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Covid-19 and Firms' Stock Price Growth: The Role of Market Capitalization

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Abstract

This paper studies the role of capitalization on firms' stock price growth in response to new cases of Covid-19 infections in the United States. Controlling for firm and time fixed effects, our panel model estimates show that the effect of new cases of Covid-19 infections on firms' stock price growth is significantly increasing in capitalization: For each one standard deviation increase in capitalization, a one standard deviation increase in new cases of Covid-19 infections increases the weekly growth rate of firms' stock prices by about 0.7 percentage points. Effects of capitalization on the impact that Covid-19 infections have on firms' stock price growth are largest in the travel, tourism, and hospitality sector. Smaller but still positive effects of capitalization are present in the pharmaceutical products, high-tech, and banking and finance sectors.

Key Words: Covid-19, performance of firms, stock market capitalization, U.S. stock market

JEL classification: G10, E30

1. Introduction

In this paper we explore the role of market capitalization on the stock price growth rate of firms in response to new cases of Covid-19 infections in the United States. A firm's market capitalization is likely to play an important role with regard to the impact that Covid-19 has on its stock price growth rate. One reason for why capitalization matters is that firms with more capital are more likely to survive when there is a major shock, such as Covid-19, that has wide-reaching effects on the economy. Investors anticipate the increase in the potential market share of large firms, and this leads to a more positive effect of Covid-19 on the stock price growth of those firms which are more capitalized. We will discuss, further below in the paper, a variety of other reasons for why capitalization could matter with regard to the effect that Covid-19 has on firms' stock price growth. The main contribution of our paper is mostly empirical in nature: using a large panel of firms listed on the U.S. stock market, we are, to the best of our knowledge, the first to provide estimates of how the impact of Covid-19 on firms' stock price growth differs across firms depending on capitalization.

There is some striking anecdotal evidence that suggests a role of capitalization on firms' stock price growth in response to the Covid-19 pandemic. Figure 1 shows the time-series of the Wilshire U.S. large-cap index and the Wilshire U.S. small-cap index during 2020. These indexes are considered the benchmark for the largest and smallest corporations by market capitalization in the United States. In the year 2020 the annual return for the Wilshire U.S. large-cap index was around 40%, while the annual return for the Wilshire U.S. small-cap index was around 18%.[1] These numbers imply that the annual return of the benchmark index of the largest

[1] Data for Wilshire U.S. large-cap and Wilshire U.S. small-cap are from Fred economic dataset: https://fred.stlouisfed.org/series/WILLLRGCAPPR, and https://fred.stlouisfed.org/series/WILLSMLCAPPR , respectively.

corporations for the year 2020 was more than twice as large as the annual return of the benchmark index of the smallest corporations. Another interesting stylized fact is that for the year 2020 the 4 largest corporations by market capitalization in the U.S. -- Microsoft, Google, Amazon, and Facebook – had very large positive stock price growth rates: 41%, 31%, 76% and 33%, respectively.

In the main part of our paper, we provide a rigorous econometric analysis of the effect that a firm's market capitalization has on its stock price growth rate in response to Covid-19 infections in the United States. The baseline econometric model that we estimate has as dependent variable the weekly stock price growth rate of a firm and as the main explanatory variable an interaction term between a firm's (beginning-of-sample) capitalization and weekly new cases of Covid-19 infections in the United States. In the most parsimonious version of our panel model, we control for firm and time fixed effects. We also estimate richer panel models that include a variety of time-varying control variables.

Estimates of our panel model show that the effect of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate is about 1.8 percentage points larger for a thickly capitalized firm (90th percentile of the sample distribution of capitalization) than for a thinly capitalized firm (10th percentile of the sample distribution of capitalization). This is large difference in the effect of Covid-19 infections on the stock price growth rate between thickly and thinly capitalized firms. The sample standard deviation of weekly stock price growth is about 18 percent. A 1.8 percentage point difference in the weekly stock price growth rate between thickly and thinly capitalized firms amounts to about 10 percent of the sample standard deviation of firms' stock price growth.

We also explore the role that capitalization has on effect of Covid-19 infections on the stock price growth rate of firms for specific sectors. Our panel model estimates show that effects of capitalization are particularly large for the travel, tourism, and hospitality sector;

followed by the pharmaceutical products sectors and high-tech sector. The smallest effect is in the banking and finance sector. Our panel model estimates show that in the travel, tourism and hospitality sector, a one standard deviation increase in Covid-19 infections increases the weekly stock price growth rate by about 3.4 percentage points more for a thickly capitalized firm than a thinly capitalized firm. For the other sectors, these differences between thickly and thinly capitalized firms are also positive, though smaller, amounting to 2.0 percentage points for pharmaceutical firms, 2.0 percentage points for high-tech firms, and 1.1 percentage points for firms operating in the banking and financial services sector.

The rest of the paper is organized as follows. Section 2 discusses related literature. Section 3 describes the model, data source, and variable specifications. Section 4 presents main empirical results. Section 5 presents robustness checks. Section 6 concludes.

2. Related Literature

This paper is related to two strands of literature. The first strand is the literature on the asymmetric impact of aggregate shocks on small and large firms (see for example Baslandze (2021), Crouzet and Mehrotra (2020), and Gertler and Gilchrist (1994)). The second strand is the very recent literature which argues that the Covid-19 pandemic is a reallocation shock (see for example, Barrero, Bloom and Davis (2020), Andrews, Charlton and Moore (2021a), Andrews, Charlton and Moore (2021b)).

Asymmetric impact of aggregate shocks on small vs. large firms

The empirical work in the literature that we discuss in the following paragraphs builds on the micro-foundations of theoretical work on the financial accelerator by Bernanke and Gertler (1989) and Bernanke, Gertler, and Gilchrist (1999). The theory begins with a partial-equilibrium analysis of the leader-borrower relationship in a two-period model. Assume that new funds borrowed (b_1) in period 0 and repaid in period 1 bearing a gross real interest rate (r_1), which are used to purchase the variable input (x_1) in period 1: $x_1 = a_0 f(x_0) + b_1 - r_0 b_0$, where $a_0 f(x_0)$ denotes the gross cash flow in period 0, a_0 a technology parameter, $f(\cdot)$ is an increasing and concave function, b_0 is the past borrowing, and r_0 the gross real interest rate in period 0. Suppose that the new funds (b_1) provided by the lender in period 0 is limited by the time-discounted market value of a fixed factor K: $b_1 \leq (q_1/r_1)K$, where q_1 refers to the market price of the fixed factor per unit in period 1. It then yields Equation (3) in Bernanke and Gertler (1989) as follows:

$$x_1 \leq a_0 f(x_0) + (q_1/r_1)K - r_0 b_0, \tag{1}$$

which shows that the firm's purchase cannot exceeds its net worth, the imbalance of asset ($a_0 f(x_0) + (q_1/r_1)K$) and liability ($r_0 b_0$).

