Firm and Country Specific Determinants of Corporate Cash Holdings

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I dedicate this work to my late mother Fozia Iqbal, my father Muhammad Iqbal, my beloved wife Aqsa Shahid, my sisters and my friends for all their love, support and encouragement.

Abstract of a thesis submitted in partial fulfilment of the
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Abstract

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After the 2008 Global Financial Crisis (GFC), firm cash holdings came to the attention of scholars. During the crisis, many non-financial firms faced severe liquidity shortage due to poor cash inflows and higher interest rates for external financing. This led to numerous cases of bankruptcy. Firms hold cash for two reasons. The first reason is to transaction costs associated with liquidating assets to cover daily operational costs. The second reason firms hold cash is to create a buffer to meet their obligations. Cash holding strategies determine a firm's future growth and survival. However, if a firm holds too much cash, it can increase their opportunity costs. Holding large amounts of cash can also be costly as well, due to low or zero returns on idle assets and potential agency problems associated with free cash flows. Conversely, holding too little cash leads to low levels of investment. It can also lead to liquidity shortages, meaning that a firm is unable to meet its financial obligations. While previous studies (Baumol, 1952; Miller & Orr, 1966; Tobin, 1956) provide different cash holding strategies, these are theoretical in nature and may not have been tested empirically.

In this study, we investigate the effect of firm-specific factors (working capital and the cash conversion cycle) and macroeconomic factors (the interest rate, the inflation rate, the foreign exchange rate, and economic policy uncertainty) on non-financial firms' cash holdings. This is the first study that includes three types of factors: firm-specific variables, macroeconomic variables and macroeconomic uncertainty (economic policy uncertainty) in developed and developing economies. We examine firms in both developed and developing countries. Businesses obtain bank financing for investments purposes when they have insufficient internal funds. Firms typically mortgage their fixed assets to borrow money (Kiyotaki & Moore,

2002). Cash holdings are critical when firm cash inflows are insufficient to meet their capital demands.

We choose two developed (the US and Japan) and two developing (China and India) countries. Our data is panel and we use firm-year observation for analyses. We divide our dataset into two configurations. First, we divide dataset according to time periods i.e., pre, post and during 2008 GFC for each country. Secondly, we divide our dataset into two groups (i) financially constrained and (ii) financially unconstrained. Financially constrained firms have easier access to financial markets which is crucial when faced with liquidity shortages. This is not the case for financially constrained firms.

We apply the system generalized method of moments (SGMM) to overcome the problem of endogeneity and produce unbiased results. We find that financially unconstrained firms have higher cash inflows and assets (current and non-current) than financially constrained firms in developed and developing countries for the period of 2003 - 2015. We also find divergent results for developed and developing countries. The findings reveal that all independent variables (working capital, the cash conversion cycle, the interest rate, the inflation rate, the foreign exchange rate, and economic policy uncertainty) have a significant effect on cash holdings, for both financially constrained and unconstrained firms. The direction (positive/negative) of the relationship varies according to the country: that is, developed or developing. Our findings indicate that changes in the cash holdings of non-financial firms also depend on macroeconomic variables. Financially constrained firms have a propensity to increase cash to avoid liquidity shortages.

Our results indicate that cash holdings are important for all non-financial firms in developed and developing economies. Cash holdings provide a financial buffer in times of crisis and enable firms to invest in positive NPV projects. This research thus endorses aspects of precautionary motive theory and transaction motive theory.

Keywords: Cash holdings, economic uncertainty, financially constrained and unconstrained firms, GMM.

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ABBREVIATION

GFC	Global financial crisis
FC firms	Financially constrained firms
Non-FC firms	Financially unconstrained firms
EPU	Economic policy uncertainty
CCC	Cash conversion cycle
OLS	Ordinary least square
FE	Fixed effect
BBD	Bloom, Baker and Davis
CLRM	Classical linear regression model

