

## An Analysis of the Driving Effect of E-commerce on Residents' Income Growth

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**Abstract:** By selecting relevant data of e-commerce and residents' disposable income from China's 31 provinces, municipalities and autonomous regions except Hong Kong, Macao and Taiwan from 2013 to 2019 for a panel data model testing, the paper analyzes the driving effect of e-commerce on Chinese residents' income growth. It concludes that the driving effect of e-commerce on residents' income growth is significant. For every 1% increase in e-commerce transaction volume, residents' income growth effect increases by 4.565%; Indicators such as e-commerce delivery, regional economic environment, education investment and technology investment have a major impact on residents' income; whereas the smartphone penetration rate and unemployment rate have a slight impact on residents' income. The influence of e-commerce on residents' income differs considerably across regions, with Eastern China being impacted more significantly than Western China. Therefore, promoting the development of e-commerce in the western and central regions is of great significance. It is suggested that China needs to strengthen the construction of its e-commerce infrastructure and service system at present. The central and western regions, in particular, should boost the investment in e-commerce infrastructure, service system, policy support, logistics and express delivery, e-commerce education and e-commerce technology so as to promote the income growth of local residents.

### 1. Introduction

China's per capita disposable income reached 32,189 yuan in 2020, which was double the level in 2010. The increase in residents' income is a result of the combined effects of economic, social and political factors. Since the launch of the reform and opening-up policy, China has promoted investment in economy, education and science and technology, bringing about abundant job opportunities, better education for its residents and rising of labor productivity. E-commerce represents new productivity. On the basis of innovative corporate marketing models, it has created more job opportunities and provided new possibilities for residents' income growth.

In 2020, the transaction volume of e-commerce in China reached 37.21 trillion yuan, and online retail sales amounted to 11.8 trillion yuan. A large number of positions such as e-commerce platform operations, social e-commerce and big data analysis have been created, among which social e-commerce attracted more than 77 million employees. The rapid development of e-commerce has become a direct or indirect driving force of residents' income increase.

Research on residents' income has gained much attention from scholars both at home and abroad. William Petty believes that income differences among industrial sectors lead to the flow of labor among these sectors, which in turn bring about changes in the industrial structure. Collins Clark proposes that changes in per capita income levels are an important driving force for changes in the industrial structure[1]. Yet, Rostow points out that changes in the economic structure result in income differences[2]. A glance back at these research findings indicates that there is a correlation between residents' income and industrial structures.

In the development of China's economy, the structural changes of agriculture, industry, and service sectors have provided an important foundation for the growth of economy and residents'

income[3]. Impacted by the reform and opening up policy, the eastern coastal region has experienced a boom in the fields of manufacturing, finance and markets and developed faster than the central and western regions. Justifiably, talents have been attracted to this region given the unbalanced development of the industry and service sectors in eastern and western China, together with the double unbalanced overlapping effects of the industrial structure and regions[4,5].

In the process of urbanization, the cluster of industry and service sectors creates a gap in labor opportunities between urban and rural areas, and provides a large number of non-agricultural employment opportunities for rural laborers[6]. Therefore, the income of urban and rural residents has been further raised[7]. In the Internet age, the widespread application of Internet technologies, e-commerce technologies, modern logistics and electronic payment technologies has boosted the innovation and marketing of small and medium-sized enterprises, and reduced the cost of marketing, further promoting the transformation of modern industrial institutions[8]. The Internet plays an indispensable role in changing the income structure of residents and stimulating residents' consumption[9]. E-commerce has become an important driving force for the growth of rural economy and rural residents' income[10].

A glance back at the previous research findings indicates that e-commerce, representing new productivity[11], has a significant impact on residents' income increase. Yet, surprisingly, no measurement examples have been provided in the previous studies. In view of this, this paper will examine the economic effects of the development of e-commerce on residents' income growth. The study will divide China into eastern, central, and western regions for a panel model testing to propose more targeted e-commerce development countermeasures.

## 2. Model Construction and Data Description

### 2.1. Model Construction

#### 2.1.1. Panel Data Model

Panel data refers to data that is collected from a number of observations of the same group of units or entities over several time periods on the cross-section. As such, panel data is mixed data of time series and cross-section. Using panel data to build a model can increase observed value and make the sampling of estimators more accurate. At the same time, more dynamic information can be obtained. The panel data model can be expressed as:

$$y_{it} = \alpha_i + \beta_n X_{it} + \varepsilon_{it} \quad (1)$$

(1)

$y_{it}$  is the regressed variable (scalar);  $\alpha_i$  represents a random variable;  $X_{it}$  means  $k \times i$  order regression variable column vector (including  $k$  regressors);  $\beta$  refers to the  $k \times i$  order regression coefficient column vector and  $\varepsilon_{it}$  denotes the error term.

According to the relationship between  $\alpha_i$ ,  $\beta_n$  and  $X_{it}$ , panel models can be divided into three types: mixed model, fixed-effect model and random-effect model. The specific model can be selected by F statistic and Hausman test.

#### 2.1.2. The Panel Model of E-commerce's Driving Effect on Residents' Income

A model has been constructed as below to investigate the driving effect of e-commerce on residents' income growth:

$$Inc_{jit} = \alpha_i + \beta_{ni} X_{it} + \beta_{ni} M_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

(2)

We choose Income (Inc) as the explained variable representing residents' income, per capita disposable income according to most scholars. As for  $jit$ ,  $j$  represents the statistical area of resident income, including the whole country, eastern China, central China and western China;  $i$  stands for

province and  $t$  symbolizes time.  $\mu_i$  denotes individual effects;  $\varepsilon_{it}$  means random effects;  $X$  is the core explanatory variable in the study, indicating the development of e-commerce, and  $M$  is the control variable.

The core explanatory variable  $X$  represents the development of e-commerce, which is generally measured by the index of Electronic Commerce Sales (ECS) [10], or by Express Revenue (Exp) [10] and the number of online shopping users [12]. Among them, statistics for e-commerce sales and express revenue from 2013 to 2019 can be accessed, while statistics for online shopping users can not be obtained, the number of whom is denoted by Internet penetration rate instead [13]. Since 2013, the number of mobile terminals has been growing, which can reflect the growth of online shopping users. Therefore, the number of online shopping users can be indicated by the number of mobile phone users (Mob, Mobile Users). Here, the mobile phone penetration rate is used to indicate the number of online shopping users.

The control variables mainly include the regional economic environment, education investment, science and technology investment and employment expectations [8].

Regional economic environment is generally indicated in terms of GDP per capita. The previous studies shows that regional economic environment, particularly local economic environment, has a significant impact on residents' income and income expectations [14]. Regional economy is a comprehensive manifestation of the industrial structure in this region. In the previous studies, local economy is also taken as a prerequisite for residents' income. Previous findings also suggest that regional per capita income and per capita GDP are synergistic. Here, per capita GDP (GDP) is used to denote regional economic environment.

Education Input (Edu), an important prerequisite for skills and abilities, and a basic element of residents' income [15], plays an important role in social and economic development [16]. Particularly, in the development of e-commerce and digital commerce, educational investment in such fields as Internet technology, e-commerce and big data directly affects e-commerce operations, planning and promotion. Here per capita education expenditure (Edu) is used to measure education investment [17].

Science and Technology Input (Sci) is an important foundation of innovation. Corporate innovation ensures corporate revenues, which in turn affect residents' income indirectly or directly [18]. Technological investment in e-commerce platforms, tools, data analysis, etc. has a direct impact on the efficiency of e-commerce, thereby affecting the income of enterprises and residents. Here the local science and technology expenditure per capita (Sci) is used as an indicator to measure the investment in science and technology [19].

The unemployment rate (Unemp) is an important measure of residents' income opportunities. The higher the unemployment rate is, the fewer job opportunities there are [20]. In academia, urban unemployment rate (Unemp) is often used to reflect the unemployment rate [8].

The above variables are brought into model (1). Then all the variables are processed in logarithm to eliminate the influence of heteroscedasticity, and panel model (3) is constructed as follows:

$$\begin{aligned} LnInc_{jit} = & \beta_0 + \beta_{1i}LnECS_{it} + \beta_{2i}LnExp_{it} + \beta_{3i}LnMob_{it} + \beta_{4i}LnGDP_{it} + \beta_{5i}LnEdu_{it} + \\ & \beta_{6i}LnSci_{it} + \beta_{7i}LnUnemp_{it} + \mu_i + \varepsilon_{it} \end{aligned} \quad (3)$$

## 2.2. Data Description

This paper selects panel data from 31 provinces, municipalities and autonomous regions in China except Hong Kong, Macao and Taiwan from 2013 to 2019. All the data are obtained from the "China Statistical Yearbook (2014-2020)" and China Economic Net. The relevant data takes 2013 as the base period to eliminate the influence of price factors. To indicate the internal connection between the data, the descriptive statistics of relevant variables is presented in Table 1.

Table 1 Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Probability	Observations
LnInc	10.024820	9.972100	11.148200	9.193800	0.363942	0.000001	217
LnECS	8.444457	8.359800	11.588700	5.407200	1.053980	0.000218	217
LnExp	4.843835	4.667600	8.577000	2.759600	1.157223	0.000001	217
LnMob	4.596886	4.569800	5.244000	4.128300	0.213631	0.000248	217
LnGDP	10.868220	10.774900	12.008900	10.047200	0.411474	0.002452	217
LnEdu	8.247628	7.880700	11.645900	7.247300	0.957895	0.000000	217
LnSci	6.547295	6.398800	9.246600	4.205000	0.996150	0.109840	217
LnUnEmp	1.139081	1.193900	1.504100	0.182300	0.226030	0.000000	217

It can be seen from Table 1 that the development of e-commerce in China's 31 provinces, municipalities and autonomous regions is uneven, and the standard deviation of per capita e-commerce sales and per capita express revenue is greater than 1.00; education investment and science and technology investment also differ among regions, with the deviation greater than 0.90. Therefore, apart from investigating the overall impact of China's e-commerce on residents' income, it is necessary to further explore the economic effects of regional e-commerce on residents' income by dividing the country into eastern, central, and western regions.

### 3. An Analysis of the Driving Effect of E-commerce on the Increase of Residents' Income

#### 3.1. Test Results

For the panel model, comparative tests can be performed by adding or subtracting control variables or explanatory variables. Model 1 presents a direct test of the driving effect of per capita e-commerce sales on residents' income; Model 2 tests the driving effect of per capita e-commerce sales, per capita express revenue, and mobile phone penetration rate on residents' income; Model 3 is a test model with control variables added. Perform F statistic test for the model, choose the mixed regression effect model or the fixed effect model, and then use the Hausman test to select the random effect model or the fixed effect model. After comparison, select the random effect model. The results are shown in Table 2. First, we used the F statistic to test whether to choose a mixed regression model or a fixed effects model. Then, with Hasuman test, we decided whether to choose the model with random effects or fixed effects. After testing, we decided on the random effects model as the optimal measurement model.

Table 2 The test results of e-commerce's driving effect on residents' income growth

Explanatory Variable	LnInc		
	Model 1	Model 2	Model 3
C	7.640379*** (0.11899)	7.490367*** (0.247905)	5.889497*** (0.330445)
LnEC	0.282368*** (0.013763)	0.060994*** (0.010487)	0.045652*** (0.008112)
LnExp		0.208211*** (0.013098)	0.159992*** (0.010709)
LnMob		0.1199*** (0.059245)	0.030619 (0.048573)
LnGDP			0.214712*** (0.037286)
LnEdu			0.02455*** (0.003624)
LnSci			0.043091** (0.019572)
LnUnemp			-0.014002

			(0.023075)
R-squared	0.861303	0.92255	0.956477
F	419.785***	845.7168***	656.1499***
Hausman	0	0	0
Model	RE	RE	RE

Note: “ \* ”, “ \*\* ”, “ \*\*\* ” denote a significance level of 10%、5% and 1% respectively. In the brackets indicates standard errors, and FE and RE represent a fixed-effects model and random-effects model respectively.

From test results, it was discovered that  $R^2$  of Model 1, Model 2 and Model 3 are greater than 0.86 and F ration is significant at the 1% level, indicating that the models fit well.

In Model 1, the impact of per capita e-commerce sales on per capita disposable income of residents is significant at the 1% level, and the coefficient has reached 0.282368, indicating that for every 10% increase in per capita e-commerce sales, the per capita disposable income of residents will rise by 2.82368%.

In Model 2, the impacts of per capita e-commerce sales, per capita express revenue, and mobile phone penetration rate on residents' disposable income are all found to be significant at the 1% level, among which per capita express revenue has the strongest driving effect.

In Model 3, per capita e-commerce sales and per capita express revenue have significantly impacted the per capita disposable income of residents, with the coefficients being 0.045652 and 0.159992 respectively. The mobile phone penetration rate, however, has less visible impact. Among the control variables, per capita GDP, per capita education expenditure, per capita science and technology expenditure have a significant positive impact on the per capita disposable income of residents. The impact of per capita GDP is the greatest with the coefficient being 0.214712, whereas the urban unemployment rate has no significant impact. It can be seen that investment in education and technology will increase the income of residents.

### 3.2. Test Results of the Driving Effect of E-commerce on Residents' Income in Eastern, Central and Western Regions

Given the fact that e-commerce, economic environment, education investment, technology investment and employment opportunities differ considerably across regions, a comparative study of the driving effect of e-commerce on the income of residents in eastern, central and western China was conducted so as to put forward measures to develop regional e-commerce and to spur the increase of residents' income. The test results are shown in Table 3.

Table 3 The test results of the driving effect of e-commerce on residents' income in eastern, central and western regions

Explanatory variable	LnInc			
	Total	East	Middle	West
C	5.889497*** (0.330445)	6.311336*** (0.460867)	5.158285*** (0.236076)	4.606497*** (0.461384)
LnEC	0.045652*** (0.008112)	0.055495** (0.016495)	0.024197*** (0.007492)	0.016971*** (0.011773)
LnExp	0.159992*** (0.010709)	0.202808*** (0.013852)	0.165869*** (0.008754)	0.126656*** (0.020803)
LnMob	0.030619 (0.048573)	0.053778*** (0.065956)	0.004728* (0.030064)	0.006543 (0.092943)
LnGDP	0.214712*** (0.037286)	0.181156*** (0.046178)	0.048221*** (0.028176)	0.357049*** (0.055081)
LnEdu	0.02455*** (0.003624)	0.033152*** (0.00428)	0.023382*** (0.003751)	0.021825*** (0.007564)
LnSci	0.043091**	0.052073***	0.03482052073**	0.024962*

	(0.019572)	(0.032463)	(0.01325)	(0.020384)
LnUnemp	-0.014002	0.027421	0.21273*	-0.005926
	(0.023075)	(0.02501)	(0.020479)	(0.043135)
R-squared	0.956477	0.956477	0.92101	0.919885
F	656.1499***	407.4379***	79.95327***	124.6622***
Hausman	0	0	0	0
Model	RE	RE	RE	RE

Note: “ \* ”, “ \*\* ”, “ \*\*\* ” denote a significance level of 10%, 5% and 1% respectively. In the brackets indicates standard errors, and FE and RE represent a fixed-effects model and random-effects model respectively.

In Table 3, the driving effects of e-commerce on residents’ income in the country as a whole and the eastern, central and western regions are compared and tested. The results shows great regional differences, with eastern China being impacted more significantly than Western China.

The coefficients of the impact of per capita e-commerce sales on residents’ income growth in the eastern, central and western regions are 0.055495, 0.024197 and 0.016971, respectively. The coefficient of the influence of e-commerce sales on residents’ income in eastern China is 3.26 times that of western China and 2.29 times that of central China. As can be seen, the development of e-commerce has a more significant impact on the income growth of residents in the eastern region, while in the central and western regions, e-commerce has great potential for development.

The impact of express revenue on the income of residents in the eastern region is also more significant, 1.6 times that of the western region and 1.22 times that of the central region. The coefficients are 0.202808, 0.165869, and 0.126656 respectively. It can be concluded that logistics infrastructure in central and western China needs to be strengthened and logistics efficiency needs to be increased.

Internet technologies and equipment such as mobile phones have a significant positive impact on the income of residents in the eastern and central regions, but the impact on the western region is not significant. The coefficient of the impact in the eastern region is 0.053778, which is 11.37 times that of the central region. As can be noted, the widespread application of mobile phones and other equipment has greatly spurred the income growth of residents in eastern China; the impact in central China is emerging; and the effect in western China is not yet obvious.

Among the control variables, GDP, education investment, science and technology investment have significant impacts on residents’ income, with Eastern China being impacted more significantly than Western China. This phenomenon has much to do with the underdeveloped economy, the flow of talents to southeastern China and the low efficiency of science and technology investment in the west. The impact of urban unemployment rate on residents’ income growth is currently insignificant except for the central region.

#### 4. Conclusion and Suggestions

Through selecting relevant data of e-commerce and residents' disposable income from China's 31 provinces, municipalities and autonomous regions except Hong Kong, Macao and Taiwan from 2013 to 2019 for a panel data model testing, we can conclude that e-commerce has a significant driving effect on the growth of residents' income. The impact of e-commerce on residents' income differs considerably across regions, with Eastern China being impacted more significantly than Western China. Besides, such variables as local economic development, education investment, and technology investment have a major effect on boosting residents' income. Based on the above test results, suggestions are put forward as follows:

First, local governments should vigorously develop e-commerce by making plans for e-commerce development and implementing incentive policies, and promote social consumption so as to stimulate local economic development. The western region, in particular, should base e-business activities on local featured industries and form e-commerce clusters. With experience drawn from the eastern and central regions, the western region should use e-commerce to upgrade

its industrial structure and supply chain as well as promote local economic development and the balanced growth of Chinese residents' income.

Second, to spur e-commerce growth, the government needs to enhance the construction of logistics infrastructure and delivery mechanism, especially in western China, where delivery capacity and system are far from satisfactory, and the high cost of delivery service discourages e-commerce from driving residents' income growth.

Third, given the fact that residents' income potential brought about by the growth of mobile equipment in the central and western regions has not yet been fully released, China needs to further develop Internet technology, popularize and upgrade mobile Internet equipment so as to innovate e-commerce models and boost e-commerce.

Fourth, the government should make more investment in education, especially in business education and training in rural areas in central and western China. The development of rural residents' skills of e-commerce sales and consumption through education will have a strong driving effect on the growth of residents' income. The education investment in central and western China will promote the rapid development of e-commerce in this region.

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## References

- [1] Clark, C. *"The Conditions of Economic Progress"*. London: Macmillan, 1940: 203-208.
- [2] W. Rostow. *"The Economics of Take-Off into Sustained Growth"*. Chengdu: Sichuan People's Publishing House, 1988.
- [3] Wang Yanjun, Wen Jiaoxiu and Wu Jingru. *"Changes of Industrial Structure and Macro-economic Fluctuation in China"*. East China Economic Management. 2011( 2) : 21~23.
- [4] Dai Kuizao. *"Driving Factors of China's Industrial Structure: 1985-2010"*. Modern Economic Science. 2012, 34 (06): 1-14+122.
- [5] Liu Danlu. *"Unbalanced Growth of Service Industry and Income Gap of Urban Residents--A Shapley Value Approach"*. Modern Economic Research. 2017, (07): 71-81.
- [6] Pan Wenxuan. *"The Influence of Urbanization and Industrialization on Income Gap between Urban and Rural Residents"*. Journal of Shanxi University of Finance and Economics. 2010, 32 (12): 20-29.
- [7] Wei Junying and Hou Jiahui. *"The Influence of Industrial Structure Changes on the Income of Urban and Rural Residents in China"*. Agricultural Technology Economy. 2015, (08): 118-126.
- [8] Li Liwei and Li Dandan. *"Determinant of Mobile Internet Diffusion: Empirical Research Based on Country-level Cross-sectional Data"*. Technology Economics. 2015, 34 (06): 37-42.
- [9] Liu Hu and Zhang Jiaping. *"Driving Effects of Internet on Household Consumption"*. Journal of Beijing University of Posts and Telecommunications. 2016, 18 (03): 14-21.
- [10] Zhang Hong and Liu Xiuzheng. *"The Impact of E-commerce on Rural Economy---Based on Multiple Regression Model and Cluster Analysis"*. Jiangsu Agricultural Sciences. 2017, 45 (17): 305-309.
- [11] Li Qi. *"The New Productive Forces of Mankind in the 21st Century: the Origin, Essence and Development Measures of E-commerce"*. Modern Economic Science. 1999, (05): 63-67.
- [12] Li Xiaozhong and Li Junyu. *"Research on the Influence of Digital Economy Development on Urban Rural Income Gap"*. Journal of Agro-technical Economics. 2021: 1-17.

- [13]Sun Yiping and Xu Yingbo. “*The Impact of Internet Popularization on Chinese Residents' Income Distribution: An Empirical Study Based on CFPS Data*”. *Macroeconomics*. 2021, (07): 161-175.
- [14]Shi Baolin. “*The Regional Differences of Chinese Residents' Income: An Empirical Study*”. *Journal of Shanxi University of Finance and Economics*. 2012, 34 (S3): 59.
- [15]Wang Peishi. “*A Study on the Relationship between Governmental Education Investment and Disposable Income of Residents---An Empirical Analysis Based on Panel Data from 1999 to 2017 in China*”. *Journal of National Academy of Education Administration*. 2019, (04): 27-37.
- [16]Wu Qiang, Liu Xiao and Ding Wenna. “*The Impact of Education Investment on the Income Level and Income Gap: the Heterogeneity Effect Analysis*”. *Macroeconomics [J]*. 2020, (05): 111-117+144.
- [17] Li Xin and Guan Huijuan. “*The Education Input, Labor Transfer and Urban-Rural Income Inequality*”. *Statistical Research*. 2018, 35 (03): 80-92.
- [18] Zhang Yongjun. “*An Analysis of the Impact of Science and Technology Investment on Farmers and Herdsmen's Income in Inner Mongolia*”. *Scientific Management Research*. 2014, 32 (01): 98-101.
- [19] Luo Xubin and Hu Delong. “*Research on the Contribution of Scientific and Technological Progress to Narrowing the Income Gap between Urban and Rural Areas*”. *Science & Technology Progress and Policy*. 2011, 28 (03): 47-49.
- [20] Yan Jinshan. “*Can Social Security Promote Residents' consumption? An Empirical Analysis Based on Income*”. *Social Sciences in Guangxi*. 2021, (08): 134-141.