Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Is cash the panacea of the COVID-19 pandemic: Evidence from corporate performance

Michael Zheng

Finance Department, Missouri State University, Missouri, USA

ABSTRACT

This study investigates the impact of COVID-19 crisis on corporate investment and financing policies. Using a difference-in-difference approach, I find while firms suffer from a real negative shock from the pandemic on average, firms with an abundant cash reserve prior to the crisis outperform firms without. Consistent with the precautionary motive behind corporate cash holdings, this paper demonstrates the effect of cash holdings is meaningful to mitigate adverse effect of the aggregate market. My finding also highlights the difficulty in estimating the optimal cash level when rare market condition is considered.

1. Introduction

The global pandemic of the coronavirus has spread at frightening rates. What is equally alarming is the severe impact COVID-19 has on the economy.¹ This unprecedented pandemic poses a negative supply shock to firms’ production capacity due to government lockdowns. The damaging effect is aggravated by an even larger scale of a demand shock, as affected jobless workers lose income and reduce their consumption of goods and services (Brinca et al., 2020; Guerrieri et al., 2020).

In this study, I examine whether corporate cash holdings can mitigate the adverse effect of the COVID-19 pandemic on firms’ performance. It has been well acknowledged that U.S. corporations hold much more cash than they used to. On the one hand, the advantage of keeping a liquid balance sheet is vital for a business to stay alive in a bad time. In theory, financing frictions combined with deteriorating market conditions can lead to credit rationing and exacerbate refinancing risk, making externally obtained capital

E-mail address: xibei.zheng@ttu.edu.

¹ I am grateful to Sam Vigne (the editor), Betty Simkins (the handling editor), and an anonymous referee. I thank Savannah Guo for her helpful comments and feedbacks on this paper. All remaining errors are my own fault.

² COVID-19 is triggering some serious damages to the business world, including for example, changes in consumer behavior, disruption to the labor market, breakage in global supply and demand chains, business shutdowns and bankruptcies, all of which can have a profound impact on firms optimal corporate policies.

https://doi.org/10.1016/j.frl.2021.102151
Received 23 January 2021; Received in revised form 25 March 2021; Accepted 19 May 2021
Available online 26 May 2021
1544-6123/© 2021 Elsevier Inc. All rights reserved.
more expensive than those generated internally. (Stiglitz and Weiss, 1981; Holmstrom and Tirole, 1998; Froot et al., 1993). I refer to this as the Precautionary Hypothesis. Empirical evidence lends strong support to the precautionary or risk management motive of cash holdings. In a similar vein, product market competition literature suggests that firms with an ample amount of cash can deter rivals’ entry and use aggressive pricing strategies to eliminate opponents’ market shares (Bolton and Scharfstein, 1990; Fresard, 2010).

On the other hand, there are agency costs associated with excessive cash holdings to shareholders. (Jensen, 1986; Stulz, 1990). Under this framework, excess cash holdings give a manager an incentive to extract rent from shareholders and cause distortions to a firm’s optimal corporate policies. I refer to this as the Distortion Hypothesis. A number of empirical studies demonstrate the downside of excessive cash holdings. Ultimately, whether having abundant cash is beneficial to firms becomes an empirical question.

In a natural experiment setting, I employ a differences-in-differences (DiD) approach to compare firms’ performance before and after the COVID-19 pandemic as a function of their cash holdings one year prior to the crisis, controlling for firm fixed effects and observable firm characteristics. My empirical study delivers two sets of results. First, I find that the pandemic has an adverse effect on firms’ performance, where performance is measured by investment, operating performance, financing, and payout. This finding is consistent with the evidence that COVID-19 exerts a real negative shock to firms’ profit. More importantly, I find that firms with more cash holdings prior to the crisis perform significantly better than firms with less cash in using all four measures of firm performance, consistent with the Precautionary Hypothesis. My findings are robust to additional industry by year-quarter fixed effects as well as standard errors clustered by both firm and year-quarter (Petersen, 2009).

My study offers two important contributions to the literature. I show that the precautionary motive of corporate cash holdings is beneficial to firms in bad times when credit tightens and access to external finance is infeasible. While prior literature has considered the role cash holdings plays in the 2007-2008 financial crisis on corporate policy, the focus has largely been on the impact on corporate investment (Almeida et al., 2012); Campello et al., 2010; Duchin et al., 2010). This study is the first to test the effect of cash holdings on a broader set of corporate performance measures during the COVID-19 crisis, corroborating prior findings. This paper highlights the risk management function of corporate cash holdings, which is meaningful to mitigate the adverse effect of the overall market.

I also add to the growing literature on the impact of COVID-19 on firms (e.g., (Achary and Steffen, 2020); Brunnermeier and Krishnamurthy, 2020; Fahlenbrach et al., 2020). A concurrent study by Tawiah and Keefe (2020) documents similar findings of the effect of cash holdings on corporate investment during the pandemic. My results complement (Tawiah and Keefe, 2020) findings, and also shed light on other important corporate aspects, such as operating performance, financing, and payout.

2. Data and empirical design

2.1. Sample selection

My sample consists of quarterly data on publicly traded firms from Compustat. The sample includes firm observations with fiscal quarters that fall between 2018Q4 and 2020Q4. I define the post-COVID-19 pandemic period when a firm-quarter observation appears after the fourth quarter of 2019. This approach splits the pre-and post-crisis evenly by calendar quarter, and helps to average out any seasonal patterns in the quarterly data (Shin and Kim, 2002). I exclude financial and utility firms (SIC codes 4900-4999 and 6000-6999). I further exclude firms with non-positive sales and total assets, following Harford et al. (2014). These selection criteria yield a sample of 30,822 firm-quarter observations.

2.2. Variable construction

Because the focus of this study is on the impact of cash holdings on firms’ performance, I include four broad categories of corporate performance as my dependent variables: investment, operating performance, financing, and payout. For each of the corporate performance variables, I include multiple proxies to mitigate the concern of measurement error. I measure investment with capital expenditure, research and development expense, sales, general and administrative expense, net working capital excluding cash, and total inventories. I measure operating performance using the return on equity, return on asset, Tobin’s Q, asset growth, and market share. For financing activity, I proxy it using changes in short-term debt, changes in long-term debt, and equity issuance. Finally, I measure a firm’s payout using total payout, repurchases, and dividends. All measures are scaled by total assets.

The independent variable of interest is cash holdings, which I define as the ratio of cash and short-term investment to total asset. To control variations in a firm’s characteristics, I include size (log of total assets), cash flow, leverage, and Q, following Derrien and Kecskes (2013). All continuous variables are winsorized at the 1st and 99th percentiles to reduce the influence of outliers.

2.3. Empirical design

Following Duchin et al. (2010), I employ a DiD approach that considers the COVID-19 crisis as an exogenous shock and compares firms’ operating performance conditional on their cash holdings one year prior to the crisis:

---

3 See, for example, Opler, Pinkowitz, Stulz, and Williamson (1999); Almeida et al. (2005); Acharya, Almeida, and Campello (2007); Bates, Kahle, and Stulz (2009); Harford, Klasa, and Maxwell (2014).

4 See, for example, Harford (1999); Pinkowitz, Stulz, and Williamson (2006); Dittmar and Mahrt-Smith (2007); Harford, Mansi, and Maxwell (2008).
Firm performance\(_{it}\) = \(\alpha + \beta_1\) Cash\(_{2018Q4}^{\text{After}} + \beta_2\) After + \(\gamma\) Control\(_{it}\) + \(\theta_i\) + \(\epsilon_{it}\)  \(\quad(1)\)

where \(i\) indexes the firm, and \(t\) indexes the year-quarter. \(\theta_i\) is firm-fixed effect. \(\text{After}\) is an indicator variable that takes the value of one if the calendar quarter falls after 2019Q4. A firm’s cash position is measured only once within the sample – at the end of 2018Q4. Firm fixed effects subsume the level effect of cash, and standard errors are clustered at the firm level. This identification strategy assumes that the COVID-19 crisis is a truly exogenous event that is unrelated to a firm’s characteristics and year-before cash positions are not positively correlated with unobserved within-firm changes in the business fundamentals. \(\beta_1\) captures the added effect of cash holdings conditional on the crisis.5

Table 1 provides summary statistics of the variables used in the analyses. The average cash position measured one year ahead of the COVID-19 crisis is 22.0% of a firm’s total assets. This is comparable to the magnitude reported in Duchin et al. (2010). I do not impute any missing values, but the main results remain quantitatively similar if I use a balanced sample.

3. Main empirical analyses

3.1. Investment

Table 2 presents estimates from my baseline regressions using a set of corporate investment variables as the dependent variables. The coefficients on \(\text{After}\) are negative and significant at the 1% level across all specifications, indicating that COVID-19 leads to a significant reduction in firms’ investment. The coefficients of interest, \(\beta_1\), are positive and significant in all columns except for \(\text{R&D}\).6 A sufficient amount of cash reserve can mitigate the adverse effect caused by deteriorating market conditions. To gauge the economic significance, for example, one standard deviation increase in the pre-COVID cash reserve leads to an increase of \(\text{Capex}\) by 0.1 percentage point in column (2), which is comparable to the magnitude documented in Duchin et al. (2010). Across all specifications, the vector of control variables does not subsume the explanatory power of the interaction term. This provides additional evidence on the validity of the DiD setting.

3.2. Operating performance

The Table 2 results suggest firms with abundant cash reserve invest more during the post COVID-19 crisis. A natural question to ask is how do we interpret the finding? Under Distortion Hypothesis, a rise in corporate investment can be viewed as a form of inefficient overinvestment rather than the alleviation of underinvestment. To distinguish the two hypotheses, I focus on firms’ operating performance. Regardless of how I measure performance, Table 3 displays that firms experience a reduction in performance after the crisis, but the negative effect is mitigated by a sufficient pre-COVID cash reserve. Inconsistent with the Distortion Hypothesis, I find firms with large cash holdings are performing significantly better, which emphasizes the advantage of maintaining a large cash reserve. Importantly, the effect of cash holdings on market shares in column (9) & (10) demonstrates that firms “benefit from cash holdings especially from the financial turmoil by gaining a leading position in their product market” (Fresard, 2010).

3.3. Financing

The previous two tables provide a great support for the Precautionary Hypothesis. In Table 4, I focus on the effect of internal slack on firms’ financing activity. Except for changes in long-term debt, firms experience a reduction in financing activity after the COVID-19 pandemic. In column (1) & (2), I find that while the crisis reduces the level of short-term debt financing on average, firms with large cash holdings have significantly more short-term debt than firms with low cash holdings, which is consistent with the view that lenders take refinancing risks into consideration when issuing short-maturity debt (Harford et al., 2014). In column (3) & (4), I discover the opposite effect: firms take more long-term debt in the post-crisis period, while cash-rich firms have relatively less long-term debt. Unlike short-term debt that has to be repaid in a fairly short period of time and is subject to a higher refinancing risk, long-term debt provides affected firms enough liquidity to overcome the adverse shock. My empirical results support Almeida (2020)’s finding that firms take long-term debt to mitigate negative liquidity shock induced by COVID-19 pandemic. The liquidity constraint may not be binding if firms already stock up sufficient cash reserve. I find while the \(\text{After}\) dummy is positively significant, the interaction term with \(\text{cash holdings}\) is negative, supporting the notion that internal slack is less costly than external debt. Lastly, I find firms are less likely to issue new equities after the crisis on average, and this is especially true for firms with large cash reserves. Since equity is usually viewed as the last resort in the presence of financing friction, this finding is consistent with the pecking order theory.

---

5 To further alleviate the concern that time-series variations at the industry level might be driving my results, I include industry by year-quarter fixed effects. I also cluster my standard errors at both firm and year-quarter levels. My results remain the same. I list them in the appendix B.

6 The investment literature views \(\text{R&D expense}\) as a form of discretionary and risky investment. To an extent that \(\text{Capex}\) and other fundamental-related corporate investments are increasing conditional on a high cash reserve, it suggests that firms are actively managing their risk in response to the crisis and a large cash slack gives firms the flexibility to adjust.
3.4. Payout policy

In the final set of the analysis, I turn to firms’ payout policy. Because a firm’s payout policy directly affects the distribution of profits to its shareholders, this finding provides implications to the shareholder values during the COVID-19 crisis. I find the after dummy is negative and significant across total payout, dividend, and repurchase measures in Table 5. The coefficients of the interaction terms are positive and significant at the 1% level, confirming the precautionary role of cash holdings. My finding on a firm’s payout policy is especially relevant to a contemporaneous study by (Krieger et al., 2020). While the study documents that firms cut dividends to preserve financial flexibility in response to the COVID-19 crisis, I show that firms with an abundant cash reserve do not experience such a drop. By distributing profits to shareholders and mitigating the negative market reaction associated with dividends reduction, the analysis above indicates the payout policy can be a specific channel through which cash holdings increase shareholder values.

4. Conclusion

The severity and economic costs of the ongoing COVID-19 crisis is unprecedented, and the U.S. government stimulus spending is already twice as much as it was during the 2007-2008 financial crisis. In this paper, I explore the effect of the COVID-19 pandemic on firms’ performance. I find that corporate investment, profitability, financing activity, and payout policy are negatively affected by the pandemic, consistent with prior findings of the related literature. Moreover, I show a strong positive relation between the corporate pre-COVID cash reserve and firm performance, suggesting the precautionary motive behind corporate cash holdings.

This paper sheds light on the importance of risk management in a corporate setting and reveals the value-enhancing perspective of the function. My results imply that the positive effect of cash holdings on firm performance is more pronounced when the overall market condition is bad. The hedging benefit could explain the time-series pattern of increased corporate cash holdings. Contrary to the “dark side” – managerial rent-seeking view to the corporate cash holdings – I demonstrate that the advantage of the cash reserve may not be well understood if the unforeseen COVID-19 pandemic has not happened. This highlights the difficulty in estimating the optimal cash level when rare market shocks are incorporated.
Table 2
Pre Covid-19 cash holdings and corporate investment.

| Specification: | Capex | R&D | SG&A | NWC | Inventory |
|----------------|-------|-----|------|------|-----------|
|                | (1)   | (2) | (3)  | (4)  | (5)       |
| After          | -0.363*** | -0.354*** | -0.114* | -0.112* | -0.693*** |
|                | (-0.34) | (-19.84) | (-1.76) | (-1.88) | (-12.25) |
|                | -0.712*** | -2.839*** | -0.778*** | -0.891*** | -0.794*** |
|                | (-4.50) | (-12.25) | (-5.86) | (-11.91) | (-11.00) |
| After × Cash holdings | 0.343*** | 0.368*** | -1.465*** | -0.766*** | 0.629** |
|                | (7.26) | (7.75) | (-5.53) | (-3.56) | (1.87) |
|                | 0.509* | 6.951*** | 4.083** | 1.598*** | 2.091*** |
|                | (2.29) | (8.44) | (10.28) | (8.44) | (10.28) |
| Size           | -0.91** | -3.029*** | -7.598*** | -23.156*** | -2.021*** |
|                | (-2.07) | (-14.63) | (-25.10) | (-8.60) | (-9.40) |
|                | -2.102*** | -4.97 | (-0.04) | (-0.04) | (-0.04) |
| Cash Flow      | 0.179 | -6.583*** | -9.801*** | 48.738*** | -9.655** |
|                | (1.05) | (-9.05) | (-9.16) | (8.83) | (-9.41) |
|                | -2.102*** | -4.97 | (-0.04) | (-0.04) | (-0.04) |
| Leverage       | -0.224*** | 0.798** | -0.003 | 25.801*** | -0.451 |
|                | (-2.85) | (2.00) | (1.46) | (3.44) | (1.29) |
|                | 0.069 | 25.801*** | -0.451 | 25.801*** | -0.451 |
| Fixed Effects  | 0.576 | 0.578 | 0.796 | 0.847 | 0.889 |
|                | 0.930 | 0.880 | 0.905 | 0.946 | 0.948 |
| Obs            | 28,981 | 28,800 | 16,999 | 16,838 | 27,461 |
| Adj $R^2$      | 0.576 | 0.578 | 0.796 | 0.847 | 0.889 |

This table presents estimates from the firm-level quarterly OLS regression: \( \text{Investments}_{it} = \alpha + \beta_1 \text{Cash}_{2018Q4After} + \beta_2 \text{After} + \gamma \text{Control}_{it} + \theta_i + \epsilon_{it} \). Measures of corporate investments: capital expenditure in columns (1) and (2); research and development in columns (3) and (4); sales, general, and administrative expense in columns (5) and (6); Net working capital excluding cash in columns (7) and (8); total inventories in columns (9) and (10). All investment measures are divided by total assets and expressed in percentage points. Other variables are defined in Appendix A. $F$ denotes firm fixed effects and $I \times T$ denotes industry by year-quarter fixed effects. Standard errors are corrected for heteroskedasticity and clustered at the firm level, $t$-statistics are reported in parenthesis, with *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.
### Table 3
Pre Covid-19 cash holdings and performance.

| Specification | ROE | ROA | Asset Growth | Market Share |
|---------------|-----|-----|--------------|--------------|
| After         |     |     |              |              |
| After - Cash holdings |     |     |              |              |
| Size          |     |     |              |              |
| Q             |     |     |              |              |
| Cash Flow     |     |     |              |              |
| Leverage      |     |     |              |              |
| Fixed Effects | F  | F  | F  | F  | F  | F  | F  | F  | F  | F  |
| Obs           | 30,709 | 30,446 | 29,648 | 29,427 | 30,814 | 30,550 | 30,219 | 29,951 | 30,822 | 30,550 |
| Adj $R^2$     | 0.138  | 0.146  | 0.754  | 0.867  | 0.850  | 0.862  | 0.863  | 0.212  | 0.837  | 0.837  |

This table presents estimates from the firm-level quarterly OLS regression: \( \text{Performance}_{it} = \alpha + \beta_1 \text{Cash}_{2018Q4} + \beta_2 \text{After} + \gamma \text{Control}_{it} + \theta_i + \epsilon_{it} \). Measures of performance: return on equity in columns (1) and (2); return on assets in columns (3) and (4); Tobin’s Q in columns (5) and (6); asset growth in columns (7) and (8); market share in columns (9) and (10). Other variables are defined in Appendix A. F denotes firm fixed effects and I \( \times \) T denotes industry by year-quarter fixed effects. Standard errors are corrected for heteroskedasticity and clustered at the firm level, \( t \)-statistics are reported in parenthesis, with *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.
Appendix A. Variable Definitions

Cash reserve and control variables

| Variable | Definition |
|----------|------------|
| Cash holdings | Cash and short-term investment scaled by total assets. Measured once per firm at the end of fourth quarter of 2018. |
| Size | Natural logarithm of the total assets. |
| Q | Market value of assets scaled by book value of assets. |
| Cash Flow | Income before depreciation scaled by total assets. |
| Leverage | Long-term debt scaled by total assets. |
| Investment | Capital expenditure scaled by total assets. |
| Capex | |
| R&D | Research and development expense scaled by total assets. |
| SG&A | Selling, general, and administrative expenses scaled by total assets. |

(continued on next page)
### Cash reserve and control variables

| Variable              | Description                                                                 |
|-----------------------|-----------------------------------------------------------------------------|
| NWC                   | Net working capital excluding cash scaled by total assets.                   |
| Inventory             | Total inventories scaled by total assets.                                   |
| Performance           | Net income scaled by common equity.                                         |
| ROE                   | Operating income before depreciation scaled by total assets.               |
| ROA                   | Same as above.                                                              |
| Asset Growth          | One year change in total assets scaled by lag total assets.                 |
| Market Share          | Total sales scaled by the sum of Fama French 48 industry’s total sales in that year. |
| Financing             | Change in short-term debt scaled by total assets.                           |
| ∆ST_debt              | Change in long-term debt scaled by total assets.                            |
| Equity Issuance       | Equity issuance scaled by total assets.                                     |
| Payout                | Sum of share repurchases and dividends scaled by total assets.              |
| Repurchases           | Share repurchases scaled by total assets.                                   |
| Dividends             | Dividends scaled by total assets.                                           |

### Appendix B. Fama-French 48 industry by year-quarter FE and double cluster SE

This table replicates estimates from the firm-level quarterly OLS regressions above with added industry by year-quarter fixed effects and double cluster of standard errors at both firm and year-quarter levels. I only report the variables of interest, After × Cash holdings, in the table. After dummy is subsumed by the industry by year-quarter fixed effects. Control variables are the same as above. Other variables are defined in Appendix A. F denotes firm fixed effects and I × T denotes industry by year-quarter fixed effects. Standard errors are corrected for heteroskedasticity and clustered at the firm and year-quarter levels, t-statistics are reported in parenthesis, with *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

| Panel A: Investment | Capex | R&D | SG&A | NWC | Inventory |
|---------------------|-------|-----|------|-----|-----------|
| After × Cash holdings | (1)   | (2) | (3)  | (4) | (5)       |
| 0.154***             | -0.410** | 0.427* | 5.064*** | 1.376** |
| (3.38)               | (1.97) | (1.85) | (2.77) | (2.89) |
| Panel B: Performance | ROE | ROA | Q    | Asset growth | Market Share |
| After × Cash holdings | (1) | (2) | (3) | (4) | (5) |
| 0.050**              | 0.011*** | 0.587*** | 0.021* | 0.000** |
| (2.00)               | (2.91) | (3.83) | (1.94) | (2.39) |
| Panel C: Financing   | ∆ST_debt | ∆LT_debt | Equity Issuance |
| After × Cash holdings | (1) | (2) | (3) |
| 0.013**              | -0.008** | -0.045*** |
| (1.96)               | (2.09) | (4.27) |
| Panel D: Payout      | Payout | Repurchase | Dividend |
| After × Cash holdings | (1) | (2) | (3) |
| 0.002**              | 0.001*  | 0.001**       |
| (2.47)               | (2.08) | (2.21) |
| Fixed Effects        | F, I × T | F, I × T | F, I × T | F, I × T | F, I × T |
| Control Variables    | Yes | Yes | Yes | Yes | Yes |

### References

Achary, Viral V., Steffen, Sascha, 2020. The Risk of Being a Fallen Angel and the Corporate Dash for Cash in the Midst of Covid. NBER Working Paper No. w27601.

Acharya, Viral V., Almeida, Heitor, Campello, Murillo, 2007. Is cash negative debt? A hedging perspective on corporate financial policies. J. Financ. Intermediation 515–554.

Almeida, Heitor., 2020. Liquidity management during the Covid-19 pandemic. Asia-Pacific J. Financial Stud. Forthcoming.

Almeida, Heitor, Campello, Murillo, Weisbach, Michael S, 2005. The cash flow sensitivity of cash. J. Finance 177–1804.

Almeida, Heitor, Campello, Murillo, Laranjeira, Bruno, Weisbenner, Scott, 2012. Corporate debt maturity and the real effects of the 2008 credit crisis. Crit. Finance Rev. 3–58.

Bates, Thomas W., Kahle, Kathleen M., Stulz, Rene M., 2009. Why do U.S. firms hold so much more cash than they used to? J. Finance, 1985-2021.

Bolton, Patrick, Scharfstein, David S, 1990. A Theory of Predation Based on Agency Problems in Financial contracting. Am. Econ. Rev. 93-106.

Brinca, Pedro, Duarte, Joao, Faria-e-Castro, Miguel, 2020. Measuring Sectoral Supply and Demand Shocks During COVID-19. FRB St. Louis Working Paper NO.2020-011.

Brummermeier, Markus K., Krishnamurthy, Arvind, 2020. Corporate debt overhand and credit policy. Brookings Pap. Econ. Activity. Campello, Murillo, Graham, John R., Harvey, Campbell R., 2010. The real effects of financial constraints: evidence from a financial crisis. J. Finance. Econ. 470–487.

Derrien, Francois, Keeskes, Ambrus, 2013. The real effects of financial shocks: evidence from exogenous changes in analyst coverage. J. Finance 1407–1440.

Dittmar, Amy, Mahrt-Smith, Jan, 2007. Corporate governance and the value of cash holdings. J. Financ. Econ. 599–634.
Duchin, Ran, Ozbas, Oguzhan, Sensoy, Berk A., 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. J. Financ. Econ. 418–435.

Fahlenbrach, Rudiger, Rageth, Kevin, Stulz, Rene M., 2020. How Valuable is Financial Flexibility when Revenues Stop? Evidence from the Covid-19 Crisis. NBER Working Paper w27106.

Fresard, Laurent., 2010. Financial strength and product market behavior: the real effects of corporate cash holdings. J. Finance 1097–1122.

Froot, Kenneth, Scharfstein, David S, Stein, Jeremy C, 1993. Risk management: coordinating corporate investment and financing policies. J. Finance 1629–1658.

Guerrieri, Veronica, Lorenzoni, Guido, Straub, Ludwig, Werning, Ivan, 2020. Macroeconomic Implications of COVID-19: can negative supply shocks cause demand shortages? NBER Working Paper.

Harford, Jarrad., 1999. Corporate Cash Reserves and Acquisitions. J. Finance, 1969-1997.

Harford, Jarrad, Klasa, Sandy, Maxwell, William F., 2014. Refinancing risk and cash holdings. J. Finance 975–1012.

Harford, Jarrad, Mansi, Sattar A., Maxwell, William F., 2008. Corporate governance and firm cash holdings in the US. J. Financ. Econ. 535-555.

Holmstrom, Bengt, Tirole, Jean, 1998. Private and public supply of liquidity. J. Polit. Econ. 1–40.

Jensen, Michael C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. Am. Econ. Rev. 323–329.

Krieger, Kevin, Mauck, Nathan, Pruitt, Stephen W., 2020. The impact of the COVID-19 pandemic on dividends. Finance Res. Lett. In Press.

Opler, Tim, Pinkowitz, Lee, Stulz, Rene, Williamson, Rohan, 1999. The determinants and implications of corporate cash holdings. J. Financ. Econ. 3–46.

Petersen, Mitchell A., 2009. Estimating standard errors in finance panel data sets: comparing approaches. Rev. Financ. Stud. 435–480.

Pinkowitz, Lee, Stulz, Rene M., Williamson, Rohan, 2006. Does the contribution of corporate cash holdings and dividends to firm value depend on governance? A cross-country analysis. J. Finance 2725–2751.

Shin, Hyun-Han, Kim, Yong H., 2002. Agency costs and efficiency of business capital investment: evidence from quarterly capital expenditures. J. Corp. Finance 139–158.

Stiglitz, Joseph, Weiss, Andrew, 1981. Credit Rationing in Markets with Imperfect Information. Am. Econ. Rev. 393–410.

Stulz, Rene M., 1990. Managerial discretion and optimal financing policies. J. Financ. Econ. 3–27.

Tawiah, Bernard, Keefe, Michael O., 2020. Cash Holdings and Corporate Investment: Evidence from COVID-19. SSRN.