

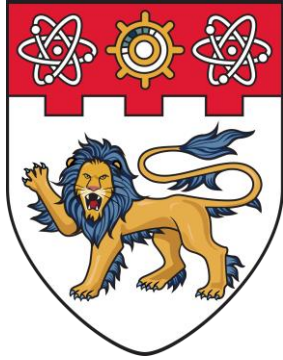
Rural Digital Economic Transformation:

The Causal Effects of E-Commerce on Economic Growth

Mengyuan Cai & Shu Tian

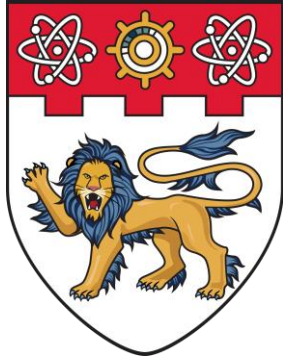
NTU & ADB

ATTN Forum 2025, Tokyo



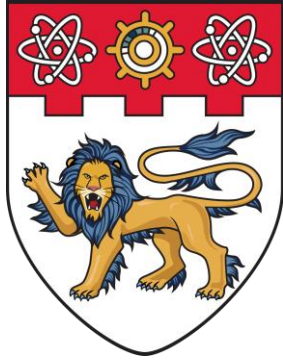
Motivation: Why Study Rural E-Commerce?

- Rapid expansion of China's digital economy
- Rural areas have historically disadvantaged
 - Geographic disadvantages
 - Limited market access
 - Heavy reliance on agriculture
- Taobao Villages: a striking case of grassroots digital transformation



Taobao Villages

- **Definition (AliResearch):** A rural village that meets two criteria:
 - **Sales Threshold:** RMB 10 million+ in annual e-commerce sales
 - **Business Density:** 100+ active online shops operated by local residents
 - From 3 villages in 2009 → 7,780 in 2022
 - By 2020: RMB 1 trillion in transactions (~1% of GDP)
- > Not by designation or selection, but spontaneously emerged
- > Bottom-up policy: successful local innovations and market-driven solutions are recognized, supported, and scaled by government authorities



Spatial Distributions of Taobao Villages in 2014 and 2022

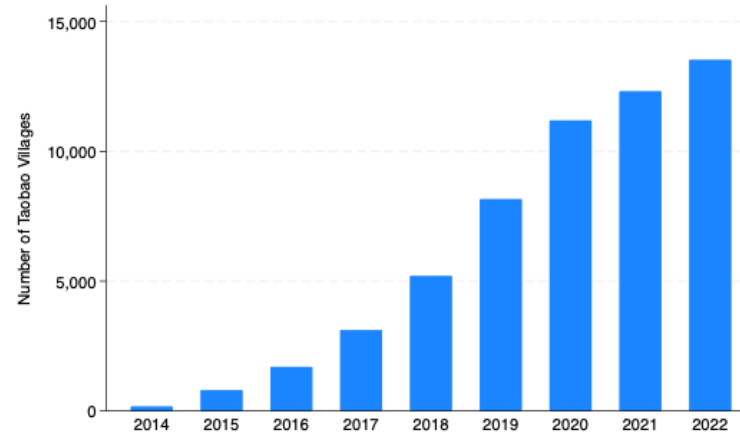
Taobao Villages Distribution (2014)

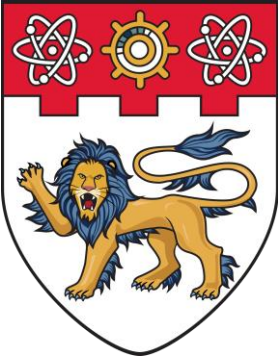
Counties with Taobao Villages: 78
Total Taobao Villages: 212
Max Taobao Villages per County: 9



Taobao Villages Distribution (2022)

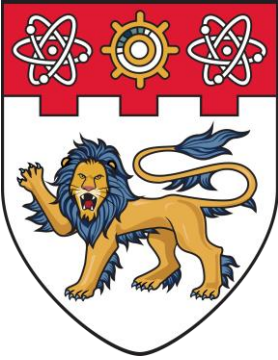
Counties with Taobao Villages: 644
Total Taobao Villages: 7780
Max Taobao Villages per County: 234





Research Gaps

- Existing studies are mostly **descriptive or case-based**
- **Endogeneity problem:** e-commerce adoption may depend on unobserved local conditions
- **Limited scope:** small samples, lack of systematic analysis
- Mechanisms remain unclear: How does e-commerce promote growth?

