

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Government information disclosure and citizen coproduction
during COVID-19 in China

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Abstract

While information campaigns have been widely recognized as a pillar of public health crisis management and heightened by the current COVID-19 pandemic, an insufficient number of studies have investigated the impact of information disclosure on influencing citizen cooperation crucial for emergency management. Focusing on generic information disclosure practices during the recovery period from 19 January to 29 February 2020 in China and by employing a difference-in-difference method, this study finds that information disclosure significantly enhanced citizen coproduction as measured by aggregated search queries of COVID-19-related information, and earlier disclosure yielded greater effect more quickly. Moreover, government capacity and citizens' trust in government at the local level significantly moderate the positive impact of information disclosure. This study uncovers the novel relationship between information disclosure and citizen coproduction during emergencies in the Chinese context.

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Data Availability Statement

The replication materials of this study (the data sets and do file) are available at Harvard Dataverse (Dataset Persistent ID: [doi:10.7910/DVN/G8BMBF](https://doi.org/10.7910/DVN/G8BMBF)).

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Introduction

Information campaigns are highly recognized by practitioners and international organizations as an indispensable policy instrument in managing public health crises (Hatchett, Mecher and Lipsitch, 2007; Val Curtis et al., 2020). The Oxford COVID-19 Government Response Tracker, for example, takes public information campaigns as an important indicator of effective health policies. Information campaigns seek to provide timely and accurate public-health-related information with the purpose of changing people's attitudes and enhancing their cooperation. Democratic countries reply more heavily on information campaigns than on stringent containment and closure policies because the campaigns are less contradictory to their core values (Toshkov, Yesilkagit and Carroll, 2020). Meanwhile, authoritarian regimes can benefit from information campaigns because they can reduce the potentially high cost of stringent containment policies. Nevertheless, insufficient academic attention has been paid to the merits of information disclosure under emergency management, particularly its impact on citizens' cooperation, which is crucial for public health crisis management.

The COVID-19 pandemic provides a timely opportunity to examine the impact of government information disclosure under emergency conditions. This study examines the case of China and employs a difference-in-difference (DID) method. It reveals that critical information disclosure has substantial impact on citizen coproduction, and earlier disclosure yields greater effect more quickly. Nevertheless,

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such positive effect hinges on government capacity and citizens' trust in governments, which may negate the positive impact of information disclosure.

This study also joins the conversation on citizen coproduction. Coproduction is broadly defined as various activities wherein state actors and citizens jointly work to produce benefits (Nabatchi, Sancino and Sicilia, 2017), and it is demonstrated by regular and long-term relationships among stakeholders in a community (Bovaird, 2007). It arises due to poor government performance or shortfall of public service provision or because of the indispensable role of citizens in providing public services (Parrado et al., 2013; Voorberg et al., 2015). Conventional studies usually examine citizen coproduction in public safety programs, recreational services, cultural arts programs, health care programs, education, and environmental protection (Parrado et al., 2013; Voorberg, Bekkers and Tummers, 2015).

Health crises, such as SARS in 2003, H1N1 in 2009, and the current COVID-19 pandemic, have heightened the imperative of citizen coproduction at the collective level, which differs from conventional coproduction at the individual and group levels (Bovaird et al., 2015). The most recent literature, however, has paid insufficient attention to collective citizen coproduction in emergencies that require citizens' temporary and intensive participation and compliance (Whitaker, 1980; Cheng et al., 2020; Palumbo, 2016). Without citizens' compliance and voluntary cooperation, such as social distancing and receiving vaccinations, it will be impossible to contain the pandemic (Anderson et al., 2020). Following a small yet emerging track of literature on citizen coproduction in public health crises (Cheng et al., 2020; Steen and

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Brandsen, 2020), this study finds that government information disclosure can significantly enhance citizen coproduction in emergency management. Along this line, it contributes to a small body of literature focusing on communication in coproduction (Clark, Brudney and Jang, 2013; Li, 2020; Palumbo, 2016) and echoes a call for studies examining the relationship between information disclosure and voluntary compliance behaviors (Fu, Ma and Wu, 2020). Moreover, it provides strong evidence showing the positive role of government capacity and citizens' trust in crisis management.

Methodologically, coproduction studies are dominated by qualitative methods (Bovaird, 2007; Voorberg, Bekkers and Tummers, 2015), and quantitative methods are long overdue. Additionally, the existing measurement of citizen coproduction often relies on self-reported data (Bovaird et al., 2015; Parrado et al., 2013), but studies based on self-reported data may exaggerate the actual effect size of the relationships concerned. This study employs panel data to examine the causes of citizen coproduction in public health emergencies. Following studies that have tracked objective observable data in other disciplines (Barrios and Hochbert, 2020; Ginsberg et al., 2009), this study adopts collective search querying as the measurement of citizen coproduction, which differs from current COVID-19 studies that use self-declared data (e.g., Briscese et al., 2020; Pickup, Stecula and Linden, 2020), answering the call for observable data in examining causal relationships in coproduction studies (Awan, Esteve and Witteloostuijn, 2020).

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Information Disclosure and Citizen Coproduction During Public Health Emergencies

Government Information Disclosure

Emergencies cause a high degree of social disorder and uncertainty.

Governments may fail to actively communicate during crises, and normal communication channels are disrupted and cannot be resumed quickly. As a result, a dramatic shortfall of accurate and reliable information is the biggest issue in society, which significantly hampers citizen coproduction. Misinformation, disinformation, and rumors often occur in a crisis situation (Baekkeskov and Rubin, 2017; Freelon and Wells, 2020; Lazer et al., 2018). Moreover, fragmented and less-regulated social media may further escalate the negative impact of inaccurate information and rumors (Hameleers et al., 2020). Citizens become fearful and anxious under emergency situations (Fu, Ma and Wu, 2020) and are unable to conduct effective citizen coproduction, even if they are willing to do so. They may even believe in false information and take inappropriate actions that have detrimental effect.

In theory, government information disclosure has either a complementary or substitutive effect on citizen coproduction. For the latter, when government information disclosure does not occur, civil society may take up a dominant role in collecting and sharing important information for guiding citizens' self-rescue activities. However, such a scenario is more likely in democratic contexts where civil society is strong and government does not play a strong censorship role in information

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disclosure (Meijer, 2011). Besides, if the health crisis is nationwide or becomes a pandemic, local civil society alone is unable to overcome the crisis. By contrast, information censorship is generally strong in authoritarian countries, particularly over sensitive information that has strong social impact, including information during a public health crisis (Baekkeskov and Rubin, 2017). Civil society and grassroots organizations heavily rely on government resources and information to play their role in crisis recovery. Within this context, government information disclosure is, therefore, more likely to complement citizen coproduction, which is the focus of this paper.

At the societal level, timely information disclosure can put society on the right track to crisis recovery (Voorberg, Bekkers and Tummers, 2015). The government is considered a more reliable and capable information provider than other entities because the government has a higher capacity for collecting and analyzing crisis-related information. Government information disclosure can serve at least three important purposes. First, when the normal social order is disrupted and reliable information is in great demand (Chatfield and Reddick, 2018), the government's timely information disclosure reduces social uncertainty and public panic about the unknown (Wang and Kapucu, 2008). Second, government-provided information is the most important resource for nongovernmental organizations and grassroots organizations that want to take proper and active participation in health crises. Studies have pointed out the self-resilience capacity of citizens and civil society, and their salient role can be strengthened during the recovery phase if the government provides

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timely and accurate information (Jurgens and Helsloot, 2018). Without the information, the actions of nongovernmental organizations and citizens with goodwill may unfortunately hamper crisis recovery. Third, as the most important information provider, the government can share general yet consistent guidelines and directions with the whole society, thus generating a more coordinative environment for citizen coproduction.

At the individual level, the extent to which citizens are prepared for a public health crisis is crucial for their coproduction. Individual preparedness decisions are affected by citizens' expectation of damages, willingness to cope with public health guidelines during the crisis, and capacity to prepare (Jurgens and Helsloot, 2018; Wang and Kapucu, 2008). At the response stage, due to the high uncertainties of public health diseases, citizens tend to underestimate the threat of the given disease and thus poorly prepare for it, increasing their exposure risk and escalating the spread of the contagion. Government information disclosure enables citizens to have more accurate and reliable information about expected ramifications and enhance their willingness to take action. Further, government information disclosure may facilitate citizens' learning in a crisis by enhancing their situational awareness and elevating their skill levels and behaviors in preventing the disease (Fu, Ma and Wu, 2020; Lazer et al., 2018). The first hypothesis is made accordingly:

H1: *Compared with no government information disclosure, the condition of information disclosure produces higher levels of citizen coproduction.*

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Government Capacity and Trust in Government

While government information disclosure in emergencies is important, its impact on citizen coproduction may vary depending on the moderation of the institutional environments. In what follows, we will discuss the potential moderating impact of government capacity and citizens' trust.