Chapter 1

Introduction

1.1. Rationale for the study

Over the last two decades, firms globally have significantly increased their cash holdings (Amess et al., 2015). Deloitte recently reported that "the top 1000 non-financial companies globally are holding $2.8 trillion in cash" (Chua, 2012). In 2014, Forbes estimated that the total sum of US firms' cash holdings was $5 trillion.[1] Dittmar and Mahrt-Smith (2007a) report that from the 1990s to 2000s, US firms' cash reserves more than doubled: they were equal to 13% of firms' total assets, an amount which was equivalent to 10% of the US' annual GDP at that time. According to Duchin (2010), the US-listed non-financial firms' cash to assets ratio increased from 10.5% in 1980 to 23.2% in 2006. This substantial increase in cash holdings has captured the attention of media; in 2006, *The New York Times* printed an article which stated that "publicly traded US firms hold so much cash that, as a group, they could pay off all their debt and still have money left over."[2] Over the last twenty years, the cash holdings of non-financial firms listed on the Standard & Poor's 500 Index (S&P 500) has tripled. Opler et al. (1999) note that the S&P 500 index showed a total of $716 billion in cash and marketable securities on their financial statements as of the 1994 fiscal year. In 2017, the S&P 500 showed that corporations' cash holdings and short-term investments had risen to $2.1 trillion in the previous twenty years. This figure represents the largest cash volume in history.

Other countries have also seen huge increases in firm cash holdings. Like the US firms, Japanese and Korean firms hold significant cash reserves: They have $2.5 trillion and $440 billion cash respectively. These figures are equal to 44% and 34% of their total GDPs. Similarly, Ferreira (2004) notes that at the beginning of the 2000s, continental European firms increased their cash holdings up to 15% of their total assets. This evidence about increasing cash reserves around the globe provides the justification for further investigation.

[1] https://www.forbes.com/forbes/welcome/?toURL=https://www.forbes.com/sites/louiswoodhill/2014/01/01/why-US-companiesare-holding-onto-5-trillion-in-cash/&refURL=&referrer=

[2] "Behind those stockpiles of corporate cash," by Mark Hulbert, *The New York Times*, Oct. 22, 2006.

The importance of cash holdings can be seen in an agreement between Chrysler's chairman Robert J. Eaton and Kirk Kerkorian, an investor. On the 8th of February, 1996 Eaton told Kerkorian to stop trying to take over Chrysler, at least for the next five years (Opler et al., 1999). In the agreement, Chrysler's chairman stated that they would issue $7.5 billion dollars' worth of liquid assets cash and marketable securities to shareholders in the form of share repurchases or dividends. This phenomenon raises questions about whether there is an optimal level of liquid asset holdings. If the answer is yes, then we must ask, is the reasonably large amount of liquid assets held by firms such as Chrysler justified? Do all the determinants equally impact on cash holdings or provide justification for such significant increases?

Another question arises (i) why did firms change their cash holdings policies globally after the global financial crisis (GFC) of 2007-009 and, (ii) are firm-specific determinants the only reason to hold cash? These questions indicate a significant gap in the finance literature.

1.2. Purposes for cash holdings

Why do non-financial firms hold a substantial amount of cash and cash equivalents? The literature offers several explanations. A popular explanation by Keynes (1936) states that firms hold cash for two reasons. First, firms hold cash to avoid paying transaction costs for their daily operations and/or to avoid liquidating assets to make essential payments. Second, they keep cash reserves to create a buffer which can be used to meet their financial obligations. The strategy of holding cash reserves determines a firm's future growth and survival.

Miller and Orr (1966) initiate the literature regarding firms' cash holdings. They suggest the optimal level of cash holdings by developing a trade-off model. The trade-off model is based on costs of running out of cash and the costs of high cash holdings (idle cash reserve). The trade-off model of optimal cash holdings by (Miller & Orr, 1966) is typically opposed to the financing hierarchy theory (Myers, 1984), which does not assume an optimal level but promotes higher cash reserves in more profitable firms. However, if a firm holds too much cash, it increases opportunity costs. In contrast, holding too little leads to underinvestment. Holding a large cash reserve is beneficial because it helps firms to avoid underinvestment in cases where they are unable to raise external funds for their investments and/or help firms to pay high transaction costs from external financing for their investments. However, high cash reserves can be costly because of low or zero returns on idle assets and the potential

agency problem of free cash flows. Therefore, firms that are capable of accessing funds for investments should not hold too much cash because their costs may exceed the benefit of doing so. Opler et al. (1999) suggest that in order to expand shareholders' wealth, firms should maintain a level of cash holding so that the marginal advantage of cash reserves is equivalent to the marginal cost of those reserves. This strategy is necessary to avoid transaction costs associated with liquidating assets to cover current payments.

1.3. Background of the study

The role of cash holdings in corporate firms is much broader. It is the sum of cash and cash equivalents of firm and helps the firm in many ways. For instance, (i) cash helps firms to avoid a state of underinvestment so that they can fund positive NPV projects, (ii) it helps firms to smooth their business operations, (iii) it assists firms to avoid costs associated with external financing and (iv) to meet financial obligations and avoid liquidity shortages.

