

# SMEs Amidst the Pandemic and Reopening: Digital Edge and Transformation

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# 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 (*in Chinese*); Kong et al., 2021; .....
  - Bartik et al., 2020; Chetty et al., 2020; Fairlie, 2020; Humphries et al., 2020; .....

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## Ways to help SMEs cope with shocks

- ▶ Policy interventions:
  - Bartlett III and Morse, 2020; Chen et al., 2020; Dai et al, 2021b; .....
- ▶ Wide media reports on the importance of e-commerce during the pandemic



## 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)
- ▶ Our paper asks two questions:
  - Whether the business digitization helps SMEs better cope with the pandemic?
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## Why China?

- ▶ Largest e-commerce and FinTech market
- ▶ Rapid reopening of the economy in 2020 → SME's digital transformation post the pandemic shock
- ▶ Sporadic outbreaks and localized lockdowns

# Timeline

- The timeline of accumulative COVID-19 cases, lockdown, and reopening

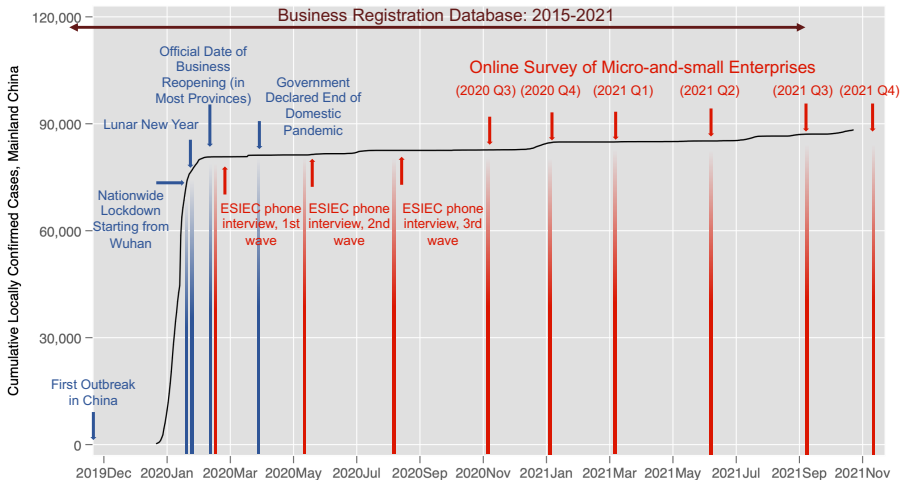


Figure 1: COVID-19 Outbreak, Reopening, Mitigation Policies, and Surveys

# Roadmap

- ▶ Offline survey with phone follow-ups: digital edge (*intuitive fact*)
- ▶ Universal firm registration data:
  - Textual analysis (NLP + ML): classify e-commerce entries & adoption
  - Event study framework

⇒ SME's Digital transformation
- ▶ Online survey on Alipay: extension on digital adoption



- ▶ Enterprise Survey on Innovation and Entrepreneurship in China (ESIEC)
  - Private enterprises and self-employed
  - Field surveys (2017-2019): ~ 8,000
- ▶ Representatives [▶ Appendix](#)
- ▶ ESIEC phone follow-up interviews in 2020:
  - Two (Feb & May) for previously surveyed entrepreneurs
  - A new sample in August
  - Each wave: ~ 1,500

# Digital Edge

## E-commerce firms are more resilient

- 1 Does the business digitization help SMEs better cope with the pandemic?
  - Firms with higher e-commerce sales prior to the pandemic are more likely to:

Table 1: Baseline Regression of Digital Edge

	Demand: order decline	Cash flow > 1 month	Reopen	Outlook for growth
Pooled	-	+	+	+
February	-	+		
May	-	+	+	+
August	-	+	+	+

Control variables on personal characteristics and business performance are controlled. Industry and city FEs are controlled.

Data source: ESIEC.