The government needs to play the role of preparation facilitator effectively to amplify the impact of information disclosure (Wang and Kapucu, 2008). To produce a high level of citizen coproduction, the government should ensure that the disclosed information is distributed in a timely and effective manner to all groups of people in society. Information accessibility entails government capacity and resources, such as the availability of different channels and social platforms to disseminate the critical information and to facilitate communication among citizens. Governments are often required to deliver tailor-made information to the intended audience as a response to citizens' voluntary provision of useful local information (Chatfield and Reddick, 2018). Governments have also increasingly adopted new information technology to facilitate citizen coproduction (Clark and Brudney and Jang, 2013).

However, the general public can be overwhelmed by too much information and experience information overload during emergencies. Thus, the government has to develop careful and attractive communication campaigns, seeking to interpret and communicate key messages in an easy and user-friendly way to the general public (Jones et al., 2020). Otherwise, key messages may not be appropriately received and

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interpreted by the public. Pandemic information may also increase people's risk perception and thus increase panic. The government thus needs to develop effective communication strategies to reduce people's concern about personal safety, family pressure, and fear derived from inappropriate information disclosure (Fu, Ma and Wu, 2020).

In addition, the government plays the important role of public interest enforcer in emergency management, including fact-checking rumors and disinformation, which may be pervasive and detrimental for citizen coproduction (Wang and Kapucu, 2008; Freelon and Wells, 2020). Leaders and their staffs are responsible for closely monitoring crowdsourced information in various channels and platforms for rumors and disinformation (Hameleers et al., 2020) and taking swift action to clarify such problematic information, which often requires scientific evidence and skillful public communication strategies. Otherwise, citizens may tend to believe in rumors and discredit the information disclosed by the government, leading to some socially irrational behavior. Sometimes, the government itself produces inconsistent information (Fu, Ma and Wu, 2020). Former US President Donald Trump, for example, made very different statements from the Centers for Disease Control director, which confused the general public. Poor local policy coordination may also be a barrier to develop an effective communication strategy during emergency management for a centralized government like China (Lawson and Xu, 2007). To sum up, governments with high capacity should be able to produce coherent communications about expected behavior from citizens and thus amplify the effect of

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information disclosure (Val Curtis et al., 2020). The second hypothesis is therefore proposed:

H2: Government capacity positively moderates the impact of government information disclosure on citizen coproduction.

An equally important factor is that citizens, as the “producer” of public goods, have to trust the information provider in order to cooperate in fighting public health crises (Curtis et al., 2020; Voorberg, Bekkers and Tummers, 2015: 1343). Existing literature has highlighted the impact of trust on government performance and citizen compliance (Barrios and Hochberg, 2020). Some inconclusive evidence also shows that people with higher trust tend to have higher engagement in coproduction (Parrado et al., 2013).

The unusual nature of emergencies may reduce citizens’ expected damages from crises. Their trust in the information provider is therefore essential for taking action (Wang and Kapucu, 2008). Governments with higher public trust tend to rely more on citizens’ voluntary decision to follow recommendations on precautions such as social distancing than on launching restrictive measures with a punitive component (Toshkov, Yesilkagit and Carroll, 2020). To sum up, citizens with higher trust in their governments may believe the credibility of information disclosed and thus are more willing to coproduce.

In contrast, distrust in the government often leads to low citizen compliance (Blair, Morse and Tsai, 2017). In democratic contexts, Francis Fukuyama (2020)

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argues that “citizens must believe that their government has the expertise, technical knowledge, capacity, and impartiality to make the best available judgments;” otherwise, citizens may not comply with public health measures. Trust is also essential in authoritarian contexts. Based on observations of citizens’ resistance during the SARS epidemic in China, James Lawson and Feng Xu (2007) found that popular distrust of local authorities partly derived from citizens’ perceptions of pervasive corruption and inefficiency in the government, which may hamper citizen coproduction. Individuals who tend to distrust the political system also have a higher belief in disinformation (Freelon and Wells, 2020), suggesting that distrust may facilitate the outbreak of rumors during crises. Therefore, citizens’ trust in government can enhance the credibility of such information and make it easier for citizens to be proactive. The third hypothesis is thus proposed:

H3: Citizens’ trust in government positively moderates the impact of government information disclosure on citizen coproduction.

Case Selection and Empirical Strategies

This study selects China’s handling of the COVID-19 outbreak to test the above hypotheses. COVID-19 first broke out in Hubei province and expanded to other localities in China. Wuhan City first officially reported cases of coronavirus on 31 December 2019, and China was the main affected country until the end of February 2020. Later, COVID-19 became a pandemic, and citizens in other countries received much information from their governments and other sources, which may have

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affected their coproduction behaviors. Focusing on the early stage in China can rule out the unobserved information disclosure that may affect citizen coproduction.

Information Disclosure in China during COVID-19

Starting from 20 January 2020, when the Chinese government announced that the novel coronavirus (later known as COVID-19) was transmissible among people, the National Health Committee (NHC) began to report COVID-19 development through various channels on a daily basis. Information disclosure practices were immediately followed by provinces and local governments. Prefectures disclosed three types of critical information, including the latest coronavirus development a) at the prefectural level and b) at the city and county levels, as well as c) patients’ commuting routes. This study focuses on the disclosure of the latest coronavirus development at the county/city level by prefectures. In particular, this type of information is more important for citizens than the information at the prefectural level. Almost all prefectures had disclosed the latest COVID-19 development at that level, shortly after the disclosure practice of the NHC. Information on patients’ commuting routes may have the endogeneity issue because such information entails higher government capacity to collect, and the disclosure may be highly related to disease development. Information about daily case numbers is generic, while the latter is detailed (Fu, Ma and Wu, 2020). The disclosure of detailed information is more vulnerable to the debate over privacy information protection. By contrast, generic information disclosure has no such issue, and findings may be more generalizable to other contexts.

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Figure A.1 reports the number of prefectures starting to disclose the information across China during the studied period. After President Xi Jinping stated on 20 January that the government should disclose virus-related information in a timely manner, prefectures quickly adopted the practice. The number of disclosing prefectures peaked by 27 January. By 29 February, 217 of 302 prefectures in the sample had disclosed confirmed cases at the county level. Prefectures with higher capacity may have disclosed information earlier, which causes an endogeneity issue. To solve this concern, prefectures are divided into eastern, central, and western regions.¹ If government capacity affects the timing of information disclosure, we would see more eastern cities disclosing information earlier because eastern cities have the highest capacity, followed by central and western cities. However, Figure A.1 shows that the timing and frequency of the three regions are quite similar to each other, reducing the concern of endogeneity.

Sample Selection: 19 January to 29 February 2020

The first prefecture disclosed disease information on 21 January 2020, after the national announcement of human-to-human transmission on 20 January. January 19 was selected as the starting point because the DID estimation method requires observations to cover both the periods before and after the exogenous shock (information disclosure) for the purpose of comparison. After 29 February, COVID-19 had been effectively contained in China, as shown in Figure A.2. The peak of newly confirmed cases in provinces other than Hubei happened on 3 February, with Hubei’s peak occurring 12 February. Provinces other than Hubei only reported three

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new cases by 29 February according to the NHC. After that, only a few cases happened across the country, and the number of new cases stabilized. Thus, the selected period covers the critical recovery stage and is suitable for investigating the impact of government information disclosure.

Measurement and Data

Citizen Coproduction. Conventional studies employ both subjective (such as citizens' willingness and attitudes to coproduce) and objective indicators (such as actual activities) to measure citizen coproduction. During public health crises, citizen collective cooperation is most important. Therefore, we look for citizen coproduction indicators we can measure at the collective level and during the implementation stage and preferably reflect citizens' actual behaviors rather than attitudes. For example, social distancing activities and number of people wearing masks can be indicators of citizen coproduction. However, these real-time data were difficult or unavailable for collection, and these activities may not necessarily measure citizens' *voluntary* behavior as China launched stringent enforceable containment policies.

