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Corporate immunity to the COVID-19 pandemic ☆

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ABSTRACT

We evaluate the connection between corporate characteristics and the reaction of stock returns to COVID-19 cases using data on more than 6,700 firms across 61 economies. The pandemic-induced drop in stock returns was milder among firms with stronger pre-2020 finances (more cash and undrawn credit, less total and short-term debt, and larger profits), less exposure to COVID-19 through global supply chains and customer locations, more corporate social responsibility activities, and less entrenched executives. Furthermore, the stock returns of firms controlled by families (especially through direct holdings and with non-family managers), large corporations, and governments performed better, and those with greater ownership by hedge funds and other asset management companies performed worse. Stock markets positively price small amounts of managerial ownership but negatively price high levels of managerial ownership during the pandemic.

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1. Introduction

The global economic crisis triggered by COVID-19 is different from past crises. Former chair of the US Federal Reserve Ben Bernanke stressed that while financial imbalances and risks grew over many years to produce the 2007–2009 global financial crisis (GFC), the public health emergency that emerged in 2019 was caused by a viral pandemic that abruptly and severely constricted global economic activity (Bernanke, 2020). Reinhart and Rogoff (2009) recount the striking similarities of crises during the eight centuries before COVID-19, and Reinhart (2020) emphasizes that the COVID-19 crisis is truly different from past crises with respect to its cause, scope, and severity. These observations motivate research into the factors shaping the responses of countries, firms, and individuals to COVID-19.

The COVID-19 pandemic has also triggered enormous, and heterogeneous, stock price movements. During the first five months of 2020, the Standard & Poor's (S&P) 500 fell by 34% from its high to its low, and the exchanges in Brazil, Hong Kong, Italy, and Japan experienced high-low declines of 46%, 25%, 41%, and 31%, respectively. Moreover, stock return volatility has been large even within the same industry and country. For example, within the US

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manufacturing industry, the standard deviation of weekly stock returns was 20% from mid-February through May 2020. These developments raise the question: Which firm characteristics make some companies more immune to the COVID-19 shock than others?

In this paper, we examine the relation between five pre-2020 corporate characteristics and stock price reactions to the COVID-19 pandemic. To conduct our study, we use data on more than 6,700 firms, which account for over 90% of world stock market capitalization, across 61 economies from January through May 2020. We consider these five pre-2020 corporate characteristics: (1) financial conditions, such as cash holdings, lines of credit, total debt, the maturity structure of debt, and profitability, (2) international supply chain and customer exposure to COVID-19, such as the degree to which a firms' inputs are purchased from, and products sold in, countries differentially exposed to COVID-19, (3) corporate social responsibility (CSR), such as investments in relations with employees, suppliers, customers, and the communities in which firms operate, (4) corporate governance, such as antitakeover provisions, board structure, and executive compensation systems, and (5) ownership structure, such as whether a firm is controlled by a family, government, nonfinancial corporation, or bank (or other financial institution), the extent to which hedge funds and other asset management companies (AMCs) hold large stakes in firms, and the proportion of shares held by management. We assess cross-firm stock price reactions to COVID-19 as functions of these pre-pandemic corporate characteristics. By examining these characteristics simultaneously, we can better identify the independent connection between each corporate characteristic and stock price reactions to the pandemic.

In evaluating how corporate characteristics shape stock price reactions to COVID-19, the dependent variable is a firm's weekly stock returns, computed during the weeks from January 3 through May 22, 2020. A key input into our set of explanatory variables is COVID-19, which is the weekly growth rate of the number of confirmed COVID-19 cases in the firm's home economy. As explanatory variables, we interact COVID-19 with pre-2020 corporate characteristics to assess how firms' stock returns respond to the pandemic as functions of individual corporate traits. We also show that the results are robust to using alternative measures of changes in exposure to infection risks from the COVID-19 virus, including measures that are scaled by testing or based on active cases, abnormal returns as the dependent variable, and alternative samples of industries, countries, and periods.

In our core analyses, we examine how firm-specific traits influence stock price reactions to the pandemic, while controlling for economy-time, industry-time, and firm fixed effects. With these fixed effects, we condition out all time-varying and time-invariant economy traits, such as differences in legal and political systems, policy reactions to the crisis, institutions and cultural norms, demographic, geographic, and population density characteristics, and other cross-country traits, as well as all time-varying and time-invariant industry differences, such as differences in the intensity of required in-person contact with customers, suppliers, and co-workers, that might influence stock price reactions to the pandemic. Conditioning on these fixed effects allows us to better isolate the differential impact of COVID-19 on stock prices as functions of firms' basic financial conditions, international network of suppliers and customers, corporate social responsibility, corporate governance systems, and ownership structures.

We make five discoveries. First, pre-pandemic financial conditions have shaped stock price reactions to COVID-19. Firms with more cash, greater unused lines of credit, less debt, less debt maturing in the short run, and larger profits experienced better stock price performance than otherwise similar firms. As the pandemic depressed corporate sales and firms sought liquidity to cover costs, stock markets considered firms' cash reserves, access to credit, leverage, debt maturity structures, and profitability when reevaluating the value of corporations. These results are robust to simultaneously controlling for the other four corporate characteristics interacted with COVID-19. These findings are consistent with previous research connecting corporate performance with financial conditions, including leverage (Giroud and Mueller, 2017), cash holdings (Fresard, 2010), lines of credit line (Berrospide and Meisenzahl, 2015), and debt maturity structure (Almeida et al., 2012).

Second, pandemic-induced declines in stock prices have been greater among firms with more exposure to the COVID-19 pandemic through their international supply chains and customers. Although research has stressed that firms are connected through networks of suppliers and customers (Acemoglu et al., 2012; Barrot and Sauvagnat, 2016, Acemoglu et al., 2017) and policy makers and industry practitioners have stressed the potential impact of global supply chain disruptions on markets [e.g., Jerome Powell, chair of the Federal Reserve, and Larry Fink, chief executive officer (CEO) of BlackRock], we evaluate empirically the connection between firms' stock returns and their exposure to COVID-19 through global supply chains and customer locations.[1] To measure this exposure, we compute for each firm in each week *Suppliers' Exposure* as the weighted average of COVID-19 for the country from which the firm receives suppliers, where the weights are the number of the firm's pre-pandemic suppliers from those countries as a fraction of the total number of the firm's suppliers, and *Customers' Exposure* as the weighted average of COVID-19 for the country in which the firm sells its products, where the weights are the proportion of the firm's pre-pandemic revenues from those countries. Our findings indicate that markets considered international exposure to the pandemic in revaluing firms.

Third, firms that engaged in more CSR activities prior to the pandemic have enjoyed better stock price performance in response to the pandemic. These results are consistent with the view that CSR strengthens bonds between a firm and its workers, customers, and local community, such that those stakeholders are more willing to make adjustments to support the business during times of duress. As shown

[1] See, for example, https://www.cnbc.com/2020/03/03/powell-says-the-fed-saw-a-risk-to-the-outlook-for-the-economy-and-chose-to-act.html and https://www.bloomberg.com/news/articles/2020-03-30/fink-sees-economy-recovering-from-virus-but-forever-transformed.

by Albuquerque et al. (2019), CSR activities strengthen customer loyalty and hence reduce a corporation's susceptibility to economic downturns. Examining US firms during the GFC, Lins et al. (2017) show that high-CSR firms enjoyed better stock returns. We examine stock price reactions to the COVID-19 pandemic using an international setting and conditioning on a constellation of corporate characteristics that also could shape stock price reactions to the pandemic to identify the influence of CSR activities on corporate immunity to COVID-19.

Fourth, in response to COVID-19, markets have penalized firms with more entrenched executives. Using the number of antitakeover provisions for each firm as a measure of executive entrenchment, our analyses suggest that stock markets viewed executive entrenchment negatively in assessing a corporation's ability to respond effectively to the pandemic. These findings are consistent with the view that entrenchment impedes the effective functioning of firms (Shleifer and Vishny, 1997; Gompers et al., 2003; Cremers and Nair, 2005; Bebchuk et al., 2009). Research also suggests that the structure of each firm's board of directors (Adams et al., 2010) and executive compensation policies (Murphy, 2013; Rau, 2015) can shape corporate behavior and valuations. We do not find evidence that stock price reactions to COVID-19 vary systematically with board structure or compensation systems.

Fifth, six features of corporate ownership structure are strongly linked with the response of stock returns to the COVID-19 pandemic. First, the stock returns of firms controlled by families have on average performed better than widely held firms following the onset of the pandemic. This finding is consistent with views stressing that family owners have longer horizons that mitigate managerial opportunism (James, 1999; Anderson and Reeb, 2003), stronger attachments to their firms (Kandel and Lazear, 1992), greater firm-specific expertise, and stronger bonds with non-shareholder stakeholders (Donnelley, 1964) that make family-control firms more resilient to adverse shocks with positive ramifications on stock prices. Second, when exploring the nature of family ownership further, we find better stock return resilience to the pandemic among family-controlled firms in which control is through direct holdings, but not through pyramid structures, and only among family-controlled firms in which the manager is not a family member. Third, firms controlled by the government, and to a lesser degree those controlled by banks, have performed better than widely held corporations. These owners could represent a source of deep pockets and support during crises. Fourth, the stock returns of firms controlled by large corporations performed better than those of widely held firms and firms controlled by smaller corporations. These results are consistent with the view that large corporations have deep pockets and a long-run commitment to the firms they control, which can help the firm navigate the COVID-19 shock. Fifth, the response of stock returns to the pandemic were worse among firms with blockholders that are asset management companies, especially hedge funds. This finding is consistent with research by Lo (2008), Stein (2009) and Khandani and Lo (2011) stressing that the combination of the quantitative trading strategies employed by hedge funds and their reliance on leverage can contribute to sharp, nonfundamental price movements in response to adverse shocks and with research by Pastor and Vorsatz (2020) and Glossner et al. (2020), who show that US actively managed funds have underperformed during the pandemic. Sixth, stock markets positively price small amounts of managerial ownership in assessing resilience to the pandemic but negatively price high levels of managerial ownership. This finding is consistent with views that managerial shareholdings create the benefits of aligning the incentives of managers and owners and that they foster entrenchment problems as management ownership increases (e.g., Morck et al., 1988; Stulz, 1988; McConnell and Servaes, 1990; Claessens et al., 2002).

We also provide country-level analyses of how country characteristics influence stock market reactions to the pandemic. We consider expected changes in COVID-19 cases, government containment and closure policies, government stimulus, and other pre-pandemic country traits, including government indebtedness, economic development, population age, and legal origin. We find that markets outside of Italy react negatively to cases in Italy and that this reaction is stronger the closer that country is to Italy. Furthermore, we find that the effect of cases in Italy on a country's stock returns falls over time as COVID-19 cases in that country emerge. We do not find that other markets react to cases in China, suggesting that global markets reacted only once it was clear that COVID-19 would spread outside of Asia. We also find that stock markets react positively to national policies that encourage social distancing, as captured by the degree of lockdown policies, and to fiscal stimulus policies and government purchases of corporate debt. We do not find a robust link between stock price resilience to COVID-19 and other pre-pandemic country traits, including government indebtedness, economic development, population age, and legal origin.

Given the severity of the COVID-19 crisis, a rapidly growing body of research is exploring the impact on stock returns. Several papers show how the US stock market differentially priced firms depending on their financial conditions (Acharya and Steffen, 2020; Alfaro et al., 2020; Fahlenbrach et al., 2021; Ramelli and Wagner, 2020), exposure to China (Ramelli and Wagner, 2020), and environmental and social ratings (Albuquerque et al., 2020). Our work is distinct in several dimensions. First, given that COVID-19 is a global pandemic, we conduct an international study that allows us to exploit cross-country, cross-time variation in exposures to COVID-19 and evaluate the sensitivity of stock returns to COVID-19 cases as functions of firm characteristics. Second, given this analytical structure, we include a large number of high-dimensional fixed effects to condition out many confounding effects at the firm, industry-time, and country-time level to enhance identification. Third, our study provides comprehensive analyses on five broad dimensions. Besides examining pre-pandemic corporate financial conditions, we consider each firm's exposure through global supply chains and international customers, CSR activities, corporate governance, and ownership structure. Evaluating these corporate characteristics simultaneously enhances identification

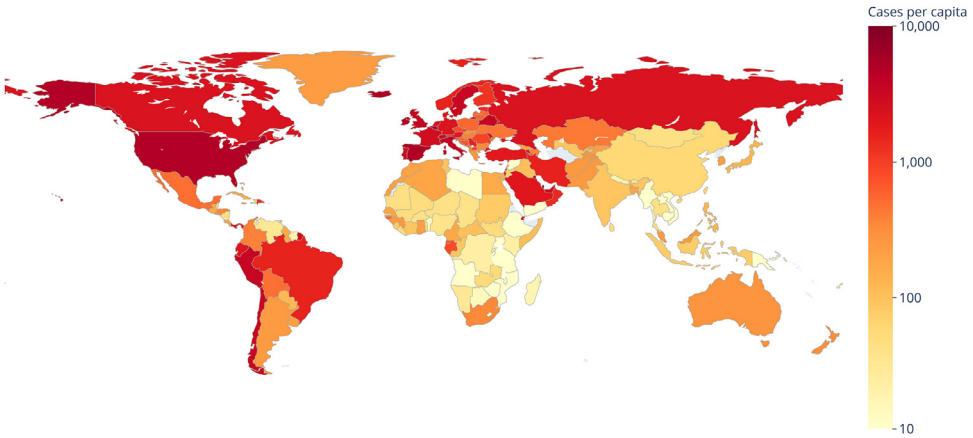

Fig. 1. COVID-19 cases per capita. This figure shows cumulative confirmed COVID-19 cases per one million people in each economy as of May 22, 2020. Darker colors indicate more cases per capita. Gray indicates that no data are available. Source: Johns Hopkins University, Center for Systems Science and Engineering.

of the independent connection between each characteristic and stock price reactions to the pandemic. Fourth, given the cross-country nature of our study, we look into how national policies, such as government stimulus, lockdown policies, and other country characteristics affect stock market reactions to the pandemic.[2]

The rest of the paper proceeds as follows. Section 2 describes the data and variables. Section 3 presents and discusses the empirical findings. Section 4 concludes.

2. Data

In this section, we describe the data on COVID-19, stock returns, and corporate characteristics.

2.1. COVID-19

COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2. The disease was first identified in December 2019 in Wuhan, China. The first case of the disease outside of China was diagnosed in Thailand in mid-January 2020, and it spread rapidly around the world. The World Health Organization (WHO) declared it a Public Health Emergency of International Concern on January 30, named the disease COVID-19 on February 11, and classified COVID-19 as a pandemic on March 11. The total number of confirmed cases around the world has been growing at a historically high speed, and it reached more than 6.2 million at the end of May 2020. Fig. 1 plots the cumulative coronavirus cases per capita reported in each economy at the end of May 2020, demonstrating substantial cross-country differences in the recent spread of COVID-19.

[2] Barrot et al. (2020) examine the impact of US state policies regarding closing businesses on firm valuations. Hassan et al. (2020) show that stock prices performed worse among firms with greater negative sentiments, as measured by text-based metrics. Instead of examining stock returns, De Vito and Gómez (2020) analyze the impact of the crisis on firm liquidity.

We obtain data on COVID-19 cases from the Coronavirus COVID-19 Global Cases Database, which is managed by Dong et al. (2020) at the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU). The JHU team collects daily data from more than 180 economies starting on January 22, 2020. The team assembles information from government reports and other sources and then confirms its figures with international health authorities, such as WHO, and local health departments, such as the respective centers for disease control and prevention. We obtain data on the number of confirmed cases, the number of deaths, and the number of recoveries.

We use several measures of changes in an economy's exposure to the COVID-19 pandemic. In our baseline analyses, we use COVID-19, which is the growth rate of the cumulative number of confirmed cases in a country in a given week. To match COVID-19 to the weekly stock return data, COVID-19 is calculated from Saturday to Friday. For each economy c in week t, we compute COVID-19 as

$$COVID19_{c,t} = \ln(1 + Cumulative\ Cases_{c,t}) - \ln(1 + Cumulative\ Cases_{c,t-1}), \quad (1)$$

where c and t index economy and week, respectively. $Cumulative\ Cases_{c,t}$ represents the cumulative number of confirmed cases in economy c as of Friday in week t. Thus, $COVID19_{c,t}$ measures the weekly growth of confirmed cases over week t in economy c. Table 1 reports the summary statistics of key variables used in the analyses. As shown, the sample mean of *COVID19* equals 0.47 across all economy-years and is 0.725 for economy-years that had some COVID-19 cases.

Fig. 2 shows the evolution of the cumulative number of COVID-19 cases per one million people in each economy through May 22, 2020. The x-axis represents the number of days since the number of confirmed cases in an economy reached 0.0001% of the population, and the y-axis depicts the cumulative number of cases per one million inhabitants. While many countries follow a concave pattern, substantial cross-economy, cross-time variation exists.

