The role of cash holdings during financial crises☆

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ABSTRACT

We examine the role of cash holdings during crises, whether the firm with higher cash holdings could quickly recover the operating performance after the financial crisis. We find that if a firm has higher cash holdings, its operating performance recovers more rapidly after financial crisis; these results hold after accounting for endogeneity and various robustness tests. Regarding possible transmission channels, we find that higher cash holdings increase capital expenditures and R&D expenditures, which improves firms' performance more rapidly after financial crisis. Furthermore, differences in financing constraints, corporate governance, and degree of financial development affect the relationship between cash holdings and post-crisis speed of recovery. Thus, firms should judiciously reserve cash holdings in their accounts to safeguard against unexpected emergencies.

1. Introduction

Can cash holdings help firms recover their operating performance after a recession due to financial crisis? Cash and cash equivalents are account items with the highest liquidity in firm assets. Based on the concept of cash holdings, Keynes (1936) proposes that cash holdings are maintained based on transaction, precautionary, and speculative motives, and they are important, particularly during a depression. Subramaniam et al. (2011) indicate that cash and cash equivalents held by firms are important assets in the balance sheet, because they attract significant attention from other firms, investors, and analysts. Cash holdings are particularly important during a depression. Duchin et al. (2010) find that financing costs largely increased during financial crises. During such crises, firms' cash holdings played a crucial role; fresh investments declined significantly, and firms with low cash reserves experienced the steepest decline. The 1997 Asian Financial Crisis, the 2007 US Subprime Crisis, the 2008 Global Financial Crisis, the 2009 European Debt Crisis, and the 2011 US Debt Crisis have all considerably hit the global economy and have shaken investor confidence in financial markets. Following these crises, the belief that "cash is king" has resounded in discussions among financial experts. Chen et al. (2020) suggest that "cash is king" as it directly determines financing, investments, operations, payouts, and consequently firm value. Moreover, with the 2020 coronavirus pandemic leading to a potential global economic recession, De Vito and Gomez (2020) point out the average firm with partial operating flexibility would exhaust its cash holdings in about two years, which the liquidity of firms is

severely affected. However, no literature has verified whether firms with high cash holdings can rapidly recover their operating performance after a financial crisis. Thus, this study focuses on this topic.

An article in *The Wall Street Journal* on August 11, 2011, reported[2] that US enterprises have continued to reserve cash since the financial crisis in order to prevent possible future crises. Among S&P 500 index companies, non-financial enterprises held a total of USD 1.12 trillion of cash and short-term investments, representing a substantial increase of 59% as compared with the third quarter of 2008. These cash reserves provide firms with the necessary buffer during economic and financial crises. As Covid-19 runs riot across the world, *The Wall Street Journal* on March 25, 2020 also reported[3] that the fast-spreading coronavirus has prompted even the biggest U.S. companies to cut their spending and bolster their balance sheets, proving once again how cash is king, especially in times of crisis. Meanwhile, Taiwan's *Business Weekly* reported that the global economy faced a tough winter in 2011. At that time, the quick ratios of many enterprises in Taiwan, including Nanya Technology, ProMOS Technology, *E*-Ton Solar Technology, Chimei Innolux, Tatung, Chunghwa Picture Tubes, Powerchip Technology, and Inotera Memories, were lower than 100%, and their quick ratios were lower than 60%. Particularly, the quick ratio of ProMOS Technology was only 9.7%, while the current and quick ratios of Inotera Memories were only 26.9% and 14.5%, respectively.[4] Nanya Technology avoided being delisted from the stock exchange, due to the support of the Formosa Plastics Group, which contributed 30 billion in the form of private capital replenishment. The financial problems these firms faced underline the importance of cash holdings.

Several studies have examined various aspects of cash holdings. In addition to studies examining the effects of cash holdings on operating performance and firm value, Fresard (2010) points out that the cash holdings policy is a result of strategic considerations. Having more cash reserves enables a firm to obtain a higher market share than its competitors. At the same time, having higher cash reserves can help improve the operating performance of the industry. The recent literature mainly discusses the determinant factors of cash holdings. Studies show that investment opportunities (Bates et al., 2009; Riddiough and Wu, 2009), financing constraints (Riddiough and Wu, 2009; Ang and Smedema, 2011; Sasaki and Suzuki, 2019), corporate governance (Harford et al., 2008; Dittmar et al., 2003; Loncan, 2020), degree of diversification (Subramaniam et al., 2011), employment protection laws (Karpuz et al., 2019), and policy uncertainty (Phan et al., 2019; Duong et al., 2020) can affect firms' cash holdings. Numerous studies also examine cash holdings in relation to corporate financial decisions, including the effects of cash holdings on investment decisions (Campello et al., 2010; Duchin et al., 2010; Denis and Sibilkov, 2010; Hirth and Viswanatha, 2011; Mercatanti et al., 2019); expenditure on R&D (Brown and Petersen, 2011; Chang and Tang, 2021); as well as decision-making related to financing (Kim et al., 1998), dividend policy (Campello et al., 2010; Lee and Suh, 2011), and other financial issues.

Some studies show that financing constraints affect the correlation between cash holdings and investments (Denis and Sibilkov, 2010), the utilization efficiency of cash holdings (Luo, 2011), and the cash holdings policy (Almeida, 2011; Kusnadi and Wei, 2011). Corporate governance also impacts the financing costs of firms, thereby affecting the cash holdings policy (Shleifer and Wolfenzon, 2002; Almeida, 2011; Kusnadi and Wei, 2011). Meanwhile, other studies report that the degree of financial development affects external financing costs, thereby affecting the proportion of cash held in firms' accounts (King and Levine, 1993; Rajan and Zingales, 1998; Levine and Servos, 1998; Demirgüç-Kunt and Maksimovic, 1998; Khurana et al., 2006).

It is worth mentioning that some studies examine the role of cash holdings during the recession or financial crises, and show that cash management policies are more important during financial crises (Tong and Wei, 2008; Ivashina and Scharfstein, 2010; Duchin et al., 2010; Campello et al., 2010; Campello et al., 2011; Chen et al., 2018; Ahrends et al., 2018). Particularly, Ang and Smedema (2011) report that firms often fail to maintain the appropriate cash level to guard against the effects of a possible recession. Chen et al. (2018) indicate that firms with more pre-saved cash tend to increase capital investments during severe economic downturns. Thus, during a financial crisis, high cash holdings can help firms deal with underinvestment problems. Ahrends et al. (2018) demonstrate that corporate cash holdings provide the flexibility to invest for firms that have expansion opportunities during crisis times. So far, no literature has investigated whether cash holdings affect the speed at which a firm recover after a financial crisis. According to the above studies, we can infer that firms with high cash holdings can make related investments and even enhance the follow-up growth momentum so as to enable themselves to rapidly recover and improve their operating performance after a financial crisis.

Hence, we aim to verify whether firms with higher cash holdings can rapidly recover their operating performance after a financial crisis. This study uses the method to measure the speed of recovery after a recession proposed by Cerra and Saxena (2005, 2008) and Cerra et al. (2009). Moreover, based on the definition and crisis years provided by Reinhart and Rogoff (2011b), the sample crisis years cover the period from 1990 to 2010, and the samples include firms in countries where currency crises, banking crises, sovereign external debt crisis, and domestic debt crises have occurred.

The empirical results reveal that if firms have higher cash holdings, their operating performance tends to recover more rapidly after a financial crisis. The results hold after accounting for endogeneity and various robustness checks. Considering the possible transmission channels, the evidence also indicates that higher cash holdings increase capital expenditures and R&D expenditures, which improves firms' performance more rapidly after financial crisis. Furthermore, differences in financing constraints, corporate governance, and the degree of financial development can affect the relationship between cash holdings and speed of recovery of operating performance after a financial crisis.

The remainder of this paper is organized as follows: Section 2 contains the literature review and hypotheses; Section 3 describes the

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[2] Wall Street Journal, August 11, 2011, "In Carnage, Cash Comforts", By Vipal Monga, Dana Mattioli and Emily Chasan.
[3] Wall Street Journal, March 25, 2020, "Coronavirus Shows Cash Is King, Even for Biggest U.S. Companies", By Theo Francis and Thomas Gryta.
[4] This figure is determined on the basis of financial statements: three indicators were used to examine hundreds of technological companies in the 1250th issue of *Business Weekly* published in November 2011.

sample and introduces the methodology, including the research models and the calculation and measurement of variables; Section 4 discusses the empirical results of the study; Section 5 considers the endogenous problem; Section 6 discusses additional test results; and Section 7 concludes the paper.

2. Literature review and hypotheses development

Chen et al. (2020) suggest that "cash is king" as it directly determines financing, investments, operations, payouts, and consequently firm value. Theoretically, the level of cash holdings is expected to be positively correlated with the likelihood of recession. McLean (2011) demonstrates that firms would issue shares to accumulate cash based on the precautionary motive. He also points out that, during the 1970s, $1.00 of issuance resulted in $0.23 of cash savings; over the most recent decade, $1.00 of issuance resulted in $0.60 of cash savings. Chen et al. (2016) argue that corporate managers tend to preserve cash when they foresee that the economy will deteriorate. Ang and Smedema (2011) investigate how firms manage their financial flexibility based on the expected probability of recession. The results indicate that firms may be unable to prepare for future recession due to financial constraints and insufficient cash holdings.

Low cash reserves may cause insufficient liquidity, underinvestment, lack of R&D expenditure, rising financing costs and a shock dividend policy, which will lead to face financial constraints, lack of future growth momentum, and financial decision-making with restrictions. Thus, there is a negative impact on firms' speed of recovery after a financial crisis. In contrast, firms with sufficient cash can solve the above problems effectively.

Regarding investment decisions, Hirth and Viswanatha (2011) specify that low-cash firms facing financing costs today are more reluctant to invest if they have less cash or if their future cash flows are less secure, which will be more pronounced during a financial crisis. Duchin et al. (2010) reveal that during a financial crisis, financing costs increase significantly and the degree of cash holdings assumes more importance. They also reveal that, during such crises, corporate investments decrease substantially, and this decline is greatest for firms that have low cash reserves or high net short-term debt, are financially constrained, or operate in industries that are heavily reliant on external finance. Campello et al. (2010) find that financially restricted firms would renounce favorable investment opportunities during a financial crisis and would drastically reduce technology spending, marketing expenses, staff costs, and capital expenditure. Therefore, although Denis and Sibilkov (2010) specify that cash holdings allow financially constrained firms to make more investments and have more investment value, during a financial crisis and with a scarcity of cash holdings, even if firms have valuable investment opportunities, they cannot invest appropriate resources. Campello et al. (2011) state that firms will substitute cash for investment expenditure during a financial crisis, and if firms raise cash, they will reduce future investment. In contrast, Chen et al. (2018) examine the role of pre-saved cash in helping financially constrained firms during the 2000 dot-com crash and the 2008 financial crisis, which find firms with more pre-saved cash tend to increase capital investments during these severe economic downturns. Thus, during a financial crisis, high cash holdings can help firms deal with underinvestment problems. Sasaki and Suzuki (2019) find that when the deterioration of bank health limits firms' future investments due to reduced bank credit facilities, while large cash holdings can mitigate such underinvestment problems. Ahrends et al. (2018) demonstrate that corporate cash holdings provide the flexibility to invest for firms that have expansion opportunities during crisis times.

With regard to strategy, R&D expenditure, financial decisions, and dividend policy, Fresard (2010) states that the cash holdings policy is a result of strategic considerations, and compared to competitors, firms which hold more cash will acquire greater market share and better operational performance in the future. In addition, Brown and Petersen (2011) reveal that firms rely on cash reserves to smooth R&D spending in the presence of financing difficulties. Particularly, during the boom and bust of US equity issuance from 1998 to 2002, young firms used cash holdings to reduce volatility of about 75% in R&D expenditure. In other words, firms with sufficient cash are better able to incur R&D expenditure. Chang and Tang (2021) indicate that higher cash holdings lead to steady increases in R&D expenditure, which improves firms' TFP. Furthermore, Kim et al. (1998) demonstrate that, in a situation of excessive external financing costs, firms tend to increase the proportion of liquid assets so as to minimize the financing costs of future investment opportunities. However, if firms lack cash reserves, they will be compelled to raise cash in the currency or capital markets, leading to higher financing costs. Moreover, Lee and Suh (2011) investigate the relationship between cash holdings and share repurchases among firms in Australia, Canada, France, Germany, Japan, the U.K., and the U.S., and find a positive correlation between them. The results show that firms use repurchases to distribute temporary cash flows and discharge excess capital to reduce agency conflicts. Campello et al. (2010) indicate that constrained firms tend to reduce their planned dividend distributions more drastically during a crisis.

In summary, having insufficient cash holdings not only affect the market share and R&D expenditure, but also increase financing costs and affect dividend policy. More importantly, it influences firms' investment decisions, resulting in underinvestment despite effective investment opportunities and reducing the future growth momentum. Duchin et al. (2010) and Campello et al. (2010) argue that such firms will be more severely affected by a financial crisis. Ang and Smedema (2011) propose that firms often fail to maintain insufficient cash reserves to tide over a possible recession, and the scarcity of cash holdings has a negative impact on the speed of recovery after the recession. Firms with high cash holdings can make related investments (even if they are facing a financial crisis) and even enhance the follow-up growth momentum so as to enable themselves to rapidly recover and improve their operating performance after a financial crisis. Accordingly, we establish hypothesis 1 as follows:

Hypothesis 1. Firms with high cash holdings can rapidly recover their operating performance after a financial crisis.

As mentioned above, constrained firms tend to reduce tech spending, employment, and capital expenditure during a financial crisis. Evidence suggests that firms rely on cash holdings to increase capital investments (Chen et al., 2018), smooth R&D spending and dampen the aggregate R&D cycle during severe economic downturns (Brown and Petersen, 2011). Chang and Tang (2021) probe a

transmission mechanism between cash holdings and TFP and verify that firms with high cash holdings can improve TFP through increased R&D investments. Accordingly, we establish hypotheses 2a and 2b as follows:

Hypothesis 2a.   Firms with high cash holdings can rapidly recover their operating performance after a financial crisis through capital expenditures.

Hypothesis 2b.   Firms with high cash holdings can rapidly recover their operating performance after a financial crisis through R&D expenditures.

3. Data and methodology

3.1. Data

In the literature, there are different definitions of "financial crises"; these definitions mainly include banking, currency, sovereign external debt, and domestic debt crises (Frankel and Rose, 1996; Kaminsky and Reinhart, 1999; Caprio and Klingebiel, 2003; Laeven and Valencia, 2008; Broner et al., 2010; Reinhart and Rogoff, 2011a). Based on the definition and crisis years that provided by Reinhart and Rogoff (2011b), the crisis years are objectively identified the countries and their respective records of financial crises. The sample crisis years cover the period from 1990 to 2010, and the samples include firms in countries where happened the following four types of financial crises.

1. Currency crisis: Currency depreciation in the current year is more than 15%.

2. Banking crisis: Bank runs cause banks to close, merge, or be taken over by the public sector or financial institutions; even if there are no bank runs, a banking crisis may arise when financial organizations other from banks face similar crises in their operations.