Recognizing the role of internet communication technology in citizen coproduction, crisis management studies often adopt online behavioral indicators, such as numbers of tweets favorited, commented on, and retweeted, and number of active users who were reached by government information disclosure, to measure citizen coproduction (Bonsón, Perea and Bednárová, 2019; Chatfield and Reddick, 2018). The underlying rationale is that these indicators show the extent to which

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government has achieved the goal of reaching out to and engaging with citizens online during crisis management. Following this track of literature, this study adopts the frequency of citizens' search queries for COVID-19 information, aggregated at the prefectural level, as the measure of coproduction. An Internet development report reveals that the Internet penetration rate is as high as 70.4% (almost 1 billion netizens) in 2020 and highlights the positive role of the Internet in fighting COVID-19 (Cyberspace Administration of China, 2021). This validates search queries as representative of citizens' coproduction behavior. Citizens' search query data were collected from the most popular search engine in mainland China, Baidu Index.² With the keyword "COVID-19" (*Xin Guan Fei Yan* in Chinese), we manually collected the data for each prefecture per day during that period. The index is weighted based on the search frequencies of the keyword "COVID-19" from both personal computers and cellphones within a prefecture, with a higher value denoting more intensive search queries.³

Government information disclosure has two important goals—information dissemination and to persuade citizens to follow a government's preventive guidelines. First, search queries directly measure the frequencies of information searching activities, capturing social attention to COVID-19 at the prefectural level. Lockdowns and stringent quarantine have made online information communication more important during the recovery stage. Moreover, an online survey in China found that as high as about 70% of respondents shared COVID-19 related information through Wechat during the recovery stage (Yan, Zhang and Zhu, 2020). The

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percentage of people who shared the information would be higher if other social media were considered as well, given the large number of netizens and rapid development of social media in China. Cities with higher search queries provide more COVID-19 information and facilitate citizens’ experiential information sharing and strengthen the social-emotional support through their online network, thereby yielding better citizen information coproduction (Meijer, 2011).⁴

Second, online searching shows how individuals “efficiently seek and absorb information” related to COVID-19 (Bento et al., 2020: 1), essentially reflecting citizens’ preparedness during the recovery stage. The public is generally less sensitive to “low-probability, high-impact” crises, which leads to poor preparation (Wang and Kapucu, 2008). People may even choose not to react when facing a real health threat if the threats of previous crises were overstated (Sherlaw and Raude, 2013). A low search query volume means little attention is being paid to the health crisis. It is difficult to imagine that people would show high cooperation and compliance if they had little care about COVID-19. By contrast, a high search query volume shows that citizens spent more time and effort in searching for related information and were more aware of the disease and thus may have better prepared to take necessary preventive actions, even activities with higher costs (Bento et al., 2020). A recent study found that Chinese citizens focus on three types of information: 1) factual information about COVID-19, 2) professional and scientific explanations of COVID-19 prevention, and 3) government recommendations and measures to fight COVID-19 (Liu, 2020). Based on an online national survey covering 371 cities in China in May 2020, researchers

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found that respondents who paid more attention to COVID-19 were more likely to donate and show higher social engagement to support anti-epidemic efforts during the recovery period (Zhao et al., 2021). This finding provides greater support for the validity of search queries as a proxy for citizen coproduction.

In addition, since search queries echo the voluntary nature of coproduction (Meijer, 2011), which is more salient in democratic contexts, the impact of generic information disclosure on voluntary citizen coproduction should be more useful in a broader context. China adopted stringent measures to limit the spread of COVID-19, including locking down some cities since late January. Citizens' compliance behaviors may be largely caused by the government's compulsory prevention measures. Methodologically, this indicator contains readily observable information, overcoming the common-method bias often found in coproduction studies (Ginsberg et al., 2009; Bento et al., 2020).

To construct the variable of information disclosure, we manually collected information for each prefecture about 1) whether it disclosed the information and 2) the assigned date to disclose the number of confirmed COVID-19 cases at the sub-prefectural level from official websites of prefecture health commissions. Data of confirmed cases and deaths from COVID-19 are from Sozdata (<http://sozdata.com/index.html>). Tibet is excluded due to missing information.

Government Capacity and Trust in Governments. Multiple indicators are used to measure government capacity and trust. The number of days spent in contract

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enforcement in resolving a commercial dispute is the first indicator of government capacity. The data are from a survey conducted by the World Bank in 2006.⁵ This variable measures the efficiency of the judicial system in enforcing contracts. The second indicator is the number of discredited people at the provincial level from the China Enforcement Discredit Website (<http://zxgk.court.gov.cn/>). This website was set up by the Supreme People's Court in 2013 and discloses a list of discredited people (*Shi Xin* in Chinese) who refused to execute judgments, together with their specific dates of discredit. The number of discredited people in 2018 aggregated at the provincial level is used as a proxy for government enforcement capacity to measure the legal capacity (Besley and Perrson, 2009). The third indicator is fiscal transparency from *China Fiscal Transparency Report 2018*, which measures the degree of fiscal transparency at the provincial level. Fiscal transparency entails concentrated effort expended on data collection, coordination, compilation, and information disclosure (Deng, Peng and Wang, 2013). The first two indicators echo the government's public interest enforcer role, whereas the last one reflects the role of preparation facilitator.

Three other indicators are used to measure trust in government. The survey 2016 China Family Panel Studies contains a question that asked the respondents: "how much do you trust local government officials," with a scale ranging from 0 (distrustful) to 10 (very trustworthy). We aggregated the average value at the provincial level as a proxy of trust. A question from a survey conducted by the Chinese Enterprise Survey System in 2001 is also used to measure citizens' trust

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(Zhang and Ke, 2003). Managers of enterprises were asked: “According to your experience, can you list the top five provinces where the enterprises are most trustworthy in order?” The share of each province mentioned as one of the most trustworthy provinces is calculated as an indicator of trust. The third indicator is trust in the legal system as evaluated in the 2006 World Bank Survey. The survey contained the following question: “How much confidence do you have that the disputes in your province will be settled with justice by the local legal system,” with the answers ranging from 0 to 100. We aggregated the answers at the provincial level as a proxy for trust.

Estimation Framework

To identify the effect of information disclosure concerning confirmed COVID-19 cases, we employ a DID estimation and use time and regional variations from 19 January 2020 to 29 February 2020. The DID estimation requires comparing search queries of prefectures before and after the disclosure with those prefectures that did not disclose the information in the same period. The final sample includes a panel of 302 prefectures, with 217 prefecture-level units eventually disclosing the information by 29 February 2020. Figure A.3 shows the number of prefectures disclosing the information within each province by 29 February. Figure A.4 shows that the accumulated number of days before the information disclosure is not associated with search queries on COVID-19, suggesting that the disclosure of information is not driven by social demand.

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Ideally, information disclosure should be randomly distributed among prefectures, where the timing of information disclosure is uncorrelated with baseline characteristics of these prefectures. Nevertheless, the above assumption cannot be realized in reality. In the absence of a randomized controlled trial, a simple DID approach is used, based on the disclosure status:

$$\text{Search query}_{it} = \alpha + \beta(\text{Disclose}_{it-1}) + \mu_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where Search query denotes the value of the Baidu Index on COVID-19 for prefecture i and day t , and Disclose_{it-1} indicates that prefecture i had disclosed the information by day $t-1$. The prefecture fixed effect, μ_i , controls for the permanent heterogeneity across prefectures, whereas the time fixed effect, γ_t , controls for day-specific shocks that are common to both disclosing and non-disclosing prefectures. The parameter β thus captures the impact of information disclosure on search queries, namely the difference between search queries before and after the disclosure between the prefectures with information disclosure and those without disclosure. If information disclosure contributes to a significant increase in search queries in disclosing prefectures as compared with non-disclosing prefectures, β is expected to be positive.

Empirical Results

The Impact of Government Information Disclosure on Collective Search

Querying

Baseline Results. Given the nonnegative integers of the dependent variable, a negative binomial model is adopted. Table 1 presents the estimates of the baseline model. A

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positive and statistically significant relationship exists between information disclosure and search querying. Column 1 includes only *Disclosure*. Disclosure in a prefecture is associated with a substantial increase in Baidu Index searches about COVID-19 as compared with non-disclosing prefectures, and the result is statistically significant at the 1% level. Column 2 includes prefectural dummy variables. Column 3 further controls both prefecture and time dummy variables. Although the estimated coefficient of the *Disclosure* variable decreases to 0.123 and 0.051, respectively, the positive impact of information disclosure remains statistically significant at the 1% level in both columns 2 and 3. The marginal effect of information disclosure is as high as 46.85% for column 3 of Table 1, supporting the first hypothesis.

Table 1 about here

Validity of the Identification Assumptions. Equation 1 is valid provided that the non-disclosing prefectures can provide valid counterfactual changes in search queries for the disclosing prefectures, had they not been affected by and conditional on covariates. Two potential issues may violate the above assumption: 1) there is a systematic difference in pre-existing trends in search query increase, and/or 2) the disclosure is associated with some unknown factors that may explain the change in search queries in the post-treatment period.

To examine the pre-existing trend, we test whether the increase in search queries occurred in correspondence with the absence of information disclosure in a prefecture or not. A flexible DID model that allows coefficients to vary from day to

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day is therefore employed. More specifically, the dummy $Disclose_{it-1}$ in Equation 1 is replaced with a full set of dummies continuing from 20 days before information disclosure to 30 days after the disclosure, with these coefficients named $\beta_{-20}, \dots, \beta_{30}$. The estimated coefficients are plotted in Figure 1 with 95-percent confidence intervals. Figure 1 clearly demonstrates that the increase in search querying at the prefectural level did not occur before disclosure of COVID-19 information. None of the coefficients for the days before the information disclosure is significantly positive. The significant positive effect of disclosure is realized three days after the disclosure. Moreover, the positive impact grows gradually in the consecutive days of disclosure after that. This result increases the validity of the identification strategy and, more importantly, indicates that earlier information disclosure yields more substantial citizen coproduction. Following the literature (La Ferrara, Chong and Duryea, 2012), we further perform a placebo test to solve the concern that the treatment effect is potentially driven by other policy changes before information disclosure, and the results passed the placebo tests. In sum, these results support the parallel-trend assumption, suggesting that the estimated coefficient is not biased.