The model implies that adverse shocks on the economy drive the reallocation of credit in downturns from low net-worth to high net-worth borrowers (see Bernanke and Gertler (1989), Bernanke and Gertler (1990), and Calomiris and Hubbard (1990)). The reallocation likely results in a 'flight to quality' that causes investors to stay away from the high-risk small firms and switch toward relatively safer large firms (see Bernanke and Gertler (1989), Perez-Quiros and Timmermann (2000)).

Gertler and Gilchrist (1994) report that small firms are less collateralized than large firms on average. Therefore, small firms are more vulnerable during periods of economic downturns. Gertler and Gilchrist's (1994) analysis builds on the theoretical framework of Bernanke and Gertler (1989), and Bernanke, Gertler, and Gilchrist (1999). These models illustrate how macroeconomic shocks can be amplified by procyclical financial frictions. Gertler and Gilchrist (1994) employ quarterly data of small and large manufacturing U.S. firms from 1958Q1 to 1985Q4 to study the impact of monetary tightening. Their empirical results show that small firm's contraction is disproportionally larger than for large firms after monetary tightening.

Recently, Crouzet and Mehrotra (2020) studied how sales, inventories and investment of small and large firms respond to business cycles using quarterly microdata data from the U.S. Census Bureau's Quarterly Financial Report from 1977 to 2014. Their empirical results show that the top 1 percent largest firms are significantly more resilient to gross domestic product (GDP) contractions.

An alternative interpretation of why large firms respond less to aggregate shocks is that large firms pursue non-productive strategies that give them an advantage over small firms. These strategies include political connections, non-productive-patenting and anti-competitive acquisitions. A discussion of such non-productive strategies is provided in Baslandze (2021).

Covid-19: A reallocation shock

Cutter and Thomas (2020) argue that because of the Covid-19 pandemic, well-capitalized companies have an opportunity to hire high skilled workers from small firms which have run out of capital. Barrero, Bloom, and Davis (2020) develop a novel forward-looking allocative measure with firm-level expectation data from the survey of business uncertainty for jobs and sales. Their study shows that from February to April 2020, the expected excess reallocation rates were 2.4 times higher than for the pre-Covid-19 levels.

Andrews, Charlton, and Moore (2021a) estimate the change in employment at the firm level since the start of the pandemic in early 2020 using data for Australia, New Zealand, and the United Kingdom. They find that high productivity firms were more likely to expand than low productivity firms. Andrews, Charlton, and Moore (2021b) document that tech-savvy firms (defined as firms that were connected to 5 or more apps before the pandemic) experience higher employment growth than firms that were connected to less than 5 apps.

Baker et al. (2020) focus on the early stage of the Covid-19 pandemic (until April 2020) and compare the impact of Covid-19 to previous pandemics on the stock market. This study captures mostly the initial plunge of the U.S. stock market. The results in Baker et al. (2020) suggest that the shutdown of commercial activities and social distancing restrictions imposed by the U.S. government are the main reason for the unprecedented decline in the U.S. stock market in early 2020.

3. Econometric model and data sources

3.1. The Econometric Model

We use the following econometric model to estimate the impact that a firm's market capitalization has on its stock price growth in response to Covid-19 infections in the U.S.:

$$P_{i,t} = A_i + B_t + \beta_1 Covid19_t \times Capitalization_i + \sum_{k=2}^{K} \beta_k Controls_{k,t} + \varepsilon_{i,t}, \quad (2)$$

where $P_{i,t}$ denotes the growth rate of the stock price of firm i in a week (day) t. $Covid19_t$ refers to new cases of registered Covid-19 infections in the U.S. $Capitalization_i$ is the stock market capitalization of firm i at the beginning of the sample period (January 1 in 2020). A_i are firm fixed effect. B_t are time fixed effects. $Controls_{k,t}$ are control variables, and the error term is $\varepsilon_{i,t}$. (Note that in the panel data model, we exclude the time fixed effects B_t when the model includes $Controls_{k,t}$.) We present the regression coefficients and their standard errors that are Huber robust and clustered at the firm level.

In equation (2) the coefficient of interest is β_1. This coefficient measures the differential impact of Covid-19 on the stock price growth of a firm depending on the firm's capitalization. To see this, differentiate equation (2) with regard to Covid-19. This yields $\partial P_{i,t}/\partial Covid19_t = \beta_1 * Capitalization_i$

3.2. Data

Our baseline empirical analysis uses weekly data. In a robustness check, we will present results for daily data. We use weekly data rather than daily data as our baseline since there is a possible time-lag in reporting Covid-19 infections. Weekly data is likely less subject to this type of measurement error.

The sample period is from January 1, 2020, to April 31, 2020, in all estimations except for the results Table 2 in which the sample covers the period from January 1 in 2020 to January 31 in 2021. We use the period January 1, 2020, to April 31, 2020 as our baseline because this is the time period of the first major outbreak of Covid-19 infections in the U.S. (see Figure 1B). The dependent variable in the econometric model is the weekly (or daily) growth rate of firms' stock prices. The beginning-of-sample stock market capitalization of a firm is defined as the product of shares outstanding and stock prices as of January 1 in 2020. We obtain firm-level financial variables for publicly traded companies from the Standard and Poor's Compustat daily database. We handle missing values by listwise deletion and winsorize continuous firm-level variables at the 1st and 99th percentiles to reduce the impact of extreme outliers. We exclude daily stock price growth rates with absolute values greater than 100%.

We draw Coronavirus (Covid-19) data from *Our World in Data* developed by Roser, *et al* (2020),[2] including the new cases of U.S. registered Covid-19 infections, the number of Covid-19 deaths, number of Covid-19 tests, the number of global Covid-19 infections, and a stringency index that measures restrictions imposed by the U.S. in response to Covid-19.

Other control variables are the MSCI World Index, weekly economic activity in the US, and weekly M2 in the United States. The MSCI World Index is a proxy of global stock market activity.[3] We obtain weekly economic activity and weekly M2 money supply from the Federal Reserve Economic Database.[4]

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[2] The data is available at https://ourworldindata.org/coronavirus-data. Note that the stringency index is defined as contained 9 measures of government restrictions: school closures, workplace closures, cancellation of public events, restrictions on public gatherings, closures of public transport, stay-at-home requirements, public information campaigns, restrictions on internal movements, and international travel controls.

[3] The data is available at https://www.msci.com/developed-markets.

[4] The data is available at https://fred.stlouisfed.org/series/WEI and https://fred.stlouisfed.org/series/M2.

4. Empirical results

In Table 1 we present our baseline estimates of equation (1). The sample period is January 1, 2020, to April 30, 2020. The frequency is weekly. In the estimated equation (1) the coefficient of interest is β_1, i.e. the coefficient on the interaction between Covid-19 infections and firms' capitalization, $Covid19_t \times Capitalization_i$. In column (1) of Table 1 we present estimation results for a model that includes both firm and time fixed effects. In columns (2) to (5), we show estimation results for a model that includes firm fixed effects and time-varying control variables that are common across firms (and hence, we do not include in the model time fixed effects.).