3. Sovereign external debt crisis: The state is unable to pay interest or principal on the maturity of the debt (external debt).

4. Domestic debt crisis: The state is unable to pay interest or principal on the maturity of the debt (domestic debt).

The Standard Industrial Classification Code (SIC code) is used in the sample screening to make industry classifications. Given the restrictions on the regulations of the public sector and the financial industry as well as the significant differences between industrial characteristics, financial industry (SIC codes in 6000–6999) and utility industry (SIC codes in 4900–4999) are excluded. Sample firms with incomplete variables are also eliminated.

The financial statements of firms in various countries are collected from Compustat Global Vantage. The required information about the firm market value is collected from DataStream and Compustat Global Vantage, and information about the overall economy is sourced from the World Development Indicators (WDI) of the World Bank, Global Development Finance (GDF), and International Country Risk Guide (ICFG) Database.

3.2. Methodology

We set the dummy variable *Trough* to represent the year which has the operating performance recession in a valley during the banking, currency, sovereign external debt, or domestic debt crises to verify whether the operating performance of the firms with higher cash holdings can recover rapidly after a financial crisis. This verification is conducted by referring to the methods of measuring the speed of recovery after a recession proposed by Cerra and Saxena (2005, 2008) and Cerra et al. (2009).

$$Trough_{ijt-1} = \begin{bmatrix} 1, \text{if } Performance_{ijt-1} \leq 0 \text{ and } Performance_{ijt} > 0 \\ 0, \text{if } Performance_{ijt-1} \leq 0 \text{ and } Performance_{ijt} \leq 0 \\ 0, \text{if } Performance_{ijt-1} > 0 \end{bmatrix} \qquad (1)$$

In the dummy variable *Trough$_{ijt-1}$*, as shown in Eq. (1), subscripts *i*, *j*, and *t* refer to the sample firm, country, and current year, respectively. Thus, *Trough$_{ijt-1}$* refers to the dummy variable of operating performance recession in a valley of *i* firm in country *j* during the financial crisis of *t*-1 year. If the operating performance in the previous year (*Performance$_{ijt-1}$*) is equal to or less than zero, and the one in the current year (*Performance$_{ijt}$*) is more than zero, these variables indicate that the operating performance in the previous year is in a valley; thus, it is set to one. Meanwhile, if the operating performance in the previous year is equal to or less than zero, and the one in the current year is still equal to or less than zero, these variables indicate that the operating performance in the previous year is not in a valley; thus, *Trough$_{ijt-1}$* is set to zero. Finally, if the operating performance in the previous year is more than zero, it also indicates that the operating performance at that time is not in a valley; thus, *Trough$_{ijt-1}$* is set to zero. We place *Trough$_{ijt-1}$* in a regression model, which is expressed as

$$Performance_{ijt} = \alpha_0 + \beta_1 Trough_{ijt-1} + \varepsilon_{ijt} \qquad (2)$$

Referring Cerra and Saxena (2005, 2008) and Cerra et al. (2009), a recovery is defined to be the year(s) of positive operating performance growth immediately following a trough. Therefore, we further restrict the samples with positive operating performance (*Performance$_{ijt}$* > 0) based on definition to compare the speed of the recovery from recession with that in all other years of positive operating performance growth. Thus, the regression model is further expressed as follows:

$$Performance_{ijt}/Performance_{ijt} > 0 = \alpha_0 + \beta_1 Trough_{ijt-1} + \varepsilon_{ijt} \qquad (3)$$

We further adopts the cash holdings (*CashHolding*) and the interaction term of the dummy variable of operating performance

recession in a valley during a financial crisis and cash holdings ($Trough \times CashHolding$), in order to verify whether the operating performance of the firms with higher cash holdings can rapidly recover after the financial crisis, and to determine the control variable influencing the operating performance, especially considering the heterogeneity of each firm, country, and the yearly dummy variables, as shown in Eq. (4). This is expressed as

$$
\begin{aligned}
Performance_{ijt}/Performance_{ijt} > 0 = {} & \alpha_0 + \beta_1 Trough_{ijt-1} + \beta_2 CashHolding_{ijt-1} \\
& + \beta_3 Trough_{ijt-1} \times CashHolding_{ijt-1} \\
& + \sum_{n-1}^{N} \gamma_n CV_{nijt-1} + \alpha_k + \alpha_j + \eta_t + \varepsilon_{ijt}
\end{aligned}
\tag{4}
$$

where α_0 refers to the intercept term, and CV_{nijt} refers to the numerical values of the nth control variables of i sample firm in country j in the t year, including the firm size, the rate of dividend payout, the debt ratio, the standard deviation of the return rate of total assets, the real per capita gross domestic product (GDP) growth rate, and the inflation rate. Considering the heterogeneity of each industry and country, we add the specific effect of the industry and country, α_k and α_j, into the above mentioned equation; the yearly dummy variables η_t is also included.

Table 1
Sample distribution, the cash holdings, and the firm performance by country.

Country	Number of firms	Percentage	Number of firm-years	Percentage	CashHolding	SALESG	EBITDAG	MBG
Argentina	51	0.331%	223	0.660%	0.0798	0.2006	0.1878	0.0611
Australia	873	5.668%	1028	3.041%	0.1893	0.5335	0.3046	−0.3500
Austria	63	0.409%	129	0.382%	0.1405	0.2081	0.1853	−0.1663
Belgium	83	0.539%	179	0.529%	0.1307	0.1832	0.1606	−0.1716
Brazil	132	0.857%	162	0.479%	0.1297	0.2637	0.2692	−0.3414
Canada	230	1.493%	230	0.680%	0.1066	0.3635	0.3075	−0.6071
Switzerland	160	1.039%	231	0.683%	0.1451	0.1612	0.0781	−0.2384
Chile	71	0.461%	71	0.210%	0.0593	0.1981	0.0547	−0.4714
China	91	0.591%	177	0.524%	0.1299	0.2014	0.1333	−0.0862
Germany	598	3.883%	1306	3.863%	0.1631	0.1898	0.1732	−0.1092
Denmark	87	0.565%	128	0.379%	0.1209	0.1958	0.1225	−0.3376
Spain	95	0.617%	193	0.571%	0.1079	0.1680	0.1199	−0.1616
Finland	21	0.136%	21	0.062%	0.1404	0.1898	0.2586	−0.0998
France	620	4.026%	1379	4.079%	0.1484	0.1671	0.1296	−0.1647
United Kingdom	1445	9.383%	2357	6.972%	0.1460	0.2786	0.1901	−0.2339
Greece	179	1.162%	377	1.115%	0.0934	0.2023	0.0823	−0.3500
Indonesia	215	1.396%	554	1.639%	0.1279	0.2396	0.1595	−0.2542
India	978	6.350%	1147	3.393%	0.0787	0.3415	0.3177	−0.2014
Ireland	59	0.383%	139	0.411%	0.1950	0.2553	0.1859	−0.2003
Italy	122	0.792%	152	0.450%	0.1224	0.1503	0.1597	0.0119
Japan	3129	20.317%	9435	27.907%	0.1760	0.1273	0.2333	−0.0520
Korea	1034	6.714%	2243	6.634%	0.1376	0.2223	0.1144	−0.3355
Mexico	81	0.526%	238	0.704%	0.0786	0.1630	0.0379	−0.1440
Malaysia	404	2.623%	738	2.183%	0.1072	0.2408	0.1727	−0.1644
Netherlands	111	0.721%	212	0.627%	0.1193	0.1715	0.1773	−0.1501
Norway	124	0.805%	124	0.367%	0.1264	0.3453	0.1254	−0.9345
New Zealand	69	0.448%	72	0.213%	0.0750	0.2788	0.1995	−0.3017
Peru	8	0.052%	10	0.030%	0.0551	0.1894	0.4792	0.0342
Philippines	66	0.429%	114	0.337%	0.0910	0.2564	0.0839	−0.1531
Poland	206	1.338%	211	0.624%	0.1118	0.3512	0.1540	−0.8551
Portugal	38	0.247%	76	0.225%	0.0729	0.1476	−0.0110	−0.1798
Russia	78	0.506%	99	0.293%	0.0827	0.2584	0.1342	−1.0579
Singapore	63	0.409%	63	0.186%	0.1258	0.1560	0.1853	−0.3226
Sweden	279	1.812%	391	1.156%	0.1508	0.2438	0.1972	−0.2547
Thailand	232	1.506%	469	1.387%	0.0882	0.1660	0.0569	0.0045
Turkey	76	0.493%	133	0.393%	0.1349	0.1596	0.0464	−0.5586
United States	3020	19.609%	8678	25.668%	0.1943	0.1845	0.1511	−0.0579
South Africa	210	1.364%	320	0.946%	0.1290	0.2222	0.1859	−0.3583
Sum	15,401	100.000%	33,809	100.000%				
Mean					0.1674	0.3212	0.2676	0.0472
Standard Deviation					0.1679	0.3637	0.6946	0.5337

This table presents the sample distribution and the mean values of the cash holdings (*CashHolding*), the growth rate of revenue (*SALESG*), the growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*) and the growth rate of market-to-book ratio (*MBG*) as classified by country.

3.3. Empirical variables

3.3.1. Cash holdings variable

Referring to Dittmar and Mahrt-Smith (2007), Campello et al. (2011), Subramaniam et al. (2011), Lee and Suh (2011), and Brown and Petersen (2011), we adopt the ratio of cash and short-term investment to total assets in order to measure the cash holdings variable.

3.3.2. Operating performance variable

Referring to Bannist et al. (1997), Core et al. (1999), Mitton (2002), Joh (2003), Mitton (2006), Atanassov and Kim (2009) and Fresard (2010), we use the growth rate of revenue, the growth rate of earnings before interest, tax, before depreciation, and amortization, and the growth rate of market-to-book ratio to measure the operating performance of the firms in sample countries.

In order to yield robust results, we further consider the industrial adjustment of the operating performance. *IndAdjSALESG*, *IndAdjEBITDAG*, and *IndAdjMBG* are the industry-adjusted *SALESG*, *EBITDAG*, and *MBG*, respectively. *IndAdjSALESG* is the *SALESG* subtracted from the industry median *SALESG* in the corresponding year; *IndAdjEBITDAG* is the *EBITDAG* subtracted from the industry median *EBITDAG* in the corresponding year; and *IndAdjMBG* is the *MBG* subtracted from the industry median *MBG* in the

Table 2

Sample distribution, the cash holdings, and the firm performance by industry.

Industry	Number of firms	Percentage	Number of firm-years	Percentage	CashHolding	SALESG	EBITDAG	MBG
Agriculture	90	0.584%	186	0.550%	0.1206	0.2165	0.2145	−0.1744
Food Products	582	3.779%	1333	3.943%	0.1163	0.1509	0.1556	−0.1324
Candy & Soda	53	0.344%	143	0.423%	0.1434	0.1418	0.1565	−0.1320
Beer & Liquor	129	0.838%	238	0.704%	0.0993	0.1658	0.1300	−0.1050
Tobacco Products	24	0.156%	46	0.136%	0.1759	0.2087	0.1773	−0.0758
Recreation	116	0.753%	245	0.725%	0.1748	0.1581	0.1967	−0.0963
Entertainment	288	1.870%	520	1.538%	0.1557	0.2404	0.1966	−0.1334
Printing and Publishing	156	1.013%	272	0.805%	0.1243	0.1429	0.1179	−0.1806
Consumer Goods	347	2.253%	761	2.251%	0.1420	0.1622	0.2004	−0.0945
Apparel	288	1.870%	612	1.810%	0.1432	0.1473	0.1420	−0.1026
Healthcare	151	0.980%	402	1.189%	0.1056	0.1835	0.1797	−0.1416
Medical equip.	279	1.812%	738	2.183%	0.2173	0.1968	0.1470	−0.1169
Pharmaceutical Products	621	4.032%	1356	4.011%	0.3109	0.2899	0.1065	−0.1188
Chemicals	589	3.824%	1414	4.182%	0.1156	0.1676	0.2018	−0.1162
Rubber and Plastic Products	218	1.415%	496	1.467%	0.1168	0.1587	0.1886	−0.1232
Textiles	213	1.383%	405	1.198%	0.0928	0.1589	0.1711	−0.1367
Construction Materials	620	4.026%	1300	3.845%	0.1090	0.1720	0.1835	−0.1889
Construction	655	4.253%	1389	4.108%	0.1496	0.1917	0.1426	−0.1860
Steel Works Etc	517	3.357%	1103	3.262%	0.0968	0.1943	0.2368	−0.1441
Fabricated Products	71	0.461%	133	0.393%	0.1306	0.2167	0.1537	−0.2084
Machinery	712	4.623%	1661	4.913%	0.1568	0.1869	0.1983	−0.1253
Electrical equip.	314	2.039%	705	2.085%	0.1574	0.2009	0.2639	−0.1061
Automobiles and Trucks	399	2.591%	927	2.742%	0.1196	0.1723	0.2254	−0.1366
Aircraft	48	0.312%	128	0.379%	0.0937	0.1345	0.0752	−0.1136
Shipbuilding	44	0.286%	105	0.311%	0.1604	0.2090	0.1038	−0.2218
Defense	14	0.091%	45	0.133%	0.2187	0.1778	0.2537	−0.0630
Precious Metals	118	0.766%	158	0.467%	0.1928	0.5630	0.2594	−0.2610
Mining	256	1.662%	354	1.047%	0.1978	0.5711	0.4017	−0.3103
Coal	45	0.292%	76	0.225%	0.1369	0.3377	0.2875	−0.1367
Petroleum and Natural Gas	495	3.214%	938	2.774%	0.1009	0.3882	0.2390	−0.2237
Communication	399	2.591%	771	2.280%	0.1293	0.2036	0.2010	−0.1829
Personal Services	149	0.967%	352	1.041%	0.1713	0.1788	0.1888	−0.1569
Business Services	1878	12.194%	3859	11.414%	0.2283	0.2241	0.1742	−0.1776
Computers	445	2.889%	965	2.854%	0.2616	0.2255	0.2177	−0.1194
Electronic equip.	751	4.876%	1711	5.061%	0.2332	0.2201	0.2654	−0.1351
Measuring equip.	199	1.292%	533	1.577%	0.2178	0.1816	0.2336	0.0009
Business Supplies	267	1.734%	606	1.792%	0.0911	0.1503	0.1518	−0.1346
Shipping Containers	98	0.636%	225	0.666%	0.0917	0.1465	0.1169	−0.1647
Transportation	570	3.701%	1265	3.742%	0.1286	0.1710	0.1570	−0.1799
Wholesale	773	5.019%	1868	5.525%	0.1224	0.1590	0.1806	−0.1127
Retail	881	5.720%	2222	6.572%	0.1399	0.1461	0.1315	−0.1459
Restaraunts, Hotels, Motels	314	2.039%	742	2.195%	0.1291	0.1621	0.1519	−0.1076
Other	225	1.461%	501	1.482%	0.1387	0.2094	0.1804	−0.1710
Sum	15,401	100.00%	33,809	100.00%				
Mean					0.1674	0.3212	0.2676	0.0472
Standard Deviation					0.1679	0.3637	0.6946	0.5337

This table presents the sample distribution and the mean values of the cash holdings (*CashHolding*), the growth rate of revenue (*SALESG*), the growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*) and the growth rate of market-to-book ratio (*MBG*) as classified by industry.

corresponding year.

