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Cash Holdings and Firm-Level Exposure to Epidemic Diseases:

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Abstract

We study the effects of firm-level exposure to an epidemic disease on corporate cash holdings amongst U.S firms. Using a text-based measure of firm-level exposure to epidemic diseases and difference-in-difference estimation strategy, we document a positive relationship between the onset of an epidemic disease and corporate cash holdings. We find that, amongst all the recent epidemics, COVID-19 has the strongest impact on cash holdings and that this effect is mostly driven by negative sentiments around the COVID-19 pandemic.

JEL Classifications: G30, G31, G32, G38

Keywords: Cash, COVID-19, SARS, H1N1, Ebola, Zika, Epidemics, Epidemiology, Virus, Pandemic, Liquid assets, Liquidity management

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1 Introduction

The ongoing COVID-19 pandemic has sparked renewed interest from economists and policymakers on the impacts of epidemic diseases on firms' real decisions. While the COVID-19 pandemic started out as a health crisis, it has since impacted every sector of the global economy and has become both a demand and a supply shock. The pandemic is an unprecedented shock on corporate revenues and has magnified liquidity risk amongst U.S firms.

In this paper, we focus on the impact of epidemic diseases on cash holdings amongst U.S firms. We focus mainly on the most recent epidemic diseases. These epidemic diseases are: COVID-19, H1N1, SARS, Ebola and Zika virus. Epidemic diseases tend to be unanticipated and their impacts can sometimes be large and widespread leading to exogenous economic shocks. The very nature of epidemic diseases implies that managers cannot fully anticipate the pathways, intensity and the duration of each disease and their impacts on the wider financial markets. Effectively, epidemic diseases create a wedge between current period's liquid assets and costly external financing in future states, which could lead to inefficient investments in future states due to insufficient liquidity.¹ That is, shocks induced by an epidemic disease potentially affect the relative attractiveness of current period's investments when compared to future investments, leading to a fluctuations in cash flows, fluctuations in the demand for cash and limited access to external financing.

In anticipation of a potential epidemic-induced negative shock(s) to the supply of external finance, managers might accumulate cash. During such shocks, managers might build up sufficient financial slacks so as to finance profitable investment opportunities in future states (Stiglitz and Weiss, 1981, Holmstrom and Tirole, 1997, Duchin, Ozbas and Sensoy, 2010, Opler, Pinkowitz, Stulz and Williamson, 1999, Campello, Graham and Harvey, 2009, 2011).

¹For theoretical discussions on the impact of insufficient liquidity on investments and other corporate policies, see Myers 1977, Myers and Majluf 1984, Jensen and Meckling 1976, Fazzari, Hubbard and Petersen, 1988, Lemmon and Roberts, 2010, Holmstrom and Tirole, 1998, Tirole, 2006.

The potential widespread of an epidemic disease might results in cash flow uncertainty. Firms might be unable to meet their obligations as outlays might exceed revenues. There is ample empirical evidence that managers consider having sufficient internal funds to finance future investments outlays to be the main determinant of corporate policy decisions (Graham and Harvey, 2001, Campello, Graham and Harvey, 2009). To mitigate against cash flow risk, firms might significantly increase cash holdings during an ongoing epidemic disease. This is further compounded by the fact that development and efficacy of a vaccine(s) can be unpredictable and having sufficient financial slacks reduces the likelihood of liquidating valuable assets or raising funds during an ongoing market wide exogenous shock.²

While epidemics tend to be aggregate in nature, their impact differs across firms and sectors. Our first test focuses on firm-level exposure to epidemic diseases and impacts on corporate cash holdings. We use Hassan, Hollander, Schwedeler, van Lent and Tahoun (2021) measure of firm-level exposure to an epidemic disease. The measure is based on quarterly earnings conference calls which are important venues during which managers directly repond to (unfiltered) questions from market participants. Because of the Q&A nature of such events, managers might potentially reveal some private information that might be useful in quantifying the direct effects of an epidemic disease on firms' real decisions. Hassan et al. (2021) measure not only identifies the firms that are exposed to an epidemic disease at a given point in time, but also captures the intensity of the exposure to each of the firm identified. As a result, the measure allows us to directly quantify the impacts of epidemic diseases on cash holdings amongst the U.S firms. To further validate our findings and to take into account the potential aggregate effects of epidemic diseases, we employ a staggered difference-in-difference approach in which we compare the cash holdings of firms before and after the onset of an epidemic disease.

²For example, in the case of COVID-19, inspite of the currently available vaccines, the uncertainties regarding the spread, mutation of genetic variants and efficacy of booster vaccines, imply that it is difficult to determine the timeline and the duration of the epidemic. Managers might continue to accumulate cash in anticipation of a stronger and more deadly variant, which might significantly impact firms' future prospects.

Using staggered difference-in-difference estimation strategy, we find a strong and statistically positive relationship between the onset of an epidemic disease and corporate cash holdings. But not all epidemics are created equal, our tests using the firm-level, time-varying measure of exposure to epidemic diseases, reveal a strong and statistically positive relationship between the onset of COVID-19 pandemic and cash holdings. We do not find any impact on cash holdings from the other epidemics under consideration, that is: SARS, H1N1, Ebola and Zika virus. The results reflect both the intensity and the widespread nature of COVID-19 relative to the other recent epidemics. We also establish the channel of transmission, showing that sentiments drive the demand for cash during the ongoing COVID-19 pandemic. As the pandemic continue to unfolds, sentiments capture real-time impact of stakeholders' revisions on a firm's future growth opportunities. Specifically, we show that both positive and negative sentiments around COVID-19 have direct impact on cash holdings. But that the positive relationship between COVID-19 and cash holdings is mostly driven by negative sentiments around the pandemic.

Our paper contributes to two main strands of literature. First, we contribute to the literature on financing frictions and on the impact of the COVID-19 pandemic on U.S firms (Acharya and Steffen, 2020, Acharya, Almeida, Ippolito and Perez-Orive, 2020a-b, Au, Dong, Zhou, 2020, Ferrando, 2020, Greenwald and Paul, 2020, Almeida 2021, Brown, Gustafson and Ivanov, 2020). And we also contribute to the broader literature on the impact of epidemic diseases on financial markets (Bae, Karolyi and Stulz, 2003, Philipson, 1999, Kyle and Xiong, 2001). We provide evidence that epidemic diseases serve as exogenous shocks, resulting in fluctuations in cash flows leading to an increase in the demand for cash. We show that the COVID-19 pandemic, relative to the other recent epidemic diseases, has the strongest impact on corporate cash holdings. We find that the main channel of transmission is via sentiments. Specifically, via negative sentiments around the COVID-19 pandemic.

Second, we contribute to the literature on the determinants and the impact of external shocks on cash holdings amongst U.S firms (Duchin, Ozbas and Sensoy, 2010, Almeida, Campello and Laranjeira, 2009, Almeida, Campello and Weisbach, 2004, Bates, Kahle and Stulz, 2009, Harford, 1999, Acharya, Almeida and Campello, 2007, Keynes 1936, Almeida, Campello, Cunha and Weisbach, 2014, Mikkelson and Partch, 2003). In general, this literature finds that exogenous shocks create financing frictions, amplifying the importance of liquidity management amongst firms. Firms respond by accumulating cash so as to protect themselves against cash flow shocks. Consistent with this literature, we find that cash is positively associated with aggregate business risk induced by epidemic diseases. Our findings support the precautionary motive of cash holdings.

The remainder of the paper proceeds as follows. Section 2 describes our firm-level data and our measure of firm-level exposure to epidemic diseases. Section 3 outlines our estimation approach and identification strategy. Section 3 also presents our empirical results. Section 4 presents some robustness tests. And section 5 concludes.

2 Data

2.1 Firm-Level Data

The sample consists of firm-quarter samples from Compustat for the period 2002Q1-2021Q1. We require that a firm be incorporated in the U.S. We also exclude financial firms (SIC 6000-6999) and exclude utilities (SIC 4900-4999) because of the difficulty in assessing their liquidity levels in the case of financial firms and because of heavy regulatory requirement in the case of utilities. We also require that a firm has positive asset levels.