Across all specifications of Table 1 the estimated coefficients on the interaction term $Covid19_t \times Capitalization_i$ are positive and significantly different from zero at the 1 percent level. The positive coefficients on the interaction term mean that the effect of Covid-19 infections on firms' stock price growth is increasing in capitalization. Quantitatively, the estimated effect is sizable. Consider, for example, the estimate of β_1 in column (1) of Table 1. In column (1) of Table 1, β_1 is 2.96 and has a standard error of 0.13. One way to interpret this estimated coefficient is in terms of standard deviations. According to the estimates in column (1) of Table 1, a one standard deviation (1.71) increase in $Covid19_t \times Capitalization_i$ increases the weekly growth rate of firms' stock prices by around 0.19 standard deviations. For each one standard deviation increase in $Capitalization_i$ (0.027), a one standard deviation increase in $Covid19_t$ increases the weekly growth rate of firms' stock prices by about 0.7 percentage points.

That the estimated effects in Table 1 are economically large and meaningful becomes apparent by considering how the effect of a one standard deviation (8.84) increase in $Covid19_t$ on the growth rate of firms' stock prices differs across firms' capitalization. Formally, this difference in effect can be obtained by taking the difference of the following two derivatives, which are evaluated at two different values of firms' capitalization, θ and ϑ, respectively:

$$\frac{\partial(Growth_{it})}{\partial Covid19_t}|_{Capitalization_i=\theta} - \frac{\partial(Growth_{it})}{\partial Covid19_t}|_{Capitalization_i=\vartheta} = 8.84 \times \beta_1 \quad \times (\theta \quad - \vartheta \quad) \quad (3)$$

Consider two hypothetical firms: one at the 10th percentile of the sample distribution of capitalization (which we will refer to as a "thinly capitalized firm") and another firm at the 90th percentile of the sample distribution of capitalization (which we refer to as a "thickly capitalized firm"). According to the estimates in column (1) of Table 1, the effect of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate is about 1.79 percentage points larger for a thickly capitalized firm than for a thinly capitalized firm. This is a large difference in effect that Covid-19 infections have on the stock price growth rate between thin and thickly capitalized firms. The difference in effect between firms with thin and thick capitalization amounts to about 0.1 standard deviations of the weekly growth rate of stock prices during the sample period on which the econometric model is estimated.

Columns (2)-(5) of Table 1 report estimates from a model that includes firm fixed effects and time-varying control variables that are common across firms. In these model specifications we do not include time fixed effects since the time fixed are perfectly collinear with the time-varying controls common across firms.

Column (2) of Table 2 shows estimates of the interaction model that includes a linear term of $Covid19_t$ and no time fixed effects. Comparing columns (1) and (2), one see that the estimated coefficient on the interaction term $Covid19_t \times Capitalization_i$ is similar in the two model specifications. In column (2) the estimated coefficient on $Covid19_t$ is negative and significantly different from zero at the conventional significance levels. Economically, the negative coefficient on $Covid19_t$ means that, for thinly capitalized firms, covid-19 infections have a significant negative effect on stock price growth. Specifically, in column (2) of Table 1, the estimated coefficient on $Covid19_t$ is -0.20 and has a standard error of 0.04. One way to interpret this coefficient is as follows: when $Capitalization_i$ is equal to zero, a one standard deviation increase in $Covid19_t$ decreases the weekly stock price growth rate by around 0.18 percentage points.

There is no firm in the sample with $Capitalization_i$ equal to zero. But take, for example, a thinly capitalized firm at the 10th percentile of the sample distribution (where $Capitalization_i$ is equal to 0.155). For that particular firm, the estimates in column (2) of Table 1 imply that a one standard deviation increase in $Covid19_t$ increases the weekly stock price growth rate by 1.9 percentage points. In contrast, for a thickly capitalized firm the effect of new cases of Covid-19 on its stock price growth is much larger: According to the estimates in column (2) of Table 2, for a firm with capitalization at the 90th percentile of sample distribution (where $Capitalization_i$ is equal to 0.224), a one standard deviation increase in $Covid19_t$ increases the weekly stock price growth rate by about 3.5 percentage points. Hence, for a thickly capitalized firm the effect on its weekly stock price growth rate of a one standard deviation increase in Covid19 infections is about 1.6 percentage points larger than for a thinly capitalized firm.

Column (3) shows that the estimates are robust to including in the model controls for the number of Covid-19 deaths as well as two additional interactions between Covid-19 infections and firm-specific characteristics: a dummy variable that is unity for firms in the high-tech sector and a dummy that is unity for labor-intensive firms. [5] In column (3), the estimated coefficient on Covid-19 deaths is positive and significantly different from zero. This means that, on average, Covid-19 deaths have a significant positive effect on firms' stock price growth. This result is similar to what our interaction model yields for the effect of Covid-19 infections

[5] The high-tech dummy is equal to unity for firms doing business equipment, telephone, and television transmission and 0 otherwise. The labor-intensive dummy is equal to unity for firms in the airline, hotel, and delivery services and 0 otherwise. The classification is based on the industrial classification of the Fama-French library.

when setting capitalization equal to the sample average: for a firm with average capitalization, Covid-19 infections have a significant positive effect on stock price growth. The estimated coefficients on the interactions between Covid-19 infections and the dummy for high tech and the dummy for labor-intensive industries suggest that, conditional on capitalization, Covid-19 infections have a more positive effect on stock price growth on high-tech firms and those firms that operate with a relatively higher labor intensity.

Column (4) adds to the model squared terms of Covid-19 infections and Covid-19 deaths. One can see that in this model specification the estimated coefficient on the interaction between Covid-19 infections and capitalization continues to be positive and significantly different from zero at the 1 percent significance level. The estimated coefficients on the squared terms of Covid-19 infections and Covid-19 deaths are positive and significantly different from zero at the 1 percent significance level.

Column (5) adds to the model a stringency index and its interaction with capitalization. The estimated coefficients on the stringency index and the interaction between the stringency index and capitalization are negative; individually, each of these estimated coefficients is significantly different from zero at the 1 percent significance level. This suggests that lockdown policies had a significant negative effect on firms' stock price growth, and more so for thickly capitalized firms. One can also see from column (5) that the estimated coefficients on Covid-19 infections and the interaction between Covid-19 infections and capitalization are positive and significantly different from zero at the 1 percent significance level. Thus, Covid-19 infections have a significant positive effect on firms' stock price growth, more so for thickly capitalized firms, and these effects of Covid-19 on firms' stock price growth are present over and beyond any association that may exist between new cases of Covid-19 infections and the severity of lockdown policies.