# Digital Edge

## E-commerce firms are more resilient

- Higher growth in online sales than offline sales at the national level

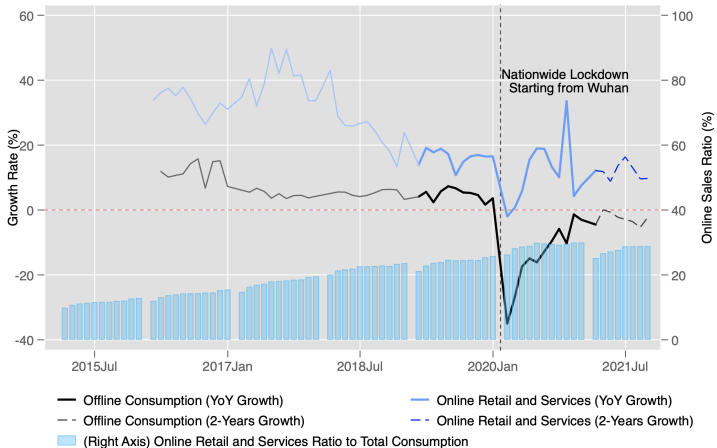


Figure 2: National Trend of Online and Offline Sales in China (National Bureau of Statistics)

# Digital Edge

## E-commerce firms are more resilient

- Firms with online sales had faster turnover rate of capital.

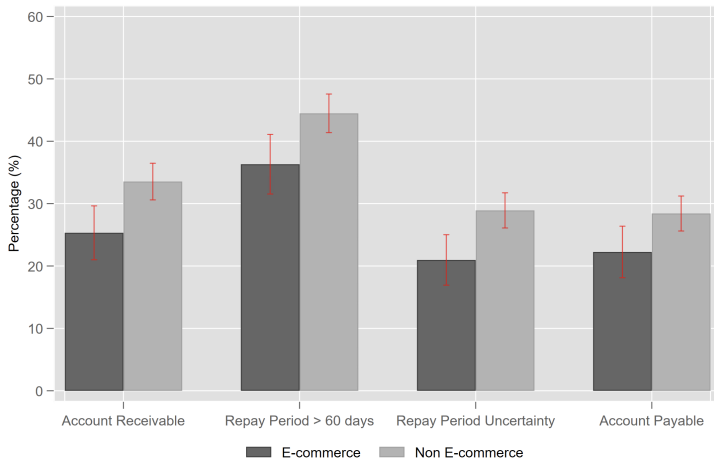


Figure 3: Short-term Impact of E-commerce on Corporate Finance during the Early Reopening

# Digital Transformation

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

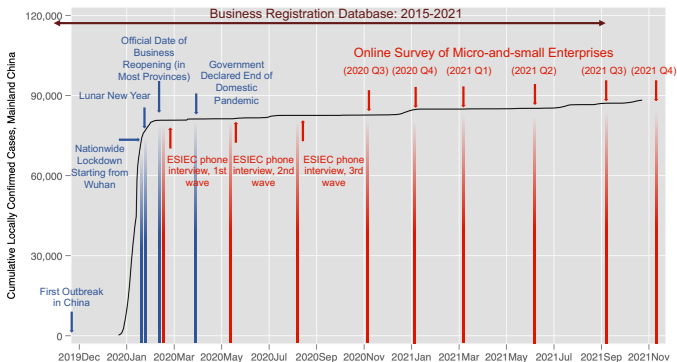


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# Digital Transformation

## Data and NLP

### ► SAIC Business Registration database

- Universe of registered businesses in China
- “Business operation scope”:

企业类型	有限责任公司(自然人投资或控股)	行业	畜牧业 <b>livestock industry</b>	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 <a href="#">附近公司</a>				
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) <b>[Business Operation Scope]</b> Sales of prepackaged foods, honey, bee pollen, bee paste, cosmetics, and daily necessities (including online sales); <b>bee farming</b> ; production and sale of health food; design and production of web pages; business consulting; .....				

### ► Natural language processing (NLP): identify “e-commerce” related firms

- ML algorithms with proprietary training set in W & R sector
- Interpretability: keywords
- **Alteration record on business operation scope**: incumbents' digital adoption

# Digital Transformation

## Identification

- ▶ Aggregate at city-industry-month level (2015-2021)
  - Extensive margin: e-commerce  $\Rightarrow$  # new entries
  - Intensive margin: e-commerce adoption  $\Rightarrow$  # incumbents' alterations
- ▶ Difference-in-differences event study framework:
  - Following Fang et al. (2020) and Chen et al. (2020)

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

-  $c$  indicates the city,  $j$  the industry,  $m$  the month, and  $y$  the year.

