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Shifting Gears Amid COVID-19: Information Availability, Pandemic Imprints and Firms' PPE Production

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ABSTRACT We examine the role of available information in imprinting processes and investigate how a significant environmental shock can have long-lasting effects on the future decision-making of corporate leaders. We argue that information about local infection rates of Severe Acute Respiratory Syndrome (SARS) in 2003 left a pandemic imprint on those who were young adults at that time. The more strongly imprinted corporate leaders would then be more alert to and respond faster to the COVID-19 outbreak in 2020, a new but similar infectious disease. We study this connection by examining a sample of Chinese publicly traded firms' initiation of personal protective equipment (PPE) production. We further argue that past informational factors, such as media sentiment regarding the SARS outbreak in 2003, and more recent contemporary informational factors, such as media sentiment about COVID-19 and online-reported population mobility from Wuhan, China, where the COVID-19 outbreak started, influenced the strength of the imprinting effects. Results support our hypotheses, and we discuss contributions to imprinting theory as well as the literature on media in authoritarian regimes.

Keywords: imprinting, upper echelons, information, China, COVID-19

INTRODUCTION

Research on imprinting has shown the long-lasting influence of CEOs' earlier experiences on the future behaviour of the firms they lead (e.g., Marquis and Qiao, 2020; Schoar and Zuo, 2017). However, most existing research has taken the imprinting process as a given (Simsek et al., 2015), leading to 'a risk that imprinting will become a meaningless umbrella concept' (Marquis and Tilcsik, 2013, p. 194). To unpack how individuals

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transform external environmental features into organizational imprints, researchers have started to examine how corporate leaders' imprinting is, at least in part, influenced by their information processing (Terbeck et al., 2022), however, significant questions remain about the underlying processes whereby exposure to different types of information affects lasting imprints.

For instance, previous work has typically relied on indirect proxies, such as CEO age, belonging to certain groups, the severity of events, or other experiences, to assess exposure to different types of information (e.g., Law and Zuo, 2021; Li et al., 2023; O'Sullivan et al., 2021; Wang et al., 2019). For a more nuanced and accurate assessment of the effects of available information on imprinting, it is essential to understand the specific content of the information. Furthermore, prior studies have mainly considered the context during a single time period, typically during the initial imprint formation. Little is known about whether and how the correspondence of information available both at the time of the imprint, and later when the imprint is expressed influences imprinting processes. Considering these limitations allows us to better address a significant question that remains unanswered in the literature: Why do individuals who have experienced the same events during sensitive life periods – an important element of the imprinting argument – establish imprints with varying levels of strength (e.g., Simsek et al., 2015; Wang et al., 2019)?

The two serious coronavirus outbreaks in China in the last 20 years serve as an appropriate setting to test our theory and advance understanding of imprinting for several reasons. In 2003, China experienced a Severe Acute Respiratory Syndrome (SARS) outbreak and then COVID-19, which started in early 2020 (Yang et al., 2020). During these pandemics, the Chinese government and its agencies – such as the media – implemented heightened information control measures, with all pandemic-related information and its release strictly controlled (Chang et al., 2022). While there may be some questions about the accuracy of data in China, these concerns do not affect our theorizing and testing, which rest on understanding the information individuals are exposed to. In fact, focusing on this context also brings attention to effects of information reliability, which is increasingly important globally given the growing spread of misinformation in mass media and the rise of authoritarian systems that systematically constrain information flows (e.g., Douai, 2019; Southwell and Thorson, 2015).

One notable business decision that firms faced during the early stages of COVID-19 was whether to pivot to produce personal protective equipment (PPE) (Peng and Kathuria, 2021). Although COVID-19 created significant challenges to medical supply chains that led to a PPE shortfall, if the virus was quickly contained, firms that shifted their production might be left with a surplus of unneeded equipment. The absence of information and substantial uncertainty surrounding the emerging pandemic could impede traditional strategic approaches, and at such times, prior research has shown that corporate leaders' quick decisions are influenced by their existing cognitive patterns and mental models, which are likely derived from previous imprints (e.g., Hambrick, 2007; Immelmann, 1975). Therefore, firms' initiation of PPE production provides a useful setting in which to examine imprinting by focusing on how firms' initial responses to COVID-19 reflect their leaders' prior imprints. We also discuss our investigation of alternative responses.

We argue that if corporate leaders were early adults during the SARS pandemic and in areas where local infections were reported as higher, they would establish a stronger and more lasting perception about the pandemic's severity. We predict that the varying strength of such pandemic imprints would shape how attuned they were to a subsequent similar event – i.e., COVID-19 – and influence their firms' decisions and responses, such as initiating PPE production.

Furthermore, we examine how imprint manifestation may vary depending on media coverage and other available information flows across different time periods. Specifically, we examine the influence of media sentiment about SARS during the imprint-formation period. During the more recent imprint-expression period, we examine the effects of media sentiment about COVID-19 as well as online-reported population mobility from Wuhan. We tested our hypotheses on a longitudinal sample of publicly traded Chinese firms and hand-collected information on their leaders' pandemic imprints and initial responses at the beginning of the COVID-19 pandemic.

We contribute to the existing literature in several ways. First, we extend imprinting theory by more clearly showing the role of available information across different time periods in imprinting processes. Our imprinting model helps explain why the strength of imprints may vary among individuals with the same experiences, which is an understudied area (e.g., Simsek et al., 2015; Wang et al., 2019). Building on existing imprinting studies (Marquis and Tilcsik, 2013), we also further consider the importance of sensitive periods (early adulthood in our context), one necessary element in the imprinting process, to understand the potential enduring effects of early exposure to public discourse.

A growing body of literature has focused on state-controlled media and how media censorship in authoritarian regimes influences individuals' knowledge and political attitudes (e.g., Chen and Yang, 2019; Zheng and Wang, 2020). However, it remains unclear whether the effects of government propaganda and censoring will persist or backfire in the long run. While conventional wisdom predicts that economic and technological development will gradually foster democracy and press freedom (e.g., Fukuyama, 1992), drawing on imprinting theory, our study suggests that propaganda effects in these contexts can be long lasting – particularly if individuals experience such propaganda during influential life periods.

THEORETICAL BACKGROUND

Imprinting is a process whereby salient external environmental features during sensitive periods persistently affect individuals' subsequent decisions and behaviours (Marquis and Tilcsik, 2013). The concept of sensitive periods, which refer to time periods when individuals are especially susceptible to external influence, was first introduced by embryologist Charles Stockard (1921). The theory was then famously adopted by Konrad Lorenz (1935), who showed that baby geese would follow him like their mother if they first saw him after hatching. In this case, the sensitive time period is when baby geese first see another creature and thus become imprinted.

Prior studies in many fields such as accounting (e.g., Schoar and Zuo, 2017), entrepreneurship (e.g., Hallen, 2008), finance (e.g., Bernile et al., 2017), management (e.g., Tilcsik, 2014), psychology (e.g., Arnett and Tanner, 2016), sociology (e.g., Johnson, 2007), and even neurology (e.g., Knudsen, 2004) have consistently shown that experiences during sensitive periods are especially influential later in life. During these periods, individuals are prone to adopt prominent environmental features, and establish relatively inert cognitive patterns and mental models, which 'resist extinction to a high degree' (Immelmann, 1975, p. 22).

Research has focused on early adulthood as one common sensitive period and explored why individual experiences during that time can generate persistent influence (Arnett, 2000; Berzin and De Marco, 2010). Specifically, early adulthood is a crucial transition period when many people experience a series of life-altering events including higher education, a first job, romantic partnerships, marriage, and parenthood (Arnett et al., 2014; Nelson and Barry, 2005). During these key role transitions, early adults explore and solidify their identities and beliefs, leading to 'imprinted' mindsets that persist in subsequent periods (Arnett and Tanner, 2016; Nelson and Barry, 2005). For instance, prior work has shown that when individuals find their first job and become socialized into an organization, they develop 'taken-for-granted assumptions, beliefs, and worldviews', leading to deep imprints that last throughout their lives (Higgins, 2005, p. 10). Such first-job imprints can enduringly shape individuals' working styles (Schoar and Zuo, 2017) and subsequent job performance (Tilcsik, 2014).

However, most previous research, as we noted, has taken the imprinting process for granted and/or relied on indirect proxies of information, resulting in limited knowledge of how exposure to information can transform into organizational imprints (e.g., Simsek et al., 2015; Wang et al., 2019). To address these limitations, we examine both the content and tenor of information and investigate how corporate leaders' imprints are shaped by information they are exposed to, and how later information can result in variation in how an imprint is subsequently manifested.

Our imprinting model thus includes dynamics across two crucial time periods. First, we focus on the initial imprint-formation period and examine the role of media – a significant and direct information provider – in shaping the strength of imprints. Second, we examine informational factors in the contemporary imprint-manifestation period and consider their interplay with information available at the time of the imprint. Research has revealed that individual characteristics will manifest as expressive behaviours only when relevant informational cues are present (Lievens et al., 2008). As such, imprint-relevant information embedded in current environments plays a crucial role in evoking imprints and stimulating them into action. In other words, the same imprint may lead to varying behaviours depending on a later informational environment.

We follow a well-established research tradition of examining how leaders' characteristics can affect firm-level processes (e.g., Gupta et al., 2017; Zhang et al., 2022; Zhu and Chen, 2014). For non-western settings in particular, prior studies have shown that key corporate decision-makers, such as CEOs and board chairs, play an especially significant role in shaping and influencing firm decisions (Marquis and Qiao, 2022; Peng et al., 2007). Our research also complements prior studies which have mostly examined

Western contexts, and so contributes to a better understanding of management globally (Wickert et al., 2024).

We develop hypotheses regarding how corporate leaders' pandemic imprints influenced their decisions of whether to produce PPE in response to COVID-19. Our model unpacks varying expressions of corporate leaders' imprints by outlining past imprint-formation and present imprint-manifestation conditions. We summarize the hypotheses we articulate below in Figure 1.

PANDEMIC IMPRINTS AND PPE PRODUCTION DURING COVID-19

Given today's fast-changing business environments, a key topic in management and strategy research is how corporate leaders make prompt corporate decisions and respond to environmental shocks (e.g., Armanious and Padgett, 2021; Panpatte and Takale, 2019). To address uncertainty and complexity derived from sudden environmental changes, leaders might subconsciously rely on initial and less-informed perceptions from past experiences and arrive at rapid cognitive conclusions (e.g., Kahneman, 2003). Therefore, we contend that corporate leaders' imprints formed during sensitive periods such as early adulthood[1] plays an important role in such decision-making processes. We argue that corporate leaders who were exposed to local infection information at that time would leverage such information to establish a persistent belief about the severity of pandemics.

To investigate this pandemic imprinting effect, we focus, as noted, on imprints formed during the outbreak of SARS, a contagious and atypical respiratory disease with a very high death rate (ranging between 7 per cent and 27 per cent; Chan et al., 2003). Prior country-level research has also shown that governments paid earlier attention to COVID-19 if they had experienced SARS (Ru et al., 2021).