Table 1
Summary statistics.
This table presents the summary statistics of the key variables used in our analyses. N designates the number of non-missing observations for the variable. The average (mean) and standard deviation are determined across these observations for the variable. Also reported is the value of the variable at the 10th, 25th, 50th, 75th percentile, and 90th percentile of the distribution of the variable.

Variable	N	Mean	Standard deviation	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
Weekly Stock Return	126,711	-0.678	9.85	-12.1	-4.93	-0.303	3.57	9.75
Abnormal Return	126,431	-0.176	8.200	-8.410	-3.620	-0.307	2.89	7.99
COVID19	1,208	0.470	0.707	0	0	0.138	0.667	1.46
COVID19 (exposed economy-week)	784	0.725	0.766	0.038	0.154	0.448	1.08	1.79
COVID19, Active	1,208	0.404	0.805	-0.149	0	0.022	0.666	1.54
COVID19, Testing Adjusted 1	879	0.172	2.36	-2.21	-0.125	0	0.007	3.10
COVID19, Testing Adjusted 2	944	0.331	1.65	-1.12	-0.232	0	0.105	2.08
Firm characteristics								
Firm Size	126,711	15	1.70	12.9	13.9	14.9	16	17.1
Leverage	126,711	0.284	0.22	0.007	0.117	0.269	0.410	0.547
Cash	126,711	0.157	0.186	0.013	0.037	0.092	0.193	0.395
ROA	126,711	0.015	0.163	-0.068	0.008	0.035	0.069	0.119
ROA (Operating Income)	126,669	0.047	0.133	-0.022	0.024	0.055	0.097	0.153
ROA (EBITDA)	123,081	0.085	0.148	-0.008	0.057	0.098	0.145	0.205
ROA (EBIT)	125,409	0.045	0.141	-0.047	0.026	0.059	0.100	0.155
Undrawn Credit	86,216	0.106	0.118	0.010	0.035	0.075	0.134	0.218
Maturing Debt	79,877	0.093	0.184	0	0	0	0.097	0.325
Suppliers' Exposure	111,294	0.552	0.604	0	0.082	0.288	0.941	1.54
Customers' Exposure	121,853	0.545	0.620	0	0.060	0.260	0.953	1.53
Suppliers' Exposure (exposed firm)	92,897	0.661	0.604	0.082	0.154	0.421	1.06	1.61
Customers' Exposure (exposed firm)	100,686	0.660	0.624	0.068	0.151	0.405	1.07	1.62
CSR Score	126,711	0.508	0.200	0.258	0.344	0.490	0.674	0.79
Environmental	126,690	0.508	0.223	0.220	0.322	0.498	0.686	0.822
Social	126,690	0.509	0.212	0.226	0.344	0.510	0.668	0.799
CSR Strategy	126,711	0.507	0.270	0.152	0.354	0.394	0.768	0.901
Antitakeover Devices	126,690	3.5	2.9	0	1	3	6	8
Board Size	124,591	9.11	2.9	6	7	9	11	13
Board Independence	124,633	61.1	24.9	27	43	64	83	90
Performance-based Compensation	124,675	0.87	0.337	0	1	1	1	1
Executive Compensation LT Objectives	124,675	0.097	0.295	0	0	0	0	0
Individual/Family	126,711	0.060	0.237	0	0	0	0	0
Bank and Other FI	126,711	0.028	0.165	0	0	0	0	0
Corporation	126,711	0.070	0.256	0	0	0	0	0
Government	126,711	0.037	0.188	0	0	0	0	0
Asset Management Companies	126,669	0.161	0.170	0	0	0.109	0.282	0.403
Hedge Fund	126,669	0.011	0.045	0	0	0	0	0
Other AMC	126,669	0.150	0.159	0	0	0.101	0.259	0.379
Management Ownership	122,388	0.035	0.112	0	0	0	0.008	0.082
Management Ownership (nonzero)	44,031	0.097	0.169	0.001	0.004	0.021	0.099	0.318
Economy traits								
Weekly Market Return	1,132	-0.824	5.33	-7.48	-2.41	-0.08	1.77	4.62
COVID19 (Italy), Distance-wgt	1,132	0.42	0.687	0	0	0.101	0.577	1.27
COVID19 (China), Distance-wgt	1,132	0.335	1	0	0	0.002	0.0285	0.93
Lockdown	1,132	3.10	3.01	0.00	0.00	2.05	6.33	7.17
Fiscal Stimulus	1,132	1.11	2.06	-0.452	-0.452	-0.45	2.55	3.92
Corporate Debt Purchase	1,132	0.123	0.749	0	0	0	0	0
Corporate Debt Purchase (Dummy)	1,132	0.081	0.273	0	0	0	0	0
GDP per Capita	1,132	9.870	1.11	8.10	9.24	10.1	10.8	11
GDP Growth	1,132	0.029	0.018	0.013	0.018	0.026	0.040	0.053
%Population (Above Age 65)	1,132	13.30	6.56	4.31	7.22	14.4	19	21.5
Civil Law	1,132	0.667	0.472	0	0	1	1	1
Government Debt to GDP	1,048	42.0	41.4	7.6	13.7	24.8	67.4	95.8

The rationale for using a growth-based measure of COVID-19 follows from a typical corporate valuation framework, in which changes in stock valuations [e.g., price-to-earnings (P/E) multiples] reflect changes in the expected growth rate of future cash flows. To the extent that changes in the expected growth rate of COVID-19 cases shape changes in the expected growth of future cash flows, a higher expected growth rate of COVID-19 infections would imply a slower growth rate of future cash flows, a lower P/E multiple, and lower stock returns. Thus, in our analyses, we use the most recent growth of COVID-19 cases to proxy for the market's expectation of the future growth rate of COVID-19.

Besides examining the growth rate of cumulative cases, we consider two alternative measures that scale by COVID-19 testing to better gauge changes in infection risk. Given that many countries had limited testing capacity especially during the earlier period of the pandemic and that large

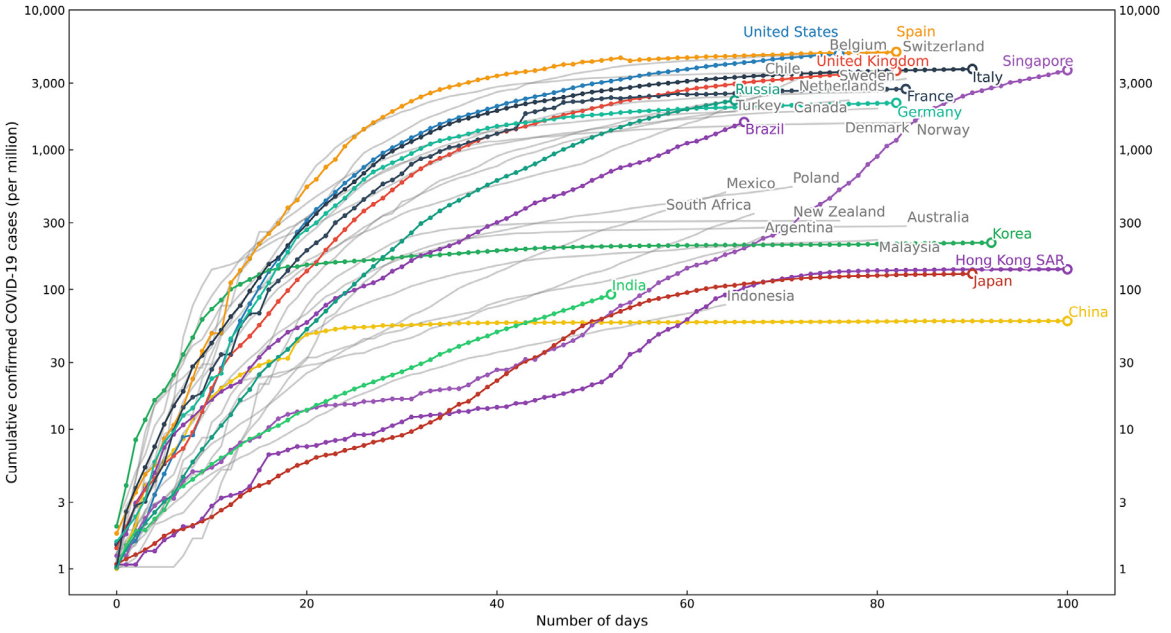

Fig. 2. Evolution of cumulative COVID-19 cases per capita by economy. This figure depicts the cumulative number of COVID-19 cases per one million people for selected economies. The y-axis denotes the cumulative number of confirmed cases per one million people in an economy. The x-axis denotes the number of days since an economy reached one confirmed case (per million). Source: Johns Hopkins University, Center for Systems Science and Engineering.

and changing differences exist in testing across countries, considering testing is important when measuring changes in the risk of contracting COVID-19. Testing data are from the Foundation for Innovative New Diagnostics, which has a partnership with the World Health Organization and the Bill & Melinda Gates Foundation.

We examine the following two testing-adjusted measures:

$$COVID19_{c,t}, Testing\,Adjusted\,1 = \frac{\Delta Cases_{c,t}}{\Delta Tests_{c,t}} - \frac{\Delta Cases_{c,t-1}}{\Delta Tests_{c,t-1}}, \quad (2)$$

where $\Delta Cases_{c,t}$ is the number of newly confirmed cases in economy c in week t, i.e., $\Delta Cases_{c,t}$ = *Cumulative Cases*$_{c,t}$ – *Cumulative Cases*$_{c,t-1}$, and *Cumulative Cases*$_{c,t}$ is the cumulative number of confirmed cases in economy c as of Friday in week t. $\Delta Tests_{c,t}$ equals the number of tests for COVID-19 performed during week t in economy c, and it equals *Total Tests*$_{c,t}$ – *Total Tests*$_{c,t-1}$. Thus, $COVID19_{c,t}$, *Testing Adjusted* 1 is the change in the proportion of positive tests in economy c in week t.

$$COVID19_{c,t},\ Testing\,Adjusted\,2 = \ln(1 + Cumulative\,Cases_{c,t}/Total\,Tests_{c,t}) - \ln(1 + Cumulative\,Cases_{c,t-1}/Total\,Tests_{c,t-1}), \quad (3)$$

where *Total Tests*$_{c,t}$ is the total number of tests for COVID-19 performed in economy c as of Friday in week t. Thus, $COVID19_{c,t}$, *Testing Adjusted* 2 is the percentage change in the ratio of positive results per test.

The testing data have limitations. They are not available for all countries and weeks, which reduces the sample by about 22%. Critically, these missing observations are concentrated during the first months of the pandemic, which coincides with large market declines. Thus, we use the testing-adjusted measures as robustness tests.

As a third alternative measure of changes in exposure to COVID-19 and infections risk, we use active cases. This measure is

$$COVID19, Active_{c,t} = \ln(1 + Active\,Cases_{c,t}) - \ln(1 + Active\,Cases_{c,t-1}), \quad (4)$$

where *Active Cases*$_{c,t}$ denotes the number of active cases in economy c as of as of Friday in week t. *Active Cases*$_{c,t}$ equals *Cumulative Cases*$_{c,t}$ − *Recoveries*$_{c,t}$ − *Deaths*$_{c,t}$. This measure has shortcomings as well, because the number of recoveries depends on the standards that hospitals use to admit and discharge patients and the ability of authorities to identify and count the people who recover from COVID-19, all of which can differ across countries and over time.

2.2. Stock market data

We retrieve stock price information during the first five months of 2020 from the DataStream data set in Thomson Reuters Eikon. We obtain data on 6,744 firms in 61 countries, the same countries from which we can also obtain data on corporate financial statements (Worldscope) and environmental, social, and governance (ESG) performance (ASSET4). These countries account for 93% of world gross domestic product (GDP) and 99% of global stock market capitalization. Online Appendix Table OA1 lists the sample of countries and the number of firms in each country. With respect to the selection of firms, we follow existing research (Hanselaar et al., 2019) and include stocks that were actively trading in 2020 and calculate *Weekly Stock Return* (in percentage) using dividend-adjusted closing prices on

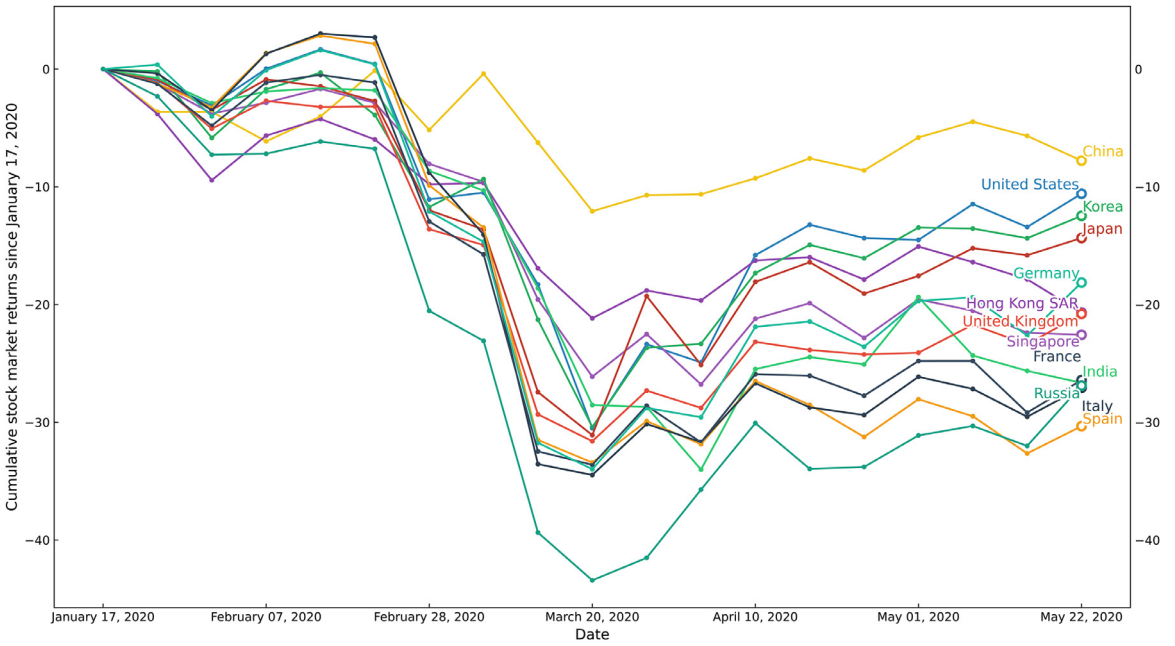

Fig. 3. Stock market returns since the spread of COVID-19. This figure plots the cumulative stock market returns since January 17, 2020 for selected economies. Cumulative returns are calculated from the value-weighted market index in each economy. Source: Thomson Reuters.

the last trading day of the week. We also evaluate the robustness of the findings to using weekly abnormal returns as the dependent variable. *Abnormal Return* equals weekly stock returns of each firm minus beta times domestic market returns, with beta provided by Thomson Reuters and calculated using monthly data on the domestic stock markets (value-weighted) over the last five years.

Fig. 3 plots the cumulative stock market returns from January 17, 2020 through May 22, 2020 for each economy. While almost all markets fell by 20 to 40% from their 2020 high to their 2020 low, large variations are evident in the severity of this decline in February and March and in the subsequent recovery during April and May. As shown in Table 1, the sample mean and standard deviation of *Weekly Stock Return* are -0.68 and 9.9%, respectively, suggesting large cross-firm, cross-time variations in weekly stock returns.

2.3. Financial conditions

We retrieve corporate financial data in 2019 from the Worldscope database of Thomson Reuters Eikon and S&P Capital IQ Capital Structure database, with all financial items measured in US dollars. When a firm's 2019 financial data are yet unavailable, we use the corresponding data from 2018. We consider four basic financial characteristics that are readily available. *Firm Size* equals the natural logarithm of the book value of total assets. *Leverage* equals the ratio of total debt divided by total assets. *Cash* equals the total amount of cash and short-term investments divided by total assets. *ROA* is the ratio of net income to total assets. In addition to using *ROA*, we examine the ratio of operating income to total assets [*ROA (Operating Income)*], the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) to total assets [*ROA (EBITDA)*], and the ratio of earnings before interest and taxes (EBIT) to total assets [*ROA (EBIT)*]. Given the adverse impact of the pandemic on cash flows and liquidity, these basic preexisting corporate financial conditions can shape the response of stock prices to the evolution of COVID-19 cases.

We also consider measures of two other corporate financial characteristics, undrawn lines of credit and the maturity structure of firms' debts, which we obtain from the S&P Capital IQ Capital Structure—Debt. These data are from company filings such as 10-Ks, 10-Qs, and annual reports. As noted in Lins et al. (2010), International Financial Reporting Standards do not explicitly require the disclosure of credit line data. We were, however, able to obtain credit line data for 68% of our sample of firms using Capital IQ Capital Structure. *Undrawn Credit* equals the ratio of undrawn revolving credit to the book value of total assets at the end of 2019. In addition, the database provides information on the maturities of all debts for each firm. Following Almeida et al. (2012), we compute *Maturing Debt* as the ratio of corporate debt maturing during the last three quarters of 2020 to total debt. As shown in Table 1, the sample mean of *Cash* and *Undrawn Credit* are 15.7% and 10.6%, respectively, suggesting that both are important components of corporate liquidity. Total debts, on average, account for 28% of total assets, and maturing debts account for 9% of total debts on average, with a standard deviation of 18%.

2.4. Global supply chain

We obtain data on firms' international supply chains and customer locations from FactSet Revere database, which includes information from corporate annual reports and regulatory filings, investor presentations, press re-

leases, websites, and corporate actions. One unique feature of the Revere database is that it contains both direct relations (relations disclosed by the reporting company) and reverse relations (relations disclosed by companies doing business with the company. For example, Bayerische Motoren Werke AG (BMW) does not report the chemical producer BASF as its supplier. However, BASF Group's reports show that BMW is a customer of BASF, i.e., BASF is a supplier to BMW. Thus, identifying these types of reverse relations provides a fuller picture of corporate supply chains. The Revere database provides information on supplier relations for more than 20 thousand publicly traded companies in 2019, involving more than 255,132 such connections. We use each firm's supply-chain relations to infer the firm's supply-chain exposure to each country. Revere also provides data on each firm's revenues by country in 2019, which we use to measure each firm's customer exposure by country.

Suppliers' Exposure equals the weighted average of *COVID19* among the countries in which the firm's suppliers are situated, with the weights being the fraction of the firm's pre-pandemic suppliers from a country. *COVID19* varies weekly as defined above. Revere does not provide the proportion of supplies of a firm from a given country. Thus, we use the fraction of the number of suppliers as the weight when calculating *Suppliers' Exposure. Customers' Exposure* equals the weighted average of *COVID19* among the countries in which the firm sells its products, with the weights being the proportion of the firm's pre-pandemic revenues in a country. We use these two measures to examine whether and the extent to which stock markets price a corporation's exposure to the pandemic via its suppliers and customers.

Figs. 4 and 5 illustrate the intuition of the measures, using International Business Machines (IBM) and General Electric (GE), respectively, as an example. As shown in Panel A of Fig. 4, IBM has 291 suppliers located in 26 countries. Panel B plots the cross-country dispersion of IBM's revenues, visualizing the 155 countries in which the firm sells products. Panel A of Fig. 5 shows that GE has 726 suppliers located in 39 countries. Panel B shows the cross-country dispersion of GE's revenues in 101 countries. Thus, IBM and GE received different levels of COVID-19 shocks due to heterogeneity in their supply-chain networks and customer locations.

As reported in Table 1, the sample mean and standard deviation of *Suppliers' Exposure* are 0.66 and 0.60, respectively, for firms that had some exposure to COVID-19. These statistics demonstrate the large cross-firm differences in exposure to COVID-19 through their international supply chains. The same holds for firms' exposure to COVID-19 through their international customers.

2.5. CSR

We retrieve information on firms' CSR performance from the Thomson Reuters ASSET4 ESG database. Thomson Reuters ASSET4 collects more than 130 individual indicators of firms' CSR activities and then forms three indices that focus on particular categories of CSR activities: (1) environment concerns, including resource use, emissions, and green innovation, (2) social and non-shareholder stakeholders themes, including employee welfare, human rights, and the ethical treatment of customers, suppliers, and the communities in which the firm operates, and (3) strategy and governance arrangements for operationalizing and implementing CSR activities. The Appendix provides detailed definitions of these environmental, social, and CSR strategy components of each firm's commitment to CSR. We average these three indices to form an overall measure of CSR performance: *CSR Score*. We focus most of our analyses on this aggregate index but also separately examine the three underlying indices: *Environmental, Social*, and *CSR Strategy*.

2.6. Corporate governance

Thomson Reuters ASSET4 provides pre-pandemic measures of managerial entrenchment, the structure of corporate boards, and executive compensation systems. To measure managerial entrenchment, we use *Antitakeover Devices*, which equals the number of antitakeover devices (from Thomson Reuters ASSET4) when more than two such devices are in place and zero otherwise. We also calculate the simple number of antitakeover devices from the detailed raw data (i.e., *# Antitakeover Devices*). All of the results hold when using this alternative measure. To measure the structure of corporate board, we use *Board Size*, which equals the total number of board members, and *Board Independence*, which equals the percentage of independent board members of a company. To measure executive compensation, we consider two features of each firm's approach to executive compensation. *Performance-based Compensation* equals one if the firm has a performance-based compensation policy for the higher-level executives and board members. *Executive Compensation LT Objectives* equals one if executive and board compensation are partially linked to longer-term objectives, i.e., objectives that are more than two years in the future. Table 1 shows that the sample mean of *Antitakeover Devices* is 3.5, with a standard deviation of 3.

2.7. Ownership structure

To measure ownership structure, we use two databases: Bureau van Dijk Orbis and Thomson Reuters Ownership. Orbis provides information on each firm's ultimate controlling owner and shareholdings by management. It traces control by calculating voting rights, not cash flow rights. Orbis defines an ultimate controlling owner as a legal entity controlling, either directly or indirectly, 50% of the voting rights. That is, it identifies an ultimate owner of a firm if the entity directly owns more than 50% of the voting shares or controls more than 50% of the voting shares through some combination of direct ownership and control via a pyramid structure. If firms have ultimate controlling owners, these owners are classified into four types: (1) individuals or families, (2) governments, (3) banks and other financial institutions, and (4) widely held corporations. For these ownership variables, we use indicator variables, not the percentages of voting rights owned, so that

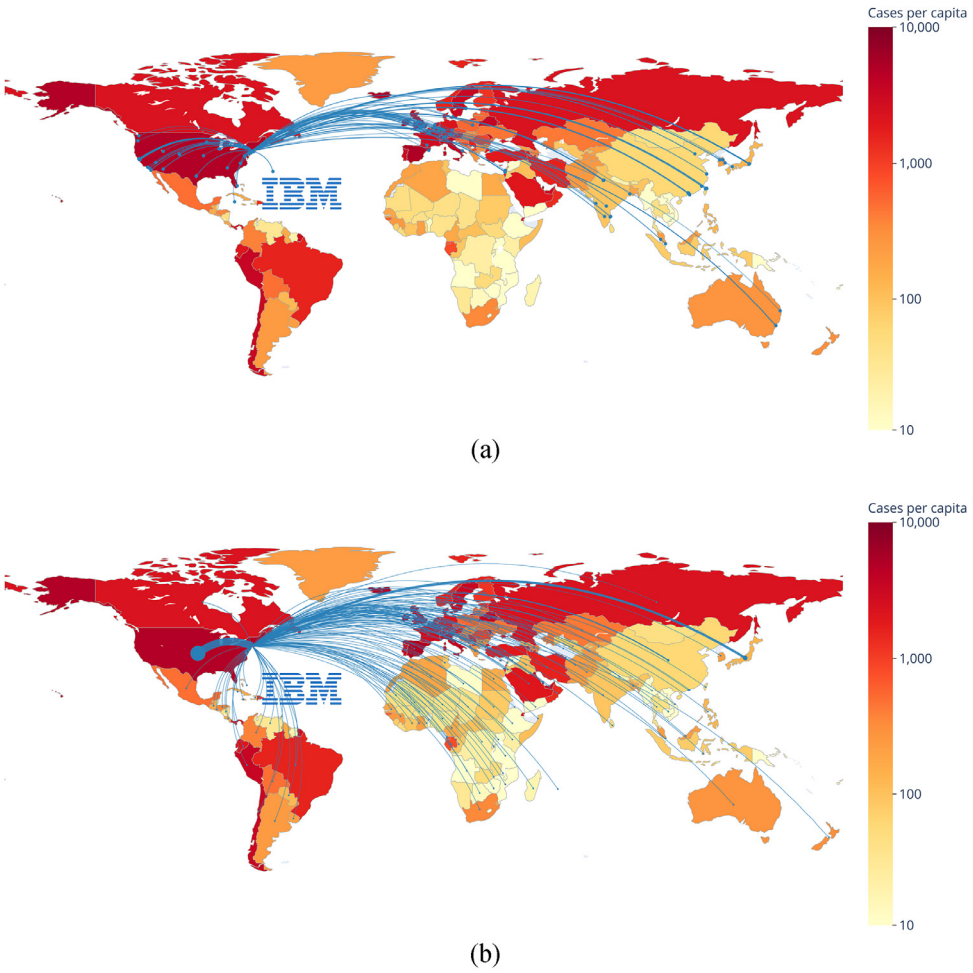

Fig. 4. Global supply chain and customer exposure to COVID-19, International Business Machines (IBM). This figure illustrates a firm's exposure to COVID-19 through its global supply chain and customer locations. Using IBM as an example, Panel A shows the company's suppliers in 2019. The lines denote connections between the headquarters of IBM and the location of each of its suppliers. Each node represents a supplier in the supply chain network. Panel B shows IBM's revenues by country in 2019. The lines denote connections between the headquarters of IBM and the country of its customers. Each node represents a country to which the firm sells its products, and the size of the node represents the relative proportion of the firm's pre-pandemic revenues in a country. Similar to Fig. 1, this figure plots the cumulative coronavirus cases per one million people reported in each economy at the end of May 2020. Darker colors indicate more confirmed cases per capita. Gray indicates that no data are available. Source: FactSet Revere; Johns Hopkins University, Center for Systems Science and Engineering. Panel (a): Firm global suppliers, IBM, Panel (b): Firm global customers, IBM.

Individual/Family, Government, Bank and Other FI, and *Corporation* equals one if a firm has an ultimate controlling shareholder of type individual or family, government, bank and other financial institution, or widely held corporation, respectively, and zero otherwise. As reported in Table 1, *Individual/Family, Government, Bank and Other FI*, and *Corporation* account for 6%, 3.7%, 2.8%, and 7%, respectively, of the sample firms.

Among individual or family owners, the Orbis database also indicates whether the ultimate controlling owner controls the firm through direct holdings and those in which the ultimate controlling owner controls the firm through a pyramid structure (i.e., through multiple layers) and whether the ultimate controlling owner is the manager (i.e., the CEO or executive director) or not. Accordingly, *Individual/Family (Direct)* equals one if a firm is controlled by an individual or family ultimate owner through direct holdings and zero otherwise. *Individual/Family (Pyramid)* equals one if a firm is controlled by an individual or family ultimate owner through multiple layers of control links and zero otherwise. *Individual/Family (Manager)* equals one if an individual- or family-controlled firm ultimate controlling owner is the manager (i.e., active control of the firm) and zero otherwise, and *Individual/Family (Not Manager)* equals one if the ultimate owner is not a manager and zero otherwise.

When the ultimate controlling shareholder is a widely held corporation, i.e., when *Corporation* equals one, we collect addition information on the size of the controlling corporation. We then separate *Corporation* into two groups: *Corporation (Large)* and *Corporation (Small). Corporation (Large)* equals one when the size of the controlling corporation is in the top tercile of the size distribution of all firms and zero otherwise. *Corporation (Small)* equals one

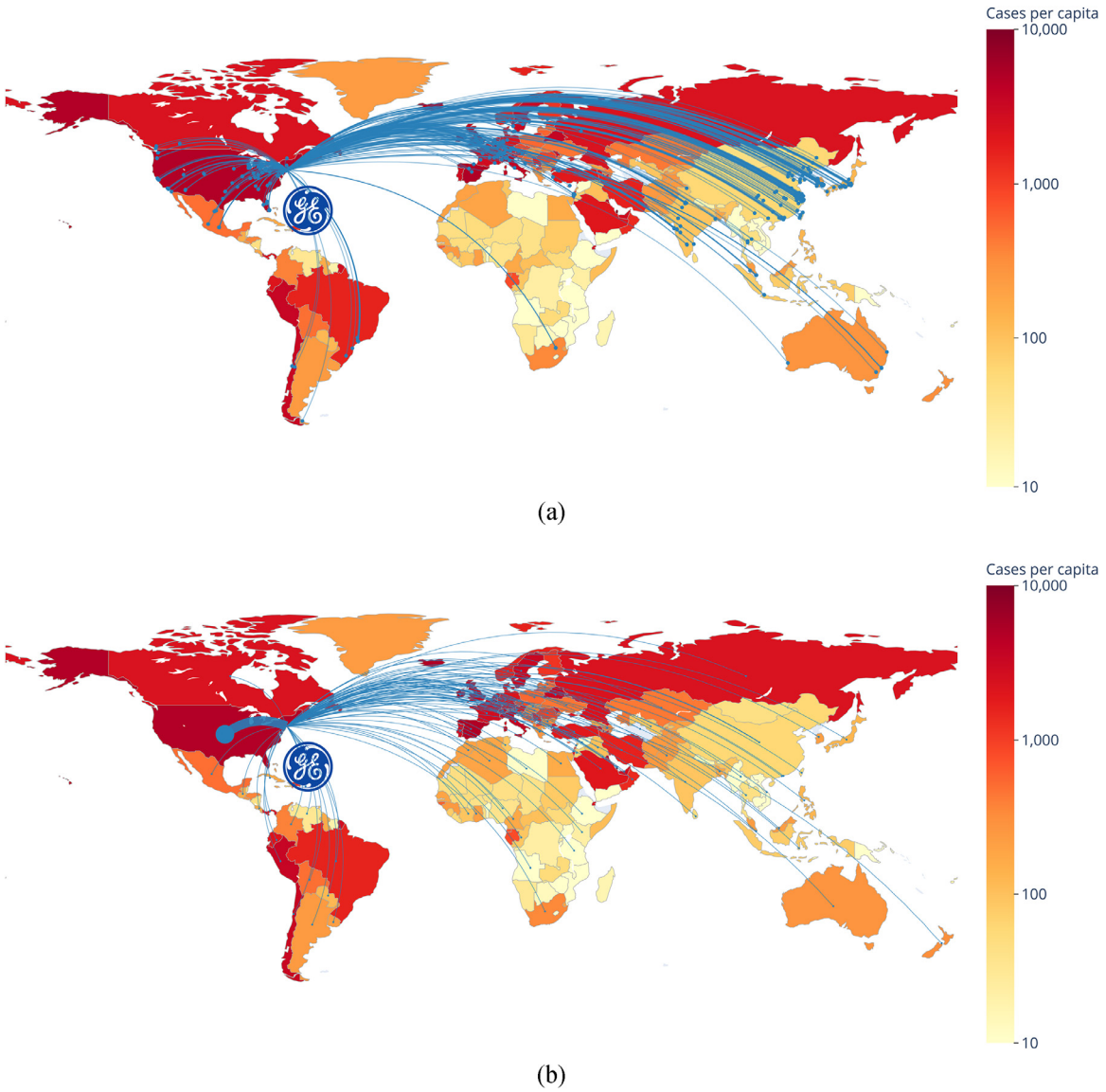

Fig. 5. Global supply chain and customer exposure to COVID-19, General Electric (GE). This figure illustrates a firm's exposure to COVID-19 through its global supply chain and customer locations. Using GE as an example, Panel A shows the company's suppliers in 2019. The lines denote connections between the headquarters of GE and the location of each of its suppliers. Each node represents a supplier in the supply chain network. Panel B shows GE's revenues by country in 2019. The lines denote connections between the headquarters of GE and the country of its customers. Each node represents a country to which the firm sells its products, and the size of the node represents the relative proportion of the firm's pre-pandemic revenues in a country. Similar to Fig. 1, this figure plots the cumulative coronavirus cases per one million people reported in each economy at the end of May 2020. Darker colors indicate more confirmed cases per capita. Gray indicates that no data are available. Source: FactSet Revere; Johns Hopkins University, Center for Systems Science and Engineering. Panel (a): Firm global suppliers, GE, Panel (b): Firm global customers, GE.

when the size of the controlling corporation is not in the top tercile of the size distribution of all firms and zero otherwise.