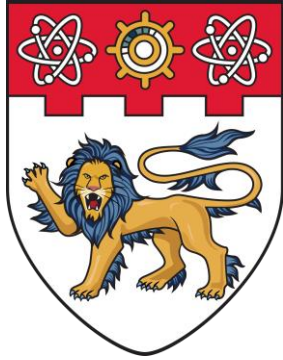


Research Questions

- Does e-commerce adoption through Taobao Villages causally promote local economic growth, and if so, through which mechanisms?

Contribution of This Paper

- **Causal Identification:**
 - Novel IV based on the spillover effect
 - Endogenous treatment effect model
- **Mechanisms:** structural change, productivity gain, innovation improvement, entrepreneurial activity



Identification Strategy

$$Y_{it} = \beta_0 + \beta_1 \cdot TBintensity_{it} + \beta_2 \cdot X_{it} + \mu_i + \lambda_t + v_{it} \quad (1)$$

Y: GDP growth

TB intensity: number of Taobao Villages per 10,000 local residents

2009-2022 county level panel data

To address the endogeneity issue:

- IV: presence of a Taobao Village within a 100 km radius
- Endogenous Treatment Effect Model:

$$TB_{it} = \mathbf{1}\{X_{it}'\alpha_1 + Z_{it}'\alpha_2 + v_{it} > 0\},$$

$$Y_{it} = TB_{it}y_{1it} + (1 - TB_{it})y_{0it},$$

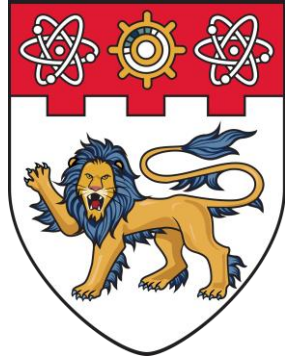
$$Y_{0it} = X_{it}'\beta_{10} + \varepsilon_{0it},$$

$$Y_{1it} = X_{it}'\beta_{11} + \varepsilon_{1it},$$

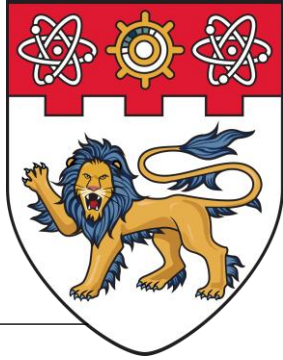
$$\text{cov}[\varepsilon_{jit}, v_{it}] \neq 0 \text{ for } j \in \{0, 1\}.$$

Baseline Results

Dep. Var.	(1) Panel FE GDP growth	(2) 2SLS First TB intensity	(3) 2SLS Second GDP growth
TB intensity	0.002* (0.001)		0.010*** (0.003)
Infiscal	0.082*** (0.009)	0.017 (0.026)	0.080*** (0.009)
Insaving	-0.007 (0.006)	-0.180*** (0.046)	-0.004 (0.006)
Inind firm	0.091*** (0.006)	-0.018 (0.022)	0.091*** (0.006)
Inhumancap	0.014** (0.006)	0.057 (0.039)	0.013** (0.006)
L.InGDP	-0.180*** (0.010)	0.046 (0.042)	-0.181*** (0.010)
Spill 100 km		1.096*** (0.178)	
County FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	17,025	17,025	17,025
R-squared	0.418	0.573	0.105



Robustness Checks



Rescale TB intensity by area

Dep. Var.	(1) First stage TB intensity	(2) Second stage GDP growth
TB intensity		0.128*** (0.039)
Infiscal	-0.002 (0.005)	0.081*** (0.009)
Insaving	-0.030*** (0.011)	-0.002 (0.007)
Inind firm	0.000 (0.002)	0.091*** (0.006)
Inhumancap	-0.005 (0.007)	0.014** (0.006)
L.InGDP	0.006 (0.004)	-0.182*** (0.010)
spill 100 km	0.082*** (0.016)	
County FE	YES	YES
Year FE	YES	YES
Observations	19,094	19,094
R-squared	0.536	0.289

