

# Social Media and Government Responsiveness: Evidence from Vaccine Procurement in China

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# Media on government response and public policy

- Media as the fourth estate: watchdog pressing the government to respond to public needs (e.g., Besley and Burgess 2002; Stromberg 2004; Stromberg and Snyder 2010).
- The era of social media
  - Rapid and massive circulation of political information
  - Huge information shocks to countries with little pre-existing informational diversity
  - Noisy, fake, and susceptible to manipulation
  - Cause of political turbulence
- Does social media improve government responsiveness and accountability?
- Limited evidence on the effect of social media on government behavior and public policy

# Potential effects of social media

- Information
  - Policy oversight and government misconduct (corruption)
  - Viable in non-democracies: communication between top leaders and citizens in areas of common interests (e.g., public health, food safety, environmental protection)
  
- Pressure
  - Bottom up: grassroots political participation (e.g., voting, protests) increases government sensitivity to citizens' needs.
  - Public visibility/attention generates top-down pressure
  
- Different mechanisms: distinct implications for accountability

# This paper

- Studies whether and how social media affect local governments' procurement of vaccines in China
  - Public procurement accounts for a significant share of government expenditure and is important for accountability and state effectiveness. (Bosio et al. 2021; Best et al. 2021)
  - Social media information about vaccine issues is abundant.
- Data (2014-2019)
  - Records of government procurement of vaccines and related products (equipment and services)
  - Sina Weibo (Chinese equivalent to Twitter) posts
- Empirical strategy: event study + DID estimation + IV
  - Exploit abrupt changes in information landscape on social media, induced by sudden events

# Preview of main findings

- In cities experiencing more intensive Weibo discussion about vaccine safety, local governments
  - improved the transparency of vaccine procurement by increasing the share of open-bid (competitive auction) format.
  - increased online interaction with citizens by blogging more about vaccine safety and government accountability.
  
- Local governments respond to event-specific information shocks rather than general Weibo penetration.
  
- The Weibo effect depends on local governments' sensitivity to top-down pressure
  - Stronger when political leaders have a stronger career concern.
  - Stronger in cities at a lower administrative rank.

# Vaccination in China

- Vaccination is a key public health issue
  - Category I (14vaccines): DPT, MMR etc., compulsory, free, >95% coverage, well regulated
  - Category II: chickenpox, flu, rabies, substitutes of Category I; voluntary, self-paid, low coverage (10%), less strictly regulated
  
- Market development of Category-II
  - Size: 2<sup>nd</sup> largest in the world, 15% growth rate
  - Home bias: 35 producers, 66% domestic private, 25% SOEs, 9% foreign
  - Profit margin: retail price /factory price > 200%

# Government procurement

- Since 2005, all vaccines and related products (e.g., equipment and services for storage and transportation) must be procured by governments.
- Format: open-bid (default), invited-bid, negotiation, assignment
  - Purpose: improve transparency to reduce corruption, decrease prices through competitive bidding
- Decisions on quantity, scope, and format are decentralized to prefectural FDAs and CDCs.
- Reasons for resisting open-bid: corruption, efficiency (faster delivery)
  - Supply shortage, unexpected surge of demand
  - specialized and customized

# Vaccine scandals

- Notable problems:
  - Product: substandard, defect, expired  
Service: inappropriate storage and transportation
  - Unqualified distributors (subcontractors) and service/equipment providers
  - Pricey Category-II vaccines
  
- Scandals: more than a dozen in the last two decades
  - 2007 Shanxi: vaccines exposed to high temperature, 100+ death and disability, covered up by local governments until reported by journalists in 2010
  - 2016 Shandong: a vaccine distributor sold defective/expired vaccines for 6 years, 355 arrested, 64 civil servants prosecuted
  - 2017-2018 Jilin: substandard vaccines produced by a listed company, fake records, sentencing of 15 senior managers, company delisted



# Social media in China

- Sina Weibo
  - First service in Aug. 2009, 500m users in 2012, declined after 2013, remain hugely influential
  - Strategic censorship: censoring information against the regime but allowing criticism of government (King, Pan, Roberts 2013, 2014)
  - Ample discussion about issues that the regime and the public share common interests (e.g., corruption, strikes, local protests) (Qin, Stromberg, and Wu 2017, 2021)
  
- Government control and use of Weibo
  - Service providers directly controlled by the National Internet Information Management Office
  - Local governments operate Weibo accounts to make policy announcements and interact with citizen users
  - Invest in ICT: public opinion monitoring system/software (221 prefectures procured this system before 2016)

