

Research on the impact of e-commerce on county economic resilience -- A quasi-natural experiment based on the policy of "comprehensive demonstration of e-commerce into rural areas"

Siyi Xiong*, Ying Meng, Ruirui Zhao

Department of Economics and Finance, Xi'an International Studies of University, Xi'an, China, 710128

*Corresponding author: xsy0721xsy@163.com.

Abstract. Against the backdrop of high-quality county economic development and advancing e-commerce initiatives, the mechanism through which e-commerce drives county economic resilience has become a research focus. Current challenges include unbalanced development and inter-provincial disparities in resilience. Using balanced panel data of 265 counties from 2001 to 2021, this study employs the "Comprehensive Demonstration of E-Commerce in Rural Areas" policy as an exogenous shock, applying multi-time DID and mediating effect models. Results show the policy significantly enhances economic resilience, especially within two years of implementation, the influence coefficient of which rises from 0.724 to 1.379. Industrial scale expansion mediates 2.37% of this effect via agglomeration and innovation. Heterogeneity analysis reveals stronger effects in non-Yangtze River counties and eastern regions. The study provides empirical references for digital-era county development, advocating strengthened e-commerce-industry synergy and location-based differentiated policies to boost resilience.

Keywords: E-Commerce, Economic Resilience, Influence Mechanism, Multi-Time DID, Mediating Effect.

1. Introduction

China's 2022 urbanization policy emphasizes county-led development to advance rural revitalization and common prosperity [1]. County economic resilience—defined as post-shock restructuring capacity critical for economic circulation [2]—is particularly vital given counties' structural vulnerabilities (agricultural dependence, limited diversification). This study examines how e-commerce (commercial activities via information networks [3]), promoted through national policies since 2013, enhances resilience. Using relative county-to-national GDP growth as an objective resilience metric, a multi-period difference-in-differences design with 2001–2021 county data was implied. The "E-commerce into Rural Comprehensive Demonstration" policy serves as a quasi-natural experiment to identify causal effects, with industrial scale analyzed as a transmission mechanism. Findings provide theoretical and empirical foundations for e-commerce-driven county development, supporting sustainable growth and common prosperity goals. And the research uses policy instead of results estimated by various method as core explanatory variable, would avoid many problems such as subjectivity.

Existing research on county economic resilience has advanced significantly, encompassing measurement methods, influencing factors, spatiotemporal differences, and mechanisms. Chinese studies employ diverse assessment approaches, including the PSR model [4] and entropy-weighted normal cloud model [5], while international work like Han et al. (2015) uses input-output data for indices [6]. Research on influencing factors demonstrates that the digital economy enhances resilience through improved resource allocation efficiency [7], and sustainable finance optimizes economic structures [8]. Spatially, studies such as Wang et al. (2023) identify patterns like "core-periphery" resilience gradients [9], and mechanisms like the digital economy-driven "technology empowerment-structural upgrading-resilience improvement" pathway have been proposed [10]. Concurrently, studies specifically linking e-commerce policies to resilience primarily evaluate policy effects and

enabling mechanisms. For instance, rural e-commerce is shown to enhance agricultural resilience via circulation efficiency and technology diffusion, particularly in poorer counties [11]; cross-border e-commerce pilot zones boost resilience in surrounding areas through technology spillover and industrial chain integration [12]; and multi-stage DID designs test the impact of policies like the "Comprehensive Demonstration of E-Commerce in Rural Areas" on rural economic resilience [13]. Foreign research often emphasizes evolutionary theory-driven universal models, contrasting with domestic studies focusing on policy intervention effects using county-level data.

Notably, two key limitations persist: (1) Data constraints, with county-level e-commerce metrics relying on proxies (e.g., postal volume) and insufficient panel data, addressed here via policy shocks as exogenous variations. (2) Theoretical gaps, including inconsistent mechanisms and overlooked regional heterogeneity in policy effects. This study focuses on the "Comprehensive Demonstration" policy to examine heterogeneous impacts, bridging theoretical gaps and providing empirical foundations for location-specific policies to facilitate urban-rural digital integration and coordinated development.

2. Mechanism analysis and research hypotheses

2.1. Impact of e-commerce development on county economic resilience

With the rapid digitalization in China, the trends of digital industrialization and industrial digitalization have been increasingly pronounced. E-commerce platforms have emerged as pivotal hubs connecting online consumption and product markets, increasingly dominating the circulation landscape. Driven by e-commerce policies, a county-level e-commerce ecosystem has taken shape, establishing a broad marketplace for consumers, producers, and investors. This has attracted capital and labor inflows, forming an economic development hub that aggregates production factors for county economies. E-commerce development not only strengthens the economic foundation of counties but also enhances their risk resilience through multiple channels. It optimizes production and consumption structures, boosting industrial adaptability and competitiveness to withstand external shocks. For instance, during natural disasters, while traditional agriculture may suffer severe damage, e-commerce broadens agricultural product sales channels, mitigates disaster losses, promotes non-agricultural industry growth, diversifies employment opportunities, and reduces single-industry dependence. Additionally, e-commerce generates stable fiscal revenue, which is less susceptible to single-industry fluctuations, further reinforcing the risk resistance of county economies. Based on the above theories, this paper puts forward Hypothesis 1:

H1: The development of e-commerce can significantly improve the resilience of county economy.

2.2. Impact of e-commerce demonstration village policy implementation on county economic resilience

Since the 2015 launch of the "Comprehensive Demonstration of E-Commerce in Rural Areas" policy by the Ministry of Commerce and other agencies, it has been progressively rolled out at the county level. The policy core lies in providing not only financial support but also enabling environments through e-commerce infrastructure construction, talent cultivation, and platform development. Focused on pilot areas, policy support transforms demonstration villages into e-commerce models, attracting resource inflows, preferential policies, and investments. This stimulates youth return migration, fostering human capital upgrading and industrial restructuring to achieve economies of scale. Mechanistically, policy implementation drives industrial agglomeration, technological innovation, and employment growth, expanding industrial scales. Upstream-downstream enterprise clustering forms integrated industrial chains, enhancing collaborative innovation and risk mitigation. Larger industrial scales boost household incomes, expand domestic demand, and accelerate economic recovery from shocks, thereby strengthening county economic resilience. Based on the above theories, this paper puts forward Hypothesis 2:

H2: The implementation of e-commerce demonstration village policy can significantly improve the resilience of county economy.

2.3. The implementation of e-commerce demonstration village policy has an impact on the resilience of county economy by increasing the industrial scale

Industrial scale, measured by industrial added value, reflects sectoral production and economic benefits. Its expansion fosters agglomeration, drives industrial coordination, and diversifies structures, enhancing resistance to shocks. The e-commerce demonstration policy boosts county economic resilience partially via industrial scale growth. Policy-driven improvements in e-commerce parks and infrastructure attract enterprises, promoting agglomeration and scale expansion. Integrated supply chains and collaborative environments enable risk-sharing, while larger scales create jobs, raise incomes, and stabilize domestic demand. Based on the above theory, this paper puts forward hypothesis 3:

H3: The implementation of e-commerce demonstration village policy can significantly improve the resilience of county economy through its effect on industrial scale.

2.4. The impact of e-commerce demonstration village policy implementation on the economic resilience of counties in different locations is heterogeneous

The e-commerce demonstration policy yields heterogeneous effects on county economic resilience across regions. Eastern counties, with robust economic bases and infrastructure, quickly integrate e-commerce into traditional industries to enhance resilience [14]. Central/western counties, though less developed, leverage policy support to foster characteristic industries, promote inter-regional cooperation, and stabilize economies. The Yangtze River Basin's economic heterogeneity—owing to diverse development models and resource endowments—further contributes to disparities in policy-driven resilience across its counties and non-basin areas. Based on the above theories, this paper puts forward Hypothesis 4:

H4: The effect of e-commerce demonstration village policy implementation on the economic resilience of counties in different locations is heterogeneous.