We note that the R-squared in column (1), where we included both firm and time fixed effects, is 0.25. In columns (2)-(5), the R-squared is around 0.11 to 0.21, which is smaller than the R-squared in column (1). This suggests that the time fixed effects account for a large share of the variation of the dependent variable, over and beyond standard time-varying variables that are common across firms. The reason why we report in columns (2)-(5) estimates of a model that includes time-varying variables common across firms as controls (and no time fixed effects) is to see how this affects the estimated coefficient on the interaction between $Covid19_t$ (which is a time-varying variable common across firms) and $Capitalization_i$ (which is a firm-specific variable measured at the beginning of the sample, and thus time-invariant). Our preferred model specification is the one that includes both time and firm fixed effects.

Table 2 presents estimates of our baseline econometric model for different time periods. In column (1) of Table 2 the time period is January 1 in 2020 to March 31 in 2020. In column (2) the time period is January 1 in 2020 to April 30 in 2020. We add an additional month to the time span in each column. In the last column of Table 2, i.e. column (11), the time period is January 1 in 2020 to January 31 in 2021. One can see from Table 2 that the estimated coefficients on the interaction term $Covid19_t \times Capitalization_t$ are positive and significantly different from zero at the 1 percent level for all time periods.

Based on the estimates in Table 2, Figure 2 plots the difference in the effect between thickly and thinly capitalized firms of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate. For the solid (dashed) line in Figure 2, thickly capitalized firms are defined as those firms with a market capitalization at the 90^{th} (75^{th}) percentile of the sample distribution; thinly capitalized firms are defined as those firms with a market capitalization at the 10^{th} (25^{th}) percentile of the sample distribution of market capitalization.

The largest difference in effect is during the time period from January 1 in 2020 to April 30 in 2020. This is the time period that ends in the month April, which is the month during 2020 when the first Covid-19 wave hit the US (see Figure 1B). One way to interpret this result is that Covid-19 had a surprise effect. A surprise effect, in the sense, that new cases of Covid-19 infections were totally new: there were near zero cases of Covid-19 infections in the US in the months preceding April 2020. Thickly capitalized firms were more positively affected by Covid-19 than thinly capitalized firms, and the difference in effect between thickly and thinly capitalized firms is particularly large when the first wave of Covid-19 infections hit the U.S.

Table 3 shows that our baseline estimates are robust to splitting the sample into firms with above median capitalization and firms with below median capitalization. For comparison purposes, we report in column (1) of Table 3 estimates of the interaction model for the full sample. From column (2) of Table 3, one can see that the estimated coefficient on the interaction term $Covid19_t \times Capitalization_i$ is positive and significantly different from zero at the 1 percent level in the sample of firms with below median capitalization. Specifically, for the sub-sample of firms with below median capitalization, the estimated coefficient on the interaction term is 2.83 and has a standard error of 0.18. This estimated coefficient on the interaction term for sub-sample of firms with below median capitalization is similar, both quantitatively and statistically, to the coefficient on the interaction term that is estimated in the full sample (see column (1)). Column (3) of Table 3 shows that when the model is estimated on the sub-sample of firms with above median capitalization, the coefficient on $Covid19_t \times Capitalization_i$ is 2.91 and has a standard error of 0.21.

Quantitatively, the estimates in columns (2) and (3) of Table 3 can be interpreted as follows. For the sub-sample of firms with below median capitalization, a one standard deviation increase in $Covid19_t \times Capitalization_i$ increases the weekly stock price growth rate by 4.3 percentage points. For the sub-sample of firms with above median capitalization, a one standard deviation increase in $Covid19_t \times Capitalization_i$ increases the weekly stock price growth rate by 5.5 percentage points.

4.2. Firm-level estimates for different sectors

Table 4 reports estimates of our baseline econometric model for different sectors. The sectors that we focus on are: (i) banking and financial services; (ii) high-tech; (iii) pharmaceutical products; and (iv) travel, tourism, and hospital. Columns (1)-(4) of Table 4 report estimates of our baseline econometric model when the sample includes only those firms in a specific sector. Column (1) of Table 4 shows estimates of our baseline econometric model for firms in the banking and financial services sector. Estimates for firms in the high-tech sector, the pharmaceutical products sector, and the travel, tourism, and hospital sector are shown in columns (2), (3), and (4), respectively. All estimates in Table 4 are for the period January 1 in 2020 to April 30 in 2020. Control variables are firm and time fixed effects.

From Table 4, one can see the estimated coefficient on the interaction term $Covid19_t \times Capitalization_t$ is positive and significantly different from zero for all four sectors. This suggests that, qualitatively, capitalization mattered for the effect that Covid-19 has on a firm's stock price growth rate in all four sectors. Thickly capitalized firms experienced larger stock price growth rates in response to an increase in Covid-19 infections in the U.S. than thinly capitalized firm. And this is so regardless of whether a firm was located in the banking and financial services sector, the high-tech sector, the pharmaceutical products sector, or the travel, tourism, and hospital sector.

Quantitatively, the estimates in Table 4 show that capitalization mattered most in the travel, tourism, and hospitality sector. Column (4) of Table 4 shows that when the model is estimated on the sample of firms in the travel, tourism, and hospitality sector, the estimated coefficient on the interaction term $Covid19_t \times Capitalization_t$ is 4.6. For comparison, in the other sectors, see columns (1)-(3), the estimated coefficients on the interaction term are 2.7, 2.6, and 3.8, respectively. Differences in capitalization of firms in the travel, tourism, and hospitality sector implied larger differences in the response of firms' stock price growth rate to

Covid-19 infections in the U.S. than in other sectors. Specifically, the estimates in column (4) of Table 4 imply that in the travel, tourism and hospitality sector a one standard deviation increase in Covid-19 infections increases the weekly stock price growth rate by about 3.4 percentage points more for a thickly capitalized firm than a thinly capitalized firms. For the other sectors, these differences between thickly and thinly capitalized firms are also positive, though smaller, amounting to 2.0 percentage points for pharmaceutical firms, 2.0 percentage points for high-tech firms, and 1.1 percentage points for banking and financial firms.

Statistically, it is important to note that, at the conventional significance levels, we reject the hypothesis that the effects of capitalization on the response of firms' stock price growth to Covid-19 infections in the U.S. is the same across sectors. The p-value in column (5) of Table 4 from a Wald test on the joint hypothesis that the coefficients on the interaction terms in columns (1)-(4) are the same is less than 0.001.

Figure 3 shows the difference in the effects of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate between thickly and thinly capitalized firms, across sectors and over time. Figure 3 is similar to Figure 2, with the only difference that the underlying sample on which Figure 3 is based on is the sub-sample of firms in each of the four sectors.

4.2.1 *The role of stock market capitalization across industries: Alternative definition for thinly and thickly capitalized firms*

Our benchmark definition of a thickly (thinly) capitalized firm was a firm at the 90^{th} (10^{th}) percentile of the sample distribution of capitalization. This was our benchmark definition when we discussed the magnitude of the estimated effects in the previous sections. In this sub-section we discuss the magnitude of the estimated effects using an alternative definition of thickly and thinly capitalized firms: the 75^{th} and 25^{th} percentile of the sample distribution of capitalization.

Table 5 displays the relevant results. Specifically, the numbers in column (1) of Table 5 are based on the estimates in column (1) of Table 1, columns (2)-(5) of Table 5 are based on the estimates in columns (1)-(4) of Table 4, respectively.

The numbers in Table 5 should be read as follows. On average, across all firms, a one standard deviation increase in Covid-19 infections increases the weekly stock price growth rate by about 1.0 percentage points more for a firm at the 75th percentile of capitalization than for a firm at the 25th percentile of capitalization. For the banking and financial service sectors, a one standard deviation increase in Covid-19 infections increases the weekly stock price growth rate by about 0.7 percentage points more for a firm at the 75th percentile of capitalization than for a firm at the 25th percentile of capitalization. For the high-tech sector, a one standard deviation increase in Covid-19 infections increases the weekly stock price growth rate by about 1.2 percentage points more for a firm at the 75th percentile of capitalization than for a firm at the 25th percentile of capitalization. For the pharmaceutical products sector, a one standard deviation increase in Covid-19 infections increases the weekly stock price growth rate by about 1.1 percentage points more for a firm at the 75th percentile of capitalization than for a firm at the 25th percentile of capitalization. For the travel, tourism, and hospital sector, a one standard deviation increase in Covid-19 infections increases the weekly stock price growth rate by about 1.5 percentage points more for a firm at the 75th percentile of capitalization than for a firm at the 25th percentile of capitalization.

5. Robustness

In section 5.1, we show that our results are robust to controlling for additional variables that are proxies for firms' elasticity of demand, productivity, and financial constraints. In section 5.2, we show that our results are robust to estimating our baseline model on daily data.

5.1 Controlling for proxies of firms' elasticity of demand, productivity, and financial constraints

The literature emphasizes a variety of mechanisms of the size effect on the performance of firms on the stock market, for example, the elasticity of demand (e.g., Bloom et al. (2007)), productivity (e.g., Andrews et al. (2021a, 2021b)), and financial frictions (e.g., Crouzet and Mehrotra (2020)). In the robustness analysis that follows the logarithm of the ratio of sales to capital is a proxy for the long-run elasticity of demand; the logarithm of the ratio of sales to numbers of workers is a proxy for productivity; the ratio of debt to assets is a proxy for leverage; the ratio of cash to assets is a proxy for liquidity; and the ratio of market price to earnings per share and the ratio of market price to book value per share are proxies for the market value, using the annual data ending in December in 2019.

The main finding, see the estimates in Table 6, is that including in the model interaction terms between Covid-19 and proxies for the elasticity of demand, productivity, and financial constraints continue to yield a significant positive coefficient on the interaction term $Covid19_t \times Capitalization_t$. The estimates in Table 6 suggest that market capitalization affects the impact of Covid-19 on firms' stock price growth over and beyond the relation that market capitalization may have with the standard proxies used in the literature for firms' elasticity of demand, productivity, and financial constraints.

5.2 Daily data

We have also checked robustness of our results with regarding to using daily data. Column (1) of Table 7 shows estimates of our baseline interaction model using daily data and including as controls firm and time fixed effects. The remaining columns of Table 7 show estimates of the interaction model when controlling for firm fixed effects and (instead of time fixed effects) a variety of variables that are time-varying and common across firms, such as new daily cases of Covid-19 infections in the US, new daily Covid-19 deaths, a hi-tech dummy × Covid-19, a labor-intensive dummy × Covid-19, the squares of Covid-19 infections and Covid-19 deaths, a stringency index, Covid-19 tests, global Covid-19 infections excluding the U.S., and the global stock market return. All estimates in Table 7 are for the time period January 1 in 2020 to April 30 in 2020.

One can see from columns (1) – (15) of Table 7, that throughout all specifications, the estimated coefficient on the interaction term $Covid19_t \times Capitalization_t$ is positive and significantly different from zero at the 1 percent significance level. Using daily data yields an estimated coefficient on the interaction term $Covid19_t \times Capitalization_t$ that is similar to what we obtained in our baseline using weekly data. For example, in column (1) of Table 7 the estimated coefficient on $Covid19_t \times Capitalization_t$ is 2.72; in column (1) of Table 1 the estimated coefficient on $Covid19_t \times Capitalization_t$ is 2.96.

Some additional results that are visible from Table 7 are as follows. The estimated coefficient on the stringency index is negative and significantly different from zero at the 1 percent significance level. This suggests that lockdown policies had a negative effect on firms' stock price growth. Another interesting result is that the rise in the new cases of global Covid-19 infections excluding the U.S. adversely affected the stock market performance in the U.S. The estimated coefficient on the global stock market return is positive and significantly different from zero at the 1 percent significance level, which is consistent with the view of significant positive spillovers of stock markets across countries (see also Narayan, et al. (2011)).

6. Conclusion

This paper examined the role of market capitalization on firms' stock price growth in response to Covid-19 infections in the United States. Our panel model estimates showed that firms' capitalization plays an important role in the impact of Covid-19 on the stock price growth of firms. New cases of Covid-19 infections have a more positive effect on the stock price growth rate of firms with more capital. Effects of capitalization on the impact that Covid-19 infections have on firms' stock price growth are significantly positive in all sectors, with the largest effect in the travel, tourism, and hospitality sector.

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Figure 1A. Wilshire U.S. large-cap price index and Wilshire U.S. small-cap price index (January 2020=100), weekly data (January 1, 2020 - January 1, 2021)