When the 2003 SARS outbreak emerged in China, people became frightened by nearby SARS infections. For instance, Beijing was identified by the Chinese government as one of the virus epicentres. As He Jianming, a famous non-fiction writer, evocatively described the mood at the time in his book, *In Memory of SARS – Guarding Beijing*: 'One

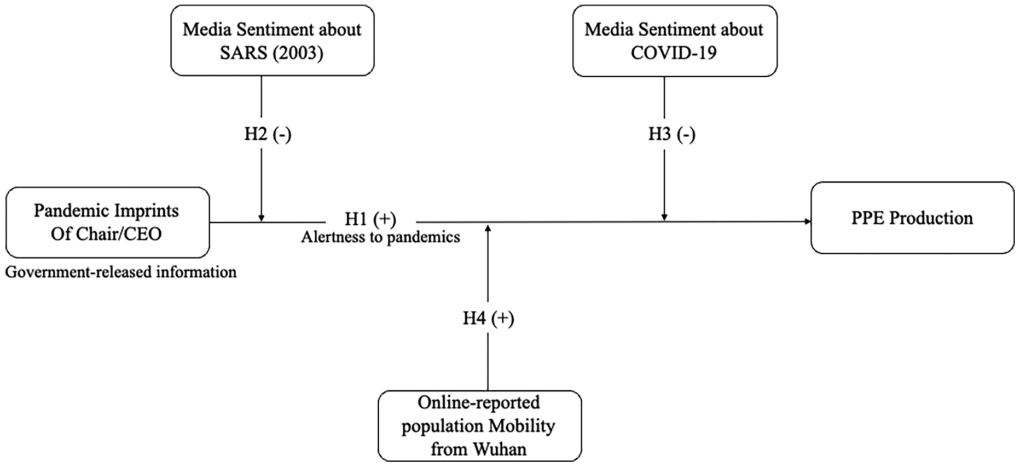

Figure 1. Theoretical model of pandemic imprints and PPE production during COVID-19

day [in Beijing], someone on a bus coughed a few times, all people in that bus immediately asked the driver to stop and then scrambled to get out' (He, 2013). A similar situation occurred in another SARS epicentre, Guangzhou, where 'the whole city had fallen in panic' (Chen et al., 2013, p. 166).

Indeed, researchers have revealed that many people in China, especially those living in locales with more government-reported SARS infections, have a deep memory of the SARS pandemic despite the elapse of almost two decades (e.g., Chen et al., 2020; Li et al., 2023; Qian, 2021; Wang, 2013). This long-term memory would be particularly pronounced for young adults who were going through a sensitive period when they were more inclined to internalize salient environmental features.

As a result, we argue that when such individuals encounter another unknown but similar coronavirus, their pandemic imprints may be evoked and influence their responses. COVID-19 was a novel virus, and its source, host, transmission risk, treatment, and fatality rates were largely unclear at the onset of the pandemic (Lu et al., 2020). Despite this overwhelming uncertainty, given the similarities between SARS and COVID-19, there are several reasons why stronger pandemic imprints likely aroused alertness to COVID-19, leading to faster responses such as initiation of PPE production. First, COVID-19 caused significant disruptions in medical supply chains (Peng, 2021). Chinese doctors in Wuhan ran out of PPE and had to make their own masks and protective gear. In late January of 2020, one health worker wrote on China's micro-blogging platform Weibo,[2] 'The problem right now is that there are no masks in hospitals'. In addition, Chinese medical advisors consistently highlighted the importance of PPE and encouraged people to wear such equipment in public at the beginning of the outbreak, which may have evoked pandemic imprints and strengthened the perceived necessity of PPE.

To summarize, we argue that corporate leaders with stronger pandemic imprints would more quickly recognize the potentially dangerous consequences of a new pandemic and the associated scarcity of PPE, and so their firms would be quicker to take actions to increase the PPE supply. This logic leads to our first hypothesis:

> *Hypothesis 1:* During the early outbreak of COVID-19, firms whose corporate leaders had stronger pandemic imprints initiated PPE production more quickly.

VARIATION IN THE FORMATION OF PANDEMIC IMPRINTS

Past work on imprinting theory has often focused on the CEO's age or the severity of imprinting events as indirect proxies of available information to explain differences in imprint formation (e.g., O'Sullivan et al., 2021; Wang et al., 2019). However, to better understand imprinting processes, we directly examine how variation in available information during the SARS outbreak in 2003 affected corporate leaders' pandemic imprints.

The role of media in the imprinting process has been surprisingly understudied, despite longstanding research demonstrating that media outlets significantly

influence managers' perceptions of external environments (e.g., Gamson et al., 1992; Jia et al., 2016). Newspapers and other media deliver timely information about significant social issues and serve as essential information intermediaries between external environments and corporate leaders (e.g., Gamache and McNamara, 2019; Jia et al., 2016). For example, Liu and McConnell (2013) found that managers consider information from the media when deciding whether to complete proposed acquisitions. Research has revealed that the media selectively report certain events and can directly shape individual opinions about the selected issues, leading to 'the social construction of reality' (Gamson et al., 1992, p. 373).

During the 2003 SARS pandemic, the Chinese media played a critical role in shaping individual perceptions of the outbreak by providing information about it. Indeed, the Chinese government was under immense national and international pressure to increase transparency and release more information about the virus (Tai and Sun, 2007). Although SARS-related articles were banned at the beginning of the pandemic (He, 2004), the Chinese government eventually bowed to the pressure and starting in April 2003, altered their censorship strategy. After that, daily updates about local SARS infections and a considerable number of media reports about the virus appeared in the state-controlled media.

Some media articles used a relatively positive tone and argued that the victory of the 'people's war' against the SARS pandemic would arrive soon (People's Daily, 2003). For example, on 26 April 2003, the *Beijing Daily* published an article titled 'Beijing has formed a complete system to prevent the SARS pandemic'. Since positive media articles implied that the SARS pandemic would soon be under control, they may have weakened the perceived severity and thus dampened the strength of pandemic imprints.

By contrast, some articles used a more negative tone to alert individuals to the dangers of SARS, which may have helped form a stronger pandemic imprint. One article, published in *Jilin's Daily* on 2 May 2003, emphasized that 'the pandemic situation remains severe and insufficient prevention will cause detrimental consequences'. Another example was the coverage of the dismissal of Beijing Mayor Meng Xuenong and China's Health Minister Zhang Wenkang. The day after their official dismissal, some newspapers reported it and revealed their mishandling of SARS (Zhang, 2007).

Thus, media sentiment about SARS may have shaped managers' perceived significance of the pandemic. Corporate leaders that experienced more positive media coverage about SARS tended to form a weaker pandemic imprint, leading to reduced alertness and slower responses to new pandemics. We therefore predict:

> *Hypothesis 2:* The positive effects of corporate leaders' pandemic imprints on firms' PPE production were weaker when media sentiment about the SARS pandemic was more positive.

VARIATION IN THE MANIFESTATION OF PANDEMIC IMPRINTS

We further consider informational variation in the manifestation of pandemic imprints to understand imprint arousal in subsequent environments. The psychology literature

has shown that an activating context is important in stimulating underlying attributes into expressive behaviours (e.g., Tett et al., 2013). Many studies further support that consistencies between individual characteristics and current environments affect the expression of latent characteristics (e.g., Van Hoye and Turban, 2015; Wihler et al., 2017). Our imprinting model explores how available information in the current environment will arouse or suppress past imprints.

Media Sentiment about COVID-19

We explore media sentiment about COVID-19 as one important source of informational difference in imprint manifestation. Our basic logic is that media sentiment about contemporary contexts likely shapes perceived severity of a current environmental shock and thus the extent to which imprints will be stimulated into expressive behaviours. Unlike in 2003 during the SARS outbreak, in the digital era, corporate leaders can learn about what is happening in their locales from both traditional media, such as newspapers and press conferences, and new social media, such as various online platforms[3] (Dewan and Ramaprasad, 2014). The widespread use of platforms like the microblogging site Weibo allows the general public to share information about their local communities, and provides CEOs with a unique opportunity to leverage such information from social media and adjust their business strategies accordingly (Ang et al., 2021). Research has revealed that social media plays a critical role in shaping CEOs' decision-making processes, as it provides first-hand local information and real-time insights into business operations (Ang et al., 2021; Ollier-Malaterre and Rothbard, 2015).

Similar to traditional media like local newspapers, information from social media also exhibits geographic variation in its sentiment. Although it may be accessible to a broader audience, research has revealed that users pay more attention to social media information about their locales (e.g., Chen et al., 2021; Shibuya and Tanaka, 2019). Such geographical variation is especially prominent in the context of COVID-19, given the uneven spread of the virus and individuals' tendency of relying on information about local infections to assess their pandemic risk (e.g., Broomell, 2020; Broomell and Kane, 2021; Li et al., 2011).

Second, while content on social media is user-generated, as we previously discussed with respect to censoring of newspaper articles, government intervention can also suppress online discourse and serve as a powerful tool to shape public opinion (Gunitsky, 2015; Yang, 2009).

In our research context, online pandemic posts – especially those involving negative content (e.g., patient deaths) – were strictly censored by both central and local governments (Tai and Fu, 2020). Thus, with the censorship of negative online posts, media sentiment would be relatively more positive. But prior work has also shown that local governments have different levels of openness and leniency (Chen et al., 2018; Kuang, 2018), so some authorities might implement varying levels of censorship, leading to variation in the expression of CEOs' pandemic imprints.

Relatedly, variation also exists in local regulations regarding punishments for posting negative messages about COVID-19. For example, Dr. Li Wenliang, a doctor at

Wuhan Central Hospital, reported a SARS-like virus and potential infection risks to other doctors on a social media platform. However, not only were his warning messages deleted by government censors, but he was also reprimanded for 'spreading rumours' and forced to sign an acknowledgment of this 'misdemeanour' by the local police (Green, 2020). In another case in Jiangxi province, a man was detained for five days due to his online messages alleging ten COVID-19 deaths in the province (Azeem, 2020).

Taken together, relatively more-positive media sentiment about a virus might reduce the perceived severity of a current pandemic and suppress the expression of pandemic imprints. Hence, we expect a weaker pandemic-imprinting effect if media sentiment about COVID-19 is more positive:

> *Hypothesis 3:* The positive effects of corporate leaders' pandemic imprints on firms' PPE production were weaker when media sentiment about COVID-19 was more positive.

Online-Reported Population Mobility from Wuhan

Online-reported population mobility from COVID-19 epicentres is another key informational cue that helps explain why the same imprint may be expressed differently. COVID-19 initially emerged in Wuhan, the capital city of Hubei Province. Research has shown that not only did a stigma develop toward Wuhan residents, but people throughout China also vigilantly monitored whether Wuhan residents travelled to their area (Di et al., 2021). For instance, it was reported that people checked car licence plates and blocked cars from Wuhan entering their communities.[4] The further uncertainty created by the potential existence of asymptomatic infections of COVID-19 accentuated such fears about Wuhan residents (Li et al., 2021).

In addition to controlling information flows, the Chinese government highlighted concerns and negative perceptions about people with a travel history to/from Wuhan. For example, a slogan released by the Henan government cautioned, 'If you are returning from Wuhan, stay at home so as not to infect others with COVID-19'.[5] Furthermore, during the pandemic, Baidu, the most widely used search engine in China, published real-time information about population mobility that was viewed billions of times during the initial stage of the pandemic outbreak, suggesting that the Chinese population was significantly concerned about spread of the virus through travel and person-to-person transmission.[6]

In summary, online information flows regarding travellers from Wuhan likely raised concerns about the novel coronavirus, which would arouse pandemic imprints, and thus amplify the pandemic-imprinting effect. Stated formally,

> *Hypothesis 4:* The positive effects of corporate leaders' pandemic imprints on firms' PPE production were stronger for corporate leaders currently in regions with greater levels of reported population mobility from Wuhan.

