COVID-19 Pandemic: The Interplay Between Firm Disruption and Managerial Attention Focus

Abstract: Pandemics and epidemics occur regularly, yet their impact on firm behaviours is under-researched. COVID-19 provides a unique opportunity to examine the impact of a once-in-a-century pandemic – given its scope, swift spread, health and economic devastation – on firms' behaviours. Attention is the critical and initial step of the environmental adaptation process. In this paper we draw on two complementary theories – contingency and attention-based view – and examine the relationship between disruption experienced by firms and their COVID-19 attention focus – a sudden exogenous shock. Industry environments may influence which signals attract managerial attention; hence, we examine if firm disruption – COVID-19 attention focus is moderated by industry dynamism. Drawing on the publicly available data and using a sample of 1,861 USA and 1,154 Chinese firms – two diametrically opposite situational contexts – we test the generalizability of our hypotheses. We find a positive relationship between firm disruption and COVID-19 attention focus for the USA sample and that industry dynamism negatively moderates this relationship. In the case of Chinese firms, these relationships were insignificant. Further analysis using topic modelling revealed that business-government relationships accounted for this difference.

Introduction

Epidemics and pandemics are regular events; there have been five this millennium so far – SARS (2002–2003), Swine Flu (2009–2010), MERS (2012–present), Ebola (2014–2016) and COVID-19 (Honigsbaum, 2020). Evidence suggests that they are likely to occur more frequently in the future (Honigsbaum, 2020) – hence the significance of understanding their impact at all levels. At the national level their impact has been studied extensively (Keogh-Brown *et al.*, 2010; Prager, Wei and Rose, 2017; Smith, Keogh-Brown and Barnett, 2011); however, there is a paucity of systematic empirical research at the firm level (Fan, Jamison and Summers, 2018). The ferocity and scope of epidemics and pandemics vary; COVID-19 is a once-in-a-century health crisis with economic devastation consequences akin to a natural disaster. Past studies examining the impact of natural disasters point to far-reaching consequences, such as the breakdown of firms and industries, huge job losses and social precarity (Hällgren, Rouleau and De Rond, 2018; Pearson and Clair, 1998). We contend that the impact of COVID-19 will be as consequential, if not more so, providing the closest empirical example of a 'doomsday' scenario of relevance to management scholarship (Brammer, Branicki and Linnenluecke, 2020; Narayanan *et al.*, 2021). In this paper, we draw on two complementary and longstanding management theories – contingency and attention-based view – to examine the relationship between COVID-19-induced firm disruption and managerial attention focus. The emerging evidence points to the differentiated impact of COVID-19 on firm and industry outcomes which, we argue, results in a varied level of attention focus – hence the choice of firm disruption as our independent variable and managerial attention focus as the dependent variable. Furthermore, we examine whether industry dynamism moderates this relationship. To test the generalizability of our hypotheses, we examine whether they hold true across two distinct situational contexts – the USA and China.

Contingency theory – matching organizational resources with the corresponding environmental context – occupies a central position in the organization and strategic management literature (Andrews, 1980; Chandler, 1962; Donaldson, 2001; Ginsberg, 1988; Pfeffer, 1982; Schendel and Hofer, 1979). Firms that respond in a timely fashion to environmental change outperform firms that fail to respond (Baum and Wally, 2003; Cottrell and Nault, 2004; Haveman, 1992; Nerkar and Roberts, 2004; Smith and Grimm, 1987; Wright and Nyberg, 2017). More consequentially, firms that fail to adjust might enter a downward spiral from which they may never recover (Cameron, Sutton and Whetten, 1988; Cozzolino, Verona and Rothaermel, 2018; Hambrick and D'Aveni, 1988; Hill and Rothaermel, 2003). Puzzlingly, only some firms pay attention to the environmental signals (Barr and Huff, 1997; Bundy, Shropshire and Buchholtz, 2013; Hedberg, 1981; Tushman and Romanelli, 1985). This paper aims to examine this puzzle in the light of unprecedented disruption caused by COVID-19.

Contingency theory is an instrumental theory (doing X results in Y, under Z), linking superior performance to environmental adaption, but it is silent on the adaptation process. The attention-based view complements the contingency theory, asserting that adaptation entails a tripartite information processing sequence: attention, interpretation and action (Daft and Weick, 1984; Dutton and Jackson, 1987; Hambrick and Mason, 1984). Both theories assume the environment to be a source of constant input and stimulus; hence, to remain competitive, firms need to respond appropriately to environmental change. We contend that the tripartite process underpins environmental alignment; hence, we examine the relationship between COVID-19-induced disruption and attention – the critical first step of the process.

The attention-based view does not fully address the puzzle of why only some firms pay attention to environmental change. Scholars posit that the cognitive process influences the

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selection of environmental events that attract managers' attention (Bogner and Barr; 2000; Eggers and Kaplan; 2008; Fiol and O'Connor, 2003; Nadkarni and Barr, 2008; Ocasio, 1997; Ocasio, Laamanen and Vaara, 2018). Arguably, attention is likely to be selective because managers have discretion in shaping organizational outcomes (Hambrick and Finkelstein, 1987; Oh *et al.*, 2016). Furthermore, the degree of discretion is a function of industry-, organization- and individual-level factors (Hambrick and Finkelstein, 1987). Among these contextual factors, industry dynamism is identified as a crucial industry-level variable influencing managerial cognition and discretion (Henderson, Miller and Hambrick, 2006; Steinbach *et al.*, 2017). Drawing on this literature, we contend that industry dynamism moderates the firm disruption–managerial attention focus relationship.

The temporal and contextual factors set the boundaries of a theory's generalizability (Whetten, 1989). Context is viewed variously, including the salient situational features – for example, the country, which in turn influences firms' behaviours (Hitt *et al.*, 2020; Johns, 2017; McGinnis, 2011). Hence, we offer separate hypotheses for each country. Furthermore, the crisis has brought to the fore the importance of an international perspective (Budhwar and Cumming, 2020). We test the generalizability of our hypotheses using separate samples of firms drawn from two diametrically different situational contexts – the USA and China. The two vary on numerous dimensions, for example, institution, business-government relationships, ownership structure, international openness and so forth (Meyer, 2006; White, 2000). Moreover, as the world's largest and second-largest economies, they matter to the global economy.

Taken together, we pose three research questions. First, does objective economic disruption affect managerial attention to COVID-19? Second, does industry dynamism moderate the

relationship between firm disruption and COVID-19 attention focus? Third, do firms operating in the USA and China exhibit the same relationship between firm disruption and managerial attention, moderated by industry dynamism?

We use a cross-sectional sample, including 1,861 USA firms and 1,154 Chinese firms, to address our research questions. In the case of firms operating in the USA, we find a positive relationship between firm disruption and managerial attention focus on COVID-19, and a negative role played by industry dynamism in moderating the firm disruption–managerial attention focus relationship. In the case of Chinese firms, we fail to document a significant correlation between firm disruption and managerial attention focus nor a significant moderating effect of industry dynamism. Our findings point to the importance of country- alongside industry-, organization-, and individual-level factors affecting managerial discretion.

