the country." The Midwest of China, in particular, faces a serious challenge of insufficient efficiency and growth of related industries. In addition, the eastern, central and western regions in China have developed unevenly. These constitute the major challenges in the transformation and upgrading of China's industrial structure. An important tool for the transformation and upgrading is to use the Internet technology to promote information dissemination, expand product

markets, establish product channels, build a market price equilibrium mechanism, and promote the full and balanced development of the regional economy.

The Internet technologies and applications such as e-commerce, community marketing, 5G, the Internet of Things, big data, cloud computing, and block chain have developed rapidly, and played an increasingly important role in agricultural economic growth. The country has formulated Internet Plus initiatives, smart agriculture, and rural revitalization strategies. Much emphases have been placed on the Internet Plus Agriculture strategy to promote agricultural production and consumption as well as transformation and upgrading of the entire industrial chain, and boost the multi-level, and sustainable development of agriculture in an all-round way.

By the end of 2018, the number of Chinese netizens has reached 854 million, and the Internet penetration rate has reached 61.2%, with the number of websites amounting to 5.18 million, and the number of domain names adding up to 3.79 million. In 2018, China's e-commerce transactions totaled 31.6 trillion, of which online retail sales in rural China in 2018 reached 1.37 trillion yuan, a year-on-year increase of 30.4 percent. The national online retail sales of agricultural products reached 230.5 billion yuan, up 33.8 percent year-on-year. E-commerce in rural China has boomed.

The implementation of Internet Plus Agriculture strategy has generated certain benefits, but the impact of its economic effects vary in different regions and periods. By constructing a panel using relevant data of the country's 31 provinces, municipalities and autonomous regions, the present study is intended to analyze the economic effects of Internet Plus Agriculture practices in various regions of China, and contrast the economic effects of China's eastern, central, and western regions in an endeavor to provide suggestions for the implementation of Internet Plus Agriculture model in our country. The study is highly implicational for promoting the full and balanced agricultural economy in China.

2. Literature Review

The Internet has fundamentally changed economy. Li Qi pointed out that as new productivity, Internet applications such as e-commerce have become an important driving force for economic growth[1]; Internet technologies, in accordance with Moore's Law, make it possible for Internet users to obtain more value[2].The rapid development of the Internet has been changing many industries. The benefits of an integration of informatization and industrialization has emerged. E-commerce expands the product market, and the Internet of Things technology makes distance no longer a problem. These Internet technologies are also playing an increasingly important role in agriculture. Since Premier Li Keqiang first proposed Internet Plus initiative in the government work report on March 5, 2015, the Internet Plus Agriculture model has gained great popularity.

To date, much work has been done to investigate the issue of Internet Plus Agriculture from the planes of connotations, paths, and countermeasures [3]. In addition, conferences have been organized by agricultural organizations of science and technology and agricultural informatization organizations to discuss the theories, practices and policies of Internet Plus Agriculture initiative [4]. Research findings abound in Internet-based sharing economy [5] and industrial clusters [6]. Yet, a glance back at the previous studies indicate that they mainly tackle the transformation of agriculture development [7], the agricultural industry chain, and the agricultural upgrading model. So far, no thorough empirical research has been carried out to explore the impact of Internet Plus on agricultural economy.

In the previous studies concerning the impact of the Internet or Internet Plus on economy, the Internet penetration rate is often used as an important indicator of population penetration[8], and the number of websites and the number of domain names as indicators of Internet application are also used [9]. Therefore, these three indicators will be taken into consideration in the present study.

Among the variables of agricultural economic growth, gross agricultural output or the increase in gross agricultural output is generally selected as the dependent variable; and agricultural fixed investment, agricultural manpower input, and agricultural farmland, animal husbandry and fishery resources input are used as agricultural input variables. In order to simplify the input of agricultural manpower and agricultural resources, certain substitution variables such as agricultural financial support can be used for analysis.

3.   Model Construction

In previous studies, indicators such as Internet penetration rate, number of websites per capita, and number of domain names per capita are generally used to measure the level of Internet investment. Due to the lack of relevant data on Internet penetration rate in 2017 and beyond, two indicators, namely, the number of websites per capita and the number of domain names per capita, are commonly used, with the former representing the level of Internet application and the latter standing for the investment in Internet basic resources. As some provinces and cities differ greatly in the number of websites and domain names, and their per capita websites and per capita domain names are relatively small, the number of websites and the number of domain names per 10,000 people are used as the analysis index here.

The gross agricultural output value is defined as the value of agricultural, forestry, animal husbandry, and fishery products produced in a given time period (usually one year), and reflects the scale and results of agricultural production. By analyzing the impact of the Internet on agricultural economic growth and choosing the gross agricultural output value as the dependent variable, we can better observe the impact of the Internet on agriculture as a whole.

Given that the growth of agricultural economy is attributed to the input of various resources, we use the per capita gross agricultural output as the tested variable and the Internet input, agricultural fixed asset investment, and agricultural fiscal expenditure as the independent variables by drawing on Cobb Douglas Function so as to establish a C-D model. We take logarithms on both sides of the model, and with adjustment, the model takes the form.

$$\mathrm{LnGDP}_{it} = c + \beta_1 Lnwzs_{it} + \beta_2 Lnyms_{it} + \beta_3 Lnczzc_{it} + \beta_4 Lngdtz_{it} + \mu_i + \xi_{it} \qquad (1)$$

Among them, c is a constant. GDP signals the per capita gross agricultural output; wzs stands for the number of websites per 10,000 people; yms indicates the number of domain names per 10,000 people; czzc means per capita agricultural financial expenditure; gdtz refers to per capita agricultural fixed asset investment; i =1，2，3......n, representing individual; t=1，2，3......T, symbolizing the sample year; μ_i denotes the time effect; ξ_{it} is the random interference term; β_1, β_2, β_3, β_4 represent the number of websites, the number of domain names, agricultural expenditure and the elasticity of changes in agricultural fixed investment respectively.

In order to avoid the problem of false regression of the model and ensure the reliability and validity of the research findings, the unit root stability test and panel co-integration test are performed on the

model. The results of unit root test show that the variables LnGDP, Lnwzs, Lnyms, Lnczzc, and Lngdtz are all first-order single integer sequences, which are stable under first-order differences. The model is used to check whether there is a panel cointegration relationship between the time series. Given that the variables in the model are first-order single-integer sequences, the model is tested by co-integration using Pederoni, Kao, and Johansen Fisher tests to ensure the reliability of the conclusions. Panel co-integration relationship exists between each group of model variables.

4. An Analysis of the Test Results

4.1. Impact of Internet on Agricultural Economic Growth in China and and its Eastern, Central and Western Regions

The methods for estimating and testing panel models mainly include fixed effects regression model, random effects regression model and pooled regression model. In selecting the panel model, we use F test to identify whether to use a pooled regression model or fixed effects regression model, and the hausman test to determine whether to use fixed effects regression model or random effects regression model. After an analysis, we decide on fixed effects regression model as the right one to measure the Internet's impact on the agricultural economic growth in China and its eastern, central and western regions. Econometrics Views (Eviews) is used to analyze the model and the results are presented in Table 1.

Table 1. Effect of the Internet on Agriculture Growth

Variable	LnGDP			
	China	East of China	Middle of China	West of China
C	5.0067***	5.772141***	5.539971***	4.393318***
	(11.13791)	(8.502373)	(37.58749)	(5.449594)
Lnwzs	0.019133**	0.210044***	-0.040244*	-0.027971*
	(0.656251)	(3.073181)	(-1.04774)	(-0.604927)
Lnyms	0.030485*	0.053023*	0.00308	0.05219
	(1.658211)	(1.887703)	(0.133292)	(1.381316)
Lnczzc	0.394139***	0.241606**	0.395712***	0.418807***
	(6.538216)	(2.586712)	(7.387303)	(4.075119)
Lngdtz	0.169308***	0.13704***	0.143874***	0.198283***
	(10.25632)	(5.778833)	(3.114496)	(6.212367)
R^2	0.962511	0.929971	0.95961	0.978451
AR^2	0.956938	0.912463	0.953765	0.973369
model	FE	FE	FE	FE

Not: ***, **, * indicates significance at the 0.01, 0.05 and 0.10 level; The data in the brackets refer to the T value; FE stands for the fixed effects model.

Table 1 indicates that the number of websites (Lnwzs) and domain names (Lnyms) have a significant impact on China's per capita agricultural gross output (LnGDP), and the coefficients are all positive, showing a clear picture of the positive effect of Internet development on China's agricultural economy. As can be seen, the impact of agricultural fiscal expenditure (Lnczzc) and agricultural fixed asset investment (Lngdtz) on the country's agricultural economy is significant. In addition, the number of websites has a significant impact on the agricultural economy in eastern, central, and western China, and the effect of input is positive in the eastern region whereas it is negative in the central and and

western region. As can be seen, the growth of the Internet on the agricultural economy has shown a positive effect in eastern China. In the central and western regions, however, the Internet investment may have a negative effect because it may have the crowding-out effect on agricultural investment. The number of domain names has a positive impact on the agricultural economy in eastern China, but its impact on the central and western regions of China is not clear. It can be seen that there is still a lack of understanding of such Internet assets as domain names among rural households and enterprises.

Agricultural fiscal expenditure has a significant positive impact on the added value of the agricultural economy in the eastern, central, and western parts of China. Compared with eastern China, central and western China are more dependent on agricultural financial support. Obviously, the self-development capacity of agricultural economy in eastern China is significantly higher than that of central and western China. In addition, agricultural fixed assets have a significant positive impact on the agricultural economy of the eastern, central, and western regions of the country, but the western area apparently depends more on the input of agricultural fixed asset for development than the eastern and central areas.

4.2. Individual Effects of the Internet on Agricultural Economic Growth

To further analyze the individual effects of Internet investment on the agricultural economic growth in each province and city, particularly the effects of other random disturbances (such as urbanization rates), it is of great necessity to examine the individual economic effects in the model. The result is presented in Table 2.

Table 2. Individual Economic Effect of the Internet on Agriculture Growth

Region	Individual Economic Effect	Region	Individual Economic Effect	Region	Individual Economic Effect
Hainan	0.653917	Henan	0.234476	Chongqing	-0.152275
Liaoning	0.511707	Jilin	0.232365	Guizhou	-0.214931
Fujian	0.444326	Xinjiang	0.187960	Gansu	-0.281302
Jiangsu	0.436114	Anhui	0.164901	Tianjin	-0.338862
Shandong	0.436063	Sichuan	0.145201	Ningxia	-0.371046
Hubei	0.377429	Nei Menggu	0.116778	Shanghai	-0.399213
Heilongjiang	0.347578	Zhejiang	0.017658	Shanxi	-0.572075
Hunan	0.269572	Jiangxi	-0.024139	Qinghai	-0.718208
Guangdong	0.258444	Yunnan	-0.109213	Beijing	-0.798281
Guangxi	0.251377	Shaanxi	-0.140007	Tibet	-1.211160
Hebei	0.244850				

Table 2 shows that Beijing, Shanghai, Tianjin and other regions with high urbanization rates have unsatisfactory individual economic effects. As can be seen, the implicit urbanization rate variables in the model have a significant impact on the model. In future studies, The urbanization rate can be taken as the main variable of the model.

Here, the effects of some disturbance variables can be analyzed through individual economic effects: the areas with richer rural tourism resources, such as Hainan, have better individual economic effects;

the areas with distinctive agricultural products and relatively good economic conditions, such as Liaoning (rice), Fujian (tea), Jiangsu (hairy crabs), and Shandong (garlic and apples) have better individual economic effects. The areas with underdeveloped economies (Tibet, Qinghai, Shanxi and Ningxia, etc.), high urbanization rates (Beijing, Shanghai and Tianjin, etc.), and small-scale agricultural products (Chongqing and Guizhou, etc.) all have relatively poor individual economic effects.

5. Conclusion and Suggestions

The number of websites has significantly impacted China's eastern, central and western regions, particularly the eastern region. The number of domain names has a significant impact on eastern China, but its impact on the central and western regions is not significant. It can be seen that the impact of Internet resources on the agricultural economy in eastern China has emerged, and the economic potential of Internet Plus Agriculture can continue to be tapped. In the central and western regions of China, it is advisable to select agricultural production areas of scale operation and with featured agricultural products and strengthen Internet investment and application in these areas. Furthermore, such measures as investing in Internet infrastructure, promoting e-commerce, doing community promotion, and building network brand should be adopted to boost the agricultural economy in these regions and the surrounding areas as well.

In terms of regional individual economic effects, the effect of the Internet on agricultural economy is relatively small in highly urbanized regions where markets are highly mature. Therefore, it is advisable for other regions to enhance publicity of these economically developed regions   through the Internet so as to sell agricultural products to these areas by means of e-commerce, community marketing and other channels. And the underdeveloped areas should invest heavily in the Internet. Specifically, they should invest in Internet infrastructure in areas with featured agricultural products, agricultural tourism resources or ethnic cultural characteristics and concentrated poverty-stricken areas as well in an endeavor to realize the potential of agricultural economic growth and boost agricultural economy in these underdeveloped areas.

In terms of the period effects, China's Internet Plus Agriculture initiative has achieved great results. On the basis of building the demonstration effect, the country should strive for the wider application of the Internet in more areas and in more agricultural fields, tap the potential of Internet Plus Agriculture model, improve the influence of agricultural brands, and promote the balanced development of agricultural economy, particularly in the central and western regions.

The analysis also reveals that central and western China are more dependent on fiscal and fixed expenditures than the eastern region.

Based on the analysis of the economic effects of Internet Plus Agriculture initiative, several recommendations are proposed as follows:

(1) Continue to increase China's Internet investment in agriculture. Combining agricultural characteristics, rural tourism and culture, and poverty alleviation in various regions of China, we should increase investments in Internet technologies such as 5G, Internet of Things, big data, e-commerce, community marketing and talent training required by the agricultural sector in order to bring the economic effects of Internet Plus Agriculture into full play, and promote the rapid growth of China's agricultural economy.

(2) Strengthen Internet investment in the agricultural sector in central and western China where the economic effects of Internet Plus Agriculture still have great potential to grow. We should enhance investment in Internet infrastructure exemplified by featured agriculture, rural tourism, and featured culture in the central and western regions and stimulate the economic growth of the Internet Plus Agriculture in the surrounding areas with demonstration effect.

(3) The period effects of Internet Plus Agriculture has been or is being reflected. Continued investment in the Internet Plus Agriculture practices in central and western China will, due to its lag effect, better promote the balanced development of China's agricultural economy .

(4) Enhance the cultivation of talent in China's Internet Plus Agriculture initiative. To nurture scientific and technological talents required by Internet Plus Agriculture initiative, it is necessary to upgrade the existing agricultural workforce with Internet knowledge and skills training, strengthen the cultivation of talents in such fields as agricultural products, agricultural materials as well as e-commerce, and encourage the recruitment and introduction of agricultural talents or institutions.

Acknowledgement

References

[1] Li Qi. "On Human New Productivity in the 21st Century—The Origin, Essence and Development Measures of E-commerce." Modern Economic Science. 1999(05):63-67.

[2] Xie Yincheng and Gao Jie. "An Empirical Study of the Impact of Internet Development on China's Economic Growth". On Economic Problems. 2015(07):58-61+105.

[3] Ning Jiajun. "The Implementation of Internet Plus Action Plan: Background, Connotation and Content." E-Government. 2015(06):32-38.

[4] Jiang Qiping. " 'Internet Plus' and the Future Pattern of the Chinese Economy." Frontiers. 2015(10):52-63.

[5] Zhao Zhijun and Chen Yao. "Internet Plus Agriculture: Theory, Practice, and Policy---Summary of the 2015 Annual Conference of the Agricultural Technical and Economic Branch of the Chinese Technical Economics Association." Journal of Agrotechnical Economics. 2015(11):126-128.

[6] Tang Tianbo and Wu Xiaojuan. "Shared Economy: A Subversive Economic Model under the Background of Internet Plus." Scientific Development. 2015(12):78-84.

[7] Liu Zhou. "Study on the 'Internet Plus' and the Internet-Based Upgrading of Industry Clusters." Science of Science and Management of S.& T. 2015,36(08):73-82.

[8] Li Liwei and Jing Feng. "Relationship between Internet Diffusion and Economic Growth: Empirical Research Based on Panel Data of China's 31 Provinces." Journal of Beijing Technology and Business University (Social Sciences). 2013, 28(03):120-126.

[9] Guanghai Tang, Ruili Chu. "Research on the Economic Effects of Regional Inbound Tourism Based on Internet Diffusion." Proceedings of the 7th International Conference on Management, Education, Information and Control (MEICI 2017). 2017.

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