Harford (1999) notes that corporate cash holdings have received relatively little direct attention in the academic literature until Kim et al. (1998) contemporaneous study on corporate cash holdings. Before Kim's study, most of the literature on cash holdings were descriptive in nature. Researchers start working on cash holding patterns empirically after 1998. Cash management studies argue that on average, firms hold 15 % of their total assets in cash (Ferreira & Vilela, 2004; Guney, 2003; Kalcheva, 2007). This enables firms to (i) lessen their transaction costs and fulfil payment obligations and (ii) it helps firms to take funds from internal sources so that they can invest in positive NPV projects (Boubaker et al., 2015). Further, efficient cash management helps firms to capture investment opportunities, because if cash reserves are reduced then firms cannot fund their projects.

Myers and Rajan (1998) suggest that cash is essential for management to execute firm operations. Cash holdings provide liquidity to meet a firm's daily operational needs and reduce liquidity risks. Likewise, the authors also suggest that a company's growth increases when its cash is invested in operations.

However, excessive cash reserves create hindrances for effective performance because its value declines with increasing inflation and firms endure depreciation costs associated with currency. Depreciation of currency means that the value of idle cash reserve decreases with increases in inflation. Thus companies have to hedge their financial assets to overcome devaluation costs associated with cash (Wang et al., 2014). Reserving cash for future

investments is easy for Non-FC[3] firms because these firms have high cash inflows. Cash hedging helps firms to avoid risk factors, such as financial distress in terms of asset deficiency, to meet short-term obligations, to recover interest coverage ratios and pay shareholder dividends (Outecheva, 2007). Firms most often avoid an increase in short-term obligations because of its financing cost and prefer to take trade-credit. Trade-credit helps firms to increase cash holdings and to avoid short-term liquidity shock. Firms utilize this cash in their daily operations (Kling et al., 2014). Cash holdings have a positive effect on credit rights, which firms use to accomplish their short-term goals (Yung & Nafar, 2014). While maintaining short-term obligations, firms need cash reserves to provide a buffer against the cash shortage in the financial crisis period. Acharya et al. (2012) argue that firms can either invest cash in the long run or retain it as a cash buffer until they have met all their obligations. The 2008 global financial crisis (GFC) transformed corporate cash holding strategies. This crisis has increased the importance of firm cash holdings for meeting the demand for liquid assets in periods of financial turmoil when external financing is very costly (Song & Lee, 2012).

Moreover, the major conflict between shareholders and managers is the decision regarding the usage of internal funds (Jensen, 1986). Harford et al. (2006) find that firms with weak governance structures hold lower cash reserves. They suggest that while circulating cash to shareholders in the form of dividends, firms with weaker governance structures tend to repurchase shares to avoid future payout obligations. This mix of, (i) surplus cash and (ii) weak shareholder rights, prompts capital uses in acquisitions which lead to the devaluation of the firm.

Based on the review of the literature, the main question of the study is that if the corporate firms already managing their cash reserves to meet their demand like investments in projects, financial obligations and investment in operations such as working capital then why firms increase their cash holdings extensively? To answer the main research question, this study attempts to reveal the extreme changes in cash behaviour of firms. The aim of the study is to explore the cash holdings determinants of non-financial firms through different strategies such as, (i) cash behaviour of non-financial firms in the context of firm characteristics, (ii) cash behaviour in the context of macroeconomic environment, (iii) cash behaviour in the context of both micro and macroeconomic factors. In addition, this study aims to regress all the

[3] Non-FC shows financially unconstrained firms and FC shows financially constrained firms herein after.

determinants (micro and macro) of cash holdings on FC and Non-FC firms. Moreover, the impact of 2008 GFC cannot be disregarded while analysing firm's cash behaviour because Song and Lee (2012) suggest that firms change their cash holdings strategies after the 2008 GFC.

1.4. Problem statement

Businesses obtain bank financing to invest in business operations when they have insufficient internal funds. Previous literature suggests that financial institutions are the most important source of financing and non-financial firms often mortgage their fixed assets to the financial institutions to meet their cash demands (Kiyotaki & Moore, 2002). Kiyotaki further note that cash holdings become more valuable for firms when cash inflows are poor. However, to obtain the external financing, most of the time, firms face corporate and legal constraints from banks and corporate regulators. Because of this financial constraint, firms try to meet most of their cash requirements by using their own internal cash reserves. Nevertheless, firm's dependency on financing through external source is not always be a better option.

