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The relationship between firm financial distress, firm life cycle and firm cash holdings of non-financial listed Vietnamese companies

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Abstract: The body of research on the connection between cash holdings, financial trouble and the life cycle of a corporation is still ambiguous. Panel data and the generalised least squares (GLS) method have been used to explore the association between these parameters. We discover that businesses will hold less cash in the beginning phases and more cash as they move towards the mature stage. Financial trouble is more likely to affect businesses throughout their start-up and expansion phases than during their mature phase while companies in financial trouble will have less cash on hand. Moreover, across the life-cycle stages, there are significant differences between financial distress and the level of cash, including observed and target cash, target cash determinants and cash value. Our research adds to the body of knowledge on corporate governance, particularly in the areas of firm life cycle theory and corporate policy.

Keywords: cash holdings; firm life cycle; financial distress.

JEL codes: G33, G34, P33.

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1 Introduction

While a large number of businesses have prospered over the past 60 years, others have also collapsed as a result of both internal and external forces. In the economics and finance researches, there is a variety of financial distress and insolvency prediction models that are intended in order to better comprehend the phenomena known as financial hardship (Inekwe et al., 2018). Many studies on financial distress have been conducted recently (Altman, 1968; Taffler, 1983), with the aim of creating more correct assessments and models to anticipate insolvency and bankruptcy issues for distressed businesses. The companies that are more able to declare bankruptcy are those with weaker profitability, a smaller market capitalisation, greater debt, lower historical stock market returns, less cash on hand, historical stock return volatility, increased book to market ratios and reduce price per share of company (Campbell et al., 2008). The primary reasons for distress in industrialised nations may be a decline in the industry’s predicted market for goods and technology uncertainties (Sudarsanam and Lai, 2001). Asset

growth, loan loss reserves, the cost to income ratio and the equity to total assets are a few characteristics that affect bank distress; nevertheless, there is little evidence to suggest whether or not the impact of macroeconomic variables is considerable (Zaki et al., 2011). Additionally, CSR is anticipated to lessen financial pain by benefiting investors and society (Becchetti et al., 2012). By contrast, the positive correlation between the interest rate on short-term treasury bills and inflation is witnessed, according to research by Ninh et al. (2018) that looks at a number of factors which have a negative impact on financial distress in Vietnamese businesses from 2003 to 2016. These factors include solvency, profitability, asset productivity, the market value of equity and financial liquidity. A corporation will experience financial difficulty if its EBITDA in two years continuously is less than its stated expenses payable (Asquith et al., 1994). If a company's EBITDA is less than its accumulated expenses for three years in a row, it is said to be in financial distress (Boubaker et al., 2020).

In recent finance literature, the subject of corporate cash management has received in-depth analysis. We make a number of contributions, and prior research has suggested that cash management can play a variety of roles, including avoiding debt (Ali et al., 2021; Chen et al., 2020a); satisfying every business need (Augustine and Jacob, 2017); enhancing performance (Alnori, 2020; Le et al., 2020; Wu et al., 2021); and maximising growth opportunities (Qin et al., 2020). A great degree of money management is the key to overcoming the financial risk and governance difficulties because shortfall or excess corporate money holdings could cause organisations to be concerned about risk and uncertainty (Chen et al., 2020a). Large cash reserves are specifically necessary for financial flexibility to compete successfully and achieve growth, strength and an improved financial performance (Ali et al., 2021; La Rocca and Cambrea, 2019), because having large sums of cash on hand and cash equivalents that can be easily converted to money ensures a sufficient amount of liquidity for investment or distribution to shareholders. Additionally, recent financial papers have examined the impact of the board of directors (Hu et al., 2020; Mun et al., 2020), company governing procedures, internal control quality (Seifert and Gonenc, 2018) and social trust (Dudley and Zhang, 2016) on cash management. Additionally, the organisational practices related to environmental issues have been discussed in a number of earlier works. For instance, the studies by Huang et al. (2019) and Benjamin et al. (2020) discuss chemical release and the influence of pollution on a company's cash flow (Tan et al., 2021). Existing literature attests to the importance of some cultural and economic factors, including cultural factors (Orlova, 2020) and geopolitical risk (Wang et al., 2021); oil price uncertainty (Zhang et al., 2020); political risk (Xu et al., 2016); the danger of the uncertain tax (Hanlon et al., 2017); and the risk of uncertain economic policy (Le et al., 2020).

Although there has been substantial investigation on the connection between cash management and financial risk, it is important to keep in mind that different business-specific factors, such as the firm life cycle, may alter this relationship. As a result, there are relatively few papers on this subject that have been published to date. This research paper aims to fill the gap by analysing how factors like firm life cycle and financial instability may affect cash management. Therefore, the aim of this study is to address the following questions:

'1 What happens to the cash holdings when a company falls into financial distress?

2 Do the cash holdings vary during different periods of business stages?

3 What stage of business cycle has the most likelihood of financial distress?'

To start, the research by Le et al. (2020), on which our study is based, examines how financial adversity affects cash holdings. Our study focuses on how financial distress affects cash holdings and then builds on the author's findings by extending the financial hardship argument to consider how the life cycle of a company affects cash holdings. This research will provide professors, associate professors and other academics with new theories. Second, we provide evidence that the firm's life cycle and financial distress can have an impact on cash holding decisions. This will help the company's board of directors and outside investors to pay more attention to these two factors, and the managers will be aware of where their company is in the life cycle.

This paper is organised with six sections as follows: The introduction is displayed in Section 1. The literature review regarding the effects of financial distress and the business life cycle on firm decisions regarding cash holding is presented in Section 2. Section 3 discusses the variables used, the methodology of the study, while Section 4 provides the empirical analysis and robustness testing. The discussion is concluded in Section 5 and Section 6 is about the limitations.

2 Literature review

2.1 Financial distress theory

Financial distress is defined as a company's inability to meet its financial obligations, including debt interest payments, due to a lack of liquidity (Gilson, 1990). It also includes failing to meet contractual debt obligations and having insufficient cash flow to meet its financial obligations (De Vito and Gómez, 2020). Due to liquidity constraints and restrictive loan commitment terms, companies in financial distress are forced to reduce or stop paying dividends (Alzoubi, 2019). According to research (Beheshtinia and Nagarajan, 2019) on financial crisis predicting in Pakistan prior to, throughout and following the financial crisis, the model's capacity to forecast financial distress decreases over difficulty time and it increases when the firm's credit rating declines. The study by (Orlova and Sun, 2018) examines the role of some country-specific factors during the different economic times on affecting financial distress.