METHODS

Data and Sample

Our sample included all publicly traded firms in China whose original business did not involve personal protective equipment (PPE) production. In our tests of moderating effects, we excluded firms located in Wuhan, given that one key theoretical interest is investigating how online-reported population influx from this region activated corporate leaders' pandemic imprints.

The accuracy of pandemic data has been questioned (Campbell and Gunia, 2020) and although the statistics may not be fully accurate, such issues do not undermine our study design, as our theory and predictions are based on available information flows regardless of whether such information fully captured the actual situation. Thus, our setting aligns with our theory on how corporate leaders process such information and establish their imprints. Furthermore, a sizable body of literature has used the same sources to understand SARS and COVID-19 (e.g., Chen et al., 2020; Fang et al., 2020; Hu et al., 2020), which also supports using this data.

We began our sample period on January 21, 2020, since the National Health Commission (NHC) of China officially started reporting COVID-19 as a class-B infectious disease on the previous day (Adhikari et al., 2020). We ended our sample period on 31 March 2020, by which the first wave of COVID-19 infections had largely come to an end, as shown in Figure 2. This period is the most relevant for our study, as our

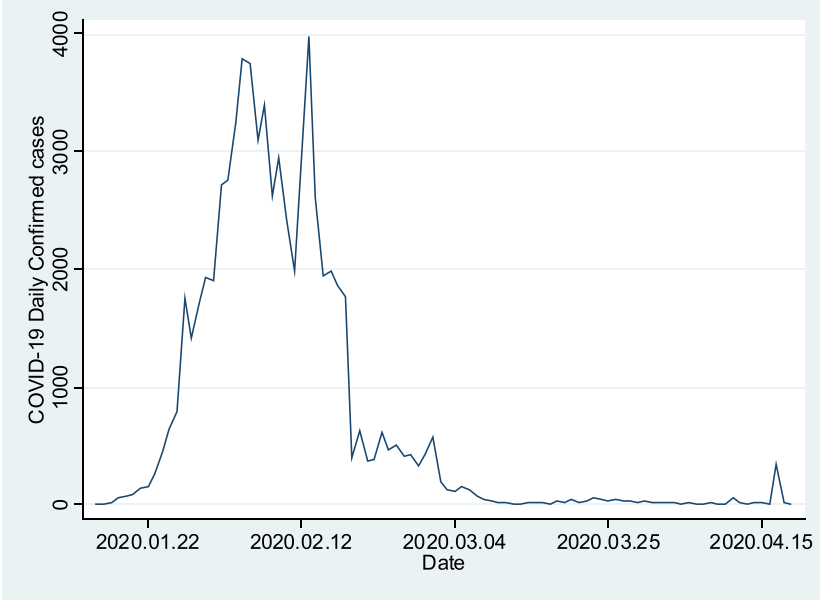

Figure 2. New confirmed daily cases of COVID-19 in Mainland China.

Note: To improve visualization of confirmed case trends, one outlying value (Feb 13, 2020), resulting from a shift in COVID-19 diagnosis procedures, is not included. Our proposed positive effect of pandemic imprints on PPE production receives support, whether we include or exclude this outlier.

theoretical focus is on corporate leaders' quick evaluation of a novel virus during the early outbreak.

We collected our data from nine sources and Appendix S3 offers more details. Specifically, we collected all public disclosures of Chinese-listed firms from the CNINFO website (www.cninfo.com.cn) between 21 January to 31 March 2020 to identify whether and when a firm decided to produce PPE. The CNINFO website is an official platform for Chinese public firms to release information, and this source has been widely used in research on China (e.g., Bailey et al., 2011; Liu and Anbumozhi, 2009).

We collected provincial-level data of total confirmed cases of SARS in 2003 from public announcements issued by the NHC of China. We also gathered biographies of board chairs and CEOs from the China Stock Market & Accounting Research (CSMAR) database, based on which we identified their 2003 locations. Other information regarding corporate leaders and public firms also came from the CSMAR database, which offers the most comprehensive information of publicly listed firms in China and has been widely used in existing studies (e.g., Wang and Qian, 2011; Zhang et al., 2016).

We manually searched the database of the China National Knowledge Infrastructure (CNKI) to collect information about SARS media sentiment. Information regarding sentiments about COVID-19 in (new) media was obtained through a content analysis of online posts on Weibo (Chen et al., 2020). Information on local medical resources and population was from the China Statistical Yearbook Database published by the National Bureau of Statistics of China. Information about online-reported population mobility was derived from Baidu Migration, an online platform similar to Google Maps (Spatial Data Lab, 2020a). As long as it follows government censorship guidelines, Baidu Migration can release real-time information regarding population movements between and within Chinese cities (Fang et al., 2020). We also obtained city-level data of confirmed cases of COVID-19 from the Harvard Dataverse (Spatial Data Lab, 2020b). Since donations are another essential pandemic response, we manually gathered firm-donation information from the China Association for Public Companies as well as public announcements of listed firms. We merged data from the aforementioned sources and our final sample comprised 2255 listed firms.

Dependent Variable

To capture the response speed, we first coded *PPE production* as 1 if a firm announced new (in-house) PPE production on that date and 0 otherwise.[7] We used survival analysis to then transform the dependent variable into a hazard rate that indicated a firm's tendency to announce new PPE production on a specific day if it had not previously done so. The dependent variable captures the speed of a firm's action.

In our determination of firms producing PPE, following the WHO's definition of PPE,[8] we included items such as medical masks, protective suits, glasses, and gloves. It is important to note that items in this definition imply a low entry barrier, and thus whether a firm decides to produce PPE is likely to be unconstrained by the firm's technical and other abilities. We did not examine other medical devices such as ventilator machines

due to their complexity, high barrier to entry, and long lead time for companies to begin production. Since our theorizing taps a firm's rapid response based on leaders' pandemic imprints, we believe the speed of deciding to produce regular PPE is the most appropriate operationalization.

Independent Variable

Our measure of *corporate leaders' pandemic imprints* included two elements: (1) whether corporate leaders were in early adulthood in 2003, as indicated by their age (Marquis and Tilcsik, 2013); and (2) whether information of the local SARS spread was available, indicated by local infection rates.[9] Following Arnett et al. (2014), we defined early adulthood as between the ages 18 to 29. If corporate leaders were not in early adulthood, no pandemic imprints were formed, and this variable was coded as 0.We also used age 25 as an alternative cut-off and still obtained supportive evidence. To measure this variable, we gathered the biographies of board chairs and CEOs[10] from the CSMAR database, manually collected their locations in 2003, and calculated local infection rates (i.e., local confirmed SARS cases standardized by the local population).[11]

We further conducted a placebo test on non-early-adulthood experience to distinguish imprinting effects from learning effects. More details are in our supplementary analyses. Finally, although age is one element of a pandemic imprint, the correlation between the two variables is low, suggesting that we are able to distinguish the age effects from the imprinting effects.

Moderating Variables

To measure *media sentiment about SARS*, we conducted a content analysis of local newspaper articles about the virus. We focused on traditional media because new media did not exist in China during the 2003 SARS pandemic (e.g., Weibo was launched in 2009). Media sentiment captures the relative prevalence of positive vs. negative newspaper articles. Following existing studies (e.g., Zavyalova et al., 2012), this variable was operationalized by the difference between the number of positive and negative newspaper articles. Based on corporate leaders' biographies, we identified their locations in 2003. We then manually searched articles in Chinese mainstream provincial-level newspapers of 2003 and collected 997 articles with 'SARS' (in Chinese '非典') in the title. Consistent with prior studies on Chinese newspapers (e.g., Kim, 2018), and given our interest in developing a local measure, our search included 31 official local newspapers. We manually coded each article title as positive or negative. In cases in which the title's sentiment was unclear, we relied on the full article for coding. A trained research assistant (RA) and one author independently coded the 997 articles and agreed on 93.58 per cent of the codes, suggesting high intercoder reliability. The RA and the coding author then discussed the remaining 64 articles that were coded differently and came to an agreement. We used the difference between the number of positive and number of negative articles to measure *media sentiment about SARS*.[12] Our calculation used the logarithmic number of articles to avoid the undue influence of outliers.

Media sentiment about COVID-19 was captured for traditional and new media. To capture *traditional* media sentiment about COVID-19, we followed similar procedures that we used for SARS media sentiment. Since new media has become increasingly influential in recent years, we used new media in the main analysis and traditional media in an alternative test. Our main measure of *media sentiment about COVID-19* was from a content analysis of online posts on Weibo. Chen et al. (2020) collected more than 40 million COVID-19 related posts, identified 153,472 posts related to COVID-19 origin, removed reposts, and finally obtained 6735 original posts. In line with existing literature (e.g., Zhao et al., 2016), Chen et al. (2020) used the Linguistic Inquiry and Word Count (LIWC) to generate a continuous measure[13] of the sentiment of each online post. Based on the location of post senders, we then calculated the mean of the sentiments in each province to reflect *media sentiment about COVID-19*. This variable and other contemporary variables were based on corporate leaders' locations (i.e., firms' headquarter cities) during the recent COVID-19 outbreak, unless otherwise noted.

We measured *online-reported population mobility from Wuhan* by the ratio of the number of people from Wuhan who travelled to a firm's headquarter city over the total population that travelled to the headquarter city. For all Chinese cities, we obtained daily data about the percentage of population inflow into a city from the top 100 departure cities and calculated the mean for the previous 14 days. We added *local COVID-19 spread*, a direct measure of local COVID-19 risk, as a control.

Control Variables

We included a series of control variables that could influence firm responses to an environmental shock. As previously mentioned, traditional decision-making processes suggest that firms' actions may be driven by a variety of strategic considerations, such as social responsibility and/or potential economic benefits. First, as corporate donations are important actions by which to take social responsibility and contribute to addressing pandemics (Zhang et al., 2016), we controlled for *cumulative firm donation to COVID-19* (measured by the logarithmic value of cumulative corporate donation in cash and in kind).

To control for corporate leaders' trust in the Chinese government and their political considerations, we included a previously researched proxy for these processes, *corporate leaders' political connections*. Following prior studies (Zhang et al., 2016), we used membership in National People's Congress (NPC) or Chinese People's Political Consultative Conference (CPPCC) to calculate this variable.

In addition, corporate leaders' overseas experience may influence their worldview and attitude toward state-controlled media. Therefore, we added dummy variables to control for *overseas education experience* and *overseas work experience*. We also generated a dummy variable reflecting corporate leaders' *medical background*. For these variables related to both board chairs and CEOs, we calculated the average for each firm. We further controlled for *managerial discretion* measured by CEO duality. Since sensitive periods are age-dependent and age plays an important role in the imprinting process, we controlled for the mean *age* of chairs and CEOs.

We also generated a dummy variable reflecting whether a firm is a state-owned enterprise (SOE) and controlled for *SOE firms*, as state influence likely leads to different decision-making processes from other firms (Yiu and Makino, 2002). As old firms are relatively inert and lack flexibility (Hannan and Freeman, 1977), we controlled for *firm age*. Furthermore, to control for firms' *ease of initiating PPE production*, we included *manufacturing capability* by assessing a firm's proximity to the pharmaceutical manufacturing industry based on the number of overlapping digits in their respective industry codes. We also controlled for *total assets* (i.e., the logarithmic value of firm total assets) and *ROA* (return on assets; net income over total assets) based on the most recent annual reports.