Post-hoc we examine the underlying reasons for the differences, taking our lead from Hoffman and Ocasio's (2001) proposition that an event can be transformed to be critical, warranting attention, if there is accountability to outsiders. We deploy topic modelling to discover connected issues covered in the COVID-19-related content of the USA and Chinese firms' corporate reports, enabling us to identify differences between the USA and Chinese firms' levels of outsider accountability.

Our contribution to the literature is four-fold. First, we extend on contingency theory, demonstrating that industry dynamism influences the relationship between objective disruption and managerial attention to the environmental signals. There is an ongoing debate whether firms in dynamic industry environments would be more agile in response to unpredictability or

be more rigid due to distraction and noise (Boynton, Gales and Blackburn, 1993; Eggers and Kaplan, 2013; Garg, Walters and Priem, 2003; Hough and White, 2004; Kiesler and Sproull, 1982; Sawyerr, 1993). We theorize and demonstrate that dynamic environments make it more difficult for managers to pay proportionate attention to the cause of one-off disruption, providing support for the second argument. Second, by analysing the differences between the USA and Chinese firms, we extend the literature on factors influencing managerial discretion, the driver of attention, beyond the Hambrick and Finkelstein (1987) suggestion to include country. Further, we empirically demonstrate that business-government relationship is a key differentiator, confirming the point made by scholars such as Meyer (2006) and White (2000). Such differences are likely to persist between developed and transition economies, hence challenging the unquestioned relevance of management theories developed in one context (mainly developed economies) to another context (transition economies). Third, research examining the relationship between environmental change, managerial attention and industry dynamism is scarce as a whole and non-existent in relation to pandemics. By conducting this research, we offer an important insight into the management implication of COVID-19. Fourth, we make a methodological contribution. Given that the current research studying COVID-19 relies heavily on retrospective survey data (e.g., Bartik *et al.*, 2020a, 2020b, 2020c; Huynh, 2020; Papanikolaou and Schmidt, 2020), we direct attention to the textual data in financial reports and propose a new approach to measure COVID-19 attention focus. Further, by tapping into unstructured textual data and deploying newer techniques, we address a perceived weakness in management research where much of the current growing data remains untapped despite advances in big data analytics, to the detriment of wider society, policy and practice (Sheng *et al.*, 2020). Moreover, future researchers can use this methodology to analyse managerial views on COVID-19 and corresponding actions. In terms of contribution to practice, this study enables managers to consider their firm in the context of the industry,

compare their attention focus to the attention focus of their industry rivals and ask if the divergence is justified.

Literature review and hypotheses

An infection that emerged in December 2019 at Wuhan – a Chinese megacity – engulfed the world by March 2020 (Gössling, Scott and Hall, 2020). The speed and geographic spread of the most potent and disruptive pandemic since the Spanish Flu of 1918 caught the world by surprise, posing a grave threat to life and livelihood (Baker *et al.*, 2020; Gössling, Scott and Hall, 2020; McKibbin and Fernando, 2020). To halt its advance, many countries introduced measures unprecedented in peacetime, disrupting normal economic activity (IMF, 2020).[1] Despite all this, by the end of May 2021, COVID-19 had infected over 160 million people, resulting in about 3.5 million deaths (Dong, Du and Gardner, 2020). In this section, we briefly review the emerging COVID-19-related literature to locate our contribution and highlight the uneven impact of COVID-19 on firms and industry outcomes. We follow this with an examination of the attention-based view, our key underpinning theory. Finally, we elucidate the relationship between disruption and attention focus, and the role of industry dynamism in moderating this relationship, thereby establishing testable hypotheses.

Emerging COVID-19 literature

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[1] For the detailed examination of each country's mitigating measure, please see Policy Responses to COVID-19 produced by International Monetary Fund: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19

COVID-19, unsurprisingly, has captured the attention of management scholars resulting mainly in voluminous commentaries and conceptual papers, often in special issues. Below we briefly review the papers most pertinent to our research.

The British Journal of Management (BJM) published a number of insightful COVID-19 related commentaries. Shankar (2020) describes the short-, medium- and long-term challenges posed by COVID-19, stressing the need for mitigating action. Both Brammer and Clark (2020) and Beech and Anseel (2020) consider the impact of COVID-19 on the future of business schools and highlight the need for COVID-19-related research. Verbeke (2020) examines the impact of the COVID-19 on the global supply chains proposing four avenues for future research.

Wang *et al.* (2021) stress the importance of action in response to the COVID-19 crisis examining the relationship between firm communication (signals), consumer response and impact on trust recovery. In a conceptual paper, Hitt *et al.* (2020) argue that firms must adapt to or shape their environments in response to COVID-19. Further, the need for refashioning applies to multi-national enterprises (Hitt *et al.*, 2021). Wenzel, Stanske and Lieberman (2020) argue that inaction in the face of a crisis is not an option, identifying four broad possible strategic responses: retrenchment, preserving, innovating and exit. Brammer, Branicki and Linnenluecke (2020) examined the impact of COVID-19 on business-society concluding that long-term consequences are uncertain. Gössling, Scott and Hall (2020) study the impact of COVID-19 on global tourism, concluding that it is likely to change society, the economy and the tourism sector permanently, and pointing to the importance of timely action. Leadership plays a critical role in relevance and timeliness of action. For example, Klebe, Felfe and Klug (2021) examine whether crises weaken or strengthen the positive relationships of health-

oriented leadership with follower strain and performance, concluding that health-oriented leadership is particularly important for followers affected by a crisis. Lawton *et al.* (2021) discuss the potential effects of Covid-19 on firms' non-market strategies identifying three major trends - formation of novel cross-sectoral collaboration, evolution of institutional environment-non-market strategy interplay, and enhanced corporate socio-political alignment.

Taken together, the emerging COVID-19 literature points to the need for rapid mitigating action. The attention-based view, our underpinning theory, suggests that action is unlikely without attention. This paper accordingly addresses a critical issue. Next, we examine the emerging literature pointing to the uneven impact of COVID-19 on firm and industry outcomes.

A number of papers argue that COVID-19's impact on firms and industry is heterogeneous (e.g., Albuquerque *et al.*, 2020; Bartik *et al.*, 2020b; Hassan *et al.*, 2020; Papanikolaou and Schmidt, 2020). For example, stocks with high environmental and social ratings have significantly higher returns and lower return volatilities than other stocks (Albuquerque *et al.*, 2020). Bartik *et al.* (2020b) surveyed 5,800 small US-based firms, concluding that COVID-19's effect on firms was varied. Using text-based measures, Hassan *et al.* (2020) concluded that firms' primary concern is related to the collapse of demand, increased uncertainty and disruption in supply chains. They also point out that some firms expect to gain, while others expect to lose. Papanikolaou and Schmidt (2020) suggest that the effect of COVID-19 is highly asymmetric, with some industries suffering more significantly than others. Further, they point out that industry-level declines reflect not only the supply-side disruptions due to the effects of lockdown, but also demand-side factors, including the collapse of global consumer demand

and expectation of future government policy. These empirical studies collectively point to the differential impact of the COVID-19 pandemic on firms and industries. This stream of literature supports our choice of disruption as the dependent variable.

Attention-based view

Cognition extends the contingency theory by proposing that the environment is not purely exogenous, and that managers' interpretation mediates the organizational response (Barr and Huff, 1997: Bogner and Barr, 2000; Cho and Hambrick, 2006; Herhausen, De Luca and Weibel, 2018; Kaplan, 2011; Karmowska, Child and James, 2017; Nadkarni and Barr, 2008; Ocasio, 2011). This view offers a plausible explanation as to why some firms fail to adjust to environmental changes. Two broad factors give rise to the need for interpretation: (a) cognitive limits (Simon and March, 1993); and (b) uncertainties that make it difficult to assign probabilities to outcomes (Knight, 1965). The literature is further divided on the role and impact of structural features (Mason, 1957) and managerial choice (Child, 1972) on actions and outcomes (Kaplan, 2011). Adner and Helfat's (2003) theoretical perspective suggests that both structural and managerial effects are crucial in understanding firm actions in the face of environmental change, identifying managerial cognition as a critical managerial capability.

Attention, core to the classic studies of decision-making, is assuming an increasingly central position within the cognitive perspectives (Narayanan, Zane and Kemmerer, 2011; Walsh, 1995). The attention-based view describes how attention in organizations shapes organizational action (Ocasio, 1997). According to the attention-based view, managers engage in a tripartite information processing sequence: attention, interpretation and action (Daft and Weick, 1984; Dutton and Jackson, 1987; Hambrick and Mason, 1984). Taking their lead from the attention-

based view, a large number of studies use attention as a measure of cognition (e.g., Eggers and Kaplan, 2009; Kaplan, Murray and Henderson, 2003; Li *et al.*, 2013; McMullen, Shepherd and Patzelt, 2009: Thornton and Ocasio, 1999). In this study, we adopt a narrower view, treating attention and casual logics as two distinct cognitive processes and focusing only on attention. A number of prominent scholars argue that such a distinction is unnecessary and that casual logics are driven by managerial attention (Cyert and March, 1963; Greve, 2008; Ocasio, 1997; Ocasio, Laamanen and Vaara, 2018).

Top managers receive a copious amount of strategic information that often exceeds their cognitive capacity (Simon, 1991). Selective attention offers a solution to cognitive overload. Top managers focus their attention on issues that they deem to be most relevant, while selectively ignoring others (Bogner and Barr, 2000; Daft and Weick, 1984; Fiol and O'Connor, 2003; Hambrick and Mason, 1984; Nadkarni and Barr, 2008; Starbuck and Milliken, 1988). Attention focus – the degree to which top managers' subjective representation of their external environment is dominated by one concept over other concepts – is critical because it influences the degree of mindful attention directed towards a given environmental event, thus influencing its likelihood of entering a firm's strategic agenda, and hence resulting in a possible response (Dutton and Jackson, 1987; Nadkarni and Barr, 2008).

Disruption and attention focus

Given the importance of attention focus to engendering organizational response, a critical question revolves around the nature of the circumstances leading managers to pay attention, and the uniformity of this attention across firms. Cognitive theorists, for a long time, have questioned why only some firms recognize the presence of a crisis by paying attention to it

(Billings, Milburn and Schaalman, 1980; Hermann, 1963, 1969, 1972; Kiesler and Sproull, 1982; Smart and Vertinsky, 1977). Central to addressing this question is how to characterize the concept of "crisis". In his seminal works, Hermann (1963, 1969, 1972) proposed a model of crisis consisting of three basic elements: threat, decision time and surprise. To elaborate, a crisis has to create a noticeable threat recognized by decision makers in order to trigger responses. In addition, crises in a short time period cause considerable change, leaving decision makers a narrow window in which to respond. Further, a crisis normally comes as a surprise since decision makers are unable to predict its occurrence. Hermann's work encouraged other scholars to explore the cognitive process of sensing a crisis. This body of work points to the importance of aspiration-level triggers (Billings, Milburn and Schaalman, 1980; Hall, 1976; Kiesler and Sproull, 1982). According to Kiesler and Sproull (1982), aspiration-level triggers are circumstances in which the damage caused by a problem exceeds the defined level of what is acceptable. In other words, managers would only notice a crisis when they evaluate it against internal performance or other aspiration criteria, and conclude that the potential consequences of the crisis fall below the aspiration level (Kiesler and Sproull, 1982).

The COVID-19 pandemic meets the definition of crisis – an evident threat, striking out of the blue, leaving decision makers a tight response window. On the other hand, its impact on firms and industry outcomes is asymmetrical. The asymmetrical impact of COVID-19 on the revenue and bottom line is likely to influence whether or not firms perceive the pandemic as a cause of the crisis. We contend that financial losses are important aspiration-level triggers, while firms experiencing a lower level of disruption may perceive COVID-19 as less than a crisis; those incurring greater losses are more likely to recognize the threats posed by the pandemic, thus having greater COVID-19 attention focus. A critical question is whether this reasoning, and the resulting hypothesis, holds in two significantly different situational contexts – the USA and

China (Tsang and Kwan, 1999). We have chosen two opposing situational contexts because if the hypothesis holds in such extremes then we can have high confidence in its generalizability. Hence, the following two hypotheses:

H1a: The level of disruption experienced by USA firms is positively related to their COVID-19 attention focus.

H1b: The level of disruption experienced by Chinese firms is positively related to their COVID-19 attention focus.

Industry dynamism

In their seminal paper, Hambrick and Finkelstein (1987) extend the attention-based view by suggesting that the discretion or latitude of action that managers possess in shaping organizational outcomes affects their cognitive process. Further, managers' degree of discretion is a function of industry-, organization- and individual-level contextual factors (Hambrick and Finkelstein, 1987). We expand on the Hambrick and Finkelstein (1987) assertion, providing a deeper explanation as to why, even in the presence of aspiration-level triggers, managers may still overlook or misinterpret a crisis. To this end, we use the "signal-to-noise" concept (Eggers and Kaplan, 2013; Kiesler and Sproull, 1982; Swets and Pickett, 1982). Put simply, noise – peripheral information – may obscure the existence or meaning of the signals pointing to the emergence of a crisis (Kiesler and Sproull, 1982). One likely source of noise is a firm's industry environment (Dess and Beard, 1984; Farjoun and Levin, 2011).

Scholars have theorized and demonstrated that different industries have different rates of change and possess different levels of unpredictability (Dess and Beard, 1984; Farjoun and

Levin, 2011; Henderson, Miller and Hambrick, 2006). This characteristic is termed industry dynamism (Dess and Beard, 1984). Instances of dynamic industries include computers, software, semiconductors, toys and games, movies and cosmetics; conversely, there are stable industries such as the food, steel, petrochemicals and airlines (Bourgeois and Eisenhardt, 1988; Farjoun and Levin, 2011; Henderson, Miller and Hambrick, 2006; Nadkarni and Narayanan, 2007). In the context of COVID-19, managers in a dynamic environment may find it difficult to interpret the causes of disruption due to the distraction of alternative explanations – disruption is common in dynamic industries, making attribution to a cause such as COVID-19 difficult. By contrast, firms operating in a stable industry may be more inclined to attribute the abrupt financial losses to the COVID-19 pandemic in the absence of a strong, alternative explanation.