Table [1], presents summary statistics for the sample. Our main variable of interest is cash. Cash is estimated as cash and short-term investment (CHEQ) adjusted by total assets (ATQ). Cash has a mean (median) of 20.53% (11.74%). Observe that during our sample period, there is a considerable variation in cash holdings across firms. In particular, the

bottom 25th per centile holds about 3.79% of total assets in cash and the top 75th per centile holds about 29.9% of their total assets in cash.³ Figure [1] illustrates the cross-sectional average of cash holdings for the period 2002Q1-2021Q1. The dotted vertical lines represent the onset of each epidemic disease.

[INSERT Figure 1 ABOUT HERE]

The remaining firm-level variables, determinants of cash holdings, are constructed as follow: Firm size is estimated as the natural logarithm of total assets, Tobin Q is estimated as the book value of total assets plus market value of equity less book value of equity adjusted by total assets. Tobin Q is bounded above 10, so as to control for outliers. Leverage is the sum of short-term debt and long-term debt adjusted by total assets. Net working capital is estimated as net working capital less cash and marketable securities adjusted by total assets. Dividend dummy takes the value of “1” if a firm pays dividend and zero otherwise.

[INSERT TABLE 1 ABOUT HERE]

2.2 Measuring Firm-Level Exposure to Epidemic Disease(s)

In order to measure firm-level exposure to epidemic diseases, we use the text-based measure of Hassan, Hollander, van Lent, Schwedeler and Tahoun (2021). The measure is constructed from quarterly earnings conference calls and captures each firm’s exposure to a given epidemic disease. The measure extract specific and relevant information on the real impact of various corporate decisions as firms response to challenges pose by the epidemic. The measure is effective because it is constructed at the firm-level and capture each firm’s exposure to each epidemic disease. In particular, Hassan et al. (2021) first identify the most common symptoms associated with each epidemic disease. They extract this information from resources including World Health Organization (WHO), online resources and newspaper articles written at the onset of each epidemic disease. They would then

³Note: Our statistical distribution is consistent with prior literature: Bates et al 2009, Dittmar and Mahrt-Smith, 2007

carry out human audit, subsample analysis, ensuring that the algorithm is indeed picking up word or combinations of words that would be associated with each epidemic disease under consideration. Disease exposure measure is then constructed as the number of times a combinations (for example: synonyms for the symptoms of each epidemic disease) appears in the transcript and this value is then scaled by the total words in each transcript.⁴

The epidemic diseases under consideration are: COVID-19, SARS, H1N1, Ebola and Zika virus. To this end, in the data we require that a firm epidemic exposure measure be available in Hassan et al. (2021). The measure starts from 2002Q1 to 2021Q1, which is our sample period. Table [2] presents a summary statistics of firm-level exposure to each epidemic disease during our sample period.

[INSERT TABLE 2 ABOUT HERE]

3 Identification Strategy and Empirical Results

3.1 Identification Strategy

To measure the effect of firm-level exposure to an epidemic disease on corporate cash holdings, we use the following augmented model of determinants of cash holdings⁵ :

$$\mathbf{Cash}_{it} = \beta_0 + \beta_1^* \mathbf{Exposure} + \mathbf{X}'\beta + \delta_i + \eta_j + \epsilon_{it} \tag{1}$$

where “**Exposure**” is firm-level exposure to a given epidemic disease and the measure is extracted from Hassan et al. (2021). \mathbf{X} is a vector of firm-level variables, determinants of cash holdngs, which include: Firm Size, Tobin Q, Leverage, Capex, Net working capital, and a dividend dummy. All our firm-level variables are constructed as outlined in Section 2

⁴For details on the construction of the time-varying firm-level measure of exposure to an epidemic disease, see Hassan, Hollander, Van Lent, Schwedeler and Tahoun, 2021

⁵A variant of Opler et al. (1999), Bates et al. (2009) model of determinants of cash holdins

above. δ_i and η_j are firm fixed effects and industry fixed effects at the two-digit SIC level respectively. And ϵ_{it} is the error term. Standard errors are heteroskedasticity-consistent and clustered at the firm-level (Petersen 2009, Bertrand, Duflo and Mullainathan, 2004). We outline our validation test in section 3.2.2.

3.2 Empirical Results

Our main research question is as follows: “Does exposure to an epidemic disease affect corporate cash holdings?” Under the precautionary motive of cash holdings, firms are likely to increase cash holdings in the even of a significant exposure to an epidemic disease. This is because it is difficult for a firm to predict not only the pathways but also the intensity and the duration of an epidemic disease. Firm-level exposure to an epidemic disease could significantly impact both the supply of intermediate goods and the demands for final goods⁶; affecting the length of cash conversion cycle. In order to hedge against extreme impact of such an event, firms might build up cash balances.

Stated differently, exposure to epidemic diseases can create a wedge between the demand for current period’s liquid assets and costly external financing in future states. The onset of an epidemic disease can lead to financing frictions and as a result managers might increase financial slacks and liquidity management becomes an important consideration. This is because the onset of an epidemic disease tends to be largely unanticipated and the potential impact cannot only be large but widespread across all sectors of the economy and even globally. However, as epidemic diseases differ in intensity and duration, the impact of each epidemic might vary across firms and sectors. Because all firms and sectors are not impacted equally, using an appropriate measure might be the key to effectively narrowing down the impact of each epidemic disease on firms’ real decisions. To account for this, we utilize Hassan et al (2021) firm-level exposure to an epidemic disease as our main measure.

⁶See Guerreri, Lorenzoni, Straub and Werning (2020) on potential impact of the pandemic and its linkages to both supply and demand.

[INSERT TABLE 3 ABOUT HERE]

Table [3] present estimates in which cash adjusted by total assets is the dependent variable. Our estimates are for the whole sample period. The variable of interest is the coefficient of each epidemic disease exposure. Columns [1,2] of Table [3] present estimates for firm-level exposure to COVID-19 and estimates for the risk or uncertainty from the COVID-19 pandemic. We find that firm-level exposure to COVID-19 has a significant positive effect on corporate cash holdings (coeff.= 0.00583, t-stat=5.42). We find a similar result in column [2], when we focus on the risk and uncertainty measure associated with the COVID-19 pandemic (coeff.=0.0294, t-stat=3.95). Column [1] suggests that cash as a fraction of total assets increased by 2.87% following exposure to the COVID-19 pandemic. Given that our “Exposure” measure is based on the length of discussion in quarterly calls regarding the impact of an epidemic disease, the estimates suggest that firms with more extensive discussions on COVID-19 pandemic are more likely to increase cash holdings. That is, our results establish that there is a positive association between the COVID-19 pandemic and corporate cash holdings.

Columns [3-6] of Table [3] present estimates for firm-level exposure to the other recent epidemic diseases under consideration. These othese recent epidemic diseases are: SARS, H1N1, Ebola and Zika. We do not find any impact on cash holdings from exposure to these epidemics for U.S firms. This is potentially because the duration, the intensity and the level of U.S exposure to these epidemics was much shorter. In the case of SARS, for example, it was detected in February 2003 and WHO declared the epidemic as having ended by late 2003. This means that the intensity of SARS was brief and that U.S firms were less exposed to the SARS epidemic. As a result impact of SARS on corporate decisions was limited⁷. The results in Columns [3-6] vis-a-vis those in coumns [1-2], suggest that both the intensity and the duration of an epidemic disease are important consideration for corporate policy.

⁷Note that SARS had a higher infection rates in China and Mexico, firms in these countries might have had a different response to the epidemic than the U.S firms- See Hassan et al 2021

Note that the estimates of our firm-level controls are generally consistent with the extant literature. In particular, Tobin Q has a positive coefficient, suggesting that firms with higher growth opportunities tend to hold more cash. Size has a negative coefficient, suggesting that smaller firms with promising future opportunities tend to hold more cash relative to large firms. Large firms tend to have greater access to external debt financing (Boughes et al. 2006). The estimates of firm size also points to profitability of investment opportunities for smaller firms and the observation that larger firms tend to have greater access to long-term debt financing. The coefficient of leverage is negative, as cash and cash equivalents tend to be use to mitigate financial distress. Cash flow has a positive coefficient. Firms with higher cash flow volatility are more likely to accumulate cash (Shyam-Sunder and Myers, 1998, Opler et al 1999). Because capital expenditure (capex) might lead to an increase in collateral base, its coefficient is negatively related to cash holdings since a large collateral base minimizes demand for cash. The coefficient for dividend dummy is negative since firms that pay dividend tend to be less risky, less financially constrained and generally have access to external financing. And because cash and net working capital are substitute; estimated coefficient of net working capital is negative.