At the regional level, we followed existing literature (e.g., Jin and Zhao, 2020; Wang et al., 2021) and generated an ordinal variable to control for *city size tier* based on the headquarter location of each firm from the CSMAR database, given that larger, urban locations may have richer and more globalized information environments. We measured *government-reported local COVID-19 spread* by the number of newly confirmed COVID-19 cases in a firm's headquarter city in the previous day, and this variable was standardized by local population. We calculated this variable on a daily basis. *Medical resources* (during the SARS pandemic) were captured by the government-reported number of registered doctors in the regions where corporate leaders were located in 2003, standardized by the local population. We calculated this for board chairs and CEOs and took the mean. The China Statistical Yearbook Database offers the number of local doctors, based on which we calculated this variable. We also added *medical resources of current location* (measured by the number of registered doctors in the headquarter city, standardized by local population). Finally, as noted, considering that firms in different industries likely bear different costs and capabilities for PPE production, we controlled for industry fixed effects. We also included province fixed effects.

Estimation

Since our theory is about how fast firms initiated new PPE production during the early period of COVID-19, we used a survival analysis to estimate our results. We also used logit models as supplementary analyses and obtained supportive evidence. We believe survival analysis is more appropriate than logit models for at least two reasons. First, survival analysis not only reflects whether a given corporate action happens, it also estimates the speed of corporate responses. Second, many of our moderating and control variables are day-specific, and survival analysis can reflect daily changes. We adopted the single-event Cox proportional hazard model because it is the most robust method for a survival analysis due to its advantage of not assuming a specific probability distribution (Trevor, 2001). To test the proportionality assumption of the Cox model, we used the *stphtest* command in Stata 17, and the global test was not statistically significant ($\chi^2 = 55.72$; $p > 0.10$), indicating no violation of the proportionality assumption. Moreover, following existing literatures, we considered the Breslow and Efron approximations to handle tied survival times (e.g., when two firms started to produce PPE on the same day) (Breslow, 1974; Efron, 1977). Both approximations yielded similar results, and we followed existing studies (e.g., Kapoor and Lee, 2013; Zhou and Park, 2020) and reported the results from the Efron method as our main analysis.

Additionally, we conducted a supplementary test using the Breslow method and reported those results separately. Finally, we used clustered standard errors to account for within-industry correlations.

RESULTS

Table I reports the means, standard deviations, and correlations of the variables.

Table II presents the results of the single-event Cox proportional hazard model for PPE production. Model 1 includes independent and control variables, while Model 2 additionally incorporates moderating variables. Models 1–2 are used to examine the main effect. Models 3–5 add each moderating variable and corresponding interaction terms, which are utilized for interpreting our results. Model 6, the full model including all interaction terms, is presented for information purposes.

Hypothesis 1 predicts that firms whose corporate leaders had stronger pandemic imprints more quickly initiate PPE production during the early period of the COVID-19 outbreak. In Table II, the coefficients estimate for *pandemic imprint* are positive and statistically significant (Model 1: $\beta = 2.049$, $p < 0.01$; Model 2: $\beta = 2.131$, $p < 0.01$). Compared with the mean level, a stronger pandemic imprint (i.e., one standard deviation above the mean) increases the hazard rate by 28.7 per cent. Considering that the average response speed[14] in our sample is 69.5 days, a stronger pandemic imprint increases firms' response speed by 19.95 days. Such alignment with governmental priorities has been shown to be particularly salient for firms' economic performance in China (Wang and Qian, 2011).

One notable result from a control variable is that the coefficient estimate for corporate leaders' age is consistently insignificant, which suggests our findings are not driven by younger leaders. These results lead us to conclude that Hypothesis 1 is supported.

Hypothesis 2 maintains that media sentiment about SARS could reduce the influence of pandemic imprints on PPE production. According to Model 3 in Table II, the coefficient estimate for the interaction term between *pandemic imprint* and *media sentiment about SARS* is negative and statistically significant ($\beta = -2.550$, $p < 0.01$). When media sentiment about SARS is at the mean level, a stronger pandemic imprint increases the hazard rate by 89 per cent, however, the corresponding value is 36 per cent when the media sentiment is at a more positive level (i.e., one standard deviation above the mean). Therefore, media sentiment about SARS decreases the positive effect of pandemic imprints. We also calculated the relative hazard of PPE production based on different values of pandemic imprints and media sentiment about SARS to illustrate this moderating effect. Figure 3a shows that as media sentiment about SARS changes from less to more positive, the effects of pandemic imprints on a firm's relative hazard of PPE production dramatically decrease, as indicated by the flatter solid line (steeper dashed line). Hypothesis 2 is thus supported.

Hypothesis 3 states that the *media sentiment about COVID-19* reduces the effect of pandemic imprints on PPE production. In Model 4 of Table II, the coefficient estimate for the interaction term between *pandemic imprint* and *media sentiment about COVID-19* is negative and statistically significant ($\beta = -0.490$, $p < 0.01$). When the media sentiment about

Table I. Summary statistics and correlation matrix

Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1. Pandemic imprint	1									
2. Media sentiment about SARS	0.07	1								
3. Media sentiment about COVID-19	−0.01	0.22	1							
4. Online-reported population mobility from Wuhan	−0.01	0.08	−0.01	1						
5. Cumulative firm donation to COVID-19	0.01	0.01	0.07	0.05	1					
6. Political connections	−0.01	−0.03	−0.01	0.04	0.08	1				
7. Overseas work experience	0.05	−0.03	−0.06	−0.01	−0.03	−0.01	1			
8. Overseas education experience	0.05	0.02	−0.04	−0.02	0	0.02	0.27	1		
9. Medical background	−0.02	0	0.02	−0.01	0.05	0.06	0.02	0.03	1	
10. Managerial discretion	0.04	0.04	−0.1	0	−0.02	0.13	0.05	0.03	0.03	1
11. SOE	−0.03	−0.01	0.18	0	0.02	−0.15	−0.09	−0.08	−0.03	−0.25
12. Age (Chair, CEO)	−0.18	0.04	0.06	0	0.06	0.08	0.03	−0.04	0.08	0.02
13. Firm age	−0.04	0.01	0	0.04	0.05	0	−0.06	−0.02	−0.01	−0.1
14. Manufacturing capability/ease of PPE production	−0.04	−0.06	0.02	0	0.03	0.09	0.04	0	0.23	0.07
15. Total asset	−0.04	0.01	0.05	0.03	0.37	0.01	−0.02	0	−0.03	−0.15
16. ROA	−0.03	0.02	−0.03	−0.01	0.07	0	−0.01	−0.01	0.06	−0.01
17. City size tier	−0.07	−0.12	0.26	0.12	0.01	0.07	−0.05	−0.05	0.01	−0.05
18. Government-reported Local COVID-19 spread	0	0.06	−0.02	0.01	0.01	−0.01	0	0	−0.01	0
19. Medical resources during SARS	0.19	0.49	0.06	−0.01	−0.01	−0.1	0.04	0.06	−0.04	−0.02
20. Medical resources of current location	0.08	−0.01	−0.45	−0.09	0	−0.12	0.06	0.05	−0.02	0.04
Mean	0.01	1.34	10.34	0.24	0.99	0.15	0.06	0.04	0.02	0.33
S.D.	0.12	1.07	6.16	1.71	2.25	0.31	0.2	0.15	0.11	0.47

Variables	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
11. SOE	1									
12. Age (Chair, CEO)	0.01	1								
13. Firm age	0.25	0.09	1							
14. Manufacturing capability/ease of PPE production	−0.2	0.06	−0.07	1						
15. Total asset	0.34	0.09	0.16	−0.23	1					

(Continues)

Table I. (Continued)

Variables	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
16. ROA	−0.05	0.05	−0.01	0.09	0.01	1				
17. City size tier	0.06	0.01	0.03	0.19	−0.05	0.02	1			
18. Government-reported Local COVID-19 spread	0	−0.01	0	−0.01	−0.01	0	−0.02	1		
19. Medical resources during SARS	0.04	−0.06	0.03	−0.14	0.05	−0.08	−0.28	−0.01	1	
20. Medical resources of current location	−0.07	−0.05	−0.05	−0.2	0.06	−0.04	−0.65	0.01	0.31	1
Mean	0.31	52.59	20.98	0.9	22.44	0.03	1.94	0.01	17.09	43.3
S.D.	0.46	5.09	5.42	0.85	1.54	0.07	1.01	0.24	6.1	17.55

Note: Correlations with absolute values no less than 0.005 have p-values below 0.05.

COVID-19 is at the mean level, a stronger pandemic imprint increases the hazard rate by 42 per cent. However, when the media sentiment about COVID-19 is at a higher level (i.e., one standard deviation above the mean), the corresponding change is a decrease of 1 per cent. Therefore, media sentiment about COVID-19 decreases the positive effect of pandemic imprints. Consistent with the pattern shown by Figure 3b, Hypothesis 3 is supported.

Hypothesis 4 suggests that the effect of pandemic imprints on firms' PPE production is stronger for corporate leaders currently in regions with more online-reported population mobility from Wuhan. In Model 5 of Table II, the coefficient estimate for the interaction term between *pandemic imprint* and *online-reported population mobility from Wuhan* is positive and statistically significant ($\beta = 1.080$, $p < 0.05$). For firms in cities with a mean-level, online-reported population mobility from Wuhan, a stronger pandemic imprint increases the hazard rate by 31 per cent. On the contrary, when the population mobility from Wuhan is at a higher level (i.e., one standard deviation above the mean), the corresponding value is 64 per cent. Therefore, online-reported population mobility from the pandemic epicentre strengthens the positive effect of pandemic imprints. Figure 3c offers a graphic illustration of this interaction effect (i.e., the steeper solid line and the flatter dashed line), suggesting that the effect of pandemic imprint is strengthened when there is a higher level of population mobility from Wuhan. Thus, Hypothesis 4 is supported.

SUPPLEMENTARY ANALYSES

We further performed several supplementary tests as follows.

Imprinting vs. Learning: The Importance of Early Adulthood as a Sensitive Period

One alternative perspective to understand the influence of previous pandemics is that it could simply be 'learning from prior experience' and not from imprinting per se. The

Table II. Results of cox proportional hazard model estimating the influence of pandemic imprints on PPE production

	Main effect		*Moderating effects*			*Full*
Variables	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Cumulative firm donation to COVID-19	0.143***	0.146***	0.147***	0.140***	0.146***	0.139***
	(0.016)	(0.022)	(0.023)	(0.024)	(0.022)	(0.023)
Political connections	−0.329***	−0.408***	−0.359***	−0.396***	−0.405***	−0.376***
	(0.123)	(0.040)	(0.041)	(0.046)	(0.042)	(0.048)
Overseas work experience	−0.284***	−0.300***	−0.176***	−0.200***	−0.292***	−0.158***
	(0.060)	(0.068)	(0.060)	(0.028)	(0.064)	(0.023)
Overseas education experience	−0.224	−0.212	−0.083	−0.119	−0.238	−0.110
	(0.289)	(0.290)	(0.324)	(0.175)	(0.322)	(0.194)
Medical background	0.495	0.459	0.418	0.351	0.457	0.341
	(0.354)	(0.366)	(0.320)	(0.347)	(0.366)	(0.342)
Managerial discretion	0.269***	0.241***	0.221***	0.236***	0.237***	0.220***
	(0.058)	(0.066)	(0.061)	(0.062)	(0.067)	(0.054)
SOE	0.107	0.121	0.144	0.157	0.120	0.161
	(0.120)	(0.133)	(0.135)	(0.158)	(0.133)	(0.162)
Age (Chair, CEO)	−0.023	−0.020	−0.009	−0.009	−0.021	−0.006
	(0.018)	(0.015)	(0.013)	(0.010)	(0.015)	(0.009)
Firm age	−0.035***	−0.035***	−0.039***	−0.039***	−0.035***	−0.040***
	(0.005)	(0.005)	(0.003)	(0.004)	(0.005)	(0.004)
Manufacturing capability/ease of PPE production	0.075***	0.086***	0.101***	0.136***	0.087***	0.141***
	(0.019)	(0.018)	(0.020)	(0.020)	(0.018)	(0.026)
Total asset	0.326***	0.326***	0.321***	0.357***	0.326***	0.352***
	(0.071)	(0.076)	(0.076)	(0.055)	(0.076)	(0.057)
ROA	−2.161***	−2.208***	−2.115***	−2.137***	−2.191***	−2.110***
	(0.309)	(0.235)	(0.239)	(0.231)	(0.252)	(0.249)
City size tier	−0.122**	−0.143***	−0.169***	−0.179***	−0.144***	−0.187***
	(0.049)	(0.043)	(0.046)	(0.056)	(0.044)	(0.059)
Government-reported local COVID-19 spread	−8.720***	−6.550***	−6.970***	−7.087***	−6.546***	−7.219***
	(0.901)	(0.546)	(0.531)	(0.856)	(0.546)	(0.928)
Medical resources during SARS	0.030	0.021	0.021	0.034	0.021	0.034
	(0.045)	(0.034)	(0.031)	(0.034)	(0.034)	(0.034)
Medical resources of current location	0.002	0.001	−0.002	−0.003	0.001	−0.003
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.007)
Pandemic imprint (H1)	2.049***	2.131***	8.710***	7.977***	2.017***	9.684***
	(0.185)	(0.178)	(0.944)	(0.667)	(0.126)	(1.521)
Media sentiment about SARS		−0.056	−0.017	−0.124	−0.054	−0.096
		(0.107)	(0.096)	(0.140)	(0.105)	(0.123)

(Continues)

Table II. (Continued)

	Main effect		*Moderating effects*			*Full*
Variables	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Media sentiment about COVID-19		−0.113	−0.227	−0.133	−0.157	−0.245
		(0.386)	(0.418)	(0.241)	(0.402)	(0.205)
Online-reported population mobility from Wuhan		−0.237***	−0.239***	−0.240***	−0.241***	−0.243***
		(0.030)	(0.032)	(0.029)	(0.035)	(0.032)
SARS imprint × Media sentiment about SARS (H2)			−2.550***			−0.913**
			(0.334)			(0.461)
SARS imprint × Media sentiment about COVID-19 (H3)				−0.490***		−0.437***
				(0.048)		(0.059)
SARS imprint × Online-reported pop mobility from Wuhan (H4)					1.080**	0.435**
					(0.432)	(0.222)
Number of observations	159,400	156,278	156,278	156,278	156,278	156,278
Adjusted R-square	0.085	0.086	0.089	0.095	0.086	0.095
Chi-square	5.977	7.660	212.437	161.924	7.881	165.863

Note: Model 1 includes firms from Wuhan and reflects a fuller sample to test our main effects. Models 2–6 add moderating variables and exclude firms from Wuhan, leading to a smaller number of observations. Industry fixed effects and province fixed effects are included in all models. Significance: ***p < 0.01, **p < 0.05, *p < 0.1.

imprinting argument differs from 'learning' in at least two ways. First, imprints are established in individuals' sensitive developmental periods, whereas learning can occur at almost any time. Second, imprints persistently influence individuals, whereas learning effects do not by definition have the same enduring nature.

In supplementary analyses, we empirically compared imprinting effects (i.e., those that occurred in sensitive periods) and what could be considered experience or learning effects (i.e., those that occurred in non-sensitive periods). As shown in Model 3 of Appendix S1, corporate leaders who experienced SARS in non-sensitive periods do not show differences regarding responses to the new and similar COVID-19 pandemic. By contrast, corporate leaders who received SARS-related information in their sensitive periods would carry a pandemic imprint and respond faster to a new pandemic, and thus we believe imprinting is the best way to characterize this effect. Future research should also consider the intersection of imprinting and learning in more detail (Sullivan et al,, 2014).

Further Robustness Checks

In addition, we also examined the following: (1) randomization inference; (2) alternative logit models; (3) an alternative early-adulthood cutoff (i.e., 18–25); (4) the use of traditional media to calculate media sentiment about COVID-19; (5) the frequency of SARS in online posts about COVID-19 to directly compare the two pandemics; (6) press conferences to examine the effects of government discourse about SARS; (7) rare-event corrections; (8) the death rate of SARS to measure pandemic imprints; (9) the potential

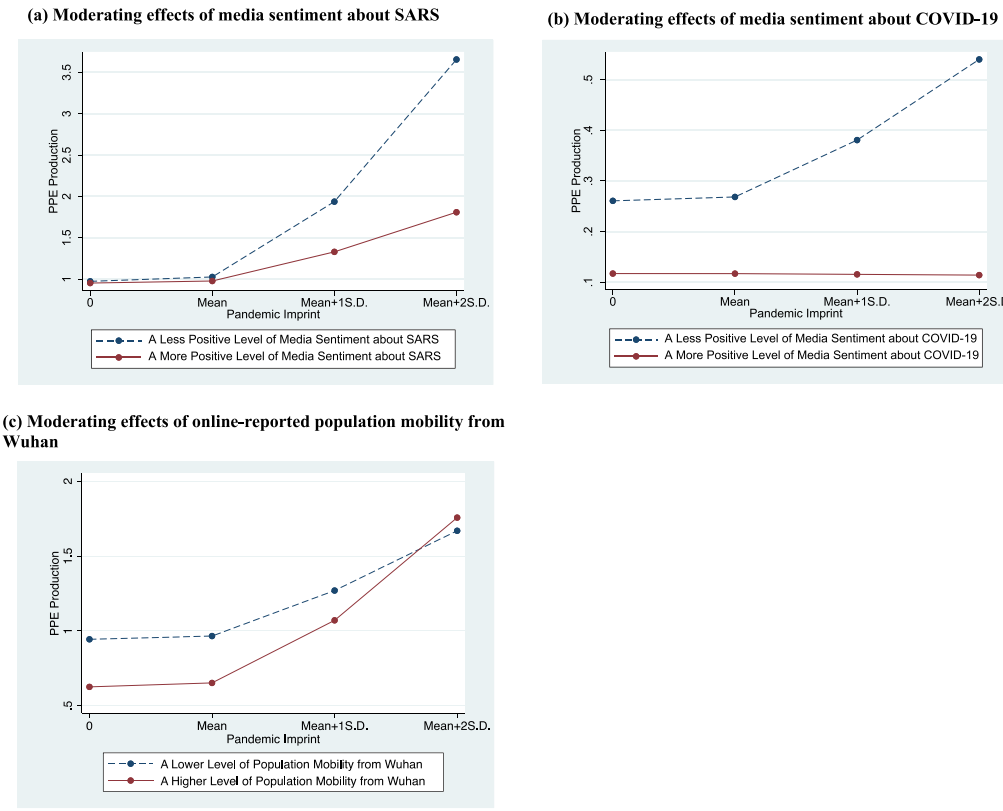

Figure 3. Graphical illustrations of moderating effects.

Note: Y axis shows the relative hazard of PPE production based on different values of pandemic imprint and moderating variables. The solid line corresponds to a higher level of moderating variables (i.e., one standard deviation above the mean) and the dashed line corresponds to a lower level of moderating variables (i.e., the mean level).

limitation of difference-score measures; (10) an alternative calculation of media sentiment of COVID-19; (11) several post-hoc analyses, and others. By and large, we obtain supportive evidence from these additional analyses. Due to page limitations, we offer a summary of these tests in Table III and report results in Appendix S1 and S2.

DISCUSSION AND CONCLUSION

We examine corporate responses to a sudden environmental shock from an imprinting perspective, unpacking informational variation in corporate leaders' imprinting. We find that corporate leaders leverage available pandemic information to form their imprints, and a subsequent new pandemic (i.e., COVID-19) likely activates these imprints, resulting in faster corporate action to help address the new pandemic (i.e., initiate PPE production). We further develop an imprinting model that directly considers the role of available information flows in imprint formation and manifestation. Specifically, past informational factors such as media sentiment about SARS, impact the strength of a pandemic-imprint formation,

Table III. Summary of supplementary analyses

Randomization inference: calculate a pseudo *p*-value based on randomly assigned pseudo treatments
We randomly assigned placebo treatments and re-estimated the coefficient of pandemic imprints. We repeated this process 100 times and obtained a pseudo *p*-value of 0.00 (i.e, divide the number of coefficients greater than the original coefficient by 100), indicating that our main findings are not driven by chance.
Using logit model to estimate the effects of pandemic imprints (Model 1 of Appendix S1)
In addition to the speed of corporate decision of new PPE production, we considered the likelihood of making that decision to understand the effects of pandemic imprints. We generated a dummy variable indicating whether a firm initiated new PPE production during our sample period and used logit models to estimate the results. For daily specific variables, we used the mean values during our sample period. Results support the positive effect of pandemic imprints on firms' PPE production.
Using an alternative cutoff to identify early adulthoods and pandemic imprints (Model 4 of Appendix S1)
We used 18–25 as an alternative cutoff to measure early adulthoods and pandemic imprints (Arnett, 2000). We obtained supportive evidence.
Using traditional media to calculate media sentiment about COVID-19 (Model 5 of Appendix S1)
In this robustness check, we calculated media sentiment about COVID-19 based on traditional media. We focused on press conferences in this test. During our sample period, 28 provinces held at least one press conference disclosing local conditions in regards to COVID-19. We collected the transcripts of these press conferences from the official website of the State Council Information Office of the People's Republic of China. Since this study investigates corporate responses during the early period of the COVID-19 outbreak, we focused on the first press conference in each province and conducted a content analysis. Similar to media sentiment about SARS, this variable was operationalized by the difference between the length (i.e., logarithmic number of words) of positive and the length of negative descriptions in press conferences of the local government. Positive descriptions indicated that the risk of COVID-19 was relatively low. Neutral descriptions presented neutral facts (e.g., entertainment during the pandemic). Negative descriptions highlighted the risk of COVID-19. Results are supportive.
Using online posts to directly capture the effects of comparisons between two pandemics (Model 6 of Appendix S1)
We investigated the moderating effects of comparisons between two pandemics. If news about COVID-19 mentioned the previous SARS pandemic, it may lead one to compare the two outbreaks and thus activate imprints from SARS. In this supplementary test, we conducted a keyword search and counted the number (in logarithm) of online posts that mentioned SARS to understand the origin of COVID-19. This variable is province-day specific, and we expect it to positively moderate the effect of pandemic imprints on PPE production and obtain supportive evidence.
Using press conferences to examine the effects of government discourse about SARS (Model 7 of Appendix S1)
In this supplementary test, we used press conferences to examine government discourse about SARS. Based on the abovementioned transcripts of the press conferences, we conducted a keyword search and counted the frequency of SARS (or the Chinese translation '非典'). The more frequently local government mentioned SARS in their press conferences, the more likely pandemic imprints would be activated. Results suggest that governments' SARS-related discourse positively moderates the effects of pandemic imprints on firms' PPE production. Our theory thus receives further support.

(Continues)

Table III. (Continued)

Examining the moderating effects of political connections (Model 8 of Appendix S1)

Our theory suggests government propaganda that typically offers positive information may obscure the severity of pandemics and weaken the imprinting effects. Since prior research has shown that individuals with political connections are more prone to follow government messaging (Marquis and Qiao, 2020), we expect that political connections reduce the effects of pandemic imprints. We obtained supportive findings of this.

Rare-event corrections: penalized maximum likelihood logistic regression and rare-event logit models (Models 9 and 10 of Appendix S1)

Since only a small portion of firms initiated PPE production during our sample period, we considered rare-event corrections in our analysis. We used the command of *firthlogit* in Stata 17 and obtained consistent findings. Results are similar if we used rare-event logit models (i.e., *relogit* in Stata 17)

Use death rate of SARS as an alternative measure of pandemic imprints (Model 11 of Appendix S1)

Use difference scores to calculate both media sentiment measures (Models 12–15 of Appendix S1)

We also include the number of negative media coverage to overcome the limitation of the two difference-score variables. Results are still supportive.

Compare corporate leaders' responses to the two media sentiments

To investigate the potential difference in managers' responses toward the two media sentiments, we conduct seemingly unrelated regressions and use a *Wald* test to compare their interactions with the imprinting variable. The interaction between pandemic imprints and media sentiment for SARS is significantly more negative than the interaction between pandemic imprints and media sentiment for COVID. In other words, the moderating effect of media sentiment for COVID is weaker than the moderating effect of media sentiment for SARS.

Post-hoc analysis: the potential moderating effect of the number of journalists

Since the amount of information is also a crucial factor, we specifically consider the potential moderating effect of the number of journalists, using data on the number of journalists in each province gathered from the All-China Journalists Association and standardizing it by local population. We find that the interaction between SARS imprint and the number of journalists is positive and significant, however have kept these tests as post hoc analyses as we believe our direct measure of article sentiment is more fine-grained and appropriate especially since our data shows there is great disparity in media coverage on pandemics.

Post-hoc analysis: the potential moderating effect of social capital

Corporate leaders' social capital is an important aspect of their information source. However, during the early period of COVID-19, information was polarized. Whether positive or negative information dominated the Chairs'/CEO's social network is an empirical question and thus we conduct a post-hoc analysis. Following existing studies (e.g., Jiang et al), we measure social capital based on the board-interlock network (i.e., the number of boards of other firms that the Chair/CEO has ever served). We find a significantly positive interaction between SARS imprint and Chair's/CEO's social capital.

Use clustered standard errors to account for within-firm correlations

In a robustness check, we used an alternative approach to identify board chairs and CEOs. In addition to the executive information reported in the most recent annual reports, we also considered specific dates for each position to identify corporate leaders and redid our analyses. These results are still supportive of our hypotheses.

Results from Cox models with Breslow Approximations (Appendix S2)

while present informational factors, such as media sentiment about COVID-19, and online-reported population mobility from Wuhan, influence the strength of the pandemic-imprint manifestation. We obtain supportive evidence for our theory.

Theoretical Implications

Using pandemic response as a setting, we study how available information regarding significant environmental shocks might enduringly (and heterogeneously) shape individuals' alertness as well as responses to *similar* future events through the activation (or suppression) of their imprints. By directly capturing the specific content and tenor of available information in a unique context, we offer a clearer understanding of the underlying mechanisms of imprinting and a more direct examination of the information-filtering arguments in imprinting theory.

In particular, given that in our context, the Chinese government directly controls media outlets (King et al., 2013) and so shape the flow of information, our findings also contribute to the growing literature on media and propaganda, particularly in authoritarian regimes with strict information control. Existing research has presented contrasting perspectives about the role of media in authoritarian regimes. Some scholars believe that media, especially social media, can provide more independent information and in some cases foster grassroots change (e.g., Khondker, 2011; Olukotun, 2002). Another school of scholars hold a more pessimistic view: Media in authoritarian regimes is under tight regulation and serves as a tool to sustain the authoritarian system (e.g., Marquis and Bird, 2018; Stockmann and Gallagher, 2011). We contribute to this literature by showing that state-controlled media can enduringly affect public opinion long after the initial exposure. In addition, we reveal effects of local variation in information censorship, indicating that the government-controlled information environment is not fully top down.

Our theoretical model contributes to imprinting theory in several ways. First, moving beyond existing studies with a generally homogeneous view of imprinting processes (e.g., Malmendier and Nagel, 2011; Schoar and Zuo, 2017), we show that imprint expression can vary based on how available information flows differ. Our findings thus contribute to resolving a long-standing puzzle in imprinting theory – why individuals with the same experience establish imprints with different levels of strength. The imprinting process, as our results suggest, varies across available information rather than remaining homogeneous based solely on external experiences.

Second, since existing research has mainly regarded imprints as equivalent to expressive behaviours, it has taken the imprinting process for granted and neglected how an imprint can be (heterogeneously) established by past environments and then (differently) activated by current environments. Our imprinting model fills this notable gap. We take past and current informational factors into account and investigate variation in the imprinting process. Relatedly, we extend imprinting theory, which traditionally focuses on environmental changes, to better understand how analogous past-present contexts affect imprints and further investigate how available information flows in similar contexts may stimulate an enduring imprint. We believe our model is highly generalizable as leaders frequently go through environmental shocks,

which might be caused naturally (e.g., Bernile et al., 2017; O'Sullivan et al., 2021), or potentially by humans such as financial crises (e.g., Dowell et al., 2011). Researchers can use these diverse types of shocks to understand the information processes we examine in more detail.

Our study also suggests several other directions for future research. First, corporate response to COVID-19 can be symbolic or substantive, which might be indicated by the amount of PPE produced. For our study, given the broad definition of PPE, such a comparison is not possible, but we encourage future studies to collect more data or use qualitative methods such as interviews to extend our research. Second, consistent with our theory, we focus on corporate reaction in a short period (i.e., around two months after the COVID-19 outbreak), during which high uncertainty and limited information hinder traditional strategic decision making. While we have controlled for and discussed the potential role of economic, CSR, and political motives in corporate PPE production during the early period of COVID-19, it would be useful to investigate corporate responses over longer periods and examine how different strategic motivations might interplay with imprinting effects. Finally, in addition to early adulthood sensitive periods, future research could identify the effects of other sensitive periods, such as childhood, and determine the interplay between multiple sensitive periods.

Practical Implications

In addition to theoretical implications that may be of interest to scholars, our study has practical implications, especially for managers and policy makers. First, even when managers and their peers have experienced the same significant events during sensitive periods, the information they have received before, during, and after those events might vary significantly. By acknowledging the potential variation across individuals' imprints, managers can foster more effective communication, collaboration, and conflict resolution within leadership teams. In addition, our findings suggest that managers should take into account their competitors' information environments and previous imprints when endeavouring to predict their corporate strategies. This may help them develop robust strategies that accommodate diverse viewpoints and mitigate potential blind spots.

Second, for policymakers, our research reveals the importance of considering the varying availability of information among the target population when designing and implementing policies. Further, our study underscores the enduring impact of government-controlled information, particularly in authoritarian regimes, irrespective of its accuracy. This is especially important since the recent global rise of authoritarianism is presenting new challenges for policy makers, particularly those from Western countries, to comprehend these distinct regimes (Diamond et al., 2016). Our findings show that the effects of an earlier information environment can have a lasting effect on individuals. Given the strict information control and propaganda regime in China, such lasting effects provide further evidence that information control earlier in one's life can sustain policies in authoritarian systems (Marquis and Qiao, 2022). Therefore, as politicians engage with counterparts in other countries, they should consider contemporary information and

communication as well as historical policies and what has been communicated to the population. Relatedly, based on our findings, future research can examine the imprinting of politicians (e.g., Wang et al., 2019; Wu et al., 2021), and how their exposure to SARS affected responses in their areas.

In conclusion, we hope future studies can continue this line of inquiry into varieties of imprint manifestation by extending our theory further and gathering more empirical evidence in other contexts.

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NOTES

[1] Although past work has shown other sensitive periods (such as childhood) that impact the lasting effect of earlier experiences, in our setting, early adulthood is the most appropriate sensitive period to investigate for a number of theoretical and empirical reasons. First, young children are still developing their abstract thinking, and thus their understanding of health-related topics, such as diseases and medicines, is quite limited (Hebestreit et al., 2010). Second, children pay less attention to serious news items such as pandemics and are more likely to read articles focused on entertainment (Guthrie, 1981). That is, as children have insufficient acquisition of pandemic-related information, they are less likely to establish pandemic imprints during their childhood. By contrast, considering that individuals' interest in and understanding of health-related topics increase by age (Hämeen-Anttila et al., 2006), early adulthood is a suitable period when individuals can digest information about pandemics and establish some enduring imprints. Third, the average age of chairs and CEOs of publicly traded Chinese firms in 2020 was more than 50; thus most corporate leaders had aged out of their childhoods during the 2003 SARS pandemic.

[2] The original report is available at https://www.aljazeera.com/news/2020/02/local-red-cross-fire-china-coronavirus-donation-mess-200202055418491.html (retrieved on 11 October 2021).

[3] In our empirical analysis, we considered the sentiment from both traditional media and new media and results are similar. More details are in the Methods section.

[4] For more details, go to https://www.hrw.org/news/2020/01/30/china-respect-rights-coronavirus-response (retrieved on 25 July 2022).

[5] For more details, go to http://www.81.cn/jfjbmap/content/2020-02/12/content_253838.htm (in Chinese; see Appendix S4 about Chinese Sources; retrieved on 11 October 2021).

[6] For more details, go to https://tech.sina.com.cn/roll/2020-04-07/doc-iimxyqwa5542061.shtml (in Chinese; see Appendix S4 about Chinese Sources; retrieved on 19 July 2022).

[7] Since PPE includes a number of different types of products such as masks, protective suits and gloves, it is not possible to validly measure the total sum of PPE production. Thus, we use an indicator variable to identify those firms that initiated PPE production.

[8] In the context of infection prevention, the World Health Organization (WHO) provides a broad definition of PPE (https://www.who.int/teams/health-product-policy-and-standards/assistive-and-medical-technology/medical-devices/ppe/ppe-ebola; retrieved on 11 October 2021): 'The Protective equipment consists of garments placed to protect the health care workers or any other persons to get infected. These usually consist of standard precautions: gloves, mask, gown. If it is blood or airborne high infections, will include: Face protection, goggles and mask or faceshield, gloves, gown or coverall, head cover, rubber boots'. We adopted this definition in this study.

[9] As shown in Model 11 of Appendix S1, results are similar if we use death rates to calculate pandemic imprints. In the main analyses, we used measures based on infection rates because SARS survivors can still suffer from long-term effects, and thus infection rates can more accurately reflect the pandemic influence.

[10] Prior research has suggested that in China, both CEOs and board chairs are responsible for critical corporate decisions (e.g., Jiang and Kim, 2015; Peng et al., 2007), and thus we considered both as the best way to proxy top leader effects. We also examined chairs or CEOs separately and obtained similar results.

[11] Since the NHC of China has only published province-level data about the SARS spread, our calculation was at the province level. In the Chinese Statistical Yearbook database, the unit of population is 10,000. We used this unit to standardize variables in this study unless otherwise noted.

[12] In the literature, there are two main approaches to calculate overall sentiment. One approach is to generate a dummy variable indicating whether an article is positive or negative, count the number of positive and negative articles, and then calculate the difference score. The other approach is to generate a continuous variable of article sentiment and then calculate the mean. We chose the former approach here because our manual coding of SARS articles suggested those within each category do not exhibit significantly different sentiments. To overcome the potential limitations of the difference-score approach, we followed Hesketh's (2000) recommendation in Models 14 and 15 of Appendix S1 and added the number of negative articles as a control, and results are similar.

[13] In supplementary analyses, we also transformed the continuous measure as a positive/negative dummy and used the difference-score approach to recalculate this variable. Results are similar if we use difference scores to calculate the two media sentiment variables, as shown in Models 12–15 of Appendix S1. Since continuous measures likely include more information than dummies, we use the mean in the main results.

[14] To calculate the average response speed, we considered non-response as the maximum response time in our sample period. This allowed us to include all firms in the analysis and generate a comprehensive measure.

REFERENCES

Adhikari, S. P., Meng, S., Wu, Y.-J., Mao, Y.-P., Ye, R.-X., Wang, Q.-Z., Sun, C., Sylvia, S., Rozelle, S., Raat, H. and Zhou, H. (2020). 'Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: A scoping review'. *Infectious Diseases of Poverty*, **9**, 29.

Ang, J. S., Hsu, C., Tang, D. and Wu, C. (2021). 'The role of social media in corporate governance'. *The Accounting Review*, **96**, 1–32.

Armanious, M. and Padgett, J. D. (2021). 'Agile learning strategies to compete in an uncertain business environment'. *Journal of Workplace Learning*, **33**, 635–47.

Arnett, J. J. (2000). 'Emerging adulthood: A theory of development from the late teens through the twenties'. *American Psychologist*, **55**, 469–80.

Arnett, J. J. and Tanner, J. L. (2016). 'The emergence of emerging adulthood: The new life stage between adolescence and young adulthood'. In Furlong, A. (Ed), *Routledge Handbook of Youth and Young Adulthood*. London: Routledge, 50–6.

Arnett, J. J., Žukauskienė, R. and Sugimura, K. (2014). 'The new life stage of emerging adulthood at ages 18–29 years: Implications for mental health'. *Lancet Psychiatry*, **1**, 569–76.

Azeem, A. (2020). *China's Provinces at Forefront of Online Censorship Enforcement*. Verfügbar unter. Available at https://www.voanews.com/a/east-asia-pacific_chinas-provinces-forefront-online-censorship-enforcement/6188573.html (accessed 31 December 2023).

Bailey, W., Huang, W. and Yang, Z. (2011). 'Bank loans with Chinese characteristics: Some evidence on inside debt in a state-controlled banking system'. *Journal of Financial and Quantitative Analysis*, **46**, 1795–830.

Bernile, G., Bhagwat, V. and Rau, P. R. (2017). 'What doesn't kill you will only make you more risk-loving: Early-life disasters and CEO behavior'. *Journal of Finance*, **72**, 167–206.

Berzin, S. C. and De Marco, A. C. (2010). 'Understanding the impact of poverty on critical events in emerging adulthood'. *Youth & Society*, **42**, 278–300.

Breslow, N. (1974). 'Covariance analysis of censored survival data'. *Biometrics*, **30**, 89–99.

Broomell, S. B. (2020). 'Global–local incompatibility: The misperception of reliability in judgment regarding global variables'. *Cognitive Science*, **44**, e12831.

Broomell, S. B. and Kane, P. B. (2021). 'Perceiving a pandemic: Global–local incompatibility and COVID-19 superspreading events'. *Decision*, **8**, 227–36.

Campbell, C. and Gunia, A. (2020). China says it's beating coronavirus. But can we believe its numbers? *TIME*. Available at https://time.com/5813628/china-coronavirus-statistics-wuhan/ (accessed 8 June 2024).

Chan, K., Zheng, J., Mok, Y., Li, Y., Liu, Y.-N., Chu, C. and Ip, M. S. (2003). 'SARS: Prognosis, outcome and sequelae'. *Respirology*, **8**, S36–S40.
Chang, K.-C., Hobbs, W. R., Roberts, M. E. and Steinert-Threlkeld, Z. C. (2022). 'COVID-19 increased censorship circumvention and access to sensitive topics in China'. *Proceedings of the National Academy of Sciences*, **119**, e2102818119.
Chen, F., Cao, S., Xin, J. and Luo, X. (2013). 'Ten years after SARS: Where was the virus from?'. *Journal of Thoracic Disease*, **5**, S163–S167.
Chen, K., Chen, A., Zhang, J., Meng, J. and Shen, C. (2020). *Conspiracy and Debunking Narratives about COVID-19 Origins on Chinese Social Media: How it Started and Who is to Blame*, 6th edition. Boston MA: Harvard Dataverse.
Chen, C., LeGates, R., Zhao, M. and Fang, C. (2018). 'The changing rural-urban divide in China's megacities'. *Cities*, **81**, 81–90.
Chen, H., Paris, C. and Reeson, A. (2020). 'The impact of social ties and SARS memory on the public awareness of 2019 novel coronavirus (SARS-CoV-2) outbreak'. *Scientific Reports*, **10**, 18241.
Chen, Y., Wang, K.-R., Xu, W. and Huang, Y. (2021). *Exploring Commenting Behavior in the COVID-19 Super-Topic on Weibo, Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*. Yokohama, Japan: Association for Computing Machinery.
Chen, Y. and Yang, D. Y. (2019). 'The impact of media censorship: 1984 or brave new world?'. *American Economic Review*, **109**, 2294–332.
Dewan, S. and Ramaprasad, J. (2014). 'Social media, traditional media, and music sales'. *MIS Quarterly*, **38**, 101–22.
Di, Y., Li, A., Li, H., Wu, P., Yang, S., Zhu, M., Zhu, T. and Liu, X. (2021). 'Stigma toward Wuhan people during the COVID-19 epidemic: An exploratory study based on social media'. *BMC Public Health*, **21**, 1–9.
Diamond, L., Plattner, M. F. and Walker, C. (2016). *Authoritarianism Goes Global: The Challenge to Democracy*. Baltimore, MD: Johns Hopkins University Press.
Douai, A. (2019). 'Global and Arab media in the post-truth era: Globalization, authoritarianism and fake news'. *IEMed: Mediterranean Yearbook*, **2019**, 124–32.
Dowell, G. W., Shackell, M. B. and Stuart, N. V. (2011). 'Boards, CEOs, and surviving a financial crisis: Evidence from the internet shakeout'. *Strategic Management Journal*, **32**, 1025–45.
Efron, B. (1977). 'The efficiency of Cox's likelihood function for censored data'. *Journal of the American Statistical Association*, **72**, 557–65.
Fang, H., Wang, L. and Yang, Y. (2020). 'Human mobility restrictions and the spread of the novel coronavirus (2019-nCoV) in China'. *Journal of Public Economics*, **191**, 104272.
Fukuyama, F. (1992). *The End of History and the Last Man*. New York: Simon and Schuster.
Gamache, D. L. and McNamara, G. (2019). 'Responding to bad press: How CEO temporal focus influences the sensitivity to negative media coverage of acquisitions'. *Academy of Management Journal*, **62**, 918–43.
Gamson, W. A., Croteau, D., Hoynes, W. and Sasson, T. (1992). 'Media images and the social construction of reality'. *Annual Review of Sociology*, **18**, 373–93.
Green, A. (2020). 'Li Wenliang'. *Lancet*, **395**, 682.
Gunitsky, S. (2015). 'Corrupting the cyber-commons: Social media as a tool of autocratic stability'. *Perspectives on Politics*, **13**, 42–54.
Gupta, A., Briscoe, F. and Hambrick, D. C. (2017). 'Red, blue, and purple firms: Organizational political ideology and corporate social responsibility'. *Strategic Management Journal*, **38**, 1018–40.
Guthrie, J. T. (1981). 'Research views: Acquisition of newspaper readership'. *Reading Teacher*, **34**, 616–8.
Hallen, B. L. (2008). 'The causes and consequences of the initial network positions of new organizations: From whom do entrepreneurs receive investments?'. *Administrative Science Quarterly*, **53**, 685–718.
Hambrick, D. C. (2007). 'Upper echelons theory: An update'. *Academy of Management Review*, **32**, 334–43.
Hämeen-Anttila, K., Juvonen, M., Ahonen, R., Bush, P. J. and Airaksinen, M. (2006). 'How well can children understand medicine related topics?'. *Patient Education and Counseling*, **60**, 171–8.
Hannan, M. T. and Freeman, J. (1977). 'The population ecology of organizations'. *American Journal of Sociology*, **82**, 929–64.
He, B. (2004). 'SARS and freedom of the press: Has the Chinese government learnt a lesson?'. In Wong, J. and Zheng, Y. (Eds), *The SARS Epidemic*, 181–98. Singapore: World Scientific.
He, J. (2013). *In Memory of SARS – Guarding Beijing*. Beijing: New World Publisher.
Hebestreit, A., Keimer, K. M., Hassel, H., Nappo, A., Eiben, G., Fernández, J. M., Kovacs, E., Lasn, H., Shiakou, M. and Ahrens, W. (2010). 'What do children understand? Communicating health behavior in a European multicenter study'. *Journal of Public Health*, **18**, 391–401.