3.3.3. The control variables that influence the operating performance

Based on the studies of Bannist et al. (1997), Core et al. (1999), Mitton (2002), Joh (2003), Mitton (2006), Atanassov and Kim (2009) and Fresard (2010), the firm size, the rate of dividend payout, the debt ratio, and the standard deviation of return on total assets are used as control variables that influence the operating performance. Moreover, based on the studies of Barajas et al. (2000) and McLean et al. (2010), we use the real per capita GDP growth rate and the inflation rate to control the effects of the economic situations of sample countries on the operating performance.

Appendix Table A gives the detailed description of each variable.

4. Empirical results

4.1. Sample description

Table 1 shows the country distribution of the sample, cash holdings of various countries, and operating performance variables. Our sample includes 38 countries, 15,401 firms, and 33,809 firm-year observations. The average *CashHolding* ratio is 0.1674, and the average *SALESG*, *EBIGDAG*, and *MBG* are 0.3212, 0.2676, and 0.0472, respectively. Japan and the United States exhibit the highest and the second highest firm-year observations, accounting for 27.907% and 25.668% of the total sample size, respectively. The other countries exhibit various *CashHolding* ratios. For example, Ireland exhibits the highest *CashHolding*, with a mean of 0.1950, whereas Portugal exhibits the lowest *CashHolding*, with a mean of 0.0729.

Table 2 shows the industry distribution of the sample, cash holdings of various industries, and operating performance variables. Business services firms represent the highest proportion of the sample, accounting for 12.194% of the entire sample. They are followed by retail firms, accounting for 5.720% of the entire sample, and wholesale firms, accounting for 5.019% of the entire sample. In addition, the pharmaceutical industry has the highest *CashHolding*, with a mean of 0.3109. The computer and the electronic equipment industries have the second and the third highest *CashHolding*, with means of 0.2616 and 0.2332, respectively.

4.2. Initial empirical results

Table 3 shows the speed of operating performance recovery after a financial crisis. The regression coefficients in panel A are 0.1912, 0.7150 and 0.0596, all reaching 1% significance level, which means that the speed of the recovery after a trough for the growth rate of revenue (*SALESG*), the growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*) and the growth rate of market-to-book ratio (*MBG*) are 19.12%, 71.50% and 5.96%, respectively. This result shows that firms' operating performance has a positive growth rate after a trough, meaning that their operating performance quickly recovers from recession due to financial crisis.

We furthermore restrict the samples with positive operating performance (*Performance$_{ijt}$* > 0) in panel B to compare the speed of the recovery after a financial crisis with that in all other years of positive operating performance growth (expansion years). The results show that the dummy variable of operating performance recession in a valley (*Trough*) during a financial crisis in the previous year has a significantly positive effect on the growth rate of revenue (*SALESG*), the growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*) and the growth rate of market-to-book ratio (*MBG*). The regression coefficients are 0.0112, 0.2539 and 0.0175, all reaching 1% significance level. These results indicate that firms' operating performance in the year after a trough truly have a recovery and the speed is even significantly faster than that in other typical expansion years.

Table 4 shows the results of the mean and median difference tests regarding the speed of the (industry-adjusted) operating performance recovery after a financial crisis between high and low cash holdings. We classify firms into two groups based on the median cash holdings: high cash holdings firms and low cash holdings firms. The results in panel A indicate that, for *SALESG*, *EBITDAG*, and *MBG*, the differences of mean and median between two groups are positive and they all reach the statistical significance, which shows that high cash holdings firms exhibit higher growth rate of operating performance than low cash holdings firms. For example, the difference in terms of the *SALESG* mean (median) between high cash holdings firms and low cash holdings firms is of 0.0409 (0.0089), both of which are statistically significant at a 1% significance level. The difference regarding the *EBITDAG* mean (median) between high cash holdings firms and low cash holdings firms is 0.0262 (0.0243), both of which are statistically significant at a 1% significance level. The difference in terms of the *MBG* mean (median) between high cash holdings firms and low cash holdings firms is 0.0073 (0.0459), both of which are statistically significant at a 5% significance level.

Panel B lists the results of the mean and median differences tests for the speed of industry-adjusted operating performance recovery after a financial crisis between high and low cash holdings. The results indicate that, for *IndAdjSALESG*, *IndAdjEBITDAG*, and *IndAdjMBG*, the differences in the mean and median between two groups are positive and all reach the statistical significance. It shows that firms with higher cash holdings have a higher operating performance growth rate.

Table 3

Speed of operating performance recovery after a financial crisis.

Panel A: Without restricting the samples with positive operating performance			
Dependent Independent	*SALESG*	*EBITDAG*	*MBG*
Intercept	0.0165***	−0.1371***	−0.1626***
	(0.0013)	(0.0031)	(0.0028)
Trough	0.1912***	0.7150***	0.0596***
	(0.0030)	(0.0060)	(0.0054)
Adjusted R^2	0.0645	0.2206	0.0022
Prob (F-statistic)	<0.0001	<0.0001	<0.0001
Observations	56,355	48,963	52,768

Panel B: Restrict the samples with positive operating performance ($Performance_{ijt} > 0$)			
Dependent Independent	*SALESG*	*EBITDAG*	*MBG*
Intercept	0.1965***	0.3240***	0.3597***
	(0.0014)	(0.0026)	(0.0030)
Trough	0.0112***	0.2539***	0.0175***
	(0.0030)	(0.0057)	(0.0053)
Adjusted R^2	0.0004	0.0742	0.0004
Prob(F-statistic)	<0.0001	<0.0001	0.0016
Observations	33,804	27,538	20,199

In this table, the figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

Table 4

Difference in the speed of (industry-adjusted) operating performance recovery after a financial crisis between high and low cash holdings.

Panel A. Difference in the speed of operating performance recovery after a financial crisis between high and low cash holdings				
	High cash holdings	Low cash holdings	Mean / Median	*P*-value
			Difference tests for *SALESG*	
Mean	0.3408	0.2999	0.0409***	<0.0001
Median	0.2207	0.2118	0.0089***	<0.0001
	High cash holdings	Low cash holdings	Mean / Median Difference test for *EBITDAG*	P-value
Mean	0.5860	0.5598	0.0262***	<0.0001
Median	0.3940	0.3698	0.0243***	<0.0001
	High cash holdings	Low cash holdings	Mean / Median Difference test for *MBG*	P-value
Mean	0.4636	0.4563	0.0073**	0.0482
Median	0.3940	0.3481	0.0459**	0.0314

Panel B. Difference in the speed of industry-adjusted operating performance recovery after a financial crisis between high and low cash holdings				
	High cash holdings	Low cash holdings	Mean / Median difference tests for *IndAdjSALESG*	P-value
Mean	0.2405	0.2020	0.0386***	<0.0001
Median	0.1176	0.1079	0.0098***	<0.0001
	High cash holdings	Low cash holdings	Mean / Median Difference test for *IndAdjEBITDAG*	P-value
Mean	0.4249	0.3930	0.0318***	<0.0001
Median	0.2453	0.2085	0.0368***	<0.0001
	High cash holdings	Low cash holdings	Mean / Median Difference test for *IndAdjMBG*	P-value
Mean	0.3980	0.3888	0.0092***	0.0056
Median	0.2968	0.2937	0.0031**	0.036

This table presents the differences in the speed of operating performance (industry-adjusted) operating performance recovery after a financial crisis between high and low cash holdings. We compare the difference in the mean and median between the two samples based on the median cash holdings: low cash holdings firms (below the median of cash holdings) and high cash holdings firms (above the median of cash holdings). Differences in the mean and median are assessed using the *t*-test and the Wilcoxon rank-sum test. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

4.3. Effect of Cash Holdings on the Speed of Recovery

4.3.1. Pooled data regression

Table 5 shows the effect of cash holdings on the speed of (industry-adjusted) operating performance recovery after a financial crisis. The empirical results in panel A demonstrate that cash holdings (*CashHolding*) relates positively to the three proxies of operating

Table 5

Effect of cash holdings on the speed of (industry-adjusted) operating performance recovery after a financial crisis.

Panel A. Effect of cash holdings on the speed of operating performance recovery after a financial crisis

Dependent Independent	SALESG				EBITDAG				MBG			
Intercept	0.1709***	0.1812***	0.2199***	0.1702***	0.2961***	0.2131***	0.4118***	0.3497***	0.2983***	0.2473***	0.2124***	0.0947***
	(0.0021)	(0.0173)	(0.0077)	(0.0190)	(0.0037)	(0.0336)	(0.0133)	(0.0385)	(0.0057)	(0.0343)	(0.0126)	(0.0358)
Trough	0.0077	0.0183***	−0.0021	0.0118**	0.2495***	0.2587***	0.2223***	0.2312***	0.0456***	0.0256***	0.0288***	0.0204***
	(0.0047)	(0.0049)	(0.0047)	(0.0048)	(0.0083)	(0.0085)	(0.0082)	(0.0083)	(0.0074)	(0.0075)	(0.0072)	(0.0072)
CashHolding	0.1604***	0.1843***	0.0625***	0.1272***	0.1705***	0.1264***	0.1528***	0.1554***	0.1334***	0.0982***	0.1170***	0.1852***
	(0.0119)	(0.0117)	(0.0141)	(0.0137)	(0.0182)	(0.0193)	(0.0207)	(0.0217)	(0.0283)	(0.0282)	(0.0292)	(0.0286)
CH_Trough	0.1154***	0.0680***	0.0962***	0.0621**	0.1074***	0.0914**	0.1303***	0.1108***	0.0967***	0.0921***	0.1316***	0.1206***
	(0.0288)	(0.0262)	(0.0277)	(0.0261)	(0.0399)	(0.0395)	(0.0400)	(0.0395)	(0.0359)	(0.0344)	(0.0343)	(0.0328)
SIZE			−0.0057***	0.0012			−0.0259***	−0.0257***			−0.0060***	−0.0033**
			(0.0007)	(0.0008)			(0.0014)	(0.0017)			(0.0013)	(0.0015)
DIV			−0.1468***	−0.5073***			−0.7886***	−0.9056***			−0.2806***	−0.5165***
			(0.0290)	(0.0352)			(0.0611)	(0.0668)			(0.0514)	(0.0564)
DEBT			−0.0812***	−0.0312***			0.0655***	0.1331***			0.1970***	0.3011***
			(0.0077)	(0.0071)			(0.0157)	(0.0162)			(0.0138)	(0.0144)
STDROA			0.3421***	0.2332***			0.2287***	0.1294***			0.4651***	0.3025***
			(0.0326)	(0.0303)			(0.0383)	(0.0327)			(0.0457)	(0.0374)
GDPG			0.6882***	0.8040***			0.4736***	−0.3607*			−0.6550***	−0.2993
			(0.0498)	(0.1011)			(0.1031)	(0.1979)			(0.0912)	(0.1843)
INF			0.5195***	0.0957**			0.1239**	0.0910			0.2491***	0.2215***
			(0.0452)	(0.0457)			(0.0562)	(0.1263)			(0.0681)	(0.0693)
Industry dummies		Included		Included		Included		Included		Included		Included
Country dummies		Included		Included		Included		Included		Included		Included
Year dummies		Included		Included		Included		Included		Included		Included
Adjusted R²	0.0197	0.1975	0.1126	0.2341	0.0863	0.1274	0.1148	0.1504	0.015	0.1253	0.1099	0.2031
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	33,804	33,804	33,804	33,804	27,538	27,538	27,538	27,538	20,199	20,199	20,199	20,199

Table 5 (*continued*)

Panel A. Effect of cash holdings on the speed of operating performance recovery after a financial crisis

Dependent Independent	SALESG				EBITDAG				MBG			

Panel B. Effect of cash holdings on the speed of industry-adjusted operating performance recovery after a financial crisis

Dependent Independent	IndAdjSALESG				IndAdjEBITDAG				IndAdjMBG			
Intercept	0.1126***	0.1004***	0.1849***	0.1409***	0.2349***	0.1075***	0.3658***	0.2905***	0.2437***	0.1426***	0.1700***	0.0083
	(0.0021)	(0.0193)	(0.0078)	(0.0210)	(0.0037)	(0.0366)	(0.0137)	(0.0413)	(0.0035)	(0.0272)	(0.0109)	(0.0307)
Trough	0.0469***	0.0567***	0.0415***	0.0518***	0.3143***	0.3174***	0.2928***	0.2924***	0.1423***	0.1774***	0.1413***	0.1716***
	(0.0057)	(0.0058)	(0.0056)	(0.0057)	(0.0091)	(0.0092)	(0.0090)	(0.0090)	(0.0062)	(0.0064)	(0.0061)	(0.0063)
CashHolding	0.1594***	0.1532***	0.0590***	0.1083***	0.1554***	0.1123***	0.1430***	0.1532***	0.0681***	0.0391**	0.0966***	0.1494***
	(0.0116)	(0.0116)	(0.0143)	(0.0140)	(0.0185)	(0.0201)	(0.0217)	(0.0228)	(0.0170)	(0.0177)	(0.0213)	(0.0202)
CH_Trough	0.1182***	0.0744**	0.0849***	0.0597**	0.0985**	0.0830**	0.1025**	0.0830**	0.0897***	0.0719***	0.0989***	0.0731***
	(0.0324)	(0.0300)	(0.0319)	(0.0301)	(0.0422)	(0.0421)	(0.0424)	(0.0421)	(0.0286)	(0.0276)	(0.0286)	(0.0272)
SIZE			−0.0074***	−0.0035***			−0.0268***	−0.0276***			−0.0103***	−0.0050***
			(0.0007)	(0.0009)			(0.0015)	(0.0018)			(0.0011)	(0.0013)
DIV			−0.1964***	−0.4718***			−0.7572***	−0.7999***			−0.1010**	−0.3414***
			(0.0340)	(0.0427)			(0.0679)	(0.0767)			(0.0404)	(0.0453)
DEBT			−0.0768***	−0.0195***			0.0568***	0.1276***			0.1701***	0.2730***
			(0.0080)	(0.0075)			(0.0161)	(0.0169)			(0.0121)	(0.0127)
STDROA			0.3112***	0.2023***			0.2158***	0.1325***			0.3213***	0.1846***
			(0.0363)	(0.0334)			(0.0506)	(0.0427)			(0.0602)	(0.0442)
GDPG			−0.0891**	−0.2728***			−0.6168***	−1.1722***			0.0116	0.1082
			(0.0435)	(0.0790)			(0.0988)	(0.1897)			(0.0808)	(0.1567)
INF			0.4150***	0.1489***			0.0208	−0.1482			0.7011***	−0.1015
			(0.0369)	(0.0455)			(0.0597)	(0.1148)			(0.0758)	(0.0999)
Industry dummies		Included		Included		Included		Included		Included		Included
Country dummies		Included		Included		Included		Included		Included		Included
Year dummies		Included		Included		Included		Included		Included		Included
Adjusted R²	0.0295	0.1768	0.1201	0.2125	0.1258	0.1517	0.1531	0.1754	0.0629	0.1512	0.1107	0.1890
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	33,804	33,804	33,804	33,804	27,538	27,538	27,538	27,538	20,199	20,199	20,199	20,199

In this table, *CH_Trough* refers to the interaction term of the cash holdings (*CashHolding*) and the dummy variable *Trough*; The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

performance at the 1% significance level. Duchin et al. (2010) demonstrate that cash-rich firms perform better than cash-poor firms during a financial crisis based on value-weighted risk-adjusted return. Fresard (2010) also states that firms that hold more cash will acquire greater market share and better operational performance in the future. Thus, our empirical results are consistent with Duchin et al. (2010) and Fresard (2010). The regression coefficients of the interaction term of cash holdings and the dummy variable *Trough* (*CH_Trough*) during a financial crisis are all positive, and they all reach the significance level of 5% at least. The empirical results support Hypothesis 1 that firms with high cash holdings can rapidly recover their operating performance after a financial crisis. In other words, firms with high cash holdings can make related investments (even if they are facing a financial crisis) and they can even enhance the follow-up growth momentum to enable them to rapidly recover and improve their operating performance after a financial crisis. Therefore, firms should focus on economic changes and reserve adequate amounts of cash and cash equivalents in a timely manner to protect themselves against unexpected demands. These cash and cash equivalents, in addition to the demand for normal operations, investment, or debt service, can galvanize the growth momentum when facing a financial crisis.