We obtain information on insider ownership from the Orbis data set, which reports on the fraction of shares held by management (*Management Ownership*). To evaluate the potential nonlinear relations between insider ownership and the market's response to the pandemic, we distinguish between smaller and higher levels of managerial shareholdings among firms with positive management ownership in two ways. First, we set *Management Ownership (Low)* equal to *Management Ownership* if *Management Ownership* is below the sample median among firms with positive management ownership and zero otherwise, and we set *Management Ownership (High)* equal to *Management Ownership* if *Management Ownership* is above the sample median among firms with positive management ownership and zero otherwise. Second, we construct three dummy variables. *Management Ownership (Dummy, Low)* is a dummy variable that equals one if *Management Ownership* is below the sample median among firms with positive management ownership. Firms with zero managerial

ownership are not included in the group of *Management Ownership (Dummy, Low). Management Ownership (Dummy, Medium)* is a dummy variable that equals one if *Management Ownership* is between the median and the 75 percentile. *Management Ownership (Dummy, High)* is a dummy variable that equals one if *Management Ownership* is above the top quartile. We use this definition of low, medium, and high insider ownership because the distribution of *Management Ownership* among firms with positive management ownership is right-skewed. As shown in Table 1, 36% of the sample firms have positive management ownership, and among firms with positive management ownership, the sample mean and median of *Management Ownership* are 9.7% and 2.1%, respectively.

From Thomson Reuters Ownership data, we obtain information on the degree to which each firm has blockholders that are asset management companies. Thomson Reuters Ownership provides information on holdings of institutional investors and fund portfolios, gathered from a variety of sources, such as regulatory filings, regulatory agencies, company reports, third-party vendors, financial publications, and newspapers. Asset management companies include mutual funds, investment and asset management companies (such as Vanguard, Fidelity, BlackRock), investment banks, hedge funds, financial companies, and private equity and venture capital firms. In constructing variables of ownership by these asset management companies, we focus on blockholders, i.e., investors who own at least 5% of the total outstanding shares. We then consider all blockholders that are asset management companies and compute *Asset Management Companies* as the summation of their holdings as a proportion of all shares before the pandemic. The sample mean of *Asset Management Companies* is 0.16, suggesting that asset management companies hold, on average, 16% of corporate shares.

Furthermore, we differentiate between two types of asset management companies: hedge funds and other asset management companies. Thomson Reuters defines a hedge fund as a firm that is permitted to use aggressive strategies that are unavailable to traditional funds, including selling short, leverage, program trading, swaps, arbitrage, and derivatives. Examples of hedge fund investors are Citadel, Two Sigma, and Renaissance Technologies. Other asset management companies are asset management companies excluding hedge funds. Thus, for hedge funds, and other asset management companies, we use the total proportion shares held by these investors conditional on each of the investors holding at least 5% of the shares.

2.8. Country characteristics

Besides the firm-level analyses that condition on economy-time fixed effects, we conduct country-level analyses. We examine expected changes in COVID-19 cases, government containment and closure policies, government stimulus policies, and other pre-pandemic country traits, including government indebtedness, economic development, population age, and legal origin. To account for expected changes in cases, we focus on Italy and China, which are two large countries on different continents that experienced a large number of cases early in the pandemic. For each country c, we use the growth of cases in Italy in week t, weighted by the inverse distance between country c and Italy and compute *COVID19 (Italy), Distance-wgt*$_{c,t}$. We do the same for China and calculate *COVID19 (China), Distance-wgt*$_{c,t}$.

To measure weekly government containment and closure policies, we use data from the Oxford COVID-19 Government Response Tracker (OxCGRT) project (Hale et al., 2020). OxCGRT collects information on eight indicators: closings of schools and universities, workplaces, canceling of public events, limits on private gatherings, closing of public transport, orders to shelter-in-place, restrictions on internal movement between cities and regions, and restrictions on international travel. OxCGRT provides ordinal scales, with higher values indicating stricter restrictions. We normalize each indicator to range between zero and one, and we construct *Lockdown* for each country-week by summing the eight measures.

We create two measures of government stimulus policies in response to the pandemic. First, OxCGRT provides data on direct government cash payments to people who lose their jobs or cannot work, government-provided relief to households from financial obligations, and fiscal stimulus spending as a share of GDP. We construct an overall measure of *Fiscal Stimulus* using the first principal component of these three indicators. Second, to measure government purchases of corporate debt, we collect information on the announcement date and dollar amount of corporate debt purchases. The underlying information comes from the International Monetary Fund (IMF) Policy Tracker. The size of the corporate bond purchasing scheme can be as high as 8.8% of GDP, as in the UK. We examine both *Corporate Debt Purchase (Dummy)*, which equals one for a country in the weeks after the government announced the purchase of corporate bonds, and *Corporate Debt Purchase*, which equals the cumulative amount of government corporate bond purchases as of Friday of each week as a percentage of the country's total amount of pre-pandemic corporate debt.

We also consider other country traits, namely, government indebtedness, economic development, population age, and legal origin, which could shape the nature and size of national responses to the pandemic. For indebtedness, we use total government debt as a share of GDP (*Government Debt to GDP*). To capture the overall level and growth rate of economic development, we include *GDP per Capita* (the natural logarithm of GDP per capita) and *GDP Growth* (the growth rate of GDP) in 2018. Because older people are especially vulnerable to COVID-19, we include the percentage of population above age 65 [*%Population (Above Age* 65)]. These data are from the World Bank's 2018 World Development Indicators, which is the latest year with complete data. We also include *Civil Law*, which equals one if a country's legal heritage is civil law and zero if it has a common law tradition.

3. Empirical results

This section presents the results from assessing stock price reactions to the COVID-19 pandemic as functions of the five sets of corporate characteristics. Although our

core analyses use firm-level analyses to study how pre-pandemic corporate traits shape stock price reactions to the COVID-19 pandemic, we begin with a cross-country assessment of the relations between national stock returns and national traits. We then implement the firm-level analyses while including country-time fixed effects to abstract from time-varying national characteristics.

3.1. Country factors

To study the relation between national stock returns and country characteristics, we use the following regression at the country-time level:

$$Ret_{c,t} = \alpha COVID19_{c,t} + \boldsymbol{\beta X_c'} + \delta_c + \delta_t + \varepsilon_{c,t}, \quad (5)$$

where c and t index economy and week, respectively. The dependent variable, $Ret_{c,t}$, is the weekly return on the stock market index (i.e., *Weekly Market Return*) for country c from the last trading day in week t - 1 to the last trading day in week t. For each country, we use the most representative market index, i.e., the market index from Ru et al. (2021). $COVID19_{c,t}$ is the growth rate of confirmed cases in economy c in week t. $\boldsymbol{X_c'}$ includes measures of country and economy characteristics, such as expected changes in COVID-19 cases, government containment and closure policies, government stimulus, and other pre-pandemic country traits, including government indebtedness, economic development, population age, and legal origin. The inclusion of economy (δ_c) and time (δ_t) fixed effects conditions out time-invariant differences across countries and common factors influencing returns in each week. We estimate Eq. (5) using ordinary least squares, with robust standard errors clustered at the economy level.

As shown in Table 2, stock markets in country c react negatively to *COVID19* in country c as well as to expected changes in COVID-19 cases as measured by the distance-weighted measure of cases in Italy. That is, markets outside of Italy react negatively to cases in Italy, and this reaction is stronger the closer that country is geographically to Italy. Furthermore, the effect of cases in Italy on country c's stock returns falls over time as COVID-19 cases in country c emerge. We show this finding by including the interaction between *COVID19 (Italy), Distance-wgt*, and *#Weeks since 100th Case* in country c, which enters positively and significantly. We do not find that other markets react to China, suggesting that markets in many countries reacted only once COVID-19 clearly spread outside of Asia.

We also find that stock markets react positively to national policies that encourage social distancing, as captured by *Lockdown*. This finding is consistent with the notion that while lockdown measures generate economic losses in the short run, the markets on average placed a positive value on the long-term benefits of reducing the spread of the disease.

We next show that national stock returns reacted positively to fiscal stimulus policies (*Fiscal Stimulus*), national authorities purchasing corporate debt in response to the pandemic [*Corporate Debt Purchase (Dummy)*], and the size of those corporate debt purchases (*Corporate Debt Purchase*). As shown in Table 2, each enters positively and significantly. The coefficient estimates from Column 7 indicate that an increase in *Corporate Debt Purchase* by one sample standard deviation (0.749) is associated with a positive stock market reaction of 0.09 percentage points (= 0.114 * 0.749).

Column 9 provides estimates of *COVID19* interacted with other pre-pandemic country traits. We consider *Government Debt to GDP, GDP per Capita, GDP Growth,%Population (Above Age* 65*)*, and *Civil Law*, that is, whether a country has a civil law legal tradition. None enters insignificantly.

The coefficient estimate on the linear *COVID19* remains negative and significant in all columns of Table 2. Fig. 6 plots the relation between weekly market returns and the weekly growth rate of COVID-19 cases using the cross-economy panel data between January 1, 2020 and May 22, 2020. The x-axis is the weekly growth rate of COVID-19 cases in an economy, and the y-axis indicates the weekly market returns. We divide the x-axis into one hundred bins and calculate the average market return within each bin. As shown, a strong negative relation exists between stock returns and the growth rate of COVID-19 cases.

3.2. Firm-level regression specification

To evaluate how corporate characteristics shape stock price reactions to COVID-19, we use the regression model

$$Ret_{i,t} = \boldsymbol{\beta X'_{i,pre2020}} \times COVID19_{c,t} + \delta_i + \delta_{j,t} + \delta_{c,t} + \varepsilon_{i,t}, \quad (6)$$

where i, c, j, and t index firm, country or economy, industry, and week, respectively. The dependent variable, $Ret_{i,t}$, is the weekly stock return of firm i from the last trading day in week t - 1 to the last trading day in week t. $COVID19_{c,t}$ is the growth rate of the confirmed cases in economy c in week t. Eq. (6) contains an array of interactions between pre-pandemic firm characteristics, $\boldsymbol{X'_{i,pre2020}}$, and *COVID19*, where $\boldsymbol{X'_{i,pre2020}}$ includes measures of financial conditions, international exposure through suppliers and customers, CSR, governance, and ownership. The inclusion of firm (δ_i) and industry-time (two-digit Standard Industrial Classification industry by week) ($\delta_{j,t}$) fixed effects conditions out time-invariant differences across firms and time-varying industry factors. We also include economy-time fixed effects ($\delta_{c,t}$) to condition out time-varying and time-invariant economy traits, including policy reactions to the crisis and differences in legal, cultural, institutional, and political systems. We estimate Eq. (6) using ordinary least squares, with robust standard errors clustered at the economy level.[3]

As a benchmark, we assess the relations between stock returns and economies' exposure to the COVID-19 pandemic. That is, we exclude the interaction terms ($\boldsymbol{X'_{i,pre2020}} \times COVID19$) and the economy-time fixed effects ($\delta_{c,t}$) and estimate Eq. (6) while including *COVID19*. As shown in Column 1 of Table 3, *COVID19* enters negatively and signifi-

[3] Following Petersen (2009), Thompson (2011) and Cameron and Miller (2015), we cluster by country (61 countries) and use a full set of country-time and industry-time fixed effects to model the time dimension (21 weeks). Thompson (2011) and Cameron and Miller (2015) suggest that fewer than 50 categories within a cluster is insufficient and that clustering with too few categories creates noisy standard errors.

Table 2
Economy traits and stock market returns during the COVID-19 pandemic, macro factors.

This table reports regression results of how national stock market returns respond to the growth rate of domestic COVID-19 cases, expected changes in the growth rate of COVID-19 cases, government lockdown policies, fiscal stimulus, corporate bond purchases, and whether pre-pandemic economy traits (i.e., *Government Debt to GDP*, *GDP per Capita*, *GDP Growth*,*%Population (Above Age 65)*, and *Civil Law*) shape the response of market returns to the pandemic. The dependent variable, *Weekly Market Return*, is the weekly return on the stock market index, where the most representative market index in each economy is used. *COVID19* is the weekly growth rate of the COVID-19 cases in an economy. We include economy and week fixed effects. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Market Return								
Variable	(1)	Excluding Italy (2)	Excluding China (3)	Excluding Italy and China (4)	(5)	(6)	(7)	(8)	(9)
COVID19	-1.031***	-0.818***	-0.989***	-0.791***	-1.093***	-0.959***	-1.025***	-0.979***	-4.498**
	(0.175)	(0.194)	(0.211)	(0.209)	(0.180)	(0.166)	(0.175)	(0.176)	(2.120)
COVID19 (Italy), Distance-wgt		-1.079**		-1.053**					
		(0.411)		(0.423)					
*COVID19 (Italy), Distance-wgt * #Weeks since 100th Case*		0.803***		1.563***					
		(0.191)		(0.501)					
COVID19 (China), Distance-wgt			0.363	0.306					
			(0.255)	(0.268)					
*COVID19 (China), Distance-wgt * #Weeks since 100th Case*			-5.243	-39.60					
			(33.27)	(34.34)					
#Weeks since 100th Case		-0.0935	0.130	0.00382					
		(0.123)	(0.156)	(0.149)					
Lockdown					0.262**				
					(0.116)				
Fiscal Stimulus						0.251***			
						(0.0888)			
Corporate Debt Purchase							0.114**		
							(0.0530)		
Corporate Debt Purchase (Dummy)								1.076***	
								(0.256)	
*Government Debt to GDP * COVID19*									-0.00407
									(0.00426)
*GDP per Capita * COVID19*									0.341
									(0.228)
*GDP Growth * COVID19*									14.68
									(8.972)
*%Population (Above Age 65) * COVID19*									-0.00344
									(0.0375)
*Civil Law * COVID19*									-0.256
									(0.282)
Economy fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1,132	1,111	1,111	1,090	1,132	1,132	1,132	1,132	1,048
Adjusted R-squared	0.677	0.682	0.679	0.684	0.679	0.679	0.676	0.678	0.691

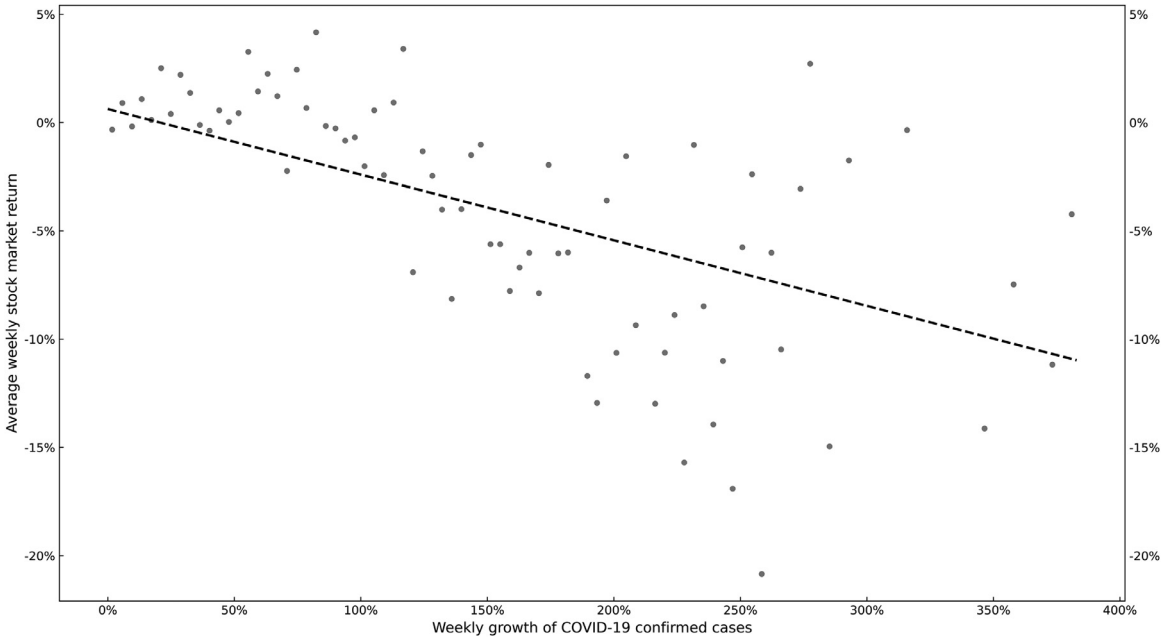

Fig. 6. COVID-19 cases and stock market returns. This figure presents the relation between stock market returns and the growth rate of COVID-19 cases using the cross-economy panel data during the weeks from January 3, 2020 through May 22, 2020. The x-axis denotes the weekly growth of COVID-19 cases, and the y-axis represents weekly stock market returns. We divide the x-axis into one hundred bins, with each bin having an equal width, so that the first bin has observations with 0 to 3% weekly growth of COVID-19 cases, the second bin has observations with 4 to 7% weekly case growth, and the one-hundredth bin has observations of between 396 and 399% weekly case growth. Each bin does not contain an equal number of observations. Each dot represents the average weekly stock market return across observations within each bin. The dashed line is the linear fitted line.

Table 3
Corporate financial conditions and stock returns in response to COVID-19.

The table reports regression results analyzing how stock prices respond to the COVID-19 pandemic as functions of pre-pandemic corporate financial conditions. The dependent variable is the weekly stock return of each firm. *COVID19* is the weekly growth rate of the number of confirmed COVID-19 cases in an economy. To measure a firm's financial conditions, we use *Firm Size*, *Leverage*, *Cash*, profitability [*ROA*, *ROA (Operating Income)*, *ROA (EBITDA)*, or *ROA (EBIT)*], *Undrawn Credit*, and *Maturing Debt*. The analyses cover the period from January 2, 2020 through May 22, 2020. The Appendix provides detailed variable definitions. We include firm, industry (two-digit Standard Industrial Classification) by week, and economy by week fixed effects. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Stock Return						
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
COVID19	-1.422***						
	(0.241)						
*Firm Size * COVID19*		0.085**	0.124***	0.124**	0.128**	0.138**	0.121**
		(0.041)	(0.041)	(0.056)	(0.055)	(0.060)	(0.058)
*Leverage * COVID19*		-1.236***	-1.628***	-1.456***	-1.645***	-1.535***	-1.556***
		(0.281)	(0.277)	(0.228)	(0.307)	(0.301)	(0.290)
*Cash * COVID19*		0.933**	1.897***	1.852***	1.877***	1.862***	1.710**
		(0.428)	(0.557)	(0.629)	(0.654)	(0.634)	(0.640)
*ROA * COVID19*		1.768***	1.838**	2.043**			
		(0.334)	(0.901)	(0.964)			
*Undrawn Credit * COVID19*			0.866*	0.966	0.903	0.946	0.908
			(0.490)	(0.600)	(0.548)	(0.582)	(0.573)
*Maturing Debt * COVID19*				-0.510***	-0.501***	-0.448***	-0.507***
				(0.123)	(0.128)	(0.122)	(0.123)
*ROA (Operating Income) * COVID19*					3.144**		
					(1.264)		
*ROA (EBITDA) * COVID19*						2.781***	
						(0.570)	
*ROA (EBIT) * COVID19*							3.017***
							(0.635)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economy-time fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	141,449	126,711	86,216	79,877	79,856	78,263	79,583
Adjusted R-squared	0.433	0.503	0.534	0.539	0.540	0.539	0.540
Number of firms	6,744	6,041	4,110	3,808	3,807	3,731	3,794

cantly, suggesting that an economy's exposure to the pandemic is strongly and negatively correlated with the stock market performance of firms in that economy. The coefficient estimates suggest that the average weekly exposure to the COVID-19 shock (0.725) is associated with the stock prices among firms in that economy falling by one percentage point (= -1.42 * 0.725).

3.3. Corporate financial conditions

Given the adverse impact of the pandemic on cash flows and the tightening of liquidity constraints, markets could view corporations with greater cash holdings, easier access to lines of credit, less debt, and less debt maturing in the short term as better positioned to absorb the shock of the COVID-19 pandemic than otherwise identical firms. We evaluate stock price reactions to COVID-19 as functions of these pre-pandemic corporate traits.

As the results in Table 3 suggest, markets view corporations with more cash, less debt, and larger profits as more resilient to COVID-19 than other firms. The interactions between *COVID19* and *Cash* and *ROA* enter positively and significantly, and the interaction with *Leverage* enters negatively and significantly. These results hold when examining each of the traits independently, simultaneously, and when conditioning on lines of credit and the maturity structure of a corporation's debt (Columns 3 and 4). To illustrate the economic impacts of financial conditions on the sensitivity of stock returns to COVID-19, consider the specification in Column 4 of Table 3. The coefficient estimates indicate that a one standard deviation increase in a firm's pre-2020 level of *Cash* (0.186) would reduce the negative stock price reaction to the pandemic by 0.25 (= 1.852 * 0.186 * 0.725) percentage points in response to the average economy-wide exposure to the COVID-19 shock (i.e., *COVID19* = 0.725). And, a one standard deviation increase in a firm's pre-2020 level of *Leverage* (0.22) would intensify the negative stock price reaction to the pandemic by 0.23 percentage points (= 1.456 * 0.22 * 0.725). Aggregating over the 14-week period from mid-February through May 2020, this illustrative example translates into stock price changes of 3.5 percentage points for the increase in pre-2020 cash holding and -3.25 percentage points for increases in pre-2020 leverage. In comparison, Lins et al., 2017) find for the period from August 2008 through March 2009 and a sample of US companies that one standard deviation increases in cash holdings and long-term debt are associated with raw stock prices changes of 3.48 and -2.16 percentage points, respectively. Thus, our estimates for the COVID-19 pandemic are similar in magnitude, despite the different empirical frameworks.[4]

We also consider two other corporate financial characteristics: undrawn lines of credit and the degree to which a corporation's debts are maturing in the short run, i.e., during the last three quarters of 2020. As shown in Table 3, firms with more debt maturing in the short run experience sharper stock price declines in response to the pandemic, with *Maturing Debt * COVID19* entering negatively and significantly. This finding is consistent with Almeida et al. (2012), which shows that the structure of corporate debt shaped responses to the GFC. Also, Table 3 presents some evidence that access to lines of credit helped cushion the impact of COVID-19 on a firm's stock price.[5] *Undrawn Credit * COVID19* enters with a positive coefficient in all specifications. To get a sense of the sizes of the point estimates on cash and lines of credit, consider a one standard deviation increase in a firm's pre-2020 *Undrawn Credit* (0.118). The estimated coefficient on *Undrawn Credit * COVID19* suggests that one standard deviation greater *Undrawn Credit* would reduce the negative stock price reaction to the pandemic by 0.08 (= 0.966 * 0.118 * 0.725) percentage points in response to an average COVID-19 shock. Thus, the estimated cushioning effect of cash holding is about 2.5–3 times greater than that of credit lines, which is consistent with research by Lins et al. (2010) and Sufi (2009) stressing differences in cash and credit lines in hedging risks. Columns 5–7 show that the results are robust to using three alternative measures of profitability: *ROA (Operating Income), ROA (EBITDA)*, and *ROA (EBIT)*.

We extend these results and show that governments' corporate debt purchases following the onset of the pandemic reduced stock price reactions to pre-pandemic corporate debt levels and cash holding. We modify the regression model by adding the interaction term between *Corporate Debt Purchase (Dummy)* and *Leverage * COVID19* and *Corporate Debt Purchase (Dummy)* and *Cash * COVID19*. Online Appendix Table OA2 provides the results. *Leverage * COVID19* enters negatively and significantly, and *Corporate Debt Purchase (Dummy) * Leverage * COVID19* enters positively and significantly, suggesting that firms with more debt are more susceptible to the pandemic-driven market downturns, but this relation weakens once the governments announce corporate debt purchases. Similarly, *Cash * COVID19* enters positively and significantly, and *Corporate Debt Purchase (Dummy) * Cash * COVID19* enters negatively and significantly, suggesting that the connection between pre-pandemic cash holdings and subsequent stock returns weakens when the governments announce corporate debt purchases.

3.4. Global supply chain and international customer exposure

We next examine how corporations' exposure to COVID-19 through their global supply chains and customer locations affect their stock price reactions to the pandemic. Those firms with networks of suppliers and customers that

[4] Although we find that stock returns fell by less among firms with less leverage and more cash in response to the pandemic, our analyses do not speak directly to the question of whether cash can be viewed as negative debt. For example, a growing body of research (Acharya et al., 2007) suggests that cash should not be viewed as negative debt, especially when firms face future investment and growth opportunities, due to the agency cost of debt (debt overhang problem) and the costs of financial distress.

[5] Media reports indicate that firms drew heavily on their lines of credit during the pandemic. As reported by the *Financial Times*, at the onset of the pandemic, more than 130 companies in Europe and the Americas have drawn at least $124 billion from their lenders. See https://www.ft.com/content/6b299c42-6c66-11ea-89df-41bea055720b.

Table 4
Global supply networks and stock returns in response to COVID-19.
The table reports regression results analyzing how stock prices respond to the COVID-19 pandemic as functions of a firm's international supply chain and customers exposure to COVID-19. The dependent variable is the weekly stock return of each firm. *Suppliers' Exposure* measures the extent to which a firm is exposed to COVID-19 in countries through its suppliers. *Customers' Exposure* measures the extent to which a firm is exposed to COVID-19 in countries through its customers. *Firm Traits * COVID19* represents the interactions of *COVID19* and a set of firm financial conditions (i.e., *Firm Size*, *Leverage*, *Cash*, and *ROA*). The Appendix provides detailed variable definitions. We include firm, industry by week, and economy by week fixed effects. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Stock Return		
Variable	(1)	(2)	(3)
Suppliers' Exposure	-0.536***		-0.323***
	(0.129)		(0.088)
Customers' Exposure		-0.873***	-0.776***
		(0.190)	(0.185)
*Firm Traits * COVID19*	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes
Economy-time fixed effects	Yes	Yes	Yes
Number of observations	111,294	121,853	108,631
Adjusted R-squared	0.506	0.511	0.512
Number of firms	5,306	5,809	5,179

are located in countries more affected by COVID-19 are likely to experience greater disruptions to production and sales than otherwise similar firms with less COVID-19 exposure.

The results reported in Table 4 show that firms experience larger stock price declines when their networks of suppliers and customers are situated in economies more affected by COVID-19. *Suppliers' Exposure* and *Customers' Exposure* enter negatively and statistically significantly in all columns. The results hold whether including *Suppliers' Exposure* and *Customers' Exposure* separately or simultaneously. Critically, the results are also robust to including the interactions between *COVID19* and basic corporate financial conditions from Table 2 (*Firm Size, Leverage, Cash*, and *ROA*) and the full array of firm, industry-time, and economy-time fixed effects. To illustrate the estimated economic magnitudes, consider the specification in Column 3. The estimates indicate that in response to an average weekly COVID-19 shock, a one standard deviation increase in a firm's suppliers and customers exposure to COVID-19 would raise the negative stock price reactions to the pandemic by 0.14 (= 0.323 * 0.6 * 0.725) and 0.35 (= 0.776 * 0.624 * 0.725) percentage points, respectively, per week.

3.5. CSR

In this section, we assess the differential sensitivity of stock price reactions to COVID-19 as a function of firms' preexisting levels of CSR. Research suggests that the relations between a firm and its workers, suppliers, customers, and local community can shape corporate resilience to shocks. Influential theories view the firm as a nexus of formal and informal contracts between shareholders and other stakeholders, in which firm performance depends on the strength of those contracts (Coase, 1937; Alchian and Demsetz, 1972; Jensen and Meckling, 1976). To the extent that CSR activities, such ensuring worker well-being, providing safe products, fulfilling informal agreements with suppliers, and protecting the environment, signal a firm's commitment to satisfy its informal contracts with stakeholders, those activities could strengthen bonds between a firm and its stakeholders. Those stronger bonds can, in turn, help retain high-quality workers and maintain stable supply chains and customers during difficult times (Albuquerque et al., 2019). From this perspective, the stock prices of high-CSR firms would be more resilient to the pandemic. Other research argues that executives use CSR to enhance their private reputations at the expense of shareholders (Tirole, 2001; Pagano and Volpin, 2005; Bénabou and Tirole, 2010; Masulis and Reza, 2015).

To assess how pre-pandemic CSR activities shape stock price reactions to the pandemic, we include the interaction between the firm-level measures of CSR activities and *COVID19*. We separately examine the interaction term using the overall CSR index (*CSR Score*) and each of its three sub-indices: *Environmental, Social*, and *CSR Strategy*. We condition on each of the firm-specific financial conditions interacted with *COVID19*, as well as the full array of fixed effects.

The results presented in Table 5 suggest that the stock prices of corporations with greater pre-2020 CSR performance were more resilient to COVID-19. This result emerges when examining the overall index, *CSR Score*, and each of the sub-indices: *Environmental, Social*, and *CSR Strategy*. The results are consistent with the view that CSR investments strengthen ties between a firm and its workers, customers, and other stakeholders, enabling the firm to more effectively work with those stakeholders in responding to the pandemic. The estimated effects are economically meaningful. For example, the Column 1 estimates suggest that if the COVID-19 cases grow at the average weekly rate in an economy, a one standard deviation increase in *CSR Score* would, ceteris paribus, increase the average weekly stock returns by 0.13 (= 0.9 * 0.2 * 0.725) percentage points, which is similar in magnitude to the study of US firms during the GFC by Lins et al. (2017).

We extend these analyses to test a corollary that emerges from the view that CSR boosts corporate immunity by strengthening bonds with stakeholders. The corollary suggests that a firm's CSR activities would have

Table 5
Corporate social responsibility (CSR) and stock returns in response to COVID-19.

The table reports regression results analyzing how stock prices respond to the COVID-19 pandemic as functions of pre-pandemic corporate social responsibility activities. The dependent variable is the weekly stock return of each firm. We measure a firm's CSR performance using the overall *CSR Score* and *Environmental*, *Social*, and *CSR Strategy* indicators. *Social Norms* is an indicator equal to one if a country has social norms that place a higher priority on treating others fairly and mitigating environmental degradation and zero otherwise. *Firm Traits * COVID19* represents the interactions of *COVID19* and a set of firm characteristics (i.e., *Firm Size*, *Leverage*, *Cash*, and *ROA*). The Appendix provides detailed variable definitions. We include firm, industry by week, and economy by week fixed effects. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Stock Return				
Variable	(1)	(2)	(3)	(4)	(5)
*CSR Score * COVID19*	0.900**				0.078
	(0.385)				(0.146)
*Environmental * COVID19*		0.735**			
		(0.364)			
*Social * COVID19*			0.638**		
			(0.249)		
*CSR Strategy * COVID19*				0.495**	
				(0.216)	
*Social Norms * CSR Score * COVID19*					1.315***
					(0.317)
*Firm Traits * COVID19*	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes	Yes	Yes
Economy-time fixed effects	Yes	Yes	Yes	Yes	Yes
Number of observations	126,711	126,690	126,690	126,711	123,065
Adjusted R-squared	0.504	0.504	0.504	0.504	0.504
Number of firms	6,041	6,040	6,040	6,041	5,867

the biggest effect on corporate resilience in societies that highly value those activities, i.e., in economies with social norms that prioritize treating others fairly and mitigating environmental degradation, because, in these economies, CSR activities are more likely to enhance loyalty and strengthen bonds and implicit contracts with stakeholders. To evaluate this prediction, we use data from the World Values Survey and construct measures of the degree to which individuals in a country prioritize the environment (*Environmental Priority*) and human and worker rights (*Human Rights*). We set *High Social Norms* equal to one if the country has both *Environmental Priority* and *Human Rights* scores above the sample median and zero otherwise.

The results are consistent with the view that pre-2020 CSR activities boosted corporate immunity to the pandemic by enhancing bonds with stakeholders. As shown in Table 5, Column 5, the triple interaction term, *High Social Norms * CSR Score * COVID19*, enters positively and significantly. This finding suggests that CSR strengthens loyalty and bonds among key stakeholders through socially responsible actions, enhancing corporate resiliency.

3.6. Corporate governance

We next examine three measures of corporate governance (managerial entrenchment, the structure of corporate boards, and executive compensation systems), each of which could influence the market's perceptions of a corporation's resilience to COVID-19. Gompers et al. (2003), Cremers and Nair (2005) and Bebchuk et al., (2009) find that greater managerial entrenchment is associated with lower stock market valuations. Johnson et al. (2000) and Johnson, La Porta, Lopez-de-Silanes, and Shleifer (2000) suggest that periods of great uncertainty and tumult, such as a crisis, can create incentives and opportunities for entrenched insiders to extract resources and rents at the expense of other stakeholders. To measure entrenchment, we use the number of antitakeover devices that a firm has in place (with a minimum of two), *Antitakeover Devices*. We then include the interaction term *Antitakeover Devices * COVID19* to assess how a firm's stock price reacts to the pandemic as a function of its antitakeover provisions.

As shown in Table 6, firms with more entrenched executives tend to experience sharper stock price declines in response to the COVID-19 crisis. The interaction between *Antitakeover Devices* and *COVID19* enters negatively and significantly, indicating that stock prices of firms with more antitakeover provisions fall more in response to COVID-19 than firms with fewer antitakeover provisions. These results are consistent with the view that stock markets viewed managerial entrenchment negatively in assessing corporate resilience to the crisis, as entrenchment could impede firms' ability to take appropriate actions during the pandemic. With respect to the estimated economic magnitude, the coefficient estimate on *Antitakeover Devices * COVID19* suggests that a one standard deviation increase in *Antitakeover Devices* is associated with weekly stock returns declining by 0.13 (= -0.0627 * 2.9 * 0.725) percentage points more in response to an average weekly COVID-19 value.

Extensive research shows that the size and composition of corporate boards can shape their monitoring incentives and effectiveness (Hermalin and Weisbach, 2003,2017; Adams et al., 2010; Beltratti and Stulz, 2012). For example, Guo and Masulis (2015) find that more independent boards tend to increase the probability of CEO turnover in response to poor performance. Meanwhile, independent directors often have less firm-specific in-

Table 6
Corporate governance and stock returns in response to COVID-19.
The table reports regression results analyzing how stock prices respond to the COVID-19 pandemic as functions of pre-pandemic corporate governance indicators. The dependent variable is the weekly stock return of each firm. To measure corporate governance, we use *Antitakeover Devices*, *Board Size*, *Board Independence*, *Performance-based Compensation*, and *Executive Compensation LT Objectives*. *Firm Traits * COVID19* represents the interactions of *COVID19* and a set of firm characteristics (i.e., *Firm Size*, *Leverage*, *Cash*, and *ROA*). The Appendix provides detailed variable definitions. We include firm, industry by week, and economy by week fixed effects. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Stock Return		
Variable	Antitakeover provisions (1)	Board (2)	Executive compensation (3)
*Antitakeover Devices * COVID19*	-0.063**		
	(0.030)		
*Board Size * COVID19*		0.031**	
		(0.015)	
*Board Independence * COVID19*		-0.000	
		(0.003)	
*Performance-based Compensation * COVID19*			-0.128
			(0.130)
*Executive Compensation LT Objectives * COVID19*			-0.079
			(0.093)
*Firm Traits * COVID19*	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes
Economy-time fixed effects	Yes	Yes	Yes
Number of observations	126,690	124,591	124,675
Adjusted R-squared	0.504	0.504	0.504
Number of firms	6,040	5,940	5,944

formation and financial incentives to monitor executives than inside directors. Regarding board size, the review by Adams et al. (2010) emphasizes that existing studies provide mixed evidence on the link between board size and firm performance. On the one hand, smaller boards are more vigilant overseers of executive performance as they are less troubled by the free-riding problem that can characterize larger boards. On the other hand, excessively vigilant boards can discourage the CEO from taking valuable actions, with adverse implications on the firm. We focus on resilience and assess the connection between stock price reactions to the pandemic and cross-firm differences in corporate board size and independence. Accordingly, we examine the size of the board (*Board Size*) and the degree of independence of board members from the executive (*Board Independence*).

As shown in Table 6, the coefficient estimate on the *Board Size * COVID19* is positive and significant, but, in later analyses that control for other firm characteristics, *Board Size* becomes insignificant. Throughout the analyses, *Board Independence * COVID19* enters with a statistically insignificant and economically small coefficient. Thus, these two features of the structure of corporate boards do not help account for stock price reactions to COVID-19.

The extant literature offers differing perspectives on executive compensation and stock price performance (Murphy, 2013; Rau, 2015). One line of work stresses that performance-based compensation can mitigate agency frictions and enhance corporate performance. Focusing on vulnerability to shocks, Lewellen (2006) emphasizes that stock-based compensation exposes managers to firm-specific risk, giving them an incentive to reduce the level of debt. From this perspective, firms with performance-based compensation could be more resilient to COVID-19. From a different perspective, equity-based compensation can spur risk-taking, making firms more vulnerable to shocks. Coles et al. (2006), for example, show that corporate fragility tends to be greater when executive wealth is more sensitive to stock volatility. Research that focuses on the extent to which executive compensation is linked to achieving longer-run corporate objectives yields similarly nuanced perspectives on stock performance. For example, Stein (1988, 1989) shows that when CEOs have strong incentives to focus on the short run (myopia) instead of the long run, they are more likely to make decisions that are privately beneficial to executives but costly to shareholders. When applied to the pandemic, compensations schemes that induce executives to make longer-duration investments could make the firm more vulnerable to pandemic-induced disruptions to liquidity and demand.

Motivated by this research, we examine two features of executive compensation: whether the company has pay-for-performance compensation policy (*Performance-based Compensation*) and whether pay-for-performance is connected to long-run objectives (*Executive Compensation LT Objectives*). As shown in Table 6, none of the features of executive compensation enters significantly. As with the findings on corporate board structure, differences in corporate compensation schemes do not help account for differential stock price reactions to COVID-19.

3.7. Ownership structure

In this section, we examine the relation between stock price sensitivity to COVID-19 and ownership structure, focusing on several different aspects and measures of ownership structure. We assess stock price reactions to COVID-19 as functions of whether a firm has a controlling share-

holder classified as *Individual/Family, Government, Bank and Other FI*, or *Corporation*, the degree to which each firm has blockholders that are asset management companies (*Asset Management Companies*), and management ownership (*Management Ownership*). We focus on two differences across family-controlled firms: whether the family directly owns the controlling shares or controls the firm through a pyramid ownership structure and whether the family-owned firm has the family member manage the firm or not. We examine controlling owners that are nonfinancial corporations and differentiate by large and small corporations. We separately examine blockholder ownership by hedge funds and other asset management companies. We also consider the relation between managerial ownership and corporate resilience to the pandemic.

3.7.1. Discussion and results on basic ownership structure measures

Research provides conflicting views on family ownership and corporate resilience. Lins et al. (2013), for example, find that family firms took actions during the global financial crisis to preserve their private benefits of control at the expense of other shareholders. Sraer and Thesmar (2007) show that family-controlled firms are less likely to fire workers in response to adverse shocks, which could deepen stock price declines. Other research advertises the potential benefits of family ownership, as family owners could have longer horizons that mitigate managerial opportunism (James, 1999; Anderson and Reeb, 2003), stronger attachments to their firms (Kandel and Lazear, 1992), and greater firm-specific expertise and stronger bonds with non-shareholder stakeholders (Donnelley, 1964).

Research also suggests how other types of controlling owners could affect firm performance during crises. On corporate ownership, some research suggests that having a large corporate owner can lower the cost of capital, boosting performance. For example, Erel et al. (2015) show that acquisitions by a large company relieve financial frictions in small target firms. On government ownership and ownership by banks and other financial institutions, these owners could also have deep pockets that can help the firms they own during crises, with positive repercussions on stock reactions.[6] Therefore, in response to adverse news about COVID-19 cases, stock prices could fall less among firms controlled by large corporations, governments, and banks and other financial institutions.

With regard to ownership by asset management companies, research highlights two interrelated features of hedge funds or other actively managed funds that could contribute to large, nonfundamental stock price movements in the firms. First, as discussed in Stein (2009) and Khandani and Lo (2011), hedge funds often employ quantitative trading strategies that can trigger overcrowding and fire sale effects on prices. Second, hedge funds often use short-term funding to lever their positions (Lo, 2008). As a result, disruptions to liquidity, which occurred during the global financial crisis and the COVID-19 crisis, can trigger the rapid sale of asset management companies, with large, nonfundamental price movements (Khandani and Lo, 2011). Thus, adverse news about COVID-19 cases can induce stock prices to fall more among firms with greater ownership of these asset management companies.

Column 1 of Table 7 shows that the stock prices of firms controlled by families, nonfinancial corporations, governments, and banks and other financial institutions performed better than widely held firms following the onset of the pandemic and that the stock prices of firms more heavily owned by asset management companies performed worse. The coefficient estimates from Column 1 suggest that the average stock return of the firm controlled by families would decline 0.27 percentage points less per week in response to an average weekly COVID-19 shock (i.e., $COVID19 = 0.725$) than a typical widely held company. In contrast, a one standard deviation increase in ownership of *Asset Management Companies* would decrease stock returns by 0.17 ($= -1.387 * 0.17 * 0.725$) percentage points in response to the same shock.

3.7.2. Discussion and results on family ownership

Research also focuses on two differing features across family-controlled corporations. First, families can control firms through direct holding of shares or through pyramidal ownership structures (La Porta et al., 1999; Claessens et al., 2000). The pyramid structure allows for the separation of control from cash flow rights, which can increase the incentives of controlling shareholders to extract private benefits from the firm at the expense of overall shareholder value (Lemmon and Lins, 2003; Morck et al., 2005). Almeida and Wolfenzon (2006) explain that the pyramid structure can be an effective control device in some business groups that does not trigger these incentive problems. Due to data limitations, we cannot calculate wedges between cash flow and voting rights for a large international sample of firms. The Orbis database indicates whether an ultimate owner controls a firm through direct ownership or multiple layers (i.e., pyramid structure). Thus, we differentiate family-controlled firms by whether the controlling ownership is through the direct holding of shares or through a pyramid structure.

Second, research differentiates family-controlled corporations by whether the firm is managed by a family member or not. For example, Anderson and Reeb (2003) and Villalonga and Amit (2006) find evidence that family-owned firms with family-CEOs create value by reducing agency frictions. Anderson et al. (2003) show that when family members hold the CEO position, the cost of debt is higher than that of family-owned firms with outside CEOs. Other works also stress that professional, nonfamily CEOs provide valuable services to firms. For example, Bennedsen et al. (2007) find that transitions to the family-CEO structure under-perform transitions to nonfamily, professional management. Thus, we distinguish *Individ-*

[6] Even without direct government ownership of firms, Faccio et al. (2006) find that politically connected firms are significantly more likely to be bailed out than other firms. Similarly, even without direct bank ownership of firms, Gatev and Strahan (2006) show that banks have a unique advantage in providing liquidity to corporations during periods of market stress.

Table 7
Ownership structure and stock returns in response to COVID-19.

The table reports regression results analyzing how stock prices respond to the COVID-19 pandemic as functions of pre-pandemic corporate ownership. The dependent variable is the weekly stock return of each firm. We measure a firm's ownership structure based on whether a firm has an ultimate controlling shareholder classified as *Individual/Family*, *Government*, *Bank and Other FI*, and *Corporation*, the total shares owned by asset management companies (*Asset Management Companies*, including hedge funds and other asset management companies), and insider ownership (*Management Ownership*). *Firm Traits * COVID19* represents the interactions of *COVID19* and a set of firm characteristics (i.e., *Firm Size*, *Leverage*, *Cash*, and *ROA*). The Appendix provides detailed variable definitions. We include firm, industry by week, and economy by week fixed effects. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Stock Return							
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
*Individual/Family * COVID19*	0.378***			0.376***	0.389***	0.425***	0.428***	0.372***
	(0.124)			(0.125)	(0.127)	(0.144)	(0.145)	(0.128)
*Government * COVID19*	0.179*	0.179*	0.175*	0.186**	0.187**	0.129	0.141	0.140
	(0.091)	(0.092)	(0.092)	(0.0906)	(0.0872)	(0.0984)	(0.0985)	(0.105)
*Bank and Other FI * COVID19*	0.269*	0.269*	0.265*	0.265*	0.267*	0.245*	0.252*	0.242*
	(0.134)	(0.135)	(0.134)	(0.134)	(0.134)	(0.137)	(0.138)	(0.138)
*Corporation * COVID19*	0.260**	0.259*	0.257*		0.282**	0.205	0.217*	0.210
	(0.130)	(0.130)	(0.131)		(0.120)	(0.129)	(0.128)	(0.132)
*Asset Management Companies * COVID19*	-1.387***	-1.382***	-1.380***	-1.389***				
	(0.410)	(0.409)	(0.406)	(0.411)				
*Individual/Family (Manager) * COVID19*		0.058						
		(0.197)						
*Individual/Family (Not Manager) * COVID19*		0.569***						
		(0.120)						
*Individual/Family (Direct) * COVID19*			0.538***					
			(0.138)					
*Individual/Family (Pyramid) * COVID19*			0.241					
			(0.174)					
*Corporation (Large) * COVID19*				0.434***				
				(0.147)				
*Corporation (Small) * COVID19*				0.182				
				(0.151)				
*Hedge Fund * COVID19*					-4.178***	-4.017***	-4.005***	-4.035***
					(0.805)	(0.857)	(0.854)	(0.860)
*Other AMC * COVID19*					-1.068***	-1.061***	-1.059***	-1.078***
					(0.329)	(0.322)	(0.321)	(0.321)
*Management Ownership * COVID19*						-0.806**		
						(0.319)		
*Management Ownership (Low) * COVID19*							18.99***	
							(4.641)	
*Management Ownership (High) * COVID19*							-0.747**	
							(0.310)	
*Management Ownership (Dummy, Low) * COVID19*								0.233***
								(0.0729)
*Management Ownership (Dummy, Medium) * COVID19*								-0.181
								(0.153)
*Management Ownership (Dummy, High) * COVID19*								-0.197*
								(0.107)
*Firm Traits * COVID19*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economy-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Coefficient differences		Family Manager versus Not Manager	Family Direct versus Pyramid	Corporation Large versus Small			Management Ownership High versus Low	Management Ownership (Dummy) High versus Low
F-statistic		6.69**	1.91	3.39*			16.88***	9.89***
p-value		(0.012)	(0.172)	(0.071)			(0.000)	(0.003)
Number of observations	126,669	126,669	126,669	126,669	126,669	122,346	122,346	122,346
Adjusted R-squared	0.504	0.504	0.504	0.504	0.504	0.506	0.506	0.506
Number of firms	6,039	6,039	6,039	6,039	6,039	5,833	5,833	5,833

ual/Family by whether the ultimate controlling owner is the manager or not.

The results emphasize the importance of differentiating among family-owned firms. As shown in Table 7, Column 2, *Individual/Family (Not Manager) * COVID19* enters positively and significantly, but *Individual/Family (Manager) * COVID19* enters insignificantly. In addition, the F-statistic indicates that estimated coefficient on *Individual/Family (Not Manager) * COVID19* is significantly different from that on *Individual/Family (Manager) * COVID19*. Thus, the stock returns of firms owned by families but managed by other individuals perform better than widely held firms. In contrast, the returns of firms in which the controlling family also manages the firm do not perform better than widely held firms. We also examine direct and pyramidal ownership control structures. Consistent with the view that the pyramid structure creates a gap between control rights and cash flow rights and thereby increases the incentives of

controlling shareholders to extract private benefits, we find that *Individual/Family (Direct)* * *COVID19* enters positively and significantly, and *Individual/Family (Pyramid)* * *COVID19* enters insignificantly. That said, the difference in the estimated coefficients on *Individual/Family (Direct)* * *COVID19* and *Individual/Family (Pyramid)* * *COVID19* is not significantly different from zero.

3.7.3. Discussion and results on large controlling corporate owners

We extend our findings on corporate owners and differentiate by the size of the controlling corporate owner. The Table 7 results indicate that the stock returns of firms with controlling corporate owners fall less in response to the pandemic than widely held firms. One potential explanation is that controlling corporate owners are especially committed to the firms they own and have deep pockets to help those firms during periods of duress. To address this explanation more directly, we separately examine controlling corporate owners that differ by size, as measured by total assets.

As shown in Table 7, *Corporation (Large)* * *COVID19* enters positively and significantly, and *Corporation (Small)* * *COVID19* enters insignificantly. Furthermore, these estimated coefficients are significantly different from each other, as indicated by the F-test. The stock prices of firms controlled by comparatively large corporations, but not firms controlled by smaller corporations, performed better than widely held firms. This finding is consistent with the notion that large corporations have deep pockets and strong commitments to the firms they own.

3.7.4. Differentiating between hedge fund and other asset management companies

We also distinguish among asset management companies. Firms with asset management companies as blockholders experience worse stock return performance in response to the pandemic. We now further determine whether these blockholders are hedge funds or other asset management companies. As shown in Column 5 of Table 7, the results on *Asset Management Companies* also hold for *Hedge Fund* and *Other AMC*. These findings are consistent with the view that hedge funds (and other actively managed funds) sell their shares rapidly in response to new information about COVID-19 cases or to meet liquidity needs (Stein, 2009; Khandani and Lo, 2011), putting downward pressure on prices. Our findings on hedge funds are consistent with anecdotal evidence. Several media reports indicate that many influential hedge funds rapidly sold off their positions following the onset of the pandemic. For example, the *Financial Times* reported that "quant funds as a whole have nearly halved the size of their positions since the beginning of the month" (Financial Times, 2020a) and that "[*h*]edge funds have suffered their worst quarterly outflows in more than a decade" (Financial Times, 2020b). Furthermore, BarclayHedge (2020) reported that "[*i*]nvestor redemptions skyrocketed from USD 8.1 billion in February to USD 85.6 billion the following month."

3.7.5. Management ownership

Finally, we examine the degree to which managers hold shares in their firms. Influential theories and empirical work emphasize that although managerial shareholdings can create the benefits of aligning the incentives of managers and owners, managerial ownership can have negative effects on firm value due to entrenchment (e.g., Morck et al., 1988; Stulz, 1988; McConnell and Servaes, 1990; Claessens et al., 2002). In Stulz (1988), managerial entrenchment increases with larger managerial shareholdings and control, and the adverse effects of entrenchment could ultimately exceed the incentive benefits at sufficiently high levels of managerial ownership. Consistent with this view, Morck et al. (1988) find that high management ownership intensifies agency problems between controlling insiders and outside investors. Lemmon and Lins (2003) find that firms in which managers have high levels of control rights under-performed during the 1997–1998 East Asian financial crisis. From this perspective, stock markets could positively value small amounts of managerial ownership in assessing corporate resilience to the pandemic, while penalizing higher levels to the extent that larger managerial ownership indicates greater entrenchment and a less effective response to the crisis. To evaluate these views of insider ownership, we examine the simple interaction between *Management Ownership* and *COVID19* and a nonlinear representation of managerial ownership to explore the more nuanced predictions about the relations between insider ownership and corporate resilience to the pandemic.