3.2.1 Channel(s) of Transmision of Shocks: The COVID-19 pandemic

The findings so far have supported our main hypothesis that a widespread epidemic disease has an impact on firms’ real decisions. In particular, we have documented that there is a significant positive association between a firm’s coronavirus “Exposure” and its cash holdings decision. To further support our empirical findings and to narrow down the main channel of transmission, we focus on the impact of COVID-19 “Sentiments” on corporate policy.⁸ Sentiments capture the impact of stakeholders’ revisions on a firm’s future growth opportunities as the impact of the pandemic continue to unfolds. As a result, sentiments

⁸For discussions on role and construction of sentiments using textual analysis, see Loughran and McDonald (2011, 2016), Hassan et al. 2021.

are important in discerning the supply and the demand effects of the COVID-19 pandemic at the firm-level. In order to assess the effect of firm-level sentiments on corporate cash holding during the ongoing COVID-19 pandemic, we use the text-based firm-level “Sentiment measures” from Hassan et al (2021).

In Table [4], we regress COVID-19 “Sentiment” measures on cash. Sentiments are largely divided into two: positive sentiments and negative sentiments. Sentiments construction is largely based on “tone”, that is whether a word has a negative tone (such as: “loss”, “decline” etc) or positive tone (such as: “great”, “good”, etc) and effectively serve as a measure of shocks to firm’s future earnings or prospects (Hassan et al. 2021, Loughran and McDonald, 2011, 2016). Sentiments are therefore important in capturing managers’ expectations about the future and as such have direct implications for firms’ cash holdings decisions.

In Table [4], columns [3,4] shows that both negative and positive sentiments explain variation and have a positive impact on cash holdings across U.S. firms during the ongoing COVID-19 pandemic. However, when we separate out the effects of each sentiment measure on cash holdings in column [5], we find that only the COVID-19 negative sentiment remains positive and statistically significant. The result suggests that negative sentiments around the COVID-19 pandemic drives the increase in cash holdings amongst U.S firms. The more negative sentiments around the COVID-19 pandemic, the higher the likelihood of increase in cash holdings. This result suggest that firms might be concerned about potential liquidity risk post-pandemic. The result is consistent with the notion that as a firm is exposed to an exogenous shock and faces financing frictions, liquidity management becomes a critical issue for managers.

[INSERT TABLE 4 ABOUT HERE]

3.2.2 Validation Test: Using Difference-in-Difference Estimation Strategy

We validate our findings obtained from using the text-based measure of Hassan et al. (2021) by employing a difference-in-difference estimation strategy. Since the timeline during which each epidemic disease was most active and intense differs, we employ a staggered difference-in-difference estimation strategy. Our specification is as follows:

$$\text{Cash}_{it} = \beta_0 + \beta_1 \text{Epidemic_dummy} + \mathbf{X}'\beta + \delta_i + \eta_j + \epsilon_{it} \quad (2)$$

where “**Epidemic_dummy**” is an indicator variable that takes a value of “1” for the timeline during which each disease was most active {i.e COVID-19 [2020-21], H1N1[2010-12], SARS [2003], Ebola [2014-15], Zika[2015-16]}. Otherwise the “Epidemic_dummy” takes a value of zero. Effectively, “Epidemic_dummy” captures the average effect of the epidemic diseases under consideration on corporate cash holdings. \mathbf{X} is a vector of firm-level variables. Construction of each variable is outlined in section 2.1 above. δ_i and η_j are firm fixed effects and industry fixed effects at the two-digit SIC level. Consistent with Petersen, 2009, Bertrand, Duflo and Mullainathan, 2004, standard errors are heteroskedasticity-consistent and clustered at the firm-level.

We present our estimates from using staggered difference-in-difference in Table [5]. Column [4] presents our estimates with the full set of firm-level controls and fixed effects. The coefficient of “Epidemic_dummy” is positive [coeff= 0.00957] and statistically significant at the 1% level [t-stat=9.44]. This translates to an increase of about 4.6% in average cash holdings over the unconditional mean of 20.53%. The result is consistent with our overarching theme, that epidemic diseases have a material impact on corporate policy.

[INSERT TABLE 5 ABOUT HERE]

3.2.3 Validation Test: The COVID-19 Pandemic:

In this section, we move our attention to the COVID-19 pandemic. Note that while the COVID-19 pandemic started out as a health crisis, it has since impacted every aspect of

the global economy; that is it has morphed into a macroeconomics shock impacting both aggregate supply and aggregate demand. This suggest that it is not only important to take the firm-level exposure into account but the aggregate impact as well. In order to validate our results obtained using Hassan et al. (2021) measure of firm-level exposure to the COVID-19, we employ a difference-in-difference estimation strategy below:

$$\mathbf{Cash}_{it} = \beta_0 + \beta_1^* \mathbf{COVID19_dummy} + \mathbf{X}'\beta + \delta_i + \eta_j + \epsilon_{it} \quad (3)$$

where “**COVID19_dummy**” is an indicator variable that takes a value of “1” for the years 2020Q1 to 2021Q1 and the value of “0” for the year 2019Q1-Q4. \mathbf{X} is a vector of firm-specific variables (see section 2.1). δ_i and η_j are firm fixed effects and industry fixed effects at the two-digit SIC level. Standard errors are heteroskedasticity-consistent and clustered at the firm-level (Petersen 2009, Bertrand, Duflo and Mullainathan, 2004).

Our difference-in-difference approach compares cash holdings of firms before and after the onset of the COVID-19 pandemic. Table [6] presents the estimates of equation [3] above. The results show that there is a positive association between COVID-19 pandemic and corporate cash holdings. Columns [2-4] shows that quarterly cash holdings as a fraction of assets by the average firm increased by 0.0241 per centage points following the onset of the pandemic. This is an increase of 11.73% relative to unconditional mean of 0.2053 (Table 1).⁹

Overall, consistent with our main hypothesis, the estimates in Table [6] suggest that the average U.S firms significantly increase cash holdings in anticipation of unfavorable short-term to medium-term poor economic outlook following the onset of the COVID-19 pandemic. This is because the COVID-19, being an exogeneous shock, potentially impacts the supply of external financing in future states and firms respond to the shock by increasing financial

⁹This results is consistent with the output from a simple univariate analysis (untabulated). Average firm cash holdings for the whole sample period (2002Q1-2021Q1) is 0.2053, average cash holding for 2019 is 0.183 and average cash holdings for 2020Q1-2021Q1 is 0.2295. This translates to an increase of about 11.8% over mean cash and an increase of 25.4% over 2019 mean cash holdings.

slacks so as to internally finance any profitable investment opportunities in future states (Stiglitz and Weiss 1981, Holmstrom and Tirole, 1997, Jaffee and Russel, 1976, Duchin et al 2010).

[INSERT TABLE 6 ABOUT HERE]

4 Robustness

4.1 Accounting for Epidemic Disease(s) Timeline(s)

Since the timeline, firm-level exposure and the intensity of each epidemic disease differs, it could be the case that using the whole sample period results in biased estimates. We restrict our sample to the periods during which each epidemic was most active and in effect in the U.S. Our timeline is extracted from World Health Organization (WHO) and from the Center for Disease Control and Prevention (CDC).

Table [7] presents our estimates, the coefficient estimates in Columns [1-4] confirm our baseline results that there is a positive association between the COVID-19 pandemic and cash holdings. And that negative sentiments around the pandemic explain the rise in cash holdings during the ongoing COVID-19 pandemic. We also find no evidence that the other epidemic diseases under consideration have any real impact on firm-level cash holdings in the U.S.

[INSERT TABLE 7 ABOUT HERE]

4.2 Placebo: Falsification Test

One potential concern is that the documented relationship between corporate cash holdings and the COVID-19 pandemic might be simply due to unobserved changes in investment opportunities. Additionally, the extant literature has documented a rise in cash holdings amongst the U.S firms starting in the early part of 2002 but increasing significantly after

the 2008 financial crisis (Bates et al. 2009, Mikkelsen and Partch, 2003) This would suggest that- since our sample period includes this duration of acute increase in cash holdings- our estimates are simply picking up an ongoing trend in cash accumulation amongst U.S. firms.

