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Corporate investment and government policy during the COVID-19 crisis

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\textbf{ABSTRACT}

We investigate the impact of the US government response to the COVID-19 pandemic, including stringent social measures and economic support packages, on corporate investment. The empirical results show that despite the overall decreased investment due to the economic impact of the pandemic, the government response to COVID-19 and economic supports have a positive effect on corporate investment after subtracting the impact of the pandemic on firm-level investment. We find that the impact of economic support packages on corporate investment is stronger than that of health containment policies. Further analyses show that the effect is weak in firms with higher levels of political risk and investment irreversibility, while being more pronounced in firms with higher technology intensity. Our findings provide fresh insights into the firms' reaction to the government policies during the pandemic and suggest that both social measures and economic support are vital to restoring corporate investment as well as the economic recovery process.

“This did not start as a financial crisis but it is morphing into a major economic crisis, with very serious financial consequences. There is a long road ahead.”

Carmen Reinhart, World Bank Chief Economist.\textsuperscript{1}

1. Introduction

The COVID-19 pandemic has sparked an unprecedented crisis around the world with respect to the fact that the virus is highly contagious and deadly. As responses to the pandemic, governments around the world have undertaken strong measures to prevent the spread of the novel coronavirus, including social distancing, school closure, business closure, limited public gathering, contact tracing, mass testing, travel restrictions, quarantine, and lockdowns. The effectiveness of these containment measures against the outbreaks of infectious diseases is confirmed internationally. However, the public is witnessing the economic impacts of COVID-19 as the long shadow of an economic recession is expanding across the globe.

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\textsuperscript{1} Available at https://www.bloomberg.com/news/articles/2020-10-16/carmen-reinhart-sees-risk-financial-crisis-emerges-from-pandemic. Last accessed on October 16, 2020.
As one of the countries with the largest number of infected cases and deaths by COVID-19, the United States (US) is experiencing one of the most devastating public health and economic crises ever in history. The former US President, Donald Trump was criticized for being slow to absorb the scale of the COVID-19 risk and to react appropriately\(^2\). A survey from The University of Chicago Harris School of Public Policy in September 2020 shows that 78 percent of Americans blame their government for the COVID-19 crisis\(^3\) in the US. Ironically, the outbreak of COVID-19 in the US has occurred and become severe during the presidential election year 2020. This coincidence induces even more uncertainty from three dimensions: political, public health, and economic crises, thus driving US firms’ business risk to an extreme level. As political uncertainty is higher during election years, firms with higher degrees of political risk are more likely to retrench their hiring and corporate investment to protect themselves from increased uncertainty (Campello et al., 2020; Hassan et al., 2019). Similarly, under economic uncertainty and changes in macroeconomic policy, firms tend to delay their investment until they find it a safer time to do so (Gulen & Ion, 2016; Kang et al., 2014; Kim & Kung, 2017). Mass reduction in investment at the firm-level would negatively affect job creation and economic growth (Adelino et al., 2017; Coibion et al., 2020), thus stimulating policymakers to react to secure social welfare and economic outlook of the nation during this difficult time. Because disasters at the global scale and severity of the COVID-19 pandemic have not been seen in a century (Goodell, 2020), it is a unique natural experiment to study how governments and businesses respond to an exogenous negative shock that is blended with a politically-complex business environment. We find it compelling to investigate how the government responses to the COVID-19-induced crisis influence the investment decision-making of US firms. Are the government responses to the COVID-19 crisis and economic support policies effective in alleviating the negative impact of the health crisis? How investment irreversibility, technology intensity and firm-level political risk play a role in moderating the influence of the government policies on firms’ investment? This paper aims to answer these questions.

The US government implements a wide range of economic countermeasures to the COVID-19 crisis, including the USD 2.2 trillion fiscal stimulus bill approved by the House Democrats in early October 2, 020,\(^4\) and the new economic stimulus offer of USD 1.8 trillion made by the US President Donald Trump on October 9, 2020.\(^5\) Before that, the government has declared numerous economic stimulus packages and immediate actions to support its citizens and the economy during the outbreak, such as interest rates cut,\(^6\) debt contract relief, and several fiscal aids for the economy.\(^7\) The sizes of the quantitative easing packages declared by the US government in 2020 surpassed the total value of all quantitative easing since the Global Financial Crisis 2008, demonstrating the government’s acknowledgment of the economic severity of the coronavirus crisis. As most US states reopened from the lockdown in mid-2020, economic activities in the US were expected to resume in a new normal, despite the number of new positive cases and deaths by COVID-19 are still on the rise.

We take into consideration the corporates’ reactions to the COVID-19 news, including news on the new confirmed COVID-19 cases and deaths by the coronavirus in the US. There is a well-known fact that the COVID-19 pandemic has caused large-scale disruption to financial systems and economic activities around the world, especially in countries heavily affected by the pandemic. Recent studies investigating the economic impact of COVID-19 usually employ an event study setting that uses a set of dummy variables to represent the events of the coronavirus outbreak and the windows around it. This approach is effective if they can well control for the government response to the disease and other confounding factors, otherwise, the findings may be contaminated. Following this conjecture, we separate the impact of the government response to COVID-19 on corporate investment from the overall impact of COVID-19, using the approach of Gulen and Ion (2016) from their influential study in policy uncertainty literature. We obtain a cleaner measure of corporate investment after accounting for the impact of COVID-19, then use it to examine how corporate investment reacts to the government’s actions and policies against the COVID-19 crisis.

The empirical results yield four significant findings. First, we document, on average, a positive reaction of corporate investment to the government responses to COVID-19. This suggests that the government’s stringency in combating COVID-19 and the economic supports have built up a certain degree of confidence of US firms to invest during the crisis. Although the general level of firm-level investment of US firms is still lower than the pre-COVID-19 periods,\(^8\) our finding implies the US firms are more inclined to invest when the government employs more responsive policies, including stringent coronavirus containment measures and economic supports. We attribute this to the higher expectation of businesses for economic recovery given the government policies and economic supports during the outbreak. We suggest that government policies to response to COVID-19 help alleviate the adverse economic impact of the pandemic on corporate investment. The finding remains qualitatively unchanged after a battery of sensitivity tests.

Second, firms in industries with higher degrees of investment irreversibility generally invest less than their counterparts in response to the government’s efforts to fight the pandemic. This is in line with those of Gulen and Ion (2016) and Kim and Kung (2017) that firms with more investment irreversibility tend to be more cautious in making investment decisions under increased uncertainty at the macro-level. As the payoff increases due to uncertainty induced by the COVID-19 pandemic, the opportunity cost of investment increases, thus firms have to consider the option to delay investment until more is known (Guiso & Parigi, 1999; Gulen & Ion, 2016). Our results suggest strong government response to the COVID-19 crisis plays a crucial role in encouraging corporate investment in both

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\(^2\) See [https://www.nytimes.com/2020/04/11/us/politics/coronavirus-trump-response.html](https://www.nytimes.com/2020/04/11/us/politics/coronavirus-trump-response.html).

\(^3\) See [https://news.uchicago.edu/story/who-fault-covid-19-crisis-most-americans-blame-us-government-survey-says](https://news.uchicago.edu/story/who-fault-covid-19-crisis-most-americans-blame-us-government-survey-says).

\(^4\) See [https://www.ft.com/content/06a7a77e-7b9e-43e3-9e63-4967a03ad997](https://www.ft.com/content/06a7a77e-7b9e-43e3-9e63-4967a03ad997).

\(^5\) See [https://www.nytimes.com/2020/10/09/us/politics/trump-covid-stimulus-pelosi-republicans.html](https://www.nytimes.com/2020/10/09/us/politics/trump-covid-stimulus-pelosi-republicans.html).

\(^6\) See [https://www.theguardian.com/business/2020/mar/15/federal-reserve-cuts-interest-rates-near-zero-prop-up-us-economy-coronavirus](https://www.theguardian.com/business/2020/mar/15/federal-reserve-cuts-interest-rates-near-zero-prop-up-us-economy-coronavirus).

\(^7\) See [https://www.wsj.com/articles/rbc-lays-out-700-billion-stimulus-effort-for-u-s-economy-11602183581](https://www.wsj.com/articles/rbc-lays-out-700-billion-stimulus-effort-for-u-s-economy-11602183581).

\(^8\) Except for the Healthcare, Medical Equipment and Drug industries as shown in our mean difference tests in Table 3. The industry classification follows the categorization of Fama-French industries.
more and less irreversible firms during the pandemic. However, we find that the impact varies cross-sectionally across the two groups.

Third, we find that firms with higher technology intensity react more positively to government policies during the pandemic. Specifically, firms with higher degrees of technology intensity invest more as a response to government policies and economic supports regarding COVID-19 crisis. The intuition of this finding emerges from the argument that firms with higher technology intensity likely face less impact from uncertainty (Czarnitzki & Toole, 2011; Vo & Le, 2017), so they can adapt to the new economic situation faster and have more flexibility to adjust than their counterparts. This finding suggests the importance of technologies in firms during the COVID-19 crisis, and possibly other similar uncertainty shocks.

Fourth, the analysis shows that the positive effect of the government responses to COVID-19 and economic supports on corporate investment is more pronounced in firms with lower political risk and vice versa. Intuitively, firms might retrench their investment during election years because higher political risk has a negative impact on investment at the firm-level (Hassan et al., 2019; Julio & Yook, 2012). The US election year 2020 exhibits a high degree of political uncertainty due to its unique situation surrounded by the COVID-19 crisis, the Black Lives Matter protests, the Capitol riots, and the ongoing US-China trade war. Therefore, it is understandable that firms with more political risk to react less positively to the government’s policies during the pandemic compared to other firms.

This study is related to the recent literature in economics and finance studying the impact of exogenous events on corporate investment (Gulen & Ion, 2016; Julio & Yook, 2012; Kang et al., 2014), however, extends to the analysis of how the government response to an extreme negative shock would influence the incentives to invest of firms. Our study has several significant contributions to the literature on government policy during extreme uncertainty. First, we show the importance of governments taking strong measures, both socially and economically, to combat the COVID-19 crisis and alleviate the adverse impact of the pandemic on corporate investment decision-making. By using a measure of corporate investment separated from the impact of COVID-19 health news, we demonstrate the positive effect of the government stringency and economic supports in the fight against COVID-19 on corporate investment, despite the fact that the US government underreacted to the COVID-19 risk in early 2020. Second, our study provides evidence of how the impact varies in the cross-section, thus providing a new understanding of the mechanisms by which the government response influence corporate investment regarding the coronavirus crisis. Our findings enrich the literature on the economic impacts of the pandemic worldwide. Third, we show how irreversible investment, technology intensity, and firm-level political risk are economically important to influence the impact of the government response to the pandemic during heightened political and economic uncertainty in the US. Fourth, our study provides practical implications for corporate strategy, policymakers, and governments across the world in decision-making or considering different measures and supports to combat the new waves of the virus or a similar pandemic to come.

The paper is organised as follows. Section 2 provides the motivation and literature review. Section 3 discusses the variables, research models, and data. Section 4 presents the empirical results and discussion. Section 5 concludes the study.

2. Literature review and hypothesis development

The economic impact of COVID-19 is a strand of literature that attracts great attention. Under the impact of the pandemic, economies worldwide experience sudden negative demand shocks (Goodell, 2020; Hassan et al., 2020), sharp drop in oil product prices (Mensi et al., 2020; Rajput et al., 2021), surges in unemployment (Campello et al., 2020; Coibion et al., 2020), and social lockdown that heavily affected economic activities. At the firm-level, businesses experience sharp shortfalls in stock prices and revenues (Fahlenbrach et al., 2020), exhausting corporate cash reserves (Vito & Gómez, 2020), and higher bankruptcy risk in large corporations (Wang et al., 2020). The impact seems to vary cross-sectionally, with some firms have a stronger immunity to the pandemic compared to others (Ding et al., 2021; Hoang, Nguyen, & Zhang, 2021).

Not until the COVID-19 pandemic, the fact that uncertainty hinders corporate investment has been well investigated for several decades. For instances, Lucas and Prescott (1971), Abel (1983), Pindyck (1993), Dixit (1995), Guiso and Parigi (1999), Schwartz and Zozaya-Gorostiza (2003), Byrne and Davis (2005), Novy-Marx (2007), Kang et al. (2014), Gulen and Ion (2016), Kim and Kung (2017), Hassan et al. (2019), Liu and Wang (2021), among others. The literature in corporate investment under uncertainty focuses on how corporate investment decision-making is affected by uncertainty at the macro-level, for example, economic uncertainty, political uncertainty, policy uncertainty, crude oil price uncertainty, and some extraneous events that might affect the business environment. Infectious diseases resulting in global pandemic such as COVID-19, however, have only attracted little attention in corporate investment literature.

We study corporate investment under the COVID-19 crisis to address the economic impact of the devastating pandemic and the consequences of the government response to the pandemic. Amid the extreme uncertainty induced by the COVID-19 crisis during the US election year 2020, how the US government reacts to the pandemic is of utmost importance as it forms the future outlook of the economy, both domestically and internationally. Strong and quick responses to protect the citizens and the economy will build public trust and boost confidence in the prospects of the economy. Prior studies show that higher expected economic growth is associated with more financial investment and corporate investment opportunities (Chen, 1991; Gulen & Ion, 2016). If firms believe in the long-term effectiveness of the government policy regarding the health crisis, then we would expect them to invest and adapt to the new state of the market during COVID-19. If firms are afraid that the worst of the crisis is yet to come, then they would continue to delay investment or even resort to disinvestment. In this scenario, the efforts of the government seem to be insufficient to encourage

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9 For example, the Gulf War (1991), the 11/9/2001 terrorist attack in the US, or the Brexit referendum in 2016.
corporate investment. Based on this conjecture, we expect a positive impact of the government response to the COVID-19 crisis on corporate investment. Our expectation is in line with the market reacts positively to government interventions during the COVID-19 pandemic (Ashraf, 2020).

**Hypothesis 1.** The government responses to the COVID-19 crisis (i.e., health containment and economic support policies) have a positive impact on corporate investment during the pandemic.

There are some potential channels through which COVID-19-induced uncertainty affect corporate investment. The first channel is investment irreversibility, as addressed by Dixit (1995), Gulen and Ion (2016), and Kim and Kung (2017). The intuition is that corporate managers can delay investment projects under uncertainty if those particular investment projects can be delayed, and more importantly if those investments are difficult to be reversed when needed to. The reversibility of investment lies in its asset liquidation value. Investments with lower asset liquidation values under uncertainty are considered less reversible and associated with more costly asset redeployment (Kim & Kung, 2017). According to Almeida and Campello (2007) and Gulen and Ion (2016), firms in highly cyclical industries likely have higher degrees of investment irreversibility. Compared to other firms, such firms are more vulnerable to negative demand shocks. As such, they would have lower asset liquidation values, as the best potential buyers of these assets (e.g., their peers or firms in the same industry) and also suffer from the same demand shocks. Therefore, investment irreversibility might be a channel through which uncertainty affects corporate investment. As such, firms with higher degrees of investment irreversibility are likely to invest less than their counterparts under the impact of COVID-19-induced uncertainty. This understanding forms our second research hypothesis as follows:

**Hypothesis 2.** The impact of government responses to the COVID-19 crisis on corporate investment is weaker for firms with higher degrees of investment irreversibility, and vice versa.

The second channel is technological intensity. Intuitively, firms with stronger technological foundations may adapt better than their counterpart in shifting business models during the pandemic. Literature on technology intensity show that higher corporate technology intensity associates with better and less volatile future performance (Pandit et al., 2011), less negative impacts of market uncertainty (Czarnitzki & Toole, 2011), higher productivity (Baumann & Kritikos, 2016), more successful equity financing (Aghion et al., 2004), and higher firm value (Greenhalgh & Rogers, 2006). Therefore, firms tend to invest more in research and development activities as a preemptive strategy when they face higher uncertainty (Vo & Le, 2017). The COVID-19 pandemic changes the world in an unprecedented way (Goodell, 2020) and undermine corporate immunity like no previous crises ever did (Cheema-Fox et al., 2021; Hoang, Nguyen, & Zhang, 2021). However, amid the long COVID-19 macroeconomic shock stand the role of technology in enhancing corporate resilience (Bai et al., 2021). The use of innovative technologies seems to have a positive impact on corporate immunity during the pandemic (Papadopoulos et al., 2020). As the COVID-19 crisis provides opportunities to firms to innovate (Seeratham, 2020), firms with higher technology intensity tend to adapt to the new economic situation faster and have more flexibility to adjust than other firms, all else equal. Therefore, we predict that:

**Hypothesis 3.** The impact of government responses to the COVID-19 crisis on corporate investment is stronger for firms with higher degrees of technology intensity, and vice versa.

Another channel is that political uncertainty increases the risk of doing business, thus influencing firms’ investment decision during the COVID-19 crisis. Increasing uncertainty leads to more risk aversion of businesses and negatively affect their investment decision-making, as suggested by Bloom et al. (2007), Julio and Yook (2012), Kang et al. (2014), Hassan et al. (2019), Hoang, Nguyen, and Hoang (2021), and Tran et al. (2021). As political uncertainty is usually higher during election years (Baker et al., 2016; Julio & Yook, 2012), more changes in macroeconomic policy are expected after the presidential election, especially if there is a change in the US presidency from the Democrats to Republicans and the other way round. Because the outcome of the presidential election is uncertain until November, firms that are sensitive to political risk or dependent on government spending are likely to delay investment (Gulen & Ion, 2016; Hassan et al., 2019). On the other hand, firms with less political sensitivity may find it costly to invest under uncertainty, as the cost of capital increases during heightened uncertainty at the macro-level (Xu, 2020). The year 2020 is undoubtedly the year of uncertainty for US firms, both politically and epidemiologically, thus it amplifies the impact of firm-specific political risk and may discourage firms from making investment decisions. Following this conjecture, we propose the fourth research hypothesis as follows:

**Hypothesis 4.** The impact of government responses to the COVID-19 crisis on corporate investment is weaker for firms with higher degrees of political risk, and vice versa.

### 3. Variables, model specifications, and data

#### 3.1. Variables

##### 3.1.1. COVID-19 cases and deaths

As there is no data on the economic damage of the COVID-19 pandemic available anywhere at the time this research is conducted, we use the numbers of infected cases and deaths by COVID-19 as the direct measures of how severe the pandemic is. The daily data is then aggregated into quarterly data to match with the frequency of corporate data. We take the natural logarithm of one plus the number of new confirmed COVID-19 cases in the US during a quarter as the proxy of how contagious the disease is (**COVID-19 CASES**). Similarly, we also add one to the number of new deaths by COVID-19 and then log-transform the total to obtain a proxy of how deadly
the virus is (COVID-19 DEATHS). Since the first case of COVID-19 in the United States was reported on January 21, 2020, we treat all daily data points before that date with the value of zero for both COVID-19 CASES and COVID-19 DEATHS.

3.1.2. Government response to COVID-19

To measure the stringency in the US government response to COVID-19, we use the Stringency Index and the Economic Support Index proposed by Hale et al. (2020). The two indexes were constructed to quantify the governments’ responses to the outbreaks of the novel coronavirus from two dimensions, including the stringency of the responses to prevent the spread of COVID-19 (Stringency Index) and the support to the economy (Economic Support Index).

Specifically, the Stringency Index (Hale et al., 2020) consists of eight indicators of social distancing and lockdown, including school closure, workplace closure, cancelling public events, restrictions on public gathering, public transport closure, stay-at-home requirements, domestic movement restrictions, and international travel restrictions. To fit the data frequency with corporate data, we aggregate the daily Stringency Index into a quarterly measure by taking the average of the daily Stringency Index, then take the natural logarithm of one plus the quarterly index as the variable-of-interest in our study (GSTRINGENCY). GSTRINGENCY is used to investigate the impact of the pandemic social distancing and lockdown measures on corporate investment of US firms. The Economic Support Index (Hale et al., 2020) indicates whether the government provides income support and debt or contract relief as the policies to support households and the economy. Similar to the case of the Stringency Index, we also compute the quarterly Economic Support Index and then log-transform it after adding one. The new variable (GESI) is to evaluate the impact of the government’s economic support on corporate investment of US firms. As there were no COVID-19 cases confirmed in the US before January 21, 2020, and the US government did not have any economic support and health containment measures implemented before January 21, 2020, so Hale et al. (2020) assign all the data points of GSTRINGENCY and GESI prior to that date in January 2020 with values of zero. We further apply this treatment applies to the government response data (GSTRINGENCY and GESI) for the whole study period. Therefore, the value zero of GSTRINGENCY and GESI indicate the zero-COVID-19 period in the US.

3.1.3. Corporate investment

Following Gulen and Ion (2016) and Chen and Wang (2019), the common corporate investment proxy is the ratio of capital expenditure on total assets (CAPEX). However, we doubt that CAPEX is a valid measure to explore the impact of the government response to the COVID-19 crisis on corporate investment for two reasons. First, the effect of government response on corporate investment might be contaminated by the impact of the COVID-19 pandemic if we use CAPEX in our model. As the negative economic impact of the pandemic on corporate operations is well acknowledged (Baker et al., 2020; Campello et al., 2020; Goodell, 2020), the effect of the government response is likely overwhelmed by the disastrous impact of the virus on the economy as a whole. We assume that firms would react to the pandemic first, then taking the government policy into consideration for investment decision-making. This assumption is reliable because the social distancing, lockdown, and economic support policy were only implemented after the spread of COVID-19 went out of control. As we expected strong government responses have a positive effect on corporate investment, such an effect should be submerged in the destructive impact of COVID-19. Consequently, there might be a potential serious measurement error existing in this study if we use the raw CAPEX variable to investigate the relationship between the government response and corporate investment. Second, the devastating impact of the COVID-19 is likely a negative driver of corporate investment in the United States via various known and unknown mechanisms, thus a general measure of corporate investment may inadvertently capture the overall economic impact of COVID-19. Using CAPEX as the dependent variable to investigate the impact of government policies on corporate investment during the pandemic, which are undoubtedly determined by the developments of COVID-19 outbreak, would expose the empirical model to a serious endogeneity problem.

We borrow the idea from Gulen and Ion (2016) to overcome this endogeneity issue. In their study, Gulen and Ion (2016) got rid of the contaminating component of the US policy uncertainty variable by extracting the elements of the US policy uncertainty orthogonal to the Canadian policy uncertainty. Their rationale behind this approach is that a policy shock in Canada might also affect the US to the Canadian policy uncertainty. Their rationale behind this approach is that a policy shock in Canada might also affect the US. The authors run a regression of the US policy uncertainty variable on that of Canada, controlling for several confounding factors at the macro-level. The residual from this regression is defined as the measure of corporate investment during the pandemic, which are undoubtedly determined by the developments of COVID-19 outbreak, would expose the empirical model to a serious endogeneity problem.

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assets investment, namely $Res_{NCAINV}$.

### 3.2. Model specifications

We use the following model to estimate the impact of government response to COVID-19 on corporate investment:

$$Res_{CAPEX,i,t} = \alpha + \beta_{Gov\_Responses} + Control + \delta_i + \vartheta_t + \epsilon_{i,t} \quad (2)$$

where $Res_{CAPEX,i,t}$ is the corporate investment proxy of firm $i$ during quarter-year $t$ as discussed in the sub-section 3.1.3. $Gov\_Responses$ is one of two government response variables $GSTRINGENCY$ or $GESI$. Following Kang et al. (2014), Gulen and Ion (2016), Amore and Minichilli (2018), Zhao et al. (2018), Chen and Wang (2019), Hassan et al. (2019), and Hoang, Nguyen, and Hoang (2021), $Control$ is a vector of firm-level characteristics and macroeconomic variables including firm size ($SIZE$), financial leverage ($LEVERAGE$), profitability ($ROA$), market-to-book ($MTB$), sales growth ($SALESGR$), net working capital ($NWC$), dividend ($DIVIDEND$), cash holdings ($CASH$), firm-level political risk ($PRISK$), economic policy uncertainty ($EPU$) and GDP growth ($GDPGR$). All variable descriptions are presented in Table 1. We also control for firm and calendar quarter fixed-effects ($\delta_i$ and $\vartheta_t$, respectively) to control for potential confounding factors at firm-level and seasonality following Gulen and Ion (2016). Standard errors are double-clustered by firm and quarter-year to alleviate the concerns of heteroskedasticity and serial-correlation in our regression.

### 3.3. Data and sample

We collect quarterly financial data of US firms from the Bloomberg database from 2002:Q1 to 2020:Q4. The use of the long data period is to capture the average investment at the firm-level across a longer period of time and avoid the bias arising from short-horizon data samples. Specifically, the 2017–2019 period witnesses the developments of the US-China trade war with multiple tariffs advocated from both sides. This international economic conflict has stimulated uncertainty from different dimensions, therefore, it can affect corporate investment in both China and the US. Using the period from 2002:Q1 to 2020:Q4, we neutralise the negative impact of pre-COVID-19 uncertainty shocks such as the US-China trade war, the Global Financial Crisis, and US election years on corporate investment. This choice of sampling period is to test the hypotheses in a broader sample period to avoid out-of-sample bias. Knowing that eliminating a bias may lead to another, we use alternative shorter sampling periods (2019:Q1 to 2020:Q4, 2017:Q1 to 2020:Q4, and 2011:Q1 to 2020:Q4) in robustness tests to verify the findings. To ensure the comparability of corporate investment among firms in our sample, we exclude all financial firms from the sample. All financial data items are winsorised at the 1st and the 99th percentiles to alleviate the impact of outliers on the outcomes of our analysis.

The Stringency Index and the Economic Support Index (Hale et al., 2020) are obtained from the Oxford COVID-19 Government Response Tracker (Ox-CGRT) database. We use official COVID-19 data from the US’s Centers for Disease Control and Prevention (US CDC), including the daily data on the number of infected COVID-19 cases and deaths by COVID-19 in the US.

### 4. Empirical results and discussion

#### 4.1. Descriptive statistics

Table 2 presents the descriptive statistics of variables used in this study. $Res_{CAPEX}$ has a mean of $-7.391 \times 10^{-6}$ and a standard deviation of 0.028. $S_{Res_{CAPEX}}$ has a mean of $-1.154 \times 10^{-6}$ and a standard deviation of 0.068. These statistics indicate a high dispersion in firm-level investment for the sample firms after accounting for the impact of the pandemic. Besides, the government response variable ($GSTRINGENCY$) has a mean of 0.007 and a standard deviation of 0.153. The higher value of the standard deviation of $GSTRINGENCY$ indicates higher volatility in government response to COVID-19, which is understandable given the varying nature of restrictions under an unprecedented lockdown scenario and otherwise. $GESI$ has a mean of 0.004 and a standard deviation of 0.115, similarly implying large changes in economic support policies during the sample period. Further, Table 2 also presents descriptive statistics for firm-level variables that show the presence of a variety of firms in our sample. For example, substantially different minimum (9.550, $-0.998$) and maximum (20.498, 0.279) value of firm $SIZE$ and $ROA$ variables indicate the presence of firms with varying size and profitability, respectively. The macro-level variables, namely $EPU$ and $GDPGR$, show a mean of 4.749 and 0.013, respectively.

Panel B, Table 2, shows the pairwise correlation between study variables. A significantly negative (positive) correlation between COVID-19 cases and $CAPEX$ ($GSTRINGENCY$) indicates that the spread of COVID-19 is negatively (positively) correlated with firm-level investment (government response). Moreover, firm characteristics such as $SIZE$, $LEVERAGE$, $ROA$, $SALESGR$, and $DIVIDEND$ are positively correlated with $CAPEX$. Conversely, $MTB$, $CASH$, $PRISK$, and $NWC$ negatively correlate with firm-level investments. Macro-level variable $EPU$ ($GDPGR$) positively (negatively) correlates with $Res_{CAPEX}$ and $Res_{NCAINV}$. Figs. 1 and 2 shows the developments in COVID-19 new cases and deaths, and Hale et al. (2020)’s indices (Stringency Index and the Economic Support Index) of the US from January 2020 to December 2020, respectively.

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10 Julio and Yook (2012) show that political uncertainty in election years affect corporate investment cycles.
4.2. The impact of COVID-19 on corporate investment

Table 3 reports the mean-difference test results that show the differences in average CAPEX by US firms during the COVID-19 period against the parallel periods from the preceding years and against the total period before the onset of the pandemic crisis. Panel A, Table 3, presents the mean-difference test results categorised by the Fama-French industry classifications.

In Panel A, Table 3, we observe a significant reduction in investment for all industries except for Healthcare, Medical Equipment, and Drug, which is understandable given the increasing demand for healthcare products and equipment during the COVID-19 crisis. Further, Panels B, C, and D of Table 3 present the mean-difference results based on quintiles of SIZE, CAPEX, and LEVERAGE. The results indicate that the reduction in US firms’ investments in 2020 is not limited to any particular firm characteristics. This observation indicates that the pandemic crisis is exerting a significant negative impact on corporate investment in all categories of firm size, capital structure, or investment intensities. Our test results are in line with the existing literature report firms reduce or delay in investments in 2020 is not limited to any particular firm characteristics. However, the test results show that the magnitudes of the decreases in corporate investment seem to be greater for larger firms, firms with more investment intensities, and highly leveraged firms.

4.3. The net effect of government response to COVID-19 on corporate investment

4.3.1. The net effect of government response

Table 4 presents the results that exhibit the impact of government response to COVID-19 on corporate investment of US firms. Columns 1–4 report the regression results of Res_CAPEX on GSTRINGENCY using different model specifications without and with the fixed effects. Similarly, Columns 5–8 report the regression results of Res_CCAPEX on GESI using different model specifications without and with the fixed effects. The results in Column 1, Table 4, show that GSTRINGENCY has a significant positive coefficient of 0.0021 (t-statistic = 7.1030; p-value = 0.0000), implying a positive net impact of the government’s COVID-19 responses on corporate investment.
### Table 2
Summary statistics and pairwise correlation matrix.

**Panel A. Summary statistics of variables used in this study**

| Variable            | Obs | Mean       | Median     | Std. Dev. | Min  | Max  |
|---------------------|-----|------------|------------|-----------|------|------|
| Res_CAPEX           | 109,315 | $\ldots \times 10^{-6}$ | $-0.002$ | $0.028$ | $-0.193$ | $0.252$ |
| S_Res_CAPEX         | 109,315 | $\ldots \times 10^{-5}$ | $-0.002$ | $0.025$ | $-0.075$ | $0.100$ |
| Res_NCAINV          | 109,315 | $\ldots \times 10^{-6}$ | $-0.004$ | $0.068$ | $-0.324$ | $0.399$ |
| GSTRINGENCY         | 109,315 | $0.007$ | $0$ | $0.153$ | $0$ | $4.291$ |
| GESI                | 109,315 | $0.004$ | $0$ | $0.115$ | $0$ | $4.377$ |
| STATE_STRINGENCY    | 109,315 | $0.006$ | $0$ | $0.132$ | $0$ | $4.251$ |
| STATE_ESI           | 109,315 | $0.005$ | $0$ | $0.122$ | $0$ | $4.615$ |
| QE_SIZE             | 109,315 | $0.094$ | $0$ | $0.385$ | $0$ | $2.700$ |
| SIZE                | 109,315 | $13.831$ | $13.793$ | $1.854$ | $9.550$ | $20.498$ |
| LEVERAGE            | 109,315 | $0.005$ | $0.038$ | $0.211$ | $0.998$ | $0.279$ |
| ROA                 | 109,315 | $6.793$ | $0.004$ | $0.068$ | $0.324$ | $0.399$ |
| MTB                 | 109,315 | $0.233$ | $0.203$ | $0.220$ | $0.111$ | $0.279$ |
| SALESGR             | 109,315 | $0.026$ | $0.001$ | $0.113$ | $-0.288$ | $0.626$ |
| NWC                 | 109,315 | $0.000$ | $0.000$ | $0.024$ | $-0.125$ | $0.114$ |
| DIVIDEND            | 109,315 | $0.365$ | $0$ | $0.485$ | $0$ | $1$ |
| CASH                | 109,315 | $0.209$ | $0.130$ | $0.231$ | $0.001$ | $0.888$ |
| PRISK               | 109,315 | $109,315$ | $4.234$ | $0.428$ | $9.311$ |
| R&D_INTENSITY       | 40,738 | $0.001$ | $2.051 \times 10^{-5}$ | $0.053$ | $0.000$ | $6.148$ |
| EPU                 | 109,315 | $4.749$ | $4.820$ | $0.341$ | $3.953$ | $5.594$ |
| GDPGR               | 109,315 | $0.013$ | $0.011$ | $0.012$ | $-0.312$ | $0.338$ |
| CIT                 | 109,315 | $0.323$ | $0.35$ | $0.21$ | $0.35$ |
| INTEREST (in %)     | 109,315 | $1.406$ | $0.79$ | $1.611$ | $0.070$ | $5.260$ |

**Panel B. Pairwise correlation matrix of variables used in the baseline model**

| Variables (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Res_CAPEX    | 1.00 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| GSTRINGENCY  | $-0.00$ | $1.00$ |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| GESI         | $0.93***$ | $1.00$ | $1.00$ |     |     |     |     |     |     |     |     |     |     |     |     |     |
| SIZE         | $-0.02***$ | $0.02***$ | $0.02***$ | $1.00$ |     |     |     |     |     |     |     |     |     |     |     |     |
| LEVERAGE     | $0.01***$ | $0.01***$ | $0.01***$ | $0.26***$ | $1.00$ |     |     |     |     |     |     |     |     |     |     |     |
| ROA          | $0.40***$ | $0.01***$ | $0.01***$ | $-0.10***$ | $1.00$ |     |     |     |     |     |     |     |     |     |     |     |
| MTB          | $0.02***$ | $0.02***$ | $0.02***$ | $-0.08***$ | $0.03***$ | $1.00$ |     |     |     |     |     |     |     |     |     |     |
| SALESGR      | $-0.01***$ | $-0.01***$ | $-0.00$ | $-0.02**$ | $0.05$ | $0.03***$ | $1.00$ |     |     |     |     |     |     |     |     |     |
| NWC          | $0.13***$ | $0.45***$ | $0.03***$ | $0.28***$ | $0.01***$ | $-0.05***$ | $0.00$ | $1.00$ |     |     |     |     |     |     |     |     |
| DIVIDEND     | $-0.02***$ | $-0.41***$ | $-0.32***$ | $-0.32***$ | $0.14***$ | $0.04***$ | $-0.04***$ | $-0.31***$ | $1.00$ |     |     |     |     |     |     |     |
| CASH         | $0.01***$ | $0.01***$ | $0.01***$ | $-0.07***$ | $-0.02***$ | $-0.08***$ | $-0.00$ | $-0.01***$ | $-0.01***$ | $0.04***$ | $0.10***$ | $1.00$ |     |     |     |
| PRISK        | $-0.10***$ | $0.07***$ | $0.07***$ | $0.08***$ | $0.06***$ | $-0.01***$ | $-0.01***$ | $-0.05***$ | $-0.01***$ | $0.04***$ | $-0.03***$ | $0.06***$ | $1.00$ |     |     |
| EPU          | $0.06***$ | $-0.05***$ | $-0.06***$ | $0.00$ | $-0.02***$ | $0.04***$ | $0.05***$ | $0.12***$ | $0.04***$ | $0.00$ | $0.01***$ | $-0.06***$ | $-0.42***$ | $1.00$ |     |
| GDPGR        | $0.08***$ | $-0.34***$ | $-0.30***$ | $-0.09***$ | $-0.08***$ | $0.02***$ | $-0.05***$ | $-0.01***$ | $0.01***$ | $-0.10***$ | $0.02***$ | $-0.03***$ | $-0.47***$ | $0.21***$ | $1.00$ |
| CIT          | $0.09***$ | $-0.11***$ | $-0.11***$ | $-0.05***$ | $-0.04***$ | $0.01***$ | $0.01***$ | $0.04***$ | $0.01***$ | $-0.05***$ | $0.01***$ | $-0.06***$ | $-0.55***$ | $0.21***$ | $-0.03***$ | $1.00$ |

This table reports the summary statistics and correlation matrix of variables. ***, **, and * denotes statistical significance at 1%, 5%, and 10%, respectively.
Fig. 1. The number of new confirmed COVID-19 cases and deaths (daily) in the United States in 2020.

Fig. 2. Developments in government response to COVID-19 and economic supports in the United States in 2020.
investment. This suggests that US firms react positively to government policies during the COVID-19 crisis in terms of making investment decisions. Similar results are documented when we include firm- and time-fixed effects into the model (Columns 2–4, Table 4).

Column 5–8, Table 4 report results regarding the impact of economic support stimulus initiated in response to the pandemic crisis on corporate investment. We observe significant positive coefficients of GESI, meaning a positive impact of economic support stimulus on corporate investment. This result suggests that economic policies and actions such as the announcement and implementation of the stimulus packages are paying off in terms of recovering business investment. This is an important finding which suggests that business activities are picking up with the economic policies of the government during the pandemic. More importantly, the significant coefficients of GESI are higher than those of GSTRINGENCY, indicating that economic support policies have a stronger impact on corporate investment of US firms relative to that of health containment and social lockdown policies.

Findings from the regression of the control variables are also worth mentioning. Looking at the results of full model regression specifications in columns 4 and 8, Table 4, it is notable that firm size (SIZE), financial leverage (LEVERAGE), cash holdings (CASH), and firm-level political risk (PRISK) exhibit a significant negative impact on corporate investment regardless of the corporate investment measured used, indicating that larger firms, firms that maintain high liquidity, firms using a higher portion of debt, and firms with higher political risk invest less compared to their counterparts. Profitability (ROA), sales growth (SALESGR), and dividend (DIVIDEND) exhibit a significant positive impact on corporate investment irrespective of the investment proxy. The findings of the control variables are widely consistent with those in the literature (Gulen & Ion, 2016; Hassan et al., 2019; Kang et al., 2014; Kim & Kung, 2017). Furthermore, economic policy uncertainty (EPU) is found in a negative association with corporate investment, which corroborates the findings of previous studies in the policy uncertainty literature (Gulen & Ion, 2016; Kang et al., 2014). We also see that corporate investment is positively associated with US GDP growth (GDPGR), thus corroborating the conjecture that businesses positively react to investment opportunities during economic growth (Julio & Yook, 2012).