Hesketh, B. (2000). 'The next millennium of "Fit" research: Comments on "The congruence myth: An analysis of the efficacy of the person-environment fit model" by H. E. A. Tinsley'. *Journal of Vocational Behavior*, **56**(2), 190–6.
Higgins, M. C. (2005). *Career Imprints: Creating Leaders Across an Industry*. Hoboken, NJ: John Wiley & Sons.
Hu, T., Guan, W. W., Zhu, X., Shao, Y., Liu, L., Du, J., Liu, H., Zhou, H., Wang, J., She, B., Zhang, L., Li, Z., Wang, P., Tang, Y., Hou, R., Li, Y., Sha, D., Yang, Y., Lewis, B., Kakkar, D. and Bao, S. (2020). 'Building an open resources repository for COVID-19 research'. *Data and Information Management*, **4**, 130–47.
Immelmann, K. (1975). 'Ecological significance of imprinting and early learning'. *Annual Review of Ecology and Systematics*, **6**, 15–37.
Jia, M., Tong, L., Viswanath, P. V. and Zhang, Z. (2016). 'Word power: The impact of negative media coverage on disciplining corporate pollution'. *Journal of Business Ethics*, **138**, 437–58.
Jiang, F. and Kim, K. A. (2015). 'Corporate governance in China: A modern perspective'. *Journal of Corporate Finance*, **32**, 190–216.
Jin, Y. and Zhao, Y. (2020). *Sanxian: Re−/un-Thinking Chinese Urban Hierarchy with a Medium-Sized City*.
Johnson, V. (2007). 'What is organizational imprinting? Cultural entrepreneurship in the founding of the Paris Opera'. *American Journal of Sociology*, **113**, 97–127.
Kahneman, D. (2003). 'A perspective on judgment and choice: Mapping bounded rationality'. *American Psychologist*, **58**, 697–720.
Kapoor, R. and Lee, J. M. (2013). 'Coordinating and competing in ecosystems: How organizational forms shape new technology investments'. *Strategic Management Journal*, **34**, 274–96.
Khondker, H. H. (2011). 'Role of the new media in the Arab Spring'. *Globalizations*, **8**, 675–9.
Kim, S. E. (2018). 'Media bias against foreign firms as a veiled trade barrier: Evidence from Chinese newspapers'. *American Political Science Review*, **112**, 954–70.
King, G., Pan, J. and Roberts, M. E. (2013). 'How censorship in China allows government criticism but silences collective expression'. *American Political Science Review*, **107**, 326–43.
Knudsen, E. I. (2004). 'Sensitive periods in the development of the brain and behavior'. *Journal of Cognitive Neuroscience*, **16**, 1412–25.
Kuang, X. (2018). 'Central state vs. Local levels of government: Understanding news media censorship in China'. *Chinese Political Science Review*, **3**, 154–71.
Law, K. K. F. and Zuo, L. (2021). 'How does the economy shape the financial advisory profession?'. *Management Science*, **67**, 2466–82.
Li, H., He, X., Hu, T.-Y. and Xie, X. (2023). 'Past lesson works: SARS memory moderates the relationship between media use and protective behavior during COVID-19 pandemic in China'. *Journal of Health Psychology*, **28**, 203–15.
Li, D., Jiang, J., Zhang, L., Huang, C. and Wang, D. (2023). 'Do CEOs with sent-down movement experience foster corporate environmental responsibility?'. *Journal of Business Ethics*, **185**, 147–68.
Li, Y., Johnson, E. J. and Zaval, L. (2011). 'Local warming: Daily temperature change influences belief in global warming'. *Psychological Science*, **22**, 454–9.
Li, W., Yang, Y., Ng, C. H., Zhang, L., Zhang, Q., Cheung, T. and Xiang, Y. T. (2021). 'Global imperative to combat stigma associated with the coronavirus disease 2019 pandemic'. *Psychological Medicine*, **51**, 1957–8.
Lievens, F., De Koster, L. and Schollaert, E. (2008). 'Current theory and practice of assessment centers: The importance of trait activation'. In *Oxford Handbook of Personnel Psychology*. New York, NY and Oxford, UK: Oxford University Press.
Liu, X. and Anbumozhi, V. (2009). 'Determinant factors of corporate environmental information disclosure: An empirical study of Chinese listed companies'. *Journal of Cleaner Production*, **17**, 593–600.
Liu, B. and McConnell, J. J. (2013). 'The role of the media in corporate governance: Do the media influence managers' capital allocation decisions?'. *Journal of Financial Economics*, **110**, 1–17.
Lorenz, K. (1935). 'Der Kumpan in der Umwelt des Vogels. Der Artgenosse als auslösende Moment sozialer Verhaltensweisen'. *Journal für Ornithologie*, **83**, 137–213; 289–413.
Lu, H., Stratton, C. W. and Tang, Y.-W. (2020). 'Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle'. *Journal of Medical Virology*, **92**, 401–2.
Malmendier, U. and Nagel, S. (2011). 'Depression babies: Do macroeconomic experiences affect risk taking?'. *Quarterly Journal of Economics*, **126**, 373–416.
Marquis, C. and Bird, Y. Z. (2018). 'The paradox of responsive authoritarianism: How civic activism spurs environmental penalties in China'. *Organization Science*, **29**, 948–68.
Marquis, C. and Qiao, K. (2020). 'Waking from Mao's dream: communist ideological imprinting and the internationalization of entrepreneurial ventures in China'. *Administrative Science Quarterly*, **65**, 795–830.

Marquis, C. and Qiao, K. (2022). *Mao and Markets: The Communist Roots of Chinese Enterprise*. New Haven, Connecticut and London, UK: Yale University Press.
Marquis, C. and Tilcsik, A. (2013). 'Imprinting: Toward a multilevel theory'. *Academy of Management Annals*, **7**, 195–245.
Nelson, L. J. and Barry, C. M. (2005). 'Distinguishing features of emerging adulthood: The role of self-classification as an adult'. *Journal of Adolescent Research*, **20**, 242–62.
Ollier-Malaterre, A. and Rothbard, N. P. (2015). 'Social media or social minefield? Surviving in the new cyberspace era'. *Organizational Dynamics*, **44**, 26–34.
Olukotun, A. (2002). 'Authoritarian state, crisis of democratization and the underground media in Nigeria'. *African Affairs*, **101**, 317–42.
O'Sullivan, D., Zolotoy, L. and Fan, Q. (2021). 'CEO early-life disaster experience and corporate social performance'. *Strategic Management Journal*, **42**, 2137–61.
Panpatte, S. and Takale, V. (2019). 'To study the decision making process in an organization for its effectiveness'. *International Journal of Business Management and Technology*, **3**, 73–8.
Peng, M. W. (2021). 'Apple, America, and China in the age of COVID-19'. *Asian Case Research Journal*, **25**, 445–9.
Peng, M. and Kathuria, N. (2021). 'Post-covid debates in global strategy'. In Fang, T. and Hassler, J. (Eds), *Globalization, Political Economy, Business and Society in Pandemic Times*. Leeds, UK: Emerald Publishing Limited, **36**, 101–8.
Peng, M. W., Zhang, S. and Li, X. (2007). 'CEO duality and firm performance during China's institutional transitions'. *Management and Organization Review*, **3**, 205–25.
People's Daily. (2003). 'Extensively mobilize and rigorously implement mass prevention and control measures to fight a people's war against SARS'. May 2, 2003.
Qian, L. (2021). 'Making memory work: The SARS memory and China's war on COVID-19'. *Memory Studies*, **14**, 1489–502.
Ru, H., Yang, E. and Zou, K. (2021). 'Combating the COVID-19 pandemic: The role of the SARS imprint'. *Management Science*, **67**, 5606–15.
Schoar, A. and Zuo, L. (2017). 'Shaped by booms and busts: How the economy impacts CEO careers and management styles'. *Review of Financial Studies*, **30**, 1425–56.
Shibuya, Y. and Tanaka, H. (2019). 'Detecting disaster recovery activities via social media communication topics'. Paper presented at the ISCRAM.
Simsek, Z., Fox, B. C. and Heavey, C. (2015). '"What's past is prologue": A framework, review, and future directions for organizational research on imprinting'. *Journal of Management*, **41**, 288–317.
Southwell, B. G. and Thorson, E. A. (2015). 'The prevalence, consequence, and remedy of misinformation in mass media systems'. *Journal of Communication*, **65**, 589–95.
Spatial Data Lab (2020a). *Baidu Mobility Data* (V21 ed.). Harvard Dataverse. https://doi.org/10.7910/DVN/FAEZIO
Spatial Data Lab (2020b). *China COVID-19 Daily Cases with Basemap* (V39 ed.). Harvard Dataverse. https://doi.org/10.7910/DVN/MR5IJN
Stockard, C. R. (1921). 'Developmental rate and structural expression: an experimental study of twins, "double monsters" and single deformities, and the interaction among embryonic organs during their origin and development'. *American Journal of Anatomy*, **28**, 115–277.
Stockmann, D. and Gallagher, M. E. (2011). 'Remote control: How the media sustain authoritarian rule in China'. *Comparative Political Studies*, **44**, 436–67.
Sullivan, B. N., Tang, Y. and Marquis, C. (2014). 'Persistently learning: How small-world network imprints affect subsequent firm learning'. *Strategic Organization*, **12**, 180–99.
Tai, Y. and Fu, K.-W. (2020). 'Specificity, conflict, and focal point: A systematic investigation into social media censorship in China'. *Journal of Communication*, **70**, 842–67.
Tai, Z. and Sun, T. (2007). 'Media dependencies in a changing media environment: The case of the 2003 SARS epidemic in China'. *New Media & Society*, **9**, 987–1009.
Terbeck, H., Rieger, V., Van Quaquebeke, N. and Engelen, A. (2022). 'Once a founder, always a founder? The role of external former founders in corporate boards'. *Journal of Management Studies*, **59**, 1284–314.
Tett, R. P., Simonet, D. V., Walser, B. and Brown, C. (2013). 'Trait activation theory'. In Christiansen, N. D. and Tett, R. P. (Eds), *Handbook of Personality at Work*. London: Routledge, 71–100.
Tilcsik, A. (2014). 'Imprint–environment fit and performance how organizational munificence at the time of hire affects subsequent job performance'. *Administrative Science Quarterly*, **59**, 639–68.
Trevor, C. O. (2001). 'Interactions among actual ease-of-movement determinants and job satisfaction in the prediction of voluntary turnover'. *Academy of Management Journal*, **44**, 621–38.

Van Hoye, G. and Turban, D. B. (2015). 'Applicant-employee fit in personality: Testing predictions from similarity-attraction theory and trait activation theory'. *International Journal of Selection and Assessment*, **23**, 210–23.
Wang, M. (2013). 'Ten Years after SARS: Missing the Relationship Between Doctors and Patients During SARS'. *China Youth Daily*.
Wang, D., Du, F. and Marquis, C. (2019). 'Defending Mao's dream: How politicians' ideological imprinting affects firms' political appointment in China'. *Academy of Management Journal*, **62**, 1111–36.
Wang, H. and Qian, C. (2011). 'Corporate philanthropy and corporate financial performance: The roles of stakeholder response and political access'. *Academy of Management Journal*, **54**, 1159–81.
Wang, C., Shen, J. and Liu, Y. (2021). 'Administrative level, city tier, and air quality: Contextual determinants of hukou conversion for migrants in China'. *Computational Urban Science*, **1**, 6.
Wickert, C., Potočnik, K., Prashantham, S., Shi, W. and Snihur, Y. (2024). 'Embracing non-Western contexts in management scholarship'. *Journal of Management Studies*. https://doi.org/10.1111/joms.13048
Wihler, A., Meurs, J. A., Wiesmann, D., Troll, L. and Blickle, G. (2017). 'Extraversion and adaptive performance: integrating trait activation and socioanalytic personality theories at work'. *Personality and Individual Differences*, **116**, 133–8.
Wu, T., Wang, Y. and Delios, A. (2021). 'Imprinting, organizational incentives, and politician behaviors towards FDI in China'. *Academy of Management Proceedings*, **2021**, 12035.
Yang, G. (2009). *The Power of the Internet in China: Citizen activism online*. New York, NY: Columbia University Press.
Yang, Y., Peng, F., Wang, R., Guan, K., Jiang, T., Xu, G., Sun, J. and Chang, C. (2020). 'The deadly coronaviruses: the 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China'. *Journal of Autoimmunity*, **109**, 102434.
Yiu, D. and Makino, S. (2002). 'The choice between joint venture and wholly owned subsidiary: An institutional perspective'. *Organization Science*, **13**, 667–83.
Zavyalova, A., Pfarrer, M. D., Reger, R. K. and Shapiro, D. L. (2012). 'Managing the message: The effects of firm actions and industry spillovers on media coverage following wrongdoing'. *Academy of Management Journal*, **55**, 1079–101.
Zhang, X. (2007). 'Breaking news, media coverage and "citizen's right to know" in China'. *Journal of Contemporary China*, **16**, 535–45.
Zhang, J., Marquis, C. and Qiao, K. (2016). 'Do political connections buffer firms from or bind firms to the government? A study of corporate charitable donations of Chinese firms'. *Organization Science*, **27**, 1307–24.
Zhang, Z., Zhang, B. and Jia, M. (2022). 'The military imprint: The effect of executives' military experience on firm pollution and environmental innovation'. *The Leadership Quarterly*, **33**, 101562.
Zhao, N., Jiao, D., Bai, S. and Zhu, T. (2016). 'Evaluating the validity of simplified Chinese version of LIWC in detecting psychological expressions in short texts on social network services'. *PLoS One*, **11**, e0157947.
Zheng, Y. and Wang, Q. (2020). 'Shadow of the great firewall: The impact of Google blockade on innovation in China'. *Strategic Management Journal*, **41**, 2234–60.
Zhou, N. and Park, S. H. (2020). 'Growth or profit? Strategic orientations and long-term performance in China'. *Strategic Management Journal*, **41**, 2050–71.
Zhu, D. H. and Chen, G. (2014). 'CEO narcissism and the impact of prior board experience on corporate strategy'. *Administrative Science Quarterly*, **60**, 31–65.

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