2.2 Firm-life cycle theory

Four unique life cycle stages were discovered by previous management science research: introduction, growth, maturity, decline and shake-out (Gort and Klepper, 1982; Miller and Friesen, 1984; Dickinson, 2011). The introduction phase of a corporate life cycle is characterised by unpredictability in income flows and costs, great degrees of managerial opportunism in terms of financing and taking risks (Miller and Friesen, 1984), while profit maximisation and significant investments are all characteristics of the growth stage (Spence, 1981). A movement towards efficiency maximisation, less uncertainty, decreased investment expenditure and increased dividends to stockholders and stronger administration mechanisms occur as a company reaches its maturity (Filatotchev et al., 2006).

In the mature stage, firm size and age both grow, and a company is more likely to reduce debt financing, leading to negative cash flows relating to financing activities (Dickinson, 2011). To simulate the phases in the life cycle of a corporate, we predominantly employ the model invented by Dickinson (2011). According to Dickinson (2011), firm's life cycle could be indicated clearly by its cash flows which track the development of a whole financial situation as opposed to depending on separate variables (such as sales growth, firm size, or age) that makes assumptions about the future. We mostly utilise the Dickinson (2011) model as a stand-in for a firm's life cycle phases. Rather than relying on a single data point (such as sales growth, firm size or age) that implies a uniform distribution across phases, Dickinson (2011) contends that the patterns of a company's cash flow are a fair stand-in for its life cycle stages. In conclusion, Dickinson (2011) shows that firm's life cycle phases are a function of its cash flow instead of its age by analysing operating, investing and financing operations cash flows. Major life cycle proxy used in the literature on dividends is the value calculated by dividing retained earnings by stockholders' equity (RE/TE), which shows monotonic relationship with a company's inclination to pay dividends. Accordingly, companies with identical RE/TE ratios should have the same payout propensities (DeAngelo et al., 2006).

The shake-out stage is characterised by liquidation of assets, liquidity levels and factors proving going-concern, a decreasing and perhaps negative cash flow of operation and debt reimbursement, whereas the decline stage is characterised by a decline in growth rates, expenditures on investing, innovation, and the level of efficiency. Shahzad et al. (2019) looked at how the firm's life cycle phase affects its financial decisions and found that the pecking order hypothesis more accurately describes funding decisions during the mature stage than the growth stage by comparing the two stages of development: growth and maturity. Companies should alter their capital structures based on the benefits and costs of debt financing at various stages of their life cycles.

2.3 Cash holdings

Macroeconomic (Anand et al., 2018), political (Xu et al., 2016), cultural (Orlova, 2020), pandemic (Turnea et al., 2020), business strategy (Chen et al., 2020b) and board characteristics are all things to think about when it comes to cash holdings in developed countries (Atif et al., 2019). Enterprises tend to reserve more cash when faced with rising policy uncertainty (Xu et al., 2016), operating in a tax-provoked unpredictability environment (Hanlon et al., 2017), or experiencing the effects of air pollution (Tan et al., 2021). Tan et al. (2020) demonstrate that firms undergoing logistics service standardisation manage less cash than other organisations due to the efficiency of the reform. The results show an inverted U-shape, which makes the company's cash reserves somewhat volatile due to geopolitical risk and uncertain oil prices (Zhang et al., 2020). Studies whose datasets include the social responsibility (precautionary) motivation of cash reserves also mention consulting company variables such as organisational waste disclosure (Benjamin et al., 2020), firm performance (La Rocca and Cambrea, 2019), land rights (Hu et al., 2020), internal controls, risk management (Chen et al., 2020a), CEOs' educational background (Mun et al., 2020) and fault lines supervised in senior managers.

Numerous publications focus on the influence of economic and financial elements on the cash holdings of corporations in connection to the data gathered in emerging countries. The literature now devotes a great deal of time to studying macroeconomic

variables. According to Anand et al. (2018), the GDP growth and oil price shocks are what create the positive association with corporate cash balances, whilst the exchange rate, long-term bond rates and short-term bond rates are what create the negative relationship. Additionally, Le et al. (2020) examine the effects of six distinct groups of factors on corporate cash holdings, with the macro environment and financial risk making up two of these groups. This suggests that factors like technological advancements, state bank lending interest rates, the global financial crisis, political instability and tax policies are relevant when determining whether managers decide to hold more or less cash. The results are in line with the theories of agency, impression management and legitimacy, which claim if the company asserts more risk disclosure, it will reserve less (Haj-Salem and Hussainey, 2021). A number of follow-up research studies use data from different nations to build and expand the dataset after the papers that concentrate on a single region. Firms often conserve more money when faced with incremental policy risks that have a negative economic impact (Demir and Ersan, 2017). Orlova (2020) recently expands research on the effects of country-level factors on three aspects of cash administration, showing a positive association between macroeconomic and cultural variables including individualism, long-term orientation, and GDP per capita and cash balances. By proving that state firm-level and country-level governance are negatively and significantly associated to corporate cash holding, whether they are looked at independently or combined, Seifert and Gonenc (2018) set their paper apart from prior studies. Dudley and Zhang (2016) examine how informal institutions play a part in the correlation between society trust and company's cash levels. They discover that trust impose a favourable impact on cash holding choices because it reduces pressure from outside investors on insiders to release capital in environments with high levels of social trust. According to Machokoto et al. (2021), peer effects and firm cash holdings are more significant and pronounced in some nations with more advanced capital markets, stronger national administration and more established legal systems. The literature that is available now, which focuses on financial concerns and drivers of cash holdings, places a lot of emphasis on the post-crisis period (after 2007), during which the dataset of the relevant firms is collected. When evaluating large-scale elements, such as the macrosystem and financial risk, a number of important factors are taken into consideration (Le et al., 2020). In addition, broader business and governmental governance is examined, including risk disclosure (Haj-Salem and Hussainey, 2021), control level (Hu et al., 2020) and national logistics reform (Tan et al., 2020). Additionally, it is believed that environmental issues including trash disclosure (Benjamin et al., 2020), air pollution (Tan et al., 2021) and the COVID 19 pandemic (Turnea et al., 2020) are becoming more well-known due to the significance of corporate social responsibility. Some articles have sought to explain the determinants of cash holdings, which range from country-level to firm-specific variables, using the benefit of a large dataset spanning several years, including the pre-crisis period. The external environment's risks include uncertainties such as economic policy uncertainty, policy insecurities, internal control and risk management (Chen et al., 2020a), geopolitical risks (Wang et al., 2021), oil price uncertainty (Zhang et al., 2020), political risks (Xu et al., 2016) and tax feelings of inadequacy. Additionally, some authors place a significant emphasis on regional and societal variables like trust (Dudley and Zhang, 2016), macroeconomic factors like exchange rates, stock market indices, oil price shocks, GDP growth and cultural determinants like individualism, long-term orientation and uncertainty avoidance (Orlova, 2020). Some studies about determinants of chemical releases also include other factors, such as the CEO's educational

background (Mun et al., 2020), board faultiness (Xu et al., 2021), internal control (Chen et al., 2020a), peer effects (Machokoto et al., 2021), country and firm-level governance (Seifert and Gonenc, 2018), institutional determinants (Orlova and Sun, 2020; Huang et al., 2019).