Overall, the results from Table 4 indicate that government response to the COVID-19 crisis in terms of controlling the spread of the disease and extending economic support is proving to be a reassuring factor for US firms to invest. The findings support our Hypothesis 1 and are consistent with current literature that shows a positive impact of government response on investors and business confidence during COVID-19 outbreaks, which resulted in enhanced stock market performance (Ashraf, 2020; Narayan et al., 2020) and liquidity (Haroon & Rizvi, 2020). Although the reactions of the US government to the COVID-19 crisis were not stringent as expected in the early stage of the pandemic, the data analysis shows that the subsequent government policies in combating COVID-19 and economic support have built up a certain degree of confidence in US firms to invest during the crisis. In other words, US firms may view the stringent coronavirus containment measures and economic supports from the government as positive signs of economic recovery in near future. The findings suggest that stringent measures and economic support by a government to counter the economic and social effects of COVID-19 encourage firms to invest, and thus accelerating the pace of economic recovery.

4.3.2. Robustness tests

We conduct several tests to confirm the robustness of our empirical results. First, we use alternative variable measurements to reperform the analysis, including using $\text{ResCAPEX}$ and $\text{ResNCAINV}$ as the dependent variable instead of $\text{ResCAPEX}$. We also use the size of quantitative easing (in billion US dollars) as an alternative for GESI in Model (2). Such unconventional monetary policies have been implemented not only in the US, but four times in total including the economic support packages during the COVID-10 pandemic, thus fitting well in our data. Second, we use different study periods to re-estimate the baseline model. We select four alternative periods: the post-H1N1 period from 2011:Q1 to 2020:Q4, the Trump administration period from 2017:Q1 to 2020:Q4, and the short period from 2019:Q1 to 2020:Q4 to test whether our empirical results are sensitive to choices of the study period. Next, to draw a cleaner sample that is free from market-level trends arising from other uncertainty shocks, we independently exclude the Global Financial Crisis (2008–2010) period and re-estimate the models.

Third, another concern about the economic impact of COVID-19 is that the pandemic has an unequal impact on various sectors, with certain sectors suffering more or less than the others. During the COVID-19 crisis, firms from certain sectors may receive government aid earlier than others and thus recovering at faster pace. Therefore, the impact of government responses to the pandemic on corporate investment might vary in the cross-section of sectors. We use a simple method to control for these variations. We generate a fixed effect recording the firm’s GICS sector and substitute the firm-fixed effect with it, then re-estimate Model (2) to test whether our findings remain after controlling for sector-level variations.

Furthermore, we employ the Driscoll-Kraay to control for the potential cross-sectional dependency caused by the simultaneous impact of the COVID-19 pandemic on all aspects and sectors of the economy. Cross-sectional dependence in corporate investment could be a potential source of estimation error given the unprecedented financial and economic contagion observed during the pandemic crisis (Akhtaruzzaman et al., 2020). To test whether our findings are sensitive to the autocorrelation of residuals, we re-estimate Model (2) using the Newey-West estimator. The estimation results are reported in Table 5.

Panel A, Table 5, shows that the US government stringency during the COVID-19 outbreaks exhibits a significant positive impact on corporate investment irrespective of the selection of variable measurements, sample periods, and sub-period analysis. Similarly, Panel B, Table 5 shows that, after accounting for the abovementioned factors, the US government’s economic supports during the pandemic

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11 GICS stands for Global Industry Classification Standard developed by MSCI and S&P Dow Jones in 1999. GICS includes ten main sectors: Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology, Communication Services, Utilities, and Real Estate.
Table 3
Tests of mean-difference of CAPEX between COVID-19 period and other periods.

Panel A. Tests of mean-difference of CAPEX between COVID-19 period and other periods by Fama-French industry

| Fama-French industry | Difference | t-statistic |
|----------------------|------------|-------------|
| Consumer durables, non-durables, wholesale, retails and some services | 0.030*** | 4.542 |
| Manufacturing, Energy, and Utilities | 0.031*** | 3.003 |
| Business equipment, Telephone and Television Transmission | 0.021*** | 3.932 |
| Healthcare, Medical Equipment, and Drug | 0.133 | 1.103 |
| Other | 0.054** | 1.928 |
| Full sample | 0.019*** | 6.828 |

Panel B. Tests of mean-difference of CAPEX between COVID-19 period and other periods by SIZE quintile

| Quintile | Difference | t-statistic |
|----------|------------|-------------|
| 1st quintile (smallest) | 0.015** | 1.901 |
| 2nd quintile | 0.019*** | 4.216 |
| 3rd quintile | 0.020*** | 2.655 |
| 4th quintile | 0.025*** | 2.845 |
| 5th quintile (largest) | 0.029** | 1.961 |

Panel C. Tests of mean-difference of CAPEX between COVID-19 period and other periods by CAPEX quintile

| Quintile | Difference | t-statistic |
|----------|------------|-------------|
| 1st quintile (lowest) | 0.003*** | 3.402 |
| 2nd quintile | 0.006*** | 9.210 |
| 3rd quintile | 0.008*** | 12.022 |
| 4th quintile | 0.019*** | 2.807 |
| 5th quintile (highest) | 0.070*** | 6.289 |

Panel D. Tests of mean-difference of CAPEX between COVID-19 period and other periods by LEVERAGE quintile

| Quintile | Difference | t-statistic |
|----------|------------|-------------|
| 1st quintile (lowest) | 0.019*** | 3.013 |
| 2nd quintile | 0.025*** | 3.309 |
| 3rd quintile | 0.026*** | 3.005 |
| 4th quintile | 0.019*** | 2.807 |
| 5th quintile (highest) | 0.031*** | 3.201 |

This table reports the mean-difference test results of CAPEX between the COVID-19 period and the pre-COVID-19 periods using full sample and a sub-sample consisting of Q1 and Q2 observations only. ***, **, and * denotes statistical significance at 1%, 5%, and 10%, respectively.
positively influence corporate investment decision-making. These observations signify that our baseline model captures the real impact of government response on corporate investment in the wake of the COVID-19 crisis. Moreover, statistically significant estimates of the Driscoll-Kraay and Newey-West estimators (Columns 9–10, Panel A and B, Table 5) indicate that our findings remain qualitatively unchanged after controlling for cross-sectional dependence and autocorrelation.

In summary, the results of robustness tests are in line with our baseline estimations, which suggest that variable measurements, sampling periods, and regression methods do not determine our findings regarding the impact of government response on corporate investment. Instead, our results confirm that there exists a positive net effect of government response to COVID-19 on corporate investment.

4.4. Further analyses

To provide a better understanding of how the government response to the pandemic could motivate corporate investment, this section seeks to explore the channels of the relationship between government responses to COVID-19 and corporate investment via three channels: investment irreversibility, technology intensity and political risk.

4.4.1. Investment irreversibility

In this section, we investigate the role of investment irreversibility in the newfound relationship between government policy during COVID-19 and corporate investment. To measure investment irreversibility, we follow the approach of Almeida and Campello (2007) and Gulen and Ion (2016) to calculate the correlation between each firm’s quarterly revenues and the US’s Gross National Product.

Table 4

| VARIABLES          | Government stringency | Economic support |
|--------------------|------------------------|-----------------|
|                    | Res_CAPEX (1)          | Res_CAPEX (2)   | Res_CAPEX (3) | Res_CAPEX (4) | Res_CAPEX (5) | Res_CAPEX (6) | Res_CAPEX (7) | Res_CAPEX (8) | Res_CAPEX (9) | Res_CAPEX (10) |
| STRINGENCY         | 0.0221*** (7.1030)     | 0.0026*** (8.0072) | 0.0023*** (7.1907) | 0.0027*** (8.0231) | 0.0029*** (6.2805) | 0.0035*** (6.9418) | 0.0029*** (6.2503) | 0.0036*** (6.8814) |
| GESI               | -0.003*** (-1.8734)   | -0.0031*** (-1.2220) | -0.003*** (-1.4882) | -0.003*** (-1.2283) | -0.003*** (-1.2135) | -0.003*** (-1.8859) | -0.003*** (-1.2189) |
| LEVERAGE           | -0.0035*** (-1.1212)  | -0.0031*** (-1.6376) | -0.003*** (-1.6124) | -0.003*** (-1.6488) | -0.003*** (-1.6283) | -0.003*** (-1.6346) | -0.003*** (-1.6289) |
| ROA                | -0.0022*** (7.4325)   | 0.0020** (2.0778) | -0.0022*** (-3.4678) | 0.0020**(2.0337) | -0.0022** (-3.4315) | 0.0020**(2.0716) | -0.0022** (-3.4468) |
| MTB                | 0.0002*** (17.5474)   | 0.0003*** (13.7524) | 0.0002*** (14.7014) | 0.0003*** (13.7281) | 0.0002*** (14.7519) | 0.0003*** (14.7015) | 0.0002*** (13.7324) |
| SALESGR            | 0.0051*** (5.4471)    | 0.0042*** (4.3458) | 0.0057*** (5.7825) | 0.0046*** (4.5463) | 0.0051*** (5.4371) | 0.0042*** (4.3367) | 0.0051*** (5.4086) |
| NWC                | 0.0029 (0.8452)       | -0.0029 (-0.8189) | 0.0027 (-0.7758) | -0.0030 (-0.8688) | 0.0029 (0.8452) | -0.0028 (-0.8169) | 0.0027 (-0.8631) |
| DIVIDEND           | 0.0004* (1.9206)      | 0.0027*** (6.9717) | 0.0004* (1.9580) | 0.0027*** (6.9756) | 0.0004* (1.9256) | 0.0027*** (6.9743) | 0.0004* (1.9617) |
| CASH               | -0.0084*** (-19.8207) | -0.0031*** (-9.2939) | -0.0084*** (-19.8516) | -0.0031*** (-9.8908) | -0.0084*** (-19.9180) | -0.0031*** (-9.8831) | -0.0084*** (-19.8480) |
| PRISK              | -0.0001 (0.8961)      | -0.0002** (2.3357) | -0.0001 (0.8937) | -0.0002** (2.3144) | -0.0001 (0.8990) | -0.0002** (2.3364) | -0.0001 (0.8955) |
| INTEREST           | 0.0014*** (18.9296)   | 0.0015*** (18.9758) | 0.0014*** (18.7928) | 0.0014*** (18.7505) | 0.0014*** (18.9605) | 0.0014*** (18.9218) | 0.0014*** (18.7604) |
| CIT                | 0.0498*** (25.5147)   | 0.0569*** (24.6553) | 0.0497*** (25.3280) | 0.0568*** (24.4729) | 0.0497*** (25.4815) | 0.0567*** (24.6055) | 0.0496*** (24.5284) |
| EPU                | 0.0011*** (2.7562)    | 0.0009*** (2.2518) | 0.0011*** (2.6675) | 0.0009*** (2.1585) | 0.0011*** (2.7363) | 0.0009*** (2.2281) | 0.0011*** (2.5643) |
| GDPGR              | 0.1653*** (11.5409)   | 0.1652*** (10.6498) | 0.1573*** (11.4493) | 0.1653*** (10.6213) | 0.1657*** (11.5607) | 0.1567*** (10.6733) | 0.1660*** (10.6454) |
| Constant           | -0.0192*** (-7.2853)  | 0.0254*** (5.5634) | -0.0190*** (-7.1501) | 0.0255*** (5.5707) | -0.0191*** (-7.2523) | 0.0255*** (5.5800) | -0.0190*** (-7.1151) |
| Firm fixed effect  | No                     | No               | No               | No               | No               | No               | No               |
| Quarter fixed effect| No                    | No               | Yes              | No               | Yes              | Yes              | Yes              |
| Observations       | 109,315                | 109,315           | 109,315           | 109,315           | 109,315           | 109,315           | 109,315           |