# Digital Transformation

## Extensive margin

- ▶ V-shaped pattern:
  - E-commerce entrants experienced a slighter initial drop and a quicker rebound.
- ▶ Extensive margin  $\uparrow$

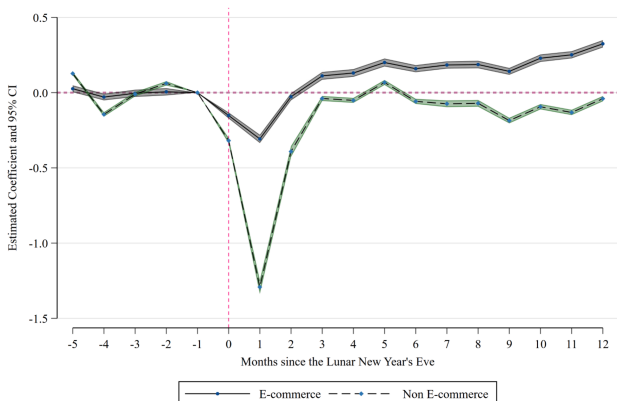


Figure 4: Event Study of COVID-19 Outbreak and Reopen on New Firm Entry, by E-commerce and Others



# Digital Transformation

## Extensive margin

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

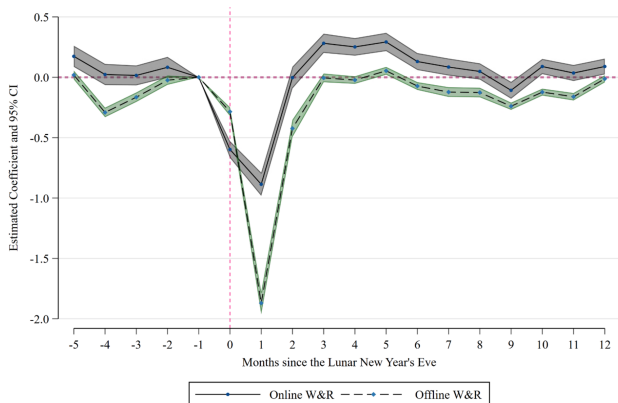


Figure 5: Event Study of COVID-19 Outbreak and Reopen on Wholesale and Retail New Firm Entry, by Online and Offline

# Digital Transformation

## Extensive margin

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

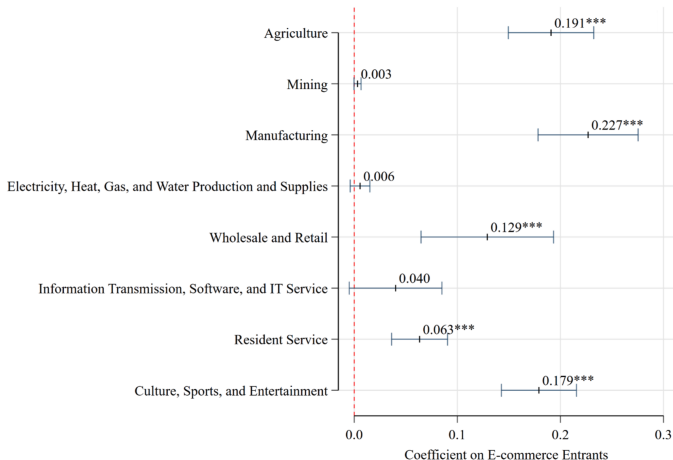


Figure 6: Heterogeneous Effect of COVID-19 Outbreak and Reopen on New Firm Entry for the E-commerce Subgroup, by Industry

# Digital Transformation

## Intensive margin

- ▶ Incumbent's alteration of operation scope to include e-commerce (non-e-commerce → e-commerce)
- ▶ Intensive margin ↑