Even though the majority of the literature mentioned goes through strict and verified processes for each variable to ensure that the results are reliable and trustworthy for further implications, there are still some limitations to overcome, particularly a lack of available data in terms of sample firm sectors or insufficient time, and the unexpected impact of subjectivity when analysing data. Exploring the gaps in these studies lays the groundwork for reducing unfavourable outcomes. According to Hu et al. (2020), there is a vacuum in the literature because corporate financial reports and papers that use cash as an object do not just examine cash holdings; they also study their value. When examining the educational histories of high-level managers, Mun et al. (2020) identify the following research limitation: it is difficult to distinguish between CFOs and typical executives, thus the research does not analyse the impact of the CFO's educational history. Additionally, the same survey finds that CEO credentials are restricted to a major in academia and a college degree, with little regard given to other professions such as the humanities or law. Despite the fact that the author has already taken CEO age into account throughout numerous regressions, this study has another fault in that the circumstances are not well addressed. Wang et al. (2021) claim that their study only looks at how geopolitical risks affect Chinese companies without expanding the dataset to include sources from around the world and that more industries, such the automobile sector, should be studied. Further research should examine the effect of environmental performance on cash management for small or private businesses because the study's sample organisations (Huang et al., 2019) only comprise major publicly traded companies. Turnea et al. (2020) concur that the study's shortcoming is that more companies may be added and their differences could be examined. There is a need for more research on the factors that determine cash holdings, and this can be filled by taking factors like cross-listing of companies into account, corporate spin-offs, corporate governance elements, business group connections, and investor protection levels (Maheshwari and Rao, 2017). Since the data was only collected from S&P 500 companies over a six-year period, the research sample companies in the waste disclosure research (Benjamin et al., 2020) are largely major corporations, and the findings are probably not applicable to small and medium businesses. Because comparing the differences in each country's environmental regulations would have been too big a challenge, the authors of this study did not incorporate comprehensive governance and environmental regimes from every country. Given a data shortage brought on by the upcoming presidential election, which may have an impact on corporate disclosure and cash holdings, Haj-Salem and Hussainey (2021) acknowledge that the inclusion of subjectivity in the manual content analysis may have a negative impact on the research's precision and robustness, despite the authors' knowledge of the availability and reliability of the disclosure scores.

2.4 Financial distress and cash holdings

The goal of bankruptcy prediction models in the economics and finance literature is to help us understand the phenomenon known as financial distress (Huang et al., 2017;

Inekwe et al., 2018). Two most popular kinds of methods measuring credit risk in researching are:

1 accounting-based models

2 market-based models.

First, accounting-based models use financial statement analysis to generate a score that separates businesses in trouble from those that are not (Boubaker et al., 2020; ElBannan, 2021). Additionally, market-based models examine how a firm's financial difficulties are impacted by market conditions. The accounting-based models of Katz and Rosen (1985) and Queen and Roll (1987) are criticised for using outdated and retroactive data from financial reports. As a result, a different technique is employed in the forecasting model that incorporates market-based information content. The method used by Black and Scholes (1973) and Merton (1974) to calculate default probability is known as the Merton distance to default (DD) model. The primary focus of this model is on the connection between a market-based strategy and the capacity to forecast company default, and in this context, the default is defined as the value that asset market volatility leads to a decline in asset prices below the debt value. The expected default frequency (EDF) from Crosbie and Bohn's (2019) global database of distressed businesses has increased the accuracy of Moody's KMV model, which was later introduced in 2003. According to Benmelech et al. (2019), retail agglomeration economies, which weaken non-bankrupt businesses and increase bankruptcy and financial distress, particularly during economic downturns or financial crises, impose negative externalities on surrounding firms that are still operating.

2.5 Hypothesis development

Companies at the introduction stage, which is comparable to being in the cradle stage, are still searching for distinct competitive advantages in order to carve out a lucrative niche market for themselves (Kallunki and Silvola, 2008). Due to substantial public investment and low to negative operational revenue from the lack of a market share, such organisations will experience net capital outflows (Tian et al., 2015). Firms are largely unstructured, have a poor reputation, and have restricted access to outside funding during the introduction stage. Early-stage corporations will employ all of their available cash to cover their operating expenses. Because they are unlikely to take out loans at this point, firms are not required to hold a lot of cash at the beginning because they are expected to use all available cash to pay their debts.

Because cash is the cheapest type of financing, as a business expands, it will invest all of its resources in the projects it has available. As a result, it will start funding its initiatives with all of the cash it has available before looking for other choices. As businesses in the growth stage start to diversify their product mix and emphasise their unique strengths, their revenue will start to climb (Tian et al., 2015). Because of their quick growth, these businesses usually need more capital than they can generate internally (Lemmon and Zender, 2010). Alzoubi (2019) claims that investment opportunities are abundant as organisations move from the non-profit start-up stage to the growth stage. However, based on the financial hierarchy hypothesis, firms will prefer to use low-cost, domestically generated capital over external borrowing. Businesses will

concentrate all of their resources to these opportunities. Therefore, it is not currently expected of corporations to hold cash.

Holding significant sums of cash has a high opportunity cost because the company will be able to access financial markets at a fair cost, necessitating them to rely on external sources of financing rather than cash. As a company matures, the quantity of capital necessary grows. Investment choices have a greater effect on company value in companies with significant cash reserves. Companies with higher cash holdings are frequently better positioned to seize investment opportunities, which increases their worth in the eyes of shareholders (Elbannan, 2021).

Therefore, we suggest Hypothesis 1 as follows:

H1 Less cash will be on hand while a company is just getting started. Manufacturers' cash holdings will rise when they finish the introduction phase and move to the mature phase.

Therefore, we suggest Hypothesis 1 as follows:

$$Cash_{i,t} = \theta_0 + \theta_{1-4} \times Firm\ life\ cycle_{i,t} + \theta_5 \times Control\ variables_{i,t} \quad (1)$$

where

$Cash_{i,t}$ firm cash holdings of firm (i) at time (t)

$Firm\ life\ cycle_{i,t}$ firm life cycle of firm (i) at time (t)

$Control\ variables_{i,t}$ control variables of firm (i) at time (t).