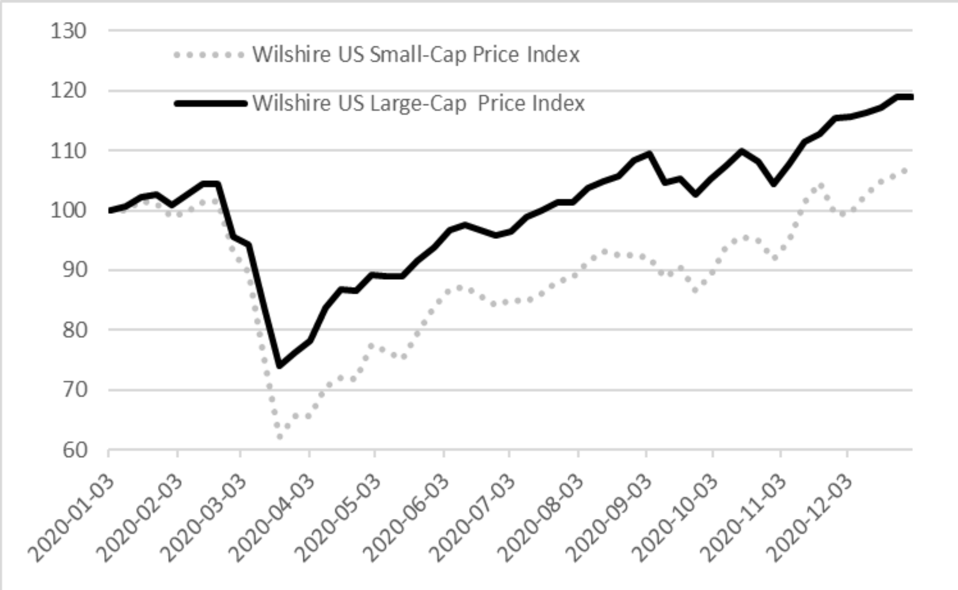
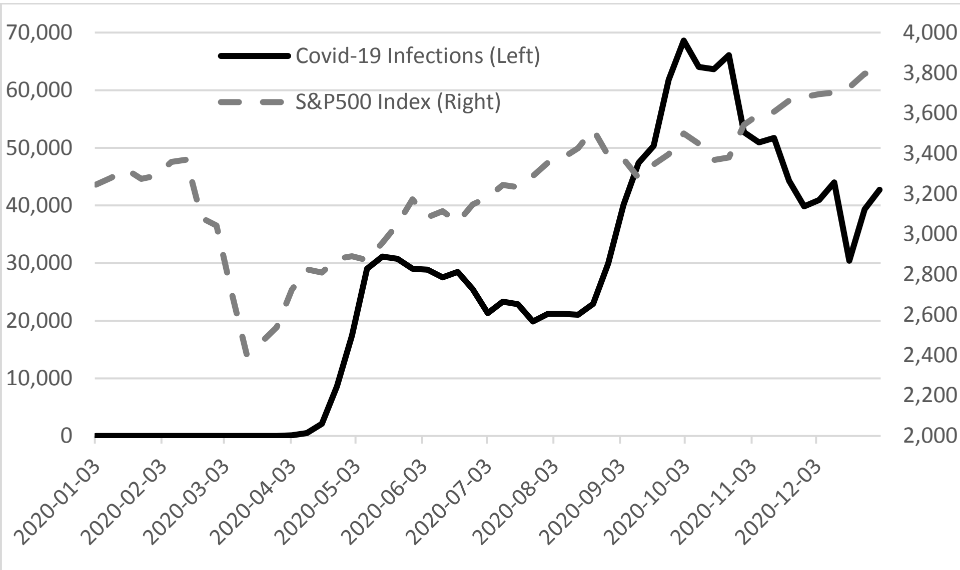
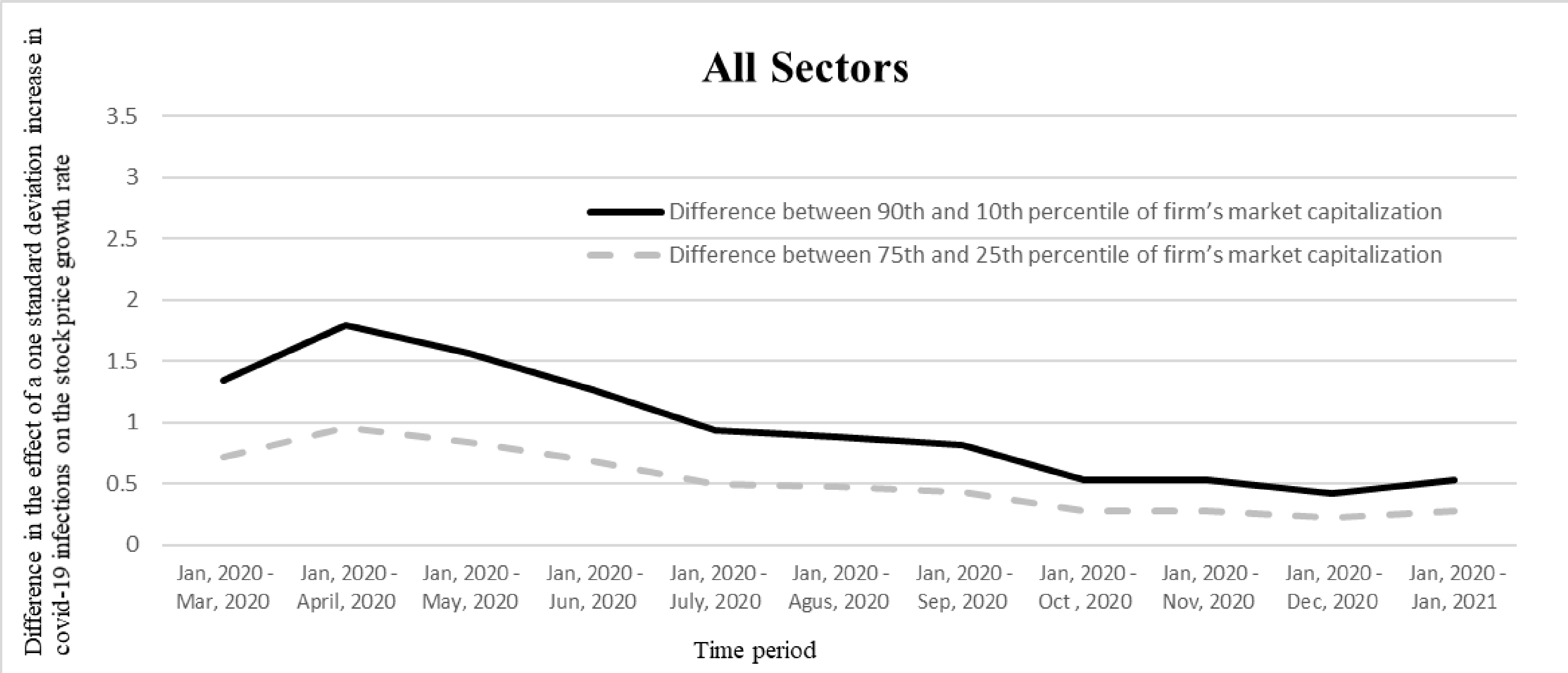


Figure 1B. Stock market index and Covid-19 infections, weekly data (January 1, 2020 - January 1, 2021)



Notes: Figure 1A shows weekly Wilshire U.S. large-cap price index and weekly Wilshire U.S. small-cap price index using January 2020=100 from January 1 in 2020 to January 1 in 2021. Figure 1B shows weekly U.S. stock market S&P500 index and Covid-19 infections from January 1 in 2020 to January 1 in 2021.

Figure 2. Differences in the effects of Covid-19 infections on the stock price growth rate between thickly and thinly capitalized firms across different time periods



Notes: The figure plots the difference in the effect between thickly and thinly capitalized firms of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate. For the solid (dashed) line, thickly capitalized firms are defined as those firms with a market capitalization at the 90^{th} (75^{th}) percentile of the sample distribution; thinly capitalized firms are defined as those firms with a market capitalization at the 10^{th} (25^{th}) percentile of the sample distribution of market capitalization. The computed effects that are plotted in the figure are based on the estimates in Table 2.