For instance, during the 2008 GFC firms reduce their bank borrowing because of (i) higher interest rate, (ii) high inflation, (iii) lower market consumption and purchasing power, (iv) high uncertainty of government. policies, and (v) lower probability of investor to invest in equity market. These financial constraints motivate corporate managers to increase their cash holdings. Further, Denis and Sibilkov (2009) note that firms hold more cash when they face constraints in obtaining external capital. The phenomena of holding cash to meet the capital requirement may also vary according to the firm size and easier access to financial market (information asymmetric). Non-FC firms have more cash and assets than FC firms. Non-FC firms have easier access to financial markets when faced with liquidity shortages. Those firms can issue securities at par, as well as on premium because of their goodwill in the market. Likewise, Non-FC firms can issue bonds and mortgage their non-current assets to commercial banks.

In contrast, FC firms do not have easy access to the financial market when faced with liquidity shortages. FC firms face liquidity problems because of insufficient non-current assets. In short, these firms cannot obtain bank financing and do not have enough liquid assets which can be used as a cash buffer.

Denis and Sibilkov (2009) examine the causes of too little cash holdings in constrained firms. They suggest that constrained firms hold too little cash because of persistently low cash flows.

Moreover, high cash holdings are a value increasing element for FC firms contrary to external financing and high financing cost. Almeida et al. (2002) suggest that firms' demands for liquid assets are based on their access to financial markets and the importance of upcoming investments. They suggest that FC firms tend to save a positive fraction of cash flow compared to Non-FC firms.

However, both types of firms face liquidity shortages in an increasingly competitive market. This study identifies non-financial firms' (FC and Non-FC) cash holding behaviour. In particular, it examines the impact of macroeconomic[4] and firm-specific variables on cash holdings in the US, Japan, China and India. For further investigation of the problem, we segregate our sample according to the two different scenarios (i) time period (pre, post and during GFC) and (ii) firm size for FC and Non-FC firms.

1.5. Purpose of the study

Previous studies suggest different strategies to determine the appropriate level of cash holdings. Baumol (1952) and Tobin (1956) argue that firms must maintain an optimal level, which balances operating investment and cash reserves. The purpose of optimal cash levels is not to increase operating investment, but so that a firm can avoid financial distress. However, FC firms are not able to maintain an optimal level of cash due to insufficient cash inflow. Therefore, firms must attempt to create a trade-off between opportunity costs and transaction costs. Miller and Orr (1966) highlight firm trade-offs between investment opportunities and cash holding decisions. Trade-offs assist firms to continue their corporate activities. Myers and Majluf (1984) suggest another cash holding strategy. This involves holding a maximum level of cash and cash equivalents because cash enables a firm to meet its financial obligations. Myers (1984) notes that firms have three sources of financing: internal funds, debt and external equity. Myers suggests that while higher levels of cash are beneficial for firms it means that some of their assets are idle. Jensen (1986) finds that shareholders negate management decisions to hold more cash as they want cashback in the form of share repurchases or dividends.

Previous literature on cash holding can be classified into two main strands. The first strand of studies is exploratory in nature and concentrates primarily on the maintenance of different cash holding levels, such as the optimal level of cash, the creation of a trade-off level between

[4] Macroeconomic variables also include macroeconomic uncertainty. See Chapter 2.

operating investment and holding a higher level of cash. Studies in the second strand are more focused on determining potential factors which influence a firm's cash holding level. Few studies have empirically examined the determinants which affect cash holding levels. Since 1936 to 1998 the focus of previous studies has been on how to maintain different cash holding levels, however, Opler et al. (1999) argue that firms should first determine the factors which influence cash holdings before determining the exact level of cash needed. In response, this study examines the effect of firm-specific and macroeconomic determinants of firm cash holdings.

1.6. Contribution of research

Finance literature is just beginning to examine the determinants which impact on non-financial firms' cash holdings. This research area gained more attention from researchers in the US after the 2008 GFC when many firms were unable to obtain financing and went bankrupt. This research aims to identify different factors that impact on non-financial firms' cash holding practices. This is the first study that includes three types of factors: firm-specific variables, macroeconomic variables and macroeconomic uncertainty in developed and developing economies. Most of the research in this area has focused on the US and has concentrated on firm-specific variables.