There are however counterarguments. Some scholars argue that managers in dynamic industries are more proactive in scanning their environments because of the high unpredictability (Boynton, Gales and Blackburn, 1993; Garg, Walters and Priem, 2003; Hough and White, 2004; Sawyerr, 1993). They argue that the lack of information caused by unpredictability leads managers to search for additional information (Hough and White, 2004). Search for information is a double-edged sword in the case of crises. It could potentially draw managers' attention to the new threat affecting their operating environment – COVID-19. On the other hand, managers operating in dynamic industries are frequently called upon to consider which one of the many endogenous factors in play is the root cause of change, potentially delaying attribution to COVID-19 (an exogenous shock) and attention to it. In crises, such a delay may result in long-term negative consequences. On balance, we are inclined to posit that industry dynamism negatively moderates the relationship between firm disruption and the COVID-19 attention focus. As before, we test generalizability by examining whether the theory

holds for two significantly different contextual situations – the USA and China. Hence, we propose the following two country-based hypotheses.

H2a: The level of industry dynamism of a USA firm's industry negatively moderates the relationship between firm disruption and COVID-19 attention focus.

H2b: The level of industry dynamism of a Chinese firm's industry negatively moderates the relationship between firm disruption and COVID-19 attention focus.

Figure 1 presents the theoretical framework of this research.

[Insert Figure 1 about here]

Methodology

Sample and data

We use the first and second quarter financial information from 2015 to 2020 to measure *firm disruption.* For the *managerial attention focus* we use the quarterly/semi-annual reports of publicly listed USA and Chinese firms published in 2020. We use firm-level financial data from both countries from 2015 to 2019 to measure industry dynamism. Financial information was collected from Compustat and the China Stock Market and Accounting Research (CSMAR) databases. The quarterly reports of the USA firms (Form name: 10-Q) are accessible at SEC's Edgar online database.[2] Chinese firms' semi-annual reports were downloaded from the official websites of the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE).[3] CEO and Board information is collected from BoardEx and CSMAR for the USA and Chinese firms respectively. At the first glance, relying on 2020 first half-year financial data

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[2] The data is available at: https://www.sec.gov/edgar/searchedgar/companysearch.html
[3] The quarterly reports for firms listed in SSE are available at: http://www.sse.com.cn/disclosure/listedinfo/regular/. The quarterly reports for firms listed in SZSE are available at: http://www.szse.cn/disclosure/listed/fixed/index.html

may appear too short a time period to test our hypotheses centred around firm disruption–managerial attention focus and the moderating role of industry dynamism at the onset of an unprecedented crisis with instantaneous impact. The instantaneous disruption to the economic activity suggests that the USA and Chinese firms in the firing line would have felt the impact by mid-2020 at the latest. Further, in the case of cataclysmic crisis the decision-making window is narrow (Hermann, 1972); hence, attention needs to manifest itself quickly to facilitate appropriate mitigating action. Taken together we content that our time frame is appropriate for attention to manifest itself.

We categorize firms according to the two-digit SIC industries. The SIC code is commonly used as an industry identifier for US firms. China, on the other hand, uses a different industry classification system – known as GB/T 4754. The CSMAR database provides two-digit GB/T 4754 codes, which are analogous to two-digit SIC codes. To reconcile the different industry classification systems of the USA and China, we manually matched two-digit GB/T 4754 and two-digit SIC codes.

We retrieved all available first- and second-quarter reports for the USA firms and the semi-annual reports for the Chinese firms excluding those with less than 500 words in English or 200 characters in Chinese in their "management discussion and analysis" (MD&A) section. This yielded 6,942 reports for the USA firms and 2,352 reports for Chinese firms. By merging financial information and corporate reports, we ended up with two separate samples: 1,861 USA firms and 1,154 Chinese firms, covering 61 and 45 industries respectively.

Dependent variable

Our dependent variable is firm-level COVID-19 attention focus. The USA federal securities laws mandate publicly listed firms to disclose certain information periodically to the public. The China Securities Regulatory Commission (CSRC) imposes a similar mandate. Company financial reports normally contain a textual description of the earning performance, and occasionally they offer a detailed analysis of risks and opportunities. The literature extensively uses the reports as an indirect representation of the managers' cognition (e.g., Hoberg and Phillips, 2016; Hussainey, Schleicher and Walker, 2003; Nadkarni and Barr, 2008; Schleicher, Hussainey and Walker, 2007). Financial reports offer a more reliable assessment of managers' attention because they capture their views contemporaneously and are superior to surveys or interviews, which frequently involve retrospective reconstruction (Kaplan, 2011). Given the profound challenge posed by the COVID-19 pandemic, it was addressed by many firms' quarterly/semi-annual reports, thus providing an ideal source of data to assess managers' attention focus. Here, we use the percentage of COVID-19-related content in the management discussion and analysis (MD&A) section as the proxy for attention focus. Following the rationale of the previous empirical research (Eggers and Kaplan, 2008; Kaplan Murray and Henderson, 2003; Nadkarni and Barr, 2008), we contend that managers would discuss COVID-19 more if, cognitively, they regarded it as a salient issue to their firms.

Hussainey, Schleicher and Walker (2003) proposed a textual-based approach to assess the forward-looking information contained in the annual report. We adopted their approach in assessing attention-focus on COVID-19. For each financial report, the computation process involved three steps. First, we identified COVID-19-related keywords. To this end, we read 30 quarterly reports produced by the USA firms and a similar number of reports produced by Chinese firms, and selected '*COVID-19*', '*coronavirus*', '*disease*', '*outbreak*', '*epidemic*' and '*pandemic*' as the keywords for the US reports, and '*xinguan*' (the abbreviation of novel

coronavirus), '*xinxing guanzhuang*' (novel coronavirus), and '*yi*' (epidemic/pandemic) as the keywords for the Chinese reports. Second, if a sentence contained any of these COVID-19-related keywords, we regarded it as a COVID-19-related sentence. Third, we computed the word count of the COVID-19-related sentences and that of the MD&A section. The attention score was calculated by dividing the word count of COVID-19-related sentences and that of the MD&A section. It is important to note that while USA firms release quarterly reports in both the first and the second quarter, Chinese firms release quarterly reports for the first quarter and then semi-annual reports. To reconcile the differences between different reporting systems, we average the attention scores of the first and second quarter quarterly reports of the USA firms, proxying their attention focus on COVID-19 for the first half-year, and use the attention scores calculated from the semi-annual reports only for the Chinese firms.