Change the threshold of spillover to 200 km

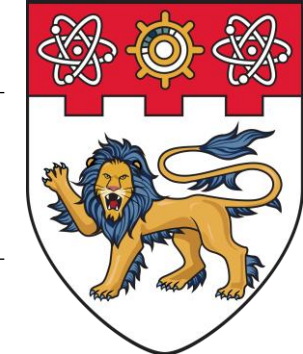
Dep. Var.	(1) First stage TB intensity	(2) Second stage GDP growth	(3) Treatment model TB	(4) Outcome model GDP growth
TB intensity		0.012*** (0.004)		
TB				0.047*** (0.009)
Infiscal	0.025 (0.027)	0.080*** (0.009)	0.405*** (0.094)	0.078*** (0.009)
Insaving	-0.188*** (0.047)	-0.003 (0.006)	0.458*** (0.062)	-0.005 (0.006)
Inind firm	-0.011 (0.024)	0.091*** (0.006)	0.382*** (0.053)	0.091*** (0.006)
Inhumancap	0.050 (0.040)	0.013** (0.006)	0.314*** (0.097)	0.010* (0.006)
L.InGDP	0.027 (0.045)	-0.182*** (0.010)	-0.118 (0.093)	-0.182*** (0.010)
spill 200 km	1.342*** (0.228)		1.750*** (0.235)	
v hat				-0.048*** (0.010)
County FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	19,094	19,094	19,119	19,094
R-squared	0.538	0.288	0.554	0.981

Robustness Checks

Address reverse causality – lag 1 year

Dep. Var.	(1) Panel FE GDP growth	(2) 2SLS GDP growth	(3) ELEM GDP growth
L. TB intensity	0.003* (0.001)	0.008*** (0.003)	
L. TB			0.021** (0.010)
Infiscal	0.082*** (0.009)	0.081*** (0.009)	0.085*** (0.010)
Insaving	-0.007 (0.006)	-0.005 (0.006)	-0.011 (0.007)
Inind firm	0.091*** (0.006)	0.091*** (0.006)	0.102*** (0.007)
Inhumancap	0.014** (0.006)	0.013** (0.006)	0.016** (0.007)
L.InGDP	-0.180*** (0.010)	-0.181*** (0.010)	-0.200*** (0.010)
L.v hat			-0.018* (0.011)
County FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	17,025	17,025	17,025
R-squared	0.418	0.106	0.408

Dep. Var.	(1) Treatment Model TB intensity	(2) Outcome Model GDP growth	(3) Treatment Model TB Dummy	(4) Outcome Model GDP growth
TB intensity		0.010*** (0.003)		
TB Dummy				0.044*** (0.009)
Infiscal	0.017 (0.026)	0.080*** (0.009)	0.409*** (0.095)	0.079*** (0.009)
Insaving	-0.180*** (0.046)	-0.004 (0.006)	0.470*** (0.060)	-0.005 (0.006)
Inind firm	-0.018 (0.022)	0.091*** (0.006)	0.350*** (0.053)	0.091*** (0.006)
Inhumancap	0.057 (0.039)	0.013** (0.006)	0.262*** (0.087)	0.010* (0.006)
L.InGDP	0.046 (0.042)	-0.181*** (0.010)	-0.102 (0.094)	-0.182*** (0.010)
spill 100km	1.096*** (0.178)		1.688*** (0.246)	
v hat1		-0.009*** (0.003)		
v hat2				-0.045*** (0.010)
County FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	17,025	17,025	17,041	17,041
R-squared	0.573	0.419	0.583	0.419

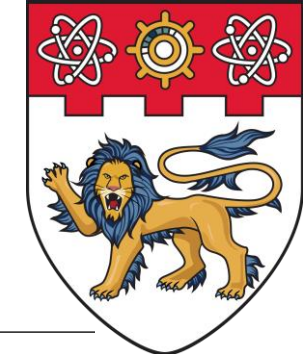


ELEM
Results

Mechanisms: Structural changes

&

Productivity gain

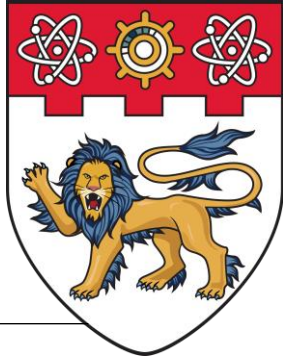


Dep. Var.	(1) Agri growth	(2) Manu growth	(3) Serv growth
TB intensity	-0.003*** (0.001)	0.009*** (0.003)	0.000 (0.001)
Infiscal	0.016*** (0.005)	0.114*** (0.014)	0.053*** (0.008)
Insaving	0.010* (0.006)	-0.034*** (0.013)	0.009 (0.006)
Inind firm	0.025*** (0.004)	0.166*** (0.011)	0.057*** (0.006)
Inhumancap	0.003 (0.004)	0.022** (0.010)	0.005 (0.005)
L.InGDP	-0.040*** (0.007)	-0.302*** (0.016)	-0.086*** (0.010)
County FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	17,025	17,025	17,025
R-squared	0.319	0.366	0.248