Figure 3. Differences in the effects of Covid-19 infections on the stock price growth rate between thickly and thinly capitalized firms across different time periods

(a) (b)

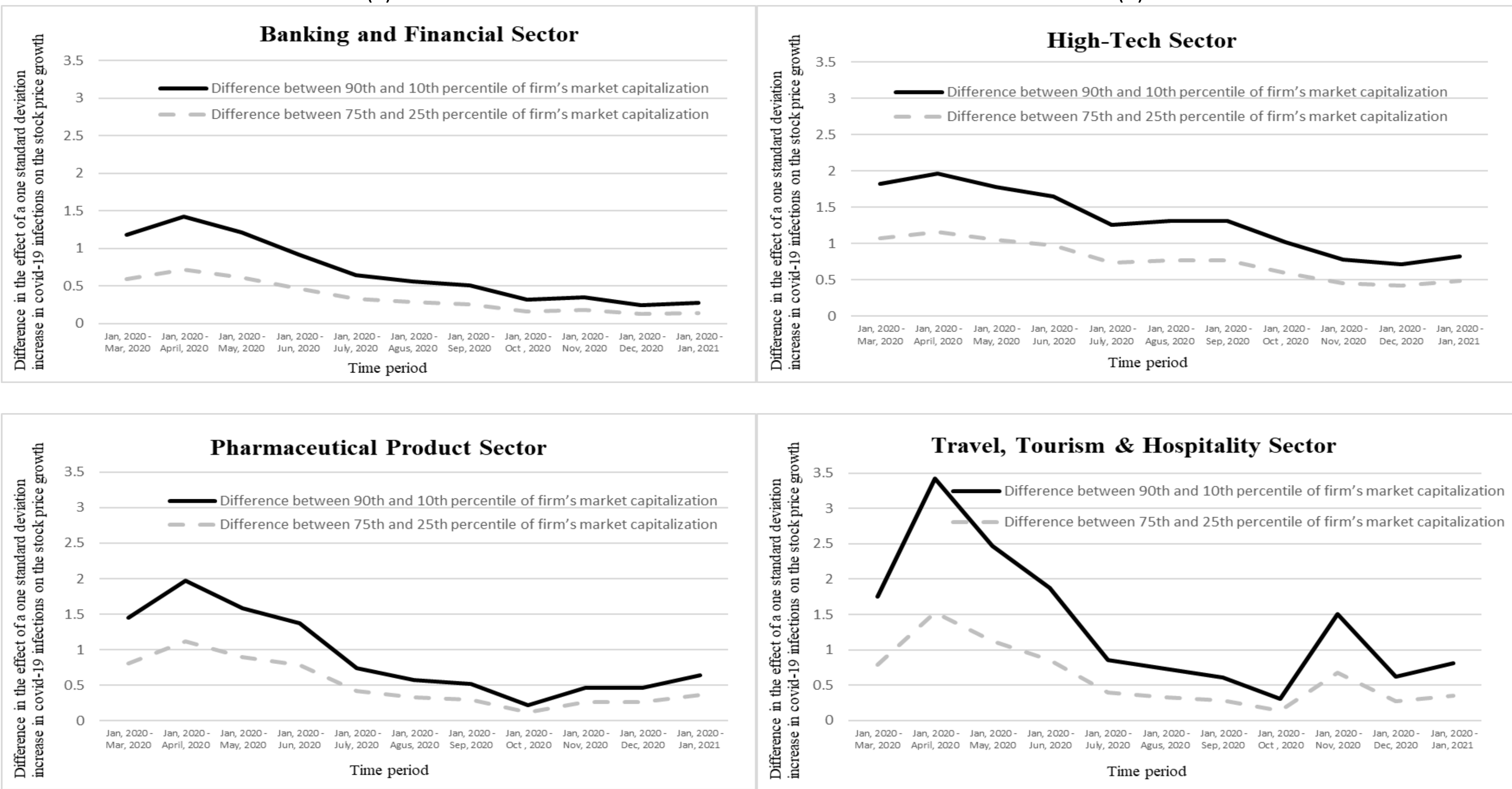


Table 1. Covid-19, capitalization, and firms' stock price growth (baseline estimates)

Dependent variable: Growth rate of stock prices (Y_{it})

	(1)		(2)		(3)		(4)		(5)	
Covid-19$_t$×Capitalization$_i$	2.9576	***	2.6655	***	2.6455	***	2.0475	***	3.5933	***
	(0.132)		(0.219)		(0.220)		(0.219)		(0.427)	
Covid-19 infection$_t$			-0.2036	***	-0.2339	***	2.9562	***	8.3417	***
			(0.044)		(0.046)		(0.095)		(0.150)	
Covid-19 death$_t$					0.0047	**	-1.3969	***	-2.1297	***
					(0.002)		(0.036)		(0.040)	
HiTech dummy×Covid-19$_t$					0.0264	*	0.0354	***	0.0412	***
					(0.014)		(0.015)		(0.015)	
Labor-intensive dummy×Covid-19$_t$					0.1714	***	0.1858	***	0.1879	***
					(0.064)		(0.067)		(0.069)	
Square of Covid-19 death$_t$							0.0059	***	0.0091	***
							(0.000)		(0.000)	
Square of Covid-19 infection$_t$							0.0297	***	-0.1057	***
							(0.002)		(0.003)	
Stringency$_t$									-0.2457	***
									(0.022)	
Stringency$_t$×Capitalization$_i$									-0.5224	***
									(0.108)	
No. of observations	126,015		126,015		126,015		126,015		126,015	
Firm fixed effect	yes		yes		yes		yes		yes	
Time fixed effect	yes		no		no		no		no	
R-Squared	0.25		0.11		0.11		0.13		0.21	

Notes: In the table, values in the parenthesis are Huber robust standard errors of regression coefficients clustered by firms. ***, ** and * denotes significance at the 1%, 5% and 10% level, respectively.

Table 2. Estimates for different time periods

Dependent variable: Growth rate of weekly stock prices (Y_{it})

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
From Jan. 2020 to	Mar. 2020	Apr. 2020	May 2020	Jun. 2020	Jul. 2020	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021
Covid-19_t×$Capitalization_i$	6.6941***	2.9576***	2.5442***	1.9972***	0.9255***	0.8509***	0.8078***	0.4772***	0.2699***	0.1486***	0.1559***
	(0.365)	(0.132)	(0.106)	(0.089)	(0.057)	(0.047)	(0.041)	(0.034)	(0.015)	(0.011)	(0.009)
No. of observations	94,187	126,015	162,736	194,091	231,290	262,008	293,103	330,018	360,655	392,056	424,493
Firm fixed effect	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time fixed effect	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
R-Squared	0.29	0.25	0.22	0.20	0.18	0.16	0.15	0.14	0.14	0.13	0.12

Notes: In the table, values in the parenthesis are Huber robust standard errors of regression coefficients clustered by firms. ***, ** and * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 3. Sample split: Above and below median capitalization

Dependent variable: Growth rate of stock prices (Y_{it})

	All Firms	Below Median Capitalization	Above Median Capitalization
	(1)	(2)	(3)
Covid-19_t×$Capitalization_i$	2.9576***	2.8330***	2.9079***
	(0.132)	(0.184)	(0.207)
No. of observations	126,015	63,005	63,010
Firm fixed effect	yes	yes	yes
Time fixed effect	yes	yes	yes
R-Squared	0.25	0.18	0.44