To address this concern, we re-examine our main hypothesis using a placebo test. The key idea here being that if indeed our estimates are simply picking up a general ongoing trend in cash holdings, then our placebo estimates should be statistically similar and consistent with our reported estimates. That is, we should expect to observe a similar impact for our placebo test. To carry out this test, we first assume an occurrence of a “Placebo Epidemic Disease” starting in 2007Q1 and ending in 2018Q4. Note that there is no real epidemic disease that was active in our sample during this period; making this timeline appropriate for our placebo test. We end our placebo period in 2018Q4 to ensure that our estimates are free of any potential anticipation of the COVID-19 pandemic during the 2019 fiscal year. Our Placebo dummy takes the value of “1” for the period 2017Q1 to 2018Q4 and “0” for 2015Q1 to 2016Q4, allowing us to compare a balanced data. We then compare firms cash holding positions before and after the “Placebo Epidemic Disease”.

Table [8] presents our estimates, columns [1-4] shows that all our coefficient estimates for the placebo dummy are indeed statistically significant but negative, which is opposite to those estimates we find under the COVID-19 pandemic. This exercise demonstrates that our results are attributable to the COVID-19 pandemic and not due to any prior ongoing trend in corporate cash holdings amongst U.S firms.

[INSERT TABLE 8 ABOUT HERE]

4.3 Accounting for Firm-Level Political Risk

The macroeconomics implications of the COVID-19 pandemic have created an urgency for policymakers to intervene in the economy. Extant literature has established that policy uncertainty tends to be countercyclical; that is politicians are more likely to intervene in the economy during recessions than during booms (Baker, Bloom and Davis, 2016). During this

ongoing COVID-19 pandemic, policymakers in the U.S. have responded quickly by providing stimulus in the trillions into the economy but they have also shut down significant parts of the economy. Providing a significant stimulus has the effect of ameliorating the impacts of the pandemic while the lock-down of the economy has the effect of accelerating the negative impacts of the pandemic on some sectors of the economy. Given the conflicting impacts of these policies, some firms might face different levels of political risk and might respond by increasing cash holdings. The concern here is on whether our findings are attributable to political risk faced by firms.

We examine whether firm-level exposure to political risk explains the rise in cash holdings during the ongoing COVID-19 pandemic. Extant literature has established that there is a positive relationship between policy uncertainty and cash holdings (Duong et al. 2017, Baker, Bloom, Davis 2016, Pastor and Veronesi 2012, Tut, 2019). To account for the impact of political uncertainty, we use Hassan, Hollander, van Lent and Tahoun (2019) measure of firm-level political risk constructed using tools from computation linguistics. The measure is based on quarterly earnings conference-call transcripts and capture the extent and type of political risk face by each firm. And the measure is highly correlated with firm real decisions, stock market volatility, aggregate and sectoral political risk used in prior literature (Baker et al, 2016). However, unlike the other measures of political uncertainty, about 91% of variation in Hassan et al. (2019) political risk measure plays out at the firm-level, which makes it an appropriate control for our study as all our main measures are at the firm-level.

Table [9] presents our estimates with firm-level political risk as an additional control. The key idea here is that if our results are due to ongoing political risks, then we should expect our measure of political risk to dominate our firm-level exposure to epidemic diseases measure. However, observe that while political risk has a positive loading, the coefficients of our measure of COVID-19 exposure remains positive and statistically significant across all models. The results suggest that the impact of COVID-19 pandemic on corporate cash holdings cannot be explained away by political risks faced by firms during the pandemic.

[INSERT TABLE 9 ABOUT HERE]

4.4 COVID-19, Cash and Financial Constraints

In this section, we consider whether the impact of COVID-19 on cash holdings vary in the cross-section of firms by financial constraints. We might expect that firms that are financially constrained might accumulate cash at a higher rate than their unconstrained counterparts. This is because the impact of COVID-19 is widespread across all segments of the economy, suggesting that it could impact not only the supply of external finance in future states but might lead to a fluctuations in the supply of intermediate inputs, raw materials and in the demand of final goods. As a result, financially constrained firms have a stronger incentive to accumulate cash, either due to limited access to external financing or in anticipation of riskier cash flows (Kaplan and Zingales, 1997, Almeida, Campello and Weisbach, 2004, Whited and Wu, 2004).

We use Kaplan-Zingales (1997) measure of financial constraints as our main measure. Following Duchin et al. (2010), we classify firms as constrained or unconstrained by dividing the sample at the median level. Table [10] presents our estimates; in columns [1,2], we restrict our sample to the 2020Q1-2021Q1 timeline. To ensure that our estimates are free of COVID-19 anticipation, we sort and classify firms based on constraint measure (KZ index) during the 2019 fiscal year. Columns [3-4] presents the estimates for our full sample period.

The key take-away from Table [10] is that there is an increase in cash holdings for both the constrained and unconstrained firms but that constrained firms increase cash holdings at a higher magnitude than their unconstrained counterparts. The results are consistent with the notion that during significant external shocks, financially constrained firms are more likely to face costly external financing in future states and as a result tend to increase financial slacks during such shocks. The positive loading on unconstrained firms suggest that, these firms are concerned about giving up profitable investment opportunities in future states and as a result increase cash holdings to mitigate the potential impact of COVID-19 pandemic.

[INSERT TABLE 10 ABOUT HERE]

4.5 Alternative Model of Cash holdings

Since a firm's ability to generate revenue is a function of its total assets, we re-examine our findings using an alternative model of cash holdings (Opler et al. 1999). Our dependent variable is the natural logarithms of cash and marketable securities scaled by total assets net of liquid assets. Our results are robust to using this alternative model. We present our results in Table [11]. In columns [1,2] the impact of COVID-19 remains positive and statistically significant, while there is no statistically significant impact on corporate cash holdings for the other recent epidemic diseases under consideration.

[INSERT TABLE 11 ABOUT HERE]

4.6 Role of Leverage: COVID-19, Debt Issuance, Cash holdings

When firms are faced with financing frictions, they might increase cash holdings by issuing debt (Acharya et al. 2007, Almeida, 2021). Firms might issue long-term debt to increase cash position and preserve financial flexibility, that is firms might engage in precautionary borrowing during significant financing frictions (Almeida et al., 2014). And because of the otherwise healthy financial position of U.S banks during the ongoing COVID-19 pandemic, lenders might be willing to extend more credit and provide some liquidity insurance (Acharya and Steffen, 2020). The concern here is that perhaps access to external financing (via lines of credit for example), explains the rise in cash holdings during the ongoing COVID-19 pandemic.

To address this concern, we control for long-term debt issuance during the ongoing COVID-19 pandemic. We estimate long-term debt issuance as the proportion of long term debt issued adjusted by total assets. We interact both our COVID-19 exposure measure and our COVID-19 dummy with long-term debt issuance. We present our estimates Table [12]. Columns [3,6] in the table show that the coefficients of the interaction terms between

long-term debt issuance and our COVID-19 measures are positive and statistically significant. But note that the coefficients of our COVID-19 measures remain positive and statistically significant. Our results are consistent with the notion that firms might draw on their lines of credit to increase cash holdings, because when faced with aggregate risk, cash is more desirable relative to lines of credit (Acharya et al. 2013, 2020). But cash is also valuable as access to lines of credit might be restricted during exogenous shocks, precisely when the marginal value of a dollar from external financing (via lines of credit for example) is most valuable to the firm (Campello, Giambona, Graham and Harvey, 2011, Tirole, 2006). [INSERT TABLE 12 ABOUT HERE]

5 Conclusion

In this paper, we study the effects of epidemic diseases on corporate cash holdings amongst U.S firms. In particular, we address the following question: “Does exposure to an epidemic disease affect corporate cash holdings”. In the presence of financing frictions, firms might accumulate cash to hedge against random variation in cash flows. We argue that the onset, pathways, intensity and duration of epidemic diseases are generally unanticipated and as a result such events are exogenous to firms’ decisions. A case in point, the COVID-19 pandemic started out as a health crisis, but has now morphed into both a demand and a supply shock impacting every sector of the global economy.