Dep. Var.	(1) Agri Prod	(2) Manu Prod	(3) Serv Prod
TB intensity	0.000 (0.018)	0.039*** (0.007)	-0.006 (0.006)
Infiscal	0.024 (0.026)	-0.171*** (0.040)	-0.051 (0.034)
Insaving	0.008 (0.033)	-0.140*** (0.048)	0.029 (0.057)
Inind firm	-0.018 (0.017)	0.174*** (0.034)	0.020 (0.028)
Inhumancap	-0.088*** (0.034)	0.015 (0.035)	0.035 (0.038)
L.InGDP	0.268*** (0.062)	0.941*** (0.061)	0.366*** (0.051)
County FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	6,895	11,272	11,283
R-squared	0.965	0.787	0.805

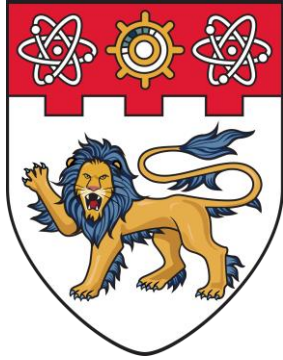
Mechanisms: Innovation

& Entrepreneurship



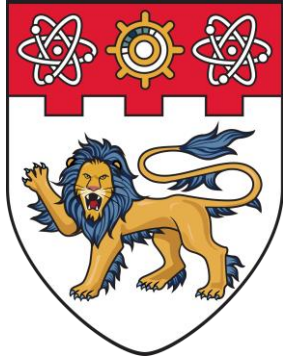
Dep. Var.	(1) lninvention	(2) lngrant
TB intensity	0.063*** (0.014)	0.093*** (0.019)
lnfiscal	0.246*** (0.067)	0.327*** (0.051)
lnsaving	0.212*** (0.054)	-0.056 (0.044)
lnind firm	0.000 (0.038)	-0.003 (0.028)
lnhumancap	0.050 (0.054)	0.131*** (0.039)
L.lnGDP	0.240*** (0.070)	0.049 (0.058)
County FE	YES	YES
Year FE	YES	YES
Observations	17,025	17,025
R-squared	0.821	0.827

Dep. Var.	(1) lnNew Firms	(2) lnNew Industrial	(3) lnNew Retail
TB intensity	0.018** (0.007)	0.018** (0.007)	0.052*** (0.010)
lnfiscal	0.121*** (0.021)	0.121*** (0.021)	0.106*** (0.026)
lnsaving	-0.021 (0.023)	-0.021 (0.023)	-0.001 (0.026)
lnind firm	0.064*** (0.014)	0.064*** (0.014)	0.024 (0.017)
lnhumancap	0.088*** (0.026)	0.088*** (0.026)	0.096*** (0.032)
L.lnGDP	0.095*** (0.025)	0.095*** (0.026)	0.260*** (0.031)
County FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	17,025	17,025	17,025
R-squared	0.932	0.932	0.905



Findings and Implications

- E-commerce spurs rural economy.
- Sources of growth:
 - structural change
 - productivity gain
 - innovation improvement
 - entrepreneurial activity



Findings and Implications

1. Strengthen Digital Infrastructure

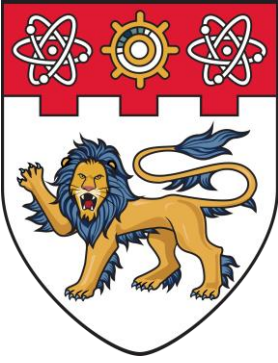
- Prioritize public investment in broadband and logistics networks to sustain growth.
- Ensure equitable access across rural and urban regions.

2. Enhance Digital Literacy

- Implement training programs that equip rural residents with essential e-commerce and data skills.
- Foster capabilities in online marketing, customer service, and supply chain management.
- Integrate education and vocational programs that support digital transformation.

3. Foster Inclusive and Sustainable Growth

- Combine infrastructure investment with human capital development.
- Create an enabling environment for grassroots e-commerce innovation and inclusive rural development.



Comments are well appreciated!