check for updates

The impact of the COVID-19 pandemic exposure on the corporate cash policy of Vietnam-listed enterprises

An Binh Nguyen[1]
Doan Trang Do[2]
Hoang Anh Le[3+]

[1,3]*Ho Chi Minh University of Banking, Vietnam.*
[2]*Binh Duong University, Vietnam.*
[1]*Email: binhna@hub.edu.vn*
[2]*Email: doantrang.bolt@bdu.edu.vn*
[3]*Email: anhlh_vnc@hub.edu.vn*

(+ Corresponding author)

ABSTRACT

The purpose of this study was to assess the impact of the COVID-19 epidemic on the daily stock returns of 177 businesses listed on the Vietnam Stock Exchange during the period spanning from the second quarter of 2020 to the first quarter of 2023. Next, we proceed to evaluate the influence of COVID-19 exposure on the cash holding ratio of these enterprises. We used research methods for panel data, such as the fixed effects method and the system GMM method. Our findings demonstrate that the exposure of enterprises to the COVID-19 pandemic has a discernible and statistically significant adverse effect on their financial reserves. When conducting research on the transmission channel of COVID-19 exposure to cash holding policies, we found that this impact persists in firms through financial frictions. Based on the findings, we have put forth several policy implications for businesses to formulate cash management policies in anticipation of future pandemics of a similar nature.

Contribution/Originality: This study represents one of the initial investigations on the effects of the COVID-19 pandemic on the cash holding strategies of Vietnamese companies, spanning from the beginning of the outbreak to the present.

1. INTRODUCTION

The COVID-19 pandemic is not only an epidemic but also deeply affects every aspect of the economy from a macro and micro perspective. Accordingly, governments quickly issued emergency response measures, including unprecedentedly large support packages accompanied by strict restrictions on social distancing to prevent the spread of the epidemic on the one hand and the recession of the economy on the other (Nguyen, Le, Thalassinos, & Trieu, 2022). Therefore, the issue of measuring the impact of the pandemic has attracted quite a lot of attention from scholars around the world.

Extensive research has delved into COVID-19's influence on the corporate sector, exploring aspects such as stock market volatility (Baek, Mohanty, & Glambosky, 2020; Onali, 2020) stock returns (Ding, Levine, Lin, & Xie, 2021; Narayan, Phan, & Liu, 2021), systemic risk (Rizwan, Ahmad, & Ashraf, 2020) and operational efficiency (Hu & Zhang, 2021; Shen, Fu, Pan, Yu, & Chen, 2020; Zheng, 2022). Notably, these studies often focus on the US, China, or international samples, leaving a dearth of research on COVID-19's impact in emerging markets. This study addresses this gap by conducting research in Vietnam, an emerging economy that achieved a rare positive economic growth of 2.9% in 2020 (Nguyen et al., 2022).

This study focuses on the role of corporate cash holding because of its importance in the day-to-day operations of businesses as well as other related management decisions such as funding, investment, payment, and corporate value in the context of the COVID-19 pandemic in Vietnam. This, in our opinion, is quite important as a consequence of restrictions and distancing measures from the government, which can lead to serious disruption of cash flows in the future as well as push companies into a liquidity crisis, thereby increasing the risk of bankruptcy (Acharya & Steffen, 2020). In addition, uncertainty stemming from the pandemic can increase the cost of external funding, exacerbating companies' financial constraints (Brogaard & Detzel, 2015).

To achieve the research objectives, we focus on answering the following two research questions:

First, will increased enterprises' COVID-19 exposure reduce the enterprise's cash holdings?

Second, does an enterprises' COVID-19 exposure have an impact on the cash holding ratio of firms with financial friction?

Our research contributes to the current line of research on this topic in a number of ways, such as the following:

First, to the best of our knowledge, this study represents one of the initial investigations on the effects of the COVID-19 pandemic on the cash holding strategies of Vietnamese companies, spanning from the beginning of the outbreak to the present.

Theoretically, the study contributes to shedding light on the theoretical basis of the pandemic's impact on businesses' cash management policies.

In practical terms, this study will be a typical reference channel for companies' cash management strategies to cope with uncertain situations.

2. LITERATURE REVIEW

Related studies by Gulen and Ion (2016); Guerrieri, Lorenzoni, Straub, and Werning (2020); Hu and Zhang (2021); Narayan et al. (2021); Shen et al. (2020) and He, Suardi, Wang, and Zhao (2022) demonstrate that companies experiencing positive responses in their stock returns corresponding to the intensity of the COVID-19 pandemic (such as medical device-related companies, etc.) tend to hold less cash amid the pandemic. To build a model and analyze their results, He et al. (2022) came up with the concept of a business's COVID-19 exposure. Specifically, this level of exposure is defined as the regression coefficient of corporate stock returns regressed on the number of COVID-19 cases. The results of He et al. (2022) suggest that a 1% increase in the company's COVID-19 exposure reduces its cash holdings by 0.1%. Therefore, in this study, for the Vietnamese market, we propose the research hypothesis as follows:

Hypothesis H_1: Increased enterprises' COVID-19 exposure will reduce the enterprises' cash holdings.