In order to verify the robustness of the above results, we further consider the industrial adjustment of the operating performance in Panel B. The empirical results are consistent: the cash holdings (*CashHolding*) and the interaction term of cash holdings and the dummy variable *Trough* (*CH_Trough*) positively impact the speed of industry-adjusted operating performance recovery after a financial crisis at 5% significance level at least.

Furthermore, the cash holdings generated through industrial adjustment is substituted so as to make the related robust detection, yielding a consistent empirical result: firms with higher cash holdings can rapidly recover their operating performance (Appendix Table B). Therefore, if the firms can foresee the crisis and acquire enough cash during turmoil in international markets, they can wind down their operations during a business recession and have enough cash for stable growth thereafter.

4.3.2. Panel data regression

We adopt a panel data regression to verify whether firms with high cash holdings can rapidly recover their operating performance after a financial crisis. The regression model is expressed as follows:

Table 6
Effect of cash holdings on the speed of operating performance recovery after a financial crisis: Panel data regression.

Dependent / Independent	SALESG	EBITDAG	MBG	IndAdjSALESG	IndAdjEBITDAG	IndAdjMBG
Intercept	−0.1377***	0.2486***	−0.6442***	−0.0894***	0.2819***	−0.6622***
	(0.0142)	(0.0472)	(0.0451)	(0.0158)	(0.0506)	(0.0329)
Trough	0.0168***	0.1702***	0.0241***	0.0417***	0.2317***	0.1414***
	(0.0038)	(0.0104)	(0.0092)	(0.0043)	(0.0110)	(0.0068)
CashHolding	0.0152	0.2109***	0.1341***	−0.0148	0.2279***	0.0847**
	(0.0158)	(0.0527)	(0.0503)	(0.0172)	(0.0563)	(0.0371)
CH_Trough	0.0422***	0.1526***	0.1196***	0.0444**	0.1183**	0.0740**
	(0.0160)	(0.0470)	(0.0397)	(0.0186)	(0.0505)	(0.0294)
SIZE	0.0456***	−0.0106	0.1059***	0.0302***	−0.0282***	0.0996***
	(0.0020)	(0.0065)	(0.0060)	(0.0022)	(0.0070)	(0.0046)
DIV	−0.1820***	−0.3809***	−0.3006**	−0.0341	−0.3213*	−0.1730*
	(0.0470)	(0.1447)	(0.1268)	(0.0569)	(0.1784)	(0.1041)
DEBT	0.1306***	0.2836***	0.7071***	0.1150***	0.2441***	0.6893***
	(0.0124)	(0.0418)	(0.0346)	(0.0141)	(0.0453)	(0.0270)
STDROA	0.1929***	0.1086	0.2751***	0.2188***	0.1631**	0.1874***
	(0.0178)	(0.0671)	(0.0443)	(0.0186)	(0.0736)	(0.0290)
GDPG	0.6773***	−0.4239*	−0.7436***	−0.3393***	−1.1413***	−0.5126***
	(0.0847)	(0.2244)	(0.1739)	(0.0778)	(0.2334)	(0.0838)
INF	0.0352	0.1505	0.2227***	0.0806	0.0179	0.0726
	(0.0459)	(0.1501)	(0.0085)	(0.0513)	(0.1600)	(0.1003)
Firm dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.6452	0.3098	0.3576	0.6307	0.3564	0.4007
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	33,804	27,538	20,199	33,804	27,538	20,199

In this table, we use panel data regression model to investigate the effect of cash holdings on the speed of recovery. The dependent variables include growth rate of revenue (*SALESG*), growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*), the growth rate of market-to-book ratio (*MBG*), the industry-adjusted growth rate of revenue (*IndAdjSALESG*), the industry-adjusted growth rate of earnings before interest, taxes, depreciation, and amortization (*IndAdjEBITDAG*), and industry-adjusted growth rate of market-to-book ratio (*IndAdjMBG*). *CH_Trough* refers to the interaction term of the cash holdings (*CashHolding*) and the dummy variable *Trough*. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

$$
\begin{aligned}
Performance_{ijt}\big/Performance_{ijt} > 0 = {} & \alpha_0 + \beta_1 Trough_{ijt-1} + \beta_2 CashHolding_{ijt-1} \\
& + \beta_3 Trough_{ijt-1} \times CashHolding_{ijt-1} \\
& + \sum_{n-1}^{N} \gamma_n CV_{nijt-1} + \alpha_i + \alpha_j + \eta_t + \varepsilon_{ijt}
\end{aligned}
\tag{5}
$$

where α_0 refers to the intercept term, and CV_{nijt} refers to the numerical values of the nth control variables of i sample firm in country j in the t year, including the firm size, the rate of dividend payout, the debt ratio, the standard deviation of the return rate of total assets, the real per capita gross domestic product (GDP) growth rate, and the inflation rate. Considering the heterogeneity of each firm and country, we add the specific effect of the firm and country, α_i and α_j, into the abovementioned equation; the yearly dummy variables η_t is also included.

In Table 6, we use a panel data regression model to investigate the effect of cash holdings on the speed of operating performance recovery after a financial crisis. The interaction term of the cash holdings variable and dummy variable of operating performance recession in a valley (*CH_Trough*) has a positive and significant effect on the speed of operating performance recovery. Again, the results support hypothesis 1.

5. Endogeneity

Although we have included the lagged cash holdings of the firm in eq. (4) to control the endogeneity problem, we still conduct two sets of tests to obtain the robustness results.

5.1. Instrumental variable estimation

We adopt an instrumental variable approach to deal with the endogeneity problem pertaining to the relationship between cash holdings and performance. Chen et al. (2019) conclude that peer firms' cash holdings directly affect corporate cash holdings because of the strategic role of the cash holding policies, but peer cash holdings are less likely to impact a firm's performance directly. Thus, the

Table 7

Effect of cash holdings on the speed of operating performance recovery after a financial crisis:Instrumental variable approach.

First stage			Second stage						
Dependent Independent	*CashHolding*		Dependent Independent	*SALESG*	*EBITDAG*	*MBG*	*IndAdj SALESG*	*IndAdj EBITDAG*	*IndAdj MBG*
Intercept	0.1674***		*Intercept*	0.1466***	0.4426***	0.1297***	0.1265***	0.3460***	0.0211
	(0.0013)			(0.0207)	(0.0465)	(0.0472)	(0.0219)	(0.0497)	(0.0370)
PeerCH	−0.9366***		*Trough*	0.0320***	0.2716***	0.0496***	0.0634***	0.3202***	0.1708***
	(0.0012)			(0.0040)	(0.0068)	(0.0059)	(0.0044)	(0.0073)	(0.0051)
SIZE	0.0024***		*CashHolding*	0.2975***	0.3479***	0.1065	0.2703***	0.2012***	0.1232**
	(0.0001)			(0.0338)	(0.0775)	(0.0775)	(0.0368)	(0.0642)	(0.0520)
DIV	−0.1011***		*CH_Trough*	0.2651***	0.7499***	0.3682***	0.2019**	0.7013***	0.3552***
	(0.0030)			(0.0692)	(0.1156)	(0.0962)	(0.0808)	(0.1271)	(0.0795)
DEBT	−0.0642***		*SIZE*	0.0023***	−0.0302***	−0.0067***	−0.0020**	−0.0296***	−0.0061***
	(0.0008)			(0.0008)	(0.0020)	(0.0016)	(0.0009)	(0.0021)	(0.0015)
STDROA	0.0413***		*DIV*	−0.4368***	−0.7598***	−0.4710***	−0.3953***	−0.7075***	−0.3147***
	(0.0008)			(0.0368)	(0.0723)	(0.0622)	(0.0464)	(0.0848)	(0.0513)
GDPG	−0.1638***		*DEBT*	−0.0466***	0.0705***	0.2568***	−0.0352***	0.0748***	0.2299***
	(0.0054)			(0.0073)	(0.0177)	(0.0152)	(0.0075)	(0.0184)	(0.0131)
INF	−0.0206***		*STDROA*	0.2637***	0.2741***	0.3799***	0.2288***	0.2327***	0.2635***
	(0.0012)			(0.0358)	(0.0496)	(0.0463)	(0.0364)	(0.0558)	(0.0623)
			GDPG	0.8922***	−0.5037**	0.1223	−0.3537***	−1.0225***	0.5596***
				(0.1160)	(0.2370)	(0.1952)	(0.0885)	(0.2210)	(0.1797)
			INF	0.1654***	0.1041	0.7489***	0.1579**	0.0783	0.0208
				(0.0642)	(0.1953)	(0.2190)	(0.0672)	(0.1877)	(0.1604)
Industry dummies	Included		*Industry dummies*	Included	Included	Included	Included	Included	Included
Country dummies	Included		*Country dummies*	Included	Included	Included	Included	Included	Included
Year dummies	Included		*Year dummies*	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.8270		Adjusted R^2	0.2363	0.1499	0.1988	0.2106	0.1815	0.1869
Prob (F-statistic)	<0.0001		Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations			Observations	33,804	27,538	20,199	33,804	27,538	20,199
p-value for Wu-Hausman test	0.7313								

This table provides the empirical results of the effects of cash holdings on the speed of operating performance recovery after a financial crisis using the instrumental variable approach. The instrumental variable for cash holdings is peer cash holdings (*PeerCH*). All regressions include an intercept, industry dummies, country dummies, and year dummies. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

instrumental variable for cash holdings that we use is peer cash holdings. Peer cash holdings are calculated by taking the average cash holdings of other firms in a focal firm's industry (i.e., industry average cash holdings minus focal firm cash holdings). To consider closest peers, we use the four-digit SIC codes for this calculation.

Firstly, we find that the peer cash holdings is positively and significantly related to cash holdings (the absolute value of the correlation coefficient = 0.84), but not significantly related to *SALESG*, *EBITDAG* and *MBG* (the absolute value of the correlation coefficient < 0.035). Then, in the first-stage regression in Table 7, peer cash holdings (*PeerCH*) is significantly related to cash holdings (*CashHolding*), indicating that it satisfies the relevance criterion for a good instrument. Therefore, we use the fitted value from the first stage as the substitution variable for cash holdings in the second-stage regression. In addition, the result of Wu-Hausman test shows that the null hypothesis of variables is exogenous cannot be rejected ($p = 0.7313$), indicating that there are no endogenous problems. The second-stage regression results show that *CH_Trough* is still positively and significantly related to the speed of operating performance recovery, which means that the operating performance of the firms with higher cash holdings recovers rapidly after a financial crisis, supporting hypothesis 1.

5.2. Theoretical cash holdings

Referring to Opler et al. (1999), Harford et al. (2008), and Lee and Suh (2011), we estimate the theoretical cash holdings (*TCH*) through the regression model of eq. (6). In the process of estimating *TCH*, we include the following variables so as to influence cash holdings in the regression model: the firm size (*LnAssets*), the cash flow ratio (CF), the net working capital ratio (*NWC*), the uncertainty

Table 8
Effect of cash holdings on the speed of operating performance recovery after a financial crisis:Theoretical cash holdings.

First stage		Second stage						
Dependent Independent	TCH	Dependent Independent	SALESG	EBITDAG	MBG	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG
Intercept	0.1710***	Intercept	0.2275***	0.4428***	0.1664***	0.1949***	0.3705***	0.0552**
	(0.0012)		(0.0193)	(0.0382)	(0.0360)	(0.0214)	(0.0412)	(0.0282)
PeerCH	−0.8392***	Trough	0.0182***	0.2602***	0.0493***	0.0647***	0.3020***	0.1566***
	(0.0014)		(0.0035)	(0.0059)	(0.0053)	(0.0040)	(0.0064)	(0.0044)
LnAssets	0.0023***	TCH	0.3308***	0.3820***	0.3331***	0.3505***	0.3365***	0.2915***
	(0.0001)		(0.0294)	(0.0499)	(0.0681)	(0.0327)	(0.0563)	(0.0465)
CF	−0.0414***	TCH_Trough	0.1463**	0.7652***	0.2812***	0.1826**	0.5875***	0.2651***
	(0.0010)		(0.0587)	(0.0950)	(0.0815)	(0.0730)	(0.1057)	(0.0661)
NWC	0.1027***	SIZE	−0.0019**	−0.0245***	−0.0025	−0.0027***	−0.0263***	−0.0044***
	(0.0010)		(0.0008)	(0.0017)	(0.0025)	(0.0008)	(0.0018)	(0.0013)
STDCF	0.0339***	DIV	−0.5259***	−0.9440***	−0.5219***	−0.4852***	−0.8350***	−0.3503***
	(0.0012)		(0.0353)	(0.0662)	(0.0563)	(0.0426)	(0.0760)	(0.0453)
RD	0.0959***	DEBT	−0.0711***	0.0723***	0.2358***	−0.0573***	0.0718***	0.2184***
	(0.0020)		(0.0066)	(0.0151)	(0.0133)	(0.0070)	(0.0157)	(0.0115)
MB	0.0003***	STDROA	0.2521***	0.1556***	0.3483***	0.2189***	0.1573***	0.2131***
	(0.00002)		(0.0299)	(0.0336)	(0.0379)	(0.0329)	(0.0439)	(0.0464)
LEV	−0.0190***	GDPG	0.7240***	−0.4770**	−0.3663**	−0.3581***	−1.2611***	0.0477
	(0.0010)		(0.1003)	(0.1989)	(0.1843)	(0.0794)	(0.1907)	(0.1568)
CAPEXP	−0.0491***	INF	0.0842*	0.0693	0.2144***	0.1258***	−0.1783	−0.1187
	(0.0017)		(0.0451)	(0.1284)	(0.0693)	(0.0447)	(0.1154)	(0.1003)
DIV	−0.0062***							
	(0.0004)							
Industry dummies	Included	Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R²	0.8292	Adjusted R²	0.2040	0.1681	0.2063	0.1820	0.1970	0.1720
Prob (F-statistic)	<0.0001	Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations		Observations	33,804	27,538	20,199	33,804	27,538	20,199