# Data (2014-2019)

- Vaccine procurement
  - Source: government websites (national and local)
  - Coverage: all vaccine-related procurement, 33,031 items
  - Each procurement: name of government, date, items, format, agencies, winners
  
- Sina Weibo
  - Source: third-party provider, verified by ourselves
  - Coverage: all posts containing “vaccine”; 3,329,058 posts
  - User information: self-reported location (prefecture), comparable to location information for users permitting tracking
  - No evidence of censorship on vaccine topics until 2020 (COVID vaccines)

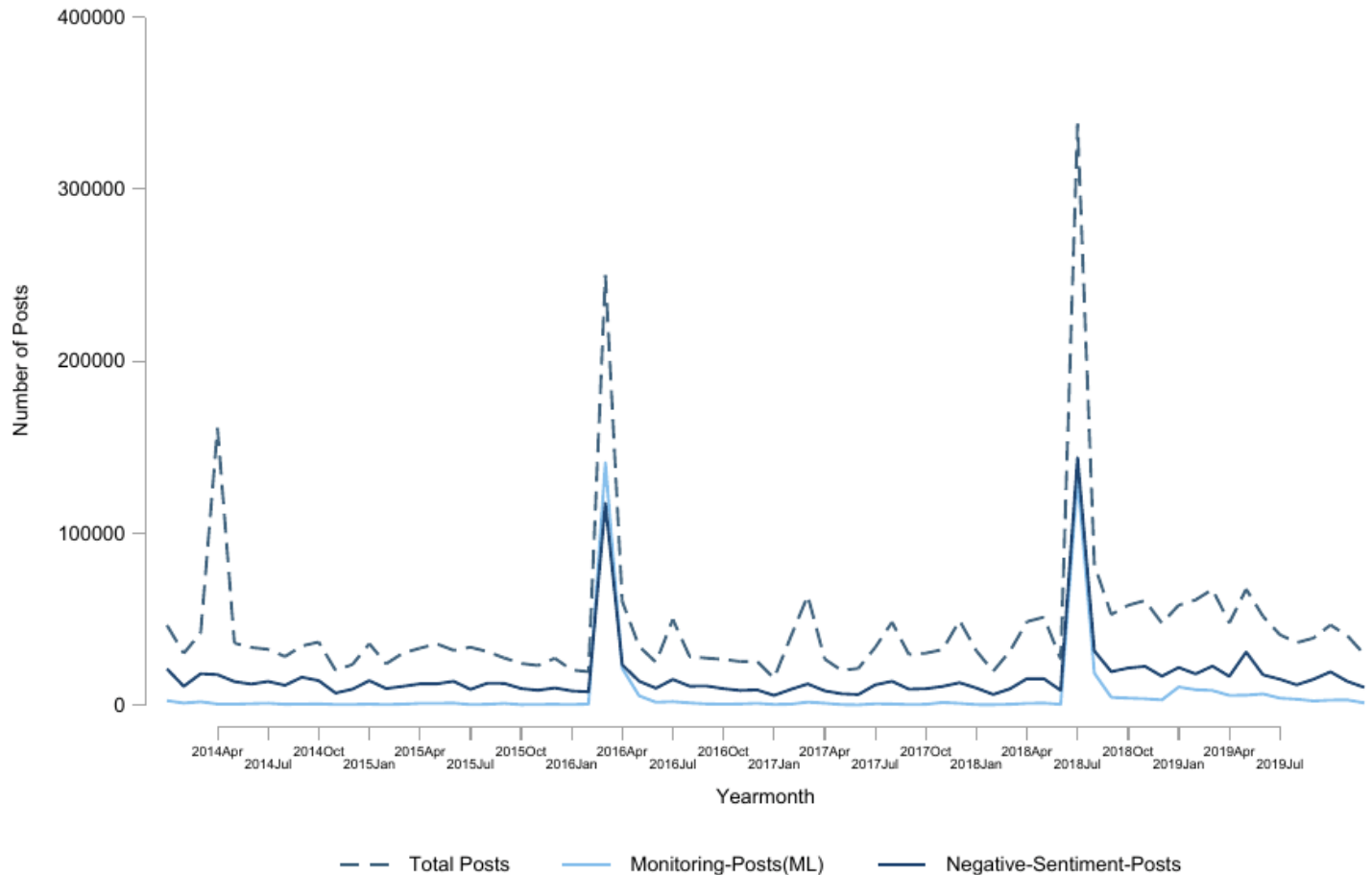
# Post content



- A large number of posts about general issues instead of vaccine quality problems
- A significant number of posts with monitoring implications (complaints and critiques), but very few referring to specific government units, officials, or firms