Figure 1 about here

Robustness Test. We conducted a battery of robustness tests. First, we performed a linear analysis for the baseline models. Second, the change of the official identification standard of COVID-19 cases effective since 20 February 2020 may lead to biased estimation;⁶ thus, we excluded prefecture-day observations after 20 February 2020 from the sample. Third, Wuhan city adopted the lockdown policy

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during the study period, which may have significantly affected search querying.

Eleven cities had adopted information disclosure before the lockdown, which may have led to biased DID estimates. Thus, these 11 cities were excluded. Lastly, we replace search queries in a prefecture with the ratio of the search queries to the total queries of the province. Regression results from these additional models show that the estimated coefficients of disclosure are all positive and statistically significant.

Therefore, the main effect of information disclosure on search querying is robust to alternative measures and alternative samples.

The Positive Externality of Information Disclosure. Given that information disclosure may have externality, it is interesting to know whether the disclosure may affect the search querying in those prefectures that had not disclosed information. Two explanatory variables are constructed, namely the number of prefectures disclosing information and the share of that number to total prefectures within a province. A subsample consisting only of prefectures without information disclosure was used in Table 2. Column 1 shows a positive and statistically significant relationship between the number of prefectures disclosing information and search querying in non-disclosing prefectures. Column 2 demonstrates that the share of prefectures disclosing confirmed COVID-19 cases has positive and significant effect on search querying in those non-disclosing prefectures. Therefore, the positive externality of information disclosure on citizen coproduction is supported.

Table 2 about here

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The Moderating Effect of Government Capacity

Table 3 introduces interaction terms between Disclosure and these respective indicators of government capacity, namely the Enforcement Days (Column 1), Discredit (Column 2), and Fiscal Transparency (Column 3) to test the moderating effect of government capacity.

Table 3 about here

As expected, the interaction terms of disclosure * enforcement days and disclosure * discredit are both negatively significant, and the interaction term of disclosure * fiscal transparency is positively significant. To accurately capture the marginal effect, Figure 2 visualizes the moderating effect of enforcement days, discredit, and fiscal transparency. With the decrease of government capacity, the positive effect of information disclosure on search querying gradually decreases. The marginal effect equals zero and even becomes negative when capacity is below a certain level (roughly 312 days of enforcement days or more, or 39.1 percent of the total sample observations, and a discredit index of 8 or higher, or 42.4 percent of the sample). Similarly, when a province’s fiscal transparency is higher than 49.5 (64.2 percent of the total sample observations), the marginal effect becomes positive and increases. The consistent findings support the moderating effect of government capacity. More importantly, the positive marginal impact of information disclosure only appears when government capacity is higher than the threshold (roughly 60% of the provinces in the sample), supporting hypothesis 2.

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Figure 2 about here

The Moderating Effect of Trust in Government

Similarly, Table 4 introduces interaction terms between Disclosure and Government Trust 1, Government Trust 2, and Trust in the Legal System, respectively, and reports the results.

Table 4 about here

All coefficients of the interaction term are positive and significant at the 1% level. Figure 3 visualizes the marginal effects of information disclosure. With the decrease in government trust, the positive marginal effect of information disclosure on search querying becomes smaller. When government trust is at a certain level or higher (4.93 or higher in the first indicator or 54.6 percent of the total sample, or 68.2 or 59.6 percent of the total sample in the third indicator), the positive marginal effect appears and increases. For the second trust indicator, although the positive effect remains for most provinces, the marginal effect is significantly moderated by trust. In sum, higher government trust positively moderates the effect of information disclosure in China, supporting hypothesis 3.

Figure 3 about here

Discussion and Conclusions

Ideally, the coproduction effect of information disclosure can be further supported if it is proved that citizens actively comply with public health prevention measures after the information disclosure. During the recovery stage, two critical public health

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recommendations were made by the government, namely, wearing a mask in public and social distancing (avoiding crowding). In theory, if the impact of information disclosure holds, citizens would more frequently wear a mask in public, and their frequency of going out would be lower after the information disclosure. However, many prefectures had a severe shortfall of masks, and the data on mask sales in each prefecture and on citizens' outdoor activities are not available. It is thus difficult to directly prove the coproduction effect. Nevertheless, newly confirmed cases and the fatality rate should fall if the coproduction effect of information disclosure is present.

Following this reasoning, we further examine the impact of information disclosure on public health outputs as measured by newly confirmed cases and the number of fatalities at the prefectural level. Results are reported in Table 5. After controlling the fixed effects of both prefectures and days, information disclosure starts to have a significant negative impact on the number of newly confirmed cases four days after the disclosure. The coefficient increases and stabilizes by eight days after information disclosure and until 20 days in the sample. Table 6 reveals that information disclosure has a negative and significant association with the number of fatalities when confirmed cases and fixed effects are introduced. These results further support the coproduction effect of information disclosure.

Table 5 about here

Table 6 about here

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China has actively disclosed critical information in a top-down manner since the central authorities recognized COVID-19 as a national public health crisis on 20 January 2020. This study reveals that generic information disclosure yields substantial effect on citizen coproduction, and timely disclosure yields greater effect earlier. The disclosure also yielded positive externality among the non-disclosing prefectures and is negatively associated with newly confirmed cases and fatalities. However, the substantial effect of information disclosure is not identical for all localities. The positive effect is significantly moderated by government capacity or citizen trust at the local level. This study echoes an ongoing call for rigorous investigation of the effect of information disclosure (Fu, Ma and Wu, 2020) and provides solid behavioral evidence supporting the effectiveness of information campaigns in public health interventions in general and citizen coproduction under emergency conditions in particular (Cheng et al., 2020; Li, 2020).

This study also enriches the existing studies of government transparency. The literature on government transparency usually concentrates on transparency's impact on the side of government, including corruption, accountability, legitimacy, and trust in government under normal circumstances (Hood and Heald, 2006; Roelofs, 2019). Instead, information campaigns as a mechanism to enhance transparency under emergencies have the goal of enhancing citizens' cooperation and compliance. This study reveals that information disclosure can exert meaningful impact on citizens' behavior under public health emergencies, adding another merit to the long list attributed to government transparency.

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This study also has government policy implications. Most importantly, it empirically proves the important role of information campaigns in public health emergency management. The findings also imply that governments should think strategically about enhancing their capacities and earning citizens' trust to better manage public health crises. Local governments should invest in programs that can enhance their capacity and seek to build up mutual trust with society, grassroots organizations, and nongovernmental organizations, both of which are crucial in information campaigns and citizen coproduction (Blair, Morse and Tsai, 2017; Cheng et al., 2020).

Admittedly, the findings are drawn from empirical data from an authoritarian country. Democratic regimes usually provide sufficient information during emergencies, and they have a decentralized governance structure with a strong civil society, which may result in different effects of information disclosure on citizen coproduction, something that deserves further investigation. Nevertheless, given the positive impact of information disclosure we found and that generic information disclosure is politically acceptable regardless of the political regime, future studies along this line are warranted. For example, the relationship between government information production and citizen coproduction may be substitutive rather than complementary in democratic contexts. Besides, this study only focuses on a critical yet short recovery period. With the disappearance of citizens' sense of urgency for public health crises, the effect of information disclosure may be reduced or even disappear, calling for future investigation on how to maintain citizen coproduction in

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the long run (Bento et al., 2020; Steen and Brandsen, 2020). Methodologically, data from Baidu Index may not be valid to examine citizen coproduction beyond China, which may constrain the external validity. Thus, future studies should employ multiple sources of observable data to investigate the relationship between information disclosure and citizen coproduction in public health crises.

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Endnotes

- ¹ Prefectures are divided according to the decisions from the National People’s Congress of China. Western regions include 12 provinces; central, eight provinces; and eastern, 11 provinces.
- ² According to the ranking of Alexa, Baidu is the third-best search engine in the world, following Google and Yahoo. However, Baidu has a much larger number of accounts than the other two engines in mainland China. The majority of Chinese use Baidu to search for information through the Internet.
- ³ Baidu Index may be affected by the population of a prefecture. However, we adopted the daily data, and the population was constant over this short period. The prefecture fixed effects thus have controlled the potential impact of population on the Index.
- ⁴ People may use the search engine to reinforce their skepticism and then show lower cooperation to governments’ public health recommendations, as shown in some democratic contexts (Freelon and Wells, 2020). However, in China, information dissemination about COVID-19 is strictly controlled by the government, and mainstream information on the Internet is scientific knowledge of COVID-19 and government recommendations. Information criticizing the government and persuading others not to cooperate does not survive long in China. Therefore, falsifying government information and finding evidence to support their anti-cooperative behavior are not common reasons for search queries in China.

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⁵ The World Bank provides the capital city-level days of contract enforcement in 2006. We assign the same value for the contract enforcement days in the capital city to the same province.

⁶ The NHC promulgated the sixth pilot version of diagnoses and treatment for COVID-19 cases, which made significant changes in various aspects, including an updated standard to confirm COVID-19 cases.

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References

Anderson, Roy M., Hans Heesterbeek, Don Klinkenberg, and T. Déirdre

Hollingsworth. 2020. "How will Country-Based Mitigation Measures Influence the Course of the COVID-19 Epidemic?" *The Lancet* 395 (10228): 931-934.

Awan, Sahar, Marc Esteve, and Arjen van Witteloostuijn. 2020. "Talking the Talk, but Not Walking the Walk: A Comparison of Self-Reported and Observed Prosocial Behavior." *Public Administration*. DOI: 10.1111/padm.12664.

Baekkeskov, Erik, and Olivier Rubin. 2017. "Information Dilemmas and Blame-Avoidance Strategies: From Secrecy to Lightning Rods in Chinese Health Crises." *Governance* 30 (3): 425-443.

Barrios, John M., and Yael Hochberg. 2020. *Risk Perception Through the Lens of Politics in the Time of the COVID-19 Pandemic*. No. w27008. Available online at <https://www.nber.org/papers/w27008>.

Bento, Ana I., Thuy Nguyen, Coady Wing, Felipe Lozano-Rojas, Yong-Yeol Ahn, and Kosali Simon. 2020. "Evidence from Internet Search Data Shows Information-seeking Responses to News of Local COVID-19 Cases." *Proceedings of the National Academy of Sciences* 117 (21): 11220-11222.

Besley, Timothy, and Torsten Persson. 2009. "The Origins of State Capacity: Property Rights, Taxation, and Politics." *American Economic Review* 99 (4): 1218-44.

Blair, Robert A., Benjamin S. Morse, and Lily L. Tsai. 2017. "Public health and public trust: Survey evidence from the Ebola Virus Disease epidemic in Liberia." *Social Science & Medicine* 172: 89-97.

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Bonsón, Enrique, David Perea, and Michaela Bednárová. 2019. "Twitter as a Tool for

Citizen Engagement: An Empirical Study of the Andalusian Municipalities."

Government Information Quarterly 36 (3): 480-489.

Bovaird, Tony. 2007. "Beyond Engagement and Participation: User and Community

Coproduction of Public Services." *Public Administration Review* 67 (5): 846-

860.

Bovaird, Tony, G. G. Van Ryzin, Elke Loeffler and S. Parrado. 2015. "Activating

Citizens to Participate in Collective Co-production of Public Services." *Journal*

of Social Policy 44 (1): 1-23.

Briscese, Guglielmo, Nicola Lacetera, Mario Macis, and Mirco Tonin. 2020.

Compliance with COVID-19 Social-Distancing Measures in Italy: The Role of

Expectations and Duration. No.w26916. Available online at

<https://www.nber.org/papers/w26916>.

Chatfield, Akemi Takeoka, and Christopher G. Reddick. 2018. "All Hands on Deck to

Tweet #Sandy: Networked Governance of Citizen Coproduction in Turbulent

Times." *Government Information Quarterly* 35 (2): 259-272.

Cheng, Yuan, Jianxing Yu, Yongdong Shen, and Biao Huang. 2020. "Coproducting

Responses to COVID-19 with Community-based Organizations: Lessons from

Zhejiang Province, China." *Public Administration Review*. DOI:

10.1111/puar.13244.

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Clark, Benjamin Y., Jeffrey L. Brudney, and Sung-Gheel Jang. 2013. "Coproduction of Government Services and the New Information Technology: Investigating the Distributional Biases." *Public Administration Review* 73 (5): 687-701.

Curtis, Valerie, Robert Dreibelbis, Myriam Sidibe, Jason Cardosi, Jennifer Sara, Chris Bonell, Kaposo Mwambuli, Soma Ghosh Moulik, Sian White, Robert Aunger. 2020. *Strategic Thinking in a Pandemic: A Blueprint for Government-led National Hygiene Communication Campaigns to Combat COVID-19*. Available online at <https://www.preprints.org/manuscript/202005.0042/v2>.

Cyberspace Administration of China. 2021. *China Internet Network Information Center Releases the 47th Report on the China's Internet Development*. Available at: http://www.cac.gov.cn/2021-02/03/c_1613923422728645.htm.

Deng, Shulian, Jun Peng, and Cong Wang. 2013. "Fiscal Transparency at the Chinese Provincial Level." *Public Administration* 91 (4): 947-963.

Freelon, Deen, and Chris Wells. 2020. "Disinformation as Political Communication." *Political Communication* 37 (2): 145-156.

Fu, Yang, Weihong Ma, and Jinjin Wu. 2020. "Fostering Voluntary Compliance in the COVID-19 Pandemic: An Analytical Framework of Information Disclosure." *The American Review of Public Administration* 50 (6-7): 685-691.

Fukuyama, Francis. 2020. "The Thing that Determines a Country's Resistance to the Coronavirus." *The Atlantic*. Available online at <https://www.theatlantic.com/ideas/archive/2020/03/thing-determines-how-well-countries-respond-coronavirus/609025/>.

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Ginsberg, Jeremy, Matthew H. Mohebbi, Rajan S. Patel, Lynnette Brammer, Mark S.

Smolinski, and Larry Brilliant. 2009. "Detecting Influenza Epidemics Using Search Engine Query Data." *Nature* 457 (7232): 1012-1014.

Hameleers, Michael, Thomas E. Powell, Toni G.L.A. Van Der Meer, and Lieke Bos.

2020. "A Picture Paints a Thousand Lies? The Effects and Mechanisms of Multimodal Disinformation and Rebuttals Disseminated via Social Media." *Political Communication* 37 (2): 281-301.

Hatchett, Richard J., Carter E. Mecher, and Marc Lipsitch. 2007. "Public Health

Interventions and Epidemic Intensity during the 1918 Influenza Pandemic." *Proceedings of the National Academy of Sciences* 104 (18): 7582-7587.

Hood, Christopher, and David Heald. 2006. *Transparency: The key to better governance?* Volume 135. Oxford University Press for The British Academy.

Jurgens, Manon, and Ira Helsloot. 2018. "The Effect of Social Media on the Dynamics of (Self) Resilience During Disasters: A Literature Review." *Journal of Contingencies and Crisis Management* 26 (1): 79-88.

La Ferrara, Eliana, Alberto Chong, and Suzanne Duryea. 2012. "Soap Operas and Fertility: Evidence from Brazil." *American Economic Journal: Applied Economics* 4 (4): 1-31.

Lawson, James, and Feng Xu. 2007. "SARS in Canada and China: Two Approaches to Emergency Health Policy." *Governance* 20 (2): 209-232.

Lazer, David M. J., Matthew A. Baum, Yochai Benkler, Adam J. Berinsky, Kelly M.

Greenhill, Filippo Menczer, Miriam J. Metzger, Brendan Nyhan, Gordon

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Pennycook, David Rothschild, Michael Schudson, Steven A. Sloman, Cass R.

Sunstein, Emily A. Thorson, Duncan J. Watts, and Jonathan L. Zittrain. 2018.

"The Science of Fake News." *Science* 359 (6380): 1094-1096.

Li, Huafang. 2020. "Communication for Coproduction: A Systematic Review and

Research Agenda." *Journal of Chinese Governance* 5 (1): 110-135.

Liu, Shaojie. 2020. "Information Preference and the Dissemination Effect of the

Online Networked Emotions and Attitudes of Citizens." *Academics* (In Chinese)

261 (2): 50-67.

Meijer, Albert J. 2011. "Networked Coproduction of Public Services in Virtual

Communities: From a Government-centric to a Community Approach to Public

Service Support." *Public Administration Review* 71 (4): 598-607.

Nabatchi, Tina, Alessandro Sancino, and Mariafrancesca Sicilia. 2017. "Varieties of

Participation in Public Services: The Who, When, and What of

Coproduction." *Public Administration Review* 77 (5): 766-776.

Palumbo, Rocco. 2016. "Contextualizing Co-production of Health Care: A Systematic

Literature Review." *International Journal of Public Sector Management* 29 (1):

72-90.

Parrado, Salvador, Gregg G. Van Ryzin, Tony Bovaird, and Elke Löffler. 2013.

"Correlates of Co-production: Evidence from a Five-nation Survey of

Citizens." *International Public Management Journal* 16 (1): 85-112.

Pickup, Mark, Dominik Stecula, and Clifton van der Linden. 2020. "Novel

Coronavirus, Old Partisanship: COVID-19 Attitudes and Behaviors in the United

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

States and Canada." *Canadian Journal of Political Science/Revue Canadienne De Science Politique* 1-10.

Roelofs, Portia. 2019. "Transparency and Mistrust: Who or What Should be Made Transparent?" *Governance* 32 (3): 565-580.