According to Faff et al. (2016), companies are more susceptible to financial distress during their introduction and growth phases, so they tend to increase their debt issuance resulting in decreasing corporate liquidity, which also increases the possibility of financial risk. On the other hand, financial crisis and bankruptcy are more likely in the region because of the economic and political insecurity, which shows that, during the early stages of a business when the retained earnings balance is zero or earned equity capital is not high, financial difficulty is highly likely to occur. The contrasting trend is true with matured enterprises where the ratios of retained earnings to total assets are higher leading financial difficulties are less. Therefore, we suggest Hypothesis 2 as follows:

H2 Financial trouble is more likely to affect businesses in the launch and growth phases, while it is less likely to affect businesses in the mature phase.

As a result, we suggest the following for the research model (2):

$$Financial\ distress_{i,t} = \theta_0 + \theta_{1-4} \times Firm\ life\ cycle_{i,t} + \theta_5 \times Control\ variables_{i,t} \quad (2)$$

where

$Financial\ distressi_{,t}$ firm financial distress level of firm (i) at time (t)

$Firm\ life\ cycle_{i,t}$ firm life cycle of firm (i) at time (t)

$Control\ variables_{i,t}$ control variables of firm (i) at time (t).

Numerous studies look at how businesses react to poor performance and trouble. Using Z-scores from Taffler (1983), Sudarsanam and La (2001) divided the turn-about

techniques into operational, financial, managerial and asset reorganising tactics as well as assessed the impact of these tactics on company recuperation. According to our argument, corporations in financial crisis maintain less cash than they would normally because of liquidity restrictions and limited clauses in legally compulsory debt covenants forcing them to lower or forgo dividend payments. Therefore, we suggest Hypothesis 3 as follows:

H3 Companies in financial trouble will have less cash on hand.

For research model (3), we suggest the following formula:

$$Cash_{i,t} = \theta_0 + \theta_1 \times Firm\ financial\ distress_{i,t} + \theta_2 \times Control\ variables_{i,t} \quad (3)$$

where

$Cash_{i,t}$ firm cash holdings of firm (i) at time (t)

$Financial\ distress_{i,t}$ firm financial distress level of firm (i) at time (t)

$Control\ variables_{i,t}$ control variables of firm (i) at time (t).

3 Methodology

3.1 Data

Our sample is collected from the Vietstock database. Specifically, we take quarterly data of all the listed companies on HOSE and HNX in Vietnam from 2011 to 2021. Similar to previous finance research (Phillips et al., 2003), financial and utilities institutions are excluded from our sample. Data is winsorised at the 1% level. After eliminating missing values and outliers, our dataset includes 241 companies in Vietnamese stock markets which results in 10,379 firm-year observations in our final sample. Note that, by construction, our study is based on the panel data, and regression has been employed for investigating how corporate cash holdings is affected by the corporate life cycle and corporate financial crisis. The generalised least squares (GLS) model is the most suitable model among pooled ordinary least squares, fixed effect and random effect models as suggested by both the likelihood ratio and Hausman tests (Arafat et al., 2013; Aruna and Warokka, 2013; Chaker et al., 2012; Fetais et al., 2019). We applied F-test, Breusch-Pagan test and Wooldridge test to ensure that the model does not have autocorrelation and serial correlation problems. We also replaced the dissimilar measurements of the corporate lifecycle, firm cash holdings as well as firm financial distress to solidify the results.

3.2 Cash holdings measurement

There are several different approaches and a long history of measuring corporate cash balances. According to Huang et al. (2019) and Xu et al. (2016), the cash holdings of businesses are calculated as cash to the book value of assets ratio or cash and cash equivalents to total assets ratio (Mun et al., 2020; Mortal et al., 2016; Wang et al., 2021). To illustrate the corporate cash management level, the authors of this study use the cash

ratio (Anand et al., 2018; Zhang et al., 2020) and the firm's target ratio of cash (Orlova, 2020).

According to Harford et al. (2008), Kuan et al. (2012), Huang et al. (2019) and Xu et al. (2016), cash holding is calculated as the cash to total assets ratio minus cash. Following Hu et al. (2020), Mun et al. (2020) and Mortal et al. (2016), in order to test the robustness of the results, we have replaced another cash holding proxy, is evaluated as the ratio of cash equivalents with the total of cash to net assets, and cash equivalents and the natural logarithm of cash (Tan et al., 2020).

3.3 Financial distress measurement

A corporate financial crisis is characterised by four distinct variables: failure, default, insolvency and bankruptcy. According to that, failure implies that, either the corporation's revenues are not enough to cover its expenses, the obtained return on investment rate is lower than the returns on comparable investments. In contrast to a legal default, which happens when a corporation misses normal loan repayment deadlines, a technical default when a company infringes a debt covenant. Insolvency is described as the inability to pay off debts due to a cash flow problem. The phrase 'bankruptcy' denotes a company's financial difficulties, which call for a court-initiated declaration (Habib et al., 2020). When a corporation is experiencing an intractable financial crisis, bankruptcy is the next step (Volkov et al., 2017). Although there are many alternative ways to gauge financial distress, in this study we use the Z-score, O-score and the ZM-score model.

To measure the financial distress, we follow Boubaker et al. (2020) and use accounting-based measures to calculate FDR, including O-score (*FDR2*) which was originated from Ohlson (1980) and developed by Griffin and Lemmon (2002), ZM-score (*FDR3*) of Zmijewski (1984). A higher Z-score represents a lower FDR, whereas a higher O-score or ZM-score mean a higher FDR.

$$O-score = -1.32 - 0.417\times\log(TA) - 1.43\times\frac{WC}{TA} + 0.076\times\frac{CL}{CA} - 1.72\times TL_{dummy}$$
$$-2.37\times\frac{NI}{TA} - 1.83\times\frac{FFO}{TL} + 0.285\times NL_{dummy}$$
$$-0.521\frac{NI(i,t) - NI(i,t-1)}{|NI(i,t)| + |NI(i,t-1)|'}$$

where *WC* is working capital (= current assets – current liabilities), *TA* is total assets, *CA* is current assets, *CL* is current liabilities, *TL* is total liabilities, *FFO* is cash flows from financing activities, *NL* is net loss, *NI* is net income.

$$ZM-score = -4.336 - 4.513\times\frac{NI}{TA} + 5.679\times\frac{TL}{TA} + 0.004\times\frac{CA}{CL},$$

where *NI* is net income, *TA* is total assets, *TL* is total liabilities, *CA* is current assets, *CL* is current liabilities.