# Information flows over time



- Monitoring-Posts (ML): monitoring posts identified by supervised learning
- Negative-Sentiment-Posts: posts containing negative sentiment

# Summary statistics

- Main outcome variables: share/number of open-bids
- Weibo variables: total posts (referencing vaccines), monitoring-posts(ML), negative-sentiment-posts
- Prefecture-month observations

	N	mean	sd	min	max
<i>Procurement Variables</i>					
Number of procured items	14976	0.60	4.79	0	200
Number of open-bid procurement	14976	0.43	4.22	0	200
Share of open-bid procurement	1367	0.60	0.47	0	1
<i>Weibo Variables</i>					
Total posts	14976	194.18	890.36	2	55422
Monitoring-Posts(ML)	14976	27.11	258.52	0	15629
Negative-Sentiment-Posts	14976	69.75	304.78	0	18138

# OLS: posts-procurement correlations

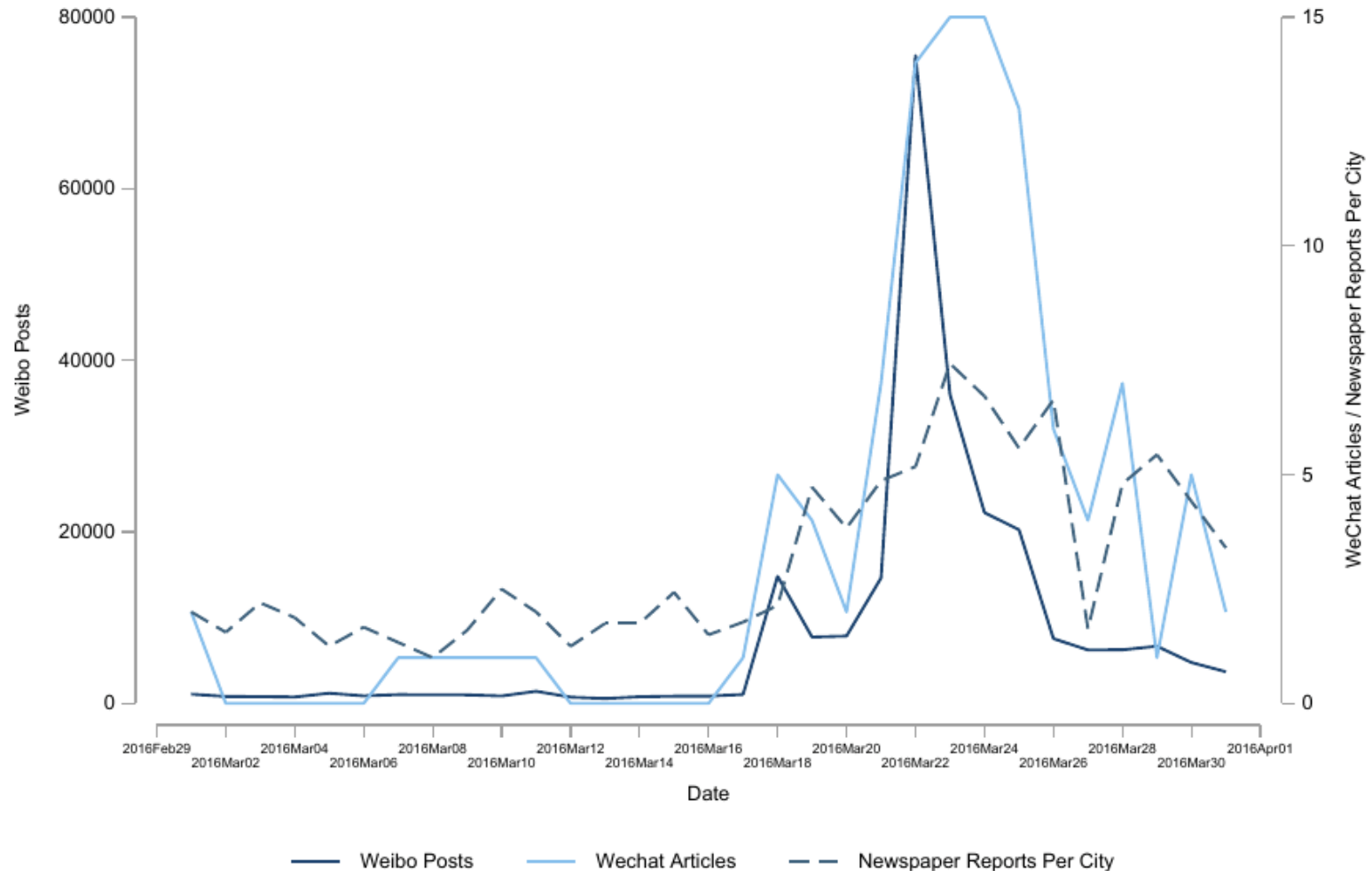
	(1) log(open)	(2) log(nonopen)	(3) openshare
L1.#posts pca	-0.053 (0.062)	0.045 (0.052)	-0.035 (0.051)
L2.#posts pca	0.102** (0.043)	-0.071* (0.041)	0.271*** (0.042)
L3.#posts pca	-0.019 (0.085)	-0.004 (0.042)	0.012 (0.087)
Observations	11742	11742	1025
Adjusted R <sup>2</sup>	0.121	0.078	0.180
Controls	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes
Provincial Time Trend	Yes	Yes	Yes