As shown in Table 7, Columns 6–8, management ownership is strongly connected with the reaction of stock returns to COVID-19. As shown in Column 6, *Management Ownership* * *COVID19* enters negatively and significantly, suggesting that stock returns react more negatively to the pandemic in firms with greater managerial ownership. The other two specifications in Columns 7 and 8 indicate that this relation is nonlinear. In Column 7, the coefficient estimate on *Management Ownership (Low)* * *COVID19* is positive and that on *Management Ownership (High)* * *COVID19* is negative. Similarly, in Column 8, *Management Ownership (Dummy, Low)* * *COVID19* enters positively, and *Management Ownership (Dummy, Medium)* * *COVID19* and *Management Ownership (Dummy, High)* * *COVID19* enter negatively. The findings are consistent with the view that stock markets positively price small amounts of managerial ownership in assessing resilience to the pandemic but negatively price high levels of managerial ownership.

To interpret the estimated economic magnitudes, consider the specification in Column 8 that includes *Management Ownership (Dummy, Low), Management Ownership (Dummy, Medium),* and *Management Ownership (Dummy, High)*, where each is interacted with *COVID19*. The coefficient estimates imply that the average stock return of the firm with below-median managerial ownership [*Management Ownership (Dummy, Low)* =1] would decline by 0.17 (= 0.725 * 0.233) percentage points less per week in response to an average weekly COVID-19 shock than an otherwise similar firm with zero managerial ownership. Stock

Table 8
Corporate characteristics: simultaneous analyses.
The table reports regression results of how stock prices respond to the COVID-19 pandemic as functions of pre-pandemic corporate characteristics, including corporate financial conditions, international supply chain and customer exposure to the pandemic, corporate social responsibility, corporate governance systems, and ownership structure. The dependent variable is the weekly stock return of each firm in a week in Columns 1–6 and abnormal returns in Columns 7–8. The variables are defined in the earlier tables and the Appendix. The measure of *COVID19* in Columns 5 and 6 uses the growth rate of active cases, which accounts for the number of recoveries and deaths from the COVID-19 virus. We include firm, industry by week, and economy by week fixed effects in all columns. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Stock Return						*Abnormal Return*	
					COVID19, Active			
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
*Firm Size * COVID19*	0.039	0.014	0.053	0.019	0.048	0.019	0.082	0.076
	(0.032)	(0.036)	(0.034)	(0.037)	(0.037)	(0.036)	(0.053)	(0.053)
*Leverage * COVID19*	-1.174***	-1.099***	-1.314***	-1.168***	-1.104***	-0.964***	-1.140***	-1.114***
	(0.213)	(0.235)	(0.203)	(0.211)	(0.206)	(0.212)	(0.218)	(0.230)
*Cash * COVID19*	1.209**	1.243**	1.804***	1.661***	1.645***	1.512**	2.411***	2.319***
	(0.490)	(0.521)	(0.598)	(0.610)	(0.591)	(0.602)	(0.508)	(0.578)
*ROA * COVID19*	1.842***	1.818***	2.243**	2.121**	1.897**	1.777*	0.908*	0.887
	(0.378)	(0.424)	(1.018)	(1.043)	(0.938)	(0.929)	(0.498)	(0.537)
*Undrawn Credit * COVID19*			1.148***	0.993***	0.816**	0.722**	1.365***	1.279***
			(0.406)	(0.362)	(0.404)	(0.358)	(0.439)	(0.421)
*Maturing Debt * COVID19*			-0.493***	-0.398***	-0.444***	-0.374***	-0.600***	-0.545**
			(0.112)	(0.118)	(0.105)	(0.102)	(0.209)	(0.207)
Suppliers' Exposure	-0.303***	-0.285***	-0.257**	-0.245**	-0.219*	-0.200	-0.468***	-0.458***
	(0.089)	(0.085)	(0.109)	(0.110)	(0.131)	(0.139)	(0.169)	(0.164)
Customers' Exposure	-0.740***	-0.732***	-0.624***	-0.619***	-0.601***	-0.613***	-1.112***	-1.069***
	(0.175)	(0.168)	(0.163)	(0.156)	(0.138)	(0.128)	(0.269)	(0.269)
*CSR Score * COVID19*	0.751*	0.676*	0.950*	0.906*	0.883*	0.852*	0.958*	0.883*
	(0.382)	(0.387)	(0.513)	(0.520)	(0.454)	(0.452)	(0.515)	(0.521)
*Antitakeover Devices * COVID19*	-0.061***	-0.050**	-0.064***	-0.048***	-0.058***	-0.044***	-0.032**	-0.017
	(0.020)	(0.019)	(0.017)	(0.016)	(0.015)	(0.015)	(0.014)	(0.013)
*Board Size * COVID19*	0.019	0.015	0.025	0.020	0.023	0.017	0.029	0.020
	(0.016)	(0.017)	(0.022)	(0.023)	(0.019)	(0.020)	(0.020)	(0.021)
*Individual/Family * COVID19*		0.449***		0.733***		0.706***		0.584***
		(0.159)		(0.150)		(0.129)		(0.176)
*Bank and Other FI * COVID19*		0.194		0.225		0.177		0.557***
		(0.138)		(0.182)		(0.170)		(0.163)
*Corporation * COVID19*		0.273**		0.307***		0.219**		0.303**
		(0.114)		(0.102)		(0.090)		(0.129)
*Government * COVID19*		0.205		0.258		0.198		0.402
		(0.137)		(0.246)		(0.219)		(0.312)
*Hedge Fund * COVID19*		-3.998***		-5.147***		-4.491***		-2.713**
		(0.802)		(0.863)		(1.299)		(1.044)
*Other AMC * COVID19*		-0.843***		-0.771***		-0.631***		-0.050
		(0.246)		(0.219)		(0.234)		(0.497)
*Management Ownership * COVID19*		-0.637**		-0.579*		-0.612**		-0.719
		(0.241)		(0.323)		(0.303)		(0.449)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economy-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	106,679	104,056	69,657	67,768	69,657	67,768	69,582	67,706
Adjusted R-squared	0.513	0.515	0.539	0.541	0.539	0.541	0.182	0.180
Number of firms	5,086	4,961	3,321	3,231	3,321	3,231	3,318	3,228

returns of firms with high managerial ownership [*Management Ownership (Dummy, High)* =1] would decrease by 0.14 (= -0.197 * 0.725) percentage points more in response to the COVID-19 shock than otherwise similar firms with no managerial ownership. Remarkably, these results hold when controlling for other features of corporate ownership structure. Thus, conditional on ownership by hedge funds, other asset management companies, families, governments, banks, and other firms, we continue to find these strong results on insider ownership.

3.8. Corporate characteristics: simultaneous analyses and other robustness checks

In Table 8, we simultaneously examine all five pre-2020 corporate characteristics: corporate financial conditions, international supply chain and customer exposure to the pandemic, corporate social responsibility, corporate governance, and ownership structure. We add the five characteristics in a stepwise manner, ultimately including all of them simultaneously in Column 4. Because many firm

Table 9
Corporate characteristics, testing-adjusted measures of COVID19.

This table presents the analyses using testing-adjusted measures of national exposure to COVID-19. *COVID19, Testing Adjusted 1* is the change in the ratio of positive tests in an economy. *COVID19, Testing Adjusted 2* is the percentage change in the ratio of positive results per test. Variables are defined in the main text and the Appendix. Robust standard errors clustered at the economy level are reported in parentheses. ***, **, and * denote significance levels at 1%, 5%,and 10%, respectively.

	Weekly Stock Return							
	COVID19, Testing Adjusted 1				*COVID19, Testing Adjusted 2*			
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
*Firm Size * COVID19*	0.010	0.005	0.007	0.002	0.021	0.014	0.017	0.009
	(0.010)	(0.012)	(0.010)	(0.011)	(0.015)	(0.017)	(0.014)	(0.016)
*Leverage * COVID19*	-0.312***	-0.305***	-0.309***	-0.302***	-0.339**	-0.332**	-0.340**	-0.333**
	(0.040)	(0.047)	(0.041)	(0.050)	(0.146)	(0.159)	(0.145)	(0.159)
*Cash * COVID19*	0.188***	0.197***	0.210***	0.220***	0.450***	0.450***	0.472***	0.471***
	(0.049)	(0.053)	(0.043)	(0.049)	(0.083)	(0.091)	(0.075)	(0.084)
*ROA * COVID19*	0.334***	0.365***	0.326***	0.360***	0.281***	0.285***	0.263***	0.269**
	(0.044)	(0.052)	(0.045)	(0.055)	(0.073)	(0.093)	(0.081)	(0.103)
Suppliers' Exposure	-0.051***	-0.045**	-0.047**	-0.042**	-0.083**	-0.090***	-0.079**	-0.088***
	(0.018)	(0.017)	(0.019)	(0.018)	(0.032)	(0.031)	(0.033)	(0.031)
Customers' Exposure	-0.091***	-0.085***	-0.097***	-0.090***	-0.148**	-0.138**	-0.165**	-0.153***
	(0.031)	(0.029)	(0.031)	(0.030)	(0.062)	(0.054)	(0.062)	(0.054)
*CSR Score * COVID19*	0.120	0.108	-0.211**	-0.208**	0.253	0.236	-0.094	-0.085
	(0.134)	(0.121)	(0.086)	(0.085)	(0.161)	(0.146)	(0.206)	(0.226)
*Social Norms * CSR Score * COVID19*			0.474***	0.454***			0.534**	0.497**
			(0.092)	(0.093)			(0.218)	(0.246)
*Antitakeover Devices * COVID19*	-0.022***	-0.019***	-0.020***	-0.016**	-0.027***	-0.023***	-0.023***	-0.020***
	(0.005)	(0.006)	(0.006)	(0.007)	(0.005)	(0.005)	(0.006)	(0.005)
*Board Size * COVID19*	0.004	0.004	0.006	0.005	0.001	0.001	0.003	0.003
	(0.008)	(0.009)	(0.008)	(0.008)	(0.010)	(0.010)	(0.009)	(0.010)
*Individual/Family * COVID19*		0.152***		0.153***		0.192***		0.199***
		(0.034)		(0.035)		(0.056)		(0.056)
*Bank and Other FI * COVID19*		0.092*		0.095		0.156		0.151
		(0.053)		(0.059)		(0.095)		(0.098)
*Corporation * COVID19*		0.044		0.035		-0.038		-0.044
		(0.040)		(0.039)		(0.080)		(0.077)
*Government * COVID19*		-0.014		-0.080		0.098		0.060
		(0.093)		(0.103)		(0.091)		(0.089)
*Hedge Fund * COVID19*		-0.646***		-0.621***		-1.042***		-1.015***
		(0.143)		(0.147)		(0.241)		(0.248)
*Other AMC * COVID19*		-0.240***		-0.243***		-0.329***		-0.330***
		(0.072)		(0.075)		(0.093)		(0.094)
*Management Ownership * COVID19*		-0.138		-0.166		-0.153		-0.184
		(0.124)		(0.118)		(0.127)		(0.116)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economy-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	83,722	81,641	81,201	79,139	88,478	86,298	86,005	83,844
Adjusted R-squared	0.496	0.498	0.498	0.500	0.493	0.495	0.495	0.497
Number of firms	5,086	4,961	4,942	4,818	5,086	4,961	4,942	4,818

traits could be correlated, we include them simultaneously to assess the independent connection between stock price reactions to COVID-19 and each of these corporate characteristics. Besides conditioning on firm, industry-by-time, and economy-by-time fixed effects, we include the interactions between *COVID19* and the four basic financial condition indicators (*Firm Size, Leverage, Cash,* and *ROA*), the measures of exposure to the pandemic through international supply chain and customer locations (*Suppliers' Exposure* and *Customers' Exposure*), CSR activities (*CSR Score*), corporate governance measures (*Antitakeover Devices* and *Board Size*), and ownership structure, as measured by whether a firm is controlled by *Individual/Family, Government, Bank and Other FI*, or *Corporation*, the extent to which each firm has blockholders that are hedge funds and other asset management companies, and shareholdings held by management.

As shown in Columns 1–2 of Table 8, almost all of the indicators enter statistically significantly, with the same sign and similar estimated coefficients as the earlier findings (Tables 3–7), except for *Board Size*. In Columns 3 and 4, we repeat these analyses while including the interactions between *COVID19* and *Undrawn Credit* and *Maturing Debt*. While the sample size falls due to data limitations on these two variables, our key findings remain. The consistency of the estimated coefficients on these five corporate characteristics across various specifications highlights the independent connection between each of these corporate characteristics and the sensitivity of stock prices to the COVID-19 pandemic.

Table 10
Corporate characteristics, alternative sample.

This table presents the analyses using alternative samples. In Columns 1 and 2, the sample period starts in December 2019 and November 2019, respectively. The sample period in Column 3 covers only the first quarter of 2020. The sample in Column 4 excludes the energy sector. Columns 5 and 6 use countries with more than five or ten firms. Variables are defined in the main text and tables. We include firm, industry by week, and economy by week fixed effects in all columns. Robust standard errors clustered at the economy level are reported in parentheses.***, **, and * denote significance levels at 1%, 5%, and 10%, respectively.

	Weekly Stock Return					
	Since December 2019	Since November 2019	2020 Q1	Excluding energy sector	Countries with more than five firms	Countries with more than ten firms
Variable	(1)	(2)	(3)	(4)	(5)	(6)
*Firm Size * COVID19*	-0.003	-0.005	-0.015	0.024	0.014	0.013
	(0.032)	(0.028)	(0.037)	(0.032)	(0.035)	(0.035)
*Leverage * COVID19*	-1.034***	-1.007***	-1.148***	-1.291***	-1.100***	-1.096***
	(0.197)	(0.189)	(0.173)	(0.330)	(0.236)	(0.238)
*Cash * COVID19*	1.346***	1.210***	1.178**	1.186**	1.234**	1.233**
	(0.484)	(0.383)	(0.548)	(0.562)	(0.526)	(0.526)
*ROA * COVID19*	1.617***	1.453***	1.403***	1.859***	1.815***	1.817***
	(0.378)	(0.320)	(0.365)	(0.483)	(0.426)	(0.425)
Suppliers' Exposure	-0.266***	-0.264***	-0.362***	-0.340***	-0.286***	-0.290***
	(0.083)	(0.082)	(0.083)	(0.075)	(0.085)	(0.085)
Customers' Exposure	-0.715***	-0.737***	-0.684***	-0.735***	-0.735***	-0.734***
	(0.160)	(0.165)	(0.168)	(0.173)	(0.168)	(0.168)
*CSR Score * COVID19*	0.598*	0.521	0.453*	0.688*	0.678*	0.669*
	(0.340)	(0.316)	(0.257)	(0.376)	(0.387)	(0.392)
*Antitakeover Devices * COVID19*	-0.037**	-0.032**	-0.036**	-0.064***	-0.049**	-0.049**
	(0.015)	(0.014)	(0.017)	(0.021)	(0.020)	(0.020)
*Board Size * COVID19*	0.016	0.013	0.010	0.014	0.015	0.015
	(0.016)	(0.013)	(0.013)	(0.018)	(0.017)	(0.017)
*Individual/Family * COVID19*	0.377***	0.305**	0.431**	0.413***	0.440***	0.437***
	(0.129)	(0.115)	(0.196)	(0.153)	(0.161)	(0.162)
*Bank and Other FI * COVID19*	0.177	0.152	0.250*	0.123	0.194	0.178
	(0.132)	(0.116)	(0.143)	(0.143)	(0.139)	(0.138)
*Corporation * COVID19*	0.210*	0.203*	0.363***	0.252**	0.282**	0.281**
	(0.124)	(0.107)	(0.124)	(0.119)	(0.116)	(0.115)
*Government * COVID19*	0.222*	0.227*	0.258*	0.124	0.200	0.212
	(0.128)	(0.127)	(0.148)	(0.127)	(0.137)	(0.139)
*Hedge Fund * COVID19*	-4.161***	-4.054***	-3.174***	-4.494***	-4.001***	-4.004***
	(0.641)	(0.523)	(0.894)	(0.885)	(0.801)	(0.801)
*Other AMC * COVID19*	-1.136***	-1.177***	-0.190	-0.694**	-0.845***	-0.842***
	(0.239)	(0.223)	(0.324)	(0.294)	(0.247)	(0.247)
*Management Ownership * COVID19*	-0.614**	-0.542**	-0.488*	-0.525**	-0.627**	-0.636**
	(0.236)	(0.216)	(0.245)	(0.217)	(0.244)	(0.241)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Economy-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	123,900	148,705	64,493	100,360	103,749	103,522
Adjusted R-squared	0.500	0.477	0.530	0.518	0.515	0.516
Number of firms	4,961	4,961	4,961	4,785	4,946	4,935

We extend these analyses in two ways. First, instead of using the simple weekly stock returns of each firm based on closing prices, we conduct the analyses using weekly abnormal returns, *Abnormal Return*. As shown in Columns 7 and 8 of Table 8, the key results hold. Second, instead of using the growth rate in confirmed cases (*COVID19*), we redid the analyses while using *COVID19, Active*, which measures the growth rate in active COVID-19 cases. As shown in Columns 5 and 6 of Table 8, all of the key findings hold.

