SMEs Amidst the Pandemic and Reopening: Digital Edge and Transformation

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Research Theme: Digitization and Entrepreneurship

- Intersection of Entrepreneurship, Development, and Technology.
- Digitization and entrepreneurship in China: evidence from e-commerce expansion and the pandemic shock.
  1. Resilience and entrepreneurial decisions
     SMEs amidst the pandemic and reopening: Digital Edge and Transformation ←
  2. How Digital Platforms Influence Entrepreneurship and Industrialization: Evidence from E-Commerce Expansions in China ▸ Appendix
  3. Bridging the Gender Gap in Entrepreneurship and Empowering Women via Digital Technologies ▸ Appendix
- Research methodology:
  - Big data (Big-Tech, administration) + survey data + big data analysis; ESIEC (field), OSOME (online)
  - Shift-share instrument, textual analysis, and direct surveys.

Introduction

- Small and Medium-sized Enterprises (SMEs)
  - China: “Five Six Seven Eight Nine”
    - *90% market entities, 80% urban employment, 70% patents, 60% GDP, 50% tax*
  - US: 44% employment & 99% firms (Bartlett III and Morse, 2020)
- Yet SMEs are vulnerable to shocks (Davis et al., 1996)
  - COVID-19 pandemic: no exception
    - Zhu et al., 2020; Kong et al., 2022; .....
    - Bartik et al., 2020; Chetty et al., 2020; Fairlie, 2020; Humphries et al., 2020; .....
    - Policy interventions: tax breaks, rent reduction, loan support, ...e.g., Bartlett and Morse (2021))
- Media description on the importance of digitization (e.g., e-commerce)
- Transformation after the reopening: any long-term effects from the pandemic?

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Preview

- Knowledge gap:
  - Role of digitization in improving firms' resilience against shocks
  - Digital adoption: disaster (Shklovski et al., 2010), policy intervention (Crouzet et al., 2019), short-run impact of COVID-19 (Tut, 2020; Fu and Mishra, 2020)
- We pose two questions:
  1. Whether business digitization helps SMEs better cope with the pandemic?
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Timeline

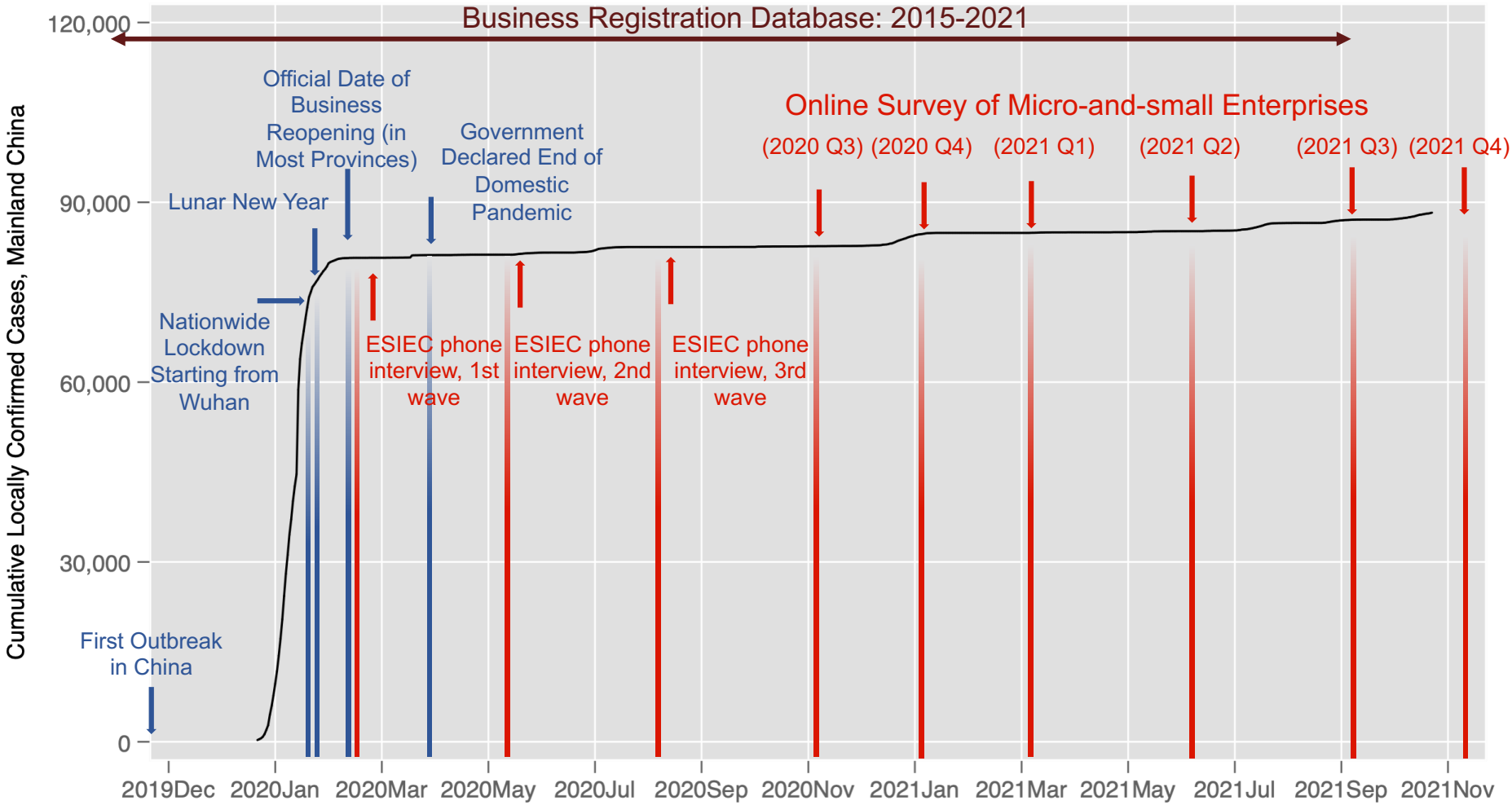

Figure 1: COVID-19 Outbreak, Reopening, Mitigation Policies, and Surveys

Digital Edge

ESIEC data

- Enterprise Survey on Innovation and Entrepreneurship in China (ESIEC)
  - Private enterprises and self-employed ▸ Appendix
  - Field surveys (2017-2019, e-commerce & other performance) + phone follow-up interviews (2020, response to lockdown) covering Gansu, Guangdong, Zhejiang, Liaoning, Henan, Shanghai, and Beijing
- Firms with higher e-commerce sales prior to the pandemic are more resilient.

The Digital Edge

	(1) Pooled	(2) February	(3) May	(4) August
Panel A:	Demand: order decline as main challenge			
E-commerce ratio	-0.028**	-0.114*	-0.020***	-0.013***
	(0.011)	(0.060)	(0.006)	(0.005)
adj. R-sq	0.374	0.072	0.018	-0.007
Panel B:	Cash flow >1 month			
E-commerce ratio	0.129***	0.099**	0.104***	0.204***
	(0.020)	(0.045)	(0.026)	(0.041)
adj. R-sq	0.050	0.088	0.030	0.018
Panel C:	Reopen status			
E-commerce ratio	0.078***	0.060	0.062***	0.106***
	(0.015)	(0.045)	(0.020)	(0.015)
adj. R-sq	0.501	0.097	0.035	0.022
Panel D:	Outlook for growth			
E-commerce ratio	0.103***	0.024	0.062*	0.201***
	(0.024)	(0.037)	(0.036)	(0.048)
adj. R-sq	0.139	0.008	0.080	0.042

Digital Edge

E-commerce firms are more resilient

1. Higher growth in online sales than offline sales at the national level
2. Firms with online sales had faster turnover rate of capital

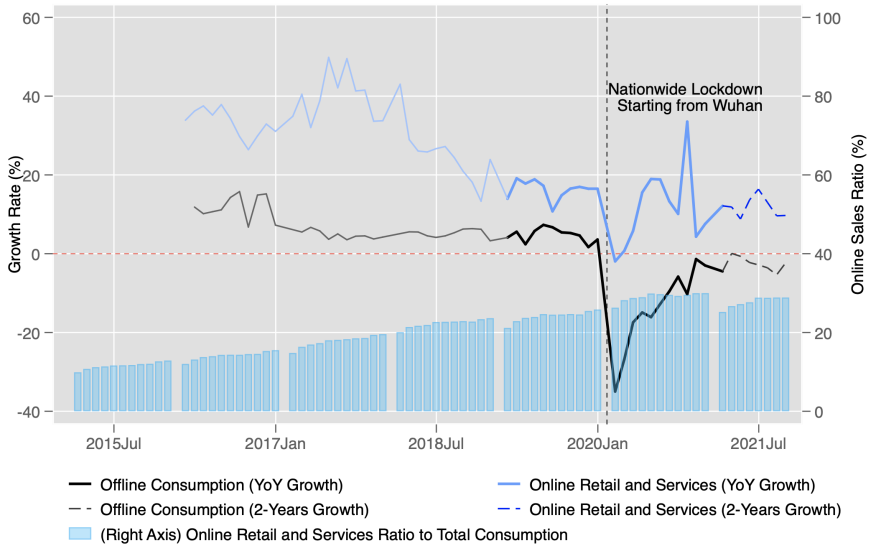

Figure 3: National Trend of Online and Offline Sales in China (National Bureau of Statistics)

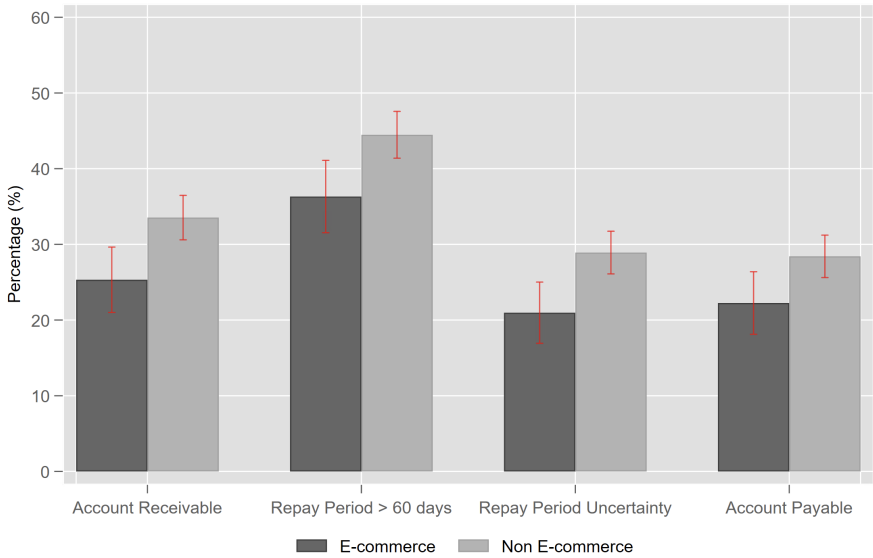

Figure 4: Short-term Impact of E-commerce on Corporate Finance during the Early Reopening

Digital Transformation

1. Can business digitization help SMEs better cope with the pandemic? ✓
2. Has the pandemic induced SMEs' digital technology adoption?

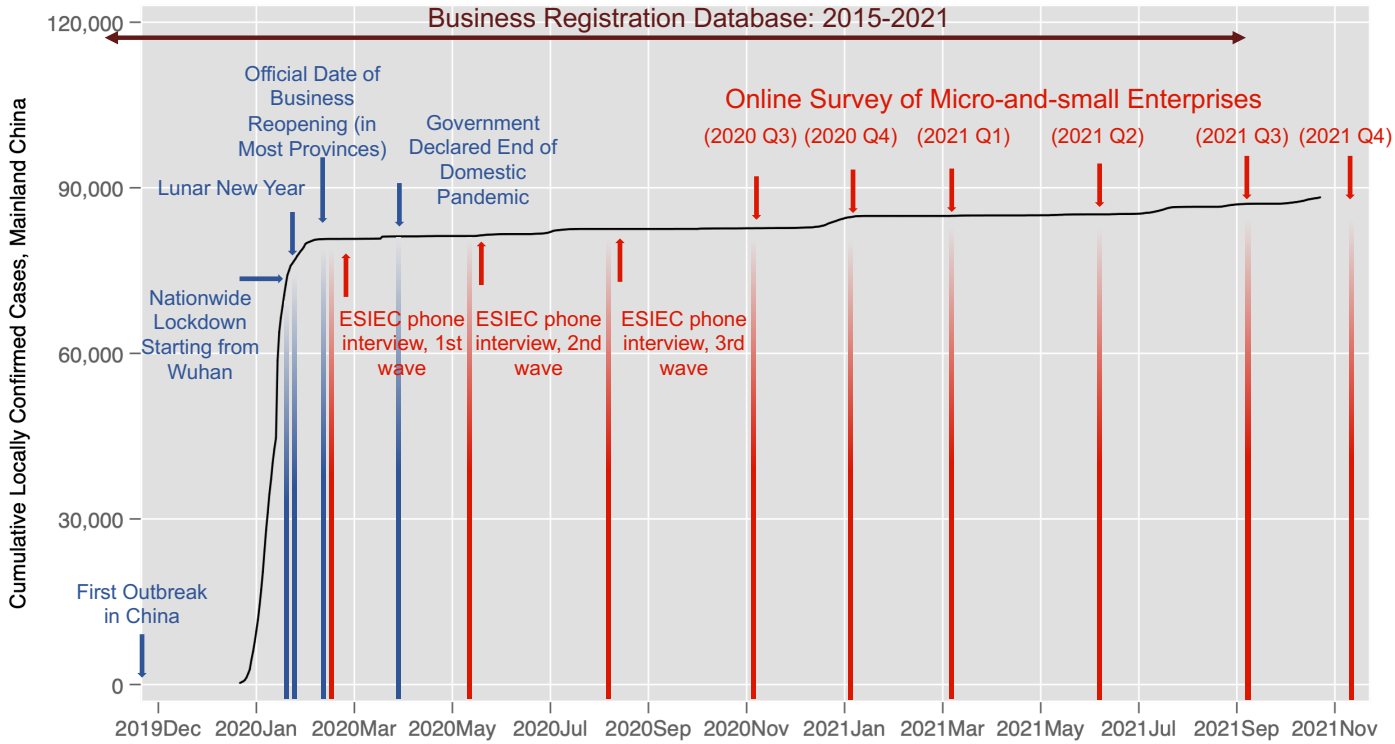

Figure 1: COVID-19 Outbreak, Reopening, Mitigation Policies, and Surveys

Digital Transformation

Data and NLP

- Universal Business Registration Data by State Administration for Market Regulation (formerly the State Administration for Industry and Commerce, SAIC)
  - Universe of registered businesses in China (90% are SMEs)
  - "Business operation scope": mandatory, regulated, and standardized text record