# Event (2016 March)

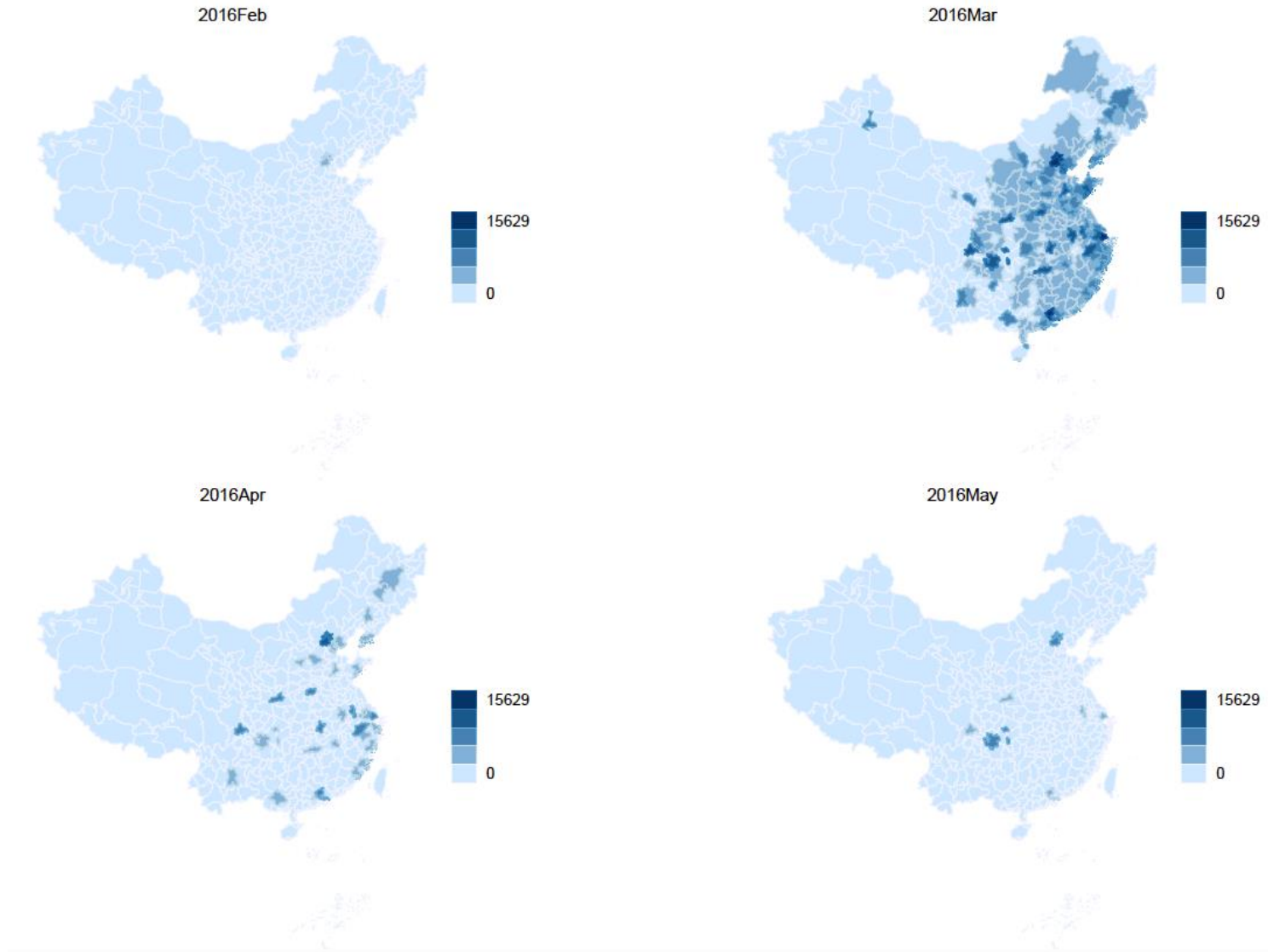
- 2016 Shandong scandal: vaccine distributor (subcontractor of suppliers winning in government procurement) sold defective/expired vaccines
- Media response: news leaked by an online media outlet (The Paper, 澎湃) on March 18; heated discussion on social media
- Impact of the event
  - More strict national regulation of vaccine distribution: restrict subcontracting
  - Increased transparency: procurement reported to provincial digital platforms, discretionary implementation until 2017
  - Shortage of vaccine supply