Notes: In the table, values in the parenthesis are robust standard errors of regression coefficients clustered by firms. ***, ** and * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 4. Estimates for different industries

Dependent variable: Growth rate of stock prices (Y_{it})					
	(1)	(2)	(3)	(4)	(5)
Covid-19$_t$×Capitalization$_i$ for banking/financial firms	2.7430***				2.6843***
	(0.140)				(0.146)
Covid-19$_t$×Capitalization$_i$ for high-tech firms		2.5804***			3.046***
		(0.425)			(0.158)
Covid-19$_t$×Capitalization$_i$ for pharmaceutical product firms			3.7555***		3.360***
			(0.596)		(0.170)
Covid-19$_t$×Capitalization$_i$ for travel, tourism & hospitality firms				4.6146***	3.6690***
				(1.115)	(0.208)
No. of observations	62,505	14,057	11,190	1,980	89,732
Firm fixed effect	yes	yes	yes	yes	yes
Time fixed effect	yes	yes	yes	yes	yes
R-Squared	0.34	0.22	0.20	0.39	0.27
Wald statistics (p-value)					< 0.001

Notes: In the table, Column (1) shows the estimates of banking/financial firms, Column (2) the estimates of high-tech firms, Column (3) the estimates of pharmaceutical product firms, Column (4) the estimates of travel, tourism & hospitality firms. In column (5) we add indicator variables interacted with Covid-19$_t$×Capitalization$_i$, where the indicator variables are unity for firms in a specific sector. Values in the parenthesis are robust standard errors of regression coefficients clustered by firms. ***, ** and * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 5. The difference in the effects between thickly and thinly capitalized firms of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate

	Full sample	Banking/financial firms	High-tech firms	Pharmaceutical product firm	Travel, tourism & hospitality firms
Difference in the effect of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate between firms at the					
• 90^{th} and 10^{th} percentile of market capitalization	1.79	1.42	1.96	1.97	3.42
• 75^{th} and 25^{th} percentile of market capitalization	0.96	0.72	1.16	1.12	1.53

Note: The table shows the difference in the effect between thickly and thinly capitalized firms of a one standard deviation increase in Covid-19 infections on the weekly stock price growth rate. Thickly capitalized firms are defined as those firms with a market capitalization at the 90^{th} (75^{th}) percentile of the sample distribution, thinly capitalized firms are defined as those firms with a market capitalization at the 10^{th} (25^{th}) percentile of the sample distribution of market capitalization.

Table 6. Models with additional interaction terms

Dependent variable: Growth rate of stock prices (Y_{it})

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Covid-19$_t$×Capitalization$_i$	2.4058***	2.3195***	2.1184***	2.4062***	2.4238***	2.4136***	2.4085***	2.0351***
	(0.362)	(0.371)	(0.360)	(0.362)	(0.362)	(0.361)	(0.362)	(0.361)
Covid-19$_t$×Log of Sales$_i$/Capital$_i$		0.0030						0.0024
		(0.003)						(0.003)
Covid-19$_t$×Log of Sales$_i$/No. of workers$_i$			0.0114*					0.0132*
			(0.007)					(0.007)
Covid-19$_t$×Debt$_i$/Asset$_i$				-0.0004				0.0007
				(0.008)				(0.008)
Covid-19$_t$×Cash$_i$/Asset$_i$					0.0793*			0.0966**
					(0.043)			(0.044)
Covid-19$_t$×Price$_i$/Earning$_i$						-0.0060**		0.0026**
						(0.003)		(0.001)
Covid-19$_t$×Market$_i$/Book$_i$							-0.0036***	-0.0037***
							(0.001)	(0.001)
No. of observations	34,423	34,423	34,423	34,423	34,423	34,423	34,423	34,423
Firm fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Time fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
R-Squared	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34

Notes: The table shows estimates of the potential mechanism of the role of capitalization using proxies of elasticity, productivity, and financial constraints in the literature. Values in the parenthesis are Huber robust standard errors of regression coefficients clustered by firms. ***, ** and * denotes significance at the 1%, 5%, and 10% level, respectively.

Table 7. Estimates using daily data

Dependent variable: Growth rate of daily stock prices (Y_{it})

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Covid-19$_t$×Capitalization$_i$	2.71***	2.45***	5.47***	2.54***	1.31***	3.93***	0.26***	2.36***	2.39***	2.55***	3.01***	2.47***	2.53***	2.55***	2.57***
	(3.97)	(3.59)	(52.35)	(16.14)	(10.47)	(21.75)	(3.44)	(27.64)	(30.40)	(3.67)	(8.73)	(3.61)	(3.69)	(3.68)	(3.70)
Covid-19 infection$_t$		-0.01								-0.45***		0.63***	0.89***	-0.189	1.60***
		(0.07)								(3.14)		(4.32)	(4.74)	(1.20)	(7.41)
Stringency$_t$			-0.02***							-0.01***			-0.01***	-0.01***	-0.02***
			(25.77)							(8.26)			(10.51)	(8.91)	(11.81)
Covid-19 death$_t$				-0.41						1.20***	-4.43*		1.82***	-10.35***	-18.18***
				(1.01)						(2.73)	(1.76)		(4.09)	(4.17)	(6.98)
Covid-19 test$_t$					0.03***					0.06***			0.04***	0.06***	0.05***
					(8.62)					(12.54)			(9.85)	(12.91)	(10.35)
Global Covid-19 infection$_t$ excluding U.S.						-0.18***				-0.11***			-0.28***	-0.08**	-0.26***
						(7.67)				(3.18)			(7.60)	(2.45)	(7.30)
Global stock market return$_t$							1.00***			0.99***			0.99***	0.99***	0.98***
							(118.73)			(116.43)			(114.69)	(116.29)	(114.11)
HiTech dummy×Covid-19$_t$								0.08**		0.09**			0.09**	0.09***	0.09***
								(2.00)		(2.18)			(2.19)	(2.18)	(2.19)
Labor-intensive dummy×Covid-19$_t$									0.38***	0.40***			0.40***	0.40***	0.40***
									(3.11)	(3.17)			(3.17)	(3.18)	(3.18)
Square of Covid-19 death$_t$											12.38 *			33.57***	58.42***
											(1.70)			(4.77)	(7.82)
Sqaure of Covid-19 infection$_t$												-0.21***	-0.31***		-0.36***
												(11.84)	(11.22)		(12.52)
No. of observations	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050	549,050
Firm fixed effect	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time fixed effect	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no
R-Squared	0.51	0.45	0.45	0.45	0.45	0.45	0.50	0.45	0.45	0.50	0.45	0.45	0.50	0.50	0.50

Notes: Huber robust standard errors (shown in parentheses) are clustered at the firm level. ***, ** and * denotes that the estimated coefficient is significantly different from zero at the 1%, 5% and 10% level, respectively.