Independent variable

The independent variable is firm disruption. There is no consensus as to how to assess disruption, consequently a variety of measures are used (e.g., Bartik *et al.*, 2020b; Papanikolaou and Schmidt, 2020). For example, Papanikolaou and Schmidt (2020) used survey data assessing employees' ability to work remotely to measure industry supply-side disruption. Bartik *et al.* (2020b) assessed both the supply-side and the demand-side disruption using survey instruments. Surveys provide a subjective view. In this research, we rely on an objective economic measure of disruption offering greater reliability and replicability, adopting a three-step process.[4] First, we calculate the firm's semi-annual total revenue by summing its revenue in the first and second quarters. Second, we calculate the percentage

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[4] In line with the evolving COVID-19 literature, as well as the crisis-related literature, we only consider the negative consequences of the pandemic (Bartik *et al.*, 2020b; Papanikolaou and Schmidt, 2020; Tomlin, 2006). Positive disruption is mainly used in assessing the impact of technological breakthroughs (e.g., Gomber *et al.*, 2018).

change of the first half-year revenue for each firm from 2015 to 2020. Third, we use the difference between the mean value of firm revenue growth (in the first half-year) for the past five years (2015–19) and firm revenue growth (in the first half-year) in 2020 as the proxy of disruption. Apart from being an objective measure, negative performance changes are more likely to draw managers' attention (Finkelstein, Hambrick and Cannella, 1996; March and Shapira, 1992; Nadkarni and Barr, 2008).

Moderator variable

The moderator variable is industry dynamism. Following Keats and Hitt (1988), Datta, Guthrie and Wright (2005), Mueller, Mone and Barker (2007), Gupta and Misangyi (2018) and Richard *et al.* (2019), we calculate industry dynamism using a two-step process. First, we regressed the log-transformed industry sales of the past five years against time (2015–2019). Second, we antilogged the standard error of the regression slope and used it as the value of industry dynamism.

Control variables

Hambrick and Finkelstein (1987) posit that managers' degree of discretion, a critical determinant of cognitive process, is not random but a function of industry-, organization-, and individual-level contingency factors (Hambrick and Finkelstein, 1987). In the previous section, we explained our rationale for selecting industry dynamism as our moderator variable, here we describe our control variables.

Using Hambrick and Finkelstein's (1987) assertion as our starting point, we control for a number of individual- (CEO tenure, CEO duality), firm- (firm size, current ratio, debt-to-equity, return on asset (ROA), revenue growth, capital intensity) and industry-level factors (essential industry and industry revenue growth), that might affect firm-level COVID-19 attention focus. The literature suggests that a CEO's power affects managerial cognition and decisions (Li and Tang, 2010; Nadkarni, Chen and Chen, 2016). In this research, we proxy CEO power by CEO duality and CEO tenure, two indicators frequently used in the related research (Gupta, Nadkarni and Mariam, 2019; Li and Tang, 2010; Wang *et al.*, 2019). CEO duality is a dummy variable denoted as one if the CEO is also the chair of the board, and zero if otherwise. CEO tenure is the number of years since the executive assumed office.

Smaller firms could be more dynamic (Nadkarni and Chen, 2014) and, as such, are more likely to shift focus to COVID-19. On the other hand, large firms have greater capabilities to deal with the risks associated with the pandemic (Greenwood, Iverson and Thesmar, 2020) and, as a result, they might address it more extensively in their financial report to signal to markets the steps taken to hedge the COVID-19 risks. Therefore, we control for firm size, which is the natural log of firm total assets. Similarly, firms with greater slack resources have greater opportunities to instigate mitigating strategies; therefore, they are likely to devote more space in their reports to discussing their approaches. Following Zona (2012) and Nadkarni and Chen (2014), we consider the current ratio as the proxy of available slack and debt-to-equity as the proxy of potential slack. Current ratio is the total asset of a firm over its long-term liability. Good past performance may buffer the risks associated with COVID-19, resulting in less attention focus. We control for past performance by ROA and sales growth. These indicators are calculated using the financial information pertaining to the end of 2019.

The literature suggests that managerial cognition and decision-making are influenced by their industry environment (Gupta, Nadkarni and Mariam, 2019; Li and Tang, 2010; Walrave *et al.*, 2017; Wang *et al.*, 2019). Hence, we control for industry-level variables, including essential industry and industry revenue growth. Both the USA and Chinese governments offer special consideration to a number of industries deemed essential to the basic functioning of the country during lockdowns. Firms operating in essential industries may therefore pay less attention to COVID-19 given the government support. The Cybersecurity and Infrastructure Security Agency (CISA) of the USA lists 16 critical infrastructure sectors.[5] The Chinese central government, on the other hand, does not provide a list of essential industries, leaving local governments to identify industries deemed as essential. The differences between the list of industries deemed as essential by different Chinese local governments are minor. Thus, here we use Beijing local government's list of essential industries comprising of 14 essential industries. We then manually match the essential industries (or sectors) with two-digit SIC industries, and create a dummy variable, which is denoted as one if the industry is an essential industry, and zero if otherwise. Further, we also contend that firms in poorly performing industries may pay more attention to COVID-19 because of their industries' vulnerability to COVID-19-induced disruption. Hence, we control for industry revenue growth, which is the percentage change of the industry revenue from the first half-year of 2019 to the same period of 2020.

Empirical results

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[5] The details of essential industries listed by CISA are available at: https://www.cisa.gov/identifying-critical-infrastructure-during-covid-19

Descriptive statistics

Table 1 reports the descriptive statistics and correlation matrix of the key variables used in this study.

[Insert Table 1 about here]

We calculate variable variance information factors (VIFs) for the models for multicollinearity diagnostics. The VIF value of each model is below 1.55 and the mean VIF value is 1.25. The values are below the recommended cut-off of 5 (Hair *et al.*, 2016); hence, there is no evidence of multicollinearity in our models.

Results

Our data include two cross-sectional samples – 1,861 USA based firms and 1,154 Chinese firms. We use OLS regression analysis with attention focus as the dependent variable, disruption as the independent variable, industry dynamism as the moderator variable and we add individual-, organization- and industry-level control variables. Additionally, we control for industry fixed effects. Robust standard errors are clustered at the firm level. Interaction graphs are an important tool to interpret interaction effects. Following Nadkarni and Chen (2014), we use one standard deviation above (or below) the mean to represent high (or low) industry dynamism. Table 2 presents the results of regression analysis in relation to our four hypotheses.

[Insert Table 2 about here]

H1a posits that the USA firm disruption is positively correlated with managerial attention focus on COVID-19. Model 3 supports this hypothesis. We find a significant and positive coefficient of disruption ($\beta = 0.23$, $P < 0.05$). Model 4 tests H1b for the sample of Chinese firms. In this model we find no such support; the coefficient of disruption is positive but

insignificant ($\beta = 0.04$, $P > 0.10$). Hence, the USA firms are more likely to pay attention to COVID-19-induced disruption than Chinese firms.

H2a and H2b propose that industry dynamism negatively moderates the relationship between firm disruption and managerial attention focus on COVID-19 in the USA and China. Similarly, we find support for this hypothesis when testing the USA data. However, we find no support in the case of Chinese firms. Specifically, in Model 5 (USA data), the interaction between firm disruption and industry dynamism is significant and negative ($\beta = -22.42$, $P < 0.05$). The coefficient in Model 6 (Chinese data) is insignificantly negative ($\beta = -1.55$, $P > 0.10$). Figure 2 lends further support for the results – we document a clear interaction effect in the context of the USA. There is an indication of an interaction effect in the case of China, but the effect is weaker than the USA.

[Insert Figure 2 about here]

Post-hoc analysis: why the difference?

We used topic modelling, a relatively new technique, to uncover why our hypotheses hold for the USA firms but not for the Chinese firms. Topic modelling is used by management researchers to analyse complex textual data – in our case corporate reports – to develop a more profound and nuanced understanding (for a review see Hannigan *et al.*, 2019).

Topic modelling, a computer-aided technique, utilizes algorithms to generate a list of latent topics from a "corpus" (i.e., a given set of textual documents), enabling scholars to extract, analyse and interpret connotations hidden within voluminous textual information. We use topic modelling to identify topics covered in the COVID-19-related content of the USA and

Chinese firms' corporate reports (hereafter, USA/Chinese corpora). We do so because Hoffman and Ocasio (2001) proposed that an event can be transformed to critical, warranting attention, if there is accountability to outsiders giving specificity to "other" aspiration criteria alluded to by Kiesler and Sproull (1982).[6]

Guided by Hannigan *et al.* (2019), we pre-processed the USA/Chinese corpora, taking the following steps. First, we focused only on COVID-19-related sentences extracted as described previously. Second, we trimmed the documents by excluding corporate reports with the number of COVID-19-related sentences less than the fifth percentile of all the reports, and those exceeding the ninety-fifth percentile, safeguarding against firms with a lengthy discussion of COVID-19 dominating the "rendered topics" and against the potential skew caused by firms discussing the pandemic thinly. Third, we split the COVID-19-related sentences into words. While it is possible to split English sentences naturally by the blanks between words, in Chinese, there are no such blanks in sentences. We use a Python package "*Jieba*" to split Chinese sentences into words. Fourth, we removed "stop words" (e.g., in English, "*the*", "*in*" and "*a*"; in Chinese, "*zhe*", "*na*" and "*de*"). We use English stop words provided by the Natural Language Toolkit (NLTK) and for Chinese Baidu stop words list. Fifth, we transform English words into their roots (e.g., "*companies*" into "*company*"). Finally, we select only nouns, excluding verbs, adjectives and adverbs.

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[6] Kiesler and Sproull (1982) suggest that internal performance is the critical aspiration criteria recognising possibility of "other" aspiration criteria. In our case, objective disruption.

The above steps generated two sentence-word matrices for USA/Chinese corpora respectively. Each matrix is composed of rows representing COVID-19-related sentences in the corpora, with columns representing unique words in the corpora, and cells showing the number of times each word appears in each sentence. We then used one of the most popular topic modelling algorithms, Latent Dirichlet Allocation (LDA), to process the matrices and render topics (Blei, Ng and Jordan, 2003).

We use a Python package, Turi Create (TC), to execute LDA. A key concern of running LDA is determining parameters including, most importantly, the number of topics. To this end, we use *perplexity* – a popular evaluation metric for language models – to determine the optimal number of topics (Blei, Ng and Jordan, 2003; Jacobi, Van Atteveldt and Welbers, 2016). TC generates perplexity scores by inputting a given number of topics. Given the complexity of the concept, we do not further explicate the calculation details of perplexity (for a detailed explanation, see e.g., Blei, Ng and Jordan, 2003). In sum, a lower perplexity indicates a better model. Hence, the model with the lowest perplexity score suggests the optimal number of topics. As such, we run different LDA models with different numbers of topics ranging from 1 to 20, plotting the change of perplexity scores with an increasing number of topics (see Figure 3).

[Insert Figure 3 about here]

The perplexity scores of LDA models analysing USA/Chinese corpora reach the lowest point around five (see Figure 3). Hence, we generate five topics for the USA and China respectively. Each topic contains a list of representative words ranked by their relevance to the specific topic. Additionally, we manually inspected and confirmed that the topic models generated by LDA are semantically meaningful. The results are presented in Table 3.

USA firms when discussing COVID-19 overwhelmingly focus on its impact on financial performance and the overall economy (see Table 3). Specifically, 4 out of 5 topics are related to financial (Topic 1, 2 and 3) and economic (Topic 4) aspects, with only Topic 5 discussing travel restrictions, actions and measures imposed by the government. This suggests that the market is their key outsider accountability. In contrast, Chinese firms, apart from discussing the economy (Topic 6), financial performance (Topic 8) and markets (Topic 9), focus more on epidemic prevention and control (Topic 7 and 10). Comparatively, Topic 7 is concerned more with preventing COVID-19 in workplaces, and Topic 10 leans toward the discussion of social responsibilities by providing medical supplies to hospitals and other medical institutions. Our analysis suggests that Chinese outsider accountability is split.

[Insert Table 3 about here]

We offer two possible explanations as to why the outsider accountability of Chinese managers, unlike that of their USA counterparts, is split. First, China was among a handful of countries to quickly bring the pandemic under control and, hence, was one of the fastest countries to resume normal economic activity (Kuo, 2020). It stands to reason that Chinese managers would focus their attention on COVID-19 prevention and control in workplaces, to reassure employees that they can work safely. Second and more importantly, unlike the USA, the Chinese government led by the Chinese Communist Party (CCP) has substantial control over corporations because of the significance of state-owned enterprises (SOE) in the economy and the notable presence of CCP committees ("*dangwei*") in both privately-owned enterprises (POE) and SOEs (Haveman *et al.*, 2017; Wang, Du and Marquis, 2019). Hence, the Chinese firms tend to pay close attention to government signals and are keen to please the government; for example, during the COVID-19 crisis, firms' assumed greater social responsibility, financing medical supplies to hospitals.

To investigate the importance of CCP leadership in navigating managerial attention focus on COVID-19, we searched CCP-related keywords including "*Dangzhongyang*" (Central Committee of the Chinese Communist Party), "*Dangyuan*" (Party member), "*Dangwei*" (Party committee), "*Dangzu*" (Leading party members' group), "*Zongshuji*" (General secretary), "*Xi Jinping*" in COVID-19-related sentences. We find that 460 out of 2,352 (20%) Chinese financial reports mention these keywords at least once when discussing COVID-19, suggesting CCP leadership plays a significant role in shaping Chinese firms' managerial attention focus.

Our analysis suggests that the USA managers' key outside accountability is to the market; hence, we find a positive relationship between attention-focus and disruption. On the other hand, Chinese managers' outside accountability is split between the market and the demands of the government. The result is a positive but statistically insignificant relationship between attention-focus and disruption. A similar argument holds in relation to moderating impact of environmental dynamism. Our finding extends Hambrick and Finkelstein (1987) contextual factors to include country as a key determinant of managers' degree of discretion.

Discussion

Crises are typically treated as infrequent occurrences and outside the typical operations of an organization; hence, a paucity of systematic research. Prior studies treating industry characteristics as endogenous have examined the relationship between industry characteristics,

managerial cognition and response (e.g., Nadkarni and Barr, 2008).[7] Yet there are likely to be differences in attention focus between events viewed as endogenous (characteristic of ongoing operations) and those considered exogenous (one-off disruptions). For example, in high clockspeed industries certain kinds of disruptions are more common than slow speed ones (Fine, 1999; Nadkarni and Barr, 2008) and the regularity of occurrences of these disruptions may engender attentional differences between the firms in these two types of industries. However, disruptions such as the COVID-19, often treated as an infrequent occurrence, may receive managerial attention but the managers, despite their awareness, have discretion not to consider them to be worthy of their attention viewing the crises as beyond their control, and this perception of uncontrollability may prevent a response to the crises. The literature is sparse with respect to exogenous disruptions and crises (Fan, Jamison and Summers, 2018).

Only some firms react to environmental change; yet, environment-strategy alignment assumes greater importance in the face of the COVID-19 – the closest empirical example of a doomsday scenario of relevance to management scholarship (Brammer, Branicki and Linnenluecke, 2020). Theory and empirical evidence suggest that significant misalignment with the environment will result in permanent scarring of the economy. In this study, we investigated the circumstances under which managers exhibited greater COVID-19 attention focus, thus, offering an important practical insight.

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[7] The genesis of this paper differs from Nadkarni and Barr's (2008) paper that examines the relationship between clockspeed (factors endogenous to an industry), mediating role of managerial cognition and speed of response. They demonstrate that industry characteristics influence the speed of response and the relationship is moderated by managerial cognition. Our work examines the impact of exogenous shock linking contingency theory and attention-based view to develop and test an entirely different theoretical model.

We posited that managers would increase their COVID-19 attention focus if their firms experience a greater level of disruption. In addition, we argued that managers in dynamic industries could be distracted by noise information, and hence, they were less likely to attribute the causes of disruption to the COVID-19, resulting in lower COVID-19 attention focus. In other words, we argued that industry dynamism negatively moderates the firm disruption–managerial attention focus relationship. In the process, we extend the contingency theory by theorizing and demonstrating that in certain circumstances industry dynamism negatively moderates managerial attention to the environmental signals.

We developed four hypotheses respectively and tested them using a sample that included 1,861 USA firms and 1,154 Chinese firms. Using two diametrically different situational contexts allowed us to test the generalizability of our hypotheses, thereby addressing a weakness in management research (Meyer, 2015; Tsang and Kwan, 1999).

Empirically testing the hypotheses, we found that Hypotheses 1a and 2a pertaining to the USA were supported, but Hypotheses 1b and 2b pertaining to China were not supported. Using topic modelling, we examined the reason for this difference. The key reason for the observed difference, discussed in the prior section, was the business-government relationship. The USA managers' principal outsider accountability was to the market, as manifested in financial and economic topics surrounding COVID-19, while Chinese managers' accountability was split between the market and the government. The observed difference raised an important question regarding the applicability of management theories, primarily those developed based on Western contexts, to countries with different economic, social and political environments (Blackler, 1993; Blunt and Jones, 1997; Chen, Chen and Xin, 2004; Park and Luo, 2001;

Rondinelli, 1981). Finally, the paper makes an important methodological contribution as discussed in the previous section.

Conclusion

Our study not only addresses an important and unresolved theoretical conundrum, but also offers empirical evidence helpful to policymakers and practitioners. We add to the literature by stressing the role of industry dynamism and accountability to outsiders in shaping managerial attention focus. In addition, by drawing on publicly available data, our methodology offers replicability. Furthermore, by drawing on objective data (financial information) and contemporaneous management views rather than retrospective recollection, our analysis offers a high degree of integrity and reliability. Our study offers an international perspective drawing on a sample of firms operating in two distinct jurisdictions, highlighting the impact of situational context on theory. Finally, our study adds to the understanding of the impact of epidemics and pandemics on the behaviours of firms – an under-researched area.

Reliance on two diametrically opposite situational contexts is a limitation. To test the generalizability of our hypotheses, it is necessary to test them using broader situational contexts.

In terms of future research in this paper, we focus on the first step of the tripartite process sequence: attention. Attention is a prelude to interpretation and action. Future researchers might examine the relationship between COVID-19 attention focus and ensuing action – tactics and strategies firms put in place in order to address the effects of COVID-19.

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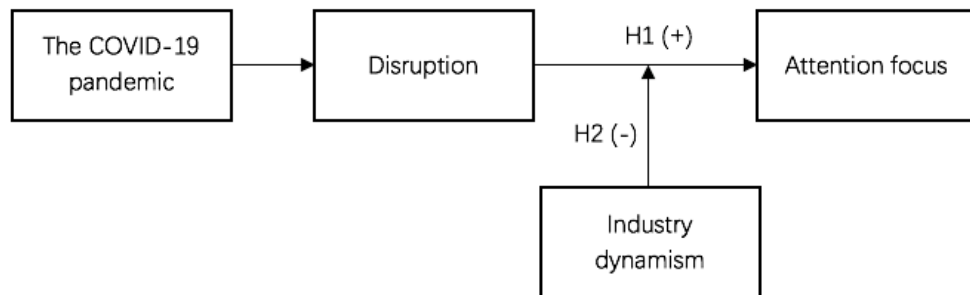
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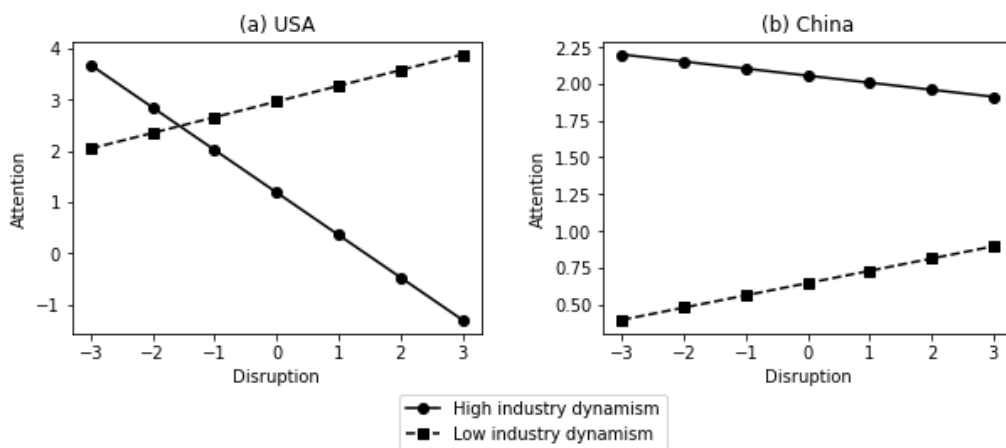

Figure 1. Theoretical framework

Figure 2. Interaction plots of disruption, industry dynamism and attention
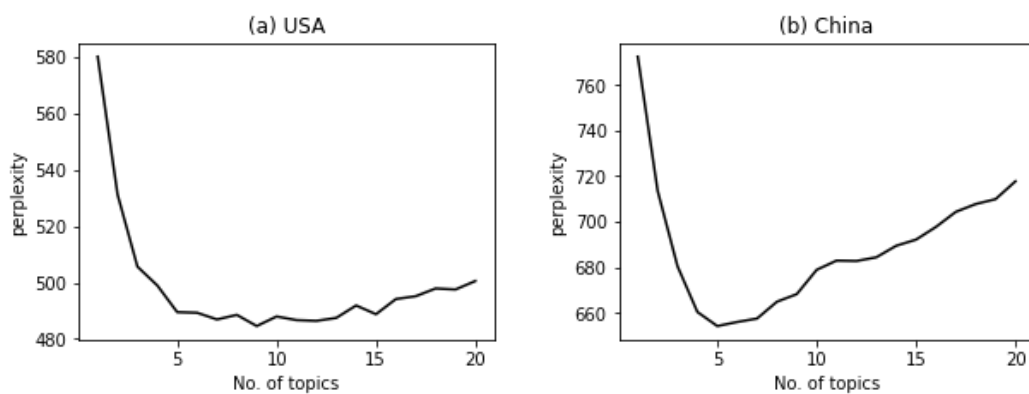