3. Research Design

3.1. Variable Selection

3.1.1 Explained variables

In measuring county economic resilience, this study employs the relative GDP growth rate as the core proxy variable. Existing methods include constructing comprehensive index systems such as principal component analysis and using a core variable to analyze shock responses. The former suffers from subjectivity in indicator selection and lacks a universally accepted framework, while the latter—grounded in Martin (2012) [15]—has been widely used in literature, such as Feng Yuan (2020) [16] and Tan Juntao et al. (2020) [17], to assess regional resilience by comparing local vs. national GDP growth. Focusing on dynamic economic recovery, this approach avoids subjective weighting, ensures data comparability, and facilitates causal inference. Thus, this study measures economic resilience as the relative GDP growth rate of specific regions against the national average, which is specifically expressed as:

$$Re_{it} = \frac{g_{it} - g_{nt}}{|g_{nt}|} = \frac{\frac{Y_{it} - Y_{i,t-1}}{Y_{i,t-1}} - \frac{Y_{nt} - Y_{n,t-1}}{Y_{n,t-1}}}{\left| \frac{Y_{nt} - Y_{n,t-1}}{Y_{n,t-1}} \right|} \quad (1)$$

Here, Re_{it} denotes the economic resilience of county i in year t , reflecting the relative change in its growth rate compared to the national average. A positive Re_{it} indicates a higher local growth

rate, with values closer to 0 signaling weaker resilience. g_{it} and g_{rt} are the growth rates of county i and China, respectively, while Y_{it} is the county's real GDP. To mitigate the impact of GDP growth rate signs, explained variables are standardized using the following formulas to eliminate dimensional effects.

$$RES_{it} = \frac{Re_{it} - \min Re_i}{\max Re_i - \min Re_i} \quad (2)$$

$$RES_{it} = \frac{\max Re_i - Re_{it}}{\max Re_i - \min Re_i} \quad (3)$$

3.1.2 Core explanatory variables

Implemented since 2014 by the Ministry of Finance, Ministry of Commerce, etc., the "Comprehensive Demonstration of E-Commerce in Rural Areas" policy promotes rural e-commerce development, circulation modernization, and poverty alleviation through fiscal support, logistics system improvement, and service station construction. The July 2014 Notice initiated the first e-commerce construction in 56 counties, each receiving 20 million yuan in central and local funds to upgrade rural public services, logistics, and circulation enterprises, aiming to boost farmer income, rural consumption, and rural revitalization. This study examines policy effects in counties listed from 2014 to 2021.

3.1.3 Mediating variables

Industrial scale: Industrial added value is a key indicator to measure industrial scale, which reflects the production scale and economic benefits of the industrial sector. The higher its value is, the more active the production activities of the industrial sector are, and the greater the contribution to economic growth is. The expansion of industrial scale can bring about industrial agglomeration effect, promote the coordinated development of related industries, form a diversified industrial structure, and enhance the stability and anti-risk ability of county economy. At the same time, the improvement of industrial scale can also create more employment opportunities, improve residents' income level, further promote the virtuous cycle of consumption and economy, and provide strong support for the improvement of county economic resilience. Due to the original data is too large, to take logarithm processing.

3.1.4 Control variables

Based on the existing literature, this paper selects the following control variables that affect the resilience of rural economy: 1. Consumption level, measured by the total retail sales of consumer goods in each county; 2. Fixed asset investment level, measured by the total amount of social fixed asset investment in each county; 3. The level of county medical service is measured by the number of beds in hospitals and health centers;

4. Human resources, measured by population density; 5. Agricultural labor productivity is measured by the ratio of the gross output of the regional primary industry to the number of labor in agriculture, forestry, animal husbandry and fishery. The variable meanings and measurement methods are shown in Table 1.

Table.1. Description of control variables

Variable names	Variable symbol	Variable description	Measurement Methods	Units
LC	COM	SC	-	RMB10,000
LFA	FIX	TSI	-	RMB10,000
LM	HOS	AL	-	/
HR	PEO	PD	RP	Ten thousand people/square kilometers
	PRO	PAL	PIP	Yuan/person

Notes: LC: Level of consumption; SC: Social consumer goods total retail sales; LFA: Level of investment in fixed assets; TSI: Total social investment in fixed assets; LM: Level of medical services at county level; HHC: Hospitals, health centers number of beds; HR: Human resources; PD: Population density; RP: Number of registered population/land area of administrative region; AL: Agricultural labor productivity PAL: Productivity of agricultural labor PIP: Primary industry production total value /number of labor force in agriculture, forestry, animal husbandry and fishery.

The descriptive statistical results are shown in Table 2.

Table.2. Descriptive statistics

Categories	Symbols	Name	Explanation	noo	Mean	med	std	Minimum	Maximum
Explained variable	RE	CER	CG	5351	0.552	0.491	3.186	-45.643	133.987
Explanatory variables	DID	EPS	CPP	5351	-	0	0.374	0	1
Mechanism variable	LNIND	IS	IVA	5351	0.206	0.165	0.159	0.024	2.469
Control variables	COM	LS	SC	5351	519253.12	234466.5	832612.265	2110	16256811
	FIX	LFA	TSI	5351	832293.3	385512	1210709	-1314000	18959268
	HOS	LC	HHC	5351	1548.535	1120	1449.362	54	16669
	PEO	HR	PD	5351	0.624	0.613	0.116	-2.835	1.869
	PRO	AL	PIP	5351	0.624	0.613	0.116	-2.835	1.869

Notes: noo: Number of observations; med: Median; std: Standard deviation CER: County economic resilience ;CG: County GDP growth rate relative to the national level; EPS:E-commerce

policy shock; CPP: Counties with pilot policies =1; Other counties =0; OS Industrial size; IVA: Logarithm of industrial value added; LS: Level of spending.

3.2. Data sources

Given the varying timeliness of county-level data updates and the numerous indicators that would result in unbalanced panel data, this study selects data from the period 2001–2021 for analysis. Based on the balanced panel data of 265 counties and districts in China from 2001 to 2021, this paper evaluates the economic effects of the e-commerce driven policy (namely, the comprehensive demonstration county policy of e-commerce in rural areas). The data come from the macro-statistical data such as China County Statistical Yearbook, China County (City) Social and Economic Statistical Yearbook and some provincial statistical bulletins over the years, and the county economies with more missing values are discarded.

3.3. Model Construction

3.3.1 Progressive DID model

The explanatory variable of this paper is the comprehensive demonstration policy of e-commerce into rural areas (DID). The implementation of e-commerce pilot demonstration zone policy is a quasi-natural experiment in essence. The list of demonstration areas will be adjusted every year according to the application situation, and the time points of the impact of the policy in the experimental group are not consistent. Therefore, in order to further identify whether and to what extent policies have an impact on county economic resilience in the standardized implementation stage, this paper refers to the research of Tao and Zhu [18,19] and other practices, based on the exogenous policy experiment of e-commerce into rural comprehensive demonstration counties, constructs a progressive DID model for analysis. The basic model is set as follows:

$$RES_{it} = \alpha_0 + \alpha_1 DID_{it} + a_2 \sum CONTROL_{it} + County_i + Time_t + \varepsilon_{it} \quad (4)$$

Where RES is the calculation result of county economic resilience after standardization. DID_{it} Represents the core explanatory variable, namely the policy dummy variable of e-commerce pilot demonstration zone, which is 1 if the county is included in the list and 0 if it is not. α_1 Is the core concern coefficient of this paper, which reflects the impact of the implementation of e-commerce pilot demonstration zone policy on the resilience of county economy. i and t represent district and county and time respectively; α_0 Is the intercept term; a_2 Is regression coefficient of control variable; $CONTROL_{it}$ Is the control variable; $County_i$ And $Time_t$ are county fixed effects and time fixed effects; ε_{it} Represents the disturbance term.

3.3.2 Mediating effect model

In order to further explore the influence mechanism of e-commerce demonstration village policy on county economic resilience, this paper draws on the results of Wen [20] and adopts DID model to test the mechanism.

$$M_{it} = \beta_0 + \beta_1 DID_{it} + \beta_2 \sum CONTROL_{it} + County_i + Time_t + \varepsilon_{it} \quad (5)$$

$$RES_{it} = \gamma_0 + \gamma_1 DID_{it} + \gamma_2 M_{it} + \gamma_3 \sum CONTROL_{it} + County_i + Time_t + \varepsilon_{it} \quad (6)$$

Within the mediating effect framework, M is the mediating variable; β_1 captures the core explanatory variable's (e.g., e-commerce policy) effect on M, while γ_1 and γ_2 denote its direct effect on resilience (the outcome) and M's effect on resilience, respectively, after M's inclusion. If the total effect (α_1) is significant without M, but γ_1 becomes insignificant while β_1 and γ_2 remain significant, complete mediation occurs: the policy affects resilience solely through M. If α_1 , γ_1 , β_1 , and γ_2 are all significant and $|\gamma_1| < |\alpha_1|$, partial mediation exists, indicating M transmits part of the policy's effect. If α_1 and γ_1 exhibit opposite signs while the indirect effect ($\beta_1 \times \gamma_2$) aligns with α_1 's sign, a masking effect arises: the mediating variable's positive indirect effect obscures the policy's negative direct effect, with the total effect driven by the indirect pathway [21].

4. Main empirical results

4.1. Regression results of the benchmark model

Table.3. Benchmark regression

	(1)	(2)
DID	1.001*** (5.21)	0.981*** (5.06)
COM		-0.042 (-0.47)
FIX		0.186*** (2.55)
HOS		-0.047 (-0.54)
PEO		0.079 (0.74)
PRO		-0.040 (-0.83)
Constant	0.467*** (13.12)	0.476*** (9.48)
County fixed effects	yes	yes
Year fixed effects	yes	yes
Number of observations	5,351	5,351
R-squared	0.067	0.095

Note: T-statistics are reported in parentheses,*** p<0.01, ** p<0.05, and * p<0.1

This paper tests the impact of e-commerce demonstration policies on county economic resilience using Equation (1), with regression results in Table 3. Column (1) shows a significantly positive effect of the policy when controlling for county and year fixed effects, while Column (2) adds control variables, confirming a 1% significant positive coefficient for the policy interaction term, verifying Hypothesis 1. Control variables indicate consumption has a 10% significant negative effect (limited county consumption capacity) and fixed asset investment a 1% significant positive effect, aligning with Zhang Shaojie et al. (2025) on multi-factor coordination for resilience.

4.2. Robustness test

4.2.1 Preliminary test of parallel trend hypothesis

This paper uses the parallel trend test to investigate the dynamic treatment effect of the impact of the comprehensive demonstration policy of e-commerce into rural areas on the resilience of county economy before and after the implementation of the policy. The results in Figure 1 show that before the implementation of the policy, the effect of the policy on the resilience of the county economy is significant but very weak, while after the implementation of the policy in the demonstration counties, the impact of the policy on the resilience of the county economy is significantly positive and significantly increased compared with that before the implementation of the policy, and the strongest in two years after the implementation of the policy. It may be that the policy has certain leading effect, affect policy before the implementation of economic running, so there is a potential role; After the implementation of the policy, various preferential policies and talent introduction policies will have a substantial impact on the economy. Therefore, the parallel trend hypothesis is valid.

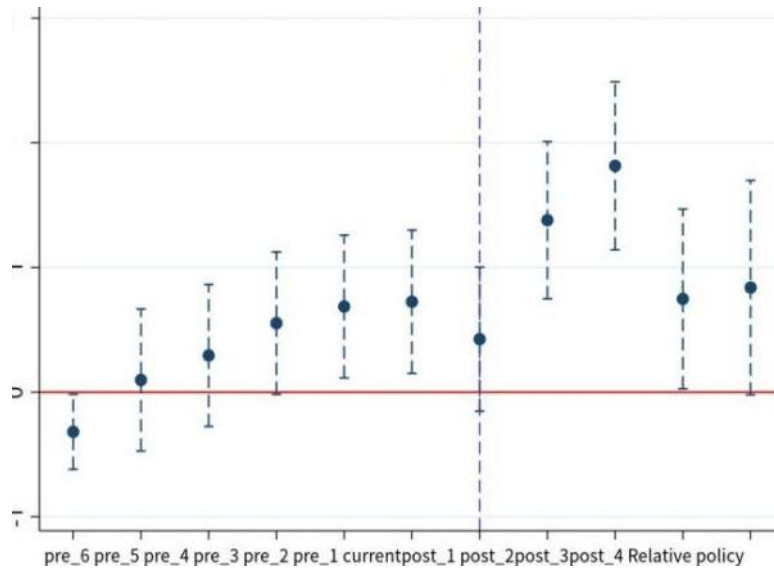


Figure 1. Parallel trend test

4.2.2 Placebo test

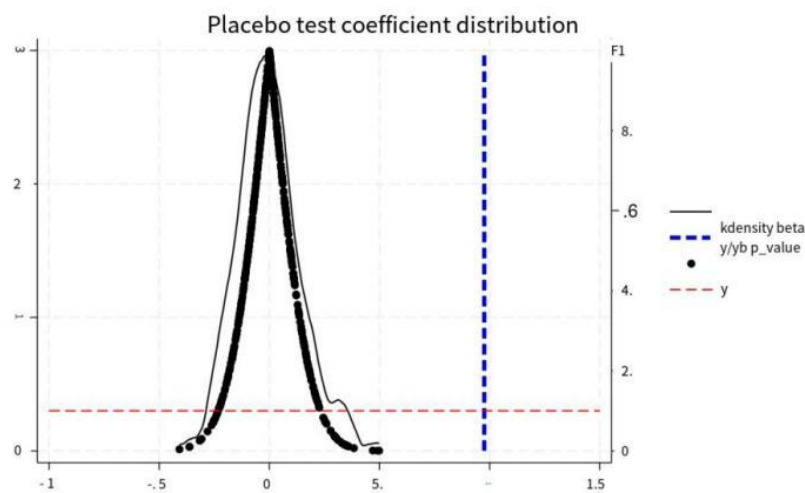


Figure 2. Placebo test

To address unobserved confounding in quasi-natural experiments, a placebo test was conducted by randomly assigning 30 of 265 counties as a pseudo-treatment group with artificial shock timing. After 500 regressions, Figure 2. shows the mean placebo coefficient (approximately zero) significantly deviates from the actual policy coefficient (0.981), confirming that omitted variables do not drive the results. This validates the robustness of the primary empirical findings.

4.3. Further testing

4.3.1 Test of heterogeneity along the Yangtze River

To explore the policy impact heterogeneity, this study considers the Yangtze River Economic Belt Strategy [22], whose factor endowment and logistics cost differences with non-basin areas affect policy transmission. Heterogeneity tests compare Yangtze River basin and non-basin counties. The basin sample’s DID coefficient is 0.256 (ns), as its inherent geographical and economic advantages limit policy marginal effects. In contrast, non-basin counties have weak traditional circulation systems, where the policy more effectively breaks regional constraints and releases economic vitality.

4.3.2 Test of regional heterogeneity

The results of heterogeneity test are shown in Table.4 and Figure 3. Regional heterogeneity tests (columns 3-5) show significant policy effects: eastern regions had a DID coefficient of 1.339 ($p < 0.01$), western regions 0.356 ($p < 0.1$), and central regions 0.370 (ns). The east's robust digital infrastructure and diversified industries enable policy-driven resilience via innovation and agglomeration, while the west benefits from policy "weakness supplementation." The central region's agricultural dominance and weak industrial base constrain policy efficacy. Thus, eastern e-commerce support should be strengthened, western infrastructure gaps addressed, and western industrial upgrades leveraged to amplify policy impacts.

Table.4. Heterogeneity analysis

	(1)	(2)	(3)	(4)	(5)
DID	0.256 (1.01)	1.124*** (3.76)	1.339*** (2.96)	0.370 (1.22)	0.356* (1.79)
Control variables	yes	yes	yes	yes	yes
constant	0.808*** (10.27)	0.265 (1.63)	0.071 (0.72)	0.548*** (7.60)	0.643*** (13.95)
County fixed effects	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes
Number of observations	2,789	2,555	1,686	671	2,994
R-squared	0.098	0.095	0.138	0.200	0.080

Note: the eastern coastal region includes Beijing, Liaoning, Jiangsu, Zhejiang, Fujian and

Guangdong (6 provinces and municipalities); The central inland region includes Anhui and Jiangxi (two provinces); The western remote regions include Yunnan, Inner Mongolia, Sichuan, Guangxi, Guizhou and Xinjiang (6 provinces and regions).

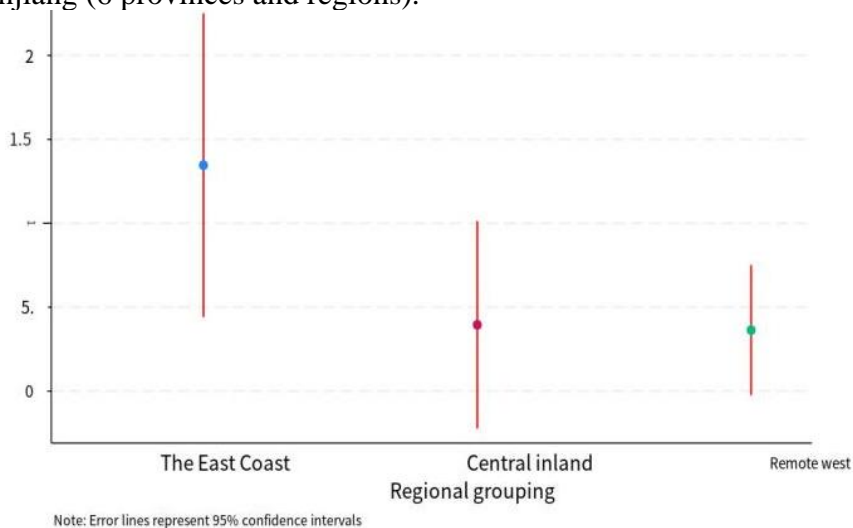


Figure 3. Comparison of DID coefficients in different regions

As analyzed, the e-commerce policy drives county economic development primarily via industrial scale expansion. Using Equations (2) and (3), this study verifies the mechanism, with results in Table 5 showing consistently significant positive coefficients (1% level) for both the policy and industrial scale regression terms. This indicates that establishing e-commerce demonstration counties fosters industrial agglomeration and scale advantages through digital infrastructure investment and factor accumulation, partially mediating the policy's effect on county economic development.

Table.5. Mechanism test

Variables	RES	RES	LNIND	RES	LNIND	RES	LNIND
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	Benchmark regression	LNIND (1)	(2)	(3)	(4)	(5)	(6)
DID	0.981*** (5.06)	0.764*** (4.27)	0.210*** (3.37)	0.830*** (4.27)	0.220*** (3.29)	0.760*** (4.24)	0.200*** (3.23)
Control variables	All	Parts	Parts	Parts	Parts	All	All
County effects	fixed yes	yes	yes	yes	yes	yes	yes
Time effects	fixed yes	yes	yes	yes	yes	yes	yes
Observations	5,351	5,351	5,351	5,351	5,351	5,351	5,351
R-squared	0.095	0.068	0.585	0.068	0.522	0.068	0.593

5. Conclusions

Using 2001-2021 county-level panel data, this study confirms China's "E-commerce into Rural Comprehensive Demonstration" policy significantly enhances county economic resilience ($p < 0.01$), with peak effects in the first two years. Beyond direct impacts, industrial scale expansion serves as a significant mediating channel. Regional heterogeneity reveals stronger policy effects in eastern Yangtze River regions, while agriculturally dependent central areas exhibit constrained efficacy due to traditional industrial structures. Policy recommendations include: (1) Establishing a dynamic county economic resilience evaluation system for ongoing policy assessment; (2) Prioritizing targeted digital infrastructure investments in central/western counties and developing cross-regional e-commerce platforms to facilitate factor mobility and policy experience sharing; (3) Integrating local industrial scale with policy implementation into resilience metrics, coupled with transparent fund allocation mechanisms.

The mechanism analysis in this paper needs to be deepened, and there may be unidentified transmission paths. At the same time, there may be some residual policy endogeneity, which may lead to estimation bias. So further study will put concentration on the data updating and more mechanism test, which would lead to more clear understanding of the process that e-commerce influence the county economic resilience.

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