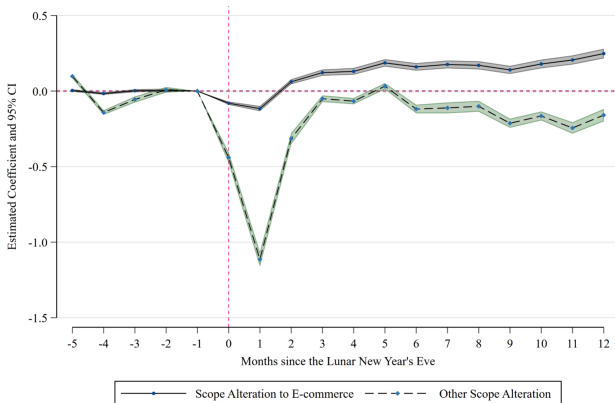


Figure 7: Event Study of COVID-19 Outbreak and Reopen on Operation Scope Alteration, by E-commerce Adoption and Others

# Digital Transformation

## Intensive margin

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

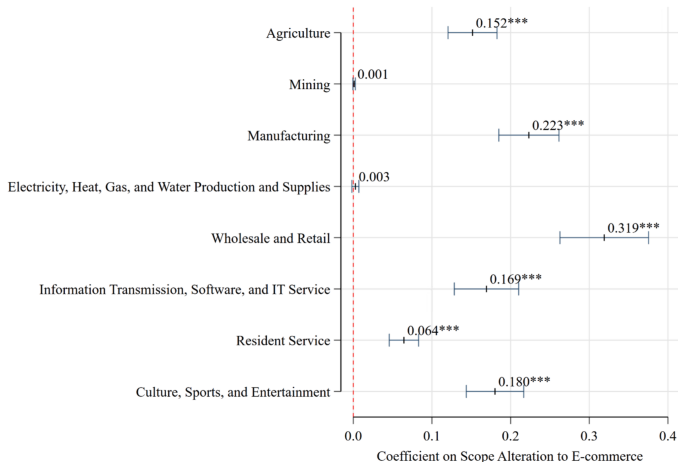


Figure 8: Heterogeneous Effect of COVID-19 Outbreak and Reopen on Incumbents' Business Operation Scope Alteration to E-commerce, by Industry

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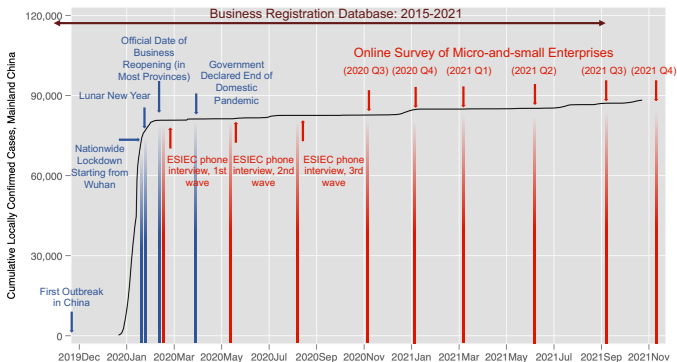


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# Digital Transformation

## OSOME data

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

# Digital Transformation

## OSOME sample

- Example: adoption of electronic information systems:

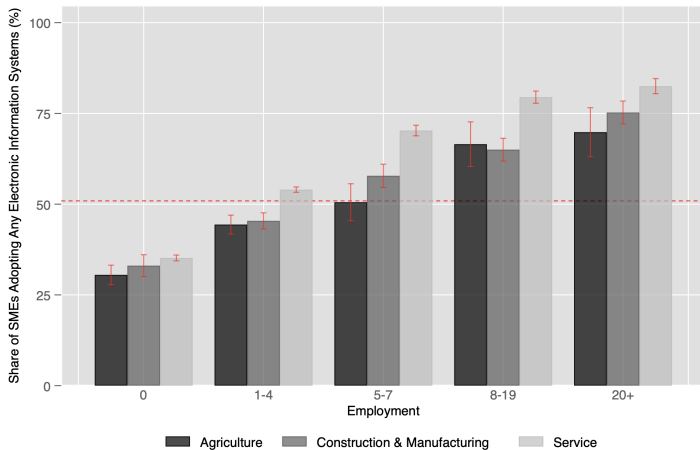


Figure 6: Share of SMEs Adopting Any Electronic Information Systems in OSOME, by Industry and Employment