The effect of macroeconomic variables and economic uncertainty together has not yet been investigated. Furthermore, research on cash holdings and its determinants have not been extensively investigated in countries other than the US. Macroeconomic uncertainty and macroeconomic variables are important factors for managers to consider when making investments and corporate cash holding decisions. In an uncertain economic environment, both external (macroeconomic variables and economic uncertainty) and internal forces (firm-specific variable) impact upon cash holding decisions. Therefore, this study includes both variables (firm-specific and macroeconomic variables) to determine their combined effect on cash holdings in non-financial firms. However, firms are not homogenous according to financial health (firm size). In the finance literature, firm size is determined by a firm's assets. While some firms are Non-FC others are financially constrained. FC firms do not have enough liquid and fixed assets. These firms have a higher probability of liquidity shock due to changes in firm-specific factors, macroeconomic variables, and economic uncertainty. Hence, segregation of our sample into these two categories is one of the significant contributions in this research.

1.7. Research objectives

The research objectives are:

1. To determine if macroeconomic variables (such as inflation, interest rates, and foreign exchange rates) and uncertainty in economic affect corporate cash holdings for non-financial firms.
2. To determine the impact of firm-specific variables (such as working capital and the CCC) on corporate cash holdings of FC and Non-FC firms.
3. To determine the combined effect of firm-specific and macroeconomic variables on cash holdings of FC and Non-FC firms in developed and developing countries.

1.8. Significance of the study

To the best of our knowledge, this is the first study that investigates the relationship between firm-specific variables (working capital and the CCC), macroeconomic variables (inflation rates, interest rates, foreign exchange rates, and economic uncertainty) on non-financial firms' (FC and Non-FC) cash holdings in developed and developing countries. Previous research focuses on the role of firm-specific factors on cash holdings. There is a significant body of literature which examines this issue in a variety of countries. While there are many studies on firm performance and investment, there are none on cash holdings. This study will be a benefit to firms in non-financial sectors as it will enable corporate managers and policymakers to make strategic decisions regarding appropriate cash holding levels and how much to allocate to projects.

1.9. Structure of the thesis

Having provided a brief overview of the study's aims, and anticipated contributions, the following chapter presents an overview of the relevant literature. The next chapters of this thesis are organized as follows. Chapter 2 covers the theoretical background of working capital, the CCC, interest rates, inflation rates, foreign exchange rates, and economic uncertainty as they are associated with cash holdings. Chapter 3 describes the empirical models, estimation techniques, nature of the data used, and the methods used to collect it. Chapters 4 and 5 present the empirical results. Chapter 6 summarizes the study's major findings and implications, followed by limitations of the research and recommendations for future work.

Chapter 2

Literature review and theoretical background

2.1 Introduction

This chapter provides an overview of the theories, the evolution, and determinants of cash holdings. The chapter is organized as follows: section 2.1 discusses theories relating to cash holding decisions and managers' preferences for (external) firm financing. Section 2.2 discusses factors which affect cash holdings: not only firm-specific and macroeconomic factors but also economic policy uncertainty. Section 2.2 discusses the macroeconomic uncertainty (economic policy uncertainty) index and how it is used in this study. Section 2.3 provides a summary of the chapter's key points.

2.2 Theories related to cash holdings

2.2.1 Agency theory

Jensen (1986) discuss the problem of agency theory and free cash flow between managers and shareholders. Shareholders require cash to be converted into dividends, while firms require excess cash for investment activities. These different priorities lead to the agency problem. Opler et al. (1999) suggest that cash holdings of firms are a wealth increasing process. They argue that shareholders always want more cash in the form of dividends while management needs to maintain an optimal level of cash which will allow them to fund their daily operations and profitable projects.

2.2.2 Pecking order theory

Myers and Majluf (1984) introduce the pecking order theory by argues that firms are not required to maintain the optimal level of cash reserves, hence, cash can be obtained from external sources when required. However, pecking order theory only supports Non-FC because these firms have high cash inflows and these firms easily can obtain fund from external sources when required.

Pecking order theory and agency theory of cash flow both negate each other because as stated by the agency theory of cash flow, shareholders require cash in the form of dividends. In contrast, pecking order advocates retaining cash for operational and investment purposes.