Next, He et al. (2022) also showed that COVID-19 exposure can impact corporate cash holdings through financial frictions. Financial friction in the credit market is understood as the impact factors that create the difference in the cost of using capital outside the enterprise compared to the cost of using internal capital, also known as the compensation fee for using capital outside the enterprise (Aysun, Brady, & Honig, 2013). These factors are due to frictional forces occurring in financial markets, typically asymmetric information between lenders and borrowers, or the costs of contract enforcement. These frictional forces limit the efficient allocation of resources, namely capital, and incur additional costs in the allocation process. Financial frictions may compel firms to forego lucrative investment prospects, particularly those characterized by significant asymmetrical knowledge against external capital lenders. A company with high financial friction has many barriers and complex procedures in the process of managing and using finance. These barriers and procedures can cause extra costs, reduce operational performance, and slow down a company's growth. Some of the causes of high financial friction include: (i) Ineffective financial management system: If the company does not have a good financial management system, the management and use of finance can become complicated and slow down the business process; (ii) Complex financial

processes: If the company has many complex financial processes, requiring a lot of paperwork and approvals from many different departments, it will lead to delays and loss of time; (iii) Financial constraints: If the company does not have sufficient financing to meet operational needs, then financial management will become difficult and lead to financial friction; (iv) Lack of a professional financial management team: If the company does not have a professional financial management team, then the financial management may not be done properly, resulting in financial friction. The firms with financial friction in this study were those that were small or had a low book value to market value.

In this study, we look for evidence of the impact of enterprises' COVID-19 exposure on corporate cash holdings through the financial friction channel by hypothesizing the following:

Hypothesis H₂: Enterprises' COVID-19 exposure has an impact on the cash holdings of firms with financial friction.

3. RESEARCH METHODOLOGY

3.1. Research Model

By estimating the model put forth by He et al. (2022) we first determine the degree of COVID-19 exposure of businesses listed on the Vietnam Stock Exchange. Enterprises' COVID-19 exposure was the main independent variable in this study, which quantifies the degree of responsiveness exhibited by business stocks' daily rate of return to the occurrence of the COVID-19 pandemic. The daily increase in new cases of the COVID-19 pandemic serves as a measure of the outbreak. For each firm and quarter, we estimate the equation below with date data for the period from April 1, 2020, to March 31, 2023. The equation is as follows:

$$r_{it} = \beta_0 + \beta_1 \times Covid_t + \beta_2 \times r_{m,t} + \varepsilon_{it} \ (1)$$

In particular, r_{it} is the daily stock return of enterprises i on day t, $Covid_t$ is the number of people infected with COVID-19 increases on day t, $r_{m,t}$ is the stock return of the Vietnamese market on day t. In this study, VNINDEX is defined as a market index. Thus, the level of COVID-19 exposure of enterprises in each quarter between Q2 2020 and Q1 2023 will be measured through a coefficient β_1. A positive (negative) level of COVID-19 exposure, β_1 greater than zero (less than 0), indicates that the company's stock rate of return responds positively (negatively) to the COVID-19 outbreak. For any corporate, corporate stocks will react negatively to the outbreak of the COVID-19 epidemic. However, with some enterprises in the pharmaceutical, medical, and food sectors, corporate stocks reacted positively to the epidemic.

Next, to assess the impact of the COVID-19 epidemic on the cash holdings of firms listed on the Vietnam stock exchange in the context of the pandemic, we use the following equation:

$$CASH_{it} = \alpha_0 + \alpha_1 \times CVD_{it} + \sum_{k=1}^{p} \alpha_k \times \phi_{k,i,t} + \propto_i + \theta_t + \varepsilon_{it} \ (2)$$

In particular, $CASH_{it}$ is the proportion of the enterprise's (i) cash holdings in t time. CVD_{it} is that the enterprises' COVID-19 exposure in t time will be measured through the coefficient β_1 in Equation 1. $\phi_{k,i,t}$ is a set of control variables, including enterprise size (natural logarithm of total assets), financial leverage (ratio of debt to total assets), return on assets (ROA), revenue on asset, and enterprise age (Age).

To determine the transmission channel for the COVID-19 pandemic's effects on businesses listed on the Vietnam Stock Exchange's cash holdings through financial frictions, we estimate Equation 2 with different business models. Specifically, we divide the sample of businesses into large-scale (B) and small-scale (S) businesses by market capitalization. Then, based on book value to market value, continue to divide small-scale enterprises (S) into SL (low-L), SM (medium-M), SH (high-H), and enterprises in large-scale group (B) into BL (low-L), BM (medium-M), BH (high-H). Thus, we have 6 business groups to carry out research.

Finally, to ensure the results are convergent, using robustness analysis, we adjust Equation 1 by, in turn, adding components of the Fama-French three-factor model, including:

(i) SMB (small minus big) variable is a factor in market size, measuring the additional rate of return that investors receive when investing in stocks of companies with low market capitalization instead of investing in

shares of companies with high market capitalization, then recalculating the level of COVID-19 exposure in the manner previously presented. The model is as follows:

$$r_{it} = \beta_0 + \beta_{twofactor} \times Covid_t + \beta_2 \times r_{m,t} + \beta_3 \times SMB_t + \varepsilon_{it} \ (3)$$

(ii) HML (high minus low) variable is a book-to-market value factor that measures the value premium that investors receive when investing in companies with high book-to-market value ratios instead of investing in companies with low book-to-market value ratios, then recalculates the level of COVID-19 exposure in the manner previously presented. In detail:

$$r_{it} = \beta_0 + \beta_{threefactor} \times Covid_t + \beta_2 \times r_{m,t} + \beta_3 \times SMB_t + \beta_4 \times HML_t + \varepsilon_{it}(4)$$

The new level of COVID-19 exposure $\beta_{twofactor}$, $\beta_{threefactor}$ used interchangeably for β_1 robustness analysis to ensure the impact of the COVID-19 epidemic on the cash holdings of firms listed on the Vietnam stock exchange is reliable.

3.2. Sample

Due to the large number of estimates in Equation 1, we collected a sample of 177 companies listed on the Vietnam stock exchange with daily returns, the daily stock returns of VNINDEX, and the number of new COVID-19 infections by day. Data on the returns of corporate stocks and VNINDEX are collected from April 1, 2020, to March 31, 2023, through the Application Programming Interface (API) of Saigon Securities Incorporation (SSI) Securities Joint Stock Company, an official unit of stock and market data in Vietnam (https://www.ssi.com.vn). Data on the number of new COVID-19 cases by day was collected from the database of Our World in Data (https://ourworldindata.org), a scientific online publication focusing on major global issues such as poverty, disease, hunger, climate change, war, existential risks, and inequality. For each business and the days in each quarter, we estimate the Equation 1. Thus, in theory, we have about 12 (quarters) x 177 (enterprises), which is 2124 times the estimate of Equation 1, which corresponds to 2124 values of β_1. However, some businesses will not have enough data, combined with the elimination of outlier observations, the number of β_1 values we obtained in this study are 1982 values. To perform this massive workload, we used the Python language to program automatic estimation. Details on estimation programming, β_1, SMB_t, HML_t, $\beta_{twofactor}$, $\beta_{threefactor}$ can be found at our GitHub repository at the following path: https://github.com/anhle32/Covid-19-Exposure.git

To estimate the above models, we use regression methods for panel data. First, we model the impact of enterprises' COVID-19 exposure on cash holdings using fixed-impact methods, fixed-impact impacts over time, and businesses are included in the model to control the influence of immutable company characteristics over time and business cycles.

However, with financial data, endogenous phenomena often occur and lead to unreliable estimates. Hence, in order to address the aforementioned issues of endogeneity, autocorrelation, and heteroscedasticity, Arellano and Bond (1991) used Generalised Method of Moments (GMM) regression. Furthermore, Blundell and Bond (1998) expanded upon the DGMM estimation technique by combining two estimate approaches, namely the fundamental model and the variable model. This combined approach is commonly referred to as the System Generalised Method of Moments (SGMM). In this study, we will test the endogenous phenomenon of the independent variables in the model. When endogenous phenomenon occur, we use System Generalized Method of Moments (SGMM) to re-estimate the model. Specifically, we use instrumental variables and endogenous variables in the model for estimation. Instrumental variables will be correlated with endogenous variables but not with the residuals in the model. This is the core of the SGMM method.

In addition, one of the shortcomings of previous studies is that they often do not perform model robustness tests. This is also the reason why conclusions about the direction of impact of variables in the model in previous studies often differ as the data changes. Therefore, in this study, we use $\beta_{twofactor}$, $\beta_{threefactor}$ to test the

robustness of the impact of enterprises' COVID-19 exposure on the cash holdings of businesses listed on the Vietnamese stock exchange.

Compared to previous studies, in terms of data, our study used a fairly large sample of companies in the Vietnamese market. At the same time, in terms of methodology, our study tested and identified endogenous variables and then used instrumental variables corresponding to these variables. This approach has rarely been performed in previous studies.

3.3. Research data

After measuring enterprises' COVID-19 exposure through coefficients β_1 for corporations on a quarterly basis, we continue to use quarterly data for 177 listed Vietnamese enterprises for the period from Q2 2020 to Q1 2023. The use of the most up-to-date quarterly data allows us to determine in a timely manner how the impact of the COVID-19 outbreak has affected the company's cash holdings. We use data collected from: Quarterly financial statements from companies listed on the Vietnamese stock market. The data is collected through the API of SSI Securities Joint Stock Company, an official unit of stock and market data in Vietnam (https://www.ssi.com.vn). The data collected to calculate variables in the model include: firm size (natural logarithm of total assets), financial leverage (ratio of debt to total assets), Return on total Assets (ROA), business opportunity (Revenue on asset), and enterprise age (Age).

4. EMPIRICAL RESULTS

4.1. Descriptive statistics

Table 1 displays the statistical data pertaining to the primary variables examined in this study. The analysis of descriptive statistics reveals that the mean proportion of cash holdings in relation to total assets across the enterprises included in our sample was 6.7%. The 25th percentile exhibits a cash holdings to total assets ratio of 1.8%, while the 75th percentile demonstrates a ratio of 9.1%. The highest observed figure for the cash holdings to total assets ratio is 53.4%. These results show significant differences in cash holdings between businesses in our study sample. Descriptive statistics also show that enterprises' COVID-19 exposure in the 25th percentile is negative, while in the 75th percentile onwards, it is positive. This result shows significant heterogeneity in the day-to-day response of stock returns to the number of new COVID-19 infections.