# Digital Transformation

## Result

Table 2: Impact of Local Lockdowns on SMEs' Digital Adoption

	Online business	( <i>Online only</i> )	Online sales	Remote work	Sale system
<b>Full sample</b>	+		+	+	+
<i>Newly established subsample</i>		+			
<i>Incumbent subsample</i>	+		+	+	+

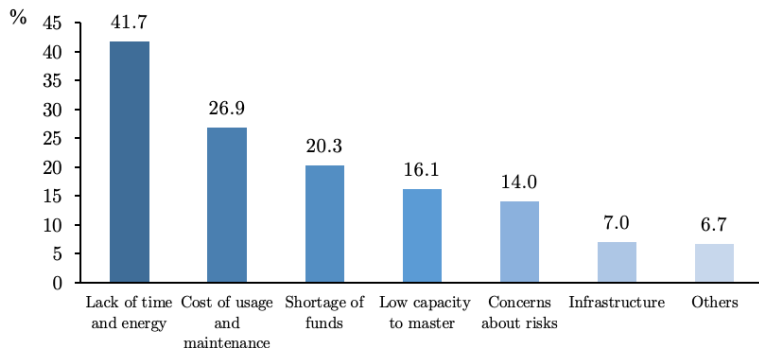
Control variables on personal characteristics and business performance are controlled. City, industry, quarter, city  $\times$  industry, city  $\times$  year, and industry  $\times$  year FEs are controlled.

Data source: OSOME.



## Digital Transformation

- “The lack of time and energy to learn” is the key to hinge SMEs’ digital adoption.



Difficulties in digital transformation  
Figure 7: 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.
- ▶ Impact of other types of digitization also exists, even for micro businesses.

# Appendix

## ESIEC sample

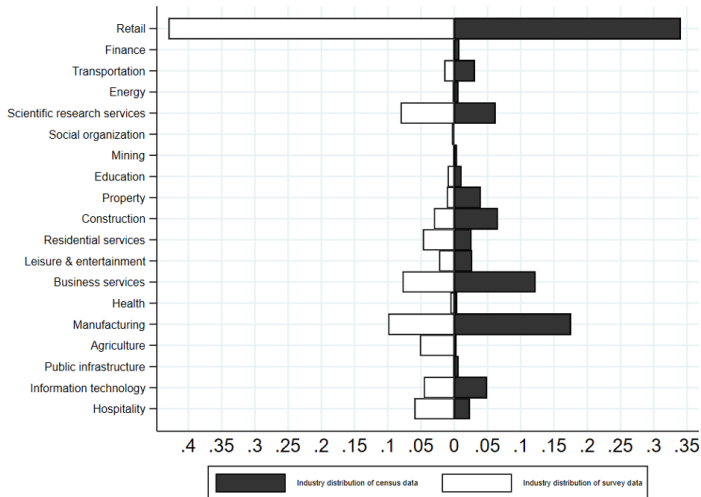
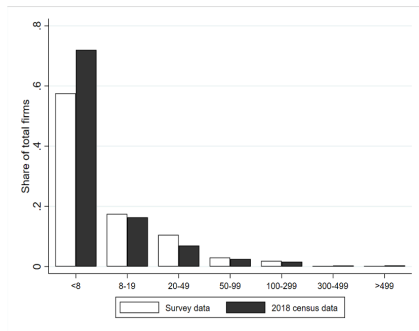


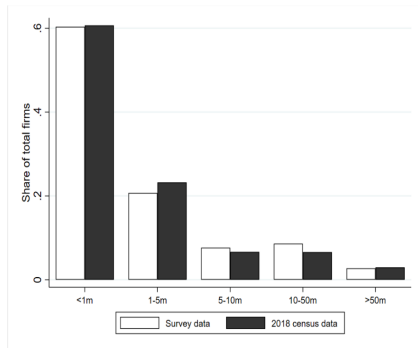
Figure A 1: Industrial Distribution of the ESIEC Sample and of the China Economic Census of 2018 (Dai et al., 2021b)

# Appendix

## ESIEC sample



(a) Employment



(b) Revenue

Figure A 2: Size Distribution of the ESIEC Sample and of the China Economic Census of 2018 (Dai et al., 2021b)

Return