# Event-induced information eruption



# Changes in information landscape



# Econometric specification

- Unit of observation: prefecture  $i$  and month  $t$

$$y_{it} = \alpha + \beta \mathbf{WeiboShock}_i \times \mathbf{Event}_t + \theta \mathbf{Postbase}_{it} + X'_{it} \delta + \lambda_i + \eta_t + \epsilon_{it}$$

- $y_{it}$ : share (or log number) of open bids
- $\mathbf{WeiboShock}_i$ : #monitoring posts per capita in the event month-  
average # monitoring posts three months pre-event
- $\mathbf{Event}_t$ : dummy =1 if in or after scandal month
- $\mathbf{Postbase}_{it}$ : # all posts referencing vaccine at the monthly level
- $X'_{it}$ : time-variant prefecture characteristics (e.g., pop, GDP, internet users, government expenditure/revenues)
- $\lambda_i$ : prefecture fixed effects
- $\eta_t$ : year-month fixed effects
- Two-way (time and prefecture) clustering of standard errors

# Effect on open-bids: share

- March 2016, leaked information on Shandong scandal
- Sample period: 2015.3 – 2017.3
- #prefectures: 208

	Overall		Category I		Category II and Supplement	
	(1) open share	(2) open share	(3) open share	(4) open share	(5) open share	(6) open share
WeiboShock × Event	0.118*** (0.027)	0.084* (0.044)	0.044 (0.085)	-0.037 (0.072)	0.148*** (0.031)	0.144*** (0.034)
Observations	431	431	179	179	315	315
DV Mean	0.662	0.662	0.667	0.667	0.652	0.652
Adjusted R <sup>2</sup>	0.198	0.222	0.062	0.144	0.187	0.230
Regional FE	Province	Prefecture	Province	Prefecture	Province	Prefecture
Prefectural Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Provincial Time Trend	Yes	Yes	Yes	Yes	Yes	Yes

- Province-fixed effects are used to mitigate the potential bias arising from an unbalanced panel at the prefecture level.