To ensure the robustness of our results, we base them on two other methods for financial distress measurement from Al-Hadi et al. (2017), utilised in the finance and

accounting research of Berger et al. (1999) model (*DIS*1) and Altman (1968) model (*DIS*2):

$$DIS1 = (0.715 \times Receivables + 0.547 \times Stocktaking + 0.535 \times Net\ PPE) / Total\ assets$$

$$DIS2 = (Cash + 0.715 \times Receivables + 0.547 \times Stocktaking + 0.535 \times Net\ PPE) / Total\ assets$$

3.4 Firm-life cycle measurement

We define a corporate life cycle as a dummy variable, which depends on the firm's cash flows' patterns; the stages can be identified as follows using the methods of Dickinson (2011). According to Dickinson (2011), the firm life phases are categorised into five stages based on OCF – operating cash flow, ICF – investing activities cash flow and FCF – financing activities cash flow: Introduction (Int1) when OCF, ICF are negative and FCF is positive; growth (Gro1) when the firm experiences are positive OCF, negative ICF and positive FCF; mature (Mat1) when its OCF is positive, ICF and FCF are negative, decline (Dec1) if OCF, ICF and FCF are all negative, shake-out when the firm's cash flow cannot categorise into any above stages. Nevertheless, retained earnings is another way to divide the corporate life cycle (DeAngelo et al., 2006; Hasan and Habib, 2017). Companies have the ratios of RE/TA as well as RE/TE are lower which are younger and have a tendency to be more susceptible to financial hardship, while firms have the ratios of RE/TA as well as RE/TE are higher which are more developed and well-established. As a result, the RETA classification (Int2; Gro2) and the RETE classification (Gro3; Mat3) are also used in this study as other proxies for the firm's life cycle phase, where companies in the growth and decline phases are prone to possessing low earned capital ratios while companies in the mature phase have higher earned capital ratios.

3.5 Control variables measurement

We follow the previous research: Agha and Eulaiwi (2020) and Alqahtani et al. (2021) used several control variables, such as:

1 net working capital (WC; WT)

2 plant, property and equipment (PPE; PT)

3 leverage (LEV)

4 firm size (Size)

5 stock market capitalisation (SM

6 GDP

7 profitability (ROA)

8 cashflow (CF)

9 industry effects (IND).

4 Results

4.1 Descriptive statistics

The statistical result of main variables included in the research are indicated in Table 1. The mean of corporate cash holdings (Cash2) for the sample are 11.9%, which is similar to that of Jordanian firms (Alzoubi, 2019) and lower than that of the firms in the context of China (Xu et al., 2019). The mean of Cash2 is 21.14 with a standard deviation of 2.01 being similar to the study by Trung (2019) in the context of listed firms in Vietnam. The mean of Cash3 is 0.085, with a 10.91% standard deviation which being to the research by Elbannan (2021) who reported 0.07 and 2% respectively. The average of FDR2, FDR3, FIS1, DIS2 are –9.63, –1.47; 0.42; 0.51 with a standard deviation 1.83; 1.27; 0.12; 0.59, respectively. This report is lower than Arab listed firms of Elbannan (2021) who reports an average of 3.22 and standard deviation 8.565. The mean for firm size is 25.61, which means that there is a decent combination of large and small firms in our sample. Moreover, the mean (1.47) leverage ratio (LEV) and the mean (1.6%) return on assets (ROA) indicate that some firms in the sample have great opportunities to grow.

4.2 Firm life cycle and firm cash holdings

Table 2 shows the firm life cycle and firm cash holdings regression results which show a negative link during the introduction phase and an opposite relationship during the mature stage. These results are similar to the results of Drobetz et al. (2015) as they found that companies, at their earlier stages, hold less cash and support the hypotheses one, which suggests that firms should use their cash to meet their financial needs at their early stages including introduction and growth, and will not hold cash when firms at their mature stages would hold abundant cash to call upon the faith of the investors. Larger firms are better able to enter financial markets to raise funds externally is the reason why our result shows the negative correlation between cash holding and size of firm, thus they typically retain less cash. This is not different from the research results of Kim et al. (1998), Almeida et al. (2004), Opler et al. (1999), Ferreira and Vilela (2004) and Ozkan and Ozkan (2004). Cash holding is significantly positively related to firms' profitability; profitable firms depend more on internal financing. The relationship between leverage and cash holding is negative, which is akin to Kim et al. (1998), Faulkender (2002), Ferreira and Vilela (2004) and Ozkan and Ozkan (2004). The adjusted R-square is 40.28%, representing the model's strong explanatory ability; the overall model is significant with an F statistic of 50.04. The GLS model is the most suitable model among pooled ordinary least squares, fixed effect and random effect models as suggested by both the Likelihood ratio and Hausman tests (Achim, 2017; Tabsh, 2015; Talukdar, 2012; Yusuf, 2003). We applied F-test, Breusch-Pagan test, Wooldridge test to ensure that the model does not have autocorrelation and serial correlation problems (Bahl et al., 2019). To evaluate the robustness of our main regression results, we use variables Cash3 (Table B1), Cash4 (Table B2) as dependent variables and also find the same results presented in Table 2.

Table 1 Variables description

Variable	*N*	*Mean*	*Std. dev.*	*Min*	*Max*
		Cash measurement			
Cash2	10,379	0.1196329	0.2510227	0.0000781	6.521523
Cash3	10,379	24.13459	2.016643	15.56591	31.04179
Cash4	10,379	0.0852304	0.1091655	0.0000781	0.8670482
		Financial distress measurement			
FDR2	10,379	–9.63326	1.837684	–36.32247	0.799
FDR3	10,379	–1.472268	1.267992	–5.277598	3.447177
DIS1	10,379	0.4221717	0.1230612	–0.4424742	0.6773492
DIS2	10,379	0.5073619	0.588582	–0.4399201	0.903949
		Firm life cycle measurement			
Int1	10,379	0.1220006	0.327312	0	1
Gro1	10,379	0.1173263	0.3218337	0	1
Mat1	10,379	0.1916485	0.3936286	0	1
Shak1	10,379	0.3627298	0.4808252	0	1
Int2	20,586	0.4850384	0.4997882	0	1
Gro2	20,586	0.3822015	0.4859372	0	1
Gro3	20,586	0.4372389	0.4960575	0	1
Mat3	20,586	0.203002	0.4022438	0	1
		Control variables			
WC	10,379	6.55E+11	3.18E+12	–2.81E+13	9.47E+13
WT	10,379	0.2160239	0.2285795	–0.5652292	1.000191
PPE	10,379	8.08E+11	4.03E+12	2306956	1.27E+14
PT	10,379	0.2503878	0.2237456	8.28E-06	0.9764196
LEV	10,379	1.473633	2.134022	–95.63686	133.9136
Size	10,379	25.60756	1.686278	16.20448	31.65016
SM	10,379	2895495	1.45E+07	2121.584	3.31E+08
GDP	10,379	0.1595565	0.1190071	–0.0858479	0.604853
ROA	10,379	0.0160238	0.0270532	–0.2714045	0.646877
CF	10,379	0.0004768	0.0899519	–1.16895	0.7651821
IND	10,379	0.1162791	0.3205642	0	1