We estimate the theoretical cash holdings (*TCH*) through the regression model of eq. (6). In the process of estimating *TCH*, we include the following variables so as to influence cash holdings in the regression model: the peer cash holdings (*PeerCH*), the firm size (*LnAssets*), the cash flow ratio (CF), the net working capital ratio (*NWC*), the uncertainty of cash flow (*STDCF*), the R&D expenditure ratio (*RD*), the market-to-book ratio (*MB*), the debt ratio (*LEV*), the capital expenditure ratio (*CAPEXP*), a dividend payout dummy variable (*DIV*), and industry and year dummy variables. We then use the *TCH* from eq. (6) to substitute the cash holdings (*CashHolding*) in eq. (4), and run the second-stage regression.

$$TCH_{ijt} = \gamma_0 + \gamma_1 PeerCH_{ijt-1} + \gamma_2 LnAssets_{ijt-1} + \gamma_3 CF_{ijt-1} + \gamma_4 NWC_{ijt-1}$$
$$+ \gamma_5 STDCF_{ijt-1} + \gamma_6 RD_{ijt-1} + \gamma_7 MB_{ijt-1} + \gamma_8 LEV_{ijt-1} \quad (6)$$
$$+ \gamma_9 CAPEXP_{ijt-1} + \gamma_{10} DIV_{ijt-1} + \alpha_j + \eta_t + \varepsilon_{ijt}$$

In the second stage regression, the main independent variable *TCH_Trough* refers to the interaction term of the theoretical cash holdings (*TCH*) and the dummy variable *Trough*. All regressions include an intercept, industry dummies, country dummies, and year dummies. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

Table 9

Transmission channels: Relationship between cash holdings, capital expenditure, R&D expenditure, and speed of operating performance recovery after a financial crisis.

Panel A: Mean difference tests

	High cash holdings	Low cash holdings	Mean difference tests for *CAPEXPG*	P-value	High cash holdings	Low cash holdings	Mean difference tests for *RDG*	P-value
with positive *SALESG*	0.5375	0.4459	0.0916***	0.0002	0.0321	0.0213	0.0107***	0.0001
with positive *EBITDAG*	0.4867	0.3929	0.0938***	0.0005	0.0240	0.0159	0.0081***	0.0035
with positive *MBG*	0.2787	0.2114	0.0673***	0.0026	0.0053	0.0007	0.0047*	0.0926

Panel B: Effect of capital expenditure growth ratio (*CAPEXPG*) and R&D expenditure growth ratio (*RDR*)

Dependent — Independent	*SALESG*	*EBITDAG*	*MBG*	*SALESG*	*EBITDAG*	*MBG*
Intercept	0.1091***	0.4374***	0.1008**	0.1588***	0.3430***	0.0851**
	(0.0154)	(0.0501)	(0.0466)	(0.0183)	(0.0390)	(0.0360)
Trough	0.0106***	0.2507***	0.0532***	0.0078*	0.2471***	0.0306***
	(0.0034)	(0.0093)	(0.0086)	(0.0042)	(0.0086)	(0.0073)
CashHolding	0.0573***	0.1516***	0.1928***	0.1273***	0.1500***	0.1710***
	(0.0084)	(0.0291)	(0.0320)	(0.0097)	(0.0218)	(0.0285)
CH_Trough	0.0568***	0.1067***	0.1041***	0.0392*	0.0871**	0.0997***
	(0.0136)	(0.0393)	(0.0386)	(0.0219)	(0.0407)	(0.0330)
CAPEXPG	0.0005***	0.0003	−0.00003			
	(0.0001)	(0.0003)	(0.0002)			
CAPEXPG_Trough	0.0003**	0.0009***	0.0148***			
	(0.0001)	(0.0003)	(0.0039)			
RDG				0.0001	0.0007*	0.00001
				(0.0002)	(0.0004)	(0.0003)
RDG_Trough				0.0363***	0.1124***	0.0364***
				(0.0094)	(0.0279)	(0.0129)
SIZE	−0.0145*	−0.0257***	−0.0104***	0.0008	−0.0258***	−0.0024
	(0.0088)	(0.0020)	(0.0017)	(0.0007)	(0.0017)	(0.0015)
DIV	−0.1805***	−0.8409***	−0.4842***	−0.4892***	−0.8745***	−0.5119***
	(0.0304)	(0.0728)	(0.0616)	(0.0281)	(0.0668)	(0.0566)
DEBT	−0.6410***	0.0829***	0.3609***	−0.0281***	0.1381***	0.2989***
	(0.1181)	(0.0201)	(0.0184)	(0.0063)	(0.0163)	(0.0146)
STDROA	0.0670	0.0986***	0.3062***	0.2303***	0.1297***	0.3187***
	(0.0659)	(0.0330)	(0.0414)	(0.0071)	(0.0334)	(0.0372)
GDPG	−0.0023	−0.7431***	−0.2121	0.8017***	−0.3307*	−0.3182*
	(0.0288)	(0.2503)	(0.2557)	(0.0982)	(0.1990)	(0.1863)
INF	−0.0402***	0.0869	0.5758**	0.0952**	0.1157	0.2217***
	(0.0154)	(0.1959)	(0.2443)	(0.0481)	(0.1281)	(0.0692)
Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.2035	0.1690	0.1573	0.2331	0.1450	0.1999
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	33,804	27,538	20,199	33,804	27,538	20,199

Panel C: Effect of capital expenditure growth ratio (*CAPEXPG*) and R&D expenditure growth ratio (*RDR*): Industry-adjusted operating performance

Dependent — Independent	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG
Intercept	0.0648***	0.3554***	0.0279	0.1460***	0.3563***	0.0116
	(0.0177)	(0.0566)	(0.0409)	(0.0196)	(0.0139)	(0.0309)
Trough	0.0396***	0.2961***	0.1917***	0.0649***	0.3114***	0.1486***
	(0.0040)	(0.0102)	(0.0077)	(0.0046)	(0.0093)	(0.0057)
CashHolding	0.0596***	0.1447***	0.1801***	0.1060***	0.1421***	0.1443***
	(0.0093)	(0.0322)	(0.0230)	(0.0102)	(0.0218)	(0.0183)
CH_Trough	0.0474***	0.0753*	0.0815**	0.1177***	0.0723*	0.1279***
	(0.0157)	(0.0429)	(0.0317)	(0.0188)	(0.0438)	(0.0251)
CAPEXPG	0.0002**	0.0002	0.0060***			
	(0.0001)	(0.0002)	(0.0013)			
CAPEXPG_Trough	0.0003**	0.0007**	0.0070**			
	(0.0001)	(0.0003)	(0.0034)			
RDG				0.0015***	0.0006	0.0003
				(0.0005)	(0.0006)	(0.0006)
RDG_Trough				0.0343***	0.0879***	0.0253**
				(0.0097)	(0.0329)	(0.0114)

Table 9 (*continued*)

Panel A: Mean difference tests								
	High cash holdings	Low cash holdings	Mean difference tests for *CAPEXPG*	P-value	High cash holdings	Low cash holdings	Mean difference tests for *RDG*	P-value
SIZE	−0.0020***	−0.0274***	−0.0132***	−0.0031***	−0.0265***	−0.0044***		
	(0.0008)	(0.0023)	(0.0017)	(0.0008)	(0.0018)	(0.0012)		
DIV	−0.2566***	−0.7780***	−0.3313***	−0.4564***	−0.7809***	−0.3356***		
	(0.0312)	(0.0847)	(0.0497)	(0.0343)	(0.0752)	(0.0460)		
DEBT	−0.0218***	0.0721***	0.3482***	−0.0194***	0.1329***	0.2713***		
	(0.0067)	(0.0221)	(0.0173)	(0.0069)	(0.0157)	(0.0102)		
STDROA	0.0950***	0.1087**	0.1815***	0.1999***	0.1321***	0.1831***		
	(0.0349)	(0.0437)	(0.0548)	(0.0074)	(0.0200)	(0.0139)		
GDPG	−0.4632***	−1.2270***	0.2107	−0.2629***	−1.1172***	0.1197		
	(0.0824)	(0.2528)	(0.2106)	(0.0868)	(0.1964)	(0.1328)		
INF	0.1115*	−0.1829	−0.1413	0.1423***	−0.1593	−0.1107		
	(0.0584)	(0.1627)	(0.1657)	(0.0502)	(0.1164)	(0.0776)		
Industry dummies	Included	Included	Included	Included	Included	Included		
Country dummies	Included	Included	Included	Included	Included	Included		
Year dummies	Included	Included	Included	Included	Included	Included		
Adjusted R^2	0.1130	0.1841	0.1760	0.2311	0.1909	0.1959		
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Observations	33,804	27,538	20,199	33,804	27,538	20,199		

In this table, panel A presents the differences in capital expenditure growth ratio (*CAPEXPG*) and R&D expenditure growth ratio (*RDR*) between high and low cash holdings. We compare the difference in the mean between the two samples based on the median cash holdings: low cash holdings firms (below the median of cash holdings) and high cash holdings firms (above the median of cash holdings). We further restrict the samples with positive operating performance (with positive *SALESG*, with positive *EBITDAG*, and with positive *MBG*). Differences in the mean and median are assessed using the t-test and the Wilcoxon rank-sum test. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively. Panel B presents the effect of capital expenditure growth ratio (*CAPEXPG*) and R&D expenditure growth ratio (*RDR*) on the speed of operating performance recovery after a financial crisis. *CAPEXPG_Trough* refers to the interaction term of the growth rate of capital expenditure (*CAPEXPG*) and the dummy variable *Trough*. *RDG_Trough* refers to the interaction term of the growth rate of R&D expenditure (*RDG*) and the dummy variable *Trough*. Panel C presents the effect of capital expenditure growth ratio (*CAPEXPG*) and R&D expenditure growth ratio (*RDR*) on the speed of industry-adjusted operating performance recovery after a financial crisis. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

of cash flow (*STDCF*), the R&D expenditure ratio (*RD*), the market-to-book ratio (*MB*), the debt ratio (*LEV*), the capital expenditure ratio (*CAPEXP*), a dividend payout dummy variable (*DIV*), and industry and year dummy variables. Referring to Chen et al. (2019), we further include the peer cash holdings (*PeerCH*) in regression model. We then use the *TCH* from eq. (6) to substitute the cash holdings (*CashHolding*) in eq. (4), and run the second-stage regression.

$$
\begin{aligned}
TCH_{ijt} = &\ \gamma_0 + \gamma_1 PeerCH_{ijt-1} + \gamma_2 LnAssets_{ijt-1} + \gamma_3 CF_{ijt-1} + \gamma_4 NWC_{ijt-1} \\
&\ + \gamma_5 STDCF_{ijt-1} + \gamma_6 RD_{ijt-1} + \gamma_7 MB_{ijt-1} + \gamma_8 LEV_{ijt-1} \\
&\ + \gamma_9 CAPEXP_{ijt-1} + \gamma_{10} DIV_{ijt-1} + \alpha_j + \eta_t + \varepsilon_{ijt}
\end{aligned} \tag{6}
$$

The regression results in Table 8 present a positive relationship between theoretical cash holdings (*TCH*) and the speed of operating performance recovery at the 1% level; the interaction term of the theoretical cash holdings and dummy variable of operating performance recession in a valley (*TCH_Trough*) have a positive and significant impact on the speed of operating performance recovery. The results probe that high cash holdings can help firms rapidly recover their operating performance after a financial crisis.

6. Transmission channels

In the first place, we provide an analysis of mean and median difference regarding the growth rate of capital expenditure (*CAPEXPG*) and the growth rate of R&D expenditure (*RDG*). We classify firms into two groups based on the median cash holdings: high cash holdings firms and low cash holdings firms. The results in Table 9 indicate that, for *CAPEXPG*, and *RDG* (see Panel A), the differences of mean between two groups are positive and they all reach the statistical significance (median difference tests exhibit the same results), which shows that high cash holdings firms exhibit higher growth rate of capital expenditure and growth rate of R&D expenditure than low cash holdings firms.

Then we explore the effect of growth rate of capital expenditure (*CAPEXPG*) and growth rate of R&D expenditure (*RDG*) on the speed of operating performance recovery after a financial crisis. The empirical results in Panel B demonstrate that the cash holdings (*CashHolding*) relates positively to the *SALESG*, *EBITDAG* and *MBG* at 1% significance level. The regression coefficients of the interaction term of growth rate of capital expenditure and the dummy variable *Trough* (*CAPEXPG_Trough*) and the interaction term of growth rate of R&D expenditure and the dummy variable *Trough* (*RDG_Trough*) during a financial crisis are all positive and significant, which means that firms with high capital expenditure and R&D expenditure can rapidly recover their operating performance after a financial crisis.

To sum up, high cash holdings firms exhibit higher growth rate of capital expenditure and growth rate of R&D expenditure, then

capital expenditure and R&D expenditure can promote firms to recover their operating performance from financial crises. Therefore, it can be proved that firms with high cash holdings can rapidly recover their operating performance after a financial crisis through capital expenditures and R&D expenditures, supporting hypotheses 2a and 2b.

7. Additional analyses

7.1. Financing constraints

   With the presence or absence of financing constraints will affect the value of cash holdings and their proportion. Chang et al. (2017) state cash holdings are more valuable to constrained firms, compared to unconstrained firms, and the value impact is also more pronounced during the crisis. Denis and Sibilkov (2010) indicate that, for financially constrained firms with high hedging demand, cash holdings are positively related to the investment amount; higher cash holdings facilitate greater investment expenditure that increases the firm value. More precisely, the investment spending of such firms can translate into higher corporate value as compared with non-financially constrained firms. Luo (2011) also proposes that firms with financial constraints will not waste cash, and their cash expenditure can result in better operating performance than that of non-financial constraint firms. Ang and Smedema (2011) indicate that firms often fail to maintain the appropriate amount of cash against a possible recession and may be unable to prepare for future recession as a consequence of financial constraints and insufficient cash holdings. In other words, firms are able to prepare for a future recession because they have no financial constraints and they have enough cash. Almeida (2011) demonstrate that future financing constraints lead firms to have a preference for investments with shorter payback periods, or investments with less risk.

   This shows that the presence or absence of financial constraints will likely impact empirical results. The literature review indicates that financially constrained firms are less likely to waste cash, and investment spending can result in higher corporate value. However, financially constrained firms encountered difficulties in corporate financing during the financial crisis (Ivashina and Scharfstein, 2010) and this will be further aggravated by a recession and shortage of funds. In such periods, whether the cash holdings of firms are enough to see them through the crisis and to recover their operating performance is still unknown. Consequently, we predict that for financially constrained and non-financially constrained firms, the impact of cash holdings on the speed of recovery after a recession will be different.

   Therefore, in order to test the effect of financing constraints, we divide the samples into two groups: the financially constrained group and the financially unconstrained group. We consider the dividend payout ratio (*DIV*) as the standard to determine whether the sample firms have financing constraints based on Fazzari et al. (1988), Faulkender and Wang (2006), Duchin et al. (2010), Denis and Sibilkov (2010), McLean (2011), Tong (2011) and Brown and Petersen (2011). The empirical results after the sample classified by corporate governance are shown in Appendix Table C1. In Panel A, the cash holdings (*CashHolding*) still has a positive impact on the speed of operating performance recovery at 1% significance level even after the sample is divided into two groups, financially constrained group and financially unconstrained group. The interaction term of the cash holdings variable and the dummy variable of operating performance recession in a valley (*CH_Trough*) has a significant positive effect on *SALESG*, *EBITDAG* and *MBG* for financially constrained group; *CH_Trough* has a significant positive effect on *SALESG* for financially unconstrained group. This means that the operating performance of the firms with higher cash holdings recovers rapidly after a financial crisis, supporting hypothesis 1. Among them, the *CH_Trough* regression coefficients of financially constrained group are 0.0664, 0.1279 and 0.1291, respectively; the *CH_Trough* regression coefficients of financially unconstrained group are 0.0604, 0.0793 and 0.0773, respectively. The regression coefficients of financially constrained group are all larger than the regression coefficients of financially unconstrained group. We further consider the industrial adjustment of the operating performance in Panel B of Appendix Table C1 and the empirical results are consistent. Hence, it proves our prediction that for financially constrained and non-financially constrained firms, the impact of cash holdings on the speed of recovery after a recession are different, and for firms with financial constraints, the higher cash holdings will be more efficient to help recovers rapidly after a financial crisis.

7.2. Corporate governance

   The differences in corporate governance will affect the value of cash holdings. More precisely, in case of agency problems (Jensen and Meckling, 1976), when the firm has fewer growth opportunities despite having a high free cash holding, managers may still carry out investment activities that can hurt firm value (Jensen, 1986). Bhuiyan and Hooks (2019) also find that problem directors provide lower quality (weak) corporate governance, and the tendency of firms with higher cash holdings to engage in over-investment is more pronounced in this case. Dittmar and Mahrt-Smith (2007) propose that firms with better governance can create higher value through the use of their cash holdings. Chang et al. (2017) also demonstrate that governance affect the relationship between cash holdings and firm value during the financial crisis, and effective corporate governance can make each dollar of cash places a higher value when firms facing market stress. Tong (2011) finds that firm diversification has a negative impact on the value of cash among firms with a lower level of corporate governance.

   Nonetheless, corporate governance can be regarded as an indicator of the difference in external financing costs. Shleifer and Wolfenzon (2002) and Almeida (2011) state that the degree of the investor protection can be regarded as an indicator of external financing costs. Kusnadi and Wei (2011) also reveal that a strong investor protection can reduce a firm's financing costs. Dittmar et al. (2003) support the above argument and find that firms in countries with poor investor protection will increase their cash reserves because of high financing costs. Anderson and Hamadi (2016) find a strong positive association between the ownership concentration and cash holding, indicating a precautionary motive regarding the controlling shareholders who value control.

Thus, differences in corporate governance will affect the value and proportion of cash holdings, which will influence our empirical results. Based on the above literature, firms with good governance can increase firm value by improving the use of cash holdings, by reducing financing costs, and by quickly recovering operating performance after a financial crisis. We predict that compared with countries with poor investor protection, for firms with effective corporate governance, cash holdings have a positive impact on the speed of recovery after a financial crisis.

Therefore, we divide the samples into two groups: higher investor protection group and lower investor protection group. We use the anti-self-dealing index as an indicator of corporate governance, based on Djankov et al. (2008). The empirical results indicate that the cash holdings (*CashHolding*) still has a positive impact on the speed of operating performance recovery at 1% significance level for two groups. The *CH_Trough* has a significant positive impact on the speed of operating performance recovery after a financial crisis for higher investor protection group. The *CH_Trough* positively impacts the *EBITDAG* after a financial crisis at 10% significance level for lower investor protection group. Furthermore, the *CH_Trough* regression coefficients of higher investor protection group are 0.0936, 0.1258 and 0.1166, respectively; the *CH_Trough* regression coefficients of lower investor protection group are −0.0109, 0.0967 and 0.0774, respectively (Panel A of Appendix Table C2). The regression coefficients of higher investor protection group are all larger than the regression coefficients of lower investor protection group. We further consider the industrial adjustment of the operating performance in Panel B of Appendix Table C2 and the empirical results are consistent. Hence, it proves our prediction that compared with countries with poor investor protection, for firms with effective corporate governance, cash holdings have a more positive impact on the speed of recovery after a financial crisis.

7.3. Degree of financial development

The degree of financial development affects the external financing costs, thereby impacting the proportion of cash held in the firm's accounts and influencing our empirical results. Rajan and Zingales (1998) indicate that countries with a high degree of financial development can effectively help firms overcome the problems of moral hazard and adverse selection, leading to deceased external financing costs. King and Levine (1993) and Levine and Servos (1998) also demonstrate that financial development can reduce external financing costs, while increasing investment and economic growth. Demirgüç-Kunt and Maksimovic (1998) find that, in countries with a high degree of financial development, firms are more likely to avail long-term external debt and equity financing, and to have a higher growth rate. Khurana et al. (2006) further indicate that cash flow sensitivity will decrease as financial development increases. In other words, in countries with a low degree of financial development, firms focus more on their cash management policy because of high external financing costs.

Hence, during a financial crisis, external debt and equity financing will aggravate the negative impact of the recession and shortage of funds on firms in countries with a low degree of financial development. At this moment, whether the cash holdings of firms are enough to weather the crisis and to recover the operating performance is still unknown. Accordingly, we predict that the impact of cash holdings on the speed of recovery after a recession will be different between countries with a high degree and a low degree of financial development.

Therefore, to test the effect of the degree of financial development, we divide the samples into two groups: higher financial development group and lower financial development group. Based on Khurana et al. (2006), we consider the sum of the stock market and financial intermediary development indexes as the financial development indicator. The empirical results indicate that the cash holdings (*CashHolding*) still has a positive and significant impact on the speed of operating performance recovery for two groups. The *CH_Trough* also positively impacts the speed of operating performance recovery after a financial crisis for higher financial development group, all reaching 1% significance level. The *CH_Trough* has a significant positive impact on *MBG* after a financial crisis at 5% significance level for lower financial development group. Furthermore, the *CH_Trough* regression coefficients of higher financial development group are 0.1282, 0.1550 and 0.1544, respectively. The *CH_Trough* regression coefficients of lower financial development group are 0.0468, 0.0965 and 0.1133, respectively (Panel A of Appendix Table C3). The regression coefficients of higher financial development group are all larger than the regression coefficients of lower financial development group. We further consider the industrial adjustment of the operating performance in Panel B of Appendix Table C3 and the empirical results are consistent. Hence, it proves our prediction that the impact of cash holdings on the speed of recovery after a recession will be different between countries with a high degree and a low degree of financial development, and cash holdings have a more positive impact on the speed of recovery after a financial crisis for countries with higher financial development.

8. Conclusion

Firms' cash holdings play a crucial role, especially during financial crises. Most literature about cash holdings focuses on determinant factors of cash holdings, instead of the role of cash holdings in a financial crisis. Therefore, we aim to verify whether firms with higher cash holdings can rapidly recover their operating performance after a financial crisis.

The empirical results show that, if firms have higher cash holdings, their operating performance tends to recover more rapidly after a financial crisis. The results hold after considering endogenous problems and various robustness checks. We also find that firms with high cash holdings can rapidly recover their operating performance after a financial crisis through capital expenditures and R&D expenditures. Furthermore, differences in financing constraints, corporate governance, and the degree of financial development can affect the relationship between the cash holdings and the speed of recovery of the operating performance after a financial crisis.

This study offers several contributions. Firstly, no extant literature has examined whether cash holdings facilitate the recovery of firms after a financial crisis. Secondly, this study has several practical applications. It examines the validity of the adage "Cash is king"

with regard to firms' cash holdings policy. Moreover, the empirical results of this study can serve as a reference for firms to create a liquidity management policy. Thirdly, this study is in the form of an international empirical study, which helps in understanding the effects of various countries' cash management policies on the speed of recovery and improvement in their operating performance after a financial crisis. The empirical results of this study show that if the firms have higher cash holdings, their operating performance tends to recover more rapidly after a financial crisis, which support that firms should accumulate cash reserves in a timely manner to provide for contingencies. The empirical results also prove that firms with high cash holdings can rapidly recover their operating performance after a financial crisis through capital expenditures and R&D expenditures, which means that firms with high cash holdings can make related investments (even if they are facing a financial crisis) and they can even enhance the follow-up growth momentum to enable them to rapidly recover and improve their operating performance after a financial crisis. Therefore, firms should focus on economic changes and reserve adequate amounts of cash and cash equivalents in a timely manner to protect themselves against unexpected demands. These cash and cash equivalents, in addition to the demand for normal operations, investment, or debt service, can galvanize the growth momentum when facing a financial crisis.

CRediT authorship contribution statement

Chong-Chuo Chang: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition. **Han Yang:** Formal analysis, Methodology, Investigation, Writing – original draft, Writing – review & editing, Visualization, Project administration.

Appendix

Appendix Table A
Definition of variables.

Name	Description
CashHolding	Sum of cash, cash equivalents, and short-term investments divided by total assets
IndAdjCH	*IndAdjCH* is the industry-adjusted *CashHolding*, which is calculated by subtracting the *CashHolding* from the industry median *CashHolding* in the corresponding year.
SALESG	Current net operating revenue minus the previous net operating revenue divided by the previous net operating revenue
EBITDAG	Current earnings before interest, taxes, depreciation, and amortization minus the previous earnings before interest, taxes, depreciation, and amortization divided by the absolute value of previous earnings before interest, taxes, depreciation, and amortization
MBG	Current market-to-book ratio minus the previous market-to-book ratio divided by the absolute value of previous market-to-book ratio, the market-to-book ratio (*MB*) is a firm's market value divided by its equity
IndAdjSALESG	*IndAdjSALESG* is the industry-adjusted *SALESG*, which is calculated by subtracting the *SALESG* from the industry median *SALESG* in the corresponding year.
IndAdjEBITDAG	*IndAdjEBITDAG* is the industry-adjusted *EBITDAG*, which is calculated by subtracting the *EBITDAG* from the industry median *EBITDAG* in the corresponding year.
IndAdjMBG	*IndAdjMBG* is the industry-adjusted *MBG*, which is calculated by subtracting the *MBG* from the industry median *MBG* in the corresponding year.
Trough	Dummy variable of operating performance recession in a valley during the financial crisis: if the operating performance in the previous year is in a valley, *Trough*$_{ijt-1}$ is set to one; if the operating performance in the previous year is not in a valley, *Trough*$_{ijt-1}$ is set to zero
SIZE	Natural logarithm of total assets of the sample firms
DIV	Ratio of the sum of common cash and common stock dividends to the net income
DEBT	Total liabilities divided by total assets
STDROA	Standard deviation of return on assets over the previous five years
GDPG	Difference between current and previous real per capita GDP divided by the previous real per capita GDP
INF	Growth rate of the consumer price index
PeerCH	average cash holdings of other firms in a focal firm's industry
CAPEXPG	Current capital expenditure ratio minus the previous capital expenditure ratio divided by the absolute value of previous capital expenditure ratio, the capital expenditure ratio is defined as the ratio of capital expenditure to total assets
RDG	Current R&D expenditure ratio minus the previous R&D expenditure ratio divided by the absolute value of previous R&D expenditure ratio, the R&D expenditure ratio is defined as the ratio of the R&D expenses divided by the total assets

Appendix Table B
Effect of industry-adjusted cash holdings on the speed of operating performance recovery after a financial crisis.

Dependent Independent	*SALESG*				*EBITDAG*				*MBG*			
Intercept	0.1926***	0.2034***	0.2343***	0.1931***	0.3203***	0.2240***	0.4579***	0.3757***	0.3168***	0.2569***	0.2336***	0.1185***
	(0.0014)	(0.0174)	(0.0076)	(0.0190)	(0.0027)	(0.0337)	(0.0126)	(0.0385)	(0.0039)	(0.0338)	(0.0119)	(0.0351)
Trough	0.0201***	0.0252***	0.0081***	0.0177***	0.2810***	0.2866***	0.2570***	0.2621***	0.0580***	0.0372***	0.0467***	0.0364***
	(0.0031)	(0.0037)	(0.0030)	(0.0035)	(0.0060)	(0.0061)	(0.0059)	(0.0060)	(0.0051)	(0.0055)	(0.0051)	(0.0053)
IndAdjCH	0.1369***	0.1368***	0.0390***	0.0818***	0.1078***	0.0935***	0.0683***	0.1146***	0.0916***	0.0617**	0.0876***	0.1524***
	(0.0132)	(0.0122)	(0.0139)	(0.0135)	(0.0208)	(0.0202)	(0.0220)	(0.0221)	(0.0317)	(0.0309)	(0.0316)	(0.0306)
	0.1269***	0.0753**	0.0958***	0.0632**	0.0975**	0.0855*	0.1057**	0.0950**	0.0870**	0.0926**	0.1020***	0.1076***

(continued on next page)

Appendix Table B (*continued*)

Dependent Independent	SALESG				EBITDAG				MBG			
Intercept	0.1926***	0.2034***	0.2343***	0.1931***	0.3203***	0.2240***	0.4579***	0.3757***	0.3168***	0.2569***	0.2336***	0.1185***
IndAdjCH_Trough												
	(0.0339)	(0.0305)	(0.0328)	(0.0306)	(0.0473)	(0.0466)	(0.0467)	(0.0462)	(0.0402)	(0.0386)	(0.0386)	(0.0370)
SIZE			−0.0053***	0.0012			−0.0252***	−0.0256***			−0.0050***	−0.0031**
			(0.0007)	(0.0008)			(0.0015)	(0.0017)			(0.0013)	(0.0015)
DIV			−0.1630***	−0.5111***			−0.8224***	−0.9055***			−0.3191***	−0.5179***
			(0.0293)	(0.0353)			(0.0614)	(0.0669)			(0.0522)	(0.0567)
DEBT			−0.0936***	−0.0472***			0.0189	0.1046***			0.1744***	0.2872***
			(0.0078)	(0.0072)			(0.0154)	(0.0161)			(0.0135)	(0.0142)
STDROA			0.3499***	0.2428***			0.2533***	0.1454***			0.4932***	0.3207***
			(0.0325)	(0.0305)			(0.0410)	(0.0344)			(0.0459)	(0.0378)
GDPG			0.6652***	0.8098***			0.4176***	−0.3611*			−0.6558***	−0.2901
			(0.0500)	(0.1015)			(0.1029)	(0.1981)			(0.0910)	(0.1844)
INF			0.4963***	0.0965**			0.0683	0.0990			0.2471***	0.2203***
			(0.0433)	(0.0458)			(0.0557)	(0.1261)			(0.0679)	(0.0692)
Industry dummies		Included		Included		Included		Included		Included		Included
Country dummies		Included		Included		Included		Included		Included		Included
Year dummies		Included		Included		Included		Included		Included		Included
Adjusted R^2	0.0083	0.1873	0.1069	0.2278	0.0749	0.1191	0.1048	0.1425	0.0069	0.1209	0.1018	0.1972
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	33,804	33,804	33,804	33,804	27,538	27,538	27,538	27,538	20,199	20,199	20,199	20,199

In this table, *IndAdjCH_Trough* refers to the interaction term of the industry-adjusted cash holdings (*IndAdjCH*) and the dummy variable *Trough*. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

Appendix Table C1
Effect of cash holdings on the speed of (industry-adjusted) operating performance recovery for financially constrained and financially unconstrained groups.

Panel A: Effect of cash holdings on the speed of operating performance recovery after a financial crisis for financially constrained and financially unconstrained groups

Dependent Independent	with financing constraints			without financing constraints		
	SALESG	EBITDAG	MBG	SALESG	EBITDAG	MBG
Intercept	0.1624***	0.4087***	0.1294**	0.1543***	0.2417***	0.0211
	(0.0234)	(0.0651)	(0.0588)	(0.0296)	(0.0436)	(0.0428)
Trough	−0.0048	0.2795***	0.0286***	0.0197***	0.1648***	0.0179*
	(0.0050)	(0.0127)	(0.0107)	(0.0075)	(0.0101)	(0.0092)
CashHolding	0.0508***	0.1098***	0.1682***	0.1160***	0.0975***	0.1382***
	(0.0135)	(0.0322)	(0.0379)	(0.0194)	(0.0268)	(0.0407)
CH_Trough	0.0664***	0.1279**	0.1291***	0.0604*	0.0793	0.0773
	(0.0248)	(0.0537)	(0.0428)	(0.0366)	(0.0516)	(0.0474)
SIZE	0.0091***	−0.0174***	0.0008	0.0015*	−0.0142***	0.0036**
	(0.0014)	(0.0030)	(0.0024)	(0.0019)	(0.0008)	(0.0017)
DIV	−2.0900***	−7.0962***	−2.8906***	−0.0966***	−0.2449***	−0.1409**
	(0.5106)	(1.0241)	(0.9921)	(0.0300)	(0.0635)	(0.0600)
DEBT	−0.0612***	0.0694***	0.3768***	0.0151**	0.1015***	0.2155***
	(0.0116)	(0.0261)	(0.0215)	(0.0075)	(0.0194)	(0.0203)
STDROA	0.1847***	0.0213	0.2241***	0.3641***	0.6061***	0.5874***
	(0.0315)	(0.0260)	(0.0362)	(0.0501)	(0.1080)	(0.0894)
GDPG	0.5655***	−0.9752***	−0.3448	0.9075***	0.1654	−0.3204
	(0.1569)	(0.3431)	(0.2669)	(0.1257)	(0.2298)	(0.2507)
INF	0.0411	−0.2157	0.1403	0.0915**	0.1862	0.3012***
	(0.0786)	(0.2094)	(0.1099)	(0.0466)	(0.1384)	(0.0049)
Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.2642	0.1444	0.1829	0.1705	0.1260	0.2309
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	16,980	13,010	10,567	16,824	14,528	9632

Panel B: Effect of cash holdings on the speed of industry-adjusted operating performance recovery after a financial crisis for financially constrained and financially unconstrained groups

Dependent independent	with financing constraints	without financing constraints

Appendix Table C1 (*continued*)

Panel A: Effect of cash holdings on the speed of operating performance recovery after a financial crisis for financially constrained and financially unconstrained groups

	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG
Intercept	0.1339***	0.1713***	0.0019	0.1239***	0.3446***	−0.0382
	(0.0252)	(0.0462)	(0.0486)	(0.0324)	(0.0717)	(0.0387)
Trough	0.0319***	0.2202***	0.1927***	0.0617***	0.3507***	0.1507***
	(0.0063)	(0.0114)	(0.0091)	(0.0086)	(0.0133)	(0.0087)
CashHolding	0.0589***	0.0848***	0.1358***	0.0882***	0.1277***	0.1095***
	(0.0138)	(0.0270)	(0.0281)	(0.0197)	(0.0337)	(0.0248)
CH_Trough	0.0619**	0.1075*	0.1398***	0.0549	0.0023	0.0695*
	(0.0306)	(0.0580)	(0.0367)	(0.0418)	(0.0556)	(0.0404)
SIZE	−0.0024***	−0.0155***	−0.0059***	0.0025*	−0.0233***	0.0064***
	(0.0008)	(0.0021)	(0.0020)	(0.0015)	(0.0031)	(0.0015)
DIV	−0.0742*	−0.2037***	−1.8683**	−2.4803***	−7.1821***	−0.1117**
	(0.0394)	(0.0761)	(0.8583)	(0.6407)	(1.1783)	(0.0490)
DEBT	0.0217***	0.0919***	0.3889***	−0.0429***	0.0629**	0.1513***
	(0.0081)	(0.0207)	(0.0194)	(0.0125)	(0.0272)	(0.0180)
STDROA	0.2943***	0.5695***	0.1225***	0.1573***	0.0309	0.4177***
	(0.0564)	(0.1091)	(0.0386)	(0.0346)	(0.0311)	(0.1061)
GDPG	−0.3787***	−0.8973***	0.1246	−0.2976**	−1.4276***	−0.0240
	(0.0965)	(0.2203)	(0.2434)	(0.1305)	(0.3348)	(0.2048)
INF	0.0875	−0.0889	−0.0635	0.1456**	−0.2998	−0.1325
	(0.0575)	(0.1203)	(0.1630)	(0.0739)	(0.1950)	(0.1106)
Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.1099	0.1596	0.2132	0.2524	0.1756	0.1550
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	16,980	13,010	10,567	16,824	14,528	9632

In this table, we consider the dividend payout ratio (*DIV*) as the standard to determine whether the sample firms have financing constraints based on Fazzari et al. (1988), Faulkender and Wang (2006), Duchin et al. (2010), Denis and Sibilkov (2010), McLean (2011), Tong (2011) and Brown and Petersen (2011). First, the sample firms in different countries are divided independently to avoid variations in the rates of dividend payout among countries. Second, based on the annual mean values of the rates of dividend payout of firms in various countries, the sample firms with the dividend payout ratio less than the mean value are subject to the firms with financing constraints; otherwise, they are subject to those without financing constraints. The dependent variables include the growth rate of revenue (*SALESG*), the growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*) and the growth rate of market-to-book ratio (*MBG*). The independent variable *Trough* is a dummy variable of operating performance recession in a valley during the financial crisis. *CH_Trough* refers to the interaction term of the cash holdings (*CashHolding*) and the dummy variable *Trough*. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

Appendix Table C2
Effect of cash holdings on the speed of (industry-adjusted) operating performance recovery after a financial crisis classified by corporate governance.

Panel A: Effect of cash holdings on the speed of operating performance recovery after a financial crisis classified by corporate governance

Dependent independent	higher investor protection			lower investor protection		
	SALESG	EBITDAG	MBG	SALESG	EBITDAG	MBG
Intercept	0.2643***	0.3082***	0.1401**	0.0691***	0.4557***	0.3559***
	(0.0347)	(0.1032)	(0.0578)	(0.0238)	(0.0638)	(0.0969)
Trough	0.0119	0.2053***	0.0508***	0.0181***	0.2560***	0.0036
	(0.0075)	(0.0120)	(0.0101)	(0.0057)	(0.0118)	(0.0106)
CashHolding	0.1161***	0.1164***	0.2167***	0.1115***	0.1569***	0.1586***
	(0.0196)	(0.0322)	(0.0357)	(0.0145)	(0.0291)	(0.0476)
CH_Trough	0.0936**	0.1258**	0.1166***	−0.0109	0.0967*	0.0774
	(0.0367)	(0.0610)	(0.0408)	(0.0258)	(0.0513)	(0.0541)
SIZE	−0.0002	−0.0297***	−0.0209***	0.0047***	−0.0188***	0.0139***
	(0.0014)	(0.0026)	(0.0022)	(0.0008)	(0.0022)	(0.0020)
DIV	−0.5273***	−0.8248***	−0.5289***	−0.3924***	−0.9483***	−0.3954***
	(0.0458)	(0.0815)	(0.0727)	(0.0448)	(0.1069)	(0.0872)
DEBT	−0.0692***	0.0357	0.3775***	0.0037	0.2308***	0.2415***
	(0.0120)	(0.0241)	(0.0219)	(0.0077)	(0.0221)	(0.0185)
STDROA	0.2051***	0.0681**	0.2309***	0.4276***	0.7776***	0.6432***
	(0.0317)	(0.0285)	(0.0372)	(0.0388)	(0.0974)	(0.0826)
GDPG	0.3509*	−0.2274	−0.1066	0.8089***	−0.2382	−0.4692*
	(0.1979)	(0.3989)	(0.3524)	(0.1250)	(0.2493)	(0.2397)
INF	0.4059***	0.1576	0.2210	−0.0182	0.0730	0.2182***
	(0.1373)	(0.2967)	(0.2471)	(0.0459)	(0.1522)	(0.0686)

Appendix Table C2 (*continued*)

Panel A: Effect of cash holdings on the speed of operating performance recovery after a financial crisis classified by corporate governance						
Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.2451	0.1710	0.1616	0.2043	0.1434	0.2407
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	14,896	11,749	9394	18,908	15,744	10,850

Panel B: Effect of cash holdings on the speed of industry-adjusted operating performance recovery after a financial crisis classified by corporate governance

	higher investor protection			lower investor protection		
Dependent Independent	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG
Intercept	0.2252***	0.4560***	0.0565	0.0601**	0.2809***	0.1125
	(0.0400)	(0.0721)	(0.0520)	(0.0296)	(0.0977)	(0.0779)
Trough	0.0530***	0.3123***	0.1845***	0.0579***	0.2896***	0.1619***
	(0.0093)	(0.0134)	(0.0094)	(0.0065)	(0.0133)	(0.0091)
CashHolding	0.1036***	0.1658***	0.2052***	0.0846***	0.0995***	0.0577**
	(0.0208)	(0.0321)	(0.0281)	(0.0138)	(0.0309)	(0.0251)
CH_Trough	0.0788*	0.1213**	0.1261***	0.0108	−0.0223	0.0851*
	(0.0430)	(0.0555)	(0.0362)	(0.0300)	(0.0744)	(0.0477)
SIZE	−0.0065***	−0.0318***	−0.0217***	0.0012	−0.0175***	0.0111***
	(0.0016)	(0.0030)	(0.0020)	(0.0008)	(0.0022)	(0.0015)
DIV	−0.4632***	−0.7513***	−0.3226***	−0.3877***	−0.6520***	−0.1873**
	(0.0571)	(0.1001)	(0.0538)	(0.0478)	(0.1017)	(0.0833)
DEBT	−0.0577***	0.0325	0.3790***	0.0146*	0.2017***	0.1932***
	(0.0136)	(0.0267)	(0.0206)	(0.0078)	(0.0221)	(0.0159)
STDROA	0.1736***	0.0769**	0.1228***	0.4045***	0.7022***	0.4663***
	(0.0349)	(0.0372)	(0.0391)	(0.0401)	(0.1037)	(0.0708)
GDPG	−0.1961	−0.9232**	−0.0244	−0.2957***	−0.9280***	0.5773**
	(0.1988)	(0.4630)	(0.3676)	(0.0921)	(0.2445)	(0.2259)
INF	0.1536	−0.1833	0.1472	0.0854*	−0.1521	−0.2616**
	(0.1068)	(0.2688)	(0.2025)	(0.0508)	(0.1243)	(0.1196)
Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.2154	0.1995	0.1882	0.1713	0.1861	0.1820
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	14,896	11,749	9394	18,908	15,744	10,850

In this table, we consider the anti-self-dealing index as the indicator of corporate governance based on Djankov et al. (2008). If it is higher, it means that the protection for the minority shareholder is higher, and corporate governance is better. Based on the mean value of the above-mentioned corporate governance indicator, if the corporate governance indicators in the sample countries are higher than the mean value, the sample countries are subject to those with higher protection for the investors; otherwise, they are subject to countries with lower protection for the investors. The dependent variables include the growth rate of revenue (*SALESG*), the growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*) and the growth rate of market-to-book ratio (*MBG*). The independent variable *Trough* is a dummy variable of operating performance recession in a valley during the financial crisis. *CH_Trough* refers to the interaction term of the cash holdings (*CashHolding*) and the dummy variable *Trough*. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

Appendix Table C3
Effect of cash holdings on the speed of (industry-adjusted) operating performance recovery after a financial crisis classified by the degree of financial development.

Panel A: Effect of cash holdings on the speed of operating performance recovery after a financial crisis classified by the degree of financial development

	Higher Financial Development			Lower Financial Development		
Dependent Independent	SALESG	EBITDAG	MBG	SALESG	EBITDAG	MBG
Intercept	0.2163***	0.6324***	0.1128**	0.1285***	0.2636***	0.1004**
	(0.0347)	(0.0667)	(0.0510)	(0.0210)	(0.0455)	(0.0411)
Trough	0.0137**	0.2653***	0.0400***	0.0228***	0.2149***	0.0145
	(0.0069)	(0.0123)	(0.0105)	(0.0073)	(0.0115)	(0.0100)
CashHolding	0.1186***	0.1215***	0.2050***	0.1072***	0.1519***	0.1623***
	(0.0164)	(0.0304)	(0.0378)	(0.0210)	(0.0315)	(0.0418)
CH_Trough	0.1282***	0.1550***	0.1544***	0.0468	0.0965	0.1133**
	(0.0339)	(0.0534)	(0.0431)	(0.0428)	(0.0590)	(0.0495)
SIZE	0.0007	−0.0291***	−0.0174***	0.0031***	−0.0213***	0.0087***
	(0.0011)	(0.0027)	(0.0022)	(0.0010)	(0.0022)	(0.0020)
DIV	−0.5943***	−1.1825***	−0.6822***	−0.4712***	−0.7345***	−0.4698***
	(0.0521)	(0.1052)	(0.0939)	(0.0440)	(0.0799)	(0.0696)
DEBT	−0.0314***	0.0210	0.4098***	−0.0399***	0.2215***	0.2289***
	(0.0111)	(0.0250)	(0.0227)	(0.0096)	(0.0217)	(0.0184)

(*continued on next page*)

Appendix Table C3 (*continued*)

Panel A: Effect of cash holdings on the speed of operating performance recovery after a financial crisis classified by the degree of financial development						
STDROA	0.2754***	0.2302***	0.3811***	0.2060***	0.0769**	0.1466***
	(0.0225)	(0.0447)	(0.0384)	(0.0417)	(0.0338)	(0.0461)
GDPG	0.5562	−2.6314***	−0.2286	0.4794***	−0.5362**	−0.2589
	(0.3678)	(0.8703)	(0.9436)	(0.1128)	(0.2503)	(0.2295)
INF	−1.0208	−3.4800**	2.5141**	0.1828***	0.1684	0.2204***
	(0.7244)	(1.3680)	(1.0346)	(0.0473)	(0.1271)	(0.0687)
Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.1592	0.1694	0.1655	0.2853	0.1406	0.2376
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	13,914	10,954	8971	19,890	16,854	11,228

Panel B: Effect of cash holdings on the speed of industry-adjusted operating performance recovery after a financial crisis classified by the degree of financial development

	Higher Financial Development			Lower Financial Development		
Dependent independent	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG	IndAdj SALESG	IndAdj EBITDAG	IndAdj MBG
Intercept	0.2489***	0.5378***	0.1034**	0.1134***	0.2284***	0.0149
	(0.0414)	(0.0682)	(0.0479)	(0.0226)	(0.0486)	(0.0338)
Trough	0.0548***	0.3336***	0.2021***	0.0658***	0.2810***	0.1564***
	(0.0090)	(0.0139)	(0.0102)	(0.0087)	(0.0123)	(0.0082)
CashHolding	0.1114***	0.1568***	0.2049***	0.0698***	0.1174***	0.0771***
	(0.0174)	(0.0329)	(0.0277)	(0.0196)	(0.0313)	(0.0257)
CH_Trough	0.1530***	0.1370**	0.1441***	0.1022*	0.0871	0.1197***
	(0.0399)	(0.0575)	(0.0367)	(0.0536)	(0.0625)	(0.0399)
SIZE	−0.0043***	−0.0293***	−0.0170***	−0.0014	−0.0227***	0.0070***
	(0.0013)	(0.0030)	(0.0020)	(0.0010)	(0.0022)	(0.0015)
DIV	−0.4850***	−0.9151***	−0.3694***	−0.4360***	−0.6255***	−0.3601***
	(0.0688)	(0.1263)	(0.0800)	(0.0553)	(0.0936)	(0.0537)
DEBT	−0.0178	0.0425	0.3967***	−0.0289***	0.1921***	0.1764***
	(0.0130)	(0.0274)	(0.0216)	(0.0097)	(0.0220)	(0.0149)
STDROA	0.2596***	0.2825***	0.2647***	0.1623***	0.0622	0.0904**
	(0.0237)	(0.0474)	(0.0335)	(0.0458)	(0.0397)	(0.0423)
GDPG	−1.7487***	−3.6402***	−1.3722**	−0.2369**	−1.2060***	−0.2063
	(0.4152)	(0.9411)	(0.6342)	(0.0996)	(0.2413)	(0.1981)
INF	−1.2894**	−1.4621	0.8602	0.1858***	−0.1434	−0.0538
	(0.5988)	(1.2600)	(0.9356)	(0.0472)	(0.1161)	(0.1003)
Industry dummies	Included	Included	Included	Included	Included	Included
Country dummies	Included	Included	Included	Included	Included	Included
Year dummies	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.1607	0.2223	0.2142	0.2748	0.1804	0.1800
Prob (F-statistic)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Observations	13,914	10,954	8971	19,890	16,854	11,228

In this table, we consider the sum of the stock market development index and financial intermediary development indexes as the financial development indicator based on Khurana et al. (2006). If the value of financial development indicator is higher, this means that the degree of financial market development in this country is higher. Considering the mean value of financial development indicators as the distinguishing standard in this study, if the financial development indicators in the sample countries are higher than the mean value, the countries are subject to those with higher financial development; otherwise, they are subject to those with lower financial development. The dependent variables include the growth rate of revenue (*SALESG*), the growth rate of earnings before interest, taxes, depreciation, and amortization (*EBITDAG*); and market price/book ratio (*MBG*). The independent variable *Trough* is a dummy variable of operating performance recession during the financial crisis. *CH_Trough* refers to the interaction term of the cash holdings (*CashHolding*) and the dummy variable *Trough*. The figure in brackets is the standard error of the Newey-West correction self-correlation and heterogeneous variability (Newey and West, 1987); * refers to reaching 10% of significant level; **refers to reaching 5% of significant level; *** refers to reaching 1% of significant level.

References

Ahrends, M., Drobetz, W., Puhan, T.X., 2018. Cyclicality of growth opportunities and the value of cash holdings. J. Financ. Stab. 37, 74–96.
Almeida, H., Campello, M., Weisbach, M.S., 2011. Corporate financial and investment policies when future financing is not frictionless. J. Corp. Finan. 17, 675–693.
Anderson, R.W., Hamadi, M., 2016. Cash holding and control-oriented finance. J. Corp. Finan. 41, 410–425.
Ang, J., Smedema, A., 2011. Financial flexibility: do firms prepare for recession. J. Corp. Finan. 17, 774–787.
Atanassov, J., Kim, E.H., 2009. Labor and corporate governance: international evidence from restructuring decisions. J. Financ. 64, 341–374.
Bannist, J.W., Mihalek, P.H., Smith, C.S., 1997. Performance plan adoption and corporate performance. Manag. Financ. 23, 28–38.
Barajas, A., Steiner, R., Salazar, N., 2000. The impact of liberalization and foreign investment in Colombia's financial sector. J. Dev. Econ. 63, 157–196.
Bates, T.W., Kahle, K.M., Stulz, R.M., 2009. Why do U.S. firms hold so much more cash than they used to? J. Financ. 64, 1985–2021.
Bhuiyan, M.B.U., Hooks, J., 2019. Cash holding and Over-Investment behavior in firms with problem directors. Int. Rev. Econ. Financ. 61, 35–51.

Broner, F., Didier, T., Erce, A., Schmukler, S.L., 2010. Financial Crises and International Portfolio Dynamics, Working Paper. Department of Economics and Business, Universitat Pompeu Fabra.

Brown, J., Petersen, B., 2011. Cash holdings and R&D smoothing. J. Corp. Finan. 17, 694–709.

Campello, M., Graham, J.R., Harvey, G.R., 2010. The real effects of financial constraints: evidence from a financial crisis. J. Financ. Econ. 97, 470–487.

Campello, M., Giambona, E., Graham, J.R., Harvey, C.R., 2011. Liquidity management and corporate investment during a financial crisis. Rev. Financ. Stud. 24, 1944–1979.

Caprio, G., Klingebiel, D., 2003. "Episodes of Systemic and Borderline Financial Crises," Working Paper. World Bank.

Cerra, V., Saxena, S.C., 2005. Growth dynamics: the myth of economic recovery. In: IMF Working Paper, International Monetary Fund, WP/05/147.

Cerra, V., Saxena, S.C., 2008. Growth dynamics: the myth of economic recovery. Am. Econ. Rev. 98, 439–457.

Cerra, V., Panizza, U., Saxena, S.C., 2009. International evidence on recovery from recessions. In: IMF Working Paper, International Monetary Fund, WP/09/183.

Chang, C.C., Tang, H.W., 2021. Corporate cash holdings and total factor productivity–a global analysis. The North American J. Econom. Fin. 55, 101316.

Chang, Y., Benson, K., Faff, R., 2017. Are excess cash holdings more valuable to firms in times of crisis? Financial constraints and governance matters. Pac. Basin Financ. J. 45, 157–173.

Chen, J.L., Jia, Z.T., Sun, P.W., 2016. Real option component of cash holdings, business cycle, and stock returns. Int. Rev. Financ. Anal. 45, 97–106.

Chen, H.C., Chou, R.K., Lu, C.L., 2018. Saving for a rainy day: evidence from the 2000 dot-com crash and the 2008 credit crisis. J. Corp. Finan. 48, 680–699.

Chen, Y.W., Chan, K., Chang, Y., 2019. Peer effects on corporate cash holdings. Int. Rev. Econ. Financ. 61, 213–227.

Chen, H., Yang, D., Zhang, J.H., Zhou, H., 2020. Internal controls, risk management, and cash holdings. J. Corp. Finan. 64, 101695.

Core, J.E., Holthausen, R.W., Larcker, D.F., 1999. Corporate governance, chief executive officer compensation, and firm performance. J. Financ. Econ. 51, 371–406.

De Vito, A., Gomez, J.P., 2020. Estimating the COVID-19 cash crunch: global evidence and policy. J. Account. Public Policy 39, 106741.

Demirgüç-Kunt, A., Maksimovic, V., 1998. Law, finance, and firm growth. J. Financ. 53, 2107–2137.

Denis, D.J., Sibilkov, V., 2010. Financial constraints, investment, and the value of cash holdings. Rev. Financ. Stud. 23, 247–269.

Dittmar, A., Mahrt-Smith, J., 2007. Corporate governance and the value of cash holdings. J. Financ. Econ. 83, 599–634.

Dittmar, A., Mahrt-Smith, J., Servaes, H., 2003. International corporate governance and corporate cash holding. J. Financ. Quant. Anal. 38, 111–133.

Djankov, S., LaPorta, R., Lopez-de-Silanes, F., Shleifer, A., 2008. The law and economics of self-dealing. J. Financ. Econ. 88, 430–465.

Duchin, R., Ozbas, O., Sensoy, B.A., 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. J. Financ. Econ. 97, 418–435.

Duong, H.N., Nguyen, J.H., Nguyen, M., Rhee, S.G., 2020. Navigating through economic policy uncertainty: the role of corporate cash holdings. J. Corp. Finan. 62, 101607.

Faulkender, M., Wang, R., 2006. Corporate financial policy and the value of cash. J. Financ. 6, 1957–1990.

Fazzari, S.M., Hubbard, R.G., Petersen, B.C., 1988. Financing constraints and corporate investment. Brook. Pap. Econ. Act. 1, 141–206.

Frankel, J.A., Rose, A.K., 1996. Currency crashes in emerging markets: an empirical treatment. J. Int. Econ. 41, 351–366.

Fresard, L., 2010. Financial strength and product market behavior: the real effects of corporate cash holdings. J. Financ. 65, 1097–1122.

Harford, J., Mansi, S.A., Maxwell, W.F, 2008. Corporate governance and firm cash holdings in the US. J. Financ. Econ. 87, 535–555.

Hirth, S., Viswanatha, M., 2011. Financing constraints, cash-flow risk, and corporate investment. J. Corp. Finan. 17, 1496–1509.

Ivashina, V., Scharfstein, D., 2010. Bank lending during the financial crisis of 2008. J. Financ. Econ. 97, 319–338.

Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeover. Am. Econ. Rev. 76, 323–329.

Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. J. Financ. Econ. 3, 305–360.

Joh, S.W., 2003. Corporate governance and firm profitability: evidence from Korea before the economic crisis. J. Financ. Econ. 68, 287–322.

Kaminsky, G.L., Reinhart, C.M., 1999. The twin crises: the causes of banking and balance-of-payments problems. Am. Econ. Rev. 89, 473–500.

Karpuz, A., Kim, K., Ozkan, N., 2019. Employment protection laws and corporate cash holdings. J. Bank. Financ. 111, 105705.

Keynes, J.M., 1936. The General Theory of Employment, Interest, and Money. Macmillan, London.

Khurana, I.K., Martin, X., Pereira, R., 2006. Financial development and the cash flow sensitivity of cash. J. Financ. Quant. Anal. 41, 787–807.

Kim, C.-S., Mauer, D.C., Sherman, A.E., 1998. The determinants of corporate liquidity: theory and evidence. J. Financ. Quant. Anal. 33, 335–359.

King, R., Levine, R., 1993. Finance and growth: Schumpeter might be right. Q. J. Econ. 108, 639–671.

Kusnadi, Y., Wei, K.C.J., 2011. The determinants of corporate cash management policy: evidence from around the world. J. Corp. Finan. 17, 725–740.

Laeven, L., Valencia, F., 2008. "Systemic Banking Crises: A New Database," IMF Working Paper. International Monetary Fund, WP/08/224.

Lee, B.S., Suh, J., 2011. Cash holdings and share repurchases: international evidence. J. Corp. Finan. 17, 1306–1329.

Levine, R., Servos, S., 1998. Stock markets, banks and economic growth. Am. Econ. Rev. 88, 537–558.

Loncan, T., 2020. Foreign institutional ownership and corporate cash holdings: evidence from emerging economies. Internat. Rev. Finan. Anal. 71, 101295.

Luo, M., 2011. A bright side of financial constraints in cash management. J. Corp. Finan. 17, 1430–1444.

McLean, D., 2011. Share issuance and cash savings. J. Financ. Econ. 99, 693–715.

McLean, R.D., Zhang, T., Zhao, M., 2010. How do Firms Issue Shares? Evidence from Around the World. unpublished manuscript. University of Alberta.

Mercatanti, A., Mäkinen, T., Silvestrini, A., 2019. The role of financial factors for European corporate investment. J. Int. Money Financ. 96, 246–258.

Mitton, T., 2002. A cross-firm analysis of the impact of corporate governance on the east Asian financial crisis. J. Financ. Econ. 64, 215–241.

Mitton, T., 2006. Stock market liberalization and operating performance at the firm level. J. Financ. Econ. 81, 625–647.

Newey, W.K., West, K.D., 1987. A simple positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica 55, 703–708.

Opler, T., Pinkowitz, L., Stulz, R., Williamson, R., 1999. The determinants and implications of corporate cash holdings. J. Financ. Econ. 52 (1), 3–46.

Phan, H.V., Nguyen, N.H., Nguyen, H.T., Hegde, S., 2019. Policy uncertainty and firm cash holdings. J. Bus. Res. 95, 71–82.

Rajan, R., Zingales, L., 1998. Financial dependence and growth. Am. Econ. Rev. 88, 559–573.

Reinhart, C.M., Rogoff, K.S., 2011a. The forgotten history of domestic debt. Econ. J. 121, 319–350.

Reinhart, C.M., Rogoff, K.S., 2011b. From financial crash to debt crisis. Am. Econ. Rev. 101, 1676–1706.

Riddiough, T.J., Wu, Z., 2009. Financial constraints, liquidity management and investment. Real Estate Econ. 37, 447–481.

Sasaki, T., Suzuki, K., 2019. Bank health and cash holdings: evidence from a bank-centered financial market. Pac. Basin Financ. J. 57, 101195.

Shleifer, A., Wolfenzon, D., 2002. Investor protection and equity markets. J. Financ. Econ. 66, 3–27.

Subramaniam, V., Tang, T.T., Yue, H., Zhou, X., 2011. Firm structure and corporate cash holdings. J. Corp. Finan. 17, 759–773.

Tong, Z., 2011. Firm diversification and the value of corporate cash holdings. J. Corp. Finan. 17, 741–758.

Tong, H., Wei, S., 2008. "Real Effects of the Subprime Mortgage Crisis: Is it a Demand or a Finance Shock?" IMF Working Paper. International Monetary Fund and Columbia Business School, WP/08/186.