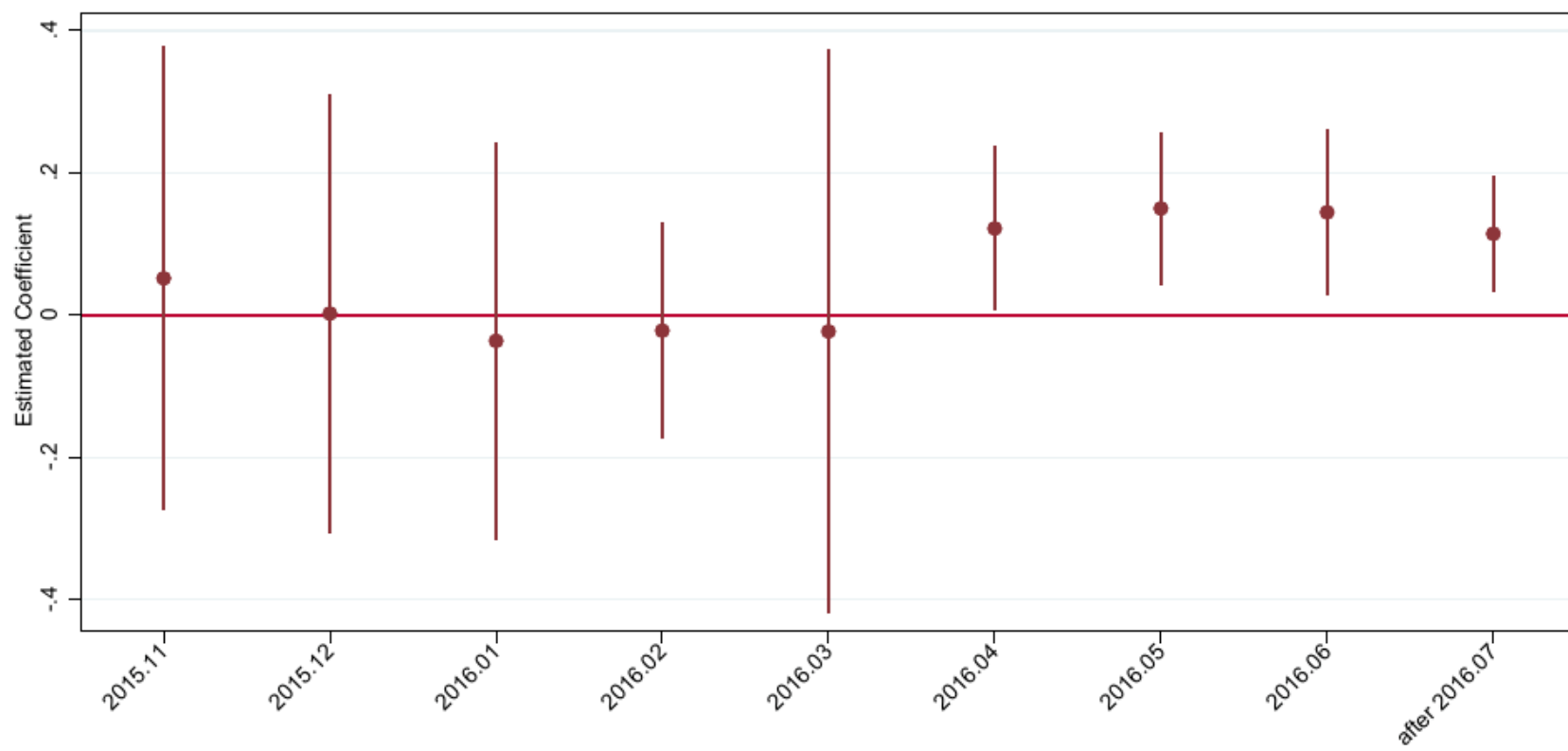
# Event on open-bids: level

- March 2016, Shandong scandal
- Sample period: 2015.3 – 2017.3
- #prefectures: 208

	Overall		Category I		Category II and Supplement	
	(1) log(open)	(2) log(nonopen)	(3) log(open)	(4) log(nonopen)	(5) log(open)	(6) log(nonopen)
WeiboShock × Event	0.033* (0.018)	0.003 (0.009)	0.015 (0.014)	0.004 (0.006)	0.026** (0.012)	-0.003 (0.011)
Observations	5150	5150	5150	5150	5150	5150
DV Mean	0.097	0.042	0.042	0.015	0.062	0.030
Adjusted R <sup>2</sup>	0.126	0.096	0.122	0.096	0.071	0.065
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Provincial Time Trend	Yes	Yes	Yes	Yes	Yes	Yes

# Pretrends and dynamics

## ➤ Effects on the share of open-bid procurement



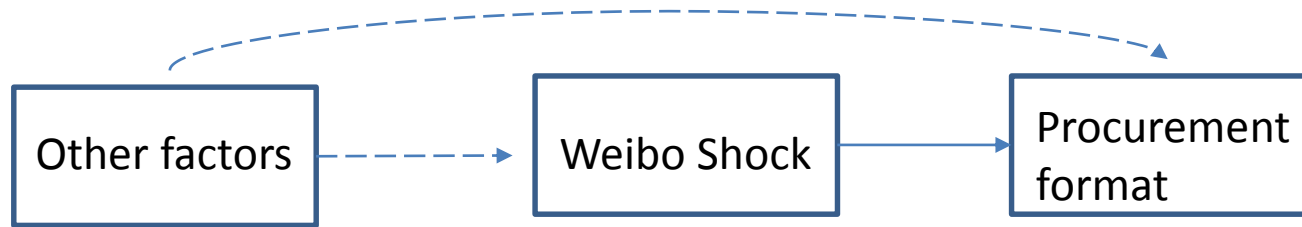
# IV estimation

- Use early-stage Weibo penetration (#posts in Aug-Oct 2009) as IV in a 2SLS with controls of regional characteristics, region fixed effects, and time fixed effects

	Overall		Category II and Supplement	
	(1)	(2)	(3)	(4)
WeiboShock × Event	0.120*** (0.026)	0.121*** (0.027)	0.150*** (0.032)	0.132*** (0.024)
WeiboShock	-0.064 (0.052)		-0.015 (0.047)	
Observations	431	383	313	265
Kleibergen-Paap rk Wald F statistic	34.526	243.336	34.937	370.527
Regional FE	Province	Prefecture	Province	Prefecture
Other Baseline Controls	Yes	Yes	Yes	Yes

# Confounders

➤ Identification concern:



➤ Rule out prominent confounding factors

- Event: differential regional response to the same event
- Policy: regulatory changes after the event
- Other informational channels: newspapers etc.