This table reports the regression results of Model (2) using alternative measures of corporate investment and government responses to the COVID-19 pandemic. Standard errors are clustered by firm and quarter. Robust t-statistics are reported in parentheses. ***, **, and * denotes statistical significance at 1%, 5%, and 10%, respectively.
Table 5
Robustness check.
Panel A. Stringency Index

| VARIABLES | Government Stringency |
|-----------|-----------------------|
|           | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| S_Res_CAPEX | 0.0015*** | (4.0548) |
| Res_NCAINV   | 0.0030*** | (4.8111) |
| Period 2011–2020 | 0.0016*** |
| Period 2017–2020 | 0.0025*** |
| Period 2019–2020 | 0.0031*** |
| Excluding GFC period (2007–2009) | 0.0023*** | (7.1460) |
| Industry fixed effect | 0.0023*** | (7.3630) |
| Driscoll-Kraay estimator | 0.0027*** | (9.4150) |
| Newey-West estimator | 0.0022*** | (5.8647) |
| STATE_STRINGENCY | 0.0015*** |
| GSTRINGENCY | 0.0039*** | (7.7904) |
| SIZE | 0.0016*** | (8.4846) |
| LEVERAGE | 0.0025*** | (3.7143) |
| ROA | 0.0031*** | (7.1460) |
| MTB | 0.0000  |
| SALESGR | 0.0002*** |
| NWC | 0.0015  |
| DIVIDEND | 0.0015*** |
| CASH | 0.0015*** |
| INTEREST | 0.0015*** |
| CIT | 0.0015*** |
| EPU | 0.0015*** |
| GDPGR | 0.0015*** |
| Constant | 0.0015*** |
| Firm fixed effect | Yes | Yes | Yes | Yes | Yes |
| Sector fixed effect | No | No | No | No | No |
| Quarter fixed effect | Yes | Yes | Yes | Yes | Yes |
| Observations | 109,315 |
| Adjusted R-squared | 0.045 | 0.255 | 0.181 | 0.463 | 0.011 | 0.070 | 0.024 | 0.045 | 0.255 | 0.181 | 0.463 | 0.011 | 0.070 | 0.024 |

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### Panel B. Economic Support Index

The table reports the regression results of Model (2) using alternative variable measurements, sample choices and estimators to control for cross-sectional dependency and serial correlation of residuals. Standard errors are clustered by firm and quarter. Robust t-statistics are reported in parentheses. ***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively.

| VARIABLES | Economic Support |
|-----------|------------------|
|           | (1)              | (2)                          | (3)                          | (4)                          | (5)                          | (6)                          | (7)                          | (8)                          | (9)                          | (10)                         |
|           | S_Res_CAPEX      | Res_CAPEX                    | Res_NCAINV                   | Period                        | Period                        | Period                        | Excluding GFC period          | Industry fixed effect         | Driscoll-Kraay estimator     | Newey-West estimator         |
| STATE_ESI |                  | 0.0019***                    |                              |                              |                              |                              |                              |                              |                              |                              |
| QE_SIZE   |                  | 0.0053***                    | (13.5635)                    |                              |                              |                              |                              |                              |                              |                              |
| GESI      |                  | 0.0030***                    | (4.8304)                     | 0.0021***                    | 0.0032***                    | 0.0049**                     | 0.0028***                    | 0.0029***                    | 0.0033***                    | 0.0028***                    |
| SIZE      | −0.0031***       | −0.0030***                   | (14.1591)                    | −0.0074***                   | −0.0043***                   | −0.0139***                   | −0.0003                     | −0.0033***                    | −0.0003***                    | −0.0033***                    |
| LEVERAGE  | −0.0151***       | −0.0161***                   | (17.9210)                    | −0.0063***                   | −0.0176***                   | −0.0080***                   | 0.0043**                     | 0.00165***                    | −0.0062***                    | −0.0162***                    |
| ROA       | 0.0023**         | 0.0023**                     | (2.7764)                     | 0.00465***                   | 0.00030*                     | 0.0053**                     | 0.0004                      | 0.0054**                     | −0.0017***                    | 0.0020                       |
| MTB       | 0.0030***        | 0.0030***                    | (14.0096)                    | 0.0000                       | 0.0000                       | 0.0000                       | 0.0000**                    | 0.0000**                     | 0.00003**                     | 0.0002**                     |
| SALESGR   | 0.0037***        | 0.0045***                    | (4.2859)                     | 0.3110***                    | 0.0026*                      | 0.0058**                     | −0.0004                     | 0.0030**                     | 0.0054**                      | 0.0042**                      |
| NWC       | −0.0006          | −0.0029                     | (0.1909)                     | 0.2760***                    | 0.0001                      | −0.0018                     | 0.0018                      | 0.0006                       | −0.0016                       | −0.0002                      |
| DIVIDEND  | 0.0026**         | 0.0027***                    | (7.2890)                     | 0.00489                      | −0.0908                      | 0.0047***                    | 0.0010                      | 0.0009**                     | 0.0026**                     | 0.0004**                     |
| CASH      | −0.0293***       | −0.0312***                   | (31.8163)                    | −0.0616***                   | −0.0339***                   | −0.0337***                   | 0.0070**                     | −0.0285***                   | −0.0092**                     | −0.0314**                     |
| PRISK     | −0.0002**        | −0.0002**                    | (2.40845)                    | 0.05891                      | 0.0001                      | −0.0002**                    | −0.0000                     | −0.0000**                    | −0.0001                       | −0.0002**                     |
| INTEREST  | 0.0014***        | 0.0016***                    | (19.3981)                    | 0.0014***                    | −0.0199**                    | 0.0007**                     | 0.0019                      | 0.0010**                     | 0.0014**                     | 0.00155**                    |
| CIT       | 0.0526***        | 0.0540***                    | (24.8416)                    | 0.05343                      | 0.03233                      | 0.0000                      | 0.0000                      | 0.0462**                     | 0.0493**                      | 0.0567**                      |
| EPU       | 0.0008**         | 0.0006                      | (2.0894)                     | 0.0006                      | 0.0040**                     | −0.0005                     | 0.0042**                     | 0.0005**                     | 0.0008*                       | 0.0011**                      |
| GDPGR     | 0.1467***        | 0.1683***                    | (11.0120)                    | 0.1815                      | 0.1970***                    | 0.1343***                    | 0.3563                      | 0.0746**                     | 0.1655**                      | 0.1566**                      |
| Constant  | 0.0278***        | 0.0264***                    | (6.7897)                     | −0.1292***                   | 0.0644***                    | 0.2216***                    | −0.0255                     | 0.0421**                     | −0.0175**                     | 0.0254                       |
| Firm fixed effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sector fixed effect | No | No | No | No | No | No | No | Yes | No | No |
| Quarter fixed effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No |
| Observations | 109,315 | 109,315 | 109,315 | 109,315 | 109,315 | 109,315 | 109,315 | 109,315 | 109,315 | 109,315 |
| Adjusted R-squared | 0.045 | 0.036 | 0.255 | 0.181 | 0.463 | 0.010 | 0.070 | 0.024 | 0.067 | 0.096 |
(GNP) for each quarter of our study period. Consequently, we compute the industry-average correlation for each 2-digit SIC industry from the firm-level correlations. The rationale for this measure is that firms in highly cyclical industries likely experience lower asset liquidation values under macro-level negative demand shocks (Shleifer & Vishny, 1992), implying that their investments are less reversible under uncertainty. Hence, we define firms with higher investment irreversibility are firms in industries with revenues-GNP correlations lower than the cross-sectional median, and vice versa. Table 6 presents the results that show the impact of government response on corporate investment in the case of firms with higher/lower investment irreversibility.

The results reveal that corporate investment of firms with higher investment irreversibility react less positively to the government’s policies during COVID-19, relative to their counterparts. Specifically, the coefficients of GSTRINGENCY (columns 1–2) and GESI (columns 3–4) remain positive and statistically significant, however, they are lower in industries with higher investment irreversibility relative to those in lower-irreversibility industries (0.0018 and 0.0022 compared to 0.0037 and 0.0045, respectively). More importantly, our results demonstrate that the difference gap in investment between higher and lower investment irreversibility industries is widening when capital expenditure is employed as a proxy of investment. This observation suggests that firms in the higher investment irreversibility industries are less inclined to make long-term investment decisions due to the prevailing uncertainties under the pandemic. Our results corroborate with the conjectures of Dixit (1995), Gulen and Ion (2016), and Kim and Kung (2017) that firms with higher investment irreversibility tend to be more cautious in making investment decisions during market turmoil. Our finding supports the real-option mechanism of investment under uncertainty (Guiso & Parigi, 1999; Gulen & Ion, 2016; Kim & Kung, 2017) that more irreversible investment implies lower asset liquidation values and less protection against adverse uncertainty shocks (Bloom,

| VARIABLES | Government Stringency | Economic Support |
|-----------|------------------------|------------------|
|           | Industries with higher investment irreversibility | Industries with lower investment irreversibility | Industries with higher investment irreversibility | Industries with lower investment irreversibility |
| GSTRINGENCY | 0.0018*** (4.2961) | 0.0037*** (6.9141) | 0.0022*** (3.6262) | 0.0045*** (5.9902) |
| GESI | –0.0054*** (-17.2392) | –0.0009** (-2.3394) | –0.0054*** (-17.2327) | –0.0009** (-2.3334) |
| SIZE | –0.0159*** (-12.1462) | –0.0153*** (-11.3063) | –0.0159*** (-12.1421) | –0.0153*** (-11.2951) |
| LEVERAGE | 0.0010 (0.6869) | 0.0022* (1.6789) | 0.0009 (0.6827) | 0.0022* (1.6785) |
| NWC | 0.0003*** (9.0117) | 0.0003*** (10.6820) | 0.0003*** (9.0108) | 0.0003*** (10.6914) |
| MTR | 0.0003*** (2.2882) | 0.0003*** (4.0495) | 0.0003*** (2.2636) | 0.0003*** (4.0196) |
| SIZE | –0.0027 (–0.5292) | –0.0001 (–0.5835) | –0.0023 (–0.5254) | –0.0031 (–0.5797) |
| LEVERAGE | 0.0038*** (7.5866) | 0.0013** (2.1909) | 0.0038*** (7.5818) | 0.0013** (2.2039) |
| NWC | –0.0003*** (–24.4869) | –0.0001 (–19.3333) | –0.0003*** (–24.4787) | –0.0001 (–19.3274) |
| LEVERAGE | 0.0009*** (9.4364) | 0.0020*** (16.1609) | 0.0009*** (9.4180) | 0.0020*** (16.1292) |
| NWC | 0.0291*** (10.2174) | 0.0833*** (22.0293) | 0.0289*** (10.1866) | 0.0830*** (22.7583) |
| EPU | –0.0004 (–0.8085) | 0.0022*** (3.4112) | –0.0004 (–0.8224) | 0.0022*** (3.4106) |
| GDPGR | 0.1606*** (8.6996) | 0.1469*** (6.3264) | 0.1609*** (8.7103) | 0.1476*** (6.3485) |
| Constant | 0.0731*** (13.0181) | –0.0194*** (–2.6902) | 0.0732*** (13.0262) | –0.0193*** (–2.6740) |
| Firm fixed effect | Yes | Yes | Yes | Yes |
| Quarter fixed effect | Yes | Yes | Yes | Yes |
| Observations | 55,582 | 53,729 | 55,582 | 53,729 |
| Adjusted R-squared | 0.041 | 0.034 | 0.041 | 0.034 |

This table reports the regression results of Model (2) at different degrees of investment irreversibility. Variable definitions are presented in Table 1. Standard errors are clustered by firm and quarter. Robust t-statistics are reported in parentheses. ***, **, and * denotes statistical significance at 1%, 5%, and 10%, respectively.
In this section, we test Hypothesis 3 to find out whether the positive impact of government responses to COVID-19 on corporate investment is stronger for firms with higher technology intensity. We follow previous studies in the literature (Aghion et al., 2004; Bah & Dumontier, 2001; Honoré et al., 2015; Padgett & Galan, 2010) to measure technology intensity using R&D intensity ($R&D_{INTENSITY}$) that equals corporate research and development expenditure scaled by total sales, however, both in the preceding year and in the current year. Following our hypothesis development, we expect the impact found in the primary analysis to be more pronounced in firms with higher $R&D_{INTENSITY}$ and vice versa. Table 7 presents the estimation results.

Column 1 and Column 4, Table 7, show the regression results of $Res_{CAPEX}$ on $GSTRINGENCY$ and $GESI$, respectively, with 2009; Kim & Kung, 2017). Hence, more irreversible firms have more incentives to delay investment (or invest less) and avoid costly capital reversibility afterward relative to less irreversible firms, even if both firm groups have the same confidence in the macro-economic outlook post-pandemic. Following Kim and Kung (2017), we attribute this type of corporate behaviour to the payoff between errors are clustered by firm and quarter. Robust $t$-statistics are reported in parentheses. ***, **, and * denotes statistical significance at 1%, 5%, and 10%, respectively.

### Table 7
The impact of technological intensity.

| VARIABLES | Government Stringency | Economic Support |
|-----------|-----------------------|------------------|
|           | (1) | (2) | (3) | (4) | (5) | (6) |
|           | Full sample available | Firms with higher technological intensity | Firms with lower technological intensity | Full sample available | Firms with higher technological intensity | Firms with lower technological intensity |
| $GSTRINGENCY$ | 0.0021*** | 0.0029*** | 0.0018*** | 0.0024*** | 0.0036*** | 0.0020*** |
|            | (2.9562) | (7.0986) | (2.9086) | (2.9246) | (6.3815) | (2.5215) |
| $GESI$ | 1.1277*** | 1.1275*** | 1.1273*** | 1.1275*** | 1.1273*** | 1.1273*** |
|            | (3.3530) | (3.3356) | (3.3356) | (3.3356) | (3.3356) | (3.3356) |
| $R&D_{INTENSITY}$ | -0.0037*** | -0.0019*** | -0.0061*** | -0.0037*** | -0.0019*** | -0.0061*** |
|            | (-12.8029) | (-6.3543) | (-11.5394) | (-12.8012) | (-6.3484) | (-11.5355) |
| $SIZE$ | -0.0148*** | -0.0163*** | -0.0154*** | -0.0148*** | -0.0163*** | -0.0154*** |
|            | (-13.2957) | (-14.6474) | (-7.6424) | (-13.2946) | (-14.6413) | (-7.6403) |
| $LEVERAGE$ | 0.0010 | -0.0013 | 0.3202*** | 0.0010 | -0.0013 | 0.3202*** |
|            | (0.9635) | (-1.2055) | (8.9402) | (0.9629) | (-1.2087) | (8.9394) |
| $ROA$ | 0.0003*** | 0.0003*** | 0.0003*** | 0.0003*** | 0.0003*** | 0.0003*** |
|            | (11.1643) | (11.2913) | (6.9479) | (11.1654) | (11.2930) | (6.9507) |
| $MTB$ | 0.0004*** | 0.0004*** | 0.0062*** | 0.0038*** | 0.0044*** | 0.0062*** |
|            | (3.3971) | (3.8477) | (2.8655) | (3.3866) | (3.8142) | (2.8547) |
| $SALESGR$ | 0.0017 | -0.0045 | -0.0008 | 0.0017 | -0.0045 | -0.0008 |
|            | (0.3921) | (-1.1195) | (-0.1143) | (0.3929) | (-1.1149) | (-0.1129) |
| $NWC$ | -0.0099*** | -0.0012 | -0.0009*** | -0.0012 | -0.0009*** | -0.0012 |
|            | (-1.7686) | (-1.4813) | (-1.7660) | (-1.7652) | (-1.4810) | (-1.7652) |
| $DIVIDEND$ | -0.0278*** | -0.0288*** | -0.0454*** | -0.0278*** | -0.0287*** | -0.0454*** |
|            | (-24.2339) | (-24.3183) | (-17.4907) | (-24.2333) | (-24.3134) | (-17.4883) |
| $PRISK$ | -0.0002 | -0.0002*** | 0.0000 | -0.0002 | -0.0002** | -0.0000 |
|            | (-1.5310) | (-2.4824) | (-1.1354) | (-1.5319) | (-2.4846) | (-1.1351) |
| $INTEREST$ | 0.0015*** | 0.0013*** | 0.0021*** | 0.0015*** | 0.0012*** | 0.0021*** |
|            | (15.7993) | (13.3355) | (13.6290) | (15.7926) | (13.3017) | (13.6236) |
| $CIT$ | 0.0513*** | 0.0546*** | 0.0604*** | 0.0512*** | 0.0545*** | 0.0603*** |
|            | (19.0007) | (19.2145) | (15.1452) | (18.9970) | (19.1732) | (15.1361) |
| $EPU$ | 0.0001 | 0.0019*** | -0.0016** | 0.0001 | 0.0019*** | -0.0016** |
|            | (0.2147) | (3.8241) | (-2.2271) | (0.2084) | (3.8083) | (-2.2320) |
| $GDPGR$ | 0.1337*** | 0.1718*** | 0.1158*** | 0.1340*** | 0.1724*** | 0.1161*** |
|            | (7.5324) | (9.8344) | (4.6159) | (7.5450) | (9.8606) | (4.1720) |
| $Constant$ | 0.0402*** | 0.0050 | 0.0798*** | 0.0402*** | 0.0051 | 0.0798*** |
|            | (7.6772) | (0.9116) | (8.6800) | (7.6800) | (0.9290) | (8.6800) |
| Firm fixed effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter fixed effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 40,738 | 20,322 | 20,416 | 40,738 | 20,322 | 20,416 |
| Adjusted R-squared | 0.050 | 0.037 | 0.098 | 0.050 | 0.037 | 0.098 |

This table reports the regression results of Model (2) at different degrees of R&D intensity. Variable definitions are presented in Table 1. Standard errors are clustered by firm and quarter. Robust $t$-statistics are reported in parentheses. ***, **, and * denotes statistical significance at 1%, 5%, and 10%, respectively.
R&D_INTENSITY as an additional control variable in both regressions. Adding R&D_INTENSITY to the regression is to control for the possible impact of technology intensity on corporate investment. Columns 2–3 present the regression results of Model (2) with GSTRINGENCY as the variable-of-interest using subsamples of high- and low-technology intensity. Columns 5–6 report the regression results of Model (2) with GESI as the variable-of-interest using subsamples of high- and low-technology intensity. It is important to mention that only about R&D expenditure data is only available for roughly 37.2 percent of the firm-quarter-year observations in our sample. Therefore, the available sample for this analysis consists of 40,738 observations.

In general, we document positive and significant coefficients of government response variables (GSTRINGENCY and GESI) in all regression specifications, indicating that our primary finding holds well even after controlling for technology intensity. Nevertheless, the regression results in columns 2–3 and 5–6, Table 7, show that the coefficients of government response variables (GSTRINGENCY and GESI) are generally higher in firms with higher technology intensity compared to those with lower technology intensity (0.0029 and 0.0036 compared to 0.0018 and 0.0020, respectively). This finding supports Hypothesis 3 and suggests that technology intensity plays an important role as a good foundation for corporate investment in response to government policies during the pandemic. Looking at a different angle, firms that are more technology-intensive tend to be more able to invest during the COVID-19 crisis. This conjecture is in line with R&D investment is a preemptive strategy to prevent the negative impacts of future uncertainty shocks (Czarnitzki & Toole, 2011; Vo & Le, 2017).

To summarize, our empirical evidence suggests that firms with higher technology intensity react more positively to government response to COVID-19 in terms of investment. This finding suggests the importance of technologies in firms under the economic impact of the COVID-19 unprecedented shock.

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We obtain similar results when using Res_NCAINV as the dependent variable in Model (2).

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This table reports the regression results of Model (2) at different degrees of firm-level political risk. Variable definitions are presented in Table 1.

Table 8
The impact of firm-level political risk.

| VARIABLES | Government Stringency | Economic Support |
|-----------|-----------------------|------------------|
|           | (1)                  | (2)              | (3)             | (4)             |
| GSTRINGENCY | 0.0022***             | 0.0035***        | 0.0030***       | 0.0050***       |
|           | (6.3779)              | (6.7843)         | (5.6114)        | (5.6717)        |
| GESI      | -0.0030***            | -0.0037***       | -0.0030***      | -0.0037***      |
|           | (-9.5461)             | (-10.1113)       | (-9.5384)       | (-10.1051)      |
| SIZE      | -0.0143***            | -0.0142***       | -0.0143***      | -0.0142***      |
|           | (-11.9386)            | (-12.9796)       | (-11.9406)      | (-12.9669)      |
| ROA       | 0.0027**              | 0.0040***        | 0.0027**        | 0.0040***       |
|           | (2.4131)              | (2.6236)         | (2.4067)        | (2.6218)        |
| MTB       | 0.0003***             | 0.0003***        | 0.0003***       | 0.0003***       |
|           | (10.4094)             | (10.3543)        | (10.4094)       | (10.3622)       |
| SIZE      | 0.0044***             | 0.0049***        | 0.0043***       | 0.0048***       |
|           | (3.6001)              | (3.2190)         | (3.5720)        | (3.1876)        |
| NWC       | -0.0029               | 0.0011           | -0.0028         | 0.0011          |
|           | (-0.6752)             | (0.2189)         | (-0.6710)       | (0.2228)        |
| DIVIDEND  | 0.0031***             | 0.0026***        | 0.0031***       | 0.0026***       |
|           | (6.4788)              | (4.6176)         | (6.4791)        | (4.6205)        |
| CASH      | -0.0301***            | -0.0292***       | -0.0301***      | -0.0292***      |
|           | (-23.2161)            | (-19.4739)       | (-23.2110)      | (-19.4574)      |
| INTEREST  | 0.0015***             | 0.0015***        | 0.0015***       | 0.0015***       |
|           | (15.4517)             | (13.4399)        | (15.4254)       | (13.4103)       |
| CIT       | 0.0602***             | 0.0544***        | 0.0600***       | 0.0542***       |
|           | (20.8295)             | (16.6695)        | (20.7996)       | (16.6271)       |
| EPU       | 0.0009*               | 0.0004           | 0.0009*         | 0.0004          |
|           | (1.7892)              | (0.6509)         | (1.7699)        | (0.6329)        |
| GDPR      | 0.1528***             | 0.1757***        | 0.1534***       | 0.1763***       |
|           | (8.2951)              | (7.9232)         | (8.3164)        | (7.9492)        |
| Constant  | 0.0218***             | 0.0361***        | 0.0218***       | 0.0362***       |
|           | (3.8196)              | (5.4628)         | (3.8310)        | (5.4736)        |
| Firm fixed effect | Yes | Yes | Yes | Yes |
| Quarter fixed effect | Yes | Yes | Yes | Yes |
| Observations | 55,008 | 54,303 | 55,008 | 54,303 |
| Adjusted R-squared | 0.032 | 0.058 | 0.032 | 0.058 |

This standard errors are clustered by firm and quarter. Robust t-statistics are reported in parentheses. ***, **, and * denotes statistical significance at 1%, 5%, and 10%, respectively.
4.4.3. Firm-level political risk

Given that 2020 is the presidential election year in the US, accounting for political risk becomes even more critical. To measure political risk, we use the firm-level political risk (PRISK) proposed by Hassan et al. (2019). The measure is constructed using textual analysis of quarterly earnings conference call transcripts of US firms that show the management’s view on their firms’ risks associated with politics. We divide firms into higher and lower political risk firms to ascertain the impact of political risk on the association between government response and corporate investment. We use the median of PRISK as the cut-off point to define higher and lower political risk firms. The high- and low-political risk firm groups are defined for each quarter-year. We then re-perform the analysis using the subsamples of high- and low-political risk firms. In line with our proposition, we expect the impact of government response to COVID-19 on corporate investment to be weaker in the high-political risk firm groups than in low-political risk firm groups. The estimations results are in Table 8.

Table 8 shows that the government response in the shape of stringency measures and the economic support exhibit a more pronounced effect on corporate investment of firms with a lower level of political risk compared to the firms with a higher degree of political risk. A comparison of coefficients indicates that the impact of government response on corporate investment for the firms with a lower degree of political risk is higher than that of firms with a higher degree of political risk (0.0035 and 0.0050 compared to 0.0022 and 0.0030, respectively). Our findings corroborate with the existing literature that indicates that higher degrees of political risk are more likely to retrench their hiring and corporate investment to protect themselves from increased uncertainty (Campello et al., 2020; Hassan et al., 2019; Julio & Yook, 2012).

To summarize, the empirical findings support our Hypothesis 4 that the positive impact of government policy response to COVID-19 on corporate investment seems weaker in firms with higher political risk, suggesting that political risk may drive firms to react less positively to the government policies during the COVID-19 crisis.

5. Conclusion

The unprecedented and devastating impact of COVID-19 on the US public health and economy has driven us to the question of whether the government response, in terms of both social stringency and economic relief bills, have an impact on corporate investment during this once-in-100-year pandemic. The fact that the US health response to the pandemic is below expectation in the early stage of the COVID-19 outbreak, and that the economic response has prevailed with the economy grew at a record pace in the third quarter - increasing 7.4% over the third quarter and a 33.1% annual rate could exhibit any hint to how corporate investment reacts to the development of the pandemic. We provide the answer to the questions by using data on the US government response to the pandemic and show that the government responses to COVID-19, especially the economic support policies, have a positive effect on corporate investment.

The special feature in the US is that the pandemic occurs in the same year as the presidential election, which shows a higher level of political risk. Our further analysis reveals that the effect of the government response in terms of the stringency measures and the economic support packages on corporate investment is more pronounced on firms with a lower level of political risk. As firms with higher political risk have higher levels of risk aversion under increased uncertainty, they react more cautiously to the government’s policies compared to other firms. Furthermore, regarding investment irreversibility, the empirical results indicate that corporate investment of firms with higher investment irreversibility react less positively to government policies during COVID-19 relative to their counterparts. Hence, those firms are less inclined to make long-term investments due to the prevailing uncertainties under the pandemic. Moreover, we emphasize the importance of technology intensity in motivating corporate investment as a response to government supports during COVID-19. This study complements our understanding of corporate behaviour during the COVID-19 pandemic as a unique natural experiment. Analysis of corporate investment at the time of the pandemic provides us with a straightforward evaluation of the effectiveness of the government’s policy and actions in this uncertain time.

Finally, the findings of this study suggest that both stringent measures and economic support stimulus packages, at the same time, by a government to counter the economic and social effects of COVID-19 could increase the businesses’ confidence to invest and accelerate the pace of economic recovery. This provides practical implications to policymakers and governments who might face dilemmas during the decision-making process to control the next waves of COVID-19 or a similar pandemic in the future. The findings also have implications for corporate R&D as a preemptive strategy to be well prepared for future uncertainty shocks.

CRediT authorship contribution statement

Khanh Hoang: Conceptualization, Methodology, Software, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. Muhammad Arif: Methodology, Writing – original draft. Cuong Nguyen: Conceptualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None.

13 These results are robust for even when we use Res_NCAINV as the investment proxy.
14 See https://www.wsj.com/articles/us-gdp-third-quarter-2020-11603908566.
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We authors are politically neutral and do not support any political faction or politician in the United States. The findings of our study solely based on the empirical evidence and existing literature in the fields of corporate finance and government policy. There is no potential financial, political, or personal interest that may bias our work. The remaining errors are ours.

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