Figure 3. Number of topics and perplexity score

Note: A lower perplexity indicates a better model, hence the optimal number of topics is determined by the lower perplexity score

Tables

Table 1. Descriptive statistics

Panel A: USA

	Mean	SD	1	2	3	4	5
1. Attention	7.86	4.58					
2. Disruption	0.27	0.87	0.01				
3. Dynamism	1.02	0.01	–0.15	0.1			
4. CEO tenure	4.29	4.8	0	–0.03	–0.03		
5. CEO duality	0.78	0.41	0	–0.02	0.02	0.18	
6. Firm size (log)	7.17	2.17	0.14	–0.1	0.05	–0.04	–0.05
7. Current ratio	2.33	1.87	–0.02	0.07	0.02	0.09	0.03
8. Debt-to-equity	0.75	2.5	0.01	–0.02	–0.02	–0.03	–0.03
9. ROA	–0.04	0.25	0.11	–0.16	–0.01	0.11	0.02
10. Revenue growth	0.13	0.45	–0.05	0.24	–0.02	–0.03	–0.03
11. Industry revenue growth	–0.08	0.13	–0.06	–0.12	–0.4	0.01	–0.01
12. Essential industry	0.72	0.45	–0.11	0.06	0.42	0.03	0.05

	6	7	8	9	10	11
7. Current ratio	–0.31					
8. Debt-to-equity	0.12	–0.12				
9. ROA	0.49	0.03	0.05			
10. Revenue growth	–0.08	0.04	0.03	–0.08		
11. Industry revenue growth	–0.07	0.04	–0.02	–0.05	0.04	
12. Essential industry	0.12	–0.02	0.01	–0.03	0.03	–0.21

Panel B: China

	Mean	SD	1	2	3	4	5
1. Attention	2.72	2.05					
2. Disruption	0.28	0.85	0.03				
3. Dynamism	1.02	0.01	0	0.09			
4. CEO tenure	4.97	3.44	0.02	–0.1	0.02		
5. CEO duality	0.26	0.44	–0.08	0	0.05	0.16	
6. Firm size (log)	22.8	1.42	–0.01	0.04	–0.08	–0.05	–0.16
7. Current ratio	2.39	1.27	0.16	–0.04	0.04	0.03	0.04
8. Debt-to-equity	0.31	0.49	–0.1	0.02	–0.07	–0.1	–0.06
9. ROA	0.02	0.09	0.08	–0.12	–0.03	0.06	0
10. Revenue growth	0.11	0.34	–0.02	–0.16	0.03	–0.02	0.03
11. Industry revenue growth	0.02	0.1	–0.15	–0.09	0.01	–0.01	0.07
12. Essential industry	0.69	0.46	–0.03	–0.04	–0.23	–0.03	–0.03

	6	7	8	9	10	11
7. Current ratio	–0.36					
8. Debt-to-equity	0.43	–0.39				
9. ROA	0.07	0.26	–0.1			
10. Revenue growth	0.09	–0.06	0.04	0.26		
11. Industry revenue growth	0.08	–0.03	0.02	0	0.17	
12. Essential industry	–0.12	0.13	–0.14	0.03	–0.06	0.1

Table 2. Regression results

	Controls		Main effect		Interaction effect	
	USA Model 1	China Model 2	USA Model 3	China Model 4	USA Model 5	China Model 6
Controls						
CEO tenure	0.01 (0.62)	0.0 (0.01)	0.01 (0.64)	0.0 (0.07)	0.02 (0.69)	0.0 (0.08)
CEO duality	0.2 (0.81)	–0.3** (–2.33)	0.21 (0.85)	–0.3** (–2.36)	0.22 (0.87)	–0.3** (–2.31)
Firm size	0.43*** (7.05)	0.1** (2.02)	0.43*** (7.07)	0.1** (1.98)	0.43*** (7.09)	0.1** (2.01)
Current ratio	0.04 (0.66)	0.2*** (2.9)	0.03 (0.54)	0.2*** (2.9)	0.03 (0.57)	0.2*** (2.91)
Debt-to-equity	–0.02 (–0.38)	–0.25** (–2.09)	–0.01 (–0.35)	–0.25** (–2.1)	–0.02 (–0.45)	–0.25** (–2.12)
ROA	0.93* (1.82)	0.81 (1.3)	1.01** (1.95)	0.83 (1.32)	1.02** (1.96)	0.79 (1.24)
Sales growth	–0.44** (–1.96)	0.04 (0.25)	–0.54** (–2.42)	0.06 (0.35)	–0.53** (–2.37)	0.07 (0.39)
Essential industry	–3.16** (–2.29)	–1.59*** (–3.22)	–3.28** (–2.41)	–1.6*** (–3.27)	–3.22** (–2.38)	–1.6*** (–3.27)
Industry revenue growth	–4.43*** (–2.55)	–0.45 (–0.87)	–4.24** (–2.4)	–0.45 (–0.87)	–4.38*** (–2.49)	–0.45 (–0.86)
Main effect						
Disruption			0.23** (1.98)	0.04 (0.53)	23.02** (2.37)	1.63 (0.68)
Dynamism			1.8*** (3.31)	0.13 (0.23)	1.84*** (3.39)	0.15 (0.26)
Interaction effect						
Disruption × Dynamism					–22.42** (–2.36)	–1.55 (–0.67)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	1861	1154	1861	1154	1861	1154
Adj. R^2	18.23%	16.11%	18.4%	16.14%	18.56%	16.16%

Note: t-value in parenthesis. Significant levels are indicated by *, **, *** for 10%, 5%, and 1%, respectively

Table 3. Topics in COVID-19-related content

ID	Topic
Panel A: USA	
1	**operation**, condition, cash, liquidity, risk, capital, factor, uncertainty, effect, ability
2	**sale**, revenue, product, customer, cost, service, volume, delay, store, demand
3	**loan**, loss, security, expense, credit, payment, asset, income, portfolio, cost
4	**market**, disruption, demand, economy, uncertainty, customer, industry, price, volatility, decline
5	**health**, measure, employee, government, response, action, restriction, order, travel, operation
Panel B: China	
6	**economy**, global, risk, shock, industry, development, market, operation, uncertainty, pressure
7	**prevention and control**, operation, production, work, resume to production, measure, development, management, employee, epidemic prevention
8	**business**, sale, expenditure, cost, operation, net income, logistics, product, activity, degree
9	**market**, product, customer, sale, industry, marketing, development, adjustment, channel, business order
10	**prevention and control**, social (responsibility), (medical) supply, epidemic prevention, responsibility, fight against (COVID-19), nationwide, hospital, medication, government

Note: Each topic contains 10 words, ranked by their relevance to the specific topic. In the interest of readability, we **bold** the first word for each topic since it is the most relevant keyword.