# Robustness: event

	Overall		Category II and Supplement	
	(1)	(2)	(3)	(4)
WeiboShock × Event		0.082* (0.047)		0.161*** (0.035)
Distance to Shandong × Event	-0.143 (0.185)	-0.035 (0.169)	-0.001 (0.387)	0.368 (0.312)
Observations	431	431	315	315
Adjusted R <sup>2</sup>	0.209	0.219	0.183	0.229
Full Baseline Controls	Yes	Yes	Yes	Yes

	Overall		Category II and Supplement	
	(1)	(2)	(3)	(4)
WeiboShock × Event		0.083* (0.046)		0.150*** (0.034)
Vaccine Shortage × Event	0.283 (0.575)	0.100 (0.624)	-1.424** (0.592)	-1.668** (0.661)
Observations	431	431	315	315
Adjusted R <sup>2</sup>	0.208	0.219	0.192	0.236
Full Baseline Controls	Yes	Yes	Yes	Yes

Shortage is a dummy for regions where there were complaints about shortage.

# Robustness: policy shock

- “Vaccine policy” is a dummy for the actual timing of implementing the new regulation

	Overall		Category II and Supplement	
	(1)	(2)	(3)	(4)
WeiboShock × Event		0.081* (0.044)		0.146*** (0.038)
WeiboShock × Vaccine Policy	0.021 (0.022)	0.007 (0.027)	0.029 (0.031)	-0.003 (0.022)
Observations	431	431	315	315
Adjusted R <sup>2</sup>	0.209	0.219	0.187	0.224
Full Baseline Controls	Yes	Yes	Yes	Yes

# Robustness: other information channels

- Newspapers (representing traditional media)
- Search index on Baidu (Chinese equivalent to Google)

	Overall		Category-II and Supplements	
	(1)	(2)	(3)	(4)
WeiboShock $\times$ Event	0.111* (0.058)	0.094* (0.054)	0.169*** (0.052)	0.129*** (0.042)
Newspaper Shock $\times$ Event	-0.020 (0.018)		-0.021 (0.025)	
Search Index Shock $\times$ Event		-0.060 (0.187)		0.132 (0.213)
Observations	234	431	158	315
Adjusted R <sup>2</sup>	0.061	0.219	0.040	0.225
Full Baseline Controls	Yes	Yes	Yes	Yes

# Effects on government Weibo activity

- Governments operate Weibo accounts to interact with netizens.
  - Low cost but highly visible
  - Tone change: more emphasis on vaccine safety and accountability
- Unit of observation: prefecture and day
- Time window: Feb-April 2016

	Routine-work Posts				Accountability Posts	
	(1) Overall	(2) Topic1	(3) Topic2	(4) Topic3	(5) Topic4	(6) Topic5
WeiboShock(Daily) × 2016.3.18-2016.3.21	3.615*** (0.652)	-0.110 (0.113)	0.146 (0.199)	0.230 (0.292)	2.339*** (0.815)	3.282*** (0.689)
WeiboShock(Daily) × After 2016.3.22	1.272*** (0.347)	0.261* (0.136)	0.164* (0.092)	0.569** (0.253)	0.308** (0.120)	1.087*** (0.303)
Observations	12627	12627	12627	12627	12627	12627
Adjusted R <sup>2</sup>	0.704	0.401	0.406	0.476	0.575	0.695
Prefecture FE	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes	Yes

# Effects on procuring agency

- Local governments use both national and local agencies for vaccine procurement
  - National agencies searched more widely but slowed down the process.
  - Local agencies are more cooperative and easier to control.
  - Shift to local agencies to shorten the duration of open-bid procurement

	Overall		Category-II and Supplement	
	(1) province/all	(2) prefecture/all	(3) province/all	(4) prefecture/all
WeiboShock × Event	0.031 (0.020)	0.052*** (0.018)	0.026 (0.022)	0.067*** (0.019)
Observations	409	409	313	313
Adjusted R <sup>2</sup>	0.440	0.413	0.390	0.366
Full Baseline Controls	Yes	Yes	Yes	Yes

# Mechanisms: political effect of social media

- Finding so far: without eruption of social media information, unlikely to observe the pattern of vaccine procurement in the data
- Source of media effect: specific information shock or general Weibo penetration?
- Political incentive: accountable to citizens (voters) or to superiors (top-down pressure)?

# Specific vs. general shocks

- General social media influence: long-term, institutionalized changes
- Specific information shocks: short-term, strategic, easy to manipulate

	Overall		Category II and Supplement	
	(1)	(2)	(3)	(4)
WeiboShock × Event		0.140*** (0.045)		0.170*** (0.060)
Weibook2011-2012 × Event	0.009 (0.048)	-0.071 (0.050)	0.073 (0.046)	-0.036 (0.059)
Observations	423	423	307	307
Full Baseline Controls	Yes	Yes	Yes	Yes

# Hot fake event vs. silent real event

## ➤ Event 1 (2017.07): fake scandal

Death caused by dog bite even after taking rabies vaccines, heated Weibo discussion about vaccine safety

	Overall (1)	Category-II and Supplement (2)
WeiboShock-2017.07 × Event-2017.07	16.484 (12.407)	22.296*** (6.963)

## ➤ Event 2 (2017.11): silent scandal

Defective vaccines produced by a Chinese firm, lukewarm discussion about vaccines due to distraction of a social event

	Overall (1)	Category-II and Supplement (2)
WeiboShock-2017.11 × Event-2017.11	-2.207 (3.648)	0.839 (2.660)
WeiboShock-2017.07 × Event-2017.07	10.556 (6.410)	10.039 (8.403)



# Another specific information shock

- Vaccine scandal in July 2018: a vaccine manufacturer in Jilin was found to provide fake information about its production of rabies vaccines.
- Eruption of information on vaccine production and firm accountability

	Overall		Category II and Supplement	
	(1) openshare	(2) openshare	(3) openshare	(4) openshare
WeiboShock × Event	0.010 (0.033)	-0.029 (0.067)	0.011 (0.042)	-0.078 (0.046)
Category II Company × Event		-0.167 (0.194)		-0.231 (0.152)
WeiboShock × Event × Category II Company		0.055 (0.065)		0.109** (0.049)
Observations	476	476	416	416
Adjusted R <sup>2</sup>	0.163	0.160	0.225	0.227
Prefectural Controls	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Provincial Time Trend	Yes	Yes	Yes	Yes

# Political incentive

- Bottom-up pressure: downwards accountability, response to citizen needs
- Top-down pressure: upwards accountability, policy compliance
- How to test? Stronger social media effects
  - In cities with larger demand for high-quality vaccines (bottom-up)
  - In cities where local governments are more likely to face inspections (top-down).
  - in cities where local officials have a stronger career concern (top-down)

# Heterogeneous effect by city size and rank

- Metropolitan cities: top 2 tiers cities according to official classification
- High-rank cities: 4 provincial-level + 10 quasi-provincial

	Overall		Category II and Supplement	
	(1)	(2)	(3)	(4)
WeiboShock × Event	0.616*** (0.141)	0.275*** (0.093)	0.392* (0.222)	0.453*** (0.133)
Metropolitan × Event	0.372 (0.261)		0.362 (0.325)	
WeiboShock × Event × Metropolitan	-0.536*** (0.157)		-0.270 (0.218)	
High Rank × Event		0.314 (0.292)		0.092 (0.331)
WeiboShock × Event × High Rank		-0.219* (0.110)		-0.289* (0.140)
Observations	431	431	315	315
Adjusted R <sup>2</sup>	0.232	0.232	0.223	0.250
Full Baseline Controls	Yes	Yes	Yes	Yes

- Results rule out the explanation that governments directly responded to market demand – higher tier cities have larger markets.

# Career concerns of local politicians

- Politicians who are younger or in their first term have stronger career concerns and are more sensitive to public opinion
- Politicians: prefectural mayors

	Overall		Category II and Supplement	
	(1)	(2)	(3)	(4)
WeiboShock × Event	0.097 (0.089)	-0.111 (0.078)	0.204** (0.076)	-0.128 (0.139)
Pre-retirement × Event	0.681* (0.396)		1.271** (0.610)	
WeiboShock × Event × Pre-retirement	-0.212* (0.107)		-0.409** (0.155)	
First Term of Tenure × Event		-0.305 (0.273)		-0.674** (0.271)
WeiboShock × Event × First Term of Tenure		0.204** (0.090)		0.299** (0.127)
Observations	396	396	283	283
Adjusted R <sup>2</sup>	0.226	0.226	0.190	0.192
Full Baseline Controls	Yes	Yes	Yes	Yes

# Conclusion

- Main results
  - Public opinion on social media increases procedural transparency in government procurement.
  - Local governments are responsive to event-specific informational shocks instead of general social media penetration.
- Mechanism: strategic response to top-down intervention
- Shed light on the theoretical debate of whether social media are useful for monitoring in nondemocracies
- Accountability implications
  - Useful for upward accountability: policy compliance, policy coordination
  - Tendency of overreaction, costly for policies requiring local adaptation
  - Limited effect for public accountability