4.3 Firm life cycle and financial distress

Table 3 shows firm life cycle and financial distress regression results. It shows that the firms introduction and growth phases are positively associated with financial crisis while companies experience the negative correlation with FDR2 in their mature and decline phases. In particular, the coefficients of Int1 with dependent variable FDR2 are 0.321*** (column 1) and 0.0129 (column 4), the coefficients of Gro1 with dependent variable FDR2 are 0.217*** (column 1) and 0.0966** (column 4). On the other hand, the coefficients of Mat1 are –0.341*** (column 1) and –0.152*** (column 4), the coefficients of Shak1 are –0.267*** (column 1) and –0.116*** (column 4). Furthermore,

FDR2 is positively associated with Int2, Gro2, Gro3 ($p < 0.1$), although negatively associated with Mat3 ($p < 0.05$ or better). The adjusted R-sq. is 67.99%, representing the model's strong explanatory ability; the overall model is significant with an F statistic of 10.99. To testify to the robustness of our main regression results, we use variables FDR3 (Table B3), DIS1 (Table B4), DIS2 (Table B5) as dependent variables to measure the financial distress and also find the same results presented in Table 3.

Table 2 Firm life cycle and firm cash holdings

	Cash2	*Cash2*	*Cash2*	*Cash2*	*Cash2*	*Cash2*
Int1	–0.0132**			–0.0112**		
Gro1	0.000408			0.000224		
Mat1	0.083**			0.0254*		
Shak1	0.00291			0.00847*		
Int2		–0.0347***			0.00196	
Gro2		–0.0239***			–0.0584*	
Gro3			–0.00572***			–0.00111
Mat3			0.0181***			0.035*
CV	No	No	No	Yes	Yes	Yes
_cons	0.0656***	0.0971***	0.0650***	0.160***	–0.0650***	–0.0616***
N	10,312	10,312	10,312	10,312	10,312	10,312
Max VIF	1.77	2.43	1.21	3.29	3.4	2.46
F-test	7.66	108.66	45.74	50.04	115.17	114.35
Adj. R-sq.	0.0372	0.2025	0.0899	0.4028	0.2454	0.2432
Hausman Chi2	29.49	67.85	204.15	102.4	164.91	122.43
Wooldridge F-test	74.786	8.578	8.584	80.801	7.341	7.338
Wald chi2	13.64	107.68	40.92	744.92	1540.21	1546.01

Note: ***p < 0.01, **p < 0.05, *p < 0.1.

Table 3 Firm life cycle and financial distress

	FDR2	*FDR2*	*FDR2*	*FDR2*	*FDR2*	*FDR2*
Int1	0.321***			0.0129		
Gro1	0.217***			0.0966**		
Mat1	–0.341***			–0.152***		
Shak1	–0.267***			–0.116***		
Int2		1.160***			0.132***	
Gro2		0.722***			0.0782***	
Gro3			0.164***			–0.00915
Mat3			–0.407***			–0.358**
CV	No	No	No	Yes	Yes	Yes
_cons	–9.462***	–10.49***	–9.487***	–6.863***	–6.100***	–5.965***
N	10,312	10,312	10,312	10,312	10,312	10,312

Note: ***p < 0.01, **p < 0.05, *p < 0.1.

Table 4 Financial distress and firm cash holdings

	Cash2	*Cash2*	*Cash2*	*Cash2*	*Cash2*	*Cash2*	*Cash2*	*Cash2*
FDR2	–0.0191***				–0.00368***			
FDR3		–0.0220***				–0.0125***		
DIS1			–0.475***				–0.389***	
DIS2				–0.404***				–0.452***
CV	No	No	No	No	Yes	Yes	Yes	Yes
_cons	–0.109***	0.0431***	0.289***	–0.122***	–0.0803***	–0.113***	0.112***	–0.129***
N	10,346	10,322	10,378	10,379	9,091	9,086	9,091	9,091

Note: ***p < 0.01, **p < 0.05, *p < 0.1.

4.4 Financial distress and firm cash holdings

Our regression results of financial distress and firm cash holdings are described in Table 4, with the specific explanation being that, during the crisis period, firms use more cash rather than saving from cash flow, which renders their cash holdings to be lower. In particular, the correlation of FDR2 with dependent variable Cash2 is –0.0191*** (column 1) and –0.00368*** (column 5). The correlation of FDR3 with dependent variable Cash2 is –0.0220*** (column 2) and –0.0125*** (column 6). In addition, the results are similar to DIS1 and DIS2, the estimated coefficients are also negative association with cash holdings, both dependent variables are statistically noteworthy at the 1% level. Therefore, our results suggest that firms in financial distress tend to keep less cash. Furthermore, the finding indicates a positive relationship between WT, Size, SM, ROA, CF, IND and Cash2, while WC, PT, LEV and GDP show a negative association with Cash2. To test the robustness of this study's main regression findings, we use variables Cash3 (Table B6), Cash4 (Table B7) as dependent variables to measure the cash holdings and also show the same results presented in Table 4.

5 Conclusions and discussion

Our research explores the influence of firm different stages and its financial distress on corporate cash policies in Vietnam from 2011 to 2021. Regarding the correlation between corporate cash holdings and firm-life cycle, firms in their early stages, including introduction and growth, will not hold much cash because they use all of their money to meet their financial needs. In these stages, firms would hold a superior proportion of cash to be capable of capturing more investment opportunities, which entices shareholders into rating these companies highly and easily calls on the faith of investors. However, when they reach their maturity, firms tend to maintain high levels of cash flow owing to the tendency towards risk-taking behaviour, which means that large companies are less likely to invest too much money at the expense of the probability of bankruptcy, thereby holding more money to minimise the potential menace of the capital market (Vidyakala et al., 2011). Additionally, the empirical observation also solidifies the influence of the firm-life cycle on corporate cash reserves. Moreover, in this study, the financial distress is measured by many models in order to ensure the robustness of the results. Firms in introduction and growth phases have a high tendency to be suffering from financial distress, which requires the firms to increase their debt issuance, because these enterprises do not get much credit for borrowing from the credit market and raising funds from investors; meanwhile, in the mature stage, the probability to be susceptible to it is lower, as mature firms can easily gain a large sum of money from the credit market or take a mortgage. Our research also investigates the relationship between financial distress and cash holdings, with the result being that firms hold less cash when facing financial distress. This is because, due to liquidity restriction, dividend payments will be significantly reduced by firms facing financial distress.

Our findings contribute to the theory of corporate governance, especially to the firm life cycle theory and corporate financial policies. The research outcome related to the relationship between corporate cash holding and firm's life cycle is consistent with the research results of Dickinson (2011), which state that risk-taking is higher in the early stages, namely introduction and growth, so firms in these stages are likely to have less cash reserves compared to the mature stage when the risk-taking is higher which creates large corporate cash flows. On the contrary, Drobetz et al. (2015) discovered that businesses maintain high levels of cash in their early and post-maturity stages and that the cash ratio gradually decreases as the firms reach maturity. They also found that the value of cash, kept by the business throughout the introduction stage and growth period, is high although it falls in later stages due to the agency issues. Similar to all the research about the financial distress, our study finds that the corporate cash reserves will decrease dramatically when the firm is facing financial distress, because they have to use all their money and sometimes borrow more money from all the financial sources according to the pecking order to pay the corporate debts.

These results have vital implications for companies in developing economies, especially the transitional economy with the analogous characteristics compared with Vietnam. The empirical evidence suggests that retaining much liquidity, by omitting dividends and gaining the equity capital, will help to prevent the likelihood of financial distress. This means the analysts specialising in finance should be careful when predicting the firm's future cash flows. Moreover, the companies in the early stages should balance between investing money into potential investment opportunities and maintaining sufficient cash reserves to overcome financial distress in a timely fashion. Additionally, regulators should not neglect the patterns of the firms' life cycle to enhance the quality of corporate financial systems and decisions related to firms' cash holdings to maximise the profits from every investing project, by selecting the appropriate time to fundraise for the investing opportunities and to reserve liquidity for the upcoming financial distress.

6 Limitations

A limitation of our investigation is that our study focuses on financial distress measured by internal factors in Vietnamese enterprises; therefore, future research should broaden the dataset into the companies in developed countries and compare between the two economies to emphasise the differences in the predictors of financial distress so that the regulators can precisely forecast the financial issues that their companies are likely to face and create suitable financial policies. Furthermore, we rely on available data, which is obtained online, due to the hesitation of companies to reveal their companies' financial operations due to the severe impact of COVID 19. Therefore, further research in the future can gather the primary databases to ensure its accuracy and the information being updated.

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Appendix A

Variable description

A1 Independent variables

Table A1 Financial distress measurement

Variable	*Definition*	*Reference*
FDR2	The O-score from Ohlson (1980): O = –1.32 – 0.407 × log(total assets) + 6.03 × (total liabilities divided by total assets) – 1.43 (working capital divided by total assets) + 0.076×(current liabilities divided by current assets) – 1.72 × (dummy variable that takes the value of one if TL is greater than TA and zero otherwise) – 2.37 (net income divided by total assets) – 1.83 × (funds from operations divided by total liabilities) + 0.285 × (dummy variable that takes the value of one if the company has had a net loss in the last two years and zero otherwise) $-0.521\times\left(\frac{NI(i,t)-NI(i,t-1)}{\lvert NI(i,t)\rvert+\lvert NI(i,t-1)\rvert}\right)$	Boubaker et al. (2020)
FDR3	The ZM-score from Zmijewski (1984): ZM = –4.336 4.513 × (net income divided by total assets) + 5.679 × (total liabilities divided by total assets) + 0.004 × (current assets divided by current liabilities)	Boubaker et al. (2020)
DIS1	Financial distress model of Berger et al. (1999) calculated as (0.715 * Receivable + 0.547 * Inventory + 0.535 * Net PPE) / Total assets)	Al-Hadi et al. (2017)
DIS2	Financial distress model of Almeida et al. (2004) calculated as ((Cash + 0.715 * Receivable + 0.547 * Inventory + 0.535 * Net PPE) / Total assets)	Al-Hadi et al. (2017)

Table A2 Firm life-cycle variable definition

Variable	*Definition*	*Reference*
Int1	Introduction: if OANCF < 0, IVNCF < 0 and FINCF > 0;	Boubaker et al. (2020), Bhattacharya et al. (2020), Hasan and Habib (2017), Faff et al. (2016) ElBannan (2021)
Gro1	Growth: if OANCF > 0, IVNCF < 0 and FINCF > 0;	
Mat1	Maturity: if OANCF > 0, IVNCF < 0 and FINCF < 0;	
Dec1	Decline: if OANCF < 0, IVNCF > 0 and FINCF ≤ or ≥ 0	
Shak1	Shake-out: the remaining firm years will be classified under the shakeout stage	
Int2, Gro2, Mat2	is measured by the earned equity proxied by the ratio of firm retained earnings to book value of total assets	
Int3, Gro3, Mat3	is the ratio of firm retained earnings to book value of total equity (RE/EQ)	

A2 Dependent variables

Table A3 Cash holdings measurement

Variable	*Definition*	*Reference*
Cash2	Ratio of cash and marketable securities to the net assets, where the net assets represent the total assets minus cash and marketable securities	Wang et al. (2021), Zhang et al. (2020)
Cash3	Log of cash ratio measured as a natural logarithm of cash plus marketable securities to net assets	Anand et al. (2018), Tan et al. (2020)
Cash4	The sum of cash and cash equivalents / non-cash assets	Hu et al. (2020), Mun et al. (2020), Mortal et al. (2020)

A3 Control variables

Table A4 Control variables measurement

Variable	*Definition*	*Reference*
NWC	Ratio of current assets minus current liabilities net of cash to total assets	Anand et al. (2018), Seifert and Gonenc (2018), Atif et al. (2019), Xu et al. (2016)
PPE	Property, plant and equipment-to-total assets	Machokoto et al. (2021)
LEV	Ratio of total debt to total assets	Demir and Ersan (2017), Xu et al. (2016a), Anand et al. (2018), Wang et al. (2021)
SIZE	Natural log of total assets	Atif et al. (2019), Machokoto et al. (2021), Wang et al. (2021), Xu et al. (2016)
GDP	The growth rate of GDP	Machokoto et al. (2021)
ROA	Ratio of net income to the total assets	Wang et al. (2021)
SM	Total stock market value as a percent of GDP	Orlova (2020)
CF	Operating cash flow divided by total assets	Xu et al. (2016)
IND	Dummy variable for political uncertainty. Each firm-year takes a value of one when the mayor or municipal party secretary is newly appointed, and zero otherwise.	Zhang et al. (2020)

Appendix B

Robustness test

B1 Firm life cycle and firm cash holdings

Table B1 Firm life cycle and firm cash holdings (Cash3)

	Cash3	*Cash3*	*Cash3*	*Cash3*	*Cash3*	*Cash3*
Int1	–0.137**			–0.031		
Gro1	–0.263***			–0.121*		
Mat1	0.0825			0.112**		
Shak1	0.133**			0.0821		
Int2		–0.304***			–0.0119	
Gro2		–0.190***			–0.0944**	
Gro3			–0.160***			–0.0988***
Mat3			0.340***			0.0956***
CV	No	No	No	Yes	Yes	Yes
_cons	23.42***	24.32***	23.97***	11.94***	3.724***	3.658***