We focus on the five most recent epidemic diseases: COVID-19, SARS, H1N1, Ebola and Zika virus. To estimate the impacts of epidemic diseases on corporate cash holdings, we use two estimation approaches. First, we recognize that there is heterogeneity in the intensity and in the impact of each epidemic disease across firms and sectors. To this end, we utilize a text-based measure of firm-level exposure to an epidemic disease. The measure allows us to both identify the firms that are exposed to each epidemic disease and to quantify the impact on firms’ real decisions.

Second, taking into consideration the potential aggregate impact of epidemic diseases, we use a staggered difference-in-difference estimation strategy to validate our findings. We document a positive relationship between the onset of an epidemic disease and corporate cash holdings amongst U.S firms. We find that, amongst all the recent epidemics under consideration, the COVID-19 pandemic has the strongest positive impact on cash holdings; reflecting its intensity and widespread impact on all the sectors of the economy. We find that the channel of transmissions of COVID-19 shocks is via sentiments. Specifically, we empirically demonstrate that the effects of COVID-19 on corporate cash holdings is mostly driven by negative sentiments around the pandemic.

Taken together, our findings support the precautionary motive of cash holdings. In the presence of financing frictions, firms might accumulate cash, preserve financial flexibility, so as to hedge against potential adverse cash flow shocks. Our findings illustrate that epidemic-induced shocks have material impact on corporate decisions.

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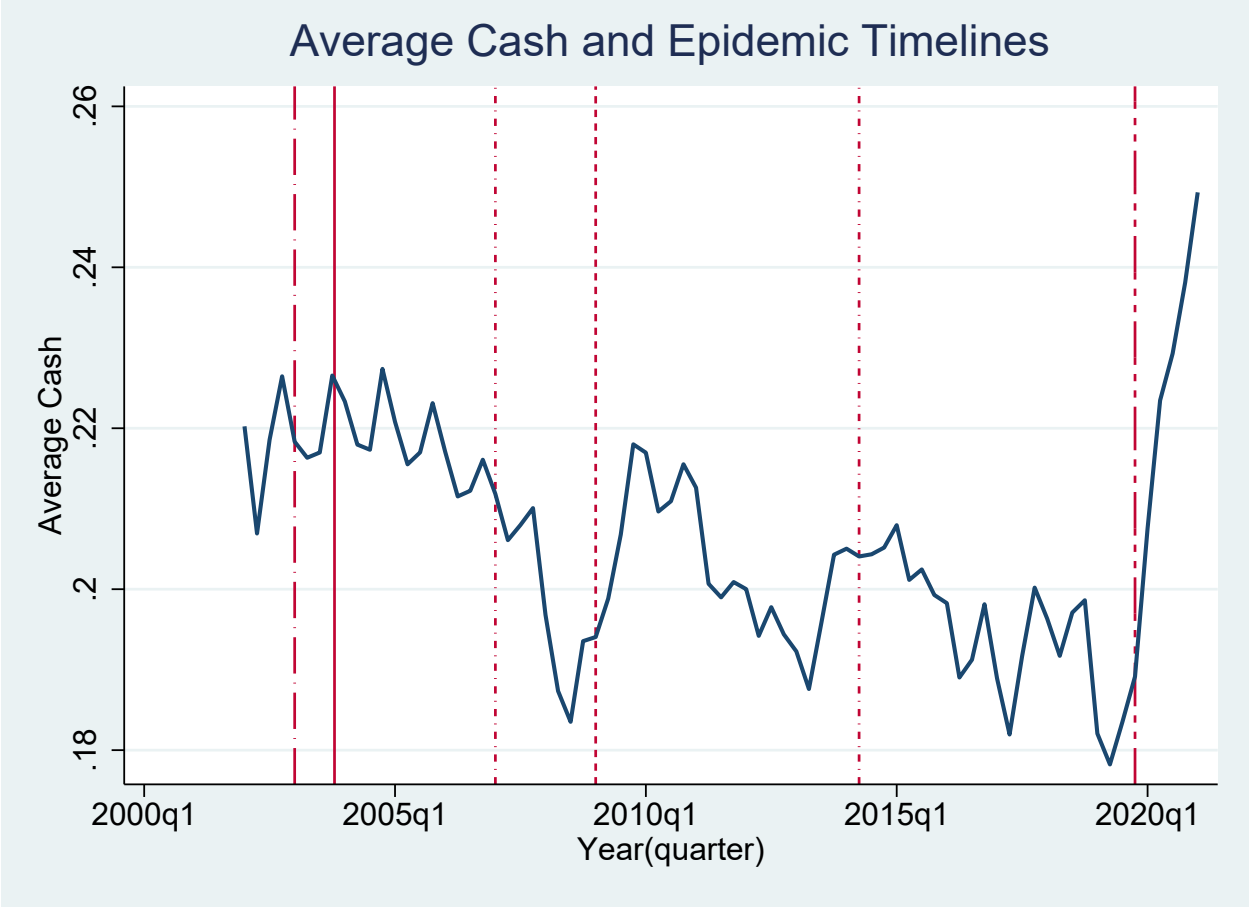


Figure 1: Average Cash and Epidemic Timeline

Figure [1] presents cross-sectional average of cash (as a percentage of total assets) for the period 2002Q1-2021Q1. The **dotted** vertical reference lines represent the onset of each epidemic disease. The epidemic diseases under consideration are: COVID-19, H1N1, SARS, Ebola and Zika virus.

TABLE 1: Summary Statistics: Firm-Level Variables

This table presents summary statistics for the sample, which consists of non-financial and non-utility U.S. incorporated firms in Compustat's quarterly files for the period 2002Q1-2021Q1. Cash is estimated as cash and cash equivalents (CHEQ) scaled by total assets. Size is the natural logarithm of total assets. We require that firm has positive total assets to be included in the sample. Tobin Q is estimated as the book value of total assets plus the market value of equity less book value of equity scaled by total assets. Dividend is a dummy equal to "1" if a firm paid or issued dividend during period t . Net working capital is net working capital minus cash and marketable securities scaled by total assets. Leverage is estimated as short-term debt plus long-term debt scaled by total assets. Capex is estimated as capital expenditure scaled by total assets.

	Mean	Median	Std. Dev	25 th	75 th
Summary Statistics:					
Cash	0.2053	0.1174	0.2221	0.0379	0.2999
Cashflow	0.01719	0.02744	0.0744	0.0102	0.0426
Tobin Q	2.0938	1.6266	1.4084	1.1999	2.4472
Size	6.7299	6.6958	1.9081	5.4514	7.9593
Capex	0.0292	0.0154	0.0436	0.006	0.03363
Leverage	0.2585	0.2128	0.3047	0.0361	0.3809
Dividend Dummy	0.06236	0.000	0.2418	0.000	0.000
Net Working Capital	0.0376	0.0386	0.2494	-0.0468	0.1412

TABLE 2: Summary Statistics: Firm-Level Exposure to Epidemic Disease(s)

This table presents summary statistics for the sample, which consists of non-financial and non-utility U.S. incorporated firms in Compustat's quarterly files for the period 2002Q1-2021Q1. Data on epidemic diseases is based on Hassan, Hollander, Van Lent, Schwedeler and Tahoun, 2021 measure. Panel A presents summary statistics for the whole sample (unrestricted) period. Panel B presents summary statistics for the timeline during which each epidemic disease was most intense and active in the US.

	Mean	Median	Std. Dev	25 th	75 th
Summary Statistics:					
Unrestricted:	PANEL A:				
COVID-19 Exposure	0.0885	0.000	0.4759	0.0000	0.0000
COVID-19 Risk	0.00661	0.000	0.053506	0.0000	0.0000
COVID-19 Positive Sentiment	0.0235	0.000	0.1520	0.0000	0.0000
COVID-19 Negative Sentiment	0.0347	0.000	0.2105	0.0000	0.0000
SARS Exposure	0.0021	0.000	0.0471	0.0000	0.0000
H1N1 Exposure	0.0028	0.000	0.0604	0.0000	0.0000
Ebola Exposure	0.0012	0.000	0.0410	0.0000	0.0000
Zika Exposure	0.0010	0.000	0.0378	0.0000	0.0000
Restricted:	PANEL B:				
COVID-19 Exposure	1.3604	1.0329	1.3245	0.3862	1.9462
COVID-19 Risk	0.1016	0.000	0.1854	0.0000	0.1530
COVID-19 Positive Sentiment	0.3626	0.20627	0.4820	0.0000	0.5305
COVID-19 Negative Sentiment	0.5332	0.3359	0.6449	0.0000	0.7731
SARS Exposure	0.0436	0.000	0.1708	0.0000	0.0000
H1N1 Exposure	0.0150	0.000	0.1378	0.0000	0.0000
Ebola Exposure	0.0048	0.000	0.0869	0.0000	0.0000
Zika Exposure	0.0028	0.000	0.0742	0.0000	0.0000

TABLE 3: Corporate Cash Holdings and Firm-Level Exposure to Epidemic Diseases

This table presents estimates from panel regressions. Cash holdings (*cheq/atq*) is the dependent variable. Firm-level epidemic exposure are based on Hassan et al. (2021) firm-level exposure to epidemic diseases measure. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Cash	Cash	Cash	Cash	Cash	Cash
COVID-19_Exposure	0.00583*** (5.42)					
COVID-19_Risk		0.0294*** (3.95)				
SARS_Exposure			-0.00280 (-0.40)			
Ebola_Exposure				0.0108 (0.48)		
H1N1_Exposure					-0.00461 (-0.80)	
Zika_Exposure						0.00409 (0.33)
Cash_flow	0.0417* (1.76)	0.0418* (1.76)	0.0416* (1.76)	0.0416* (1.75)	0.0416* (1.76)	0.0416* (1.76)
Tobin_Q	0.0143*** (13.75)	0.0144*** (13.81)	0.0144*** (13.84)	0.0144*** (13.84)	0.0144*** (13.83)	0.0144*** (13.83)
Size	-0.0256*** (-11.41)	-0.0251*** (-11.24)	-0.0249*** (-11.15)	-0.0249*** (-11.15)	-0.0249*** (-11.16)	-0.0249*** (-11.16)
Leverage	-0.126*** (-15.48)	-0.125*** (-15.42)	-0.124*** (-15.38)	-0.124*** (-15.37)	-0.124*** (-15.38)	-0.124*** (-15.38)
Dividend dummy	-0.00629 (-1.50)	-0.00628 (-1.50)	-0.00618 (-1.47)	-0.00618 (-1.47)	-0.00619 (-1.47)	-0.00618 (-1.47)
Capex	-0.146*** (-9.88)	-0.147*** (-9.97)	-0.148*** (-10.02)	-0.148*** (-10.01)	-0.148*** (-10.02)	-0.148*** (-10.02)
NWC	-0.118*** (-10.64)	-0.119*** (-10.67)	-0.119*** (-10.70)	-0.119*** (-10.69)	-0.119*** (-10.70)	-0.119*** (-10.70)
Constant	0.386*** (25.00)	0.382*** (24.90)	0.381*** (24.86)	0.381*** (24.85)	0.381*** (24.86)	0.381*** (24.87)
Firm F.E	YES	YES	YES	YES	YES	YES
Industry F.E	YES	YES	YES	YES	YES	YES
Clustered Std Errors	YES	YES	YES	YES	YES	YES
<i>N</i>	144208	144208	144208	144208	144208	144208
<i>R</i> ²	0.361	0.362	0.363	0.363	0.363	0.363

Note: t-statistics in parentheses: p:0.10, ** p:0.05, *** p:0.01

TABLE 4: COVID-19 and Corporate Cash Holdings

This table presents estimates from panel regressions. Cash holdings (cheq/atq) is the dependent variable. Firm-level COVID-19 exposure are based on Hassan et al 2021 measure. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)
	Cash	Cash	Cash	Cash	Cash
COVID-19_Exposure	0.00583*** (5.42)				
COVID-19_Risk		0.0294*** (3.95)			
COVID-19 Negative_Sentiment			0.0133*** (6.65)		0.0122*** (5.39)
COVID-19 Positive_Sentiment				0.0142*** (4.43)	0.00231 (0.62)
Cash_flow	0.0417* (1.76)	0.0418* (1.76)	0.0420* (1.77)	0.0414* (1.74)	0.0419* (1.77)
Tobin_Q	0.0143*** (13.75)	0.0144*** (13.81)	0.0144*** (13.79)	0.0144*** (13.77)	0.0144*** (13.78)
Size	-0.0256*** (-11.41)	-0.0251*** (-11.24)	-0.0255*** (-11.38)	-0.0254*** (-11.32)	-0.0255*** (-11.37)
Leverage	-0.126*** (-15.48)	-0.125*** (-15.42)	-0.125*** (-15.48)	-0.125*** (-15.45)	-0.126*** (-15.48)
Dividend Dummy	-0.00629 (-1.50)	-0.00628 (-1.50)	-0.00625 (-1.49)	-0.00628 (-1.49)	-0.00626 (-1.49)
Capex	-0.146*** (-9.88)	-0.147*** (-9.97)	-0.146*** (-9.87)	-0.147*** (-9.93)	-0.146*** (-9.87)
NWC	-0.118*** (-10.64)	-0.119*** (-10.67)	-0.118*** (-10.64)	-0.119*** (-10.67)	-0.118*** (-10.64)
Constant	0.386*** (25.00)	0.382*** (24.90)	0.385*** (25.01)	0.384*** (24.94)	0.385*** (24.98)
Firm F.E	YES	YES	YES	YES	YES
Industry F.E	YES	YES	YES	YES	YES
Clustered Std Errors	YES	YES	YES	YES	YES
<i>N</i>	144208	144208	144208	144208	144208
<i>R</i> ²	0.361	0.359	0.360	0.360	0.361

NOTE: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 5: Validation Test/Difference-in-Difference:***Firm-Level Exposure to Epidemic Disease(s) and Cash Holdings.***

This table presents estimates from panel regressions using staggered difference-in-difference. Cash holdings (cheq/atq) is the dependent variable. Epidemic dummy is an indicator variable that takes the a value of “1” for the timeline during which each epidemic disease was most intense and active in the U.S. The Epidemics under considerations are: COVID-19, H1N1, SARS, Ebola and Zika virus. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)
	Cash	Cash	Cash	Cash
Epidemic dummy	0.00528*** (4.93)	0.00957*** (19.04)	0.00957*** (9.44)	0.00957*** (9.44)
Cash_flow		0.0415*** (6.84)	0.0415* (1.75)	0.0415* (1.75)
Tobin_Q		0.0145*** (51.34)	0.0145*** (13.94)	0.0145*** (13.94)
Size		-0.0256*** (-52.86)	-0.0256*** (-11.50)	-0.0256*** (-11.50)
Leverage		-0.124*** (-69.35)	-0.124*** (-15.41)	-0.124*** (-15.41)
Dividend_dummy		-0.00568*** (-3.74)	-0.00568 (-1.35)	-0.00568 (-1.35)
Capex		-0.142*** (-18.19)	-0.142*** (-9.60)	-0.142*** (-9.60)
NWC		-0.118*** (-45.01)	-0.118*** (-10.64)	-0.118*** (-10.64)
Constant	0.203*** (440.24)	0.381*** (112.98)	0.381*** (24.90)	0.381*** (24.90)
Firm F.E	YES	YES	YES	YES
Industry F.E	YES	NO	NO	YES
Clustered Std Errors	YES	NO	YES	YES
<i>N</i>	158194	144209	144209	144209
<i>R</i> ²	0.006	0.358	0.358	0.358

NOTE: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 6: Validation Test/Difference-in-Difference:***Firm-Level Exposure to COVID-19 and Corporate Cash Holdings.***

This table presents estimates from panel regressions using difference-in-difference estimation strategy. Cash holdings (cheq/atq) is the dependent variable. We focus on the COVID-19 pandemic. COVID-19 dummy is an indicator variable that takes the a value of “1” for the period 2020Q1-2021Q1 and “0” for the period 2019Q1-2019Q4. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)
	Cash	Cash	Cash	Cash
COVID-19 dummy	0.0297*** (18.59)	0.0241*** (23.30)	0.0241*** (15.50)	0.0241*** (15.50)
Tobin_Q		0.00603*** (7.80)	0.00603*** (3.19)	0.00603*** (3.19)
Cash_flow		0.0728*** (5.53)	0.0728** (1.96)	0.0728** (1.96)
Size		0.0622*** (23.19)	0.0622*** (6.16)	0.0622*** (6.16)
Leverage		-0.0919*** (-15.93)	-0.0919*** (-5.59)	-0.0919*** (-5.59)
Dividend dummy		0.0172*** (3.31)	0.0172 (1.54)	0.0172 (1.54)
Capex		-0.0532** (-2.00)	-0.0532** (-2.04)	-0.0532** (-2.04)
NWC		-0.126*** (-18.77)	-0.126*** (-4.25)	-0.126*** (-4.25)
Constant	0.192*** (218.68)	-0.233*** (-12.02)	-0.233*** (-3.26)	-0.233*** (-3.26)
Firm F.E	YES	YES	YES	YES
Industry F.E	YES	NO	NO	YES
Clustered Std Errors	YES	NO	YES	YES
<i>N</i>	18727	17347	17347	17347
<i>R</i> ²	0.0539	0.129	0.129	0.129

Note: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 7: Restricted Sample: Corporate Cash Holdings and Firm-Level Exposure to Epidemic Diseases

This table presents estimates from panel regressions. Cash holdings (*cheq/atq*) is the dependent variable. We restrict our sample to the duration during which each epidemic disease was most intense and active in the U.S. Our firm-level measure of exposure to an epidemic disease is based on Hassan et al. (2021). The Epidemics under consideration are: COVID-19, H1N1, SARS, Ebola and Zika virus. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Cash	Cash	Cash	Cash	Cash	Cash	Cash	Cash	Cash
COVID-19_Exposure	0.00239*** (3.76)								
COVID-19_Risk		0.00811** (2.00)							
COVID-19_Negative_Sentiment			0.00556*** (4.88)		0.00549*** (4.16)				
COVID-19_Positive_Sentiment				0.00381** (2.55)	0.000186 (0.11)				
SARS_Exposure						0.00138 (0.46)			
Ebola_Exposure							0.0172 (1.63)		
H1N1_Exposure								0.00968 (1.13)	
Zika_Exposure									-0.00422 (-0.64)
Cash_flow	0.0499 (1.57)	0.0512 (1.61)	0.0495 (1.56)	0.0500 (1.58)	0.0495 (1.56)	0.121* (1.77)	0.0883*** (2.58)	0.0557 (1.56)	0.125*** (3.25)
Tobin_Q	0.00514** (2.12)	0.00525** (2.16)	0.00521** (2.15)	0.00515** (2.12)	0.00521** (2.15)	0.00194 (0.62)	0.00502** (2.37)	0.00681*** (3.64)	0.00699*** (3.24)
Size	0.119*** (7.66)	0.119*** (7.70)	0.119*** (7.71)	0.119*** (7.67)	0.119*** (7.71)	0.0780*** (3.74)	-0.0372*** (-3.73)	-0.00908 (-1.18)	-0.0335*** (-3.84)
Leverage	-0.0818*** (-2.91)	-0.0811*** (-2.88)	-0.0821*** (-2.92)	-0.0811*** (-2.88)	-0.0821*** (-2.92)	-0.0713* (-1.87)	-0.0842*** (-4.38)	-0.133*** (-8.48)	-0.0977*** (-4.76)
Dividend dummy	-0.00936 (-0.41)	-0.00871 (-0.38)	-0.00921 (-0.40)	-0.00943 (-0.41)	-0.00925 (-0.40)	0.00745 (0.39)	0.0239** (2.18)	0.00363 (0.20)	0.0120 (0.95)
Capex	0.0303 (0.75)	0.0492 (1.24)	0.0339 (0.84)	0.0442 (1.12)	0.0335 (0.84)	-0.0796* (-1.89)	-0.104*** (-5.08)	-0.136*** (-5.73)	-0.0751*** (-2.94)
NWC	-0.138*** (-4.37)	-0.137*** (-4.36)	-0.138*** (-4.39)	-0.137*** (-4.36)	-0.138*** (-4.38)	-0.197*** (-4.49)	-0.120*** (-5.40)	-0.128*** (-4.31)	-0.104*** (-5.54)
Constant	-0.611*** (-5.60)	-0.613*** (-5.61)	-0.615*** (-5.64)	-0.611*** (-5.59)	-0.615*** (-5.64)	-0.266** (-2.00)	0.479*** (6.77)	0.289*** (5.65)	0.449*** (7.04)
Firm F.E	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry F.E	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustered Std Errors	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	9433	9433	9433	9433	9433	6099	15173	24405	14691
R ²	0.126	0.127	0.127	0.127	0.127	0.102	0.316	0.326	0.301

NOTE: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 8: Placebo Epidemic Disease: Falsification Test

This table presents estimates from panel regressions. Cash holdings (*cheq/atq*) is the dependent variable. Columns 1-4 presents our estimates using the “Placebo dummy”. Our Placebo dummy takes the value of “1” for the period 2017Q1 to 2018Q4 and “0” for 2015Q1 to 2016Q4. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)
	Cash	Cash	Cash	Cash
Placebo_dummy	-0.00790*** (-4.87)	-0.00845*** (-9.00)	-0.00845*** (-5.79)	-0.00845*** (-5.79)
Cash_flow		0.0264** (2.44)	0.0264 (0.52)	0.0264 (0.52)
Tobin_Q		0.00461*** (6.26)	0.00461*** (2.61)	0.00461*** (2.61)
Size		-0.00463** (-2.03)	-0.00463 (-0.56)	-0.00463 (-0.56)
Leverage		-0.117*** (-22.45)	-0.117*** (-6.99)	-0.117*** (-6.99)
Dividend_Dummy		0.0189*** (4.16)	0.0189** (2.11)	0.0189** (2.11)
Capex		-0.126*** (-7.98)	-0.126*** (-4.78)	-0.126*** (-4.78)
NWC		-0.101*** (-16.77)	-0.101*** (-4.80)	-0.101*** (-4.80)
Constant	0.199*** (179.10)	0.256*** (15.75)	0.256*** (4.40)	0.256*** (4.40)
Firm F.E	YES	YES	YES	YES
Industry F.E	YES	NO	NO	YES
Clustered Std Errors	YES	NO	YES	YES
<i>N</i>	24455	22540	22540	22540
<i>R</i> ²	0.0192	0.307	0.307	0.307

NOTE: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 9: Accounting for Firm-level Political Risk

This table presents estimates from panel regressions. Cash holdings (*cheq/atq*) is the dependent variable. Our measure of firm-level political risk is based on Hassan et al. (2019). All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)
	Cash	Cash	Cash	Cash	Cash
COVID-19_Exposure	0.00575*** (5.34)				
COVID-19_Risk		0.0285*** (3.82)			
COVID-19_Negative_Sentiment			0.0132*** (6.55)		0.0120*** (5.33)
COVID-19_Positive_Sentiment				0.0139*** (4.37)	0.00226 (0.61)
Political_Risk	0.00281 (1.53)	0.00304* (1.66)	0.00279 (1.52)	0.00312* (1.70)	0.00278 (1.52)
Cash_flow	0.0418* (1.76)	0.0419* (1.77)	0.0421* (1.78)	0.0415* (1.75)	0.0420* (1.77)
Tobin_Q	0.0143*** (13.75)	0.0144*** (13.81)	0.0144*** (13.79)	0.0144*** (13.77)	0.0144*** (13.78)
Size	-0.0256*** (-11.41)	-0.0251*** (-11.24)	-0.0255*** (-11.37)	-0.0254*** (-11.31)	-0.0255*** (-11.36)
Leverage	-0.126*** (-15.48)	-0.125*** (-15.42)	-0.125*** (-15.48)	-0.125*** (-15.45)	-0.126*** (-15.48)
Dividend_dummy	-0.00631 (-1.50)	-0.00631 (-1.50)	-0.00628 (-1.49)	-0.00631 (-1.50)	-0.00629 (-1.50)
Capex	-0.146*** (-9.87)	-0.147*** (-9.96)	-0.146*** (-9.86)	-0.147*** (-9.92)	-0.146*** (-9.86)
NWC	-0.118*** (-10.64)	-0.119*** (-10.67)	-0.118*** (-10.64)	-0.119*** (-10.67)	-0.118*** (-10.64)
Constant	0.385*** (24.95)	0.382*** (24.86)	0.384*** (24.97)	0.384*** (24.89)	0.384*** (24.94)
Firm F.E	YES	YES	YES	YES	YES
Industry F.E	YES	YES	YES	YES	YES
Clustered Std Errors	YES	YES	YES	YES	YES
<i>N</i>	144194	144194	144194	144194	144194
<i>R</i> ²	0.361	0.362	0.361	0.362	0.361

Note: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 10: Financial Constraints, Cash and COVID-19

This table presents estimates from panel regressions. Cash holdings (cheq/atq) is the dependent variable. Our measure of financial constraints is based on Kaplan-Zingales (1997) index. Firms that are below median measure are considered as “Low” and those firms above median KZ index are considered “High” constrained firms. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)
	Cash	Cash	Cash	Cash
Sample:	Restricted	Restricted	Unrestricted	Unrestricted
Financial Constraints:	LOW	HIGH	LOW	HIGH
COVID-19_Exposure	0.00159*	0.00248***	0.00399**	0.00732***
	(1.86)	(3.42)	(2.09)	(6.91)
Cash_flow	0.0662	0.0303	0.0245	-0.00320
	(1.04)	(1.56)	(0.87)	(-0.16)
Tobin_Q	0.0135***	0.00544**	0.0269***	0.0193***
	(3.83)	(2.00)	(15.72)	(15.21)
Size	0.127***	0.151***	-0.0272***	-0.0120***
	(6.47)	(7.14)	(-7.29)	(-5.57)
Leverage	-0.0570	0.0406	-0.191***	-0.0210***
	(-1.04)	(1.22)	(-9.14)	(-2.85)
Dividend Dummy	-0.0570	0.0205*	-0.0233***	-0.00328
	(-1.63)	(1.71)	(-2.90)	(-1.07)
Capex	-0.0345	0.00314	-0.229***	-0.0736***
	(-0.57)	(0.08)	(-10.24)	(-6.93)
NWC	-0.327***	-0.171***	-0.239***	-0.0468***
	(-7.11)	(-5.82)	(-11.13)	(-4.78)
Constant	-0.566***	-1.038***	0.432***	0.181***
	(-4.34)	(-6.34)	(18.43)	(11.04)
Firm F.E	YES	YES	YES	YES
Industry F.E	YES	YES	YES	YES
Clustered Std Errors	YES	YES	YES	YES
<i>N</i>	4734	4699	73415	70793
<i>R</i> ²	0.219	0.171	0.108	0.0822

NOTE: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 11 : Alternative Measure of Cash: Cash Holdings and Firm-Level Exposure to Epidemic Diseases

This table presents estimates from panel regressions. Our dependent variable is the natural logarithms of cash and marketable securities scaled by total assets net of liquid assets. Firm-level exposure to epidemic diseases are based on Hassan et al. 2021 measure. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(cash/Netasset)	Ln(Cash/Netasset)	Ln(Cash/Netasset)	Ln(Cash/Netasset)	Ln(Cash/Netasset)	Ln(Cash/Netasset)
COVID-19_Exposure	0.0366*** (5.67)					
COVID-19_Risk		0.143*** (3.64)				
SARS_Exposure			0.0414 (1.05)			
H1N1_Exposure				-0.0306 (-0.66)		
Ebola_Exposure					0.0564 (0.77)	
Zika_Exposure						0.00938 (0.17)
Cash_flow	0.248 (0.88)	0.267 (0.95)	2.249*** (4.71)	0.942*** (3.09)	0.786** (2.22)	1.034*** (3.56)
Tobin_Q	0.0217 (1.40)	0.0233 (1.50)	0.0365** (2.57)	0.0591*** (4.26)	0.0379*** (2.80)	0.0770*** (5.72)
Size	0.686*** (6.85)	0.692*** (6.92)	0.0862 (1.14)	0.136* (1.71)	-0.424*** (-6.18)	-0.419*** (-7.19)
Leverage	-0.575*** (-2.69)	-0.564*** (-2.64)	-0.795*** (-3.63)	-1.354*** (-6.37)	-0.672*** (-4.25)	-0.796*** (-5.94)
Dividend dummy	0.0218 (0.14)	0.0315 (0.21)	-0.0603 (-0.69)	0.137 (1.23)	0.172 (1.61)	0.0712 (0.77)
Capex	-0.0116 (-0.02)	0.259 (0.50)	-0.610* (-1.82)	-0.767** (-2.03)	-0.891*** (-2.63)	-0.878*** (-2.96)
NWC	-1.141*** (-4.31)	-1.139*** (-4.29)	-1.465*** (-5.19)	-1.403*** (-7.37)	-1.206*** (-6.43)	-1.084*** (-6.91)
Constant	-6.613*** (-9.35)	-6.633*** (-9.39)	-2.451*** (-4.95)	-2.597*** (-5.13)	1.036** (2.15)	0.947** (2.30)
Firm F.E	YES	YES	YES	YES	YES	YES
Industry F.E	YES	YES	YES	YES	YES	YES
Clustered Std Errors	YES	YES	YES	YES	YES	YES
N	9419	9419	9626	16768	15142	22256
R ²	0.0673	0.0643	0.0361	0.0503	0.0419	0.0524

NOTE: statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01

TABLE 12 : Cash, Debt Issuance and COVID-19

This table presents estimates from panel regressions. Cash holdings (cheq/atq) is the dependent variable. Firm-level COVID-19 exposure to an epidemic disease is based on Hassan et al. (2021) measure. All regressions include firm fixed effects and industry fixed effects at the two-digit SIC level. All standard errors are clustered at the firm-level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Cash	Cash	Cash	Cash	Cash	Cash
COVID-19_Exposure	0.00176** (2.45)	0.00182* (1.70)	0.00155** (2.28)			
COVID-19_dummy				0.0172*** (9.55)	0.0198*** (6.66)	0.0209*** (11.59)
St_debt X COVID-19_Exposure	0.000647 (0.09)					
Lt_debt X COVID-19_Exposure		0.00187 (0.65)				
Lt debt Issuance X COVID-19_Exposure			0.00852*** (2.64)			
St_debt X COVID-19_dummy				0.0740*** (3.91)		
Lt_debt X COVID-19_dummy					0.0108 (1.52)	
LT debt Issuance X d_dummy						0.0274*** (2.79)
St_debt	-0.381*** (-8.35)			-0.399*** (-10.57)		
Lt_debt		0.0101 (0.34)	0.00927 (0.32)		-0.0325** (-2.35)	-0.0318** (-2.28)
Cash_flow	0.0667** (2.28)	0.0678** (2.24)	0.0677** (2.24)	0.116*** (3.26)	0.0936*** (2.61)	0.0919** (2.56)
Tobin_Q	0.00519** (2.24)	0.00497** (2.10)	0.00507** (2.13)	0.00581*** (3.04)	0.00643*** (3.43)	0.00639*** (3.39)
Size	0.117*** (7.59)	0.118*** (7.76)	0.118*** (7.71)	0.0643*** (6.24)	0.0632*** (6.29)	0.0625*** (6.17)
Dividend_dummy	-0.0113 (-0.51)	-0.00412 (-0.18)	-0.00534 (-0.23)	0.0214* (1.88)	0.0190* (1.69)	0.0189* (1.66)
Capex	0.0000668 (0.00)	0.0354 (0.91)	0.0177 (0.44)	-0.0819*** (-3.10)	-0.0418 (-1.60)	-0.0614** (-2.21)
NWC	-0.367*** (-9.64)	-0.103* (-1.74)	-0.101* (-1.71)	-0.336*** (-10.08)	-0.0959*** (-2.74)	-0.0931*** (-2.67)
Constant	-0.607*** (-5.61)	-0.639*** (-5.98)	-0.633*** (-5.90)	-0.257*** (-3.54)	-0.263*** (-3.70)	-0.257*** (-3.58)
Firm F.E	YES	YES	YES	YES	YES	YES
Industry F.E	YES	YES	YES	YES	YES	YES
Clustered Std Errors	YES	YES	YES	YES	YES	YES
N	9445	9643	9510	17370	17619	17356
R ²	0.178	0.127	0.128	0.155	0.115	0.116

NOTE: t-statistics in parentheses: * p:0.10, ** p:0.05, *** p:0.01