DISCUSSION PAPER SERIES

Discussion paper No. 214-2

# Measuring the Value of Corporate Cash Holdings against Predictable and Unpredictable Negative Shocks

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April 2021


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# Measuring the Value of Corporate Cash Holdings against Predictable and Unpredictable Negative Shocks*

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April 21, 2021

**Abstract**

This paper explores how cash mitigates predictable and unpredictable adverse cash flow shocks to firms using the financial data of Japanese firms. We find that (i) cash has no value after the predicted shock regardless of the severity of the financial constraint, (ii) after the unpredicted shock, the value of cash for the financially constrained firms is larger than that for the unconstrained firms, and (iii) the value of cash is similar between the two shocks for the unconstrained firms, while the value is larger when the unpredicted shock occurs than when the predicted shock occurs for the constrained firms.

**Keywords**: consumption tax hike, COVID-19, cash holdings, financial constraint, event study.

**JEL Classification**: G14,G32

*An earlier version of this paper circulated under the title "Can cash be a ventilator for firms suffering from COVID-19? Evidence from stock market in Japan." The authors are grateful to Daisuke Miyakawa and participants at the Asset Pricing Workshop and the 2nd Fall Meeting of the Nippon Finance Association, and a seminar at Kwansei Gakuin University.

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# 1 Introduction

In the absence of frictions in financial markets, cash in normal times does not contribute to firm value. However, when a firm faces an adverse cash flow shock, cash can support its value because firms can reserve their cash either for investment in profitable projects that have not been implemented or for payment of their debts that are coming due when they face a cash flow shortfall. In many cases, under such an environment, firms find it difficult to raise external funding, so the more cash they hold, the more likely they are to survive because they can pay off their debts and pay their workers.

In this paper, we examine how firms' cash is valued in the event of predicted or unpredicted adverse cash flow shocks using financial data from firms listed on the Tokyo Stock Exchange. Specifically, we regard the consumption tax hike in Japan implemented in October 2019 as a predicted shock and the COVID-19 pandemic that spread worldwide in 2020 as an unpredicted shock. While these two shocks reduced corporate cash flows and caused stock prices to decline, cash was expected to have mitigated these negative impacts.

It is well known that the precautionary motive is the one reason why firms hold cash.[1] According to this motive, firms hold cash before a shock occurs to prepare for an adverse cash flow shock. While a large literature has already studied theoretically and empirically the precautionary motives of firms' cash holdings, this paper extends the literature by exploring the following issues.

First, we highlight how the value of firms' cash holdings changes before and after the onset of an adverse cash flow shock. Suppose firms hold cash based on a precautionary motive. The value of cash can change before and after a shock because while the value of cash may be high before the shock, after the shock, the value of the remaining cash will be low as cash has mitigated the effects of the shock. However, previous studies on precautionary motives for cash holdings have mainly focused on the impact of uncertainty measures such

[1] Bates, Kahle, and Stulz (2009) note that firms hold cash based on the following four motives: transaction motive, precautionary motive, tax motive, and agency motive.

as the effect of cash flows' variance on firms' cash holdings and stock prices. Consideration has not been given to changes in the value of cash.

Second, the paper distinguishes between predictable and unpredictable adverse cash flow shocks. The distinction between these two types of shocks is essential because, in the case of predictable shocks, cash has a high value before the shock but a low value after the shock, whereas in the case of unpredictable shocks, cash has no value before the shock but a high value after the shock. If the value of cash does not change before or after a shock, then either the point in time when the shock occurred was incorrectly identified, or firms may not be holding cash based on a precautionary motive.

Third, we propose a new procedure to determine whether firms are financially constrained. If firms have free access to financial markets, then corporate financial policy becomes irrelevant because firms can raise funds as and when they need to. In other words, the cash held by a firm only has value if the firm has restricted access to financial markets. Although it is essential to determine the extent to which firms can access external financial markets, there is no general proxy for identifying financial constraints. Here, using the implication of the precautionary motive that firms will increase their cash holdings in advance when adverse cash flow shocks are anticipated, we identify financially constrained firms.

When examining the value of corporate cash holdings in light of the above issues, Japanese firms in 2019 and 2020 provide an interesting case. The consumption tax hike in 2019 was a predictable event because the government decided to implement it in October 2018. The COVID-19 pandemic could not have been predicted, at least not in 2019, and continues to impact people's health and the economy negatively. As shown in Figure 1, the TOPIX index fell temporally after the consumption tax hike on October 1. The total number of COVID-19 infections in Japan has increased rapidly since the beginning of March (Figure 1). As with the rest of the world, Japan's stock prices plummeted as the negative impact of COVID-19 on the economy became apparent; e.g., early February saw the TOPIX index fall by about 500 points a month

from about 1,700. It was the largest decline since October 2008, when the global financial crisis hit the economy.

We use the event study methodology to examine how cash can mitigate adverse impacts on stock prices of the consumption tax hike and the COVID-19 pandemic. As events, they have specific features compared with events typically considered in the literature. The consumption tax hike was predictable and exogenous, and initially unrelated to firms' fundamentals. Consequently, confounding events can be ignored because the hike was implemented nationwide on the same day, and stock prices could react to the event ahead of the event day. The fact that the consumption tax hike was a predicted event also helps to identify financial constraints. If a firm faced financial frictions, it would increase its cash holdings before the hike. Furthermore, if cash flow declined after the hike, the firm would withdraw its cash holdings to compensate for the cash flow decline. We consider firms whose financial statements show this behavior to be financially constrained.

The COVID-19 pandemic was also exogenous and independent of firms' fundamentals, but unpredictable. Thus, it serves as an ideal setting to test the causal link between corporate cash holdings and asset prices. Using the pandemic as an event, we can rule out the endogenous issue that the firms may change their cash holdings because of large stock price fluctuations. However, by using the pandemic as an event, we are faced with the following problems. During the early stages of the pandemic, investors were likely to be unaware that it would become a pandemic and significantly negatively impact the economy because our knowledge of COVID-19 was limited. Therefore, it is difficult to determine when a negative cash flow shock occurs on a specific date, nor is it possible to determine a single event window.

Following the standard procedure for event studies, we identified the event dates, the event windows, and the estimation windows. The event date of the consumption tax hike was October 1, 2019. We selected two event dates for the COVID-19 pandemic, January 30 and March 2, 2020. On the first event date, the World Health Organization (WHO) declared a "Public Health

Emergency of International Concern," and the Governor of the Bank of Japan issued an emergency statement on the second event date. We then use the data during the estimation window to estimate the Fama–French three- factor model (FF), and then use the estimated parameters to calculate the abnormal returns for the event windows. From the abnormal returns, the cumulative abnormal returns are calculated. By regressing them on cash and other variables representing firm characteristics, we examine the impact of cash on stock price changes caused by adverse cash flow shocks.

The main empirical results obtained in this paper are as follows. First, cash had a positive impact on stock prices before the consumption tax hike, but the impact disappeared after the hike. The results suggest that while the value of cash was high before the hike in the anticipation that holding cash would compensate for the decrease in cash flow, the value of cash became low once this materialized after the hike. The positive impact of cash on stock prices before the hike was not seen in the financially constrained firms but rather in the financially unconstrained firms.

Second, in the COVID-19 outbreak period, cash had a positive impact on stock prices, and the impact was more substantial for financially constrained firms than for financially unconstrained firms. These results imply that cash holdings mitigated the impact of the unpredicted negative shock at the time of the outbreak and that the precautionary motive is strengthened in the expectation that the shock could be persistent.

Third, for the financially unconstrained firms, the value of cash before the COVID-19 outbreak was not significantly different from that after the outbreak. In contrast, for the financially constrained firms, the value of cash after the COVID-19 outbreak was much higher than before the consumption tax hike. As the size and persistence of the two adverse cash flow shocks were different, it is not strictly possible to compare whether cash mitigated the negative impact more strongly in either case. Nonetheless, we can show that the value of cash holdings is stable regardless of the shocks' nature because the financially unconstrained firms have unrestricted access to financial markets.

This paper relates to the recent literature on corporate liquidity management policies. As the literature on corporate liquidity management, including cash holdings, is extensive, we only present a brief discussion.[2] If financial markets are perfect, firms' liquidity decisions are irrelevant to their firm value. However, when firms face frictions in financial markets, it is worth exploring the optimal cash holding for the firms. This literature has developed in two main directions.[3] The first direction relates to the "precautionary demand for cash"; i.e., cash holdings are effective as a precautionary hedge against the possibility that capital market frictions prevent the firms from obtaining external financing. The second direction is "cash holdings from an agency perspective." According to this argument, managers hold cash for greater discretion in management or private benefit.

Many empirical studies provide evidence of the benefits to firms of holding cash to hedge against uncertainty. Bates, Kahle, and Stulz (2009) find a growing demand for liquidity to buffer cash flow shocks as the reason for the increase in cash held by US firms. In other words, holding cash allows firms to maintain financial flexibility and minimize the damage of financial distress caused by adverse cash flow shocks. Holding cash also allows firms to accept projects that have a positive net present value quickly. For example, Almeida, Campello, and Weisbach (2004) develop a model that provides empirical evidence showing financially constrained firms hold more cash than unconstrained firms, suggesting that firms hold more cash for investment.[4] Duong et al. (2020) find that US firms increase their cash holdings in re-

[2]See Almeida et al. (2014) for a survey of the literature.

[3]Theories of liquidity management such as Holmstrom and Tirole (1998) and Tirole (2006) provide a unifying framework to help understand the main results of the literature on liquidity management and show that information asymmetries between management and capital markets make liquidity valuable.

[4]Denis and Sibilkov (2010) also find that greater cash holdings are associated with a higher level of investment for financially constrained firms, and that the positive relationship between investment and firm value is more substantial for financially constrained firms than for financially unconstrained firms.

sponse to greater economic policy uncertainty.

The 2007–2009 global financial crisis highlighted the role of cash held by firms. Several studies have explored how the crisis has changed the management policies of firms. For example, Duchin, Ozbas, and Sensoy (2010) find that US firms ran out of cash during the crisis and that investment after the crisis was positively related to cash reserves. Campello, Graham, and Harvey (2010) show that firms tend to postpone or suspend their investment plans when capital markets are tightened. COVID-19 is the first major adverse shock to the global economy since the global financial crisis. However, the two are different in terms of the nature of the event: i.e., the financial crisis was a negative shock to external funding provided by financial institutions, whereas COVID-19 was an exogenous shock unrelated to financial institutions.

A rapidly growing literature discusses the impact of the COVID-19 pandemic on the real economy. Among the many studies, those by Ramelli and Wagner (2020) and Takahashi and Yamada (2021) are closely related to this paper. Ramelli and Wagner (2020) analyze the impact of cash on stock prices in the US during the COVID-19 outbreak and find that it positively impacted stock prices. Takahashi and Yamada (2021) find that corporate governance and supply chains impacted stock prices in Japan.

Our event study methodology follows Faulkender and Wang (2006), and Wagner, Zeckhauser, and Ziegler (2018). Faulkender and Wang (2006) study the cross-sectional variation in the marginal value of firms' cash holdings resulting from different corporate monetary policies. They have in common with our study that they regress the excess returns, which are constructed by subtracting the benchmark returns from the observed returns, on various variables, including cash. However, the difference is that they do not determine a specific event date but instead view any unexpected change in cash holdings as an event. Another difference is that while the events considered in their study are firm-specific, the event examined in our study is common to all firms. Many of the events covered in the event studies are firm-specific; thus, the event dates differ for different firms. However, several recent event

studies considered political events and ensured event days are common across all firms. For example, Wagner, Zeckhauser, and Ziegler (2018) investigate stock market reactions to the outcome of the election for the 45th President of the United States of America and find evidence that a cross-section of stock returns after the election reflects expectations of a major corporate tax reduction.[5]

The paper makes several contributions to the literature. First, the paper is the first study to distinguish between predicted and unpredicted shocks and to measure the value of cash held by firms. We show that the point at which the value of cash became higher was different for these two shocks. Second, we propose a new method to identify the severity of financial constraints, exploiting firms' fiscal policies implied by their precautionary motives for holding cash.

The remainder of the paper is organized as follows. Sections 2 describes some key events related to the consumption tax hike and the COVID-19 pandemic in Japan. Section 3 explains hypothesis development, and Section 4 presents the empirical strategy and data. Section 5 reports the empirical results, and Section 6 concludes the paper.

# 2 Key Events Linked to the Consumption Tax Hike and the COVID-19 Pandemic in Japan

This section describes some key events linked to the consumption tax hike and COVID-19 pandemic in Japan. Table 1 provides a timeline of the major events.

[5]Liu, Shu, and Wei (2017) also investigate this issue through the impact of political uncertainty on asset prices using the Bo Xilai political scandal in 2012 in China as an exogenous shock event and find that the scandal caused a significant drop in stock prices, especially for firms that are more politically sensitive.

## 2.1 Consumption Tax Hike

The Japanese government raised the consumption tax rate from 8 percent to 10 percent on October 1, 2019. The main purpose of the tax hike was to cover expanding social security costs because of the declining birthrate and aging population. As the government amended the consumption tax law in October 2018, the public was able to predict this tax hike.

Japan's consumption tax is a value-added tax (VAT). However, compared with VAT in other developed countries, Japan's consumption tax has several unique characteristics. First, Japan's consumption tax is flat across the country, and transactions exempt from the tax are the exception. Therefore, after the consumption tax hike, most firms will pay more tax given that their sales remained constant. Second, Japan's consumption tax is not based on the invoice method, but the deemed taxation method. In this method, a certain percent of sales is deemed to be equivalent to the amount of consumption tax, and the firm pays the amount equivalent to the deemed tax to the tax authorities.

Household consumption changes temporarily before and after a consumption tax hike.[6] Before a tax hike, households increase spending for goods and services as last-minute demand, which will positively affect firms' cash flows. After the tax hike, however, household demand for goods and services declines, which harms firms' cash flows. From July to September 2019, seasonally adjusted real private consumption expenditures rose 0.5 percent from the previous quarter. Then, from October to December 2019, it fell 3.1 percent from the previous quarter. This was the largest drop since April 2014, when the consumption tax rate was raised from 5 percent to 8 percent.

[6] Cashin and Unayama (2011) found that when the consumption tax rate was raised from 3 percent to 5 percent in 1997, household spending in the month before the rate increase increased by about 9 percent, depending on the tax rate, and remained slightly lower until six months later.

## 2.2 The COVID-19 Pandemic

The Ministry of Health, Labor and Welfare (MHLW) confirmed the first infected person in Japan on January 15, 2020. Although the number of patients in Japan was low until February 2020, the number of infections increased rapidly as of March 2020. The number of deaths has continued to rise since the first was reported on February 13, 2020.

On February 1, 2020, the Japanese Government stepped up preventive measures against COVID-19 by classifying it as a legally designated infectious disease. In the case of severe infection, the government can legally order infected patients to be placed in a hospital and impose restrictions on their work activities to prevent further virus outbreaks. Furthermore, on February 25, 2020, the MHLW announced its "Basic Policies for Novel Coronavirus Disease Control", which summarize the measures that are currently being taken and some possible future measures that may be taken.

Despite all the measures taken, the number of COVID-19 patients continued to surge throughout March 2020 (Figure 1). Following the Diet's approval of legislation authorizing Prime Minister Abe to declare a state of emergency, the Prime Minister declared a state of emergency covering Tokyo, Osaka, and five other prefectures on April 7, 2020.[7] Under a state of emergency, the prefectural governor may require residents to stay indoors.[8] It would also allow for the expropriation of land to construct temporary medical facilities to treat the rapidly rising number of patients. The provision allows suppliers of medicines and food to order the sale to the authorities or forcefully procure goods from companies that refuse to do so. On April 16, 2020, the Prime Minister expanded the state of emergency to cover the entire country. This policy revision

[7]The Government defines a state of emergency as "a situation in which the capacity to provide medical care will reach its limit, and people's lives and health will be put at risk unless measures are taken. "

[8]They may also call for the temporary closure or curtailment of schools and other public facilities. If such a facility does not respond to a request, the prefecture will be able to publish the facility's name to ensure that measures are implemented.

reflected continued growth in the number of infections in Japan in April 2020 and an understanding that efforts to contain the virus were needed at the national level.

While the number of COVID-19 infections was limited in January and February 2020, the Japanese economy began to suffer. This was partly because Japanese firms were forced to suspend operations in China. Another reason is that the Chinese government prohibited all outbound group travel, which resulted in sharp declines in profits for Japan's retail and tourism sectors. As a result, a firm filed for bankruptcy on February 25, 2020, which marked the first business failure in Japan linked to the COVID-19 outbreak. Since March 2020, the virus has had a severe negative impact on the Japanese economy. For example, some Japanese automakers have been forced to close some of their plants and change their production plans. The Cabinet Office's consumer confidence survey reported that the Consumer Confidence Index in March 2020 was 30.9, down 7.4 points from the previous month.

To mitigate the adverse economic impact of COVID-19, the Prime Minister pledged to implement emergency spending packages. The first round of measures disbursed ¥15.3 billion in early February and the second one ¥270 billion in early March 2020. These measures included employment subsidies and zero-interest loans without collateral to small and mid-sized companies. On April 7, 2020, the Government announced its "Emergency Economic Measures for Response to COVID-19" stimulus package worth 108 trillion yen, equivalent to 20 percent of Japan's GDP. The package allows a one-year tax moratorium worth ¥26 trillion and expenditure of ¥6 trillion on cash grants for affected small and mid-sized companies, and households in need. It also includes interest-free unsecured loans and allows recurring debts to be refinanced as interest-free loans.

The Bank of Japan (BOJ) also stepped up its quantitative and qualitative monetary easing policy. On March 2, 2020, the Governor of the BOJ issued an emergency statement and pledged that the BOJ would strive to provide ample liquidity and ensure stability in financial markets through appropriate

market operations and asset purchases.[9]

# 3 Hypothesis Development

The theory of optimal firm cash holdings predicts that a role of cash is a precautionary hedge against adverse shocks. After the adverse shock occurs, the firms' cash may have no or limited impact on its stock price. This is because the firm can mitigate the negative shock's impact by holding more cash than usual before the shock occurs. Firms that are expected to be severely affected by the negative shock will increase their cash holdings more, while firms that are expected to be less affected by the negative shock will increase their cash holdings only slightly. Consequently, regardless of the amount of cash held, firms should be able to respond to the negative shock, so the amount of cash held is expected not to affect stock prices. The consumption tax hike in Japan in 2019 was determined in October 2018, and sales increased just before the tax hike because of last-minute demand. Thus, most firms in Japan could increase their cash holdings if necessary. The above argument led us to the following hypothesis for our empirical research.

(H1) *Cash had no impact on stock prices after the consumption tax hike.*

In the presence of an unpredictable shock, firms would use their cash reserves to mitigate a decline in cash flow because raising funds externally in such a situation would be costly or impossible. If the firms run out of cash or are unable to raise external funds, they will be forced to sell their essential assets or liquidate, resulting in a significant decline in their firm values. The widely accepted conclusion in the literature is that cash remains the best

[9]The BOJ has offered to buy 500 billion yen ($4.6 billion) of government bonds in a repurchase agreement to provide liquidity to market participants. Furthermore, on March 16, 2020, the BOJ pledged to buy exchange-traded funds and other risky assets at twice the current pace.

instrument for certain groups of firms even if other options such as debt capacity, derivatives, and lines of credit are also available.[10] Given the impact of COVID-19 on the economy, we expect that the stock prices of firms with more cash did not fall as much as those of firms with less cash.

(H2) *The more cash a firm holds, the less of a negative impact COVID-19 had on its stock price.*

So far, no attention has been paid to heterogeneity in financial frictions faced by firms. However, the impact of unpredictable adverse cash flow shocks on stock prices may be different for financially constrained firms (firms facing financial constraints) than for financially unconstrained firms (firms not facing financial constraints). Even if negative cash flow shocks are unpredictable, cash holdings by financially unconstrained firms will have no or limited impact on their stock prices because they can raise funds as needed. In contrast, cash holdings by financially constrained firms mitigate the impact of negative cash flow shocks on their stock prices because they have to incur higher costs in raising external funding.

When the cost of raising external funds is high, several channels can lower the stock price. For example, firms with investment opportunities are therefore more likely to abandon these valuable projects if the cost of raising external funding is high and internal funding is insufficient. However, with enough cash as internal funds, they would be able to continue such projects. An extensive literature, commencing with Fazzari, Hubbard, and Petersen (1988), provides evidence in support of this argument.

This argument motivates our third hypothesis:

(H3) *Before and after the onset of an adverse cash flow shock, cash holdings are more valuable for firms that face financial constraints than firms that do*

[10] See Almeida et al. (2014).

*not face financial constraints.*

# 4 Empirical Strategy and Data

To investigate the effects of the consumption tax hike as a predictable negative shock and the COVID-19 pandemic as an unpredictable negative shock to Japanese firms, we use the event study methodology of Campbell, Lo, and MacKinlay (1997) to measure the market value of firms listed on the Tokyo Stock Exchange, which is an estimate of the market's valuation of the impact of the tax hike and the pandemic on the firms' value. The procedure for the analysis is as follows. First, the event dates are identified. Second, we determine the event windows. Then, abnormal returns are calculated based on the FF three-factor model. Finally, we identify firms that are subject to financial constraints.

## 4.1 Event Date

### 4.1.1 The Consumption Tax Hike

As a result of the consumption tax hike on October 1, 2019, household consumption in Japan changed after this date. Thus, the event date for the consumption tax hike is October 1, 2019.

### 4.1.2 COVID-19

The COVID-19 pandemic as an event has several unique features compared with the events that the literature typically considers. First, the outbreak of COVID-19 was exogenous, unpredictable, and spread rapidly throughout the world in a short period of time. Second, because we know very little about COVID-19, the uncertainty of its impact on the economy is high. It is believed to be the first significant pandemic since the Spanish Flu in 1918. The WHO certified the 2009 Swine Flu as a pandemic, but governments at that time did

not implement measures such as voluntary restraints on overseas travel, border closures, or even lockdowns of major cities. Therefore, it is difficult to predict the impact of the pandemic on the economy based on past experiences.

We adopt two event days in our analysis because the above characteristics lead us to the difficulty of limiting the event date to a specific single day.[11] The first event date is January 30, 2020 when the WHO declared a "Public Health Emergency of International Concern" by acknowledging the outbreak of COVID-19 as a severe event endangering international public health. At that point, however, investors may not have been aware that COVID-19 would harm the economy. The second event date is March 2, 2020,the day the Governor of the BOJ issued an emergency statement informing that it might pursue a further easing of monetary policy. The emergency economic measures themselves could have a positive impact on stock prices. However, Japan has not had any experience in implementing economic policies on the grounds of infectious diseases since World War II, which suggests that COVID-19 is an unprecedented infectious disease and could have severe negative impacts on economic activity.

## 4.2 Event Windows

### 4.2.1 The Consumption Tax Hike

In order to investigate the impact of the consumption tax hike on stock prices, cumulative abnormal returns are calculated for three periods as event windows: the first from September 2 to September 30, 2019, the second from October 1 to December 30, 2019, and the third from September 2 to December 30, 2019. The first window is the month before the consumption tax hike. The reason for analyzing stock returns for this period is that a consumption tax hike is a predictable event. That is, if cash flow is expected to decline after the consumption tax hike, firms can prepare for the decline by holding

[11] In Appendix, we provide other evidence we used to determine the event date of COVID-19.

more cash than usual or raising additional funds when needed. As a result, while the severity of financial constraints and the amount of cash held do not affect the stock price after the consumption tax hike, the possibility exists that all their effects are reflected in the stock price before the consumption tax hike. The second window corresponds to the period from the date of the consumption tax hike to the date when the COVID-19 outbreak in China was recognized. Although the consumption tax hike was a predictable event, it does not mean that firms could have fully predicted the impact of the consumption tax hike on firms. By analyzing stock prices over this period, we can see how cash holdings responded to the unpredictable part of the shock because of the consumption tax hike. The third window is the four months including the day of the consumption tax hike, which was chosen to study the impact of the consumption tax hike on stock prices over a relatively long period.

### 4.2.2 COVID-19

We analyze three different sets of cumulative abnormal returns for the COVID-19 pandemic as an event: the first from January 30 to April 30, 2020, labeled the *Entire* window, the second from January 30 to February 28, 2020, labeled the *Outbreak* window, and the third from March 2 to April 30, 2020, labeled the *Spread* window.[12] The *Entire* window corresponds to the first event date of COVID-19. How the market participants were digesting information about the impact of COVID-19 on the economy over time can be understood by analyzing the cumulative abnormal returns over this period. The *Outbreak* window spans from the first event date of COVID-19 to just before the second event date. While COVID-19 may have been perceived as a serious infection between the first event date and the second event date, we did not understand COVID-19 in detail at that time, so uncertainty about its impact on

[12]Note that the method of identifying the event window in this paper follows that adopted by Wagner (2018). Typically, the event window in this paper is set for a certain period of time before or after the event date, whereas Wagner (2018) only sets the event window for a certain period of time after the event.

the economy was high. The *Spread* window corresponds to the second event date of COVID-19. Since the second event day, investors might have been aware of the coming recession. Thus, the impact of the coming recession on stock prices can be understood by analyzing the cumulative abnormal returns over this period. For the first and third windows, the last day of the event windows is April 30, 2020. While this choice for the endpoint is somewhat arbitrary, the pandemic is an ongoing event, so it makes sense to terminate calculating the cumulative abnormal returns up to a certain date. Otherwise, stock prices would reflect the impact of the various policies implemented after the pandemic, making it difficult to independently examine how cash holdings mitigated the negative cash flow shocks because of the pandemic on the stock prices.

### 4.2.3 Is the event window of the consumption tax hike really separate from that of COVID-19?

Here, we would like to discuss a possible problem due to the proximity of the consumption tax hike and the COVID-19 event dates. In other words, the stock prices during each event window do not necessarily reflect the impact of each event alone, but there is a possibility that one event (e.g., the consumption tax hike) affects the stock prices during another event window (e.g., COVID-19). However, the two reasons discussed below lead us to conclude that this is unlikely to be the case.

First, the consumption tax hike, a predictable event, was implemented earlier than the COVID-19 outbreak, an unpredictable event. Pneumonia detected in Wuhan, China, was first reported to the WHO on December 31, 2019. As the COVID-19 outbreak is an unpredictable event, it would not have affected stock prices until December 30, 2019.

Second, the drop in consumption because of the consumption tax hike is temporary. If the negative shock because of the consumption tax hike was temporary, then stock prices after 2020 did not reflect the impact of the con-

sumption tax hike or only reflected it to a limited extent. Here we present evidence that the drop in consumption because of the consumption tax hike has been temporary. Since the introduction of the consumption tax in Japan in 1989 at a rate of 3 percent, the tax rate has been raised three times: from 3 percent to 5 percent in 1997, from 5 percent to 8 percent in 2014, and from 8 percent to 10 percent in 2019. Figure 2 shows how the growth rate of Japan's real private final consumption expenditure changed around the past three consumption tax hikes. The vertical axis of Figure 2 shows the consumption growth rate, the horizontal axis shows the quarter, and 0 corresponds to the quarter that includes the day the consumption tax hike was implemented. The fluctuations in the consumption growth rate around the last three consumption tax hikes are similar. The growth rate temporarily increased by one quarter before the tax hike, declined significantly in the quarter after the tax hike, then stabilized. However, in 1997 and 2014, the growth rate returned to near zero in the two quarters following the consumption tax hike (+1 and +2), while in 2019, the growth rate remained negative in the two quarters. This is because it strongly reflects the impact of the COVID-19 pandemic. If the pandemic had not occurred, we would expect the consumption growth rate to have recovered quickly after the consumption tax hike in 2019. In light of the above evidence, we can conclude that the negative shock of the consumption tax hike is temporary and that the impact of the consumption tax hike on stock prices in 2020 and beyond was minor.

## 4.3 Abnormal Returns

To measure stock market reactions to the consumption tax hike and the COVID-19 pandemic, we calculate abnormal returns using the FF three- factor model.

$$R_{it} - R_{ft} = \alpha_i + \beta_{im}(R_{mt} - R_{ft}) + \beta_{is}SMB_i + \beta_{ih}HML_i + \epsilon_{it}, \qquad (1)$$

where $R_{it}$ is the return for firm $i$ on date $t$ , $R_{ft}$ is the risk-free rate on date $t$, $R_{mt}$ is the market return on date $t$, $SMB_{it}$ is the market capitalization factor

for firm $i$ on date $t$ and $HML_{it}$ is the book-to-market factor for firm $i$ on date $t$. $\alpha_i$ is a constant for firm $i$, $\beta_{im}$ is the beta on market return for firm $i$, $\beta_{is}$ is the beta on market capitalization factor for firm $i$, $\beta_{im}$ is the beta on book-to-market factor for firm $i$, and $\epsilon_{it}$ is an error term with mean 0 and variance $\sigma^2_{\epsilon_i}$. We estimate equation (1) for each firm $i$ using ordinary least squares for the period January 4, 2019 to August 30, 2019 (estimation window) for the consumption tax hike event and for the period January 4, 2019 to December 30, 2019 for the COVID-19 pandemic event.

We then compute the abnormal return for firm $i$ on date $t$, $AR_{it}$, after September 1 or October 1, 2019 for the consumption tax hike event, and January 30 or March 2, 2020 for the COVID-19 event. To this end, we subtract the normal return, $NR_{it}$, from daily excess returns on each stock where $NR_{it}$ is defined as follows.

$$NR_{it} = \hat{\alpha_i} + \hat{\beta_{im}}(R_{mt} - R_{ft}) + \hat{\beta_{is}} SMB_{it} + \hat{\beta_{ih}} HML_{it} + R_{ft} \tag{2}$$

$\hat{\alpha_i}$ is the estimated $\alpha_i$, $\hat{\beta_{im}}$ is that of $\beta_{im}$, $\hat{\beta_{is}}$ is that of $\beta_{is}$, and $\hat{\beta_{ih}}$ is that of $\beta_{ih}$ in equation (1), respectively. When calculating $NR_{it}$, different estimates are used for the consumption tax hike event and the COVID-19 pandemic event, which have different estimation windows. The abnormal returns (AR) and the cumulative abnormal returns (CAR) during the event window are obtained as follows.

$$AR_{it} = R_{it} - NR_{it} \tag{3}$$

$$CAR_i(T_1, T_2) = \sum_{t=T_1}^{T_2} AR_{it}, \tag{4}$$

where $CAR_i(T_1, T_2)$ is the cumulative AR for firm $i$ from $T_1$ to $T_2$, $T_1$ is the first day of the event window, and $T_2$ is the last day of it.

## 4.4 Empirical Design

To evaluate the impacts of cash holdings on stock prices, we regress CAR on a variable representing firms' cash holdings ($Cash$), other firm-specific charac-

teristics, and industry dummy variables. Assuming that the impact of *Cash* on CAR may vary across industries, the explanatory variables also include interaction terms between *Cash* and industry dummies.[13] *Cash* is calculated by dividing "cash and deposits" on the balance sheet by "total assets." If the estimated coefficient of *Cash* is positive, it implies that cash has a positive impact on stock prices.

Control variables include *Tobin's q*, cash flow (*CF*), firm leverage (*Leverage*), short-term debt ratio (*Short*), and total assets (*Size*). *Tobin's q* is measured by the ratio of the market value of the firm's total assets to its book value, where the market value of the firm's total assets is calculated by evaluating only the value of common stock minus treasury stock at the firm's stock price on August 30, 2019 for the consumption tax hike event, and on December 30, 2019 for the COVID-19 pandemic. *CF* is the cash-flow-to-assets ratio, measured as the cash flow over total assets. *Leverage* is defined as the ratio of "total liabilities" to total assets. *Short* is defined as the total amount of borrowings from financial institutions and corporate bonds due within one year divided by total liabilities. *Size* is the natural logarithm of total assets.

## 4.5 Assessing Financial Constraints

Previous studies have suggested various ways to identify the level of financial constraints faced by firms, such as the KZ index developed by Kaplan and Zingales (1997). However, there is no common agreement on what is the best proxy to identify financial constraints. For example, Almeida, Campello, and Weisbach (2004) report that the KZ index fails in characterizing the cross-sectional variation in cash management policies between financially constrained and unconstrained firms.

In this paper, we classify firms as facing financial constraints if they meet both of the following two conditions.

[13] We identify the service industry with the largest number of firms among the total sample as the reference industry

(C1) *Both Cash and CF are lower in Q4 than in Q3, 2019.*

(C2) *Cash is higher in Q3 than in Q2, 2019, but lower in Q4 than in Q3.*

(C1) is a condition of financial constraint because if a firm faces financial constraints and its cash flow declines, it will have difficulty raising additional funds, so it will withdraw its cash holdings to cover its expenses. (C2) takes advantage of the fact that the consumption tax hike was an event with a predictable adverse cash flow shock, i.e., if cash flow was was expected to decline in Q4 2019, the firm would have increased its cash holdings in Q3 to accommodate the decline in cash flow.

## 4.6 Data

This paper's sample includes firms listed on the first and second sections and the Mothers market of the Tokyo Stock Exchange, excluding the financial and insurance sectors in line with the common practice in the literature. We also exclude firms from our sample if their stocks were not traded for even one business day in 2019. After applying these filters, we have a sample of 2468 firms and drop firms whose cash flow data are not reported.

The stock and financial data, except the risk-free rate, SMB, and HML, are retrieved from Nikkei Financial-Quest. The stock prices are adjusted for splits and net dividends. The risk-free rate is the interest rate on Japanese government bonds with a 10-year maturity.[14] Both SMB and HML are obtained from the data library on Kenneth R. French's website.[15] All rates of return are translated daily. We use the most current accounting data for all firms as of August 30, 2019 for the consumption tax hike and December 30, 2019 for

[14]The risk-free rate is taken from the website of the Ministry of Finance, Japan, see `https://www.mof.go.jp/english/jgbs/reference/interest_rate/index.htm`

[15]`http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html`

COVID-19.

Table 2 presents descriptive statistics for the variables used in the paper. Panel A shows the descriptive statistics of the data used to examine the impact of the consumption tax hike on stock prices, and Panel B shows those for the COVID-19 pandemic. The mean CAR for four months in 2019 including the date of the consumption tax hike, the mean for one month before the consumption tax hike, and the mean for three months after the consumption tax hike, are all positive: 0.0206, 0.0143, and 0.0062, respectively.[16] As the consumption tax hike is a negative cash flow shock to firms, these results seem counterintuitive. However, we view these results as a reflection of investors' expectations that the negative cash flow shock because of the consumption tax hike was only temporary and that the firms would grow in the long run. The mean CAR for three months from the end of January to the end of April 2020, the mean for one month from the end of January to the end of February 2020, and the mean for two months from the beginning of March to the end of April 2020 were -0.0289, -0.0172, and -0.0116, respectively.[17] Therefore, it can be said that COVID-19 has had negative impacts on stock prices on average.

Based on the procedure described in Section 4.5, we split all firms into a group of financially constrained firms and a group of financially unconstrained firms. The number of financially constrained firms is 316 out of the 2458 firms for the consumption tax hike event, and 315 out of the 2468 firms for the COVID-19 pandemic event. Table 3 presents the test results of the difference in means of various variables between the financially unconstrained firms and the financially constrained firms. Panel A shows the results for the consumption tax hike event. The mean of *Cash* for the financially unconstrained firms is 0.2307, and that for the financially constrained firms is 0.2205; thus, the former is slightly larger than the latter, and there is no statistical difference

[16]The mean CAR for four months in 2019 and that for one month before the consumption tax hike are significantly positive at the 1 percent level, and that for three months after the hike is significantly positive at the 10 percent level.

[17]All three mean CAR in 2020 are significantly negative at the 1 percent level.

between them at the 10 percent level of significance. The control variables for which there is a statistically significant difference in mean values between the two groups are *Tobin's q* and *CF*. For both variables, the means for the financially unconstrained firms are larger than those for the financially constrained firms. We now turn to Panel B, presenting the results for the COVID-19 pandemic event. The mean of *Cash* for the unconstrained firms is 0.2324, and that for the constrained firms is 0.2257, but there is no statistical difference between them at the 10 percent level of significance. The control variables for which there is a statistically significant difference in mean values between the two groups are *CF* and *Size*. For these two variables, the means for the unconstrained firms are larger than the constrained firms' means. In sum, combined with the results in Panel A, the characteristics of the firms we classify as financially constrained are relatively low cash flow and low growth or small size.[18]

# 5 Empirical Results

## 5.1 Baseline Results from Regression Analysis

Table 4 reports the cross-section of stock price responses to the consumption tax hike using regression analysis of individual CAR on *Cash* and the control variables for before, after, and the entire period including the day of the consumption tax hike.

Columns (1) and (2) show the estimation results before the consumption tax hike. On the one hand, both results show that the estimated coefficients of *Cash* are significantly positive. On the other hand, the results in columns

[18]Even though the classification of firms has not changed between panel A and panel B, the reasons for the changes in the values of various variables are as follows. In panel A, the stock prices at the end of August are used to calculate *Tobin's q*, while in panel B, those at the end of December are used. Furthermore, the data are updated using the financial statements of firms whose fiscal year ended between September and December 2019.

(3) and (4) show that they are insignificantly different from zero after the hike. That is, *Cash* had a positive impact on stock prices before the hike, whereas it did not have an impact after the hike. The interpretation of these results is that firms held more cash than usual before the hike because it was a predictable event, and the market participants valued it, whereas cash did not affect stock prices after the hike because firms were able to use their cash holdings to cover the decline in cash flow.

Note that, at this stage, this interpretation applies to only the service industry as the reference industry. To evaluate the impact across all industries, we need to examine the estimates for all industries. However, if we examine each industry's estimated values one by one, it will be challenging to determine the tendency of all listed firms. Hence, we propose the following proxies. First, we classify all industries into three groups: "industries with significantly positive coefficients", "industries with coefficients not significantly different from zero", and "industries with significantly negative coefficients" based on the estimated coefficient of each industry. We then sum up the number of firms in each industry group and calculate their share of the total. We label the firms in the first group, second group, and third group as "positive firms", "insignificant firms", and "negative firms", respectively. We report these shares at the bottom of Table 4. About half of the firms are classified as "positive firms", and about half are "insignificant firms" before the consumption tax hike, whereas about 10 percent of firms are "positive firms" and about 80 percent are "insignificant firms" after the hike. As the share of "positive firms" after the hike is lower then before the hike, *Cash* had a positive impact on stock prices before the hike, whereas it did not have an impact after the consumption tax hike, generally. These results are consistent with (H1).

The estimated coefficient of *Tobin's q* is not significantly different from 0 before the consumption tax hike, but it is significantly negative after the hike. *Tobin's q* is a variable that represents the investment opportunities of firms. These results suggest that companies with poor growth potential saw their stock prices rise unexpectedly after the hike.

The estimated coefficient of *CF* is significantly negative before the hike but is insignificantly different from 0 after the consumption tax hike. This result is related to uncertainty about firms' ability to pass on the consumption tax to consumers. In principle, a consumption tax is ultimately borne by the consumer, so firms simply pass on the consumption tax to the consumer or to other firms. In practice, however, firms may not pass on the equivalent amount of consumption tax to the buyers of goods and services. For buyers of goods and services, passing on the consumption tax is effectively raising prices, which reduces demand for goods and services. This will cause sellers of goods and services to bear a portion of the consumption tax equivalent, which will reduce the selling firms' profit margins. Such a decrease in profit margins will be more significant for firms with higher sales and cash flow. When such a decrease in profit was expected, the coefficient of *CF* would become negative. After the hike, if the firms were aware that they could pass on the consumption tax to the consumers, it would not be significant.

The results for *Leverage* and *Short* suggest that raising funds via debt had positive impacts on stock prices. Except for *Short* before the consumption tax hike, the estimated coefficients are significantly positive. These results are consistent with the free cash flow hypothesis, where the market valued the decrease in free cash flow by debt repayment because free cash flow can be a source of agency costs.

Following Faulkender and Wang (2006), *Size* is added as a control variable.[19] According to the estimates of *Size*, CAR are smaller for larger firms both before and after the consumption tax hike periods. The reason for this is that larger firms have higher liquidity and a smaller liquidity premium. We find that larger *Size* is associated with larger turnover rate changes, a standard measure of liquidity, during those periods.[20]

[19]We use total assets for *Size*, whereas Faulkender and Wang (2006) use sales.

[20]The turnover ratio is defined as the number of shares traded within a certain period divided by the number of shares outstanding. When examining the impact of liquidity on CAR, it is better to use the change in the liquidity index rather than its value. For example,

Columns (5) and (6) report the estimated results for the periods around the consumption tax hike. The estimation results are mixed. On the one hand, column (5) shows that the coefficient of *Cash* is not significant and that the share of positive firms is only about 10 percent. On the other hand, column (6) shows that the coefficient of *Cash* is significantly positive and that the share of positive firms is more than 40 percent. Judging from the lack of robustness of the above results, the impact of cash on stock prices changed before and after the hike.

The above results support *H1*, but that does not mean that cash is worthless against predictable adverse shocks. This is because firms could have mitigated the impact of the shock by holding more cash before the shock occurred.

Table 5 presents the cross-section of stock price responses to the COVID-19 pandemic over the *Entire* window (from January 30 to April 30, 2020), over the *Outbreak* window (from January 30 to February 28, 2020), and over the *Spread* window (from March 2 to April 30, 2020). *Cash* is significantly positively associated with CAR in all but one case (result in column (6)), which implies that cash-rich firms in the service industry are valued, all other things being equal. These results are consistent with H2. The share of positive firms is about 30 percent, except for the result in column (6). Judging from these results, the value of cash holdings during the *Spread* window seems to have been lower than that during the *Outbreak* window because the emergency economic measures implemented by the BOJ suppressed investors' anxiety that financial frictions would be severe, rather than exacerbated it.

All estimated coefficients of *Tobin's q* are insignificant. If the pandemic caused firms to lose their investment opportunities, the firms with larger *Tobin's q* should experience more severe stock price drops. Therefore, the insignificance of the coefficient on *Tobin's q* means that stock prices fell uniformly amid the pandemic, regardless of the firms' investment opportunities.

The estimated coefficients of *CF* are all insignificant. If the estimated coef-

the correlation between the change between turnover in Q4 2019 and change in Q3 2019 and *size* is 0.02.

ficients on *CF* were positive, firms that performed well before the COVID-19 outbreak would have been able to stave off a decline in their stock price because they would have been expected to perform relatively well after the outbreak. However, such an effect is not observed here.

*Leverage* is significantly negatively associated with CAR in all cases. The common intuition about the coefficient for *Leverage* is that firms with higher leverage are riskier, which means that they have a higher probability of default. In the presence of default, the firms are forced to sell their essential assets and incur the cost of inefficient liquidation. Our results are consistent with this intuition because such firms' stock prices with a high probability of default are undervalued in the market. According to the estimates in column (4), the impact on CAR is different between *Leverage* and *Cash*. A one percent point increase in *Leverage* lowers CAR by about five basis points, while a one percent point increase in *Cash* raises CAR by about 11 basis points. In other words, it would be more valuable to increase cash holdings by one dollar than to reduce debt by one dollar; thus, cash is not negative debt in an emergency. This result is consistent with Acharya, Almeida, and Campello (2007), who show that financially constrained firms prefer more cash to less debt if their hedging needs are high.

The estimated coefficients of *Short* are negative in all cases, but they are insignificant. These results reflect the fact that the following two effects cancel each other out. The first effect is a reduction in free cash flow, which positively impacts on stock prices. The second effect is the effect of refinancing risk, which harms stock prices. *Short* is a variable that indicates the need for funds within one year. Firms with more short-term debt have a higher risk of refinancing and a higher likelihood of failure.[21]

The estimated coefficients of *Size* are significantly positive in all cases, which is precisely opposite to the results in the case of the consumption tax hike.

[21] Harford, Klasa, and Maxwell (2014) find that firms can reduce refinancing risk by increasing their cash holdings and saving cash from cash flow. Even if a firm cannot refinance, cash holdings make its likelihood of failure smaller.

While stock prices fell during this period in response to the COVID-19 outbreak, large stocks' prices did not fall as much. Why were the price drops smaller for the larger stocks? Larger firms are considered to be better known to investors and have better access to capital markets than smaller firms. Therefore, they have fewer constraints on raising funds. It is also believed that there are economies of scale in liquidity management, and, given that the other conditions are equal, larger firms can save more cash and its equivalent.

## 5.2 Financial Constraints and CAR

Table 6 reports the stock price responses to the consumption tax hike, separately for the financially constrained and the financially unconstrained groups of firms. Before the hike, contrary to our conjecture, the estimated coefficient of *Cash* for the financially constrained firms is not significantly different from 0, while the one for the financially unconstrained firms is significantly positive.

However, these results are only for the service industry that is the reference industry and do not necessarily reflect the tendency across all industries. To understand the overall tendency, we propose the following indexes. We compare the estimated coefficients of *Cash* for each industry based on the results of estimations with and without financial constraints for the same period and specification of the estimated equations. We then identify industries in which the estimated coefficient of *Cash* for the financially unconstrained firms is larger than the one for the financially constrained firms and calculate the number of firms in those industries. We sum the number of such firms across all industries, calculate their share of the total number of firms, and label the indicator as "firms in cash-sensitive industries." For example, in the case of the combination of columns (1) and (2), the percent of firms belonging to industries where the estimated coefficient of *Cash* for the financially unconstrained firms is larger than the one for the financially constrained firms is 47.18 percent.

Conversely, we can also calculate the percent of industries in which the estimated coefficient of *Cash* for the financially constrained firms is larger than that for the financially unconstrained firms, which is 15.25 percent. Then, in the combination of columns (3) and (4), we can calculate the same indicators, with values of 45.18 percent and 18.70 percent. Thus, the overall tendency is that the financially unconstrained firms' cash had a larger positive effect than the financially constrained firms' cash.

The following reasons can explain these counterintuitive results. Looking at the descriptive statistics in Table 3, the financially constrained firms in this paper are characterized by relatively low growth and low cash flow. These firms are declining firms, and the additional decrease in profits because of the consumption tax hike is small. Besides, the mean of *Cash* of the financially constrained firms is not significantly different from that of the financially unconstrained firms. In other words, the financially constrained firms had sufficient cash in advance to withstand the expected negative cash flow shock. However, even among the financially unconstrained firms, the more cash was held by firms, the more the market participants valued them. This is presumably because the negative cash flow shock from the consumption tax hike was predictable but the size of it was uncertain, and firms with little cash may not have fully offset the decline in cash flow by raising additional funds.

After the consumption tax hike, all the estimated coefficients of *Cash* are insignificantly different from zero. The values of "firms in cash-sensitive industries" corresponding to each of the estimated equations are not very large, which means that the estimated coefficients of *Cash* for the financially constrained firms are insignificantly different from those for financially unconstrained firms in most industries in all of the estimated equations. Therefore, after the hike, uncertainty about the adverse cash flow shocks is resolved, and many firms, with or without financial constraints, could have avoided the impact of the decrease in cash flow with cash held in advance. Finally, the results from September to December 2019 across the timing of the hike in columns (9) to (12) are a mix of the results for September and the results for October

to December 2019.

Based on the above results, the value of cash around the consumption tax hike can be assessed. For example, in the case of the service industry, column (11) shows that the estimated coefficient of *Cash* for the financially unconstrained firms is 0.1644. Thus, a one percent point increase in *Cash* would result in 0.1644*0.01 = 0.001644, or about a 16 basis point increase in stock returns. As this is the rate of return for about four months, the annualized one would be about 50 basis points. However, from column (12), the estimated coefficient of *Cash* for the financially constrained firms is not significantly different from 0, so the increase in *Cash* did not affect their stock returns.

Table 7 reports stock price responses to the COVID-19 pandemic separately for the financially constrained and the financially unconstrained groups of firms. *Cash* is significantly positively associated with CAR for the Entire window. Furthermore, the stock price responses for the financially constrained firms are significantly larger than those for the financially unconstrained firms. The values of "firms in cash-sensitive industries" are larger for the financially constrained firms than for the financially unconstrained firms. Consequently, after the COVID-19 outbreak, holding cash had a positive impact on stock prices for many firms, and the degree of this impact was larger for the financially constrained firms than for the financially unconstrained firms.

In the case of the *Outbreak* window, the results in columns (5) and (6) show that the estimated coefficient of *Cash* is only significantly positive for the financially constrained firms. In contrast, the results in columns (7) and (8) show that the estimated coefficients of *Cash* are significantly positive for both groups of firms. The latter results also indicate that the estimated coefficient of *Cash* for the financially constrained firms is larger than that for the financially unconstrained firms. The value of "firms in cash-sensitive industries" for financially constrained firms is greater than the value for the financially unconstrained firms.

The *Spread* window sees that only the multiple regression analysis of the financially constrained firms reports significantly positive estimates of the co-

efficient on *Cash*. This estimate is smaller than that in the Outbreak window. The percent of "firms in cash-sensitive industries" for the financially constrained firms is about 36 percent in the single regression analysis and about 61 percent in the multiple regression analysis. On the one hand, the impact of cash on stock prices for the financially constrained firms in the service industry is smaller than in the Outbreak window. On the other hand, cash holdings by the financially constrained firms in many industries were still valued by the market participants.

In the case of the service industry, column (3) shows that the estimated coefficient of *Cash* for the financially unconstrained firms is 0.1036; thus, the effect of a one percent point increase in cash would be 0.1036*0.01=0.001036, which would increase the stock return by about 10 basis points. As this is the rate of return for about three months, the annualized return would be about 41 basis points. Column (4) reports that the estimated coefficient of *Cash* for financially constrained firms is 0.8149; thus the effect of a one percent point increase in *Cash* would be 0.8149*0.01=0.008149, which is about an 81 basis point increase in stock returns, or about 326 basis points annualized. The latter value is much larger than not only the former value but also the value of cash around the consumption tax hike. As many previous studies have shown, this reveals that cash has an exceptionally high value for financially constrained firms when an unexpected negative cash flow shock occurs.

## 5.3 Robustness Check

In the previous section, we examined how the impact of cash holdings on stock prices differed depending on the presence or absence of financial constraints. To this end, we develop the method of identifying the presence or absence of financial constraints that has already been explained in Section 4.5. This method relies on the event of a consumption tax hike and the firm's activities inferred from it, which is reasonable. However, the number of firms identified as financially constrained firms is a small fraction of the total sample,

and we are concerned that this bias may have affected the estimation results. Therefore, we examine how the previous estimation results would change if we changed the definition of financially constrained firms. In Subsection 5.2, a firm was considered financially constrained if it satisfied both conditions (C1) and (C2) at the same time, but in this section, a firm is considered financially constrained if it satisfies only condition (C1). Consequently, the number of financially constrained firms increases, while the number of financially unconstrained firms decreases.

Table 8 reports the multiple regression analysis results for the three event windows before and after the consumption tax hike. The estimates of the coefficients on *Cash* do not differ significantly from the results in Table 5. In other words, before the hike, only the estimate for the financially unconstrained firms is significantly positive, whereas after the hike, the estimate is significantly different from zero regardless of whether firms are financially constrained or not. Therefore, the conclusion that cash had a positive impact on stock prices before the consumption tax hike but that this impact disappeared after the consumption tax hike, remains unchanged.

Table 9 shows the results of the multiple regression analysis for the three event windows of the COVID-19 pandemic. In all event windows, the estimated coefficients of *Cash* for the financially unconstrained firms are not significantly different from zero, while those for the financially constrained firms are significantly positive. These results differ from the results in Table 7 but still support (H3) amid the COVID-19 pandemic.

# 6 Conclusion

This paper explores how cash mitigated adverse cash flow shocks to firms using the event study methodology and financial data from firms listed on the Tokyo Stock Exchange. Specifically, we utilized the consumption tax hike in Japan in 2019 and the global pandemic of COVID-19 in 2020 as natural experiments to

compare the two events' impact regarding the former as a predictable adverse cash flow event and the latter as an unpredictable one. While a large literature has theoretically and empirically identified the benefits of corporate cash holdings for risk hedging purposes, so far, only a limited number of studies have examined the value of cash holdings by distinguishing the nature of the shocks.

We find that for a predictable adverse cash flow shock such as a consumption tax hike, cash has no value after the event regardless of the severity of the financial constraint. We also find that cash has value after an event for an unpredictable adverse cash flow shock such as the COVID-19 pandemic and that the value for financially constrained firms is larger than that for financially unconstrained firms. In addition, our results show that the value of holding cash does not differ much between predicted and unpredicted shocks for financially unconstrained firms, while the value is much larger when an unpredicted shock occurs than when a predicted shock occurs for financially constrained firms.

Our results also raise important questions for future research. This paper examines the impact of adverse cash flow shocks on stock prices, but not on corporate policies such as capital investment, R & D, and mergers and acquisitions. Another issue is the design of optimal insurance against negative shocks. The results from this paper imply that firms that hold cash can cope to some extent with adverse cash flow shocks. However, self-insurance, i.e., cash holdings, is not always the best way to prevent negative cash flow shocks. This is because a firm's large cash holdings in normal times reduce the probability that it will invest in profitable projects. Duchin, Ozbas, and Sensoy (2010) find that US firms reduced their investment expenditure and increased cash held after the global crisis. Therefore, there is a need for a system that provides some degree of insurance against adverse shocks.

# Appendix

## A.1. Google Search for Coronavirus and Recession

Figure A shows the number of Google searches for "coronavirus" in Japanese from January to April 2020. The first peak in the graph is observed on January 30, reflecting the WHO declaration of a "Global Health Emergency" on January 30. The second peak came in late March, when people expected the disease to have a higher probability of becoming a pandemic, partly because the government had formulated its "Basic Policies for Novel Coronavirus Disease Control" and partly because the number of infected people in Japan had begun to rise rapidly, exceeding 100. The word was searched most often on April 4, when people were waiting for Prime Minister Abe to declare a state of emergency.

To identify the point at which people began to think that the coronavirus might have a negative impact on the economy, we also report data for Google searches for "recession" in Japanese in Figure A. Searches for the word have increased since mid-February 2020, suggesting that Japanese were beginning to realize around this time that the coronavirus could have a negative impact on the economy. The first peak in the search for "recession" is observed on February 28, 2020 three days after the first business failure in Japan following the COVID-19 outbreak.

These results indirectly confirm the plausibility of our choice of event dates. While COVID-19 has attracted enormous attention since early February 2020, the Japanese have been aware of the potential negative impact of COVID-19 on the economy since March 2020.

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Table 1 Timeline of Key Events Linked to Consumption Tax Hike and COVID-19 in Japan

| | |
|---|---|
| 2018 | |
| Oct. 15 | The Japanese government decided at a cabinet meeting to implement a consumption tax hike on October 1, 2019. |
| 2019 | |
| Oct. 01 | The government has raised the consumption tax rate from 8% to 10%. |
| 2020 | |
| Jan. 15: | The Ministry of Health, Labor and Welfare confirmed the first infected person in Japan. |
| Feb. 1: | Government classified COVID-19 as a legally designated infectious disease. |
| Feb. 13: | The first confirmed fatality in Japan was reported. |
| | Government announced the first emergent package to support economy. |
| Feb. 25: | Basic Policies for Novel Coronavirus Disease Control |
| | decided by the Headquarters for Novel Coronavirus Disease Control. |
| | The first business failure in Japan following the COVID-19 outbreak |
| Mar. 2: | Governor of BOJ issued an emergency statement. |
| Mar. 13: | The Diet approved legislation authorizing the Prime Minister to declare a state of emergency. |
| Apr. 7: | The Prime Minister declared a state of emergency covering major city areas such as Tokyo. |
| | Government adopted Emergency Economic Measures for Response to COVID-19. |
| Apr. 16: | The Prime Minister expanded the state of emergency to cover the whole country. |

## Table 2 Descriptive Statistics

| PanelA | Obs | Min | P25 | Mean | Median | P75 | Max | Stdev |
|---|---|---|---|---|---|---|---|---|
| Dependent variables | | | | | | | | |
| FF-adj CAR9021230 | 2468 | -1.2585 | -0.1047 | 0.0206 | 0.0039 | 0.1205 | 1.3149 | 0.2246 |
| FF-adj CAR902930 | 2468 | -0.4048 | -0.0296 | 0.0143 | 0.0066 | 0.0492 | 0.9754 | 0.0883 |
| FF-adj CAR10011230 | 2468 | -0.9267 | -0.0931 | 0.0062 | -0.0049 | 0.0878 | 1.2660 | 0.1815 |
| Fama–French | | | | | | | | |
| Market | 2468 | -0.5005 | 0.6807 | 0.9859 | 0.9612 | 1.2651 | 2.6675 | 0.0088 |
| SMB | 2468 | -0.0171 | 0.0032 | 0.0085 | 0.0078 | 0.0130 | 0.0515 | 0.0002 |
| HML | 2468 | -0.0403 | -0.0038 | -0.0004 | 0.0008 | 0.0042 | 0.0178 | 0.0001 |
| Explanatory Variable | | | | | | | | |
| *Cash* (Full) | 2458 | 0.0055 | 0.1025 | 0.2298 | 0.1816 | 0.2989 | 0.9835 | 0.1783 |
| *Cash* (Financially Unconstrained) | 2139 | 0.0055 | 0.1019 | 0.2307 | 0.1815 | 0.3040 | 0.9835 | 0.1797 |
| *Cash* (Financially Constrained) | 316 | 0.0156 | 0.1080 | 0.2205 | 0.1774 | 0.2813 | 0.9240 | 0.1659 |
| Control variables | | | | | | | | |
| *Tobin's q* | 2458 | -1.0631 | 0.8549 | 1.6271 | 1.0341 | 1.5397 | 65.3503 | 2.4007 |
| *CF* | 2415 | -0.7569 | 0.0465 | 0.0848 | 0.0835 | 0.1292 | 0.5457 | 0.0965 |
| *Leverage* | 2424 | 0.0174 | 0.3082 | 0.4546 | 0.4522 | 0.5938 | 1.7664 | 0.1927 |
| *Short* | 2424 | 0.0584 | 0.5659 | 0.6915 | 0.7150 | 0.8420 | 1.0000 | 0.1932 |
| *Size* | 2458 | 6.0497 | 9.6912 | 10.9174 | 10.8774 | 12.0419 | 19.4721 | 1.8540 |
| Control variables (Financially Unconstrained) | | | | | | | | |
| *Tobin's q* | 2139 | -1.063 | 0.862 | 1.658 | 1.048 | 1.567 | 65.350 | 2.496 |
| *CF* | 2099 | -0.757 | 0.048 | 0.087 | 0.085 | 0.131 | 0.537 | 0.096 |
| *Leverage* | 2108 | 0.017 | 0.308 | 0.455 | 0.452 | 0.594 | 1.766 | 0.193 |
| *Short* | 2108 | 0.058 | 0.563 | 0.690 | 0.714 | 0.841 | 1.000 | 0.194 |
| *Size* | 2139 | 6.050 | 9.686 | 10.939 | 10.902 | 12.095 | 17.766 | 1.883 |
| Control variables (Financially Constrained) | | | | | | | | |
| *Tobin's q* | 316 | 0.1503 | 0.8218 | 1.4014 | 0.9675 | 1.2679 | 14.3524 | 1.5639 |
| *CF* | 313 | -0.4338 | 0.0331 | 0.0714 | 0.0730 | 0.1091 | 0.5457 | 0.0982 |
| *Leverage* | 314 | 0.0390 | 0.3105 | 0.4557 | 0.4535 | 0.5937 | 0.9984 | 0.1896 |
| *Short* | 314 | 0.2011 | 0.5870 | 0.7025 | 0.7238 | 0.8424 | 1.0000 | 0.1855 |
| *Size* | 316 | 7.1285 | 9.7290 | 10.7926 | 10.6989 | 11.6891 | 19.4721 | 1.6348 |

| PanelB | Obs | Min | P25 | Mean | Median | P75 | Max | Stdev |
|---|---|---|---|---|---|---|---|---|
| Dependent variables | | | | | | | | |
| FF-adj CAR130430 | 2468 | -0.9621 | -0.1614 | -0.0289 | -0.0149 | 0.1146 | 1.1130 | 0.2258 |
| FF-adj CAR130228 | 2468 | -0.6217 | -0.0857 | -0.0172 | -0.0132 | 0.0523 | 0.9356 | 0.1270 |
| FF-adj CAR302430 | 2468 | -0.8777 | -0.1056 | -0.0116 | -0.0024 | 0.0915 | 1.1049 | 0.1654 |
| Fama–French | | | | | | | | |
| Market | 2468 | -0.2875 | 0.6888 | 0.9806 | 0.9639 | 1.2567 | 2.4388 | 0.4151 |
| SMB | 2468 | -0.0101 | 0.0035 | 0.0082 | 0.0080 | 0.0123 | 0.0399 | 0.0067 |
| HML | 2468 | -0.0252 | -0.0031 | 0.0000 | 0.0009 | 0.0039 | 0.0279 | 0.0057 |
| Explanatory Variable | | | | | | | | |
| *Cash* (Full) | 2468 | 0.0005 | 0.1053 | 0.2319 | 0.1827 | 0.3070 | 0.9835 | 0.1793 |
| *Cash* (Financially Unconstrained) | 2147 | 0.0005 | 0.1040 | 0.2324 | 0.1827 | 0.3083 | 0.9835 | 0.1806 |
| *Cash* (Financially Constrained) | 315 | 0.0215 | 0.1123 | 0.2269 | 0.1828 | 0.2930 | 0.9240 | 0.1679 |
| Control variables | | | | | | | | |
| *Tobin's q* | 2468 | -1.3676 | 1.2850 | 2.2044 | 1.5572 | 2.2120 | 62.2814 | 2.6985 |
| *CF* | 2427 | -0.7694 | 0.0450 | 0.0819 | 0.0821 | 0.1229 | 0.5457 | 0.0951 |
| *Leverage* | 2467 | 0.0180 | 0.3050 | 0.4516 | 0.4500 | 0.5930 | 1.7670 | 0.1940 |
| *Short* | 2468 | 0.0000 | 0.0206 | 0.1362 | 0.0972 | 0.2048 | 0.8343 | 0.1402 |
| *Size* | 2468 | 6.0497 | 9.7314 | 10.9379 | 10.8866 | 12.0490 | 19.4721 | 1.8442 |
| Control variables (Financially Unconstrained) | | | | | | | | |
| *Tobin's q* | 2147 | -1.368 | 1.291 | 2.229 | 1.573 | 2.264 | 62.281 | 2.703 |
| *CF* | 2110 | -0.769 | 0.047 | 0.084 | 0.084 | 0.125 | 0.537 | 0.096 |
| *Leverage* | 2147 | 0.018 | 0.303 | 0.451 | 0.450 | 0.592 | 1.767 | 0.194 |
| *Short* | 2147 | 0.000 | 0.020 | 0.134 | 0.096 | 0.204 | 0.827 | 0.138 |
| *Size* | 2147 | 6.050 | 9.725 | 10.962 | 10.908 | 12.110 | 17.766 | 1.872 |
| Control variables (Financially Constrained) | | | | | | | | |
| *Tobin's q* | 315 | 0.7395 | 1.2507 | 2.0303 | 1.4553 | 1.9806 | 40.1433 | 2.6689 |
| *CF* | 312 | -0.4338 | 0.0297 | 0.0685 | 0.0715 | 0.1055 | 0.5457 | 0.0906 |
| *Leverage* | 314 | 0.0390 | 0.3105 | 0.4546 | 0.4505 | 0.5995 | 0.9870 | 0.1935 |
| *Short* | 315 | 0.0000 | 0.0243 | 0.1476 | 0.1167 | 0.2159 | 0.7407 | 0.1490 |
| *Size* | 315 | 7.2101 | 9.7382 | 10.7770 | 10.6858 | 11.6827 | 19.4721 | 1.6241 |

Panel A of this table reports descriptive statistics for the data used in the consumption tax hike event, while Panel B reports descriptive statistics for the data used in the analysis of the COVID-19 pandemic. Here, the observations (Obs), minimum (Min), Mean, Median, maximum (Max), and standard deviation (Stdev) are reported in addition to the first and third quartiles (P25 and P75). The dependent variables in each panel are the cumulative abnormal returns calculated based on the Fama–French three-factor model (equation(1)). Panel A reports three types of data: September 2, 2019 to December 30, 2019 (CAR9021230), September 2, 2019 to September 30, 2019 (CAR902930), and October 1, 2019 to December 30, 2019 (CAR10011230), and Panel B reports three types of data: January 30, 2020 to April 30, 2020 (CAR130430), January 30, 2020 to February 28, 2020 (CAR130228), and March 2, 2020 to April 30, 2020 (CAR302430). *Market*, *SMB* and *HML* are descriptive statistics for each coefficient of the Fama–French three-factor model calculated based on equation (1). Panel A is computed for the sample from January to August 2019, and Panel B is computed for the sample from January to December 2019. *Cash* is calculated by dividing "cash and deposits" on the balance sheet by "total assets." *Tobin's q* is measured by the ratio of the market value of the firm's total assets to their book value, where the market value of the firm's total assets is calculated by evaluating only the value of common stock minus treasury stock at the firm's stock price on August 31, 2019 in panel A and December 30, 2019 in panel B. *CF* is the cash-flow-to-assets ratio, measured as cash flow over total assets. *Leverage* is defined as the ratio of "total liabilities" to total assets. *Short* is defined as total borrowings from financial institutions and corporate bonds due within one year divided by total liabilities. Short is defined as total borrowings from financial institutions and corporate bonds due within one year divided by total liabilities. *Size* is the logarithm of total assets. We also report descriptive statistics broken down into samples based on the financial constraints discussed in Section 4.5.

Table 3　Test of Difference of Means (Financially Unconstrained vs. Financially Constrained)

PanelA：Consumption Tax Hike

| | Financially Unconstrained | Financially Constrained | Degree of Freedom | Test Statistics | P-val. |
|---|---|---|---|---|---|
| *Cash* | 0.2307 | 0.2205 | 431.6947 | 1.0148 | 0.3108 |
| *Tobin's q* | 1.6578 | 1.4014 | 584.3937 | 2.4842 | 0.0133 |
| *CF* | 0.0868 | 0.0714 | 406.4738 | 2.6063 | 0.0095 |
| *Leverage* | 0.4547 | 0.4557 | 415.7699 | -0.0821 | 0.9346 |
| *Short* | 0.6899 | 0.7025 | 421.9447 | -1.1212 | 0.2628 |
| *Size* | 10.9388 | 10.7926 | 448.0115 | 1.4538 | 0.1467 |

PanelB：COVID-19 Pandemic

| | Financially Unconstrained | Financially Constrained | Degree of Freedom | Test Statistics | P-val. |
|---|---|---|---|---|---|
| *Cash* | 0.2326 | 0.2269 | 427.9331 | 0.5539 | 0.5799 |
| *Tobin's q* | 2.2299 | 2.0303 | 413.9127 | 1.2376 | 0.2166 |
| *CF* | 0.0839 | 0.0685 | 419.9838 | 2.7993 | 0.0054 |
| *Leverage* | 0.4512 | 0.4546 | 410.3395 | -0.2900 | 0.7719 |
| *Short* | 0.1345 | 0.1476 | 397.8761 | -1.4674 | 0.1430 |
| *Size* | 10.9614 | 10.7770 | 445.6988 | 1.8437 | 0.0659 |

This table reports the results of the Welsch test (test of the difference in means) by financial constraint classification (discussed in Section 4.5) for the six variables, *Cash*, *Tobin's q*, *CF*, *Leverage*, *Short*, and *Size*, whose descriptive statistics are reported in Table 2. Panel A reports the results for the consumption tax hike and panel B for the COVID-19 pandemic.

Table 4 Baseline Results: Consumption Tax Hike

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Event Window | Sep. 02 - Sep. 30, 2019 | | Oct. 01 - Dec. 30. 2019 | | Sep. 02 - Dec. 30, 2019 | |
| *Const* | -0.0007 | 0.0118 | 0.0239 | 0.0678 | 0.0232 | 0.0797 |
| (S.E) | (0.0088) | (0.0201) | (0.0149) | (0.0421) | (0.0189) | (0.0512) |
| *Cash* | 0.0801 | 0.1073 | -0.0236 | 0.0359 | 0.0566 | 0.1432 |
| (S.E) | (0.0270) | (0.0332) | (0.0383) | (0.0460) | (0.0494) | (0.0564) |
| *Tobin's q* | | -0.0027 | | -0.0148 | | -0.0175 |
| (S.E) | | (0.0019) | | (0.0027) | | (0.0037) |
| *CF* | | -0.0864 | | -0.0086 | | -0.0949 |
| (S.E) | | (0.0484) | | (0.0620) | | (0.0892) |
| *Leverage* | | 0.0289 | | 0.0822 | | 0.1111 |
| (S.E) | | (0.0132) | | (0.0317) | | (0.0380) |
| *Short* | | 0.0197 | | 0.0518 | | 0.0716 |
| (S.E) | | (0.0124) | | (0.0273) | | (0.0336) |
| *Size* | | -0.0034 | | -0.0102 | | -0.0136 |
| (S.E) | | (0.0013) | | (0.0028) | | (0.0033) |
| obs | 2458 | 2384 | 2458 | 2384 | 2458 | 2384 |
| $R^2$ | 0.0264 | 0.0489 | 0.0100 | 0.0350 | 0.0097 | 0.0423 |
| Positive firms(%) | 50.97 | 49.84 | 9.00 | 10.45 | 10.05 | 43.88 |
| Insignificant firms(%) | 46.88 | 48.65 | 79.88 | 76.7 | 88.74 | 54.90 |

This table shows the results of a regression analysis using three cumulative abnormal returns (*CAR902930, CAR10011230, and CAR9021230*) in the consumption tax hike event. It does not take into account the financial constraints discussed in Section 4.5. See the footnotes in Table 2 for a description of each variable. *Positive firms* shows the percentage of firms for which the coefficient of *Cash* for each industry is positive. *Insignificant firms* shows the percentage of firms for which the coefficient of Cash per industry is not significant. The Standard Error (S.E) is White-corrected robust standard errors.

Table 5 Baseline Results: COVID-19 Pandemic

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Event Window | Entire(Jan. 30 - Apr. 30, 2020) | | Outbreak(Jan. 30 - Feb. 28, 2020) | | Spread(Mar. 02 - Apr. 30, 2020) | |
| *Const* | -0.1497 | -0.2500 | -0.0607 | -0.1971 | -0.0890 | -0.0529 |
| (S.E) | (0.0196) | (0.0453) | (0.0116) | (0.0273) | (0.0135) | (0.0310) |
| *Cash* | 0.1329 | 0.1719 | 0.0743 | 0.1112 | 0.0586 | 0.0606 |
| (S.E) | (0.0475) | (0.0529) | (0.0297) | (0.0320) | (0.0331) | (0.0371) |
| *Tobin's q* | | -0.0050 | | -0.0010 | | -0.0040 |
| (S.E) | | (0.0036) | | (0.0011) | | (0.0032) |
| *CF* | | -0.1012 | | -0.0264 | | -0.0748 |
| (S.E) | | (0.0687) | | (0.0380) | | (0.0558) |
| *Leverage* | | -0.1724 | | -0.0464 | | -0.1259 |
| (S.E) | | (0.0304) | | (0.0183) | | (0.0235) |
| *Short* | | -0.0123 | | -0.0064 | | -0.0059 |
| (S.E) | | (0.0387) | | (0.0236) | | (0.0302) |
| *Size* | | 0.0195 | | 0.0154 | | 0.0042 |
| (S.E) | | (0.0031) | | (0.0019) | | (0.0022) |
| obs | 2468 | 2427 | 2468 | 2427 | 2468 | 2427 |
| $R^2$ | 0.1110 | 0.1466 | 0.0357 | 0.0713 | 0.1163 | 0.1373 |
| Positive firms(%) | 32.29 | 32.21 | 30.06 | 30.06 | 32.29 | 4.34 |
| Insignificant firms(%) | 41.73 | 46.68 | 69.41 | 69.41 | 41.77 | 70.87 |

This table shows the results of a regression analysis using three cumulative abnormal returns (*CAR130430, CAR130228, and CAR302430*) in the COVID-19 pandemic. It does not take into account the financial constraints discussed in Section 4.5. See the footnotes in Table 2 for a description of each variable. *Positive firms* shows the percentage of firms for which the coefficient of Cash for each industry is positive. *Insignificant firms* shows the percentage of firms for which the coefficient of Cash per industry is not significant. The Standard Error (S.E) is White-corrected robust standard errors.

Table 6 Financial Constraints and *CAR*: Consumption Tax Hike

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| "Event Window | | Sep. 02 - Sep. 30, 2019 | | | | Oct. 01 - Dec. 30, 2019 | | | | Sep. 02 - Dec. 30, 2019 | | |
| " Liquidity Constrained | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES |
| *Const* | -0.0054 | 0.0552 | 0.0104 | 0.0436 | 0.0259 | 0.0060 | 0.0769 | -0.0037 | 0.0205 | 0.0613 | 0.0873 | 0.0398 |
| (S.E) | (0.0091) | (0.0350) | (0.0218) | (0.0536) | (0.0160) | (0.0387) | (0.0465) | (0.0983) | (0.0202) | (0.0490) | (0.0561) | (0.1165) |
| *Cash* | 0.0949 | -0.1163 | 0.1152 | -0.0756 | -0.0164 | -0.1343 | 0.0492 | -0.1374 | 0.0785 | -0.2506 | 0.1644 | -0.2129 |
| (S.E) | (0.0280) | (0.1113) | (0.0349) | (0.1175) | (0.0410) | (0.1050) | (0.0496) | (0.1143) | (0.0523) | (0.1522) | (0.0601) | (0.1456) |
| *Tobin's q* | | | -0.0019 | -0.0060 | | | -0.0141 | -0.0133 | | | -0.0160 | -0.0193 |
| (S.E) | | | (0.0020) | (0.0047) | | | (0.0030) | (0.0051) | | | (0.0040) | (0.0078) |
| *CF* | | | -0.1176 | 0.1151 | | | -0.0376 | 0.1819 | | | -0.1551 | 0.2969 |
| (S.E) | | | (0.0531) | (0.0787) | | | (0.0663) | (0.1572) | | | (0.0946) | (0.2086) |
| *Leverage* | | | 0.0209 | 0.0937 | | | 0.0841 | 0.1087 | | | 0.1050 | 0.2024 |
| (S.E) | | | (0.0145) | (0.0291) | | | (0.0361) | (0.0600) | | | (0.0430) | (0.0733) |
| *Short* | | | 0.0248 | -0.0189 | | | 0.0434 | 0.0820 | | | 0.0682 | 0.0631 |
| (S.E) | | | (0.0139) | (0.0326) | | | (0.0311) | (0.0601) | | | (0.0382) | (0.0759) |
| *Size* | | | -0.0033 | -0.0030 | | | -0.0104 | -0.0090 | | | -0.0137 | -0.0120 |
| (S.E) | | | (0.0014) | (0.0035) | | | (0.0030) | (0.0074) | | | (0.0036) | (0.0091) |
| obs | 2139 | 313 | 2071 | 308 | 2139 | 313 | 2071 | 308 | 2139 | 313 | 2071 | 308 |
| $R^2$ | 0.0289 | 0.0110 | 0.0564 | 0.0503 | 0.0059 | 0.0476 | 0.0309 | 0.0763 | 0.0090 | 0.0146 | 0.0433 | 0.0628 |
| Firms in cash-sensitive industry (%) | 47.18 | 15.25 | 45.18 | 18.70 | 22.27 | 3.57 | 12.17 | 2.43 | 15.05 | 3.57 | 48.84 | 2.60 |

This table shows the results of a regression analysis using three cumulative abnormal returns (*CAR902930, CAR10011230, and CAR9021230*) in the consumption tax hike event. In it, we consider the financial constraint discussed in Section 4.5 and report the results of splitting the sample according to whether the firm faces a financial constraint or not. *Firms in a cash-sensitive industry* shows the percentage of firms belonging to industries where the impact of *Cash* is altered by considering financial constraints. See the footnotes in Table 2 for a description of each variable. The Standard Error (S.E) is White-corrected robust standard errors.

Table 7 Financial Constraints and *CAR*: COVID-19 Pandemic

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Event Window | | Entire(Jan. 30 - Apr. 30, 2020) | | | | Outbreak(Jan. 30 - Feb. 28, 2020) | | | | Spread(Mar. 02 - Apr. 30, 2020) | | |
| Financially Constrained | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES |
| *Const* | -0.1314 | -0.3424 | -0.2064 | -0.6543 | -0.0459 | -0.2125 | -0.1638 | -0.4849 | -0.0856 | -0.1299 | -0.0426 | -0.1694 |
| (S.E) | (0.0205) | (0.0600) | (0.0488) | (0.1136) | (0.0118) | (0.0452) | (0.0287) | (0.0801) | (0.0142) | (0.0464) | (0.0338) | (0.0836) |
| *Cash* | 0.0833 | 0.6705 | 0.1036 | 0.8149 | 0.0320 | 0.5019 | 0.0648 | 0.6203 | 0.0512 | 0.1686 | 0.0388 | 0.1946 |
| (S.E) | (0.0490) | (0.1448) | (0.0554) | (0.1472) | (0.0285) | (0.1402) | (0.0309) | (0.1339) | (0.0349) | (0.1112) | (0.0403) | (0.1099) |
| *Tobin's q* | | | -0.0026 | -0.0085 | | | -0.0006 | 0.0008 | | | -0.0020 | -0.0093 |
| (S.E) | | | (0.0037) | (0.0034) | | | (0.0013) | (0.0015) | | | (0.0033) | (0.0032) |
| *CF* | | | -0.1238 | -0.2054 | | | -0.0138 | -0.2626 | | | -0.1099 | 0.0572 |
| (S.E) | | | (0.0726) | (0.2069) | | | (0.0409) | (0.1115) | | | (0.0575) | (0.1773) |
| *Leverage* | | | -0.1654 | -0.2671 | | | -0.0446 | -0.0741 | | | -0.1208 | -0.1930 |
| (S.E) | | | (0.0326) | (0.0932) | | | (0.0194) | (0.0534) | | | (0.0255) | (0.0738) |
| *Short* | | | -0.0476 | 0.1958 | | | -0.0238 | 0.1040 | | | -0.0238 | 0.0918 |
| (S.E) | | | (0.0416) | (0.1123) | | | (0.0255) | (0.0701) | | | (0.0319) | (0.0913) |
| *Size* | | | 0.0171 | 0.0426 | | | 0.0135 | 0.0290 | | | 0.0036 | 0.0136 |
| (S.E) | | | (0.0034) | (0.0083) | | | (0.0020) | (0.0058) | | | (0.0024) | (0.0062) |
| obs | 2147 | 315 | 2110 | 312 | 2147 | 315 | 2110 | 312 | 2147 | 315 | 2110 | 312 |
| $R^2$ | 0.1145 | 0.1299 | 0.1460 | 0.2251 | 0.0314 | 0.1230 | 0.0608 | 0.2035 | 0.1213 | 0.0630 | 0.1414 | 0.1254 |
| Firms in cash-sensitive industry (%) | 9.70 | 65.76 | 1.95 | 60.45 | 0.93 | 45.03 | 13.67 | 40.45 | 10.87 | 35.94 | 8.28 | 61.01 |

This table shows the results of a regression analysis using three cumulative abnormal returns (*CAR130430, CAR130228, and CAR302430*) in the COVID-19 pandemic. In it, we consider the financial constraint discussed in Section 4.5 and report the results of splitting the sample according to whether the firm faces a financial constraint or not. The line Firms in a cash-sensitive industry shows the percentage of firms belonging to industries where the impact of *Cash* is altered by considering financial constraints. See the footnotes in Table 2 for a description of each variable. The Standard Error (S.E) is White-corrected robust standard errors.

Table 8 Robustness Check: Consumption Tax Hike

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Event Window | Sep. 02 - Sep. 30, 2019 | | Oct. 01 - Dec. 30, 2019 | | Sep. 02 - Dec. 30, 2019 | |
| Liquidity Constrained | NO | Yes | NO | Yes | NO | Yes |
| *Const* | 0.0226 | -0.0197 | 0.0704 | 0.0440 | 0.0929 | 0.0243 |
| (S.E) | (0.0236) | (0.0411) | (0.0483) | (0.0938) | (0.0585) | (0.1151) |
| *Cash* | 0.1149 | 0.0540 | 0.0471 | -0.0148 | 0.1620 | 0.0391 |
| (S.E) | (0.0393) | (0.0605) | (0.0516) | (0.1062) | (0.0627) | (0.1295) |
| *Tobin's q* | -0.0029 | -0.0002 | -0.0160 | -0.0095 | -0.0189 | -0.0097 |
| (S.E) | (0.0024) | (0.0032) | (0.0033) | (0.0047) | (0.0044) | (0.0070) |
| *CF* | -0.1259 | 0.0472 | -0.0289 | 0.0798 | -0.1548 | 0.1270 |
| (S.E) | (0.0602) | (0.0560) | (0.0739) | (0.1161) | (0.1066) | (0.1502) |
| *Leverage* | 0.0198 | 0.0695 | 0.0972 | 0.0429 | 0.1170 | 0.1125 |
| (S.E) | (0.0158) | (0.0238) | (0.0399) | (0.0497) | (0.0475) | (0.0607) |
| *Short* | 0.0237 | 0.0156 | 0.0414 | 0.0906 | 0.0651 | 0.1062 |
| (S.E) | (0.0151) | (0.0242) | (0.0335) | (0.0515) | (0.0414) | (0.0644) |
| *Size* | -0.0040 | -0.0024 | -0.0103 | -0.0093 | -0.0143 | -0.0116 |
| (S.E) | (0.0015) | (0.0025) | (0.0031) | (0.0060) | (0.0038) | (0.0073) |
| obs | 1823 | 554 | 1823 | 554 | 1823 | 554 |
| $R^2$ | 0.0495 | 0.0426 | 0.0212 | 0.0529 | 0.0359 | 0.0368 |
| Firms in cash-sensitive industry (%) | 36.84 | 27.59 | 18.54 | 4.26 | 36.82 | 11.32 |

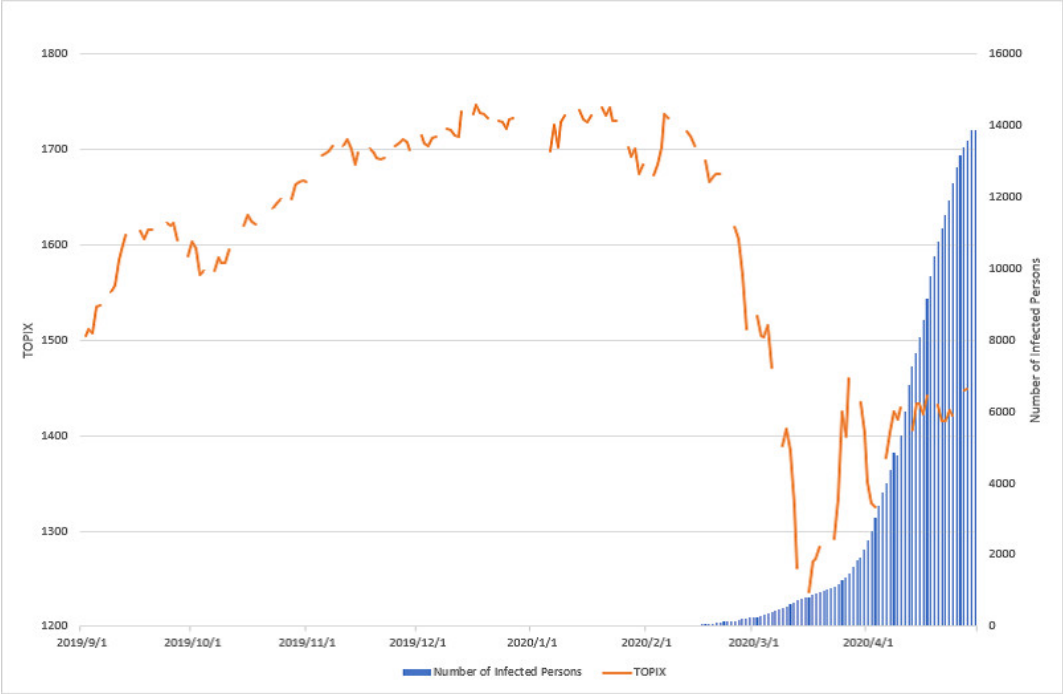
This table shows the results of a regression analysis using three cumulative abnormal returns (*CAR902930, CAR10011230, and CAR9021230*) in the consumption tax hike. In it, we consider the financial constraint discussed in Section 5.3 and report the results of splitting the sample according to whether the firm faces a financial constraint or not. Firms in a cash sensitive industry shows the percentage of firms belonging to industries where the impact of *Cash* is altered by considering financial constraints. See the footnotes in Table 2 for a description of each variable. The Standard Error (S.E) is White-corrected robust standard errors.

Table 9 Robustness Check: COVID-19 Pandemic

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Event Window | Entire(Jan. 30 - Apr. 30, 2020) | | Outbreak(Jan. 30 - Feb. 28, 2020) | | Spread(Mar. 02 - Apr. 30, 2020) | |
| Liquidity Constrained | NO | Yes | NO | Yes | NO | Yes |
| *Const* | -0.1700 | -0.4865 | -0.1450 | -0.3645 | -0.0250 | -0.1221 |
| (S.E) | (0.0512) | (0.0948) | (0.0298) | (0.0653) | (0.0353) | (0.0646) |
| *Cash* | 0.0855 | 0.4920 | 0.0532 | 0.3424 | 0.0323 | 0.1496 |
| (S.E) | (0.0577) | (0.1162) | (0.0329) | (0.0827) | (0.0419) | (0.0757) |
| *Tobin's q* | -0.0068 | -0.0032 | -0.0017 | -0.0006 | -0.0051 | -0.0026 |
| (S.E) | (0.0037) | (0.0048) | (0.0020) | (0.0012) | (0.0028) | (0.0048) |
| *CF* | -0.0931 | -0.1605 | 0.0106 | -0.1821 | -0.1037 | 0.0216 |
| (S.E) | (0.0807) | (0.1371) | (0.0462) | (0.0717) | (0.0613) | (0.1291) |
| *Leverage* | -0.1747 | -0.2214 | -0.0492 | -0.0530 | -0.1255 | -0.1684 |
| (S.E) | (0.0345) | (0.0713) | (0.0208) | (0.0400) | (0.0265) | (0.0564) |
| *Short* | -0.0685 | 0.1931 | -0.0222 | 0.0476 | -0.0464 | 0.1456 |
| (S.E) | (0.0447) | (0.0830) | (0.0276) | (0.0500) | (0.0327) | (0.0754) |
| *Size* | 0.0159 | 0.0303 | 0.0124 | 0.0237 | 0.0034 | 0.0066 |
| (S.E) | (0.0036) | (0.0068) | (0.0022) | (0.0044) | (0.0025) | (0.0051) |
| obs | 1857 | 563 | 1857 | 563 | 1857 | 563 |
| $R^2$ | 0.1387 | 0.1920 | 0.0563 | 0.1263 | 0.1396 | 0.1308 |
| Firms in cash-sensitive industry (%) | 8.28 | 51.72 | 3.08 | 37.32 | 5.6 | 51.52 |

This table shows the results of a regression analysis using three cumulative abnormal returns (*CAR130430, CAR130228, and CAR302430*) in the COVID-19 event. In it, we consider the financial constraint discussed in Section 5.3 and report the results of splitting the sample according to whether the firm faces a financial constraint or not. The line Firms in a cash-sensitive industry shows the percentage of firms belonging to industries where the impact of *Cash* is altered by considering financial constraints. See the footnotes in Table 2 for a description of each variable. The Standard Error (S.E) is White-corrected robust standard errors.

Figure 1 TOPIX and Number of Infected Persons




This figure shows the closing price of TOPIX from January to September 2019 (line, left axis) and the number of infected persons in Japan (bar graph, right axis).

Figure 2 Changes in real consumption growth rate before and after consumption tax hike

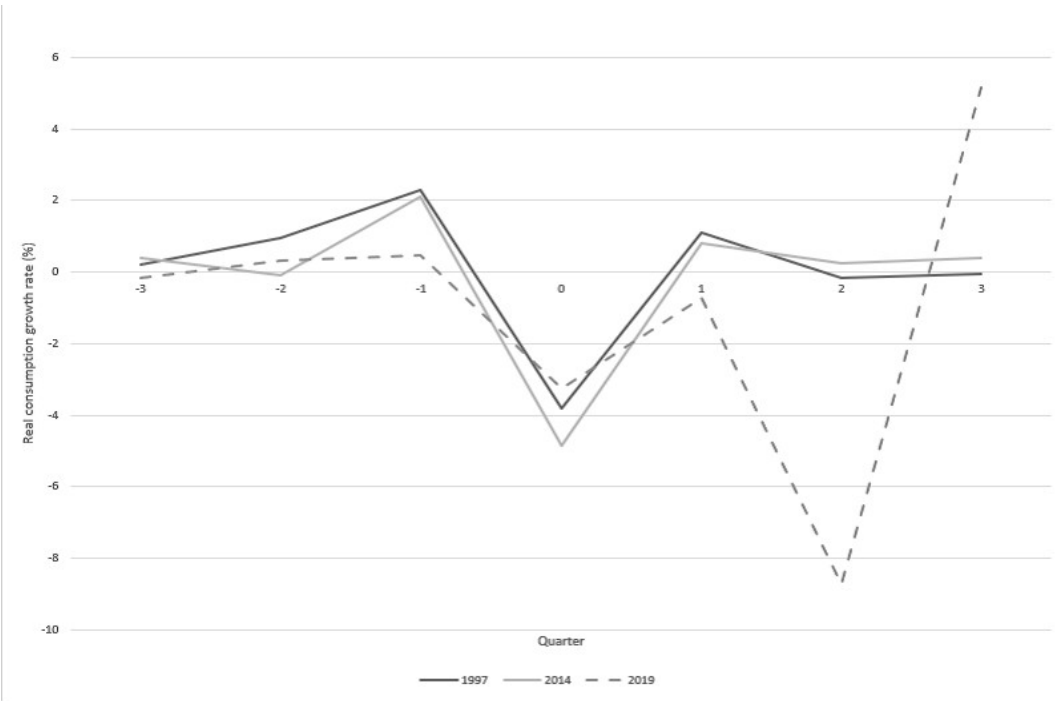
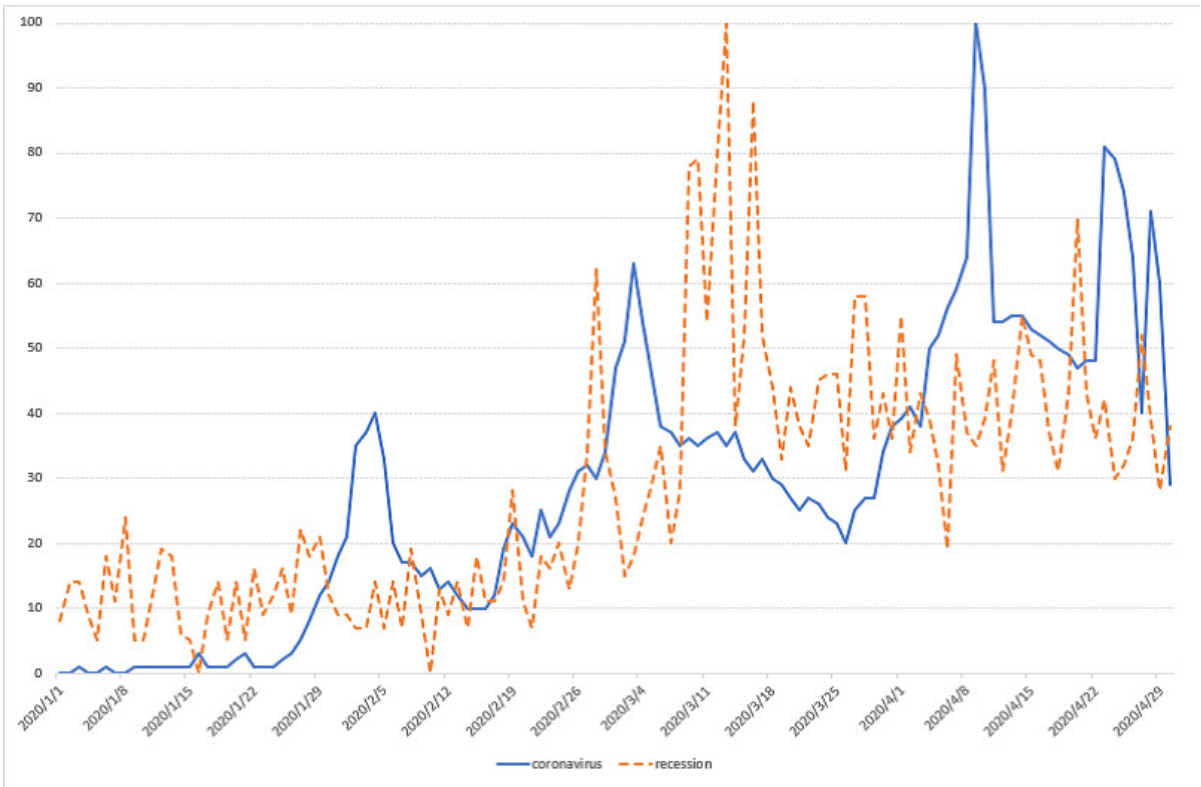


Figure A Number of Searches for "Coronavirus" and "Recession"




This figure summarizes the changes in the number of searches for "Coronavirus" and "Recession" in Japan. The maximum value for this period is set to 100 as the reference value.