Sherlaw, William, and Raude Jocelyn. 2013. "Why the French did not choose to panic: A dynamic analysis of the public response to the influenza pandemic." *Sociology of Health & Illness* 35 (2): 332-344.

Steen, Trui, and Taco Brandsen. 2020. "Co-production during and after the COVID-19 Pandemic: Will it last?" *Public Administration Review* 80 (5): 851-855.

Toshkov, Dimiter, Kutsal Yesilkagit, and Brendan Carroll. 2020. "Government Capacity, Societal Trust, or Party Preferences? What Accounts for the Variety of National Policy Responses to the COVID-19 Pandemic in Europe?" Available online at <https://osf.io/7chpu>.

Voorberg, William H., Viktor J. J. M. Bekkers, and Lars G. Tummers. 2015. "A Systematic Review of Co-creation and Co-production: Embarking on the Social Innovation Journey." *Public Management Review* 17 (9): 1333-1357.

Wang, XiaoHu, and Naim Kapucu. 2008. "Public Complacency under Repeated Emergency Threats: Some Empirical Evidence." *Journal of Public Administration Research and Theory* 18 (1): 57-78.

Whitaker, Gordon P. 1980. "Coproduction: Citizen Participation in Service Delivery." *Public Administration Review* 40 (3): 240-246.

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Yan, Wenjie, Junfang Zhang, and Yangshu Zhu. 2020. "Media's News Quality Control and Their Social Impact in a High-choice Media Environment." *News and Writing* (In Chinese) 8: 31-42.

Zhang, Weiying, and Rongzhe Ke. 2003. "Trust in China: A Cross-regional Analysis." Available online at <http://dx.doi.org/10.2139/ssrn.577781>.

Zhao, Hongjun, Jiaxin Shi, Baiguan Zuo, Xiaohui Yang, and Na Chen. 2021. "The Effectiveness and Experience of China's COVID-19 Prevention and Governance." *Social Sciences in Shenzhen* (In Chinese) 4 (1): 5-17.

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Tables

TABLE 1 Disclosure of confirmed COVID-19 cases and the search queries

Dependent variable	Search query		
	(1)	(2)	(3)
Disclosure	0.2987*** (0.0304)	0.1232*** (0.0187)	0.0508*** (0.0146)
Prefecture dummy	No	Yes	Yes
Day dummy	No	No	Yes
Obs.	12,382	12,382	12,382

Note: Robust standard errors are in parentheses. *p< 0.10, **p< 0.05, ***p<0.01.

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TABLE 2 The impact of information disclosure on search queries in prefectures

without information disclosure

Dependent variable	Search query	
	(1)	(2)
Number of prefectures disclosing the information in a province	0.0178*** (0.0024)	
Ratio of disclosing prefectures in a province		0.1546*** (0.0373)
Prefecture	Yes	Yes
Day	Yes	Yes
Obs.	5,682	5,682

Note: Robust standard errors are in parentheses. *p< 0.10, **p< 0.05, ***p<0.01. Prefectures

disclosing information are excluded in Table 2. Search query measures the Baidu Index for these prefectures without information disclosure.

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TABLE 3 The moderating effect of government capacity

Dependent variable	Search query		
	(1)	(2)	(3)
Disclosure	0.2906*** (0.0299)	0.4033*** (0.0504)	-0.1366*** (0.0403)
Disclosure*Enforcement days	-0.0825*** (0.010)		
Disclosure*Discredit		-0.0456*** (0.0063)	
Disclosure* Fiscal transparence			0.0036*** (0.0007)
Prefecture dummy	Yes	Yes	Yes
Day dummy	Yes	Yes	Yes
Obs.	12,382	12,382	12,382

Note: Robust standard errors are in parentheses. *p< 0.10, **p< 0.05, ***p<0.01.

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TABLE 4 The moderating effect of trust in government

Dependent variable	Search query		
	(1)	(2)	(3)
Disclosure	-1.5162*** (0.1342)	0.0253 (0.0154)	-1.0651*** (0.1169)
Disclosure*Government trust1	0.3213*** (0.0266)		
Disclosure*Government trust2		0.0132*** (0.0026)	
Disclosure*Trust in the legal system			0.0160*** (0.0016)
Prefecture dummy	Yes	Yes	Yes
Day dummy	Yes	Yes	Yes
Obs.	11,070	12,382	12,382

Note: Robust standard errors are in parentheses. *p< 0.10, **p< 0.05, ***p<0.01.

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TABLE 5 The impacts of information disclosure on newly confirmed cases: Different impacts in 20 days after the disclosure

Dependent variable	Confirmed	F. Confirmed	F2. Confirmed	F3. Confirmed	F4. Confirmed	F5. Confirmed	F6. Confirmed	F7. Confirmed	F8. Confirmed	F9. Confirmed	F10. Confirmed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Disclose	0.0505 (0.0312)	0.0110 (0.0291)	0.0139 (0.0276)	-0.0253 (0.0263)	-0.0549** (0.0253)	-0.0534** (0.0245)	-0.0965*** (0.0240)	-0.1157*** (0.0235)	-0.1468*** (0.0232)	-0.1641*** (0.0231)	-0.1702*** (0.0230)
Constant	-0.0275 (0.0411)	0.0005 (0.0404)	-0.0016 (0.0398)	0.0263 (0.0394)	0.0471 (0.0391)	0.0457 (0.0388)	0.0732* (0.0385)	0.0828** (0.0381)	0.1014*** (0.0378)	0.1121*** (0.0377)	0.1153*** (0.0374)
Prefecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	9,700	9,700	9,700	9,700	9,697	9,692	9,576	9,411	9,211	8,981	8,738
R-squared	0.306	0.306	0.306	0.306	0.307	0.307	0.312	0.319	0.327	0.330	0.335
Dependent variable	F11. Confirmed	F12. Confirmed	F13. Confirmed	F14. Confirmed	F15. Confirmed	F16. Confirmed	F17. Confirmed	F18. Confirmed	F19. Confirmed	F20. Confirmed	
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	
Disclose	-0.1666*** (0.0229)	-0.1588*** (0.0228)	-0.1702*** (0.0228)	-0.1703*** (0.0228)	-0.1628*** (0.0227)	-0.1651*** (0.0225)	-0.1455*** (0.0224)	-0.1465*** (0.0223)	-0.1476*** (0.0221)	-0.1549*** (0.0220)	
Constant	0.1123*** (0.0372)	0.1048*** (0.0369)	0.1117*** (0.0366)	0.1115*** (0.0362)	0.1071*** (0.0358)	0.1101*** (0.0351)	0.0980*** (0.0346)	0.1004*** (0.0341)	0.1019*** (0.0333)	0.1071*** (0.0326)	
Prefecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Obs.	8,486	8,226	7,965	7,695	7,413	7,128	6,845	6,562	6,274	5,985	
R-squared	0.337	0.336	0.334	0.336	0.329	0.324	0.312	0.299	0.281	0.262	

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Note: Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. $F(n)$ denotes the newly confirmed cases after n days of information disclosure. The dependent variable is $\ln(\text{newly confirmed cases} + 1)$.

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TABLE 6 The impact of information disclosure on fatalities

Dependent variable	Fatality		
	(1)	(2)	(3)
Disclosure	-0.1540*** (0.0506)	-0.1457*** (0.0152)	-0.0777*** (0.0152)
Confirmed	0.2338*** (0.0322)	0.2282*** (0.0045)	0.3597*** (0.0085)
Prefecture		Yes	Yes
Day			Yes
Constant	-0.3561*** (0.0546)	-0.3488*** (0.0117)	-0.7906*** (0.0334)
R Square	0.2437	0.2437	0.2941
Observations	9,735	9,735	9,735

Note: Robust standard errors are in parentheses. *p< 0.10, **p< 0.05, ***p<0.01. The dependent variable is Ln (fatalities +1).

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

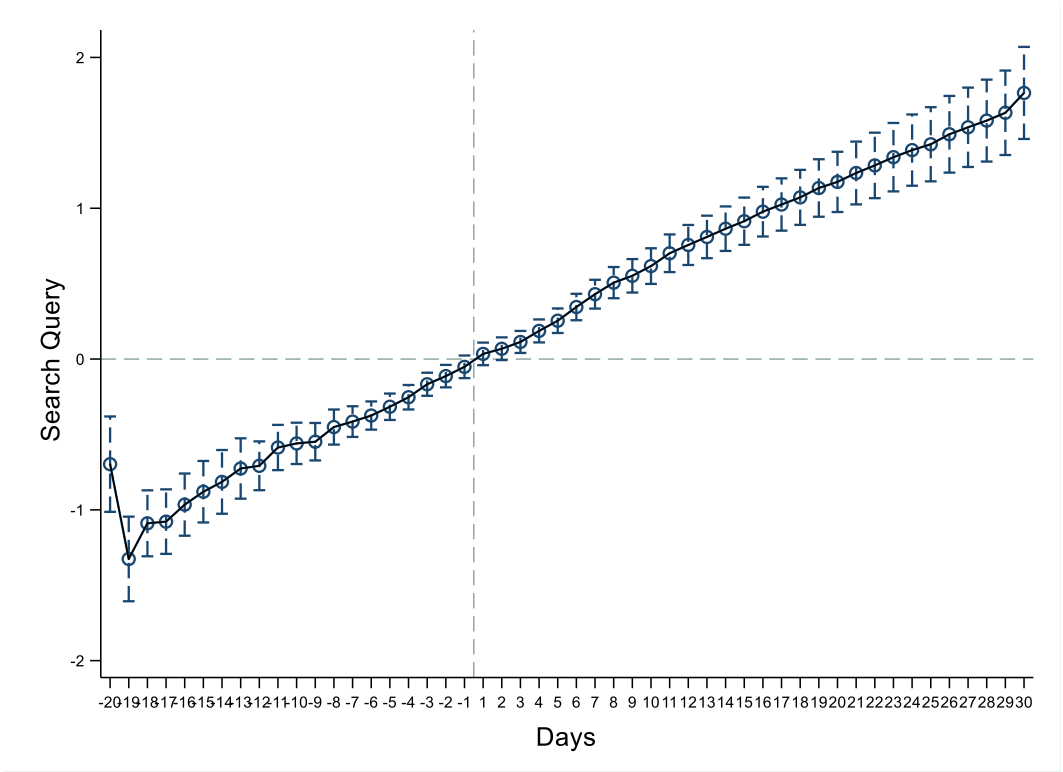


FIGURE 1. Treatment effects of information disclosure on search queries each day

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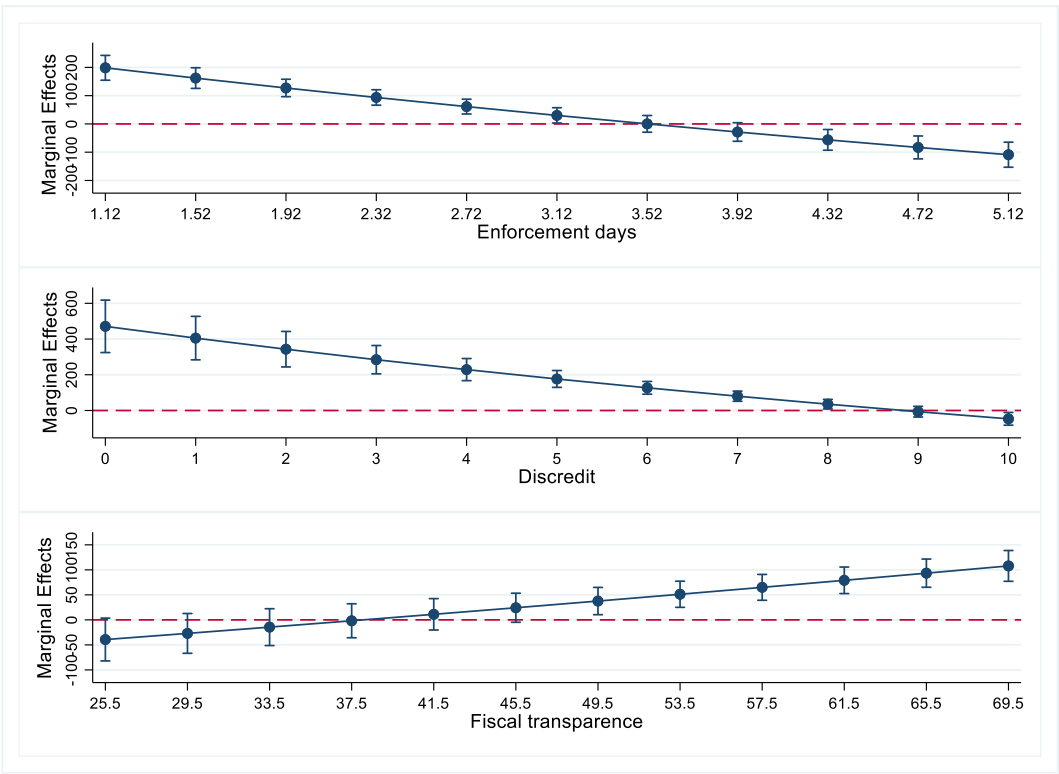


FIGURE 2 The moderating impact of government capacity

Note: These three figures are based on columns 1 to 3 of Table 3, respectively, with 95% confidence intervals.

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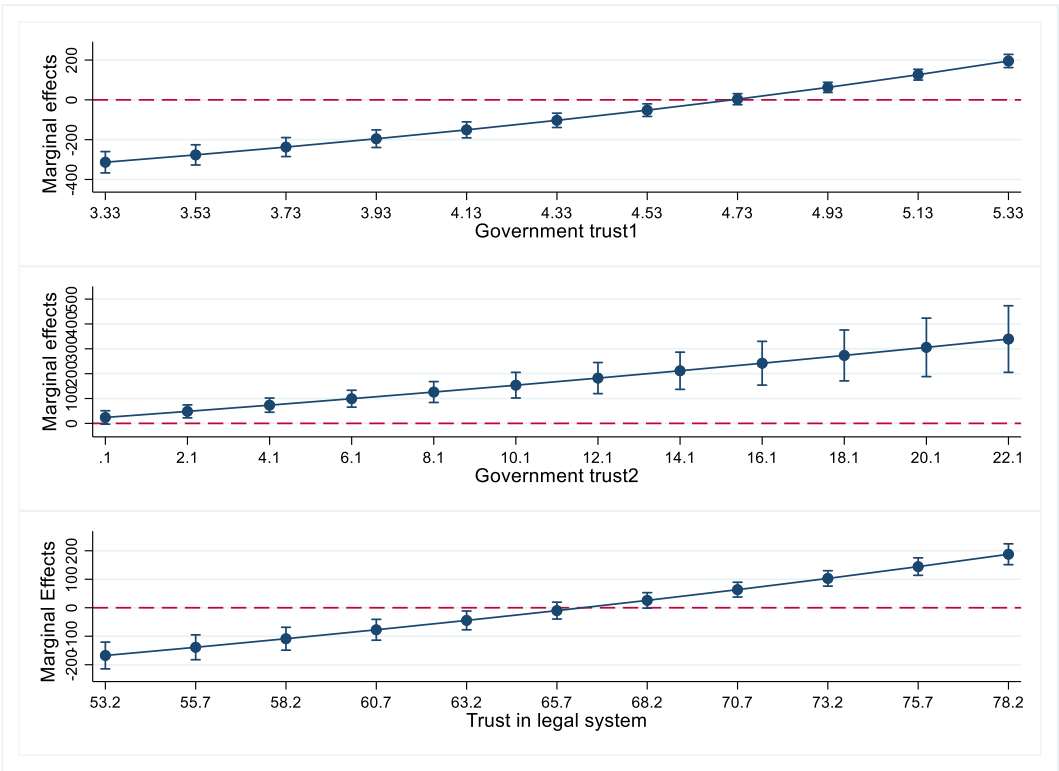


FIGURE 3 The moderating impact of trust

Note: These figures are based on columns 1 to 3 of Table 4, with 95% confidence intervals.

Wu Y.P., Xiao H.Y. & Yang F. (2021) Government information disclosure and citizen coproduction during COVID-19 in China. *Governance*. Forthcoming.

Appendixes

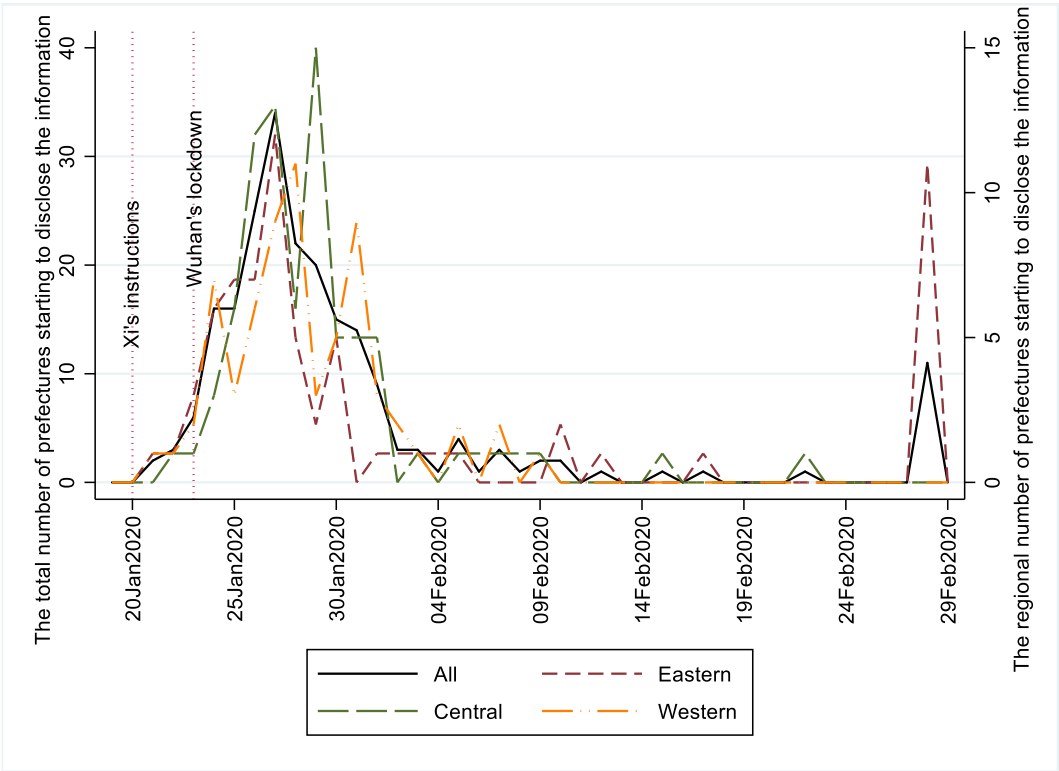


FIGURE A.1 The number of prefectures starting to disclose COVID-19 information at the country/city level per day from 20 January to 29 February 2020

Note: The total number of prefectures refers to the left y-axis, and the three regional numbers of prefectures refer to the right y-axis.

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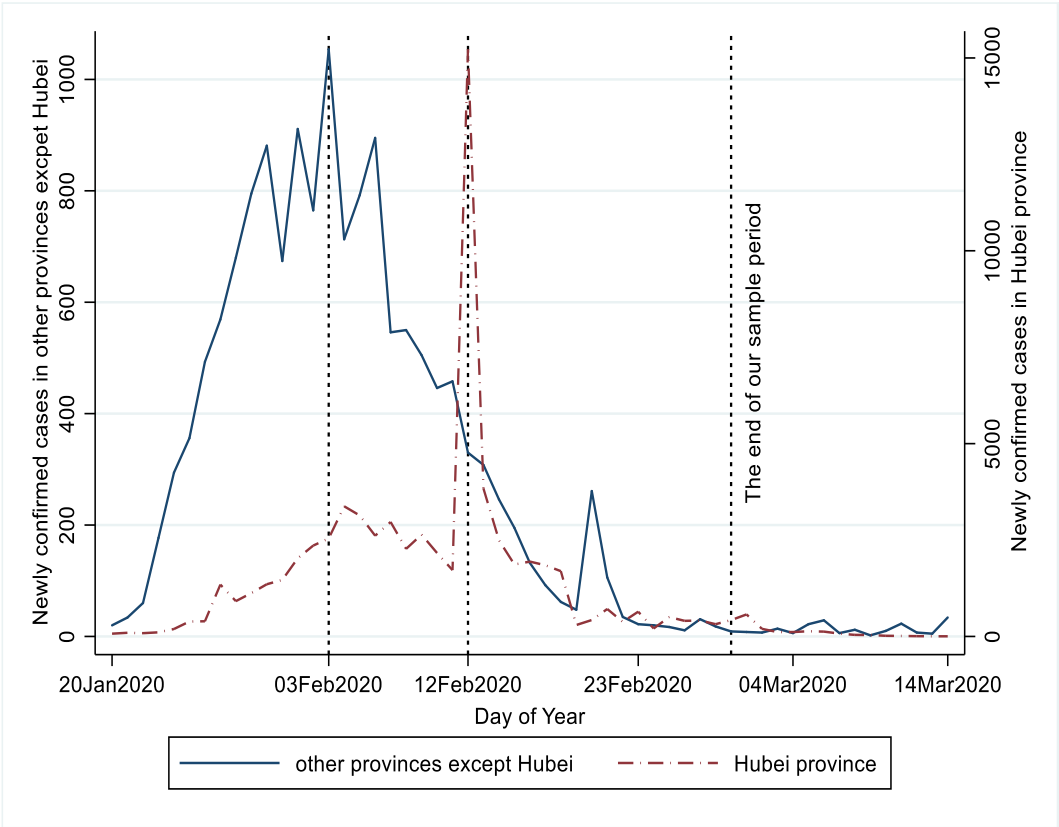


FIGURE A.2 Newly confirmed cases of COVID-19 in Hubei and other provinces in China

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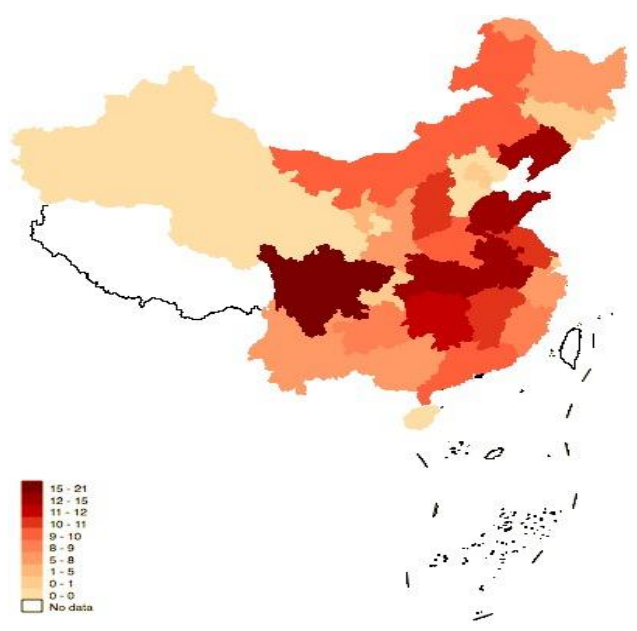


FIGURE A.3 The number of prefectures disclosing confirmed COVID-19 cases in each province by 29 February 2020

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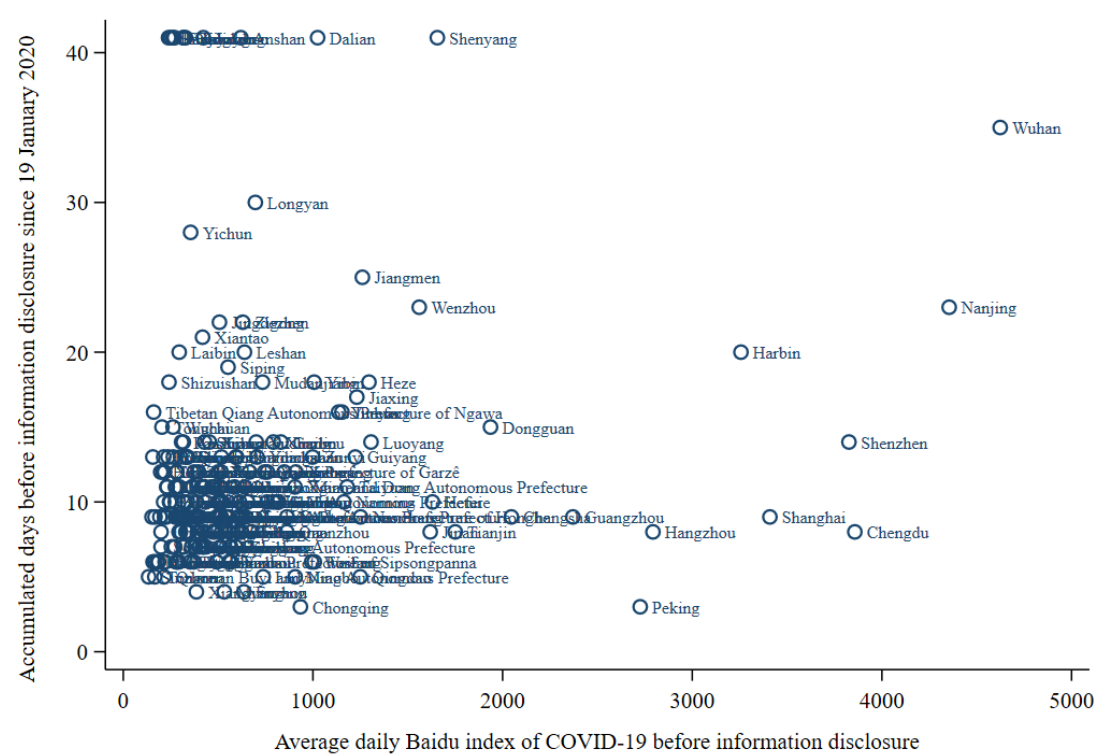


FIGURE A.4 Accumulated days before information disclosure and the average daily Baidu index of COVID-19 in prefectures since 19 January 2020

Note: The Y axis shows the accumulated days before disclosing information since 19 January 2020. The X axis denotes the average daily Baidu index of Covid-19 for these prefectures during this period. For example, Wuhan city disclosed its confirmed cases information at the county level on 22 February; the accumulated days are thus 35 since 19 January. The X axis (4624) denotes its average daily Baidu Index for these 34 days. We ran regression analysis and found an insignificant association between accumulated days and search queries before information disclosure.