Table 1. Descriptive statistics.

Variables	Obs.	Mean	Std.	Min.	25%	50%	75%	Max.
Dependent variables								
Cash on asset	1982	0.067	0.075	0.000	0.018	0.042	0.091	0.534
Covid exposure								
Covid exposure	1982	0.009	0.089	-0.689	0.000	0.000	0.002	0.747
Twofactor_COVID exposure	1982	0.010	0.089	-0.719	0.000	0.000	0.002	0.736
Threefactor_COVID exposure	1982	0.007	0.094	-1.261	0.000	0.000	0.002	0.959
Firm characteristics variables								
Firm size	1982	7.861	1.509	4.812	6.795	7.570	8.865	12.842
Leverage	1982	0.231	0.174	0.000	0.100	0.200	0.400	0.700
ROA	1982	0.063	0.082	-0.288	0.017	0.045	0.090	0.505
Revenue on asset	1982	0.854	0.945	0.000	0.300	0.700	1.100	9.600
Firm age	1982	18.528	7.079	6.000	15.000	17.000	21.000	50.000

Note: This table presents statistical results describing samples for the period from January 2020 to March 2023. Cash on asset describes companies' cash holdings.

Figure 1 presents the correlation between the main variables in the model. It showed that none of the correlations between the independent variables in the model were large enough to raise concerns about linear multi-addictiveness in our multivariate regression analysis.
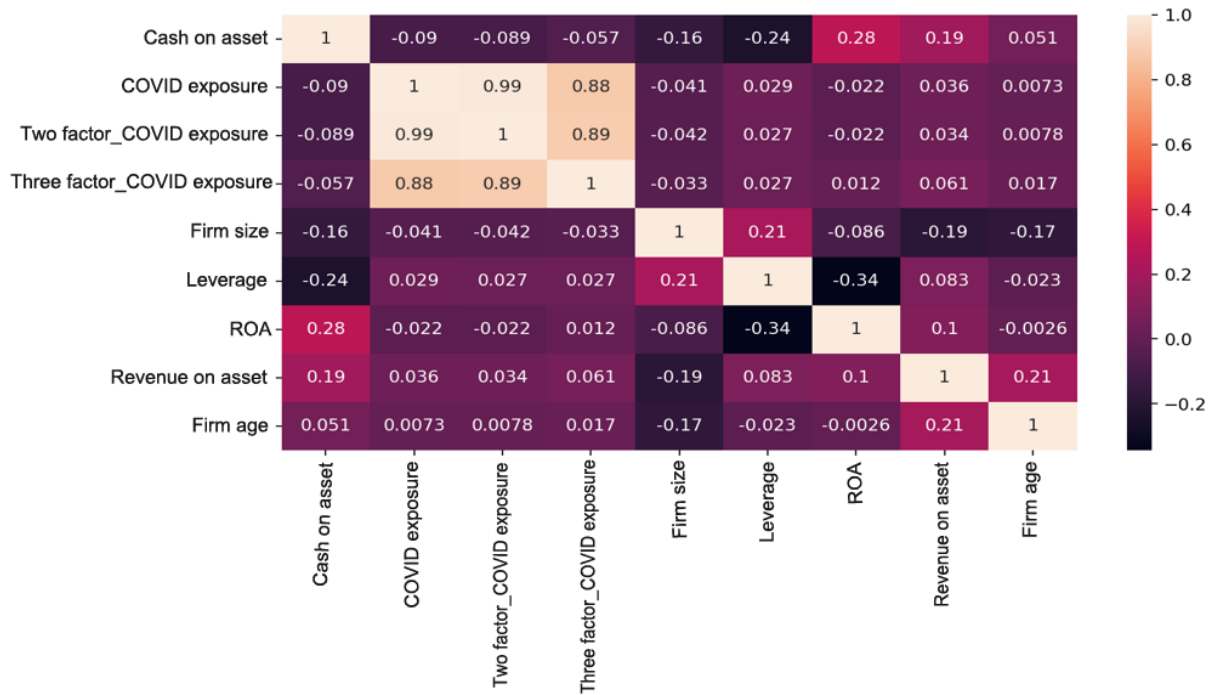
Figure 1. Correlation coefficients.

4.2. Main Findings

Table 2 presents the results of estimating models of the impact of enterprises' COVID-19 exposure on the cash holding ratio of enterprises listed on the Vietnam stock exchange. Specifically, in column (1), we estimate the model with only one independent variable: enterprises' COVID-19 exposure. In column (2), we estimate the model with enterprises' COVID-19 exposure variable, and the control variables that represent the characteristics of the business include: firm size, debt on asset, ROA, revenue on asset, and age.

Table 2. The impact of COVID-19 exposure on corporate cash holdings.

Dependent variable	Cash on asset	
	(1)	(2)
COVID-19 exposure	-0.092***	-0.090***
	(0.000)	(0.000)
Firm size		0.031***
		(0.000)
Debt on asset		-0.091***
		(0.000)
ROA		0.031
		(0.251)
Revenue on asset		-0.018***
		(0.000)
Age		-0.003***
		(0.010)
Constant	0.068	-0.082
Quarter FE	Yes	Yes
Firm FE	Yes	Yes
Observation	1982	1982

Note: This table presents the results of estimating models of the impact of enterprises' COVID-19 exposure on businesses' cash holdings. The models are estimated using the fixed-impact method. Each model includes a fixed effect by enterprise and a fixed effect on a quarterly basis. The p-value is presented in parentheses. The symbols *** correspond to 10.

The estimated results showed that the coefficients corresponding to enterprises' COVID-19 exposure were negative and statistically significant at 1% in both models. This result shows that companies with positive

(negative) exposure, i.e., the return on assets on their shares, reacted positively (negatively) to the outbreak of COVID-19, and they reduced (increased) their cash holdings. In terms of economic significance, for a company with positive COVID-19 exposure, when this level increases by 1%, the company's cash holdings decrease by 0.092%. With an average firm size of 7.861 (calculated according to the natural logarithm of total assets), i.e., VND 2593 billion, when COVID-19 exposure increases by 1%, the amount of cash held will decrease by an average of VND 2.39 billion. However, the coefficient corresponding to enterprises' COVID-19 exposure was -0.090 in column (2) after controlling for company characteristics.

In addition, we also found that the coefficients corresponding to firm size, debt-to-total assets, revenue-to-total assets, and age of the company were also statistically significant at 1%. At the same time, the sign of the coefficients corresponding to these variables is also consistent with the theory. In the context of the pandemic, it was observed that larger corporations tended to have higher levels of cash reserves, while enterprises characterized by elevated financial leverage, substantial turnover to total assets, and perpetual business models tended to possess lower cash holdings during the same period.

Besides, enterprises' COVID-19 exposure had a negative impact on the cash holdings of companies listed on the Vietnamese stock market during the pandemic. Next, we test endogenous phenomena to ensure that the results achieved are reliable.

Table 3. Tests of endogeneity.

Dependent variable	Cash on asset	
	Durbin chi2	Wu-Hausman F
COVID-19 exposure	4.370**	4.361**
	(0.037)	(0.037)
Firm size	12.357***	12.387***
	(0.000)	(0.000)
Debt on asset	1.145	1.140
	(0.285)	(0.286)
ROA	2.358	2.350
	(0.125)	(0.126)
Revenue on asset	3.621*	3.612*
	(0.057)	(0.058)
Age	1.181	1.177
	(0.277)	(0.278)

Note: We test endogenous phenomena for each variable in the model. For each variable, we use a 1-quarter lag variable as the instrumental variable for that variable. The p-value is presented in parentheses. The symbols *, **, *** correspond to statistical significance levels of 10%, 5%, 1%.

The results in Table 3 show that the enterprises' COVID-19 exposure, firm size, and revenue on asset variables are endogenous. The rest of the variables in the model are exogenous. To overcome this phenomenon, we re-estimate the impact of enterprises' COVID-19 exposure on the cash holding ratio of enterprises listed on the Vietnam stock exchange by SGMM.

The results of the estimation of the models in Table 4 show that the p-value of the F-test is less than 1% less than the statistical significance level, so the models are consistent. The tests for first-order autocorrelation (AR(1)) of the models all have a p-value less than the statistical significance level by 1%. The test for second-order autocorrelation (AR(2)) of the models all has a p-value greater than the statistical significance level by 1%. Thus, instrumental variables are appropriate. In addition, the Hansen test of the models has a p-value greater than the statistical significance level by 10%, i.e., the instrumental variables are not used in excessive quantities. Finally, the number of instrumental variables in the models is smaller than the number of groups. Thus, parameter estimates by the SGMM method ensure reliability.

Table 4. The impact of enterprises' COVID-19 exposure on corporate cash holdings.

Dependent variable	Cash on asset	
	(1)	(2)
Cash on asset (t-1)	0.5952***	0.4778***
	(0.000)	(0.000)
COVID-19 exposure	-0.0970***	-0.0851**
	(0.000)	(0.020)
Firm size		-0.0008
		(0.470)
Debt on asset		-0.0370***
		(0.000)
ROA		0.0967***
		(0.000)
Revenue on asset		0.0056***
		(0.000)
Age		-0.0001
		(0.740)
Constant	0.0240	0.0351
F-test	0.000	0.000
AR(1)	0.000	0.000
AR(2)	0.871	0.610
Hansen's test	0.422	0.286
The amount of groups	177	175
The amount of instruments	40	42

Note: This table presents the results of estimating models of the impact of enterprises' COVID-19 exposure on the cash holding rates of businesses using the SGMM method. In line with the dynamic model, we added the lag variable of the dependent variable Cash on asset (t-1). The p-value is presented in parentheses. The symbols **, *** correspond to 10%, 5% significance levels.

Column (1) of Table 4 shows that the coefficients corresponding to enterprises' COVID-19 exposure carried negative values and were statistically significant at 1% in both models. This result shows that companies with positive (negative) exposure, i.e., the rate of return on their shares, reacted positively (negatively) to the outbreak of COVID-19; they reduced (increased) their cash holdings. In terms of economic implications, for a company with positive COVID-19 exposure, when this level increases by 1%, the company's cash holdings decrease by 0.097%. With an average firm size of 7.8606 (calculated in natural logarithms of total assets), i.e., Vietnamese Dong (VND) 2593 billion, when COVID-19 exposure increases by 1%, the amount of cash held will decrease by an average of VND 2.52 billion.

This result is quite a small difference from the results obtained from Table 2. Besides, in column (2) of Table 4, the coefficient corresponding to enterprises' COVID-19 exposure was -0.0851 and was also statistically significant at 5% after controlling for company characteristics. Thus, the study results show that the H1 hypothesis is supported, i.e., increased COVID-19 exposure of enterprises will reduce the proportion of cash holdings of enterprises.

This result is also consistent with the study by He et al. (2022). Besides, compared to the results of He et al. (2022) the impact of enterprises' COVID-19 exposure on cash holdings in this study is higher. Specifically, in the Chinese market, the coefficient corresponding to enterprises' COVID-19 exposure was − 0.073 and was also statistically significant at 5% after controlling for company characteristics. This shows that enterprises in the Vietnamese market have a stronger reaction than enterprises in the Chinese market to the COVID-19 pandemic.

Next, we investigate the impact of enterprises' COVID-19 exposure on a business's cash holdings through financial frictions. The businesses with financial friction in this study were those that were small or had low book value to market value. First of all, we do research with small and large-scale businesses.

Table 5. COVID-19 exposure, corporate financial frictions, and corporate cash holdings.

Dependent variable	Cash on asset	
	Small	**Big**
Cash on asset (t-1)	0.5049***	0.4685***
	(0.000)	(0.000)
COVID-19 exposure	-0.1069***	-0.1313***
	(0.008)	(0.000)
Firm size	-0.0046	0.0042***
	(0.128)	(0.000)
Debt on asset	-0.0699***	0.0114
	(0.000)	(0.154)
ROA	0.0568***	0.1149***
	(0.010)	(0.000)
Revenue on asset	0.0048***	0.0045**
	(0.002)	(0.023)
Age	0.0000	-0.0001
	(0.949)	(0.836)
Constant	0.0671	-0.0224
F-test	0.000	0.000
AR(1)	0.000	0.000
AR(2)	0.480	0.253
Hansen's test	0.706	0.146
The amount of groups	88	87
The amount of instruments	42	42

Note: The p-value is presented in parentheses. The symbols **, *** correspond to 10%, 5% significance levels.

Similar to the argument in Table 4, the results in Table 5 show that parameter estimates using the SGMM method are all reliable. Model estimates with a sample of small businesses show that when enterprises' COVID-19 exposure increased by 1%, small businesses' cash holdings decreased by 0.1069%. Meanwhile, model estimates with a sample of large enterprises showed that when COVID-19 exposure increased by 1%, the cash holdings of large enterprises decreased by 0.1313%. This result suggests that large businesses will react to a greater extent by reducing their cash holdings during the COVID-19 outbreak. This is an interesting result that we have discovered in the Vietnamese market. Our study and the study of He et al. (2022) both support the H2 hypothesis, i.e., there is an impact of enterprises' COVID-19 exposure on a business's cash holdings through financial frictions. However, a specific market is Vietnam, where large enterprises are mostly concentrated in the fields of food, pharmaceuticals, and healthcare. As the COVID-19 pandemic worsens, the demand for products from these sectors increases while other expenditure activities (salary expenses, selling expenses, advertising) remain unchanged or even decrease. These businesses will tend to hold less cash and concentrate resources on the supply of goods to the market. Therefore, our research results are perfectly suited to the Vietnamese market. Next, we perform research with businesses with book values above different market values. The businesses in the sample studied were categorized into 6 groups, as described in Section 3. The results in Table 6 show that parameter estimates using the SGMM method ensure reliability. For businesses in the SL (Small Low) group, the results showed that no impact of enterprises' COVID-19 exposure on cash holdings existed. However, starting from the SM group onwards, the models all show the impact of enterprises' COVID-19 exposure on cash holdings. At the same time, our results show that it is very interesting that the magnitude of this impact decreases as businesses whose book value to market value gradually increase. This result shows that, with businesses with strong financial potential, they have more information, so they are better able to forecast the situation. As a result, these businesses can implement cash management policies more quickly without suffering significantly from the COVID-19 epidemic situation in the market. Except for enterprises in the BM (Big Medium) group, this group concentrates most enterprises in the fields of food, pharmaceuticals, and healthcare. As analyzed in Table 5, these businesses will have more business activity during the pandemic, so they do not regularly maintain a large cash fund on total assets. Thus, the research results in Table 6 still support the H2 hypothesis, i.e., there is an impact of enterprises' COVID-19 exposure on the cash holding rate of enterprises through financial frictions.

Table 6. COVID-19 exposure, corporate financial frictions, and corporate cash holdings.

Dependent variable	Cash on asset					
	SL	**SM**	**SH**	**BL**	**BM**	**BH**
Cash on asset (t-1)	0.5516***	0.6086***	0.2724***	0.4089***	0.4498***	0.3886***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
COVID-19 exposure	-0.0308	-0.3764***	-0.1635***	-0.0761***	-0.1796***	-0.0392*
	(0.549)	(0.000)	(0.000)	(0.001)	(0.000)	(0.054)
Firm size	-0.0176***	-0.0021	-0.0212***	0.0024**	0.0005	-0.0005
	(0.000)	(0.618)	(0.000)	(0.024)	(0.731)	(0.711)
Debt on asset	-0.0326	-0.0771***	-0.0270*	-0.0183**	0.0214***	-0.0202*
	(0.109)	(0.000)	(0.066)	(0.013)	(0.007)	(0.054)
ROA	-0.0032	0.0603	0.1468***	0.0533**	0.1569***	0.0705***
	(0.869)	(0.294)	(0.000)	(0.040)	(0.000)	(0.004)
Revenue on asset	0.0202***	0.0027***	-0.0074***	0.0101***	0.0000	0.0077***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.994)	(0.000)
Age	-0.0008	0.0001	0.0000	0.0000	0.0016***	0.0000
	(0.883)	(0.592)	(0.668)	(0.886)	(0.000)	(0.914)
Constant	0.1531	0.0517	0.1798	-0.0008	-0.0098	0.0205
F-test	0.000	0.000	0.000	0.000	0.000	0.000
AR(1)	0.005	0.013	0.034	0.003	0.005	0.085
AR(2)	0.994	0.196	0.102	0.294	0.849	0.175
Hansen's test	0.939	0.965	0.992	0.956	0.745	0.180
The amount of groups	31	29	28	30	36	21
The amount of instruments	21	22	21	22	22	19

Note: The p-value is presented in parentheses. The symbols *, **, *** correspond to 10%, 5%, 1% significance levels.

4.3. Robustness tests

Next, we used $\beta_{twofactor}, \beta_{threefactor}$ instead of measuring enterprises' COVID-19 exposure and re-estimating the model. This approach is to test the robustness of the impact of enterprises' COVID-19 exposure (β_1) on the cash holdings of enterprises listed on the Vietnam stock exchange.

Table 7. Robustness tests with alternative enterprises' COVID-19 exposure measures.

Dependent variable	Cash on asset	
	(1)	**(2)**
Cash on asset (t-1)	0.4766***	0.4765***
	(0.000)	(0.000)
Twofactor_COVID-19 exposure	-0.0843**	
	(0.022)	
Threefactor_COVID-19 exposure		-0.0755**
		(0.036)
Firm size	-0.0008	-0.0008
	(0.432)	(0.444)
Debt on asset	-0.0372***	-0.0373***
	(0.000)	(0.000)
ROA	0.0964***	0.0968***
	(0.000)	(0.000)
Revenue on asset	0.0057***	0.0058***
	(0.001)	(0.001)
Age	-0.0001	-0.0001
	(0.713)	(0.696)
Constant	0.0360	0.0359
F-test	0.000	0.000
AR(1)	0.000	0.000
AR(2)	0.614	0.616
Hansen's test	0.287	0.264
The amount of groups	175	175
The amount of instruments	42	42

Note: The p-value is presented in parentheses. The symbols **, *** correspond to 10%, 5% significance levels.

Table 7 presents the results of estimating the impact of enterprises' COVID-19 exposure on the cash holding ratio of enterprises listed on the Vietnam Stock Exchange with variables measuring COVID-19 exposure instead of β_1. We found

that enterprises' COVID-19 exposure continued to have a negative and statistically significant impact at 5% on the cash holdings of businesses in the study sample. Specifically, if enterprises' COVID-19 exposure is measured by $\beta_{twofactor}$, the results show that when COVID-19 exposure increases by 1%, the company's cash holdings decrease by 0.0843%. While COVID-19 exposure is measured by $\beta_{threefactor}$, the results show that when COVID-19 exposure increases by 1%, the company's cash holdings decrease by 0.0755%. As such, the results on the impact of enterprises' COVID-19 exposure on the cash holding ratio of businesses listed on the Vietnam Stock Exchange are unchanged as we change the way we measure COVID-19 exposure.

5. CONCLUSIONS

5.1. Practical Implications

The COVID-19 pandemic has significantly influenced the global economy and financial markets. The operational uncertainty associated with companies' share prices provides regulators with the necessary knowledge to promptly respond and modify their cash holding policies. This study aimed to assess the level of COVID-19 exposure among 177 businesses listed on the Vietnam stock exchange. To achieve this, we conducted a regression analysis, examining the relationship between their daily stock returns and the number of new daily COVID-19 infections. Additionally, we controlled for market profits to account for potential confounding factors. Next, we assess the impact of enterprises' COVID-19 exposure on these businesses' cash holdings. Our research results show that businesses exposure to COVID-19 has a negative and statistically significant impact on their cash holdings. When we conducted research on the transmission channel of COVID-19 exposure to businesses' cash holdings, we found that this impact persists in businesses through financial frictions. Specifically, in the Vietnamese market, large-scale enterprises will react to a greater extent by reducing their cash holdings during the COVID-19 outbreak than small-scale businesses. At the same time, our results show that it is very interesting that the magnitude of this impact decreases as businesses with Karma have a book value above a gradual increase in market value. In summary, the results of our study offer valuable insights for regulators in proactively shaping the cash holding practices of corporations in the face of global crises. From a governmental perspective, it is advisable to formulate preferential policies pertaining to bank loans, tax reductions, and fee reductions based on the varying degrees of impact that the pandemic has had on different enterprises. These policies aim to assist businesses in securing sufficient cash flow for their operational needs. Business enterprises that have been subject to adverse COVID-19 exposures are observed to experience a heightened level of impact from the ongoing pandemic, resulting in more pronounced financial challenges compared to their pre-pandemic circumstances. Hence, the provision of government subsidies or bailouts confers advantages upon these corporations.

5.2. Limitations and Future Research

Although it has answered all the initially proposed research questions, this study cannot avoid the following objective limitations:

First, many additional control variables that are not a part of the study's theoratical model have an impact on the cash holding ratio of businesses. Therefore, future studies need to study more theory to add other control variables that affect cash holding policy to be able to draw better conclusions.

Second, with the goal of finding evidence on the impact of COVID-19 exposure on the cash holding rate of businesses in the Vietnamese market, the results of this study are only related to the Vietnamese market. Therefore, future studies can expand the scope of research to the entire Asian region to be able to draw more comprehensive conclusions for a dynamic and rapidly developing region.

REFERENCES

Acharya, V. V., & Steffen, S. (2020). The risk of being a fallen angel and the corporate dash for cash in the midst of COVID. *The Review of Corporate Finance Studies, 9*(3), 430-471. https://doi.org/10.3386/w27601

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies, 58*(2), 277–297. https://doi.org/10.2307/2297968

Aysun, U., Brady, R., & Honig, A. (2013). Financial frictions and the strength of monetary transmission. *Journal of International Money and Finance, 32*(C), 1097–1119.

Baek, S., Mohanty, S. K., & Glambosky, M. (2020). COVID-19 and stock market volatility: An industry level analysis. *Finance Research Letters, 37*, 101748. https://doi.org/10.1016/j.frl.2020.101748

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115–143.

Brogaard, J., & Detzel, A. (2015). The asset-pricing implications of government economic policy uncertainty. *Management Science, 61*(1), 3–18. https://doi.org/10.1287/mnsc.2014.2044

Ding, W., Levine, R., Lin, C., & Xie, W. (2021). Corporate immunity to the COVID-19 pandemic. *Journal of Financial Economics, 141*(2), 802–830. https://doi.org/10.1016/j.jfineco.2021.03.005

Guerrieri, V., Lorenzoni, G., Straub, L., & Werning, I. (2020). *Macroeconomic implications of covid-19: Can negative supply shocks cause demand shortages?* NBER Working Paper No. 26918.

Gulen, H., & Ion, M. (2016). Policy uncertainty and corporate investment. *The Review of Financial Studies, 29*(3), 523–564. https://doi.org/10.1093/rfs/hhv050

He, Z., Suardi, S., Wang, K., & Zhao, Y. (2022). Firms' COVID-19 pandemic exposure and corporate cash policy: Evidence from China. *Economic Modelling, 116*, 105999. https://doi.org/10.1016/j.econmod.2022.105999

Hu, S., & Zhang, Y. (2021). COVID-19 pandemic and firm performance: Cross-country evidence. *International Review of Economics & Finance, 74*, 365–372. https://doi.org/10.1016/j.iref.2021.03.016

Narayan, P. K., Phan, D. H. B., & Liu, G. (2021). COVID-19 lockdowns, stimulus packages, travel bans, and stock returns. *Finance Research Letters, 38*, 101732. https://doi.org/10.1016/j.frl.2020.101732

Nguyen, T. D., Le, A. H., Thalassinos, E. I., & Trieu, L. K. (2022). The impact of the COVID-19 pandemic on economic growth and monetary policy: An analysis from the DSGE model in Vietnam. *Economies, 10*(7), 159. https://doi.org/10.3390/economies10070159

Onali, E. (2020). Covid-19 and stock market volatility. *Available at SSRN 3571453.* https://doi.org/10.2139/ssrn.3571453

Rizwan, M. S., Ahmad, G., & Ashraf, D. (2020). Systemic risk: The impact of COVID-19. *Finance Research Letters, 36*, 101682. https://doi.org/10.1016/j.frl.2020.101682

Shen, H., Fu, M., Pan, H., Yu, Z., & Chen, Y. (2020). The impact of the COVID-19 pandemic on firm performance. *Emerging Markets Finance and Trade, 56*(10), 2213–2230. https://doi.org/10.1080/1540496X.2020.1785863

Zheng, M. (2022). Is cash the panacea of the COVID-19 pandemic: Evidence from corporate performance. *Finance Research Letters, 45*, 102151. https://doi.org/10.1016/j.frl.2021.102151