Myers and Majluf (1984) document that the pecking order theory is only beneficial for Non-FC firms who have easy access to the financial market for investment purposes. These firms can issue stocks and debts in the financial market against valuable non-current assets. The authors also suggest that if FC firms issue stocks, they will earn discounted price (less than face value) of stock and also FC firms would not have sufficient non-current assets to take borrowing. Therefore, FC firms seek to maintain an optimal amount of cash for investment and operational purposes whereas Non-FC firms do not because of easy access to the financial market. FC firms can avail several benefits if these firms maintain an optimal level of cash. First, FC firms do not need to access financial market for operational funding hence, these firms can avoid high short-term financing cost. Secondly, FC firms can avoid the state of idle cash reserve because only required cash is retained by firms. However, the optimal level is difficult to maintain because of several internal (firm-specific) and external (macroeconomic) factors and yet there are a lot of factors need to be explored in the cash holdings literature (Bigelli & Sánchez-Vidal, 2012). Moreover, restricted access to financial market, make cash holdings more valuable for FC firms. Denis and Sibilkov (2010) describe that for future investment purpose, high cash holdings required for FC firms as these firms have persistently low cash flows.

Miller and Orr (1966) provide the optimal model regarding cash holdings for non-financial companies. They developed the trade-off structure to determine the optimal cash level through balancing operation costs and non-interest-bearing cash. However, cash holding determinants must be identified before one can maintain an optimal level of cash. Opler et al. (1999) provide the first empirical evidence of corporate cash holdings in the US firms. Next section discusses the detailed review of the literature.

2.3 Theoretical review

2.3.1 Working capital and cash holdings

Working capital is the most significant element of corporate cash holdings (Anjum & Malik, 2013). Lyngstadaas and Berg (2016) argue that it is an important component of financial management and has a significant effect on firm profitability. The evaluation of working capital is estimated by the duration of the cash conversion cycle (CCC), however, longer CCC is reflected as an undesirable feature for firms. Liquidity levels must be maintained for smooth firm operations. Small and medium-size firms' demands for cash are related to their current

liabilities (Huang et al., 2015)[5]. Current assets and current liabilities relate to each other because current assets are used to pay off liabilities. Firms also use current liabilities to generate or acquire current assets (Gill, 2012).

Firms must maintain an optimal level of cash (Jamil, 2016). Jamil suggests that the smooth running of business operations need a desirable level of cash, however, it is difficult for business managers to invest all cash in operations. Thus, firms often hold cash and cash equivalents to meet financial obligations and reinvest in day-to-day operations. Jamil suggests that working capital has a positive and significant impact on cash holdings.

A country's banking system may also determine a firm's cash balance. Banks credit line help firms to obtain financing. Easier credit policy of banks supports firms to enhance business activities such as working capital and sales growth (Pinkowitz & Williamson, 2001). This financing facility assists firms to lessen their excessive cash. Hence, firms use this excess cash in two aspects (i) investment in working capital and (ii) investment in future NPV projects. Pinkowitz notes the strict financial market conditions such as high-interest rate and limited timeline to repay borrowed amount restrain firms to avail the credit facility. The authors take the sample of US, Germany, and Japan and suggest that Japanese banks have very strict credit policy for non-financial firms. Therefore, the non-financial firms in Japan hold two times the amount of cash as US and German firms.

Apart from Japanese firms, Bigelli and Sánchez-Vidal (2012) explore that Italian firms hold 10% of their total assets in cash. They argue that higher and positive value of working capital help firms to decrease their cash adjustments. However, authors further document that accounts receivables as part of short-term assets can be converted into cash to fulfil cash demand. But higher trade receivables cannot always be beneficial for firms' liquid assets demand because of CCC. Since CCC gauge the ability of a firm to generate required cash from business operations. Their sample consists of 17,165 Italian firms and argues that working capital and bank debt are negatively related to cash holdings.

Cash holdings and working capital also affect a firm's value. Ali (2013) uses a sample of 74 companies of the Tehran stock exchange. Dudley and Zhang (2016) report that working capital has a significant and negatively related to cash holdings of the listed firm. They use data from

[5] Firms often need to borrow cash in order to meet their liabilities.

54 countries and trust levels as a macroeconomic variable along with firm-specific variables. They find that firms located in less trusting societies hold more cash[6].

Firm's shareholders also pressurize management to issue cash as dividends. Hall et al. (2014) examine the effect of firm factors and national level institutions on cash holdings in privately held and publicly traded firms. They show that working capital has a significant negative impact on cash holdings on both (private and public) types of firms.

However, firms' accrual quality also affects cash holdings. High accrual quality helps firm to lessen its cash demand because it reduces the effect of information asymmetry. García-Teruel et al. (2009) use lag and exogenous values of working capital over asset to quantify accruals quality. They document that high quality of accruals help managers to decrease asymmetry between firm and financial institutions. Hence, firms' dependency on external financing and cost to obtain this financing decreases. The easier access to external financing helps firms to retain low level of cash. Therefore, firms invest the excess cash in working capital to enhance the business operation (Hill et al., 2010). Hill notes that corporations need to adjust their operating working capital according to their sales growth, financial distress, and costly short-term financing. However, firms with excessive cash use aggressive working capital policy to increase sales revenue. This optimization of working capital provides superior access to capital market.

Since working capital optimization is not the only factor for firms to increase the value. However, firm value depends on the free cash flow of firms and financing constraints of investment. Wasiuzzaman (2015) document that high working capital optimization increases the probability of free cash flow and firm value.

Autukaite and Molay (2011) document the importance of short-term financing decisions on firm value. The authors investigate whether firms should invest an extra euro, either in cash or in working capital. They suggest that shareholders do not prefer management to invest more in working capital using external financing. They suggest that through effective use of working capital, managers can reduce firm financing costs and thus, reduce their dependency on external financing. In short, firms can use internal cash flow to invest in working capital without raising external financing.

[6] Trust includes world values Survey for each country, the first principal component of governance, regulatory quality, control of corruption, political stability, the rule of law and the voice of freedom for country.

2.3.2 Cash conversion cycle (CCC) and cash holding

Cash conversion cycle (CCC) is one of the determinants of financial management, defined as the interval between the manufacturing of goods and the cash collection period. The time period (the time it takes to manufacture the product and collect payment) cover different operational activities (Anjum & Malik, 2013). Among all operational features, the CCC is considered as an effective component up till the requirements of receivables and inventory turnover meet the optimal level set by the firm (Nobanee et al., 2011). Previous studies suggest that there may be an inverse relationship between profitability and the CCC. They suggest that shorter CCC helps firms to increase cash inflow and it consider as a vigorous sign for firms' operations (Berg, 2016). Wang et al. (2014) note that firm-specific variables, such as the operating cycle, has not been widely researched on cash holdings. It is slightly identical to the CCC. A firm's CCC depends on time and speed. This is because they (time and speed) affect cash holding levels. Hence, the time of receiving the amount from the trade receivables increases, the firm face shortage in targeted cash set by managers which suggest negative relationship between CCC and cash holdings. Since, the increase in the CCC means it takes more time for a company to convert resources (for example, raw materials) or inputs into cash inflows. A shorter cash collection period is beneficial for firms as it allows them money from their debtors and utilizes the funds to pay their creditors (Wang et al., 2014).

The literature concludes that corporate liquidity depends upon several factors: the CCC, firm leverage, size of the firm, net working capital and sales growth (Anjum & Malik, 2013). Other researchers use variables such as organizational performance, working capital and return on investment to analyze working capital efficiency and document negative relationship (Al-Najjar & Belghitar, 2011; Nobanee et al., 2011). However, firms need cash to execute daily operations and transactions. However, if the CCC is longer then firms hold more cash to decrease liquidity shortage (Bigelli & Sánchez-Vidal, 2012). They further explore that financing from external sources is expensive and to avoid this cost, SMEs attempt to hold cash. However, this phenomenon suggests that financing hierarchy theory only beneficial for large corporations these firms are capable enough to take financing from external sources such as banks and equity market.

Kroes and Manikas (2014) argue that variations in the operating cash cycle are significantly related to fluctuations in Tobin's q. They examine how changes in firm cash flows relate to changes in Tobin's q. They find that changes in account receivables and inventory cycle in days

affect a firm's financial performance. CCC performance also depends on liquidity performance factors, for instance, current ratio and quick ratio. Soumya Upadhyay and Smith (2016) use a sample from the Washington State health care sector and suggest that the current ratio is positively related to a firm's CCC. Similarly, Das (2016) uses a sample from the Indian health care industry and finds that a firm's short-term financial performance can be measured using the current ratio and the quick ratio but that the CCC explains more about a firm's performance.

CCC also represents the efficiency of firm operating activities. Das suggests that CCC is more important for smaller than larger-scale firms. Das further suggests that Non-FC firms have easier access to the financial market and that these firms can access short- term financing more easily than those which are financially constrained. Nobanee et al. (2011) suggest that while the traditional focus of corporate finance is long-term financial decisions, such as capital structure and dividend policies, recent work focuses on short terms management issues, such as working capital and the CCC. They use a sample of Japanese firms from 1990 to 2004 and find that CCC has an inverse relationship with firm profitability. An increase in CCC means that a firm recovers their account receivables after long-time of sales and services. This leads to the lessening in cash inflows. In contrast, a decrease in the CCC means that firms recover their receivable more swiftly. This shorter cycle leads to an increase in cash inflows which ultimately increases firm profitability.

2.3.3 Interest rates and cash holdings

In the last few years, scholars have begun to explore the relationship between T-bills rate of return and cash holding levels. For example, Stone (2018) suggests that the interest rates and cash holdings are of particular concern. Significantly, this issue has been ignored in the finance literature.

The firm cash to asset ratio varies across time. For instance, Zeng (2015) documents a downward trend for the cash ratio during the 1980s and 1990s. The author finds the relationship between macroeconomic variables (such as GDP & interest rates) and cash ratio of Norwegian firms. Zeng finds the negative impact of interest rate on cash holdings. During the sampled period (1980 to 1990) the cash holdings level increases. In contrast, there is a drop in GDP and interest rates.

Based on the precautionary-motive theory of cash holdings, corporations maintain ample cash to deal with unexpected external financial shocks. Weaker macroeconomic conditions, such as low GDP growth per year and higher interest rates lead to instability in the corporate sector. Thus, firms face difficulties and to get external financing for future investment. Stone (2015) notes that firms are often reluctant to use external financing in uncertain macroeconomic conditions. This finding could helps to explain the negative correlation of cash holdings and the general macroeconomic factors.

The relationship between the interest rate and firm cash holdings are examined by (Stone, 2015). The author notes that the interest rate is positively related to cash holdings. For this investigation, Stone uses the random effect model on data over 40-years. Most of the previous studies examine the nexus of firm leverage and cash holdings. Such as, Opler et al. (1999) and Ozkan and Ozkan (2004) suggest that leverage and cash holdings have inverse relationship. Moreover, Drobetz and Grüninger (2007) describe that leverage have nonlinear nexus with cash holdings. However, Drobetz suggests that firms can understate their financial distress because leverage and cash holdings have positive tendency. While Bates et al. (2009) report a negative relationship of interest rate and cash holdings. Bates document that from 1980 to 2006, interest rate increases and in response firms hold more cash to pay their debts and other obligations.

Firms frequently take financing from financial institutions to meet the obligation in normal days. Harford et al. (2014) note that continuous repayment of short-term obligations is a dilemma for firms because firms has to maintain this cash outflow on time as obligation. Otherwise firms have to pay a high financing cost. Hence to avoid the financing cost risk in future, firms tend to increase their cash level to prevent refinancing. Harford et al. (2014) report an increase in cash holdings against assets from 28% to 34% from 1980 to 2008 because of an increase in interest rate.

Regardless in the normal days, in recession periods firms increase cash level because of tightening financial market condition and poor cash inflows. Ferreira et al. (2005) suggest that cash holdings determine the financial position of firms during the recession period so that firms can run their business operation very efficiently. Ferreira further finds that FC firms hold more cash in comparison with Non-FC firms.

Pina (2017) examines the relationship between the international foreign reserve of the central bank and the global interest rates of 75 countries. They suggest that the interest rate

is positively related to the cash reserve target level. An increase in interest rates leads to increases in the foreign reserve of central banks. Pina also finds that central banks accumulate their international foreign reserves with respect to domestic financial shocks. Nevertheless, in this globalization era, central banks face external (international) financial shocks which lead to an increase in international foreign reserve.

Bo and Sterken (2002) employ a sample of lower- and higher-debt Dutch firms to examine the relationship between interest rates, firm debt, and investment levels. They suggest that a firm's financial structure is relevant to interest rate volatility and a firm's investment decisions depend on interest rates and debt levels. If firms reduce their investment activities, their cash holding levels increase and vice-versa. Kellison (1991) suggests that interest rate risk must be considered when evaluating financial derivatives. The author also suggests that calculation of the present value of future cash flow is a key factor in sinking funds and loan repayment schedules. Kellison argues that investment in positive NPV projects provide positive cash inflows at the time of investment but changes in interest rates lead to changes in corporate investment, thus firms avoid further investment till the recovery of previous NPV projects.

During the 2008 GFC, banks increase their offered interest rate for firms. Increase in interest rate is a hurdle for firms to take further borrowing, even to repay current obligations because of poor cash inflows. