

# **The Impact of E-Commerce on China's Rural Poverty**

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## **Abstract**

Global poverty is a critical topic nowadays and China's E-Commerce market seems to provide a new approach to poverty reduction. The growth of China's E-Commerce is largely driven by Taobao, a Chinese online shopping platform similar to Amazon in the US. As the internet penetrated into China's rural areas, more and more rural residents became Taobao sellers and led to the emergence of "Taobao villages". In general, Taobao village refers to a village where the number of active online stores reaches more than 10% of the number of local households, and the annual E-Commerce transaction volume reaches more than 10 million yuan. In 2009, the first 3 Taobao villages were discovered. By 2020, there were 5,425 Taobao villages in 28 provinces (autonomous regions and municipalities) across the country. The rise of Taobao villages in Chinese rural areas brings huge E-Commerce success.

This paper investigates the impact of E-Commerce on China's rural poverty using Taobao villages as a measurement of rural E-commerce development. I seek to answer the following question: How does having E-Commerce villages at the county level affect regional poverty in China? My research would provide valuable insights for other countries or regions that also engage in rural E-Commerce to promote the development of rural economies. It would contribute greatly to the grand challenge of poverty alleviation both in China and globally.

## **I. Introduction**

Global poverty is a critical topic nowadays. According to the World Bank, around 711 millions of people globally are in extreme poverty, living on less than \$1.90 per day. In China, poverty is defined as anyone in a rural area earning less than \$2.30 per day. The amount of the Chinese population living in poverty has decreased from 17.2% in 2010, which is around 230 million people, to 0.6% in 2019, which is around 8.4 million people. According to the World Bank poverty measurement of \$1.9 a day, China's poverty headcount ratio reduced from 66.6% in 1990 to 0.7% in 2015, contributing to 70% of the poverty reduction globally. Such a drastic decrease in national poverty was largely due to China's rapid economic development and poverty reduction policies. During the last forty years, China has launched several poverty relief programs that established safe residence, guaranteed food, clothing and basic medical services, provided compulsory education, and promoted the development of local industries. These targeting policies helped to lift more than 800 millions Chinese people out of poverty since 1978. While traditional poverty alleviation channels have significantly improved rural people's access to health and education, China's rapid E-commerce development in recent years seems to expand rural economic activities and increase rural employment opportunities. It seems to provide a new approach to poverty reduction.

The E-Commerce market has contributed substantially to China's economic growth. From 2004 to 2017, the total E-Commerce trade volume in China rose from less than 1,000 billion yuan (\$120.8 billion US dollars) to 30,000 billion yuan (\$4.44 trillion US dollars). In 2020, 38% of China's GDP consists of the added value of China's digital economy. About 25% of China's physical goods retail sales were sold online, exceeding the global average of 18%. In 2021, China's total E-Commerce retail sales reached 2.49 trillion US dollars and contributed to more

than half of the world's E-Commerce retail sales. China became the country with the largest digital buyer population in the world, adding up to 780 million people. Noticeably, online retail sales in rural China demonstrates faster growth than the national average. Total online retail sales in rural China increased from 180 billion RMB in 2014 to 1.24 trillion RMB in 2017. It demonstrated a compound annual growth rate of 91%, far beyond the national growth rate of 35%. The digital technologies transformed the traditional production and consumption patterns in rural areas and is likely to create more job opportunities and enhance economic growth. As total online sales increases and revenue surges, more people in rural areas may receive higher income and escape poverty.

The growth of China's E-Commerce is largely driven by Taobao, a Chinese online shopping platform owned by Alibaba company similar to Amazon in the US. As the internet penetrated into China's rural areas, more and more rural residents became Taobao sellers and led to the emergence of "Taobao villages". Taobao village is a measurement method used by Ali to count the growth of Taobao sellers in rural areas since 2009. In general, Taobao village refers to a village where the number of active online stores reaches more than 10% of the number of local households, and the annual E-Commerce transaction volume reaches more than 10 million yuan. In 2009, the first 3 Taobao villages were discovered. By 2020, there were 5,425 Taobao villages in 28 provinces (autonomous regions and municipalities) across the country. The rise of Taobao villages in Chinese rural areas brings huge E-Commerce success. This paper investigates the impact of E-Commerce on China's rural poverty using Taobao villages as a measurement of rural E-commerce development. I seek to answer the following question: How does having E-Commerce villages at the county level affect regional poverty in China?

Although a growing body of literature has studied E-Commerce development, there is a

lack of empirical research to understand the impact of E-Commerce on poverty. This study is an attempt to fill the gap. The belief that “E-Commerce reduces poverty” is taken as a common knowledge without being tested. There are many reports stating a positive correlation between the emergence of E-Commerce villages and China’s regional GDP but fail to demonstrate the causality between these two variables. The effect of confounders driving the relationship is mostly ignored. Other existing literature related to this topic either focus on the cause and formation of China’s E-commerce villages, or use theoretical approach and case studies to examine E-commerce and poverty alleviation. My research analyzes the actual impact of adopting E-commerce on poverty using data from a large sample of counties in different provinces in China using a causal inference method. My intuition is that having E-Commerce villages at county level has a negative causal effect on regional poverty in China.

Considering village level data involving long-term and large-scale observations are lacking in China, I use county level data in my research. In this research, my treatment variable is % of Taobao villages at county level, and my outcome variable is per-capita GDP at county level. My unit of analysis is county. For my treatment data, I calculate the yearly % of Taobao villages for each county in 2014, 2016 and 2021 using Taobao village yearly entrance from *Ali Research Report on China Taobao Villages (2014-2021)* and the complete provinces and counties list from *China’s National Administration Statistics*. For my outcome data, I use the per capita GDP on counties level from the *China County Statistical YearBook* and *China’s National Bureau of Statistics (2014-2021)*.

Noticeably, “Taobao village” is not a policy treatment but a result of both spontaneous and government supported rural E-Commerce development. Becoming a Taobao village does not necessarily mean the village is being specifically targeted by government policy or company

program to become a Taobao village. Taobao village is used only as a measurement method in this paper.

My main research method is a two way fixed effect panel data regression on counties in seven provinces through the years 2014, 2016 and 2021. Although the first Taobao village appeared in 2009, 2014 is the year when Ali started to systematically count the number of Taobao villages in each province and publish the Taobao villages report. *Ali Research Report on China Taobao Villages* in 2014, 2016 and 2021 are the most complete and available versions on Ali's platform. The seven provinces in my data sample have the most Taobao villages and datasets available for study among the total of thirty-four provinces in China. They include four relatively richer provinces, Zhejiang, Fujian, Guangdong, Jiangsu, and three relatively poorer provinces, Henan, Hebei, Shandong. In this model, I analyze the change of per-capita GDP over time in the same county (2014-2021). I compare the per-capita GDP growth among counties with different % of Taobao villages over time (2014-2021) in the same province. I add a county and year two way fixed effect to control unobserved time invariant county specific variables. This research method helps to eliminate some selection bias that exists in naive comparison. For instance, the counties with Taobao villages may already have better infrastructure and higher per-capita GDP before they even have Taobao villages. As a result, they may have less poverty than counties without Taobao villages due to factors other than E-commerce.

In general, my research would provide valuable insights for other countries or regions that also engage in rural E-commerce to promote the development of rural economies. It would contribute greatly to the grand challenge of poverty alleviation both in China and globally.

## **II. Literature Review**

Reports regarding Taobao villages focus on correlation instead of causation between E-Commerce and poverty alleviation. The Ali Annual Research Report(2009-2020) on China Taobao Villages demonstrates that as E-Commerce villages increase, there is an increase in online E-Commerce sales and rural job opportunities. However, there is no in-depth analysis of the causal relationship between becoming an E-Commerce village and regional poverty. The reports would provide me yearly entrance data of Taobao villages to conduct my research.

Some studies focus on the factors that affect the formation of Taobao/E-commerce villages. Jiaqi Qi [2019] conducted the first econometric analysis of the determinants of the formation of Taobao villages. The study collected county-level data set from the statistical yearbooks of Zhejiang and Jiangsu provinces for the years 2012–2015. It used random effects models, fixed effect models and negative binomial models. It found that education plays an important and positive role in the formation of Taobao villages, and credit support for other businesses makes the formation of new Taobao villages less likely. Min Liu [2020] investigated factors that impact the spatial aggregation of China's rural E-commerce. It collected all the Taobao Villages that existed in China by 2017 as research samples and quantified the factors of interest for each sample village using report data from Alibaba, spatial data from Geography Information Systems technology, company data from web crawler technology and nighttime light data from remote sensing technology. It used a random-effects probit model based on data about 2266 villages across six years and a negative binomial model based on cross-section data of 2092 villages demonstrating that the spatial aggregation at village-level with regard to rural e-commerce is significantly driven by the local industrial base and neighborhood effects. These two studies have a different focus from my paper but they could help me address potential

selection bias in my research design. For instance, they could provide me data to control confounders such as demographics, education, industry types and locations.

A few studies related to examining E-commerce and poverty alleviation used a different focus and method of approach from my paper. Chao Peng[2021] analyzed the impact of policy NRECDP (National Rural E-commerce Comprehensive Demonstration Project) on rural income using OLS regression. The treatment variable is the implementation time of NRECDP in the village as a measure of E-Commerce participation of villages. The outcome variable is the per capita disposable income at the village level. The dataset is derived from National Fixed-site Rural Survey (NFRS) village-level data conducted by the Ministry of Agriculture and Rural Affairs of China in 2018. The study concluded that rural E-Commerce could actually promote rural income and enhance rural development. In this paper, E-Commerce has been taken naturally as a positive driver of income, and the focus is on how the involvement of E-commerce villages in NRECDP impacts rural poverty, instead of the impact of village's experience about E-Commerce on poverty. My research will use Taobao villages as a measure of villagers' natural involvement in E-Commerce, and I will analyze the actual impact of E-Commerce on poverty without the assumption of E-commerce being a positive driver of income.

Xubei Luo [2019] examines the role of E-commerce participation in household income growth, drawing from a survey conducted on a representative sample of 2,118 Taobao villages in 2017. The survey used stratified random sampling design with villages as first sampling units, cell grids as secondary sampling units and households as tertiary sampling units stratified by E-Commerce participation status (whether the household owns an E-shop or not). The samples cover 453 E-households and 620 non-E-households in 80 villages across eight provinces. This paper focuses on the impact of becoming an E-Commerce household on household income



growth. The unit of analysis is households. It finds that firstly, E-Commerce participation is higher among the households with younger household heads, with secondary education, particularly those with technical and vocational education, urban work experience, and knowledge of e-commerce. Secondly, E-commerce participation is associated with higher household income, with some indications that participation has a strong positive effect on household incomes. Third, the benefits of E-commerce appear to be broadly shared among participants in an equitable way in Taobao Villages. My research will have a different method of approach by using % of Taobao villages at counties level as the measurement of E-Commerce, per-capita income as the measurement of poverty level, and counties as a unit of analysis.

Victor Couture [2021] used a randomized control trial with new survey and administrative microdata to estimate the impact of the first nationwide E-Commerce expansion program on rural households. The experiment takes place in eight counties located in Anhui, Henan, and Guizhou provinces. The unit of randomization is the village. The full sample in the survey data includes 40 control villages and 60 treatment villages, randomly selected from 432 village candidates. The surveys include household surveys data, local retail price survey data and the firm's administrative database. The studies find that there is little evidence suggesting E-Commerce helps to increase income gains to rural producers and workers. Instead, the gains are driven by a reduction in cost of living for a minority of rural households that tend to be younger, richer, and in more remote markets. These effects are mainly due to overcoming logistical barriers to E-Commerce rather than additional investments to adapt E-Commerce to the rural population. This study focuses on the impact of E-Commerce expansion on rural poverty, while my research focuses on the impact of natural involvement in E-Commerce on poverty. It provides me with an alternative explanation on how E-Commerce has little impact on poverty.

In general, these three studies mentioned above could provide me good insights and valuable data sources, and my paper would fill the gaps that they did not cover.

### **III. Background**

Alibaba is a Chinese multinational technology company founded in 1999 specializing in E-Commerce, internet, retails and technology. As one of the world's largest retailers and E-Commerce companies, Alibaba provides a wide range of online sales services including costumer-to-customer (C2C), business-to-customer (B2C), and business-to-business (B2B) along with electronic payment services. In 2003, Ali launched Taobao, the largest C2C marketplace in the world. Just as Amazon web services is a subsidiary to Amazon, Taobao is a subsidiary online shopping platform owned by Alibaba.

In the beginning, Taobao operated with a combined business model of eBay and Paypal. With a C2C business model, it established an online marketplace that enables sole traders, individual entrepreneurs and small businesses to sell goods and services to customers through individual online stores that includes express delivery service. A small percentage of the goods are auctions while the majority of the products are new merchandise labeled with fixed price. Customers could communicate directly with sellers through instant messaging and assess sellers' backgrounds from past ratings and comments on the store site. Sellers and customers complete the business transactions through the third party online payment platforms Alipay.

In 2008, Taobao included B2C business services besides the original C2C services by introducing a spun-off B2C platform called Tmall (Taobao Mall). With Tmall, Taobao offers quality brand-name goods for customers. In 2010, Taobao launched eTao, an independent search engine for online shopping that provides customers with comparable sellers' information from a variety of E-Commerce websites in China. Taobao thus includes three sub-branches, Taobao

marketplace the C2C platform, Tmall.com the B2C platform, and eTao the search engine for online shopping. It is transformed to be a combined business model of eBay, Amazon and Paypal.

In 2017, Taobao had over 1 billion products and the combined transaction volume of Taobao marketplace and Tmall.com reached over 3 trillion yuan. Taobao's E-Commerce sales channel opens up new market opportunities for individual sellers and local small businesses in rural China. The C2C business model encourages villagers to become individual entrepreneurs building their own startups, and the B2C business model encourages the development of rural industries that produce specialized local products and brands. As more and more villagers gain access to Taobao, Taobao villages quickly emerge.

Taobao village is a measurement method for both spontaneous and government supported rural E-Commerce development since 2009. The formation of Taobao villages went through three stages. Starting from 2009, grassroots development emerged and began the earliest formation of Taobao villages. Villagers who were returned migrants with certain entrepreneurial skills and internet knowledge spontaneously led the establishment of the first wave of rural online businesses. Many other local villagers then followed the models. Witnessing the flourishing of many Taobao villages, the second wave of Taobao villages emerged with government support in infrastructure, finance and E-Commerce training. It brought more villages to become Taobao villages and furtherly pushed E-Commerce development. At the third stage, local governments built an E-Commerce ecosystem by granting subsidies to E-Commerce service providers and firms as well as providing training to rural villagers to help them develop suitable and specialized local online products and branding. Under these support, more and more Taobao villages located in poor areas with fragile infrastructures, weak industrial bases and

limited human capitals emerged and succeeded.

#### **IV. Theory**

According to Ali's report, Taobao villages accounted for 50% of the country's rural online retail sales, and the number of active online stores reached 2.44 million in 2019. The annual trading volume of online stores in Taobao village and Taobao town exceeded 1 trillion RMB in 2020. It is reasonable to infer that E-Commerce villages make rural residents richer. My main hypothesis would be that having E-Commerce villages at the county level has a negative causal effect on regional poverty in China.

With the popularization of different online E-commerce platforms, there is a large increase in demand for products. E-Commerce opens up a larger sales market and creates new sales channels for people in rural areas. In non-E-Commerce villages, villagers can not afford high channel costs. They remain to be producers who sell their products to wholesalers to make profits. However, in E-Commerce villages, the channel costs for villagers with online platforms are reduced, so villagers could become both producers and sellers and enjoy higher profits. Such E-Commerce markets effectively combine the process of production, procession and sale to form specialized industry chains in rural China, promoting "rural industrialization". Villagers thus enjoy increasing revenues from a broadened selling channel and obtain higher profits from processing and sales. By promoting industry integration in rural areas, E-Commerce enhances villagers' income and reduces rural poverty.

The formation of industry chains also creates greater employment opportunities for the rural population, including women. In traditional non-E-Commerce villages, employment opportunities and salaries are low. A large number of rural laborers flowed out and became

migrant workers in big cities, which worsened local rural poverty. E-Commerce villages help to build a decentralized industrialization in rural areas that no longer rely on big cities and commercial centers to prosper. With the development of urban and rural logistic systems, E-Commerce village overcomes the disadvantage of location and provides more working opportunities and higher salaries for rural laborers. By creating decentralized rural industry chains, E-Commerce reduces rural labor turnover, enhances villagers' income and reduces poverty.

Nevertheless, there is a possibility that having E-Commerce villages at the county level may not have any effect on regional poverty in China. As Victor Couture [2021] suggests in the study, there is little evidence suggesting E-Commerce helps to increase income gains to rural producers and workers. Instead, the gains are driven by a reduction in cost of living for a minority of rural households that tend to be younger, richer, and in more remote markets. It is possible that even after access to E-Commerce, sellers from more developed regions with better products and lower prices drive village sellers out of online markets, forcing them back to traditional non-E-Commerce markets. It is also possible that E-Commerce contributes to labor turnover and flow out. After gaining higher income from E-Commerce, villagers that become richer may tend to move to big cities to enjoy a better quality of life. As they leave, local industry chains are weakened and job opportunities are reduced. More population may flow out as a result. What is more, E-Commerce may harm local sales channels and hinder the development of local industries. As villagers gain access to online sales platforms, they may find better products from companies in other regions. They may prefer shopping for products from other regions online rather than spending money on local products. As a result, local shops and industries may be driven out of the market, and more people lose jobs and incomes. Thus,

E-Commerce may even worsen poverty in local rural areas.

My secondary hypothesis would be that relatively poorer counties may have more poverty reduction than relatively richer counties after having E-Commerce villages. Poorer counties probably have more room for economic growth compared to richer counties. The profit that villagers in poorer counties make from selling products to wholesalers may be much lower than villagers in richer counties. They may thus gain a higher profit increase than villagers in richer counties after selling their products online. Villagers in poorer counties may also have much lower rural employment rate than villagers in richer counties. They may enjoy a higher job and wage increases after the development of decentralized rural industrialization in their local area. However, there is also the possibility that poorer counties have less poverty reduction than richer counties or no poverty reductions after having E-Commerce villages. People in poorer counties may lack materials and resources to produce goods with large quantities and high qualities. Even with access to E-Commerce, they could not compete with online sellers from other richer counties and may have lower profits. Due to lack of resources and knowledge, people in poorer counties may not be capable of forming a mature industry chain even after access to E-Commerce. There may be less job opportunities and lower salaries. As a result, E-Commerce may not reduce poverty in poorer counties.

## **V. Research Design**

Considering village level data are lacking in China, I use county level data in my research. In this research, my treatment variable is the % of Taobao villages at county level. My outcome variable is regional poverty at county level. My unit of analysis is county.

For my treatment data, I get Taobao village yearly entrance from *Ali Annual Research*

*Report on China Taobao Villages (2014-2021)* and the complete provinces and counties list from *China's National Administration Statistics*. Using these two data sources, I calculate the yearly % of Taobao villages for each county from 2014 to 2021. Noticeably, “Taobao village” is not a policy treatment but a result of both spontaneous and government supported rural E-Commerce development. Becoming a Taobao village does not necessarily mean the village is being specifically targeted by government policy or company program to become a Taobao village. Taobao village is used only as a measurement method in this paper.

For my outcome data, I get the per capita GDP on counties level and % of secondary industries in GDP on counties level from *China County Statistical YearBook* and *National Bureau of Statistics (2014-2021)*. Per-capita GDP demonstrates economic performances and is a measure of average living standards. It indicates the regional poverty level. Secondary industry is a mechanism to help us understand how local economic activities and structures are transformed.

There are several confounders for this experiment, including location, industry type, education, infrastructure, and culture. The most important observable confounders in this research would be the location of the counties that have Taobao villages and education level of people in these counties, and the unobservable confounder may be culture. The counties that have Taobao villages may be located closer to some natural resources and may have higher per-capita GDP. They may have higher education levels and may have higher per-capita GDP. They may also have a culture with higher working ethics and may have higher per-capita GDP. These confounders lead the naive comparison to overestimate the average treatment effect, and I will control these confounders in my research. I get data sources of these confounders from *China County Statistical Yearbook (2014-2021)*.

My main research design is a two-way fixed effect panel data regression. I analyze the change of poverty over time in counties with Taobao villages compared to counties without Taobao villages. I use two samples of time. The first sample includes observations of 2014, 2016 and 2021. The second sample includes observations of 2014 and 2021. I also analyze the change of poverty over time in relatively poorer counties with Taobao villages compared to relatively richer counties with Taobao villages. I use two samples. The first one includes observations with GDP per-capita below the medium GDP per capita in 2014. The second one includes observations with GDP per-capita above the medium GDP per capita in 2014.

The county and year two-way fixed effects help to control unobserved time invariant county specific variables. It helps to eliminate some selection bias that exists in naive comparison. For instance, the counties with Taobao villages may already have better infrastructure and higher per-capita GDP before they even have Taobao villages. As a result, they may have less poverty than counties without Taobao villages due to factors other than E-commerce. Using two-way fixed effects enables me to focus on change of per-capita GDP in the same county.

My main regression model:

$$Y_{ct} = \alpha + \beta_1 Taobao_{ct} + \beta_2 P_{ct} + \gamma_c + \gamma_t + e$$

$Y_{ct}$ : Outcome variables. GDP per capita for county c in year t / Share of secondary industry in GDP for county c in year t.

$Taobao_{ct}$ : % of Taobao villages for county c in year t

$P_{ct}$ : Population for county c in year t



$\alpha$ : constant or intercept

$\beta_1$ : intercept, the impact of 1% increase of Taobao villages on county level GDP per capita/share of secondary industry in GDP

$\beta_2$ : intercept, the impact of 1% increase of population on county level GDP per capita/share of secondary industry in GDP

c: county

t: year

$\gamma_c$ : county fixed effect

$\gamma_t$ : year fixed effect

$e$ : error term

The regression model analyzes the effect of Taobao villages on county level per-capita GDP or the share of secondary industry in GDP controlling county and year fixed effect and population.

## **VI. Data**

In the year 2021, 564 counties in China have Taobao villages, and 1982 counties do not have Taobao villages. 45 counties have no data available. The minimum % of Taobao villages at county level is 0%, and the maximum % of Taobao villages at county level is 100%. The mean % is 0.83%, and the median % is 0%. Noticeably, being a Taobao village is used only as a measurement method to indicate the level of both spontaneous and government supported E-commerce development in rural China. It simply refers to a village where the number of active online stores reaches more than 10% of the number of local households, and the annual E-Commerce transaction volume reaches more than 10 million yuan. The treatment does not

mean villages are chosen to be Taobao villages and receive any treatment policies from government or company thereafter.

Table 1: Summary Statistics for % of Taobao villages at county level in 2021

Counties with at least 1 Taobao villages	Counties without Taobao village	NA	Min%	Max%	Mean%	Median%
564	1982	45	0	100	0.83	0

A limitation in my measurement is that datas on the exact number of active online stores among local households in each village or the exact number of the annual E-Commerce transaction volume is unavailable from Ali. Therefore, I can not calculate the number of active Taobao online stores at each county level, but can only get the % of Taobao villages at each county level. It may result in some measurement errors for the precise level of E-Commerce development at county level, and may result in some deviations on my measure of the impact of E-Commerce on poverty.

Table 2: Summary Provincial Taobao County Statistics in 2021

Province	Total counties	Counties with at least 1 Taobao village	Counties without Taobao villages	NA	Min %	Max %	Mean %	Median %
27	2591	564	1982	45	0	100	0.83	0
Hebei	169	80	89	0	0	19.76	1.52	0
Zhejiang	94	72	19	3	0	44.49	5.72	2.53
Shandong	144	68	71	5	0	100	1.70	0

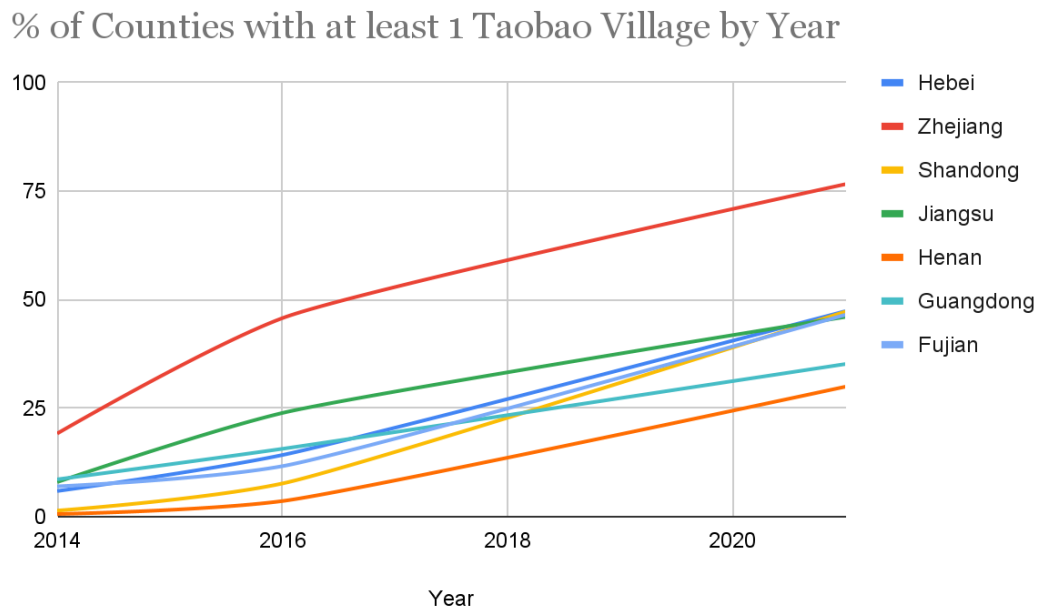
Jiangsu	113	52	57	4	0	32.25	2.07	0
Henan	167	50	112	5	0	11.54	0.54	0
Guangdong	128	45	78	5	0	41.29	4.06	0
Fujian	86	40	43	3	0	76.19	3.90	0
Jiangxi	101	23	72	6	0	5.45	0.28	0
Hubei	104	21	81	2	0	10.23	0.19	0
Anhui	104	19	85	0	0	4.65	0.24	0
Shanxi(陕西)	107	12	94	1	0	0.03	0.00	0
Guangxizhuangzu	109	10	97	2	0	0.08	0.00	0
Hunan	122	9	112	1	0	0.02	0.00	0
Shanghai	19	7	10	2	0	0.11	0.01	0
Beijing	18	7	11	0	0	10.59	1.99	0
Liaoning	100	7	93	0	0	0.02	0.00	0
Shanxi(山西)	119	7	112	0	0	0.02	0.00	0
Yunnan	129	7	122	0	0	10.59	0.00	0
Chongqing	40	7	33	0	0	0.022	0.00	0
Tianjin	18	6	12	0	0	10.59	0.02	0
Jilin	60	4	56	0	0	0.01	0.00	0
Sichuan	181	4	174	3	0	0.02	0.00	0
Xinjiangweiwuer	99	3	96	0	0	0.01	0.00	0
Guizhou	88	2	86	0	0	0.02	0.00	0
Heilongjiang	128	2	125	1	0	0.01	0.00	0
Hainan	22	0	21	1	0	0	0	0
Ningxiahuizu	22	0	21	1	0	0	0	0

The table of summary provincial Taobao county statistics in 2021 shows that there are variations of the % of Taobao villages among counties and provinces. Most counties with Taobao villages are concentrated in the provinces on the east coast of China, such as Zhejiang, Hebei, Shandong, Jiangsu, Henan, Guangdong and Fujian. In contrast, the number of counties with Taobao villages and the % of Taobao villages at county level are much lower in provinces located on the west coast. It meets my expectations. Most Taobao users who create demands for online products live in east coast cities that are more developed than west coast cities in China, so transportation costs are lower for villages that locate in the east coast to produce Taobao products, which leads to the rise of Taobao villages in the east coast.

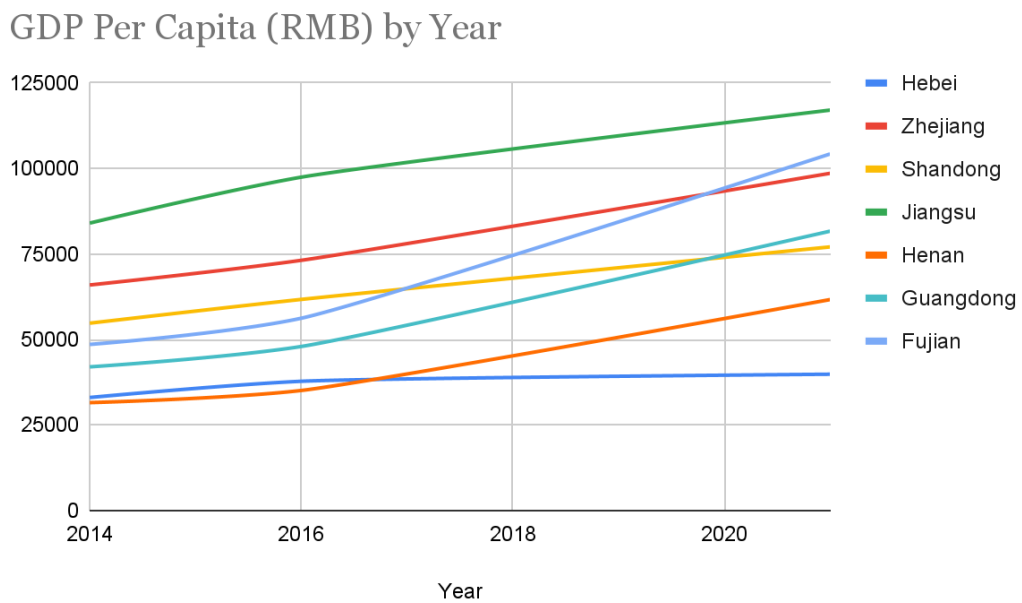
For my research, I focus on counties in 7 provinces: Zhejiang, Fujian, Guangdong, Jiangsu, Henan, Hebei, Shandong. Among them, Zhejiang, Fujian, Guangdong and Jiangsu are relatively richer provinces. Henan, Hebei and Shandong are relatively poorer provinces. These provinces have many Taobao villages in 2014, 2016 and 2021 with dates available. In contrast, the other provinces have too few Taobao villages for treatment groups and most datas are lacking.

Table 3: Summary Statistics of % of Taobao villages and GDP per-capita at county level in 2021, 2014, 2016 in My Research Sample

Year	Counties with at least 1 Taobao village	Counties without Taobao villages	NA	Min%	Max%	Mean%	Median%
2014	57	544	300	0	2.65	0.09	0
2016	141	458	302	0	10.92	0.5	0
2021	407	469	25	0	100	2.79	0



Graph 1: % of Counties with at least 1 Taobao Villages in 7 Provinces from 2014 to 2021



Graph 2: Average GDP per capita (RMB) of counties in 7 Provinces from 2014 to 2021

The graphs above show that there is a gradual increase of counties with at least one Taobao village in each of the seven provinces across time. As the % of counties with at least 1 Taobao villages in each of the seven provinces increase, the average GDP per-capita (RMB) of counties in seven provinces also increases from 2014 to 2021.

There are great differences in the GDP per capita level among provinces. For instance, Zhejiang province is a relatively richer province in China, and it is one of the first provinces that start to have Taobao villages since 2009. In 2021 Zhejiang province, 44 treated counties have Taobao villages fall into the range from 1% to 5%, the maximum reaches 44.49%. Most counties have per-capita GDP fall into the range from 50,000 RMB to 100,000 RMB, the maximum reaches 400,000 RMB.

Hebei province is a relatively poorer province in China. Many national poorer counties are located in this province. In 2021 Hebei province, 64 treated counties have Taobao villages fall into the range from 1% to 5%, the maximum reaches 19.76%. Most counties have per-capita GDP fall into the range from 30,000 RMB to 40,000 RMB, the maximum reaches 130,000 RMB.

Comparing the datas from Zhejiang province to Hebei province, we can see the drastic difference of poverty level between a richer province in China and a poorer province in China. More counties with higher GDP per capita are located in richer provinces than poorer provinces. Therefore, it is important to use a county fixed effect when comparing the per-capita GDP of counties with Taobao villages to counties without Taobao villages in order to eliminate counties level selection bias.

## VII. Results:

Table 4: Summary Statistics Table of Independent, Dependent and Control Variables for All Counties from 2014 to 2021

	Mean	Median	Standard Deviation	Min	Max	Number of observations
% Taobao villages	1.20	0	4.63	0	100	2085
GDP per-capita (RMB)	62000	46000	50312.04	2100	450000	1949
% Second Industry	46	46	14.56	3.7	98.99	1711
Population	710000	580000	898702.5	40000	33000000	1950

Table 5: Effect of Taobao villages on GDP per-capita and % second industry using samples in 2014, 2016 and 2021

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP	Log GDP	GDP	Log GDP	% 2nd	% 2nd
	per-capita	per-capita	per-capita	per-capita	Industry	Industry
% Taobao Villages	-859.28	-0.01	-368.88	-0.002	0.08	-0.23
	(533.49)	(0.01)	(380.46)	(0.005)	(0.09)	(0.37)
Population			-0.03*			
			(0.02)			
Log (Population)				-0.67***		12.30

				(0.26)		(12.68)
Observations	1949	1949	1945	1945	1741	1741
County FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
County-Clustered	YES	YES	YES	YES	YES	YES
Standard Error						

Note: All columns include county level and year level fixed effects. All columns include county-clustered standard error. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Table 6: Effect of Taobao villages on GDP per-capita and % second industry using samples in 2014 and 2021

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP	Log GDP	GDP	Log GDP	% 2nd	% 2nd
	per-capita	per-capita	per-capita	per-capita	Industry	Industry
% Taobao Villages	-727.41	-0.01	-343.77	-0.001	0.11	-0.23
	(612.43)	(0.01)	(479.43)	(0.01)	(0.12)	(0.55)
Population			-0.03			
			(0.02)			
Log (Population)				-0.66*		14.04
				(0.40)		(19.62)
Observations	1358	1358	1354	1354	1123	1123



County FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
County-Clustered	YES	YES	YES	YES	YES	YES
Standard Error						

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Note: All columns include county level and year level fixed effects. All columns include county-clustered standard error. \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

My research focuses on studying the impact of E-commerce, measured by % of Taobao villages at county level, on regional poverty in China. In this research, I used a two way fixed effect panel data regression. My outcome variables are GDP per capita and % of the second industry. My treatment variable is % of Taobao villages at county level. My confounding variable is population. The county and year two-way fixed effects help to control unobserved time invariant county specific variables. The regression includes two samples. The first sample includes observations of 2014, 2016 and 2021. The second sample includes observations of 2014 and 2021. During 2014 and 2021, significant changes on Taobao villages and GDP per-capita occurred. Using samples from these two years show the medium run effect. Adding samples from 2016 would calculate both the short run effects between 2015 and 2016 and short run effects between 2016 and 2021 besides the medium run effect.

Table 5 shows the effect of Taobao villages on GDP per-capita and % second industry using samples in 2014, 2016 and 2021. In column (1), a 1% increase in Taobao village corresponds to a decrease of 859.28 RMB in GDP per capita. This is substantially small based on the fact that the mean GDP per capita is 62000 RMB with standard deviation of 50312.04 RMB.

It suggests that in order to create a meaningful effect, an increase of more than 50% of Taobao villages is needed to result in a decrease of 50000 RMB in GDP per capita. Thus, a decrease of 859.28 RMB resulting from a 1% increase in Taobao villages is relatively low. Since the standard deviation of % Taobao villages is 4.63, a 1 standard deviation increase in % of Taobao villages will lead to a decrease of 3978.5 RMB, implying very small effect.

Other regressions in column (2), (3), (4), (5) and (6) yield consistent results with column (1). After controlling population, the impact of 1% increase in Taobao village corresponds to a decrease of 368.76 RMB in GDP per capita, which is substantially small. As Taobao villages increase by 1%, the share of second industry in GDP increases by 0.11%. Since the mean % of the second industry is 46% and the standard deviation is 14.56%, a 0.11% increase is substantially low. Similarly, Table 6 that uses samples in 2014 and 2021 also demonstrates a consistent substantially low effect of Taobao villages on GDP per-capita and % second industry.

Since all of the p values  $> 0.1$ , the results are not statistically significant. As a result, we fail to reject the null hypothesis that the effect is 0. We conclude that % of Taobao villages have little effect on per capita GDP and share of secondary industry in GDP.

To get a meaningful effect on GDP per capita, we need a pretty big increase in Taobao villages. However, the average counties in my research sample only have 1.2% of Taobao villages. In my 2021 data sample, the maximum % of Taobao villages in one county reaches 100%, but the average counties only have 2.19% of Taobao villages. Such contrast demonstrates the extremely unequal distribution of Taobao villages across areas. It is possible that the increase in GDP per capita only occurs in those few counties with a significantly high % of Taobao villages, while most counties with relatively low % of Taobao villages have little changes in

poverty. If the government invests more effort into Taobao villages or companies in Taobao villages continue to grow, the growth of GDP per capita can be substantial.

In addition, I observe the effect of Taobao villages on GDP per-capita of relatively poorer counties and relatively richer counties separately from 2014 to 2021. The regression includes two samples. The first sample is relatively poorer counties, which includes observations with GDP per-capita below the medium GDP per capita in 2014. The second sample is relatively richer counties, which includes observations with GDP per-capita above the medium GDP per capita in 2014.

Table 7: Summary Statistics Table of Independent, Dependent and Control Variables for Poorer Counties from 2014 to 2021

	Mean	Median	Standard Deviation	Min	Max	Number of observations
% Taobao villages	0.81	0	4.76	0	100	575
GDP per-capita (RMB)	33000	29000	24420.49	2100	310000	540
% Second Industry	40	41	11.27	7.9	99	458
Population	670000	570000	398797	64000	2800000	539

Table 8: Effect of Taobao villages on GDP per-capita and % second industry using samples of relatively poorer counties in 2014 and 2021

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	(1)	(2)	(3)	(4)	(5)	(6)
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	GDP	Log GDP	GDP	Log GDP	% 2nd	% 2nd
	per-capita	per-capita	per-capita	per-capita	Industry	Industry
% Taobao Villages	33.56	0.001	36.32	0.001	0.21	0.30
	(55.65)	(0.002)	(66.01)	(0.001)	(0.15)	(0.23)
Population			0.02			
			(0.02)			
Log (Population)				-0.36		-15.78
				(0.62)		(19.48)
Observations	540	540	539	539	458	458
County FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
County-Clustered	YES	YES	YES	YES	YES	YES
Standard Error						

Note: All columns include county level and year level fixed effects. All columns include county-clustered standard error. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Table 8 shows the effect of Taobao villages on GDP per-capita and % second industry using samples of relatively poorer counties in 2014 and 2021. In column (1), a 1% increase in Taobao villages in relatively poorer counties corresponds to an increase of 33.56 RMB in GDP per capita, which is substantially small based on the fact that the mean GDP per capita is 33000 RMB with standard deviation of 24420.49 RMB in poorer counties. Since the standard deviation

of % Taobao villages in poorer counties is 4.76, a 1 standard deviation increase in % of Taobao villages in relatively poorer counties will lead to an increase of 159.75 RMB, implying negligible effect. Other regression in column (2), (3), (4), (5), and (6) yields consistent results with column (1). Since all of the p values  $> 0.1$ , the results are not statistically significant. As a result, we fail to reject the null hypothesis that the effect is 0. We conclude that % of Taobao villages have little effect on the per capita GDP of relatively poorer counties.

Table 9: Summary Statistics Table of Independent, Dependent and Control Variables for Richer Counties from 2014 to 2021

	Mean	Median	Standard Deviation	Min	Max	Number of observations
% Taobao villages	1.60	0	4.95	0	44	557
GDP per-capita (RMB)	80000	68000	44069.94	12000	390000	530
% Second Industry	51	51	10.93	8.4	99	452
Population	650000	570000	401357.1	40000	3700000	530

Table 10: Effect of Taobao villages on GDP per-capita and % second industry using samples of relatively richer counties in 2014 and 2021

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP	Log GDP	GDP	Log GDP	% 2nd	% 2nd
	per-capita	per-capita	per-capita	per-capita	Industry	Industry

% Taobao Villages	-1645.74***	-0.02***	-888.71	-0.01	0.12	0.24
	(540.99)	(0.004)	(1022.92)	(0.01)	(0.11)	(0.22)
Population			-0.03			
			(0.04)			
Log (Population)				-0.28		-5.55
				(0.30)		(8.00)
Observations	530	530	530	530	452	452
County FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
County-Clustered	YES	YES	YES	YES	YES	YES
Standard Error						

Note: All columns include county level and year level fixed effects. All columns include county-clustered standard error. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Table 10 shows the effect of Taobao villages on GDP per-capita and % second industry using samples of relatively richer counties in 2014 and 2021. In column (1), a 1% increase in Taobao villages in relatively richer counties corresponds to a decrease of 1645.74 RMB in GDP per capita. Since the p value <0.01, the result is statistically significant. As a result, we reject the null hypothesis that the effect is 0. We conclude that % of Taobao villages have a negative effect on the per capita GDP of relatively richer counties.

A decrease of 1645.74 RMB resulting from a 1% increase in Taobao villages is relatively low. Based on the fact that the mean GDP per capita is 80000 RMB with standard deviation of 44069.94 RMB, an increase of more than 27% of Taobao villages is needed to result in a decrease of 45000 RMB in GDP per capita in order to create a meaningful effect. However, the average % of Taobao villages among richer counties is only 1.6. Since the standard deviation of % Taobao villages is 4.95, a 1 standard deviation increase in % of Taobao villages will lead to a decrease of 8146.41 RMB. It implies a very small effect since the average GDP per capita is 80000 RMB. Other regressions in column (2), (3) and (4) yield consistent results with column (1). In column (5), a 0.12% increase in the share of second industry as Taobao villages increase by 1% is substantially low based on the fact that the mean % of the second industry is 51%. It ends up giving consistent results with column (1).

Based on the results from Table 8 and 10, having Taobao villages seems to make people in relatively richer counties poorer but people in relatively poorer counties richer. It strongly suggests that Taobao villages may be particularly advantageous to poorer counties. In Table 5 and 6, the data that suggest having Taobao villages makes people in those counties poorer could be explained by the negative effects that are dominated by the relatively wealthier counties. The benefits on the poorer counties from Taobao villages are offset by the harms that Taobao villages bring to the richer counties when we analyze the effect of Taobao villages on GDP per-capita using all counties samples.

One reason that the positive impact of Taobao villages on GDP per capita in poorer counties is not substantial in Table 8 is probably due to selection bias. Even with county fixed effects, some potential selection bias in poorer counties may not be addressed fully, which leads

the research result to underestimate the effect of E-Commerce on GDP per capita in poorer counties. For instance, those poor areas may have lower education levels, less natural resources and poorer infrastructures, significantly hindering their GDP per capita growth even with Taobao villages.

Why are Taobao villages particularly advantageous to poorer counties? One possible explanation is that poorer counties have more room for economic growth compared to richer counties. The profit that villagers in poorer counties make from selling products to wholesalers may be much lower than villagers in richer counties. They may thus gain a higher profit increase than villagers in richer counties after selling their products online. Villagers in poorer counties may also have much lower rural employment rate than villagers in richer counties. They may enjoy a higher job and wage increases after the development of rural industrialization for Taobao production in their local area. What is more, there is a higher chance for new business in richer counties to fail due to over-competitions. Poorer counties have less local business competitions than richer counties, which give them more potential to succeed and dominate the larger online market.

Another possible explanation is that poorer counties have comparative advantages in online Taobao production. Poorer counties could produce the same goods or services for a much lower opportunity cost than richer counties do. With lower production costs, online businesses from poorer counties could sell the same goods or services at lower prices than their competitors from richer counties, winning them more market share and greater profitability. Thus, while bringing benefits to poorer counties, Taobao villages could harm local businesses in richer counties at the same time. Instead of spending money on local products, people from richer



regions may prefer buying products from poorer regions online, gradually driving local companies online out of business and making more people lose jobs and incomes. The online firms may also hurt local businesses in richer counties by stealing human capital and other resources from industries that supposedly should have advantages in the market and should create more revenues and profits. As a result, richer counties with Taobao villages may have their local sales channels harmed and local businesses losing revenues, making local people poorer.

Currently, the mean % of Taobao villages in poorer counties is only 0.81, which is too low to create a meaningful increase in GDP per-capita. We need a pretty big increase in Taobao villages in poorer counties for poverty reduction. Therefore, it is crucial for the government to design tailored policies to support the development of E-Commerce in poor counties. The government should encourage villagers to become individual entrepreneurs by providing them access to the internet and training for online businesses operations through financial subsidies or other economic assistance. In the meanwhile, the government should support existing local businesses and industries by investing money into R&D to further reduce cost and enhance local production. With adequate resources and technologies, more and more Taobao villages will rise and grow to bring more poverty reduction to poorer regions.

## **VIII. Conclusion**

This paper investigates the impact of E-Commerce on China's rural poverty using Taobao villages as a measurement of rural E-commerce development. I seek to answer the following question: How does having Taobao villages at the county level affect regional poverty in China? My intuition is that having Taobao villages at the county level has a negative effect on regional poverty in China.

In this research, I use a two-way fixed effect panel data regression. I analyze the change of poverty over time in counties with Taobao villages compared to counties without Taobao villages. My treatment variable is % of Taobao villages at county level. My outcome variable is county-level GDP per capita. My unit of analysis is county. I use two samples of time, one includes observations of 2014, 2016 and 2021, the other includes observations of 2014 and 2021. I also analyze the change of poverty over time in relatively poorer counties with Taobao villages compared to relatively richer counties with Taobao villages. I use two samples. The first one includes observations with GDP per-capita below the medium GDP per capita in 2014. The second one includes counties with GDP per-capita above the medium GDP per capita in 2014.

According to the result, when analyzing the effect of Taobao villages on GDP per-capita using all counties' samples, a 1% increase in Taobao villages corresponds to a substantially small change in GDP per capita at county level. However, when analyzing the effect of Taobao villages on GDP per-capita of relatively poorer counties and relatively richer counties respectively, Taobao villages show opposite effects on poor and rich counties. Taobao villages seem to make people in the richer counties poorer but people in the poorer counties richer. It suggests that Taobao villages are particularly advantageous to poorer counties. If there is a pretty big increase in Taobao villages in poorer counties, a meaningful increase in GDP per capita may occur. If the government invests more effort into Taobao villages in poor regions or companies in Taobao villages in poor regions continue to grow, the growth of GDP per capita can be substantial.

One explanation to the seemingly increase in GDP per capita of poor counties but decrease in GDP per capita of rich counties with Taobao villages is that poorer counties have more room for economic growth compared to richer counties due to higher potential for increase in margin of profit and employment opportunities. Poorer counties also have less local business

competitions, making new businesses easier to survive and succeed in the online market.

Another explanation is that poorer counties have comparative advantages in online Taobao production. Thus, Taobao villages could harm local businesses in richer counties while bringing benefits to poorer counties at the same time.

To bring substantial poverty reduction, the government should implement policies to encourage the development of E-Commerce in poor regions. Government should invest money into R&D development of local businesses and industry, introduce advanced technology of production, enhance education on business and operations, and grant financial subsidies or other economic assistance to local businesses. With adequate resources and technologies, there is a higher chance for Taobao villages to emerge and grow to bring higher GDP per capita in poor regions.

This paper has several insufficiencies that need further improvements. One insufficiency exists on the limitation of measurement. Datas on the exact number of active online stores among local households in each village or the exact number of the annual E-Commerce transaction volume is unavailable from Ali. Therefore, I can not calculate the number of active Taobao online stores at each county level. It may result in some measurement errors for the precise level of E-Commerce development at county level, and may result in some deviations on my measure of the impact of E-Commerce on poverty.

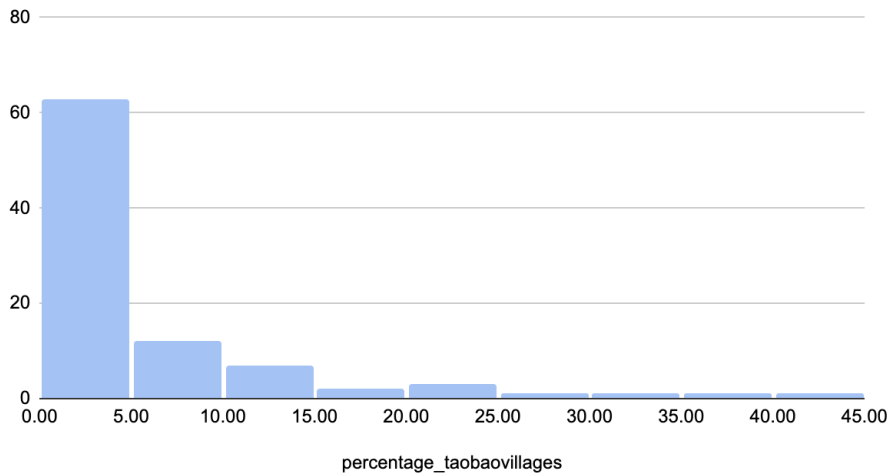
Another insufficiency is the lack of available samples of datas. Although most counties in my research sample have GDP per capita available in 2021, many of them don't have GDP per capita available in 2014 and 2016. As indicated in Table 3, 300 counties in 2014 and 302 counties in 2016 lack datas on GDP per capita, while only 25 counties in 2021 lack datas on GDP per capita. Since my research focuses on time variation of the impact of Taobao villages on

poverty, the lack of data in 2014 and 2016 creates smaller sample sizes of counties in the panel regression and may lead to inaccurate results.

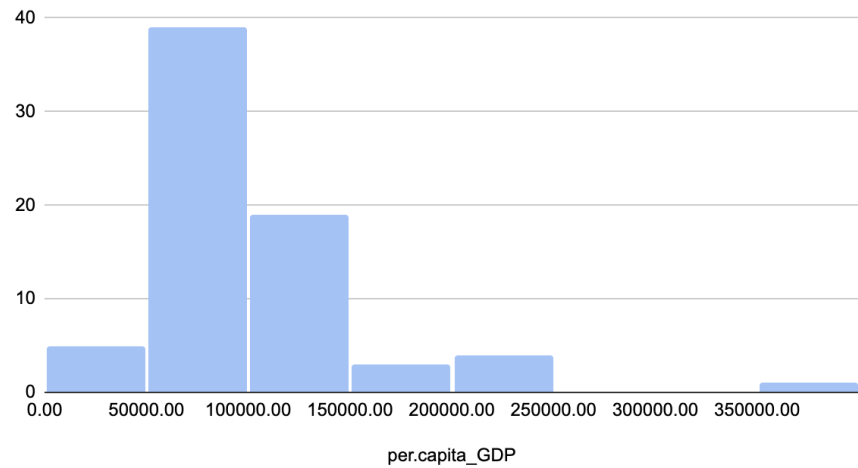
What is more, some potential selection bias may not be addressed fully even with county fixed effects. Many Taobao villages are located in poor places that have low GDP per capita in the first place. The lower education levels, less natural resources and poorer infrastructures in these poorer counties may significantly hinder their GDP per capita growth even with Taobao villages. One improvement that could be done is to include control on education levels and infrastructure levels in the regression. However, many county level data are lacking in China regarding education and infrastructure investment. The potential selection biases may lead to inaccuracies in results.

Appendix.

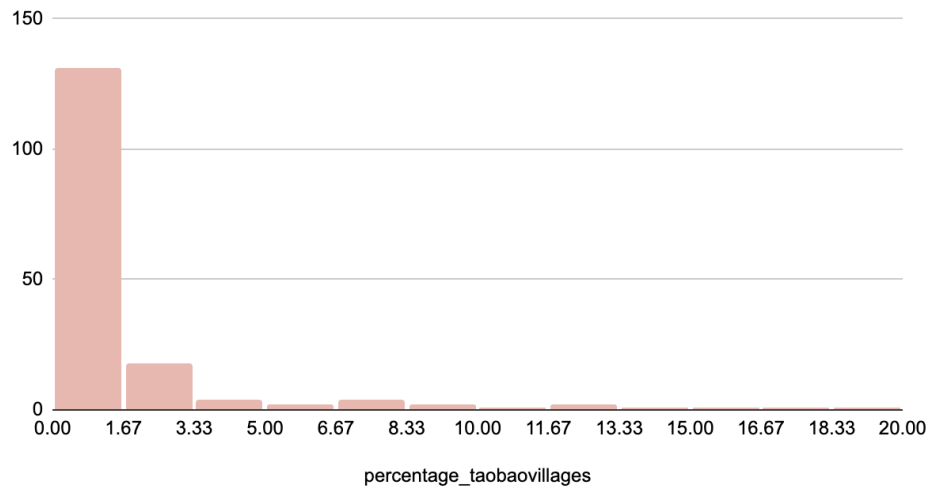
Counties % Taobao villages in Zhejiang Province 2021



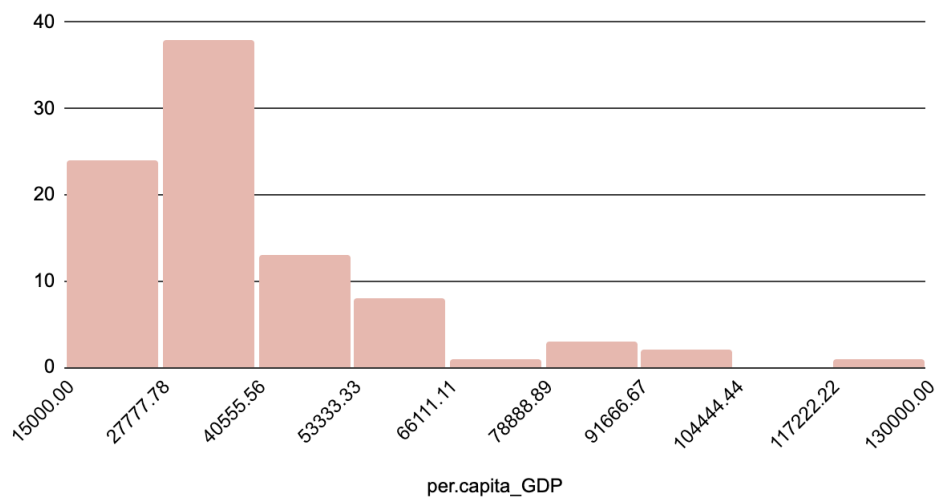
Counties Per Capita GDP in Zhejiang Province 2021



### Counties % Taobao villages in Hebei Province 2021



### Counties Per Capita GDP in Hebei Province 2021



Province	Total counties	Treated counties	Control counties	NA	Min %	Max %	Mean %	Median %
7	901	407	469	25	0	100	2.79	0
Hebei	169	80	89	0	0	19.76	1.52	0
Zhejiang	94	72	19	3	0	44.49	5.72	2.53

Shandong	144	68	71	5	0	100	1.70	0
Jiangsu	113	52	57	4	0	32.25	2.07	0
Henan	167	50	112	5	0	11.54	0.54	0
Guangdong	128	45	78	5	0	41.29	4.06	0
Fujian	86	40	43	3	0	76.19	3.90	0

Table 11: Provincial Taobao County Statistics in 2021 in My Research Sample

Province	Total counties	Treated counties	Control counties	NA	Min %	Max %	Mean %	Median %
7	901	57	544	300	0	2.65	0.09	0
Hebei	169	10	132	27	0	2.43	0.06	0
Zhejiang	94	18	43	33	0	2.38	0.22	0
Shandong	144	2	90	52	0	1.42	0.02	0
Jiangsu	113	9	56	48	0	1.48	0.1	0
Henan	167	1	100	66	0	0.35	0	0
Guangdong	128	11	70	47	0	2.65	0.11	0
Fujian	86	6	53	27	0	2.05	0.11	0

Table 12: Provincial Taobao County Statistics in 2014 in My Research Sample

Province	Total counties	Treated counties	Control counties	NA	Min %	Max %	Mean %	Median %
7	901	141	458	302	0	10.92	0.5	0
Hebei	169	24	117	28	0	4.86	0.21	0
Zhejiang	94	43	23	28	0	8.57	1.45	0.64
Shandong	144	11	70	63	0	5.21	0.11	0
Jiangsu	113	27	34	52	0	7.01	0.6	0
Henan	167	6	105	56	0	1.07	0.03	0
Guangdong	128	20	58	50	0	8.62	0.68	0
Fujian	86	10	51	25	0	10.92	0.42	0

Table 13: Provincial Taobao County Statistics in 2016 in My Research Sample

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