We conduct several additional robustness tests. Given that cross-country differences exist in the level and evolution of COVID-19 testing, we construct two alternative measures that scale cases by testing to better assess changes in infection risk. Due to data limitations with the testing data, we use the testing-adjusted measures as robustness tests. As shown in Table 9, our results remain largely consistent when using these two measures, $COVID19_{c,t}$, *Testing Adjusted* 1 and $COVID19_{c,t}$, *Testing Adjusted* 2. In addition, we redo the analyses using the change in cases per capita during the first quarter of 2020. We construct $\text{Ln}(\Delta Cases\ per\ Capita)$, which equals $\ln(1 + \Delta Cases/Population)$. As shown in Online Appendix Table OA3, the results are largely robust to using this alternative measure. Moreover, we conduct the estimation over different sample periods, when excluding the energy sector, which was heavily influenced by the price war between Russia and Saudi Arabia in early 2020, and when excluding countries with fewer than five or ten firms. Table 10 shows that the results are robust to conducting the estimation over a longer pre-pandemic period by extending the period

back by one or two months (i.e., to December or November 2019), using data over the first quarter of 2020, excluding the energy sector, or excluding countries with fewer than five or ten firms.

4. Conclusion

Which characteristics shape corporate immunity to the COVID-19 pandemic? To shed empirical light on this question, we evaluate the connection between corporate characteristics and stock price reactions to COVID-19 using data on more than 6,700 firms across 61 economies during the first five months of 2020. While the economic turmoil triggered by COVID-19 is different from past crises, we consider corporate characteristics that have been the focus of research for decades. We examine stock price reactions to COVID-19 cases as functions of five pre-2020 firm traits: (1) financial conditions, such as cash holdings, credit lines, leverage, the structure of debt maturities, and profitability, (2) international supply chain and customer locations, which provides information on each firm's exposure to COVID-19 through its international connections, (3) CSR activities, (4) corporate governance systems, such as antitakeover mechanisms, board structures, and executive compensation policies, and (5) ownership structures, such as whether a firm is controlled by family, government, and other corporations, and the extent to which a firm's shares are held by management, hedge funds, and other asset management companies.

We reach five findings. First, firms with stronger pre-2020 financial conditions, that is, more cash, more unused lines of credit, less debt, and less short-term debt, experience better stock price reactions to COVID-19 than otherwise similar firms. Second, firms' international exposure to COVID-19 matters. The pandemic-induced drop in stock prices is larger among firms that are more exposed to the COVID-19 pandemic through their supply chains and customer locations. Third, firms with stronger CSR activities prior to the pandemic experience superior stock price performance in response to COVID-19, and the CSR-resilience nexus is stronger among economies with social norms that place a higher priority on environmental and social issues. These results are consistent with the view that CSR enhances loyalty and strengthens bonds with stakeholders, which makes workers, suppliers, and customers more amenable to making adjustments to support the business in times of duress. Fourth, firms with less entrenched executives perform better in response to COVID-19 cases. Fifth, ownership is strongly associated with stock price reactions to COVID-19 cases. Firms controlled by families (especially through direct holdings and with nonfamily managers), large corporations, and governments experience smaller stock price declines in response to the pandemic, and those with greater hedge fund and other asset management company ownership experience larger corresponding stock price declines. Stock markets positively price small amounts of managerial ownership in assessing resilience to the pandemic but negatively price high levels of managerial ownership.

Appendix A. Variable definitions

Variable	Definition	Source
Weekly Stock Return	Weekly stock return of each firm in a week is calculated by using dividend-adjusted closing prices on the last trading day of the week.	Thomson Reuters Datastream
Abnormal Return	Weekly stock return of each firm minus beta times domestic market returns, where beta is provided by Thomson Reuters and calculated using monthly data relative to the domestic stock market value-weighted index over the last five years.	Thomson Reuters Datastream
COVID19	Growth rate of the number of confirmed COVID-19 cases in an economy. For economy c in week t, $COVID19 = \log(1+Cumulative\ Cases$ in week $t) - \log(1+Cumulative\ Cases$ in week t-1), where *Cumulative Cases* is the cumulative number of confirmed cases in an economy.	Johns Hopkins University Center for Systems Science and Engineering (JHU CSSE)
COVID19, Active	Growth rate of the number of active COVID-19 cases in an economy. For economy c in week t, $COVID19,\ Active = \log(1+Active\ Cases$ in week $t) - \log(1+Active\ Cases$ in week t - 1), where *Active Cases* = *Cumulative Cases* (the cumulative number of confirmed cases) – *Recoveries* (the number of recoveries) – *Deaths* (the number of deaths).	JHU CSSE
COVID19, Testing Adjusted 1	Change in the proportion of positive tests in economy c in week t. $COVID19_{c,t},\ TestingAdjusted\ 1 = \frac{\Delta Cases_{c,t}}{\Delta Tests_{c,t}} - \frac{\Delta Cases_{c,t-1}}{\Delta Tests_{c,t-1}}$, where $\Delta Cases_{c,t}$ is the number of newly confirmed cases in economy c in week t, i.e., $\Delta Cases_{c,t} = Cumulative\ Cases_{c,t} - Cumulative\ Cases_{c,t\text{-}1}$. $\Delta Tests_{c,t}$ is the number of tests for COVID-19 performed during week t in economy c and equals $Total\ Tests_{c,t} - Total\ Tests_{c,t\text{-}1}$. We multiply *COVID19, Testing Adjusted* 1 by one hundred.	JHU CSSE; Foundation for Innovative New Diagnostics (FIND)
COVID19, Testing Adjusted 2	Percentage change in the ratio of positive results per test in economy c in week t. $COVID19_{c,t},\ TestingAdjusted\ 2 = \ln(1 + Cumulative\ Cases_{c,t}/Total\ Tests_{c,t}) - \ln(1 + Cumulative\ Cases_{c,t-1}/Total\ Tests_{c,t-1})$, where *Total Tests*$_{c,t}$ is the total number of tests for COVID-19 performed in economy c as of Friday in week t. *Cumulative Cases* is the cumulative number of confirmed cases in economy c as of Friday in week t. We multiply *COVID19, Testing Adjusted* 2 by one hundred.	JHU CSSE; FIND
Firm characteristics		
Firm Size	Natural logarithm of the book value of total assets.	Thomson Reuters Worldscope
Leverage	Ratio of total debt divided by total assets.	Thomson Reuters Worldscope
Cash	Total amount of cash and short-term investments divided by total assets.	Thomson Reuters Worldscope
ROA	Net income divided by total assets.	Thomson Reuters Worldscope

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Variable	Definition	Source
ROA (Operating Income)	Operating income divided by total assets. Operating income equals total sales minus total operating expenses.	Thomson Reuters Worldscope
ROA (EBITDA)	Earnings before interest expense, income taxes, depreciation, and amortization (EBITDA) divided by total assets.	Thomson Reuters Worldscope
ROA (EBIT)	Earnings before interest expense and income taxes (EBIT) divided by total assets.	Thomson Reuters Worldscope
Undrawn Credit	Amount of undrawn revolving credit divided by total assets.	Capital IQ Capital Structure
Maturing Debt	Total amount of outstanding debt due during the last three quarters of 2020 divided by total debt at the end of 2019.	Capital IQ Capital Structure
Suppliers' Exposure	For each firm *f* in week *t*, the weighted average of *COVID19* among countries in which the firm's suppliers are situated, where the weights are the number of a firm's pre-pandemic suppliers from a country as a fraction of the firm's total number of suppliers and *COVID19* varies weekly as defined above.	FactSet Revere; JHU CSSE
Customers' Exposure	For each firm *f* in week *t*, the weighted average of *COVID19* among countries in which the firm sells its products, where the weights are the proportion of the firm's pre-pandemic revenues in a country and *COVID19* varies weekly as defined above.	FactSet Revere; JHU CSSE
CSR Score	Average of the indices of *Environmental, Social*, and *CSR Strategy*, measuring a firm's commitment to the environment, including resource use, emissions, and green innovation; non-shareholder stakeholders and social themes, including employee welfare, human rights, and the ethical treatment of customers, suppliers, and the communities in which the firm operates; and operationalizing and implementing corporate social responsibility (CSR) activities.	Thomson Reuters ASSET4
Environmental	Contains three components (resource usage, emission reduction, and green innovation), reflecting a company's performance and capacity to reduce the use of materials, energy, or water and to find more eco-efficient solutions by improving supply chain management, commitment and effectiveness toward reducing environmental emissions in the production and operational processes, and capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products.	Thomson Reuters ASSET4
Social	Index aggregating information on the extent to which firms enhance employee welfare (*Workforce*), promote human rights (*Human Rights*), engage in community development (*Community*), and fulfill their responsibilities to consumers (*Product Responsibility*).	Thomson Reuters ASSET4
CSR Strategy	Index including information on the degree to which firms organize, operationalize, and implement CSR strategies. It covers whether firms have a CSR sustainability committee, publish CSR, health and safety, and sustainability reports and whether those reports are published in accordance with the Global Report Initiative Guidelines, have an external audit on CSR-related issues, explicitly integrate financial and extra-financial factors in the management discussion and analysis section of the annual reports, and explain how firms engages with their stakeholders.	Thomson Reuters ASSET4
Antitakeover Devices	Equals the number of antitakeover devices in place if greater than two and zero otherwise. The data cover an array of antitakeover devices, including poison pills, classified boards, blank checks, supermajority votes, dual-class shares, golden parachutes, limited shareholder rights to call for special meetings, cumulative voting rights, preemptive rights, company cross-shareholdings, confidential voting policies, limited director liability, shareholder approval of significant transactions, fair price provisions, limitations on removal of directors, advance notice for shareholder proposals, written consent requirements, and expanded constituency provisions.	Thomson Reuters ASSET4
Board Size	Total number of board members.	Thomson Reuters ASSET4
Board Independence	Percentage of independent board members of a company.	Thomson Reuters ASSET4
Performance-based Compensation	Indicator equal to one if the firm has a performance-based compensation policy for the higher-level executives and board members and zero otherwise.	Thomson Reuters ASSET4
Executive Compensation LT Objectives	Indicator that equals one if executive and board compensation are partially linked to longer-term objectives, i.e., objectives that are more than two years in the future, and zero otherwise.	Thomson Reuters ASSET4
Individual/Family	Indicator that equals one if a firm has an ultimate controlling shareholder classified as individuals or families and zero otherwise.	Bureau van Dijk Orbis
Individual/Family (Direct)	Indicator that equals one if a firm is controlled by an individual or family ultimate owner through direct holdings and zero otherwise.	Bureau van Dijk Orbis
Individual/Family (Pyramid)	Indicator that equals one if a firm is controlled by an individual or family ultimate owner through multiple layers of control links and zero otherwise.	Bureau van Dijk Orbis
Individual/Family (Manager)	Indicator that equals one if the family owner of a firm is also the manager (chief executive officer or executive director) and zero otherwise.	Bureau van Dijk Orbis
Individual/Family (Not Manager)	Indicator that equals one if the family owner of a firm is not a manager and zero otherwise.	Bureau van Dijk Orbis
Government	Indicator that equals one if a firm has an ultimate controlling shareholder classified as governments and zero otherwise.	Bureau van Dijk Orbis

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(*continued*)

Variable	Definition	Source
Corporation	Indicator that equals one if a firm has an ultimate controlling shareholder classified as widely held corporations and zero otherwise.	Bureau van Dijk Orbis
Corporation (Large)	Indicator that equals one when the size of the controlling corporation is in the top tercile of the size distribution of all firms and zero otherwise.	Bureau van Dijk Orbis
Corporation (Small)	Indicator that equals one when the size of the controlling corporation is not in the top tercile of the size distribution of all firms and zero otherwise.	Bureau van Dijk Orbis
Bank and Other FI	Indicator that equals one if a firm has an ultimate controlling shareholder classified as banks or other financial institutions and zero otherwise.	Bureau van Dijk Orbis
Asset Management Companies	Total holdings of blockholders that are asset management companies (AMCs) as a proportion of all shares, where AMCs include mutual funds, investment and asset management companies, investment banks, hedge funds, financial companies, and private equity and venture capital firms. Blockholders refer to investors who own at least 5% of the total outstanding shares.	Thomson Reuters Ownership
Hedge Fund	Total holdings of hedge fund blockholders as a proportion of all shares. A hedge fund is a firm that is permitted to use aggressive strategies that are unavailable to traditional funds, including selling short, leverage, program trading, swaps, arbitrage, and derivatives, such as Citadel, Two Sigma, and Renaissance Technologies.	Thomson Reuters Ownership
Other AMC	Total holdings of blockholders that are asset management companies excluding hedge funds.	Thomson Reuters Ownership
Management Ownership	Total percentage of management shareholding.	Bureau van Dijk Orbis
Management Ownership (Low)	Equals *Management Ownership* if it is below the median of sample firm with nonzero management ownership and zero otherwise.	Bureau van Dijk Orbis
Management Ownership (High)	Equals *Management Ownership* if it is above the median of sample firm with nonzero management ownership and zero otherwise.	Bureau van Dijk Orbis
Management Ownership (Dummy, Low)	Dummy variable that equals one if *Management Ownership* is below the median of sample firm with nonzero management ownership and zero otherwise.	Bureau van Dijk Orbis
Management Ownership (Dummy, Medium)	Dummy variable that equals one if *Management Ownership* is between the median and the 75th percentile of sample firm with nonzero management ownership and zero otherwise.	Bureau van Dijk Orbis
Management Ownership (Dummy, High)	Dummy variable that equals one if *Management Ownership* is above the 75th percentile of sample firm with nonzero management ownership and zero otherwise.	Bureau van Dijk Orbis
Economy traits		
Weekly Market Return	Weekly return on the stock market index for country *c* from the last trading day in week *t* - 1 to the last trading day in week *t*. We use the most representative market index in each country.	Thomson Reuters Datastream
COVID19 (Italy), Distance-wgt	For each country *c*, we use the growth of cases in Italy in week *t*, weighted by the inverse distance between country *c* and Italy.	JHU CSSE
COVID19 (China), Distance-wgt	For each country *c*, we use the growth of cases in China in week *t*, weighted by the inverse distance between country *c* and China.	JHU CSSE
#Weeks since 100th Case	Number of weeks since the number of confirmed COVID-19 cases in an economy reaches 100.	JHU CSSE
Lockdown	Sum of eight indicators of government containment and closure policies: closings of schools and universities, workplaces, canceling of public events, limits on private gatherings, closing of public transport, orders to shelter-in-place, restrictions on internal movement between cities or regions, and restrictions on international travel. We normalize each of the measures to range between zero and one, and we sum the eight measures for each country and time period.	Oxford COVID-19 Government Response Tracker
Fiscal Stimulus	First principal component of indicators on direct government cash payments to people who lose their jobs or cannot work, government-provided relief to households from financial obligations, and fiscal stimulus spending as a share of gross domestic product (GDP).	Oxford COVID-19 Government Response Tracker
Corporate Debt Purchase (Dummy)	Indicator that equals one for a country in the weeks after the government announced the purchase of corporate bonds and zero otherwise.	IMF Policy Tracker
Corporate Debt Purchase	Cumulative amount of government corporate bond purchases as of Friday of each week divided by the total amount of pre-pandemic corporate debt outstanding in the same country (in percentage).	IMF Policy Tracker; IMF Global Debt Database
Government Debt to GDP	Ratio of total government debt to GDP (in percentage), measured in 2017.	Global Financial Development Database
GDP per Capita	Natural logarithm of GDP per capita in 2018.	World Development Indicators
GDP Growth	Growth rate of GDP, measured in 2018.	World Development Indicators
%Population (Above Age 65)	Percentage of population above age 65 among the total population of an economy in 2018.	World Development Indicators
Civil Law	Indicator equals one if a country's legal heritage is civil law and zero if it has a common law legal tradition.	La Porta et al. (2008)
Social Norms	Indicator equals one if the country has both *Environmental Priority* and *Human Rights* score above the sample median and zero otherwise. *Environmental Priority* is the percentage of respondents prioritizing the environment to the economies. *Human Rights* measures the degree to which respondents consider that their countries respect human rights.	World Values Survey

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