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

Table B2 Firm life cycle and firm cash holdings (Cash4)

	Cash4	*Cash4*	*Cash4*	*Cash4*	*Cash4*	*Cash4*
Int1	–0.00853**			–0.00743**		
Gro1	0.00207			–0.00109		
Mat1	0.0365***			0.0262**		
Shak1	0.00261			0.00329		
Int2		–0.0286***			–0.00922	
Gro2		–0.0198***			–0.0162*	
Gro3			–0.00438***			–0.0264*
Mat3			0.0142***			0.0545**
CV	No	No	No	Yes	Yes	Yes
_cons	0.0531***	0.0814***	0.0552***	0.0961***	–0.064***	–0.065***

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

B2 Firm life cycle and financial distress

Table B3 Firm life cycle and financial distress (FDR3)

	FDR3	*FDR3*	*FDR3*	*FDR3*	*FDR3*	*FDR3*
Int1	0.260***			0.0696***		
Gro1	0.165***			0.0222*		
Mat1	–0.0628			–0.0493**		
Shak1	0.00915			–0.0406**		
Int2		0.904***			0.122***	
Gro2		0.604***			0.0827***	
Gro3			0.0819***			0.0445*
Mat3			–0.214***			–0.114**
CV	No	No	No	Yes	Yes	Yes
_cons	–1.627***	–2.084***	–1.327***	–2.339***	–3.904***	–3.744***

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

Table B4 Firm life cycle and financial distress (DIS1)

	DIS1	*DIS1*	*DIS1*	*DIS1*	*DIS1*	*DIS1*
Int1	0.016***			0.0079*		
Gro1	0.0069			–0.014***		
Mat1	–0.0086*			–0.0097**		
Shak1	0.001			–0.013***		
Int2		0.047***			0.012***	
Gro2		0.034***			0.012***	
Gro3			0.00014			0.0086***
Mat3			–0.013***			–0.078***
CV	No	No	No	Yes	Yes	Yes
_cons	0.450***	0.404***	0.441***	–0.174***	0.180***	0.199***

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

Table B5 Firm life cycle and financial distress (DIS2)

	DIS2	*DIS2*	*DIS2*	*DIS2*	*DIS2*	*DIS2*
Int1	0.0034			0.012		
Gro1	0.0052			0.081*		
Mat1	–0.0021			–0.012***		
Shak1	0.0029			–0.073**		
Int2		0.003			0.056**	
Gro2		0.0622			0.044*	
Gro3			0.49***			0.0083***
Mat3			–0.59***			–0.073***
CV	No	No	No	Yes	Yes	Yes
_cons	0.53***	0.52***	0.518***	–0.026	0.182***	0.19***

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

B3 Financial distress and firm cash holdings

Table B6 Financial distress and firm cash holdings (Cash3)

	Cash3	*Cash3*	*Cash3*	*Cash3*	*Cash3*	*Cash3*	*Cash3*	*Cash3*
FDR2	–0.235***				–0.286***			
FDR3		–0.110***				–0.0570***		
DIS1			–4.602***				–5.360***	
DIS2				–2.270***				–0.955***
CV	No	No	No	No	Yes	Yes	Yes	Yes
_cons	21.79***	24.27***	26.05***	22.93***	1.843***	3.438***	4.656***	3.637***

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

Table B7 Financial distress and firm cash holdings (Cash4)

	Cash4	*Cash4*	*Cash4*	*Cash4*	*Cash4*	*Cash4*	*Cash4*	*Cash4*
FDR2	–0.0138***				–0.0247***			
FDR3		–0.0161***				–0.0968***		
DIS1			–0.297***				–0.247***	
DIS2				–0.264***				–0.277***
CV	No	No	No	No	Yes	Yes	Yes	Yes
_cons	–0.0693***	0.0401***	0.195***	–0.0651***	–0.0768***	–0.101***	0.0368***	–0.113***

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

Appendix C

Pearson correlation

Table C1 Pearson correlation

	Cash2	*FDR2*	*Int1*	*Gro1*	*Mat1*	*WC*	*WT*	*PPE*	*PT*	*LEV*	*Size*	*SM*	*GDP*	*ROA*	*CF*	*IND*
Cash2	1															
FDR2	–0.2404*	1														
Int1	–0.0583*	0.1505*	1													
Gro1	–0.0437*	0.0012	–0.1359*	1												
Mat1	0.0225	–0.0748*	–0.1815*	–0.1775*	1											
WC	0.0188*	–0.2223*	0.0363*	0.0101	–0.0637*	1										
WT	0.2966*	–0.5950*	–0.0388*	–0.0655*	–0.0547*	0.1936*	1									
PPE	–0.0126	–0.0749*	0.0521*	0.0388*	0.0267	0.2174*	–0.1037*	1								
PT	–0.1288*	0.0981*	–0.0352*	0.0445*	0.0980*	–0.1198*	–0.5370*	0.1146*	1							
LEV	–0.1079*	0.4597*	0.0679*	0.0481*	–0.0226*	–0.0301*	–0.2933*	0.0394*	–0.0009	1						
Size	–0.0258*	0.0021	0.0414*	0.0650*	0.0450*	0.2918*	–0.1925*	0.3480*	–0.0054	0.1612*	1					
SM	0.0127	–0.2175*	0.0360*	0.018	–0.0081	0.5350*	0.0399*	0.6353*	–0.007	–0.0162*	0.3751*	1				
GDP	–0.0028	0.0312*	0.0142	–0.0136	–0.0007	–0.0114	–0.0018	–0.0024	0.0386*	0.0055	–0.0452*	–0.0067	1			
ROA	0.2733*	–0.3989*	–0.0303*	–0.028	0.0431*	0.0678*	0.2604*	0.0019	–0.0227*	–0.1631*	0.0857*	0.1306*	–0.0171*	1		
CF	–0.0027	–0.1814*	–0.2289*	0.1733*	0.2515*	0.0147	–0.1194*	0.0147	0.1204*	–0.0109	0.0510*	0.0366*	–0.005	0.0523*	1	
IND	–0.0069	–0.0093	0.0046	–0.0093	0.0243*	0.0102	–0.0057	0.0076	–0.0071	–0.0083	–0.0138	0.0084	0.2940*	–0.0188*	0.0114	1

Note: *p < 0.1, **p < 0.05, ***p < 0.01.

Table C1 of Appendix C presents the Pearson correlations amongst the cash holdings, firm life cycle proxies, firm financial distress and the control variables used in this study. As hypothesized, the corporate cash holding level is negatively correlated with both the introduction and the growth stages and positively correlated with the mature and decline stage. Moreover, financially constrained firms have less cash holdings than do financially unconstrained firms for all four classifications, indicating that cash holdings are more important for firms with the limited access to external capital markets. These results support our research hypothesis.