企业类型	有限责任公司(自然人投资或控股)	行业	畜牧业 **livestock industry**	人员规模	-
参保人数	0	登记机关	西安市长安区市场监督管理局		
曾用名	-	英文名称	-		
注册地址	陕西省西安市长安区引镇街道下河滩村南二路3号 附近公司				
经营范围	预包装食品、蜂蜜、蜂花粉、蜂王浆、化妆品、日用百货的销售（含网上销售）；蜜蜂养殖；保健食品的生产、销售；网页的设计、制作；商务信息咨询（限制性咨询项目除外）；企业管理咨询；货物及技术的进出口业务经营（法律法规限制或禁止进出口货物或技术除外）。（依法须经批准的项目，经相关部门批准后方可开展经营活动）				

[Business Operation Scope] Sales of prepackaged foods, honey, bee pollen, bee paste, cosmetics, and daily necessities **(including online sales)**; **bee farming**; production and sale of health food; design and production of web pages; business consulting; ……

- NLP: identify e-commerce related firms, accuracy $> 87.5\%$ ▸ Appendix
  - Aggregate at city-industry-month level (2015-2021)
    - Extensive margin: e-commerce $\Rightarrow$ # of new entries
    - Intensive margin: e-commerce adoption $\Rightarrow$ # of incumbents' alterations

Digital Transformation

Identification

- Aggregate at city-industry-month level (2015-2021)
  - Extensive margin: e-commerce $\Rightarrow$ # of new entries
  - Intensive margin: e-commerce adoption $\Rightarrow$ # of incumbents' alterations

- Difference-in-differences event study framework:
  - Following Fang et al. (2020) and Chen et al. (2021):
  - Specification

$$\ln(Y_{cjmy}) = \sum_m (\beta_m \times COVID_y \times Dummy_m) + FEs + f(y, c, j) + \varepsilon_{cjmy}, \qquad (1)$$

  - c city (prefecture); j industry; m month(s); y year. Month of Lunar New Year's Eve as $m = 0$.

Digital Transformation

Extensive margin

- V-shaped pattern:
  - E-commerce entrants experienced a slighter initial drop and a quicker rebound
- Entry of e-commerce after reopening continued to be higher $\rightarrow$ extensive margin $\uparrow$

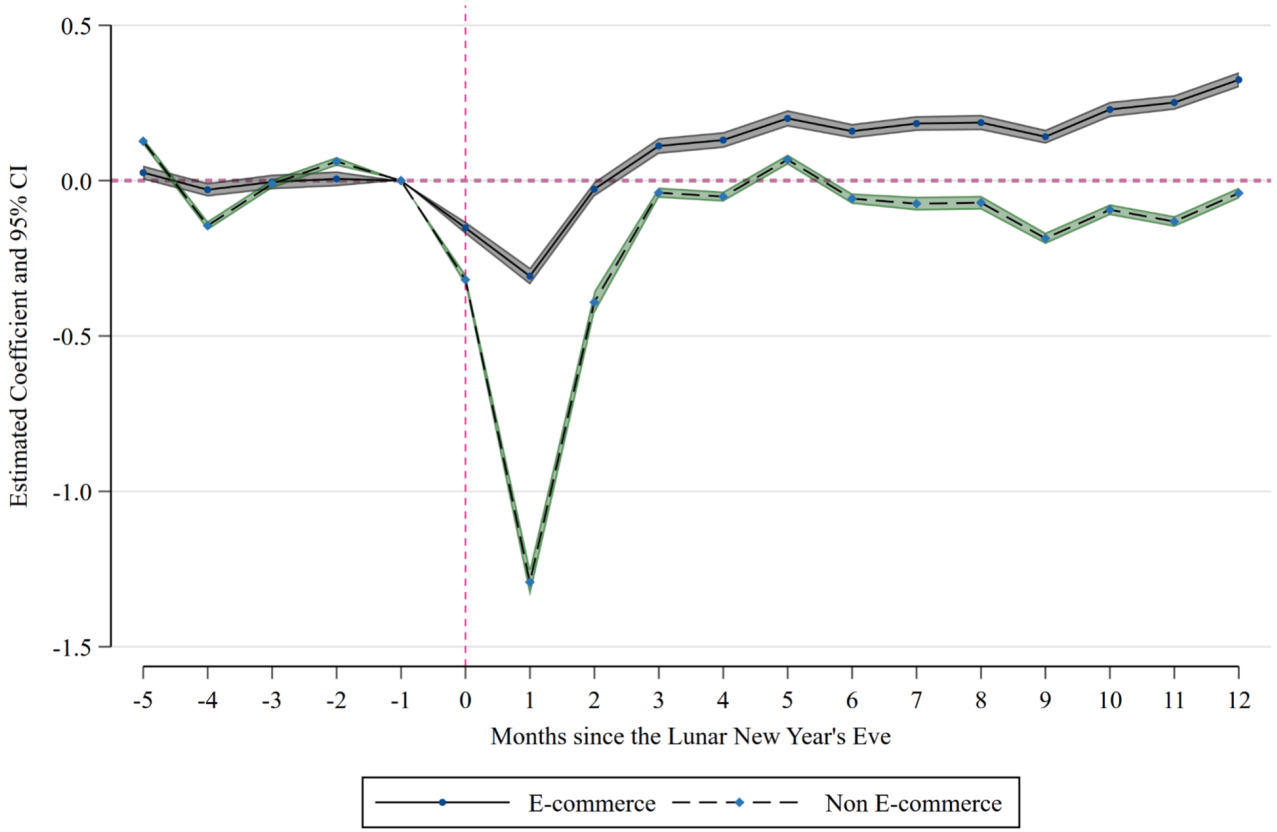

Figure 4: Event Study of COVID-19 Outbreak and Reopen on New Firm Entry, by E-commerce and Others

Digital Transformation

Extensive margin

- Entrants in agriculture and manufacturing sectors also adopt more e-commerce
- Placebo test

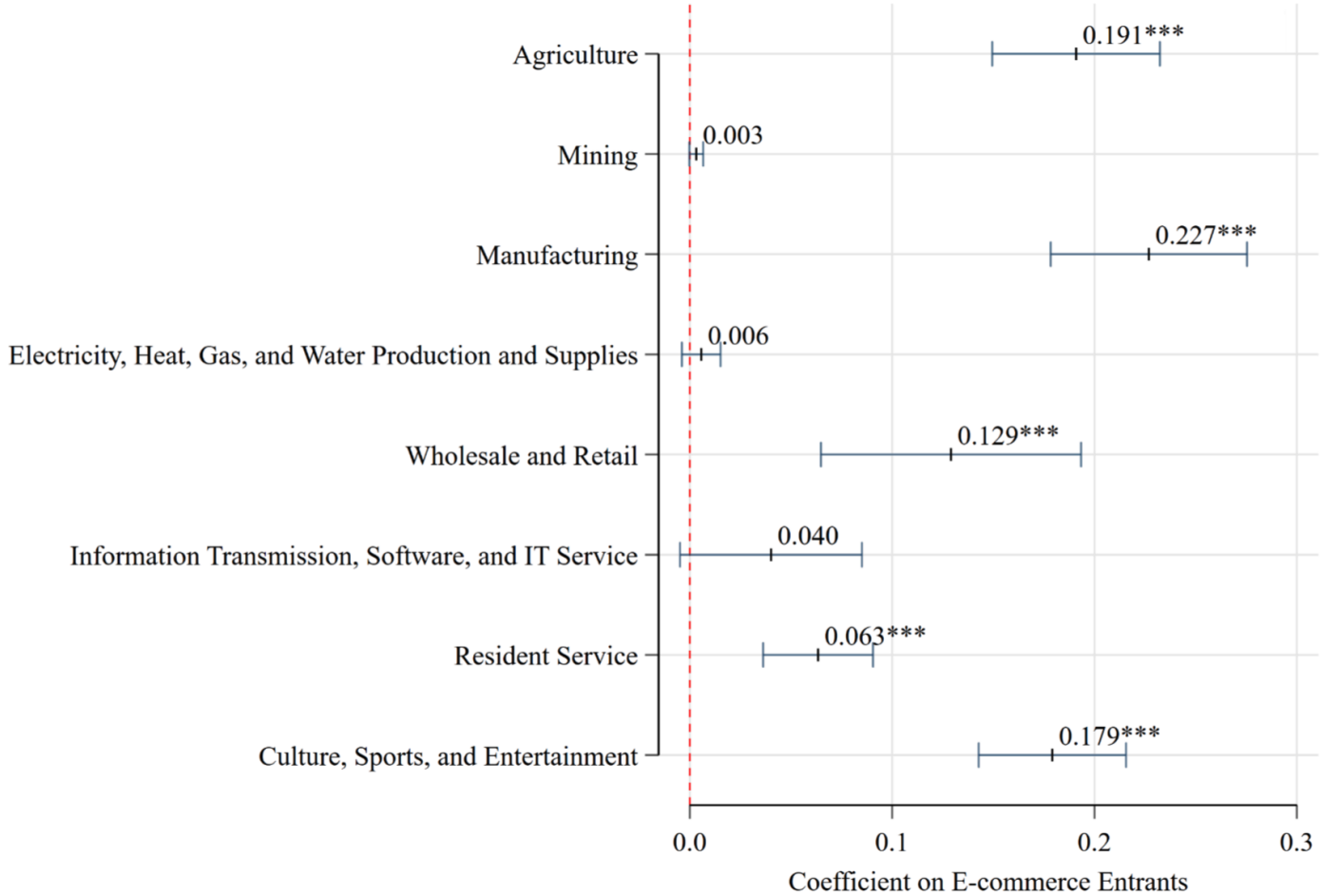

Figure 5: Heterogeneous Effect of COVID-19 Outbreak and Reopen on New Firm Entry for the E-commerce Subgroup, by Industry

Digital Transformation

Extensive margin: robustness

- Robustness check: wholesale & retail sector naturally classified by industry code

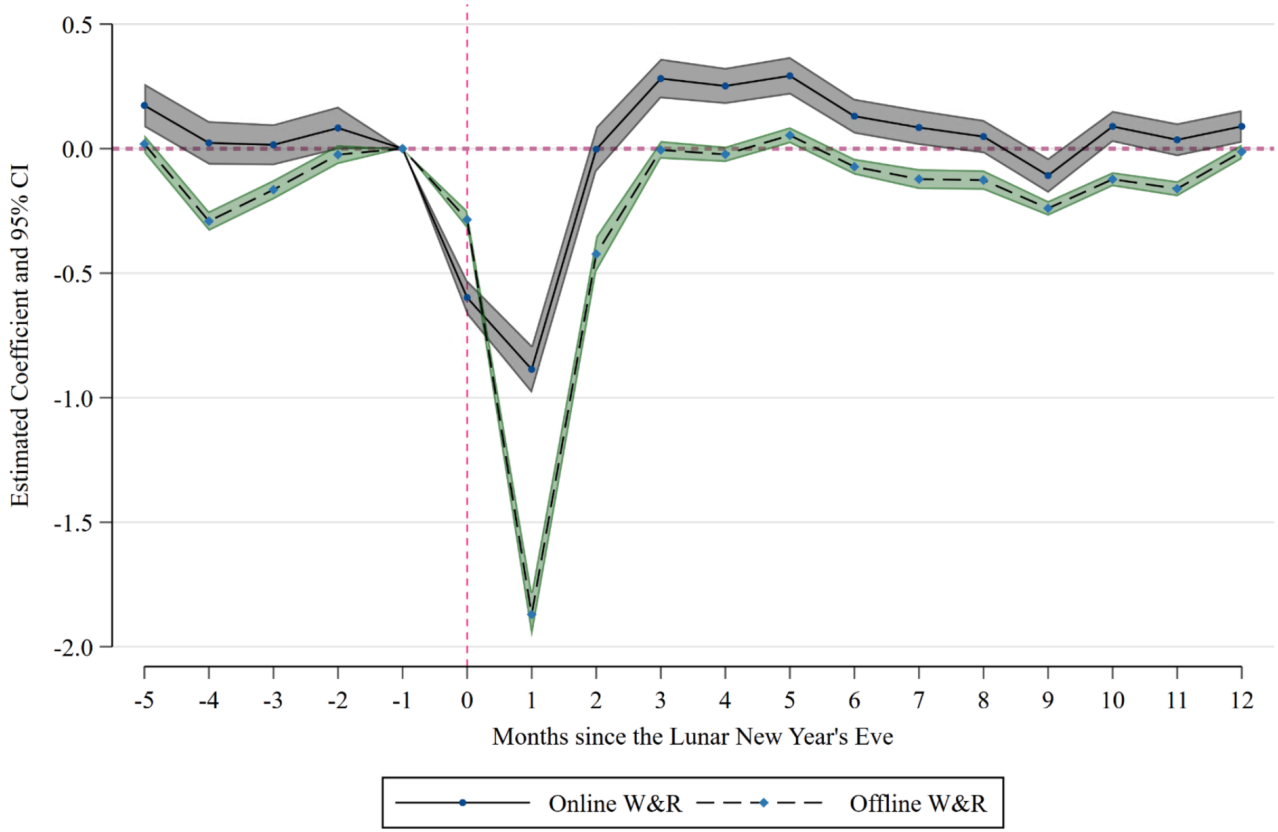

Figure 6: Event Study of COVID-19 Outbreak and Reopen on Wholesale and Retail New Firm Entry, by Online and Offline

Digital Transformation

Intensive margin

- V-shaped pattern: incumbent's alteration of operation scope to include e-commerce (non-e-commerce $\rightarrow$ e-commerce)
- More incumbents transforming into e-commerce $\rightarrow$ intensive margin $\uparrow$

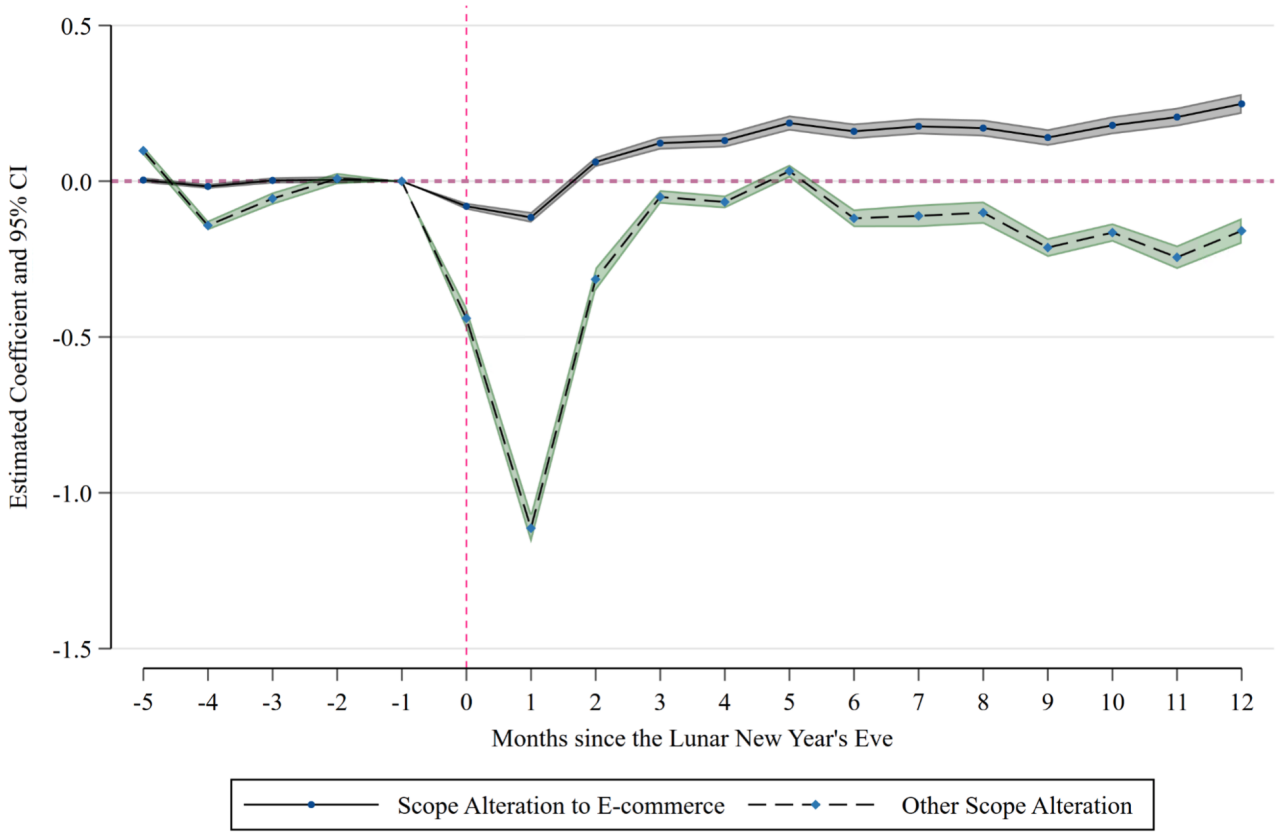

Figure 7: Event Study of COVID-19 Outbreak and Reopen on Operation Scope Alteration, by E-commerce Adoption and Others

Digital Transformation

Intensive margin

- Incumbents take more e-commerce transformation, including traditional industries like agriculture, manufacturing, and services.

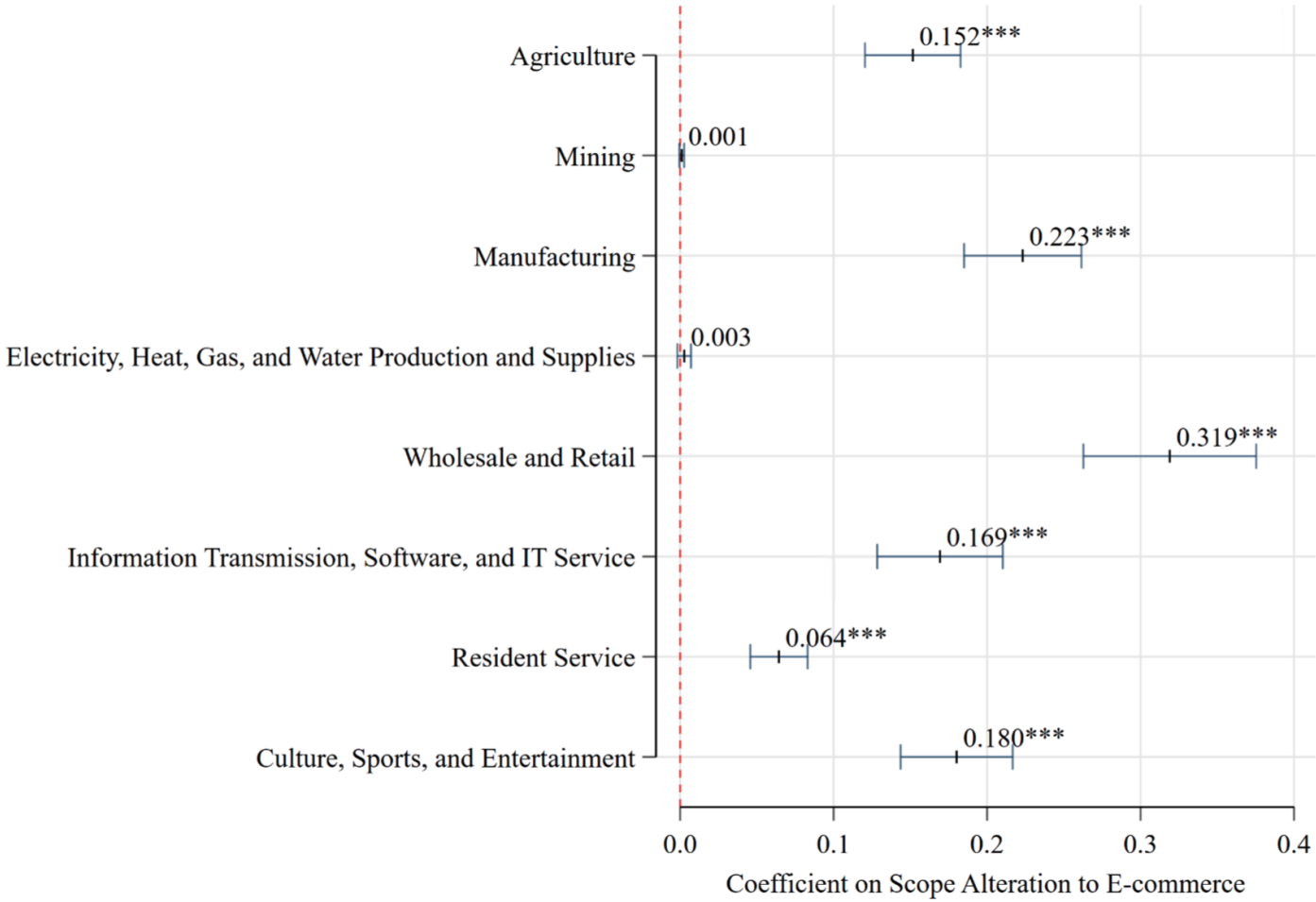

Figure 8: Heterogeneous Effect of COVID-19 Outbreak and Reopen on Incumbents' Business Operation Scope Alteration to E-commerce, by Industry

Digital Transformation

OSOME data

- Online Survey of Micro-and-small Enterprises in China (OSOME) Appendix
  - Quarterly survey since 2020Q3, beyond e-commerce.
  - Active users of Alipay (including unregistered businesses, 38.7%)
- SMEs' digital adoption:
  - More micro businesses (38.7% are unregistered)
  - More aspects: online operation, remote work, electronic information systems
- Sporadic localized lockdowns $\rightarrow$ analogous specification

Table 1: Impact of Local Lockdowns on SMEs' Digital Adoption

	Online business	*(Online only)*	Online sales	Remote work	Sale system
Full sample	+		+	+	+
Newly established subsample		+			
Incumbent subsample	+		+	+	+

Control variables on personal characteristics and business performance are controlled. City, industry, quarter, city $\times$ industry, city $\times$ year, and industry $\times$ year FEs are controlled.

Data source: OSOME.

Digital Transformation

OSOME data

Table 2: Summary Statistics of OSOME Data

Variable	Full sample		Exclude 2020Q3	
	Mean	S.D.	Mean	S.D.
Main independent variable:				
COVID×After	0.069	0.251	0.088	0.283
(COVID)	0.190	0.392	0.191	0.393
Controls:				
Firm age	4.831	5.393	4.947	5.455
Owner's age	32.430	9.035	32.490	9.003
Female owner	0.173	0.378	0.172	0.378
Business type:				
Corporate enterprise	0.107	0.309	0.114	0.318
Self-employed, register	0.506	0.500	0.502	0.500
Self-employed, unregister	0.387	0.487	0.384	0.486
Industry:				
Agriculture	0.069	0.254	0.071	0.256
Construction and manufacturing	0.106	0.308	0.113	0.317
Service	0.824	0.381	0.816	0.387
Employment:				
0	0.333	0.471	0.335	0.472
1-4	0.453	0.498	0.445	0.497
5-7	0.104	0.305	0.103	0.305
8-19	0.068	0.251	0.072	0.258
>19	0.043	0.203	0.044	0.205
City tier:				
Tier 1	0.278	0.448	0.276	0.447
Tier 2	0.190	0.392	0.192	0.394
Tier 3	0.123	0.328	0.121	0.326
Tier 4	0.208	0.406	0.208	0.406
Tier 5	0.201	0.401	0.203	0.402
Obs.	84,316		65,036	

Figure 9: OSOME Summary Stats

Digital Transformation

Cost of Digital Transformation

- "The lack of time and energy to learn" is the key to hinge SMEs' digital adoption.

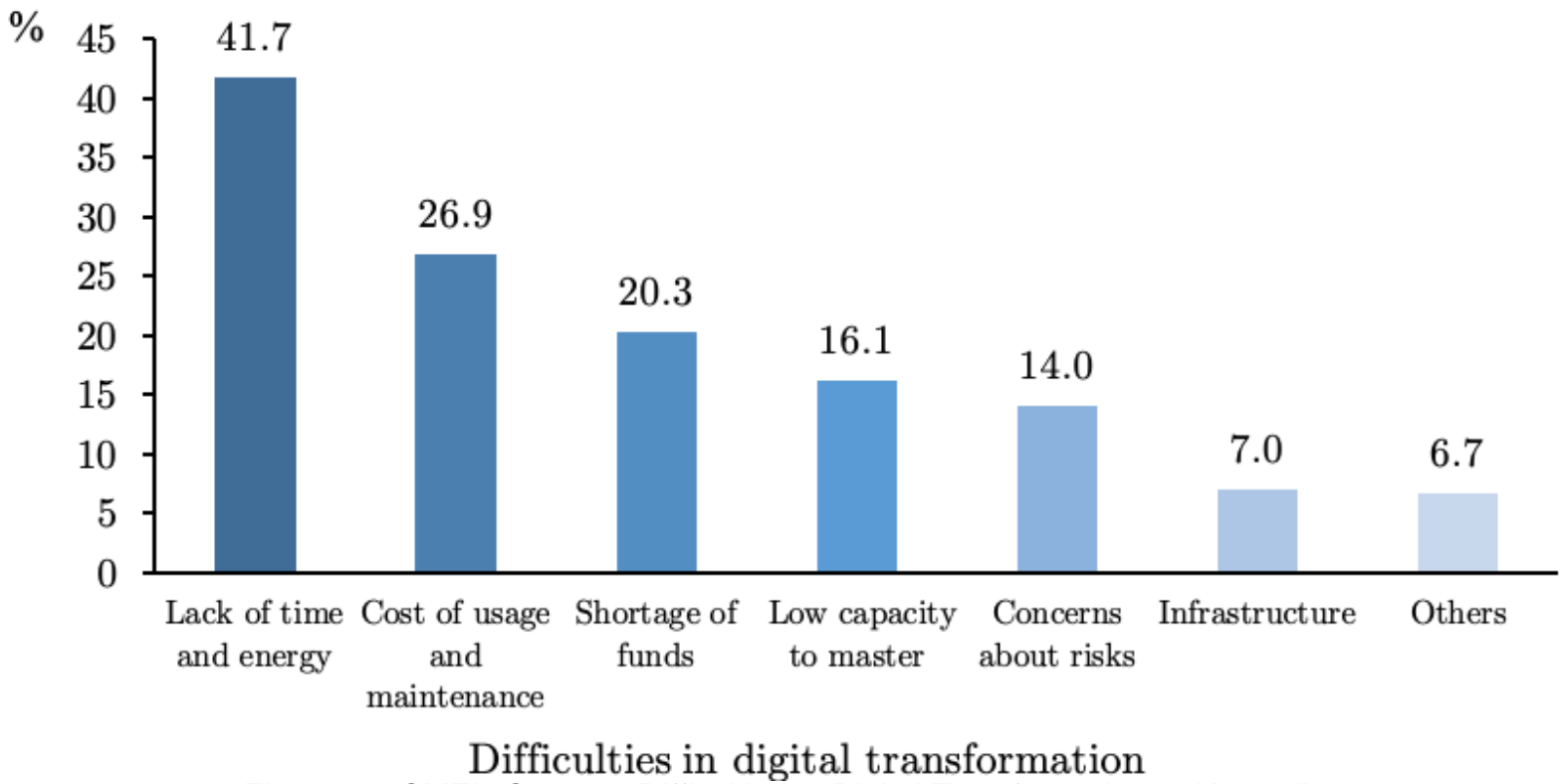

Figure 10: SME's Greatest Difficulties in Digital Transformation or Upgrading

Takeaways

- E-commerce has provided SMEs with an edge in coping with the pandemic.
  - Less demand-side challenge, faster turnover, ...
- Both new entries and incumbents have increasingly embraced e-commerce after lockdowns, and the effect persists after one year of full reopening.
  - Traditional sectors also accelerate the digital adoption.
- Other types of digitization, even for micro businesses.

Appendix

Cluster

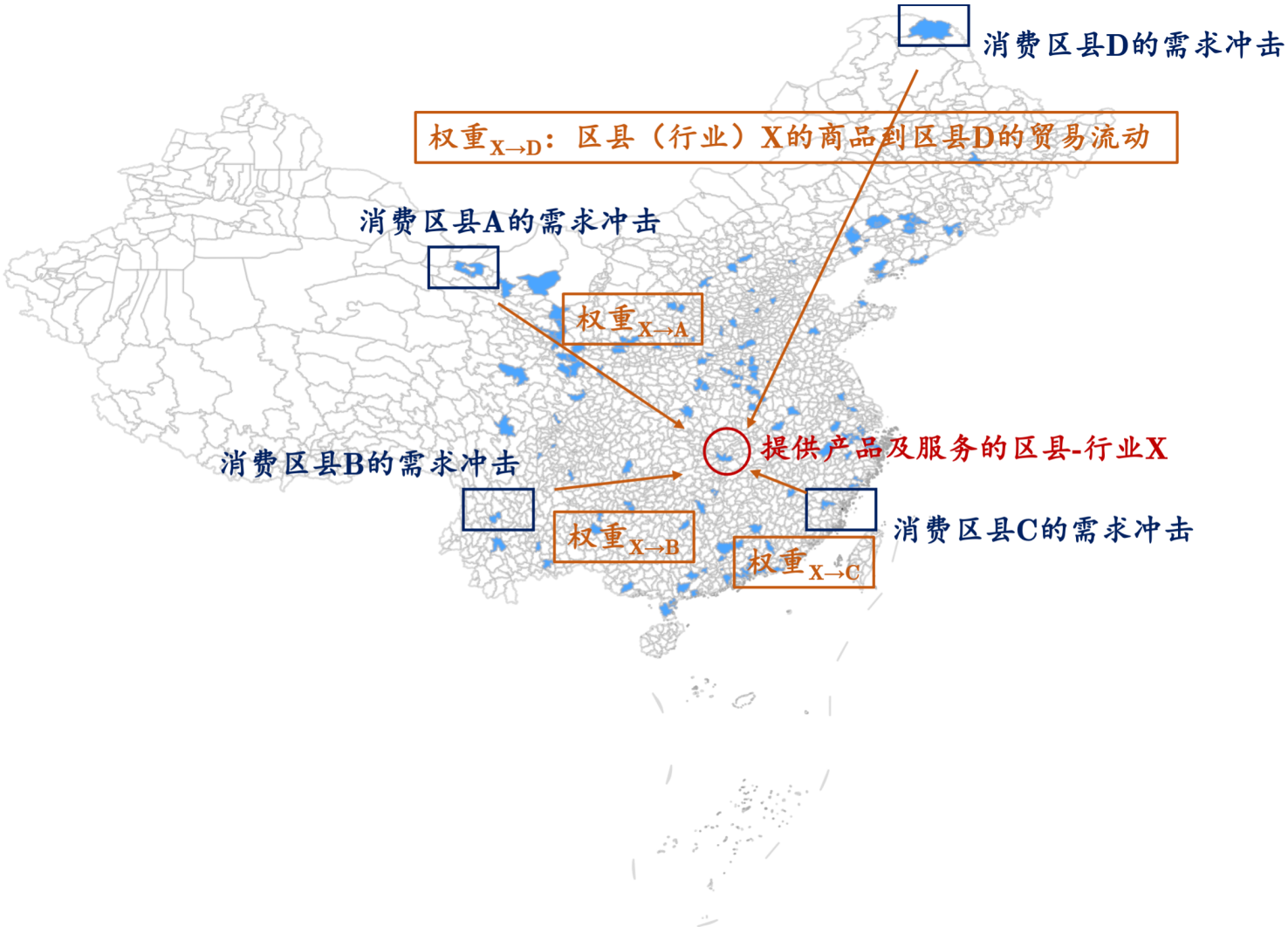

Figure A 1: E-commerce and Cluster: Bartik Instrument

Return

Appendix

Gender gap in entrepreneurship

- Lower entry barrier: overcome financial constraint
- Flexibility allows women to balance family and career

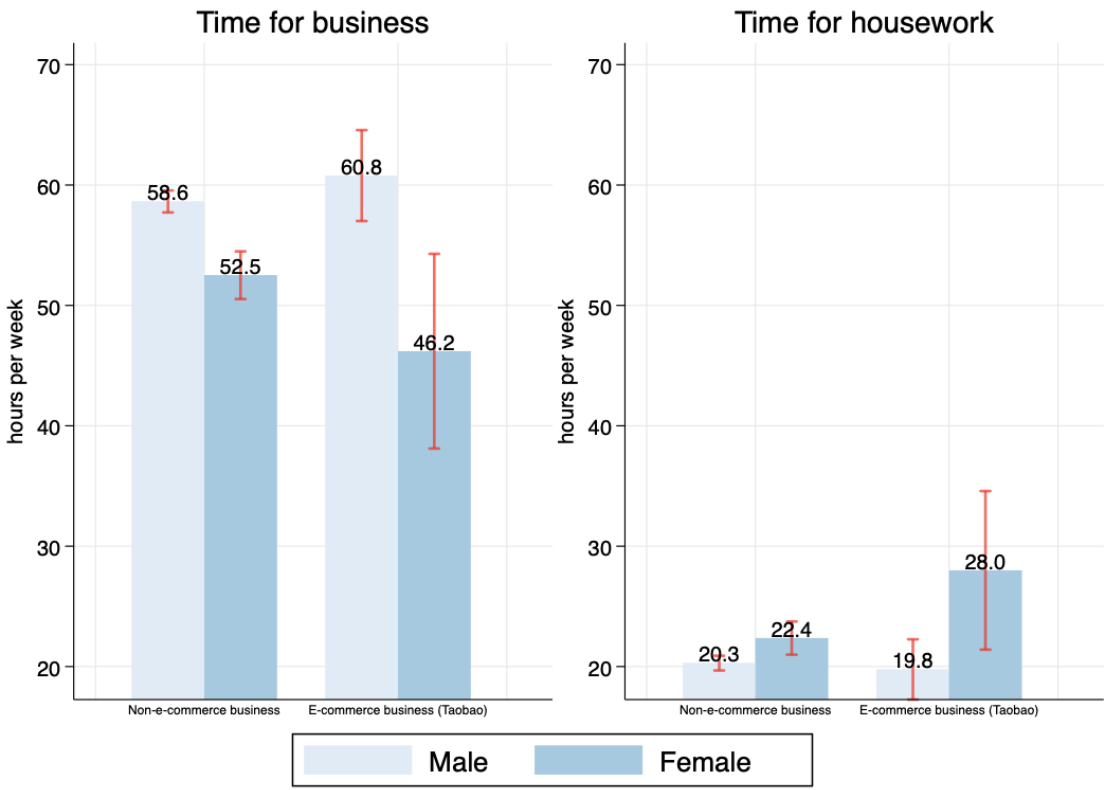

Figure A 2: E-commerce and Gender Gap: Mechanism

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Appendix

ESIEC sample

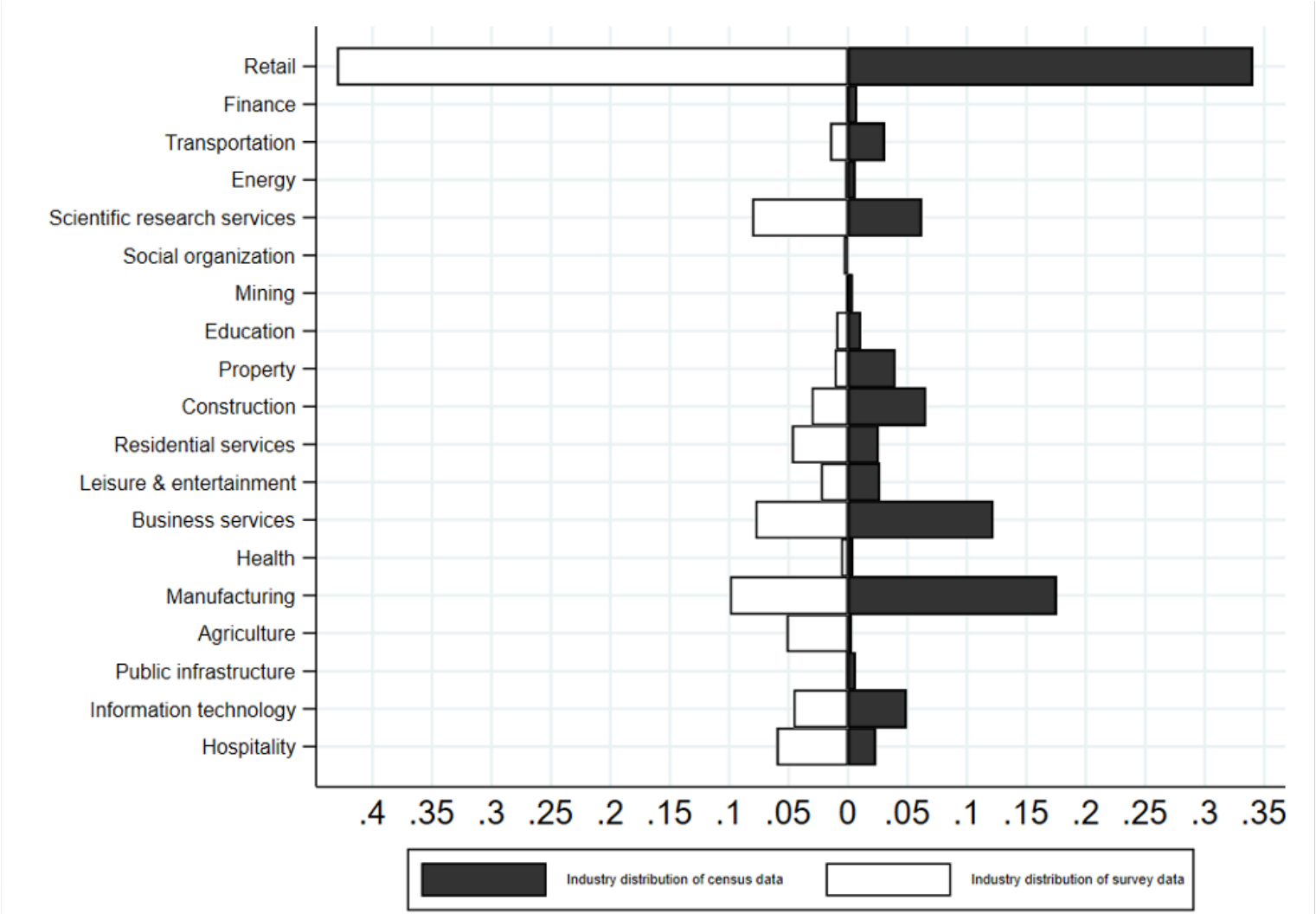
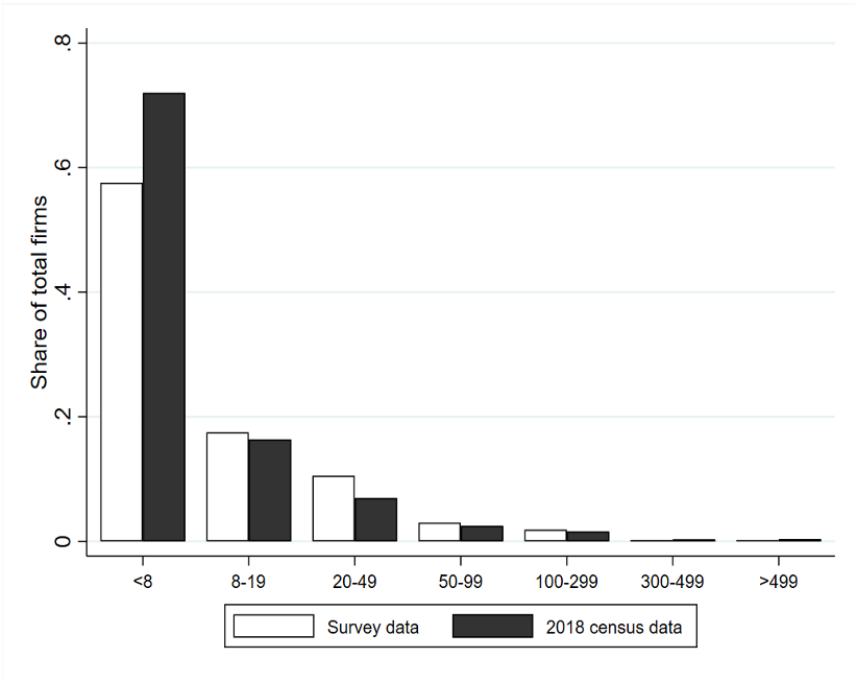


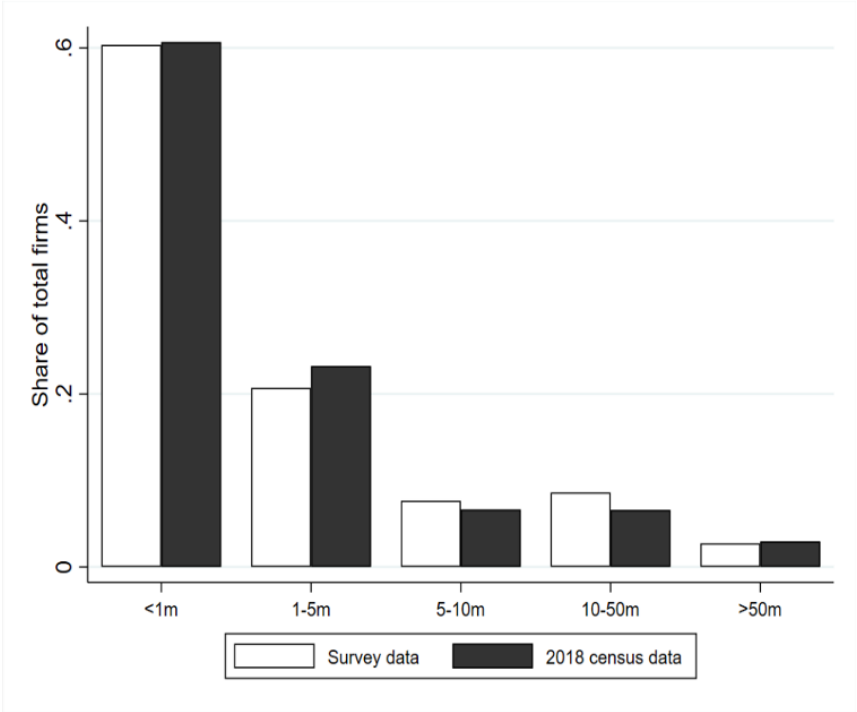
Figure A 3: Industrial Distribution of the ESIEC Sample and of the China Economic Census of 2018 (Dai et al., 2021b)

Appendix

ESIEC sample



(a) Employment



(b) Revenue

Figure A 4: Size Distribution of the ESIEC Sample and of the China Economic Census of 2018 (Dai et al., 2021b)

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Appendix

Textual analysis

- Cross-validation:
  - Business Registration: $>$ 90.0%; ESIEC field survey: $>$ 87.5%
- Underestimate & Overestimate

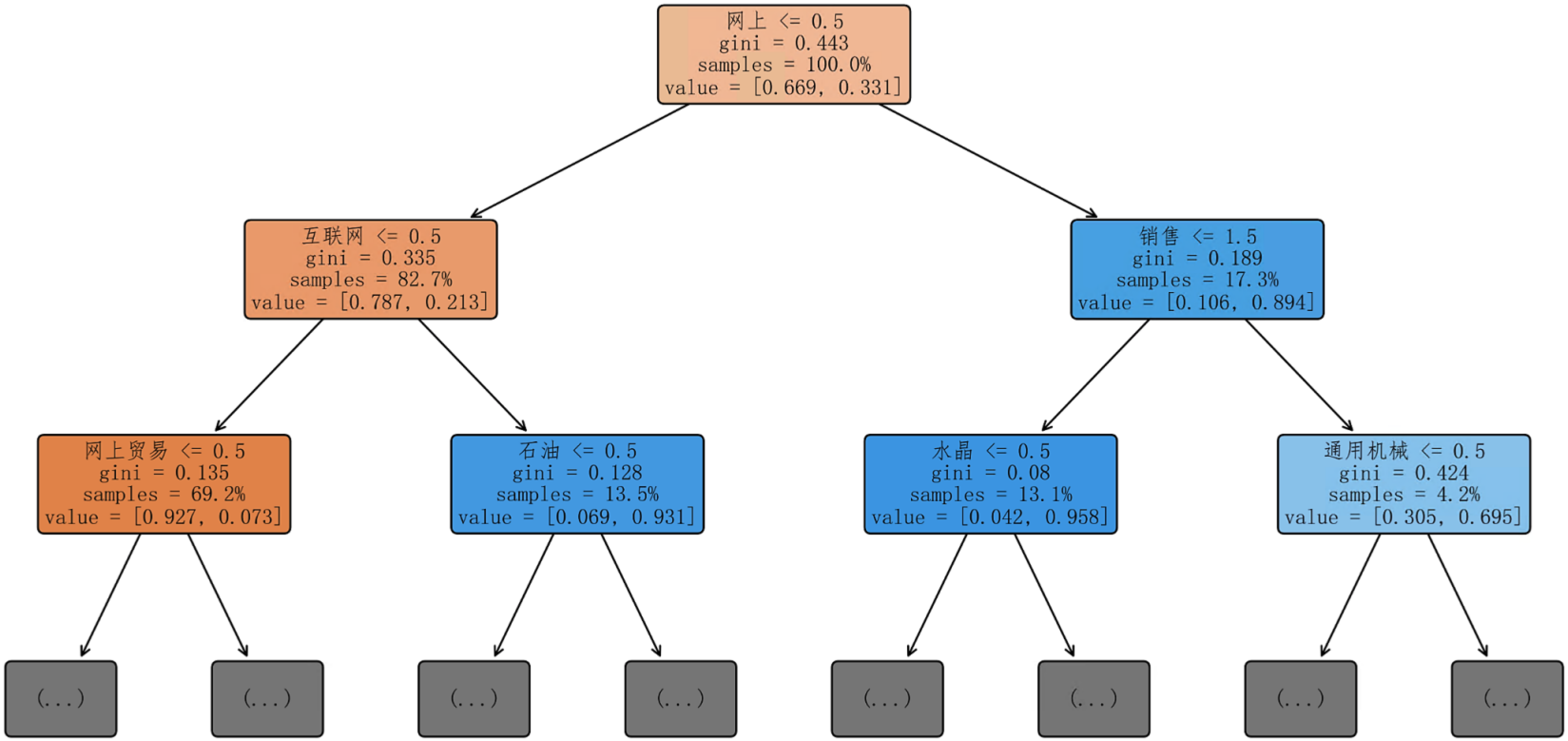

Figure A 5: Decision Tree Model (Simplified)

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Appendix

OSOME data

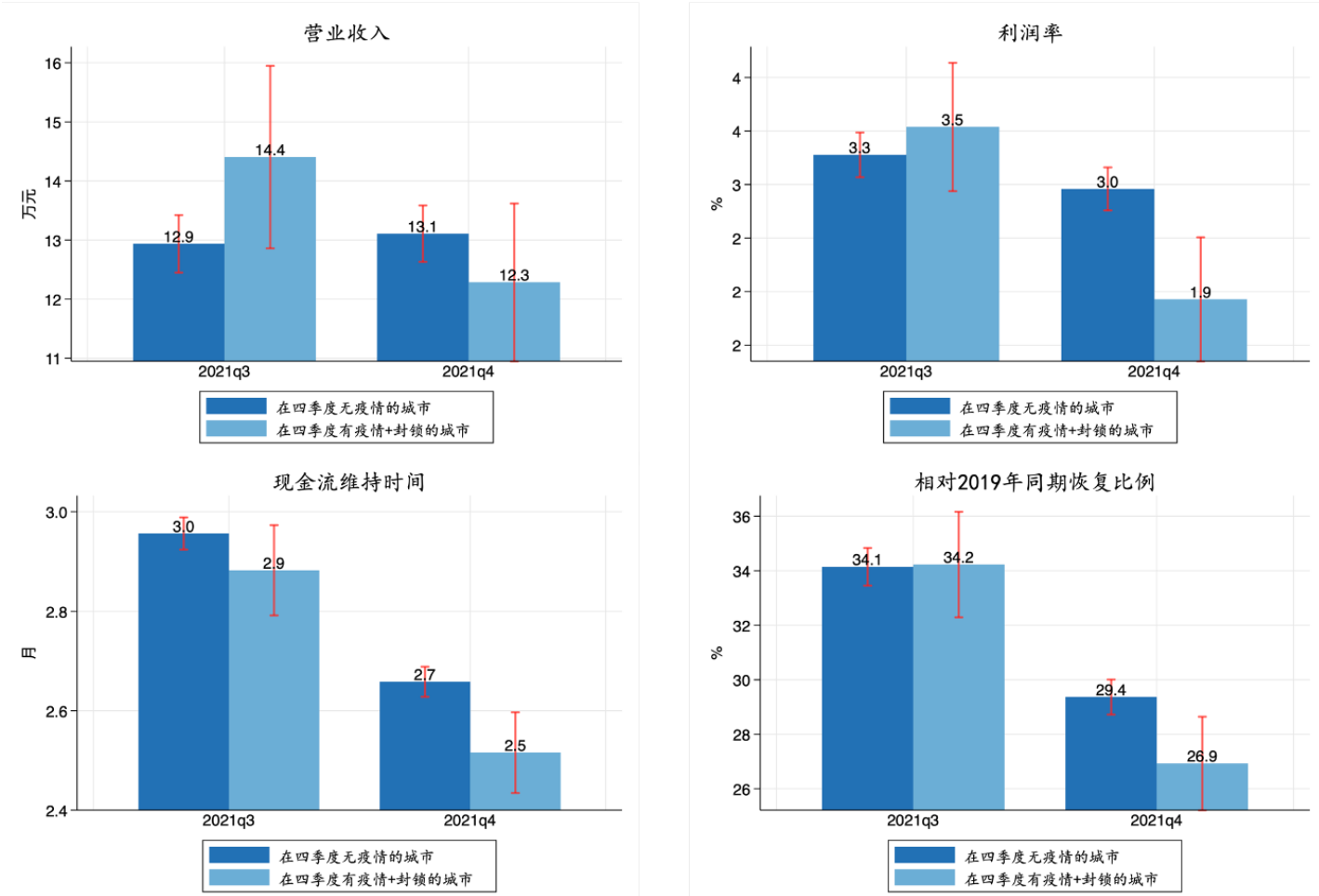

Figure A 6: the Impact of Local Outbreaks on SMEs(2021Q4)

Return

How Digital Platforms Influence Entrepreneurship and Industrialization: Evidence from E-Commerce Expansions in China

Lin William Cong, Cornell University
Jacopo Ponticelli, Northwestern University
Xiaohan Yang, Peking University and Alibaba
Xiaobo Zhang, Peking University and IFPRI

March 7, 2023

Introduction

- The world economy is turning towards digital platforms
  - "BigTech" companies
  - In emerging economies, digital platforms for electronic commerce (e-commerce) also generate opportunities to engage in trade and to develop (UN, 2018)
  - E-commerce transactions in China grows at 25.8% annually
- A key question: how does the introduction of digital platforms affect the real economy, in particular potential entrepreneurs and business owners?

Introduction

- Literature:
  - Crowding out offline retail stores (Pozzi et al., 2011; Duch-Brown et al., 2017; Chen and Qian, 2019)
  - Favoring low-cost producers at the expense of high-cost producers when e-commerce expands (Goldmanis et al., 2010), and promoting the division of labor (Lucking-Reiley and Spulber, 2001)
  - Enabling people lacking financial and social capital to become entrepreneurs (Dai and Zhang, 2015); little evidence for income gains to rural producers (Couture et al., 2021)

Introduction

- Contribution of this paper:
  - We test the hypothesis that the expansion of e-commerce results in finer division of labor, leading to more firm entries with smaller size
  - This paper uses unique online platform data in combination with administrative firms registration data
  - We employ a novel identification strategy to tease out the causality

Data

JD.com sales data

- JD.com e-commerce platform: one of the most leading platforms in China
  - Large market share covering all regions with a various range of products
  - Allow self-employed business owners → a good representative for entrepreneurship
- Aggregated data of the online trade flow on JD.com
  - 214 counties × quarter (2015Q1 to 2019Q3) × product
  - Product: similar within each category in terms of the usage and production
  - Trade flow: local to local, local to outer, outer to local
- Variables: online sales transaction amount
  1. "supply" (production, producer's activity) : (local to local) + (local to outer) as a proxy of local industrial e-commerce activity $\Rightarrow \ln(Supply)_{ijt}$
  2. "demand" (consumption, sales to consumers) : (local to local) + (outer to local)

Data

Business registration database

- Administrative data:
  - Covering the universe of registered businesses in China since 1978 by China State Administration of Industry and Commerce (SAIC)

  $\Rightarrow$ A more representative picture of entrepreneurship and industrial growth in China
- Variables:
  - Aggregate at the county-(two-digit) industry-quarter level
  - Measurement: entry, percentiles of registered capital
    1. Number of entrants
    2. Registered capital: use percentiles to alleviate outliers

Data

Construction

- Merge: industry-product linkage
  - Product category $\leftrightarrow$ two-digit industry code
    (refer to *Product Categories for Statistical Purposes* by National Bureau of Statistics)
  - Mainly match to the manufacturing and service industries, leaving out the raw material, transportation, wholesale and retail, etc.

  $\Rightarrow$ Direct effect of e-commerce expansion on the specific industries
  - Most manufacturing sectors fit well
- Example:

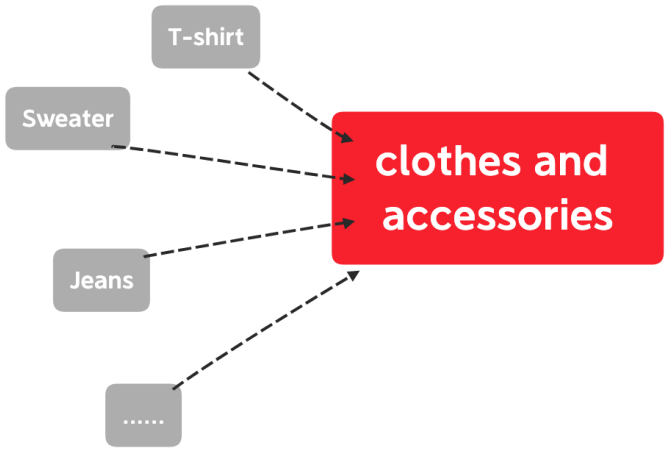

Figure 1: Example of Industry-product Linkage

Data

Construction

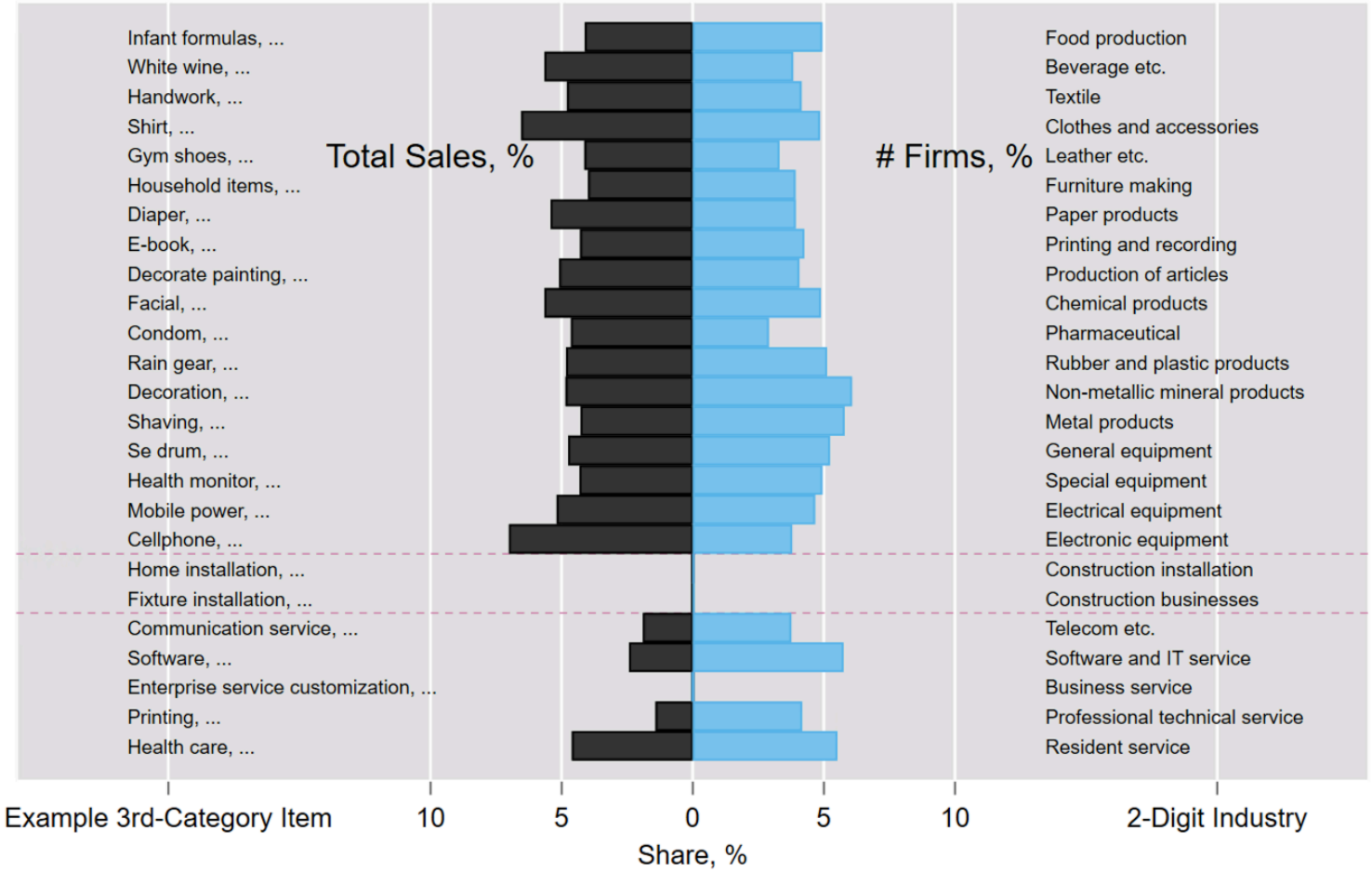

Figure 2: Share of Total Sales and Number of Firms, by Two-digit Industry, 2015-2019

The left panel is the share of each matched industry's sales from 2015 to 2019 on the total sales. The right panel is the share of the number of incumbent firms in each matched two-digit sector from 2015 to 2019.
Data source: JD.com sales data, SAIC registration data.

Identification

- Identification challenge: isolate e-commerce shocks
- Empirical strategy: Bartik instrument (shift-share instrumental variable, SSIV)
  - Intuition: transfer the consumption level changes into the corresponding producers by using the trade flows linkage to re-weigh
- 2SLS specification:

$$\ln(Entry)_{ijt} = \beta_1 \ln(\widehat{Supply})_{ijt} + \beta_2 \ln(Y_0)_{ij} + \beta' \mathbf{X}_{it} + \alpha_i + \gamma_j + \eta_t + \epsilon_{ijt}$$

$$\ln(Supply)_{ijt} = \theta_1 B_{ijt} + \theta_2 (\sum_{d \neq i} \omega_{ijd,t=0}) + \theta' \mathbf{X}_{it} + \alpha'_i + \gamma'_j + \eta'_t + \epsilon'_{ijt}$$

  - Control for economic outcome variables, county, two-digit industry, and quarter FEs
  - Initial value to rule out the potential mean reversion effect
  - Control for the sum of Bartik weights to alleviate the potential bias (Borusyak et al., 2018)

Identification

- Bartik instrument:

$$B_{ijt} = \sum_{d \neq i} \omega_{ijd,t=0} \cdot g_{d,-j,t} \ ,$$

i indexes the (producer's) county, j the industry, d the consumer's county, and t the quarter.

$t = 0$ indicates the pre-determined period.

- Shift $g_{d,-j,t}$: aggregated county-level consumption growth
  - year-on-year change rate in the total sales in demand county d in quarter t
- Share $\omega_{ijd,t=0}$: domestic trade flow linkage
  - 2012 China Multi-Regional Input-Output Table (Liu et al., 2018)
  - Pre-determined; both online and offline trade flows

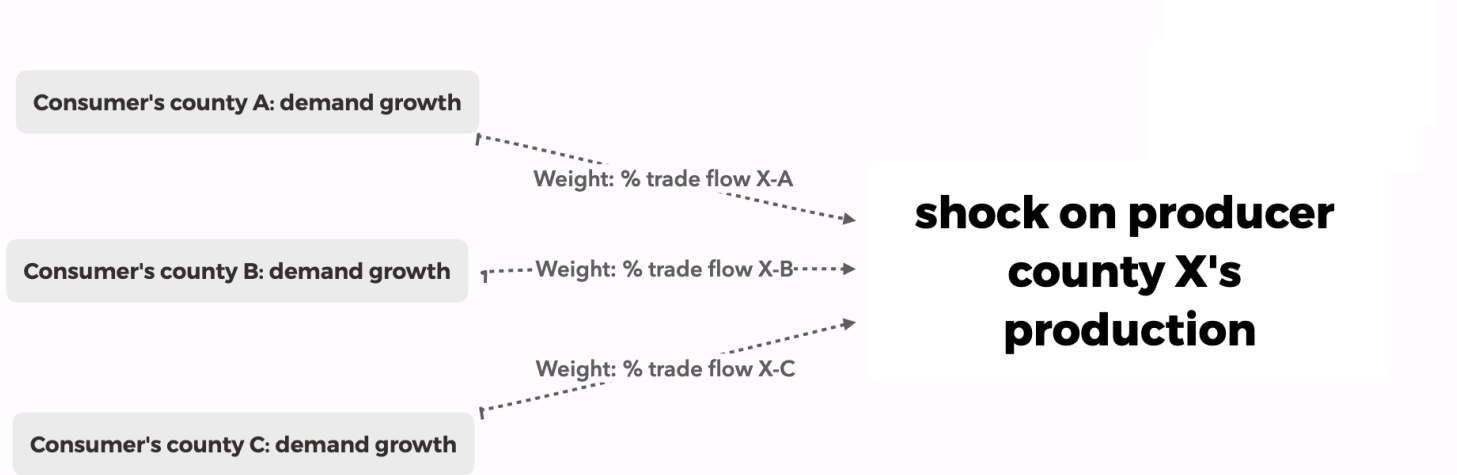

Figure 3: Example of Bartik Instrument

Identification

Validity

The recent literature gives two main perspectives on the validity of the Bartik instrument:

1. Borusyak et al. (2018): shifts are exogenous in the context of a quasi-experiment
   - Estimation can be derived from an equivalent regression using shift as an instrument, allowing shares to be endogenous
2. Goldsmith-Pinkham et al. (2020): can be valid as long as the shares are exogenous
   - The estimator is numerically equivalent to a GMM estimator with the shares as instruments and a weight matrix constructed from the shift; no necessity to require shifts to be exogenous

Identification

Validity: Shift

- JDBang: a random-assigned e-commerce promotion project
  - *... provide consumers in the countryside with promotion, valet ordering, fast delivery, cash on delivery, installation, maintenance, and return services, aiming to boost the potential demand in the county and rural online retail market ...*

1. Quasi-experimental assignment (confirmed by JD and balance check)
2. Explain the change rates of consumption

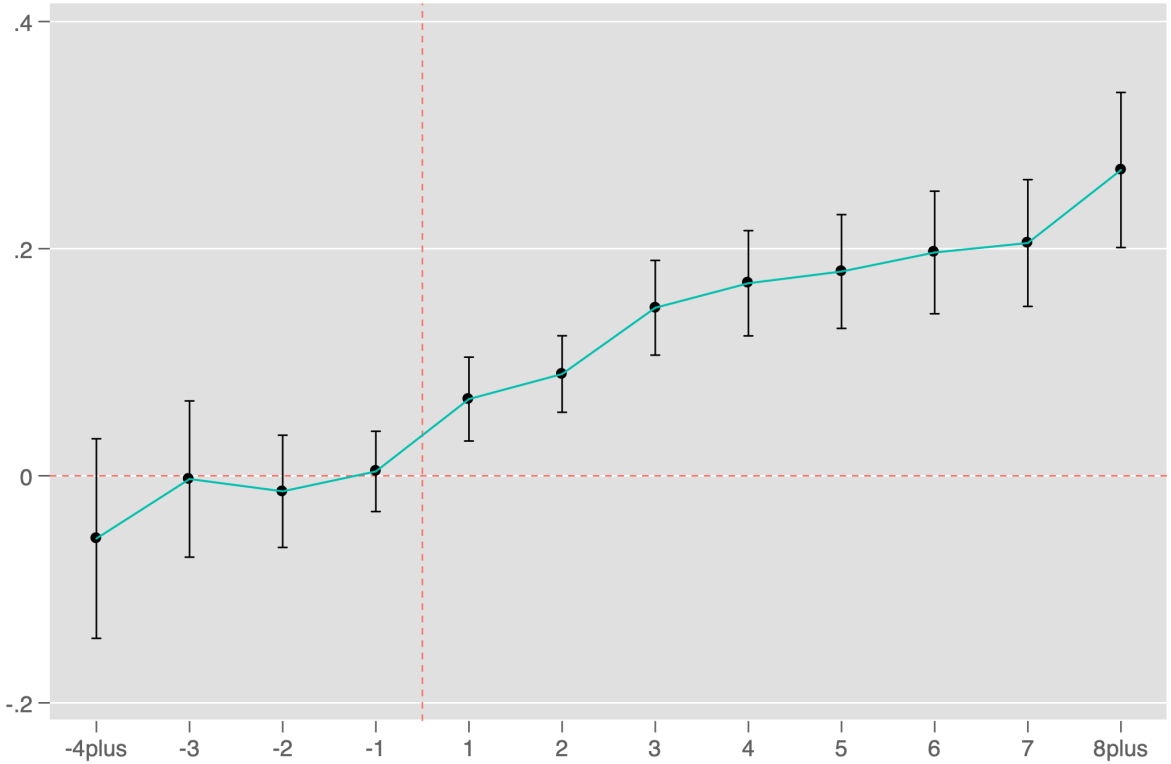

Figure 4: Event Study of JDBang Shock on Consumption

Identification

Validity: Share

- Weights from the Input-Output Table:
  1. Weights are predetermined and fixed
  2. Reflect the overall linkage among different regions
- Goldsmith-Pinkham et al. (2020) propose a pre-trend test
  - Using shares as treatment exposures in a difference-in-differences framework
  - Before the massive growth in consumption (e.g., the JDBang project), there is no trends in early periods

Result

- E-commerce encourages more new firm entry

Table 1

	Dependent variable(s): ln (# new entrants)			growth rate of # firms		
	OLS (1)	IV (2)	IV (JDBang) (3)	OLS (4)	IV (5)	IV (JDBang) (6)
ln (supply)	0.023***	0.083**	0.085***	0.029***	0.115***	0.112***
	(0.002)	(0.035)	(0.034)	(0.004)	(0.008)	(0.008)
ln (# firms) in 2014	0.422***	0.417***	0.417***	0.741***	0.653***	0.656***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.009)	(0.009)
Controls	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
2-Digit Industry FE	YES	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES
N	74,080	74,080	74,080	74,080	74,080	74,080
adj. R-sq	0.724	0.259	0.258	0.663	0.660	0.602

Significant level * p<0.1 ** p<0.05 *** p<0.01. Data source: JD.com sales data, SAIC registration data.

Result

- Mainly on private sectors

Table 2

	Dependent variable: ln (# new entrants)			
	Private Firms		SOEs	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
ln (supply)	0.020***	0.072**	0.000	0.006*
	(0.002)	(0.035)	(0.000)	(0.003)
ln (# firms) in 2014	0.078***	0.082***	0.002***	0.001***
	(0.010)	(0.011)	(0.000)	(0.000)
ln (# private firms) in 2014	0.352***	0.344***		
	(0.010)	(0.012)		
ln (# SOEs) in 2014			0.003***	0.003***
			(0.000)	(0.000)
Controls	YES	YES	YES	YES
County FE	YES	YES	YES	YES
2-Digit Industry FE	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES
N	74,080	74,080	74,080	74,080
adj. R-sq	0.727	0.272	0.033	0.018

Significant level * p<0.1 ** p<0.05 *** p<0.01. Data source: JD.com sales data, SAIC registration data.

Result

- Digital expansions significantly encourage entrepreneurship by reducing entry barriers
  - 5th percentile implies the new entry barrier is lower
  - Average level doesn't change significantly

Table 3

	Dependent variable(s):			
	ln (5th percentile of regcap)		ln (median of regcap)	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
ln (supply)	-0.035***	-0.113***	0.006	0.162
	(0.003)	(0.016)	(0.006)	(0.121)
ln (median of regcap) in 2014	-0.201***	-0.156***	0.099***	0.100***
	(0.011)	(0.015)	(0.007)	(0.007)
ln (5th percentile of regcap) in 2014	0.376***	0.341***		
	(0.010)	(0.012)		
Controls	YES	YES	YES	YES
County FE	YES	YES	YES	YES
2-Digit Industry FE	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES
N	27,654	27,654	27,654	27,654
adj. R-sq	0.155	0.050	0.191	0.166

Significant level * p<0.1 ** p<0.05 *** p<0.01. Data source: JD.com sales data, SAIC registration data.

Result

- ... and spur industrial development and clustering
  - Proximity-based measure (Ruan & Zhang, 2015): a proximity measure using the number of firms, capital or sales as weights

Table 9: Regression of E-commerce on Industrial Clustering

Table 4

	Dependent variable: ln (clustering measure)			
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
ln (supply)	0.033***	0.100***	0.014**	0.113**
	(0.006)	(0.034)	(0.006)	(0.047)
ln (# new entrants)	0.091***	0.085***	0.167***	0.138***
	(0.012)	(0.014)	(0.012)	(0.019)
ln (clustering measure) in 2014			0.995***	0.964***
			(0.027)	(0.034)
Controls	YES	YES	YES	YES
County FE	YES	YES	NO	NO
City FE	NO	NO	YES	YES
Year FE	YES	YES	YES	YES
N	923	923	923	923
adj. R-sq	0.995	0.311	0.992	0.899

Robust standard errors are reported in parentheses. All observations are at the county-year level. Column (1) and (2) control for the county and year fixed effects. Column (3) and (4) control for the clustering measure in 2014, city and year fixed effects. The dependent variable is the logarithm of clustering measure

Significant level * p<0.1 ** p<0.05 *** p<0.01. Data source: JD.com sales data, SAIC registration data.

Takeaways

- We construct shift-share instrumental variables utilizing the plausibly exogenous JDBang program. Via trade links, we construct exposures of producers to demand shocks and test the effect.
- Digital expansions significantly encourage entrepreneurship, both online and offline, by reducing entry barriers, and spur industrial development and increases business of related sectors.
- Further work:
  - Mechanism on the smaller size of new entries
  - Heterogeneous effect on different industries?
  - Network effect and the monopoly of digital platforms

Bridging the Gender Gap in Entrepreneurship and Empowering Women via Digital Technologies

Lin William Cong, Cornell University and NBER
Bo Liu, School of Management and Economics, UESTC
Xiaohan Yang, Peking University and Alibaba
Xiaobo Zhang, Peking University and IFPRI

March 7, 2023

Gender Gap and Inequality

- WEF Global Gender Gap Report: 2nd largest gender gap in Economic Participation and Opportunity, only 58% closed, takes another 267.6 years.
- World Bank: 34% female ownership with significant heterogeneity.
- U.S. 2018 census, women own 19.1% small businesses, more likely to operate in informal sector or traditional female sectors.
- Impediments to economic participation, especially entrepreneurship and MSME owners/leadership.
  - Innate gender differences, e.g., risk preference, (over-)confidence, & motivation (Croson and Gneezy, 2009; Bertrand et al., 2010; Klapper and Parker, 2011; Exley and Nelsen, 2022).
  - External financial constraints (Greene et al., 2001; Becker-Blease and Sohl, 2007; Brooks et al., 2014; Sauer and Wilson, 2016; Guzman and Kacperczyk, 2019; Ewens and Townsend, 2020).
  - Lack of social network and unfavorable social institutions (Field et al., 2010; Howell and Nanda, 2019).
  - Culture, family, and law: family/inheritance law, family obligations restricting occupational choices (Bertrand et al., 2010; Core, 2020; Zandberg,2021).

Female Entrepreneurs and MSME Owners in China

- Labor participation high, but entrepreneurship low: $< 15\%$ (1995), about 25% (2015). Trending up? Why?
- China's State Administration for Market Regulation: private enterprises grew from about 10 million/79.4% (2012) to nearly 45 million/92.1% (2021)
- Share of female entrepreneurs increased from 16% to 28%. 2021 Hurun: "China has two-thirds of the world's most successful women entrepreneurs."
- From 2014 to 2020, the share of female entrepreneurs worldwide has barely increased by 2% (We-Data project).
- Unlikely driven by financial constraints (from traditional finance service sector), specific policy targeting female entrepreneurs (mass entrepreneurship included), or changes in culture, family, social norm, or innate preferences.

Reducing the Gender Gap via Digital Technologies

- Research Questions: What's the role of digital technologies?:
  - Digital platforms and FinTech lending rely less on collateral.
  - Online merchants rely less on social network.
  - Flexibility and new opportunities: work/family balance.
- China: exponential growth of e-commerce and digital platforms, encouragement of mass entrereneurship.
- Alibaba online merchants 40% women.
- The State Council Information Office's white paper "Gender Equality and Women's Development in China" reports that women account for 55% of entrepreneurs in the Internet sector.

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- Alibaba online merchants 40% women.
- The State Council Information Office's white paper "Gender Equality and Women's Development in China" reports that women account for 55% of entrepreneurs in the Internet sector.
- Equality and efficient allocation; anecdotal or summary statistics due to lack of data.
- No consensus on technology and entrepreneurship.
- Studies on digital platforms and e-commerce have focused on consumers, antitrust, digital divide, informational issues, etc.

Key Findings and Main Contributions

1. Clear upward trend of female entrepreneurship in the past two decades; but gap still exists.
2. E-commerce-expansion-induced demand shocks increases female entrepreneurship and executive leadership.
3. Female owners tend to hire female employees, implying potential spillover from the effects of digitization.
4. Digital platforms and e-commerce appear to lower barriers to entry and enable flexibility to maintain work/family balance for women.
5. The COVID-19 pandemic accelerated women's adoption of digital technologies which increases business resilience.

Highlight the important role of technology in potentially bridging the gender gap in entrepreneurship and MSME ownership.

Data Description

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- Online Survey of Small and Micro Enterprises in China (OSOME): quarterly survey on average receives between 10,000 and 20,000 responses each round, samples including unregistered individual business households, registered self-employed businesses, and incorporated enterprises, etc.

Outline

- Introduction and Overview
- Data and Institutional Background
- Empirical Strategy
- Findings & Implications
- Takeaways

Textual Analysis for Identifying Female Entrepreneurs and Owners

- Naming conventions in China
  - “名以正体、字以表德、号以寓怀”；“招娣”, “引娣”, ；““姿”, “婉”,“婷”; “兰”, “梓” “珍”.
  - episode, clan, gender, tradition/culture (e.g. poetry, zodiac sign, " five elements"), and expectations for the offspring
- NLP algorithm using Naive Bayes Classifier.

Most Common Chinese Names in Each Decade

⩽1959		1960-1969		1970-1979		1980-1989		1990-1999		2000-2009		2010-2019	
M	F	M	F	M	F	M	F	M	F	M	F	M	F
建国	秀英	军	秀英	勇	丽	伟	静	伟	静	涛	婷	浩宇	欣怡
建华	桂英	勇	桂英	军	艳	磊	丽	超	婷	浩	欣怡	浩然	梓涵
国华	秀兰	伟	英	伟	敏	勇	娟	涛	敏	杰	婷婷	宇轩	诗涵
和平	玉兰	建国	玉兰	强	芳	涛	艳	杰	婷婷	鑫	静	子轩	梓萱
明	桂兰	建华	萍	刚	静	超	燕	鹏	丹	俊杰	悦	宇航	子涵
建平	秀珍	建军	秀兰	建军	霞	强	敏	磊	雪	磊	敏	皓轩	紫涵
军	凤英	平	玉梅	涛	红梅	鹏	娜	强	丽	帅	佳怡	子豪	佳怡
平	玉珍	建平	红	斌	燕	军	芳	浩	倩	宇	雪	浩轩	雨涵
志明	玉英	强	丽	波	红	波	丹	鑫	艳	浩然	颖	俊杰	雨欣
德明	兰英	斌	敏	辉	英	杰	玲	帅	娟	鹏	雨欣	子涵	一诺

Source：The Ministry of Public Security of the People's Republic of China，2020 National Report on Nameshttp://www.gov.cn/fuwu/2021-02/08/content_5585906.htm.

Identification: e-Commerce Expansion

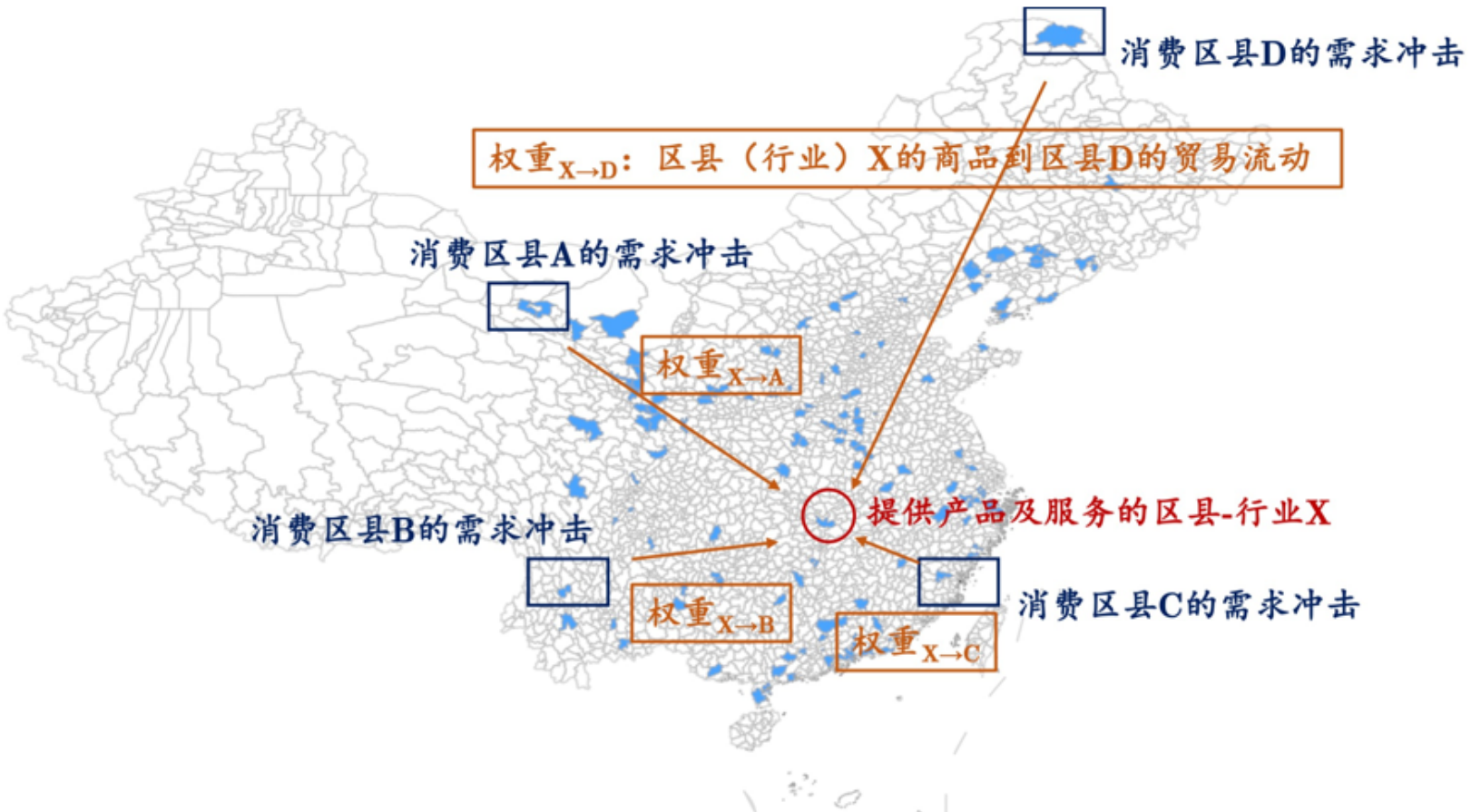
- JDBang: a random-assigned e-commerce promotion project "... provide consumers in the countryside with promotion, valet ordering, fast delivery, cash on delivery, installation, maintenance, and return services, aiming to boost the potential demand in the county and rural online retail market ..."
- Bartik instrument (shift-share instrumental variable, SSIV)

$$B_{ijt} = \Sigma_{d \neq i} \omega_{ijd,t=0} \cdot g_{d,-j,t}, \tag{1}$$

  i indexes the (producer's county), j the industry, and t the quarter,
- Shift $g_{d,-j,t}$: aggregated county-level consumption growth, YoY change in the total transactions in buyer county d in quarter t.
  - Quasi-experimental assignment (confirmed by JD and balance check).
  - Explain the change rates of consumption.
- Share $\omega_{ijd,t=0}$: domestic trade flow linkage. 2012 China Multi-Regional Input-Output Table (Liu et al., 2018); both online and offline trade flows.
  - Shares exogenous, weights are pre-determined and fixed.
  - Goldsmith-Pinkham et al. (2020) pre-trend test: use shares as treatment exposures in a DiD framework. No significant trend before JDB expansion.

Aggregated Shocks to Producer/Seller Regions

Follow Cong, Ponticelli, Yang, & Zhang (2023):
"How Digital Platforms Influence Entrepreneurship and Industrialization: Evidence from E-Commerce Expansions in China"

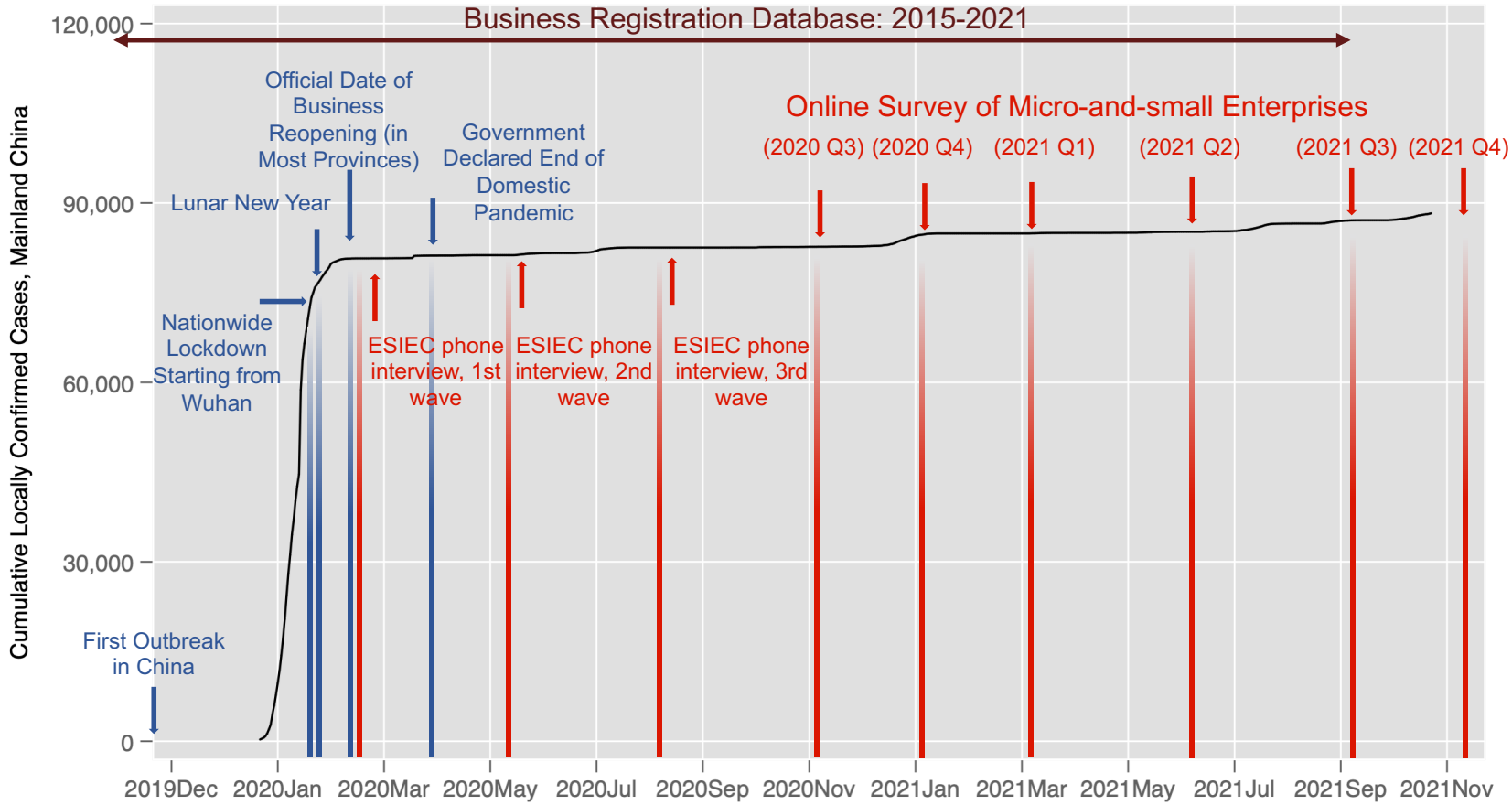


Women's Resilience and Technology Choices During the Pandemic

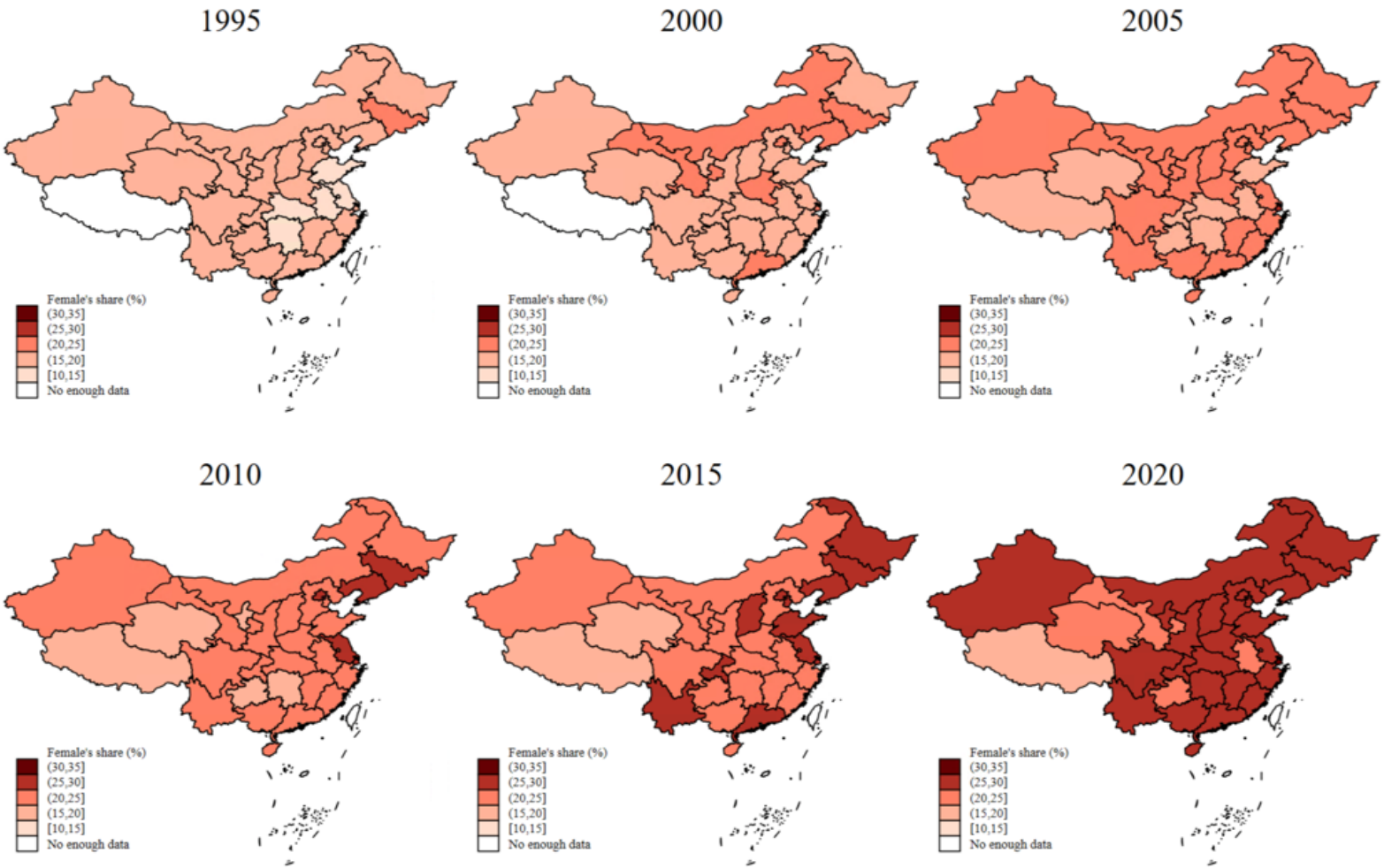
Follow Cong, Yang, & Zhang (2022): "SMEs Amidst the Pandemic and Reopening: Digital Edge and Transformation"

$$Y_{ijt} = \beta \times (\text{COVID} \times \text{After}))_{cyq} + x_i\theta + FE_S + \epsilon_{ijcq}, \qquad (2)$$

entrepreneur i, industry j, city c, quarter q, year y.



1. Trends in Distribution and Gender Gap



Female Entreprneur Ratio in Newly Registered Firms 1995-2020

2. Impact of e-Commerce Expansion on Female Entrepreneurs

Table 3: Impact of E-Commerce Expansion on Female Entrepreneurship in E-Commerce Related New Businesses

	(1)	(2)	(3)
	Entrepreneurs (legal representatives) of Newly Established Enterprises		
	Is There a Female	Number of Women (log)	Percentage of Women
Panel A: E-Commerce Related Businesses			
E-Commerce Index	0.031***	0.117***	0.032***
	(0.010)	(0.047)	(0.012)
Adj. R-sq	0.066	0.261	0.471
Panel B: Non-E-Commerce Related Companies			
E-Commerce Index	-0.009	0.332***	0.490
	(0.031)	(0.125)	(0.355)
Adj. R-sq	0.001	0.436	0.128
Control Variables	Yes	Yes	Yes
District and County Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
District-Industry Fixed Effects	Yes	Yes	Yes
Quarterly Fixed Effects	Yes	Yes	Yes
Observations	74,052	22,062	22,062

2. Impact of e-Commerce Expansion on Female Executives

Table 4: Impact of E-Commerce Expansion on Female Executive Representation in E-Commerce Related New Businesses

	(1)	(2)	(3)
	Executives (non-legal representatives) of Newly Established Enterprises		
	Availability of Female Executives	Number of Female Executives (log)	Percentage of Female Executives
Panel A: E-Commerce Related Businesses			
E-Commerce Index	0.014	0.056*	0.012*
	(0.010)	(0.031)	(0.007)
Adj. R-sq	0.071	0.079	0.052
Panel B: Non-E-Commerce Related Companies			
E-Commerce Index	0.019	0.204***	0.267
	(0.033)	(0.075)	(0.198)
Adj. R-sq	0.005	0.225	0.040
Control Variables	Yes	Yes	Yes
District and County Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
District-Industry Fixed Effects	Yes	Yes	Yes
Quarterly Fixed Effects	Yes	Yes	Yes
Observations	74,052	38,119	38,119

3. Homophily and Spillover

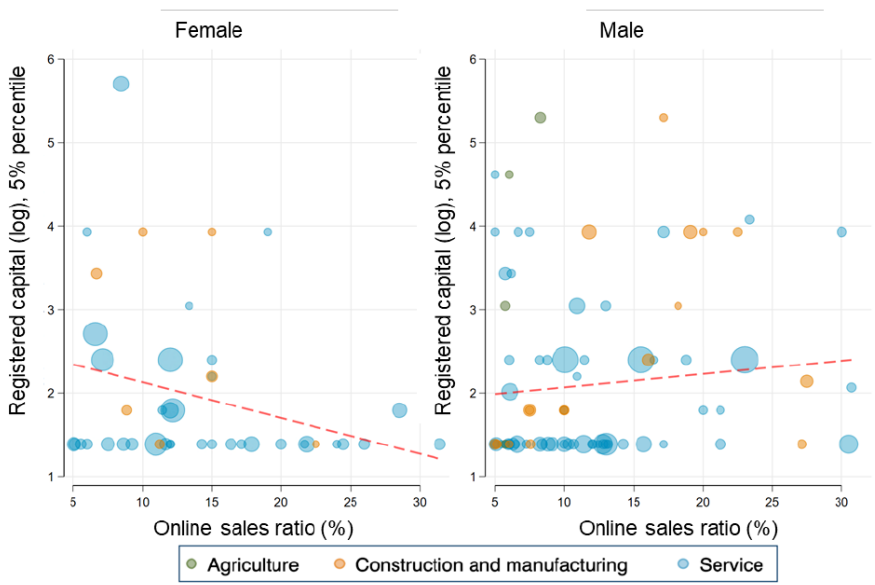
Female Ownership and Female Employment (not directly observed in registration data).

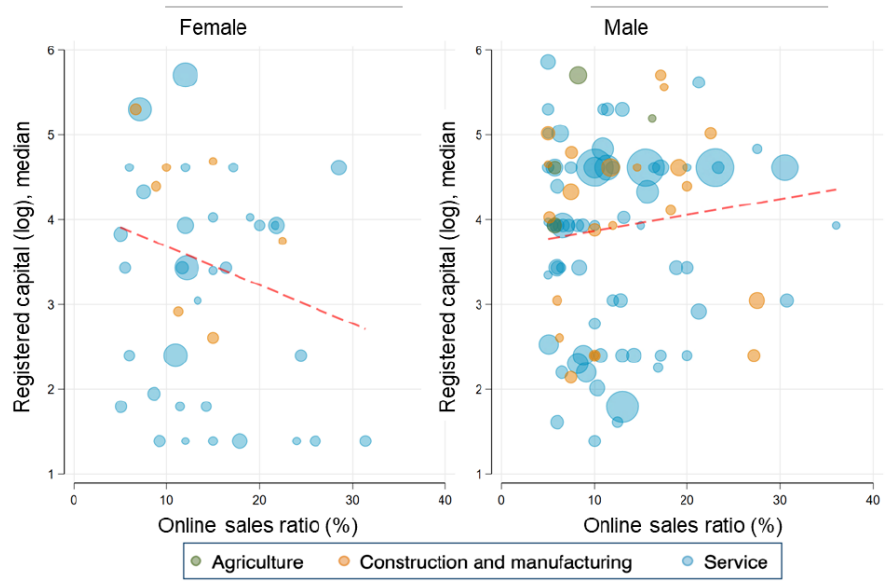
Table 5: Employees of Female Micro and Small Merchants, Taobao Sellers and the Proportion

	(1) Number of Employees	(2) Number of Female Employees	(3) Percentage of Female Employees
Female Owners x Taobao Sellers	0.352*	0.205*	0.033**
	(0.198)	(0.121)	(0.014)
Female Owners	-0.462***	0.132***	0.120***
	(0.051)	(0.029)	(0.004)
Taobao Sellers	-0.758***	-0.216	0.000
	(.109)	(0.065)	(0.006)
Adj. R-sq	0.150	0.071	0.039
Control Variables	Yes	Yes	Yes
Quarterly, City, and Industry Fixed Effects	Yes	Yes	Yes
Two-Way Fixed Effects	Yes	Yes	Yes
Quarterly-City-Industry Fixed Effects	Yes	Yes	Yes
Observations		63,568	

4. Mechanism: Lower Barriers to Entry

Online Sales Ratio vs. Registered Capital (Bottom 5% and Median)





4. Mechanism: Flexible Hours for Family Care

Table 6: Business and Family Care Time of Female Micro-Enterprise Owners and Taobao Sellers

	(1)	(2)	(3)	(4)
	Full Sample of Topics		Married Sample	
	BUsiness	Family	Business	Family
Female Operators x Taobao Sellers	2.940	8.584*	3.491	9.644*
	(5.947)	(4.362)	(7.135)	(5.476)
Female Operators	-8.888***	3.005***	-8.112***	3.159***
	(1.344)	(1.023)	(1.596)	(1.156)
Taobao Sellers	-0.928	-0.036	-2.897	-2.219
	(2.491)	(1.814)	(3.042)	(1.999)
Adj. R-sq	0.063	0.009	0.052	0.005
Control Variables	Yes	Yes	Yes	Yes
Quarterly, City, and Industry Fixed Effects	Yes	Yes	Yes	Yes
Two-Way Fixed Effects	Yes	Yes	Yes	Yes
Quarterly-City-Industry Fixed Effects	Yes	Yes	Yes	Yes
Observations	4,918		3,410	

5. Technology Choices & Business Resilience After the Pandemic Shocks

Table 8: Effects of Local Outbreak and Mitigation on Micro-Small Merchants' Online Operations and Sales, by Gender

	(1)	(2)	(3)	(4)	(5)
		Online Business		Online Sales	Online Marketing
	Any Form	Combination of Online and Offline	Online Only		
Panel A: Female Operators					
COVID x After	0.076***	0.045*	0.031*	0.073***	0.046**
	(0.027)	(0.024)	(0.016)	(0.024)	(0.021)
Mean Value of Dependent Variable	0.445	0.331	0.114	0.393	0.243
Standard Deviation of Dependent Variable	0.497	0.471	0.317	0.488	0.429
Adj. R-sq	0.010	0.003	0.050	0.024	-0.016
Observations			14,587		
Panel B: Male Operators					
COVID x After	0.009	0.006	0.003	0.002	-0.003
	(0.012)	(0.013)	(0.007)	(0.011)	(0.010)
Mean Value of Dependent Variable	0.440	0.331	0.109	0.381	0.214
Standard Deviation of Dependent Variable	0.496	0.471	0.311	0.486	0.410
Adj. R-sq	0.058	0.044	0.064	0.066	0.040
Observations			69,729		
Control Variables	Yes	Yes	Yes	Yes	Yes
Quarterly Fixed Effects	Yes	Yes	Yes	Yes	Yes
Urban Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes
City-Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes
City-Annual Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry-Annual Fixed Effects	Yes	Yes	Yes	Yes	Yes

Takeaways

1. Clear upward trend of female entrepreneurship in the past two decades; but gap still exists.
2. E-commerce-expansion-induced demand shocks increases female entrepreneurship and executive leadership.
3. Female owners tend to hire female employees, implying potential spillover from the effects of digitization.
4. Digital platforms and e-commerce appear to lower barriers to entry and enable flexibility to maintain work/family balance for women.
5. The COVID-19 pandemic accelerated women's adoption of digital technologies which increases business resilience.

Highlight the important role of technology in potentially bridging the gender gap in entrepreneurship and MSME ownership.