On the Equality between Digital Technology, Income Growth and Income Distribution: Verification Based on Survey Data of Rural E-commerce Households in China

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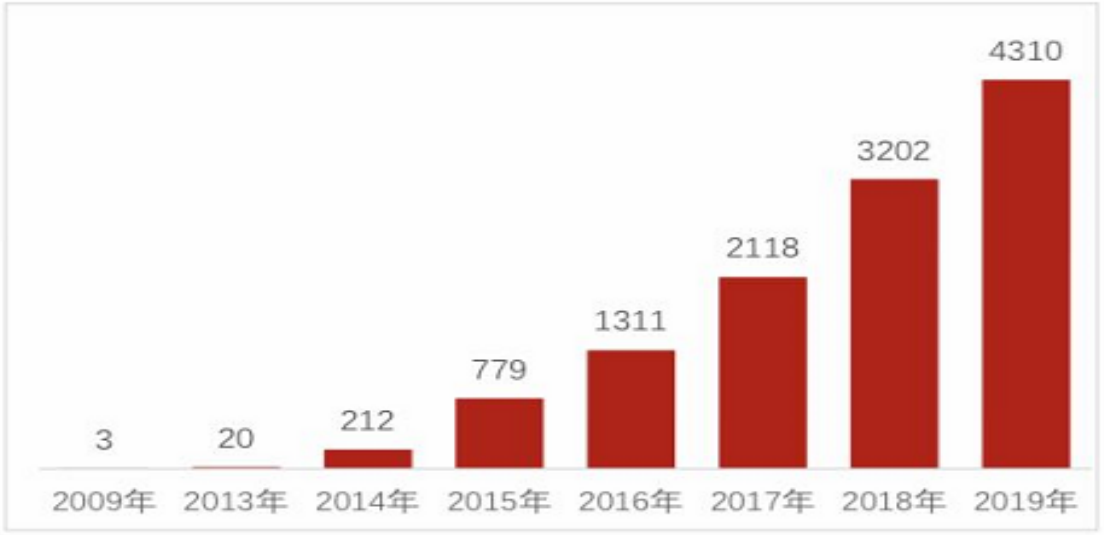
1、 Introduction

Introduction

- Digital technology has become the leading technological and industrial transformation and core technology。With the application and popularization of the Internet, mobile Internet infrastructure, and smartphones, the world has entered the era of the digital economy, and digital technology has been deeply rooted in all aspects of people's daily life and production. The popularization and application of digital technology have exerted an impact on human production and life in an all-round way (Jiang Xiaojuan, 2018).
- China has provided some typical development experience in the application of digital technology. It has made outstanding achievements not only in the construction of hardware infrastructures such as the Internet and mobile Internet but also in the application of digital technologies, such as the Internet of things, cloud computing, and big data, which leads to the rapid development of China's digital economy. As of 2019, the output value of China's digital economy industry accounts for about 35% of GDP

Introduction

Taking e-commerce, a typical representative of digital technology, as an example, its application scope is not only involved in the simple transactions of products. But it also contains a variety of services, such as financial services and sales services, thus exerting a profound impact on the daily consumption, employment, entrepreneurship, or even the production and life of urban and rural residents in China. As far as the development of e-commerce in rural areas of China is concerned, there were only three Taobao villages in China in 2009 but increased to 4310 in 2018. In the past ten years, the number of Taobao villages has increased by more than 4,000 times.



- 2009-2019 Taobao Village scale in China

Introduction

Taobao villages are widely distributed in 25 provinces (autonomous regions and municipalities directly under the Central Government), most of which are located in coastal areas, and there are more than 150 Taobao villages in the west and northeast regions.

•Figure 2 Distribution of Taobao villages in 2019

Introduction

- The question is: Does the use of digital technology create income equity?Does the use of digital technology widen or narrow the income gap between different groups?Some researches focus on the relationship between digital technology and income of e-commerce agglomeration (Zeng Yiwu et al., 2019), income gap (Xubei and Chiyu, 2019;Peng Ruimei and Xing Xiaoqiang, 2019;Zhang Xun et al., 2019), and some useful conclusions have been reached.

- However, the mechanism of how the application of digital technology affects the residents' income distribution has not been discussed in depth. And it does not match the typical fact that the booming digital economy causes an economic impact. For the research of this problem, some documents trace the problem to the historical root of the influence of information technology and information infrastructure on income and income distribution, proposed two logics of validation and draw a more consistent conclusion that the income gap will be widened by the application of information technology and information technology facilities.

Introduction

- First of all, information technology has the characteristics of skill bias and technological changes. Based on this, it is proposed that the skill bias of technological changes produces skill premium and aggravates the expansion of income gap (Murphy, 1992; Autor, 1998; Kiley, 1999; Benabou, 2005, Acemoglu, 1992 and 2002).
- Second, the coverage and popularization of information infrastructure have widened the income gap between different groups, such as between countries and between urban and rural areas, resulting in increased inequality in income distribution (Britz and Blignaut, 2001; DiMaggio and Hargittai, 2001; Bonfadelli, 2002; Jensen, 2007; Burga and Baerrto, 2014; Shimamoto et al., 2015).
- Existing studies have provided some theoretical and empirical support for the study of the application of digital technology on the income gap. However, most studies only equate digital technology with information technology or information technology facilities to measure or verify its impact on income distribution, without considering the essential characteristics of digital technology. It may lead to biased estimation of the impact of digital technology, and it may become more difficult to reveal the internal mechanism of the impact of digital technology on the income distribution of different groups.

Introduction

In fact, the difference between digital technology and general information technology lies in two aspects.

- First, the application of digital technology is more collective, and it lays more stress on the "available access" of resource collection brought by the interconnectivity of digital networks. Different from the hardware access brought by information technology or information infrastructure, digital technologies tend to be digitally independent, but not exist independently. Such collection results in the connectivity and exchange of data, information, and knowledge. For this reason, the application of digital technology, in essence, means acquiring technology set and technology-based data, information, knowledge, and other resources. Moreover, this kind of application tends to enable users to obtain more affordable access resources.

- Second, digital technology is more inclusive than information technology and information infrastructure. In a large number of documents, it is indicated that the application of digital technology has led to inclusive entrepreneurship (Peng Ruimei, Xing Xiaoqiang, 2019; Liu Yajun, 2018), inclusive innovation (Huang Weidong et al., 2016; Fan Yilin et al., 2018), and inclusive growth (Zhang Xun et al., 2019). However, the essence of the application of digital technology is that the universality of digital technology makes it possible for all labor groups to apply the technology, not only to create the dividends of technical applications for developed regions.

Introduction

- Based on the characteristics of digital technology, this paper constructs CES model of digital technology application on income distribution, establishes mathematical models at both macro and micro levels to verify the impact of digital technology adoption on income distribution, and uses e-commerce adoption as a substitute variable to verify its impact on income distribution.

- In this paper, it is found that digital technology has the characteristics of inclusiveness and technology set. In contrast, the application of digital technology by the labor force means that the set of the subdivided digital technologies embedded is adopted so that the labor force can accumulate new knowledge experience, social capital, and financial knowledge to realize the compensation to the labor force for heterogeneous resources. Furthermore, it can replace traditional production factors such as human capital, social capital, and financial capital to play a role in income distribution. In particular, for low-skilled workers, the adoption of e-commerce allows them to obtain higher income and then reduce the income gap. This conclusion is still valid after the empirical test.

Introduction

The innovations of this paper are as follows:

- First, Starting from the characteristics of digital technology, in macroscopic perspective, this paper builds general equilibrium model, and proves that the digital technology adopted increases labor wages and reduces the skilled labor, the income gap between low-skilled labor and the skilled labor. this paper further puts forward The accumulation of knowledge and experience formed by the adoption of digital technology optimizes the skill structure of the labor force;
- Second, investigate the micro influence mechanism of digital technology adoption on income distribution, and discuss the growth mode of individual income of labor force brought by individual knowledge and experience accumulation.
- Based on the relevant data of China's Rural e-commerce development Survey (2017), the adoption of e-commerce as an alternative to the adoption of digital technology, the quantile model is used to prove that digital technology reduces the income gap, and further proves that the application process of e-commerce provides heterogeneous resource compensation for rural labor.This provides a new research reference for determining whether the adoption of digital technology brings about "digital divide" or "digital dividend", and also provides a useful research exploration for further solving the problem of income distribution.

2、Literature Review

（1）Connotation of digital technology

- the definitions of digital technology vary greatly due to the different purposes of researchers. Several representative definitions are as follows:
- ①Digital artifacts. They mean to inject digital components, applications or media content into products, and ultimately provide specific functions or values, so that information or technology can be injected into a wide range of products and services step by step (Ekbia, 2009; Kallinikos, Aaltonen & Marton, 2013; Lusch & Nambisan, 2015);
- ②Digital platforms: They are a group of shared public services and frameworks for hosting digital products(Parker, Van Alstyne & Choudary, 2016; Tiwana, Konsynski & Bush, 2010), as well as building modular platforms and coordinating value creation;
- ③Digital infrastructure: It is generally defined as digital technology tools and systems that provide communication, collaboration, and/or computing capabilities to support innovation and entrepreneurship, such as cloud computing, data analysis, online communities, social media, 3D printing, and digital maker space.

（1）Connotation of digital technology

- Based on the definition of digital technology by Nambisan(2017), it is believed in this paper that digital technology is a collection of digital artifacts, digital platforms, and digital infrastructure, while the application of digital technology is a type of technology application with general purposes. It includes not only the application of digital artifacts and digital infrastructure but also the application of digital platforms.
- In fact, the application of digital technology usually refers to the use of all kinds of subdivided digital technologies with extremely low-cost use port to embed a variety of user groups in digital information, resources, and other digital networks, thus forming the circulation and exchange of information and resources in the multilateral market (Li Xiaohua, 2019). cloud computing, data analysis, online communities, social media, 3D printing, and digital maker space.

（1）Connotation of digital technology

- First, digital technology is inclusive, and it can have an inclusive effect on all kinds of workforces. Digital technology provides the global public inclusive infrastructure (GPII), and this technology offers a low-cost and timely accessible mode of application that breaks the regional limitations, making it possible for various groups in the market to adopt this technology (Gregg et al., 2013). Due to the inclusive characteristics of technology, digital technology has a profound impact on entrepreneurship, innovation and even economic growth, reflecting the inclusive characteristics (Peng Ruimei, Xing Xiaoqiang, 2019; Liu Yajun, 2018; Huang Weidong et al., 2016; fan Yilin et al., 2018; Zhang Xun et al., 2019).

- From the perspective of technology application, digital technology reduces the gap between people and the market. Young people, women, ethnic minorities, and poverty-stricken people (Roland Berger, 2017) all have the possibility to adopt this technology. The technologies that promote vulnerable groups include affordable access.

（1）Connotation of digital technology

- From the perspective of the benefits of technology application, the application of digital technology is not only to learn to use a digital port or any digital artifact, but also to acquire information, knowledge, and resources from the Internet. At the same time, it also obtains customers from all over the country and even the world through network marketing, and then users can access more public services that they used to be unable to access through the Internet, thus helping them obtain resources and share the resources and information with other users (Peng Ruimei, 2019). Moreover, it gives more access to information and knowledge (Li Yilin et al., 2017), and then eliminates information inequality and market inequality among different groups.

（1）Connotation of digital technology

- **Digital technology has the characteristics of technology set.** Digital technology, with big data and cloud computing as the underlying support, is not a simple technology, but a collection of multiple the subdivision technology, such as mobile payment technology (Njihia & Merali, 2013), cyber communication technology (Anwar and Johanson, 2015), and web-based learning technology. Due to the interconnectivity of network technology, the application of digital technology means that producers, service providers, traders, remote consumers, and other users conduct communications, exchanges, transactions and other behaviors (Srinivasan & Venkatraman, 2017), thus forming a resource network with the feature of multi-sided market and crossover network externalities (Evans Dacid et al., 2006).

- Due to the collective characteristics of digital technology, technology users need to be embedded in the network formed by digital technology. They need to interact with organizations and individuals that are embedded in the network, exchange information and knowledge or resources in a more general sense, and then form the heterogeneous compensation for their resources.

（2）The impact of the application of digital technology on the income gap of residents

- **Some scholars believe that digital technology will expand the income gap between different groups,** and its core mechanism is that digital technology has the characteristics of biased technological changes. Moreover, it is found that the highly skilled workforce can better adapt to the new environment and improve their work efficiency, while the competitiveness of the low skilled workers will decline, which will lead to a reduction of their wages (Mincer, 2000; Aghion and Howitt, 1992, 1998; Bratti and Matteucci,2004; Acemoglu et al. 1998, 2002, 2003, 2007, 2102a, 2012b).

- **Other scholars argue that digital technology may narrow the income gap**（Autor, Katez and Kearney，2006； Vivarelli，2014；Meschi et al，2011；Pavcnik，2003； Zhang Zihao and Tan Yanzhi ，2018；Song Xiaoling, 2017; Zhang Xun et al., 2019).

（2）The impact of the application of digital technology on the income gap of residents

- As a typical digital technology, e-commerce is the core variable of this paper.Sort out relevant literature on the impact of digital technologies represented by e-commerce on residents' income gap.

- ——**E-commerce expands the income gap**. Zhang Lei and Han Lei (2017), based on the provincial dynamic panel data of China from 2002 to 2013, adopted the generalized system method of moments (SYS-GMM) to investigate the impact of the development of China's e-commerce economy on the income distribution of urban and rural residents. It is found that e-commerce expands the income gap between urban and rural residents in China, which shows a specific regional heterogeneity.

- ——**E-commerce narrows the income gap**. According to the survey data of rural e-commerce development in China, Xubei and Chiyu (2019) studied the impact of e-commerce on the income of rural households in China by using the method of propensity score matching. The results showed that e-commerce did reduce the income gap between rural residents.

- In a word, there are only a limited number of documents on the impact of digital technology or e-commerce on the distribution of household income, but there has not yet been any consistent conclusion reached. At present, there are still some deficiencies in the relevant research, which are embodied in the following two aspects.
- **First,** in terms of theoretical analysis, based on the definition of digital technology, there is no theoretical model built on the impact of digital technology on the income level and the income gap, and no systematic analysis on its impact mechanism has been carried out. It also leads to a lack of definite and consistent research made in this respect.
- **Second**, in the empirical research, few studies have examined the impact of the application of digital technology on the income distribution gap, while most of the articles have examined whether e-commerce adoption has expanded or narrowed the income gap.

3、Empirical Strategies and Data Description

（1）The benchmark model of the influence of the adoption of e-commerce on the income level of rural residents

The ordinary least square method (OLS) was used to estimate the influence of the adoption of e-commerce on the household income per capita. The estimation equation is as follows:

$$ln\,Y_i = \alpha_0 + \beta_1 D_i + \beta_2 Pers + \beta_3 Fami + \beta_4 Vill + \mu_i \qquad (1)$$

In formula (1), $ln\,Y_i$ is the logarithm of the i household income per capita, Y represents the sum of the household income, property income, operating income, and transfer income divided by the total number of members in the household. D_i is the core explanatory variable, indicating the degree of the adoption of e-commerce. In addition, it is defined as "whether at least one member of the family has run an online store now or ever." if so, it is defined as 1; otherwise, it is defined as 0. $Fami$ represents the characteristic variable of the head of household and the main members of the family at the family level, and $Vill$ represents the characteristic variable at the village level.

（2）The benchmark model of the influence of the adoption of e-commerce on the income gap between rural residents

According to the application of this econometric method in economic research mentioned by Koenker and Hallock (2001) and referring to the research results of Gao Mengtao and Yao Yang (2006) and Cheng Mingwang et al. (2010), the quantile regression model[1] was adopted in this paper to distinguish the difference of the influence of the adoption of e-commerce on the distribution of rural household incomes per capita. The quantile regression model is set as follows:

$$Q_\tau[Y_i|D_i] = F_y^{-1}(\tau|D_i) \qquad (2)$$

In the formula, Y represents the logarithm of the rural household incomes per capita, D represents the degree of the adoption of e-commerce, and $F_y(\tau|D_i)$ represents the distribution function of Y_i at the point y under a given value of D_i. In case that $\tau = 0.10$, $Q_\tau[Y_i|D_i]$ expresses the first decile of Y_i under a given value of D_i. In this model, τ is set as 0.10, 0.25, 0.5, 0.75 and 0.9, representing the deciles at 25,50,75, and 90, respectively. In this model, by taking the conditional quantile of household incomes per capita as a function of the degree of the adoption of e-commerce, we can know whether the distribution of income fluctuates with the degree of the adoption of e-commerce.

（3）The benchmark model of the influence mechanism of the adoption of e-commerce on the income gap between rural residents

According to the inference in the theoretical analysis, e-commerce as digital technology has the characteristics of technology integration. The adoption of e-commerce means to accumulate knowledge and experience at multiple levels. The knowledge and experience obtained from the application of digital technology are quite different from those obtained through traditional channels, which may replace the role of traditional production factors in raising residents' income. In particular, the low skilled workforce gains higher marginal income through knowledge and experience accumulation, and then reduces the income gap between the low - and high skilled workforces.

$$ln\,Y_i = \alpha_0 + \beta_1 D_i + \beta_2 D_i * X_{ij} + \beta_3 Pers + \beta_4 Fami + \beta_5 Vill + \mu_i \qquad (3)$$

In formula (3), X_{ij}represents the knowledge accumulation level obtained by the family $i$at the layer $j$in the traditional case, including the knowledge level based on the educational level, and the level of experience and knowledge based on the level of social capital. $X_{ij}$is essentially a characteristic variable contained in$Pers$， $\beta_2$indicates whether the adoption of e-commerce enlarges or reduces the impact of the accumulation level of traditional knowledge and experience on the level of average household income.

（3）The benchmark model of the influence mechanism of the adoption of e-commerce on the income gap between rural residents

Furthermore, what do rural residents get from the adoption of e-commerce? In essence, e-commerce is a collection of online learning platforms, virtual communication and trading systems and digital financial technology, which focus on how to master e-commerce-related knowledge, experience and skills. As a result, e-commerce adopters acquire new professional skills, social capital, and financial knowledge and so on by adopting these technologies. In this part, we further find out the new knowledge and experience obtained through the adoption of e-commerce, so as to provide the compensation for heterogeneous resources for the adopters and replace the impact of traditional knowledge and experience on the household incomes per capita. To verify this, we designed the following model:↵

$$ln\,Y_i = \alpha_0 + \beta_1 Ecom_{ij} + \beta_2 Ecom_{ij} * X_{ij} + \beta_3 Pers + \beta_4 Fami + \beta_5 D_i + \mu_i \qquad (4)$$

In formula (4), $Ecom_{ij}$ represents the knowledge and experience at the level j that the family i obtains with the help of e-commerce, such as the new knowledge, tacit knowledge and financial knowledge obtained based on the adoption of e-commerce. X_{ij} represents the knowledge accumulation level obtained by the family $i$at the layer j, and β_4 represents the impact of the accumulation of knowledge and experience of rural residents due to the adoption of e-commerce on the relationship between the level of traditional knowledge and experience and the rural household incomes per capita.↵

（4）Variable description and statistical description

Table 1 Variable description and statistical description

Variables	Observations	Mean	Variance	Minimum	Maximum
Logarithm of household incomes per capita	1152	10.13	1.39	3.88	13.12
Adoption of e-commerce	1152	0.43	0.50	0	1
Years of education	1148	8.48	4.32	0	16
Health condition	1152	1.11	0.41	1	3
Property logarithm	1152	6.24	3.84	0	15.86
Place of domicile	1152	0.67	0.47	0	1
Trust	1020	0.77	0.42	0	1
The logarithm of the total population of the village	1135	8.29	1.04	6.27	10.82
The logarithm of distance from the village to the railway station	1116	2.90	1.02	0	5.01

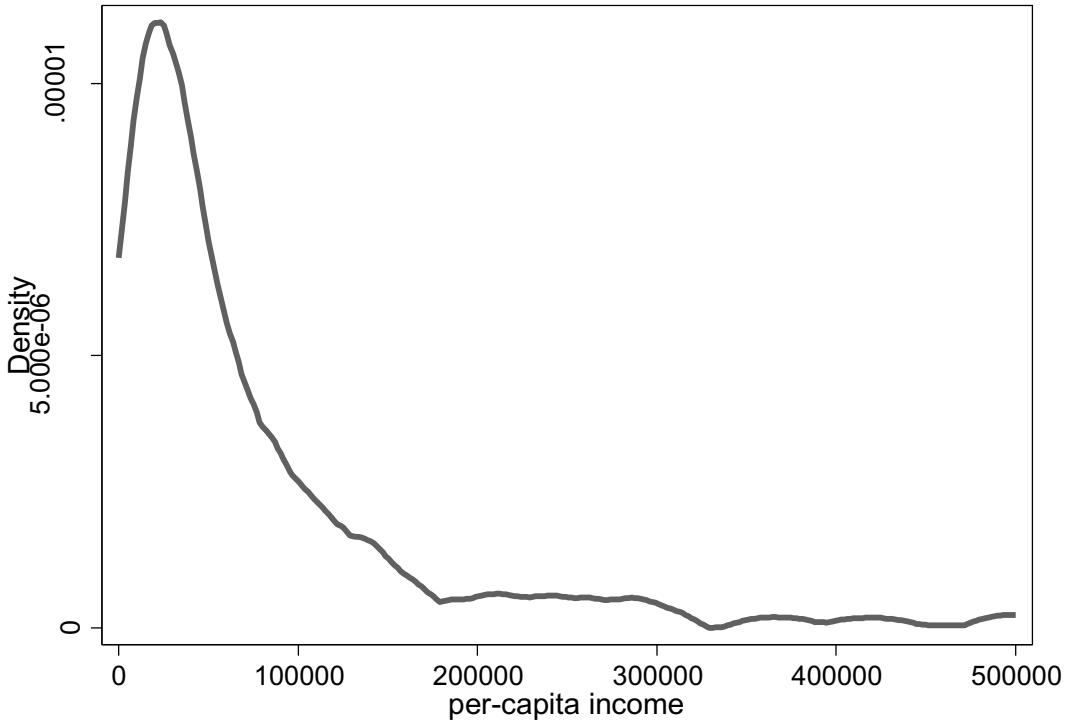
Data source: The data of the survey of rural e-commerce development in China in 2018

4、Empirical Analysis

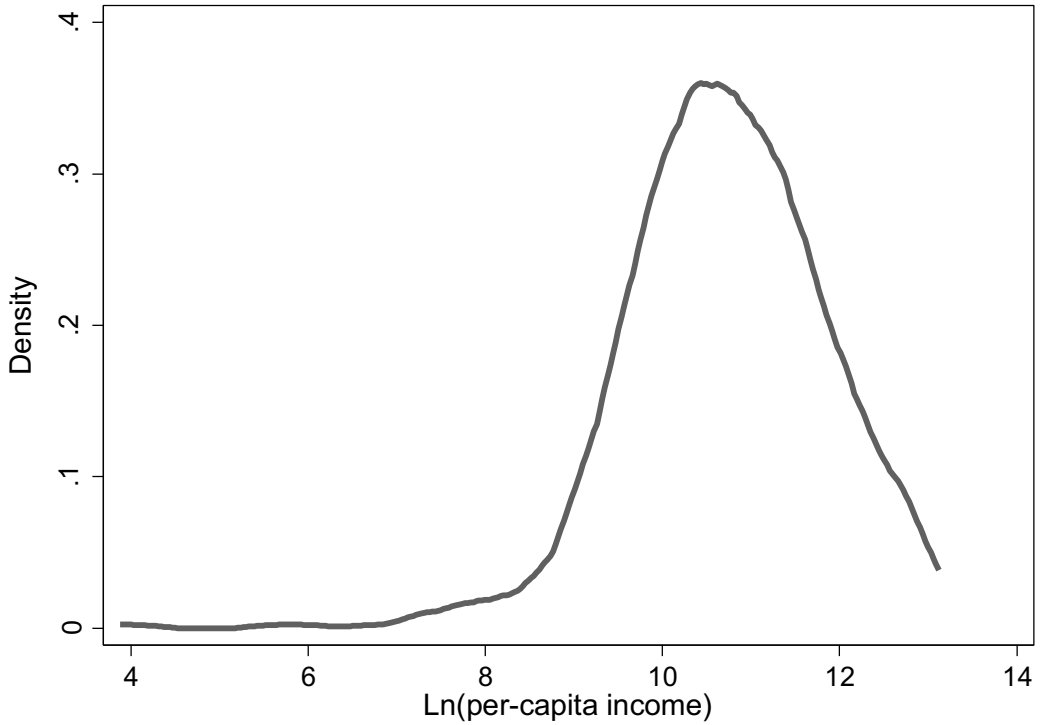
（1）Basic regression- OLS

	household incomes per capita			
	Model (1)	Model (2)	Model(3)	Model(4)
Variables	lnincome	lnincome	lnincome	lnincome
Adoption of e-commerce	1.025***	0.772***	0.643***	0.716***
	(0.0747)	(0.0721)	(0.0682)	(0.0683)
Years of education		0.0710***	0.0553***	0.0550***
		(0.00930)	(0.00887)	(0.00896)
Health condition		-0.624***	-0.530***	-0.425***
		(0.116)	(0.111)	(0.108)
Property logarithm			0.0818***	0.0767***
			(0.00858)	(0.00856)
Place of domicile			-0.558***	-0.411***
			(0.0681)	(0.0729)
Trust			0.192**	0.220***
			(0.0830)	(0.0836)
The village's permanent				0.137***
				(0.0329)
Distance from the village to the				-0.179***
				(0.0328)
Constant	9.686***	9.884***	9.684***	8.837***
	(0.0549)	(0.168)	(0.193)	(0.328)
Observations	1,152	1,148	1,148	1,112
R-squared	0.134	0.224	0.303	0.325

（1） Basic regression



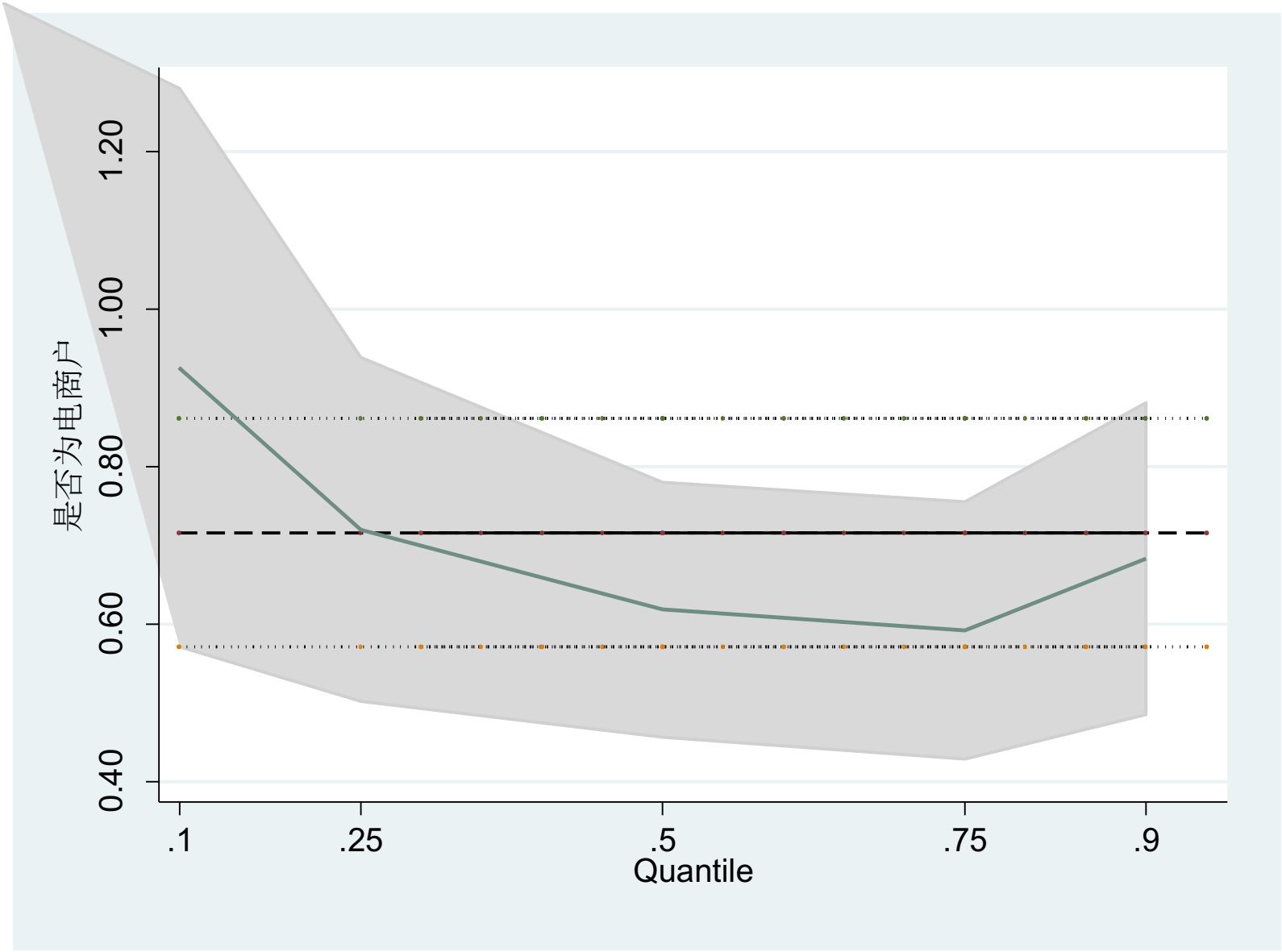
•The density function of household per capita income



•A density function of the logarithm of household per capita income

（1） Basic regression −The quantile regression

	Model (1)	Model (2)	Model(3)	Model(4)	Model(5)
VARIABLES	q10	q25	q50	q75	q90
Adoption of e-commerce	0.925***	0.720***	0.618***	0.592***	0.683***
	(0.156)	(0.0962)	(0.0803)	(0.0805)	(0.106)
Years of education	0.0755***	0.0616***	0.0508***	0.0481***	0.0274*
	(0.0201)	(0.0147)	(0.00812)	(0.00863)	(0.0141)
Health condition	-0.774***	-0.564**	-0.362**	-0.331***	-0.399**
	(0.270)	(0.240)	(0.150)	(0.0862)	(0.156)
Property logarithm	0.108***	0.0929***	0.0767***	0.0465***	0.0437***
	(0.0206)	(0.0133)	(0.00912)	(0.00911)	(0.0130)
Place of domicile	-0.693***	-0.506***	-0.395***	-0.255***	-0.227**
	(0.139)	(0.116)	(0.0928)	(0.0931)	(0.109)
Trust	0.0559	0.274**	0.232***	0.270***	-0.117
	(0.132)	(0.109)	(0.0761)	(0.0991)	(0.152)
The village's permanent population	-0.00257	0.132**	0.126***	0.215***	0.233***
	(0.0706)	(0.0533)	(0.0379)	(0.0446)	(0.0543)
Distance from the village to	-0.142**	-0.176***	-0.178***	-0.185***	-0.209***
	(0.0558)	(0.0542)	(0.0463)	(0.0541)	(0.0478)
Constant	8.666***	8.233***	9.043***	8.999***	10.02***
	(0.726)	(0.617)	(0.370)	(0.449)	(0.568)
Observations	1,112	1,112	1,112	1,112	1,112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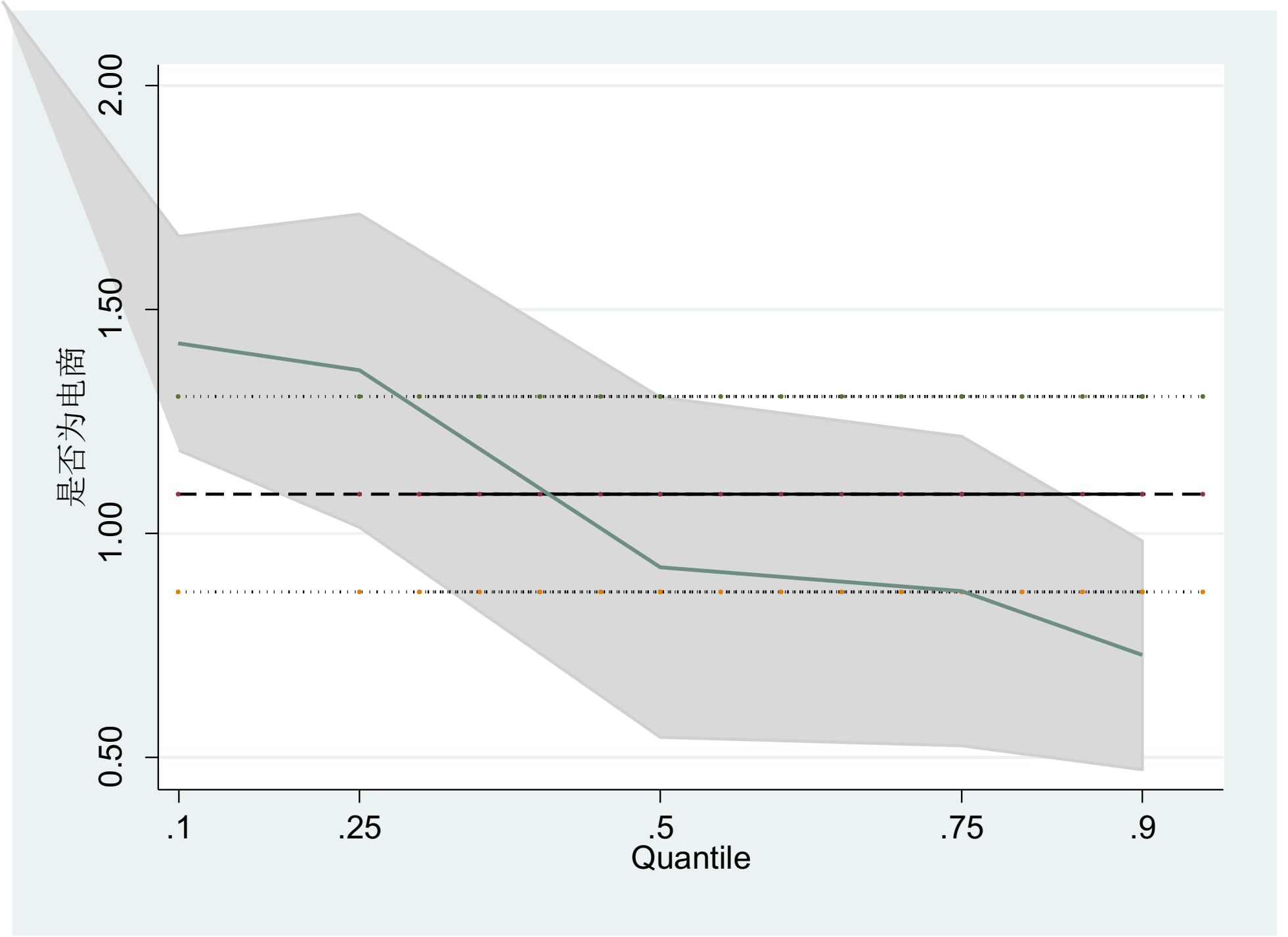
Quantile

（2） Robust regression－The quantile regression－the income per capita for household business

Table 5 Quantile regression results of the income per capita for household business

	Model (1)	Model (2)	Model(3)	Model(4)	Model(5)
VARIABLES	q10	q25	q50	q75	q90
Adoption of e-commerce	1.423***	1.363***	0.924***	0.871***	0.728***
	(0.192)	(0.185)	(0.145)	(0.154)	(0.131)
Control	Yes	Yes	Yes	Yes	Yes
Constant	2.477**	5.326***	7.873***	9.138***	9.722***
	(1.073)	(0.889)	(0.573)	(0.572)	(0.949)
Observations	699	699	699	699	699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Quantile

（2） Robust regression－Instrumental variable method

- In the previous empirical model, the adoption of e-commerce and the income of rural families may be mutually causal. On the one hand, farmers get a higher income by e-commerce. On the other hand, high-income families are more able and aware to get engaged in e-commerce activities. To some extent, it may lead to endogenous problems in the above model settings.
- In addition, many factors affect the household income of rural residents. We try to put more factors into the estimation model, but because of the availability of data, there may be missing variables.

（2） Robust regression－Instrumental variable method

- **In order to solve the endogeneity problem, we propose to introduce the instrumental variables into the regression model.**
- we chose the frequency of e-commerce in the government work reports of districts and counties in 2013 and 2014 surveyed as the instrumental variable. The main reasons for choosing it as an instrumental variable are as follows
- First of all, the government work report at district and county levels is the summary and prospect of the economic and social development of the whole county, which has a strong correlation with the industrial development of local villages and towns. "E-commerce" and other words in the government work report mainly appear in the statements concerning rural e-commerce, e-commerce parks, and e-commerce enterprises, which represent the development of e-commerce in the county in the past year and the development goal of e-commerce in the next year. Although there is a correlation with the adoption of e-commerce by local rural families, there is no direct correlation with the per capita income of individual families;
- Second, the frequency of "e-commerce" in the government work report is a relative macro variable. The participation of rural households in the e-commerce business activities and the increase of rural residents' income are micro-level behaviors, which, to some extent, weakens the endogenous problem.

（2） Robust regression－Instrumental variable method

Table 6 Quantile regression results of instrumental variables

VARIABLES	Model (1) lnincome	Model (2) lnincome	Model(3) lnincome	Model(4) lnincome	Model(5) lnincome
Adoption of e-commerce	36.09***	6.140***	3.089***	1.505***	-0.346***
	(0.134)	(0.0165)	(0.00900)	(0.00734)	(0.00956)
Control	Yes	Yes	Yes	Yes	Yes
Constant	-26.98***	4.872***	8.540***	9.808***	10.30***
	(9.382)	(1.155)	(0.630)	(0.513)	(0.669)
Observations	1,020	1,020	1,020	1,020	1,020

（3） Heterogeneity analysis of the impact of e-commerce on rural residents' income

(1) education level

Table 7 Adoption of e-commerce and household incomes per capita: Heterogeneity of educational level

	Low educational level	Medium educational level	High educational level
VARIABLES	lnincome	lnincome	lnincome
Adoption of e-commerce	0.940***	0.845***	0.497***
	(0.131)	(0.117)	(0.113)
Control	Yes	Yes	Yes
Constant	8.282***	9.185***	10.30***
	(0.565)	(0.565)	(0.555)
Observations	386	375	355
R-squared	0.286	0.252	0.243

（3） Heterogeneity analysis of the impact of e-commerce on rural residents' income

(1) material capital level

Table 8 Adoption of e-commerce and household incomes per capita: Heterogeneity of material capital

	Low material capital	Medium material capital	High material capital
VARIABLES	lnincome	lnincome	lnincome
Adoption of e-commerce	0.706***	0.732***	0.689***
	(0.126)	(0.124)	(0.100)
Control	Yes	Yes	Yes
Constant	9.530***	8.773***	9.244***
	(0.637)	(0.584)	(0.467)
Observations	372	367	373
R-squared	0.285	0.307	0.269

（3） Heterogeneity analysis of the impact of e-commerce on rural residents' income

(1) social capital

Table 9 Adoption of e-commerce and household incomes per capita: Heterogeneity of social capital

	Low social capital	High social capital
VARIABLES	lnincome	lnincome
Adoption of e-commerce	0.863***	0.663***
	(0.158)	(0.0750)
Control	Yes	Yes
Constant	9.187***	8.900***
	(0.756)	(0.358)
Observations	267	845
R-squared	0.397	0.306

4、 Influence Mechanism of the Adoption of E-commerce on the Income Gap

Compensation effect of e-commerce for heterogeneous resources

The results of the theoretical analysis show that digital technology has the characteristics of the technology set, and it is a collection of all kinds of mobile payment technologies and network communication technologies. Taking "Taobao. Com", the most widely used e-commerce platform, as an example, e-commerce adopters can not only master the technologies for the use of the software but also use the online learning and exchange platform , digital credit system , digital financial products, and other systems embedded in the e-commerce platforms. In this way, the labor force can accumulate their knowledge and experience at multiple levels, such as the improvement of professional skills, the acquisition of social capital, and access to financial knowledge. In this way, it can make up for its deficiencies in traditional production factors such as human capital accumulation and material capital, and produce the compensation function of heterogeneous resources, which may be more effective for the low-skilled labor groups.

Compensation effect of e-commerce for heterogeneous resources

- **Second,** based on the e-commerce-embedded digital credit system, the adopters can obtain the social network based on digital credit, **provide heterogeneity compensation for its limited social capital, and it can affect the income instead of the traditional social capital.**

- The application of digital transaction technology based on E-commerce by rural residents means that rural residents are included in the social norms and social networks based on digital credit so that they can obtain the social capital from virtual society, and finally be able to break the traditional restrictions of social capital. At the same time, the information asymmetry and uncertainty brought by the anonymous e-commerce market can be overcome by virtue of e-commerce-based after-sale evaluation and other online transaction rules, the concepts of commercial credit based on Internet financial products, or even invisible market rules and social norms based on the credit system (Mcknight et al. 1998; Xie Kang et al., 2016; Chen Ran, 2016; Doney et al. 1998). Moreover, it reduces the rural residents' distrust of the anonymous market (Bentian and Hess, 2011), and is conducive to the establishment of cooperation, information sharing and other trust-related participation behaviors (McKnight and Chervany, 2002). Furthermore, we can obtain trust relations, social networks, and market norms from the delocalization.

Compensation effect of e-commerce for heterogeneous resources

- **Third,** based on the e-commerce-embedded digital financial system**, e-commerce helps rural families to acquire financial knowledge and use financial capital in other places to replace traditional material capital and play a role in the improvement of income.**
- E-commerce integrates big data, cloud computing, artificial intelligence, and other technical means. It embeds digital finance and digital credit products so that the user's consumption behavior, business behavior, performance ability, and interpersonal relationship on the e-commerce platform can become accumulated credit, providing credit records, which is equivalent to that every user has a credit mortgage. It has greatly enhanced the efficiency of financial risk screening and improved the data processing ability for individual lenders.
- For rural households, it means that rural residents have a lower threshold of knowing about inclusive finance, improve their attitude, and cognition to use finance and make use of financial resources in other places. Moreover, it may replace the family's material assets and ease the loan constraints, and it may also improve the efficiency of the use of the family's material assets through the cultivation of financial literacy.

（1）the compensation effect for heterogeneous resources of e-commerce on traditional human capital

Table 10 Influence of e-commerce on the relationship between human capital and household incomes per capita

	Model (1)	Model (2)	Model(3)
VARIABLES	lnincome	lnincome	lnincome
Adoption of e-commerce	0.945***	0.916***	1.065***
	(0.179)	(0.167)	(0.171)
Years of education	0.0862***	0.0666***	0.0691***
	(0.0127)	(0.0120)	(0.0119)
E-commerce * Years of	-0.0146	-0.0306*	-0.0390**
	(0.0177)	(0.0167)	(0.0171)
Individual characteristics	N	Y	Y
Family characteristics	N	Y	Y
Village characteristics	N	N	Y
Constant	9.053***	9.604***	8.728***
	(0.118)	(0.202)	(0.332)
Observations	1,148	1,148	1,112
R-squared	0.192	0.305	0.328

（2）the compensation effect for heterogeneous resources of e-commerce on traditional human capital

Table 11 The substitution of e-commerce learning for years of education

	Model (1)	Model (2)	Model(3)
	olsd1	olsd2	olsd3
VARIABLES	lnincome	lnincome	lnincome
Adoption of e-commerce	0.597***	0.459***	0.554***
	(0.109)	(0.0996)	(0.100)
Years of education	0.0841***	0.0636***	0.0648***
	(0.0114)	(0.0107)	(0.0108)
E-commerce learning	0.471**	0.589***	0.601***
	(0.219)	(0.209)	(0.211)
Years of education * E-commerce learning learning	-0.0163	-0.0348*	-0.0402**
	(0.0187)	(0.0179)	(0.0182)
Individual characteristics	N	Y	Y
Family characteristics	N	Y	Y
Village characteristics	N	N	Y
Constant	9.068***	9.645***	8.773***
	(0.108)	(0.197)	(0.332)
Observations	1,148	1,148	1,112
R-squared	0.197	0.308	0.330

（2）the effect of the adoption of e-commerce on the compensation for heterogeneous resources for social capital

Table 12 Influence of e-commerce on the relationship between social capital and household incomes per capita

VARIABLES	Model (1) lnincome	Model (2) lnincome	Model(3) lnincome
Adoption of e-commerce	1.268***	0.818***	0.930***
	(0.163)	(0.147)	(0.148)
Trust	0.349**	0.296**	0.349***
	(0.138)	(0.121)	(0.124)
E-commerce * Trust	-0.313*	-0.229	-0.281*
	(0.183)	(0.163)	(0.164)
Individual characteristics	N	Y	Y
Family characteristics	N	Y	Y
Village characteristics	N	N	Y
Constant	9.417***	9.607***	8.733***
	(0.124)	(0.207)	(0.334)
Observations	1,152	1,148	1,112
R-squared	0.141	0.304	0.327

（2）the effect of the adoption of e-commerce on the compensation for heterogeneous resources for social capital

Influence of e-commerce credit on the relationship between social capital and household income per capita

VARIABLES	Model (1) lnincome	Model (2) lnincome	Model(3) lnincome
Adoption of e-commerce	0.775***	0.529***	0.615***
	(0.0961)	(0.0859)	(0.0858)
Trust	0.338***	0.295***	0.333***
	(0.114)	(0.101)	(0.102)
E-commerce credit	0.566***	0.350***	0.354***
	(0.109)	(0.111)	(0.109)
Trust * E-commerce credit	-0.350***	-0.271**	-0.301***
	(0.119)	(0.117)	(0.115)
Individual characteristics	N	Y	Y
Family characteristics	N	Y	Y
Village characteristics	N	N	Y
Constant	9.425***	9.622***	8.730***
	(0.108)	(0.199)	(0.329)
Observations	1,152	1,148	1,112
R-squared	0.153	0.308	0.330

（3）The effect of the adoption of e-commerce for compensation for heterogeneous resources on material capital

Influence of e-commerce on the relationship between household property and household incomes per capita

	Model (1)	Model (2)	Model(3)	
	olsc4	olsc5	olsc6	
VARIABLES	lnincome	lnincome	lnincome	
Adoption of e-commerce	1.115***	0.961***	1.043***	
	(0.178)	(0.168)	(0.171)	
Property logarithm	0.115***	0.106***	0.0980***	
	(0.0155)	(0.0141)	(0.0142)	
E-commerce * Property logarithm	-0.0215	-0.0350*	-0.0349*	
	(0.0200)	(0.0195)	(0.0199)	
Individual characteristics	N	Y	Y	
Family characteristics	N	Y	Y	
Village characteristics	N	N	Y	
Constant	8.915***	9.480***	8.476***	
	(0.135)	(0.215)	(0.353)	
Observations	945	942	909	
R-squared	0.230	0.327	0.350	

（3）The effect of the adoption of e-commerce for compensation for heterogeneous resources on material capital

Substitution of Internet finance for traditional household property

VARIABLES	Model (1) lnincome	Model (2) lnincome	Model(3) lnincome
Adoption of e-commerce	0.816***	0.529***	0.598***
	(0.0924)	(0.0890)	(0.0904)
Property logarithm	0.0947***	0.0924***	0.0856***
	(0.0109)	(0.00997)	(0.0101)
Financial acquisition	0.649***	0.593***	0.533***
	(0.175)	(0.163)	(0.161)
Property logarithm*Financial acquisition	-0.0620***	-0.0529***	-0.0444**
	(0.0195)	(0.0183)	(0.0180)
Individual characteristics	Y	Y	Y
Family characteristics	N	Y	Y
Village characteristics	N	N	Y
Constant	9.144***	9.624***	8.779***
	(0.0931)	(0.196)	(0.327)
Observations	1,152	1,148	1,112
R-squared	0.192	0.309	0.330

5、Conclusions and Policy Implications

Conclusions

- First of all, theoretical analysis shows that digital technology belongs to the skill-biased technological change so that the highly skilled workforce and the low skilled workforce can apply digital technology. In this way, the low skilled workforce can improve the level of human capital and transform it into the highly skilled workforce with the help of this technology level, so as to change the skill structure of the low- and high-skilled workforces, and then affect the gap of wages and income between the two types of workforces. At the same time, digital technology has the characteristics of technology set, and the application of digital technology essentially means that the low skilled workforce can obtain all kinds of heterogeneous resources embedded in digital technology. For this reason, it can raise its income level in a short time and narrow its income gap from that of the high-skilled workforce.

Conclusions

- Second, the empirical results show that the adoption of digital technology, represented by e-commerce, plays a significant role in improving the per capita income of rural households and narrowing the gap in the income per capita between rural households. The mechanism behind this is that the adoption of e-commerce applications actually means the adoption of technology set. In nature, it is to improve the level of knowledge and experience acquisition, the ability to acquire resources and information from virtual social capital and the ability to acquire capital based on digital finance, so as to provide rural families with the compensation effect of heterogeneity in terms of educational resources, financial resources and social capital, and replace the role of traditional production factors in the income increase of rural families. After the test of robustness and endogeneity, it is found that the conclusion of this empirical study is still valid.

Policy Implications

- On the one hand, the application of digital technology plays a vital role in increasing income and reducing the income gap. The countermeasure may provide a useful reference for the development of poverty-stricken areas and developing countries. Therefore, it is not only necessary to strengthen the construction of digital infrastructure, but also necessary to further promote the widespread popularization, promotion and application of digital technology.
- On the other hand, digital technology is a window to break the traditional economic form and access vocational education resources, credit system and digital financial system. The low skilled workforce should be further encouraged and cultivated. In particular, rural labor forces should be allowed to access digital dividends by acquiring digital resources behind the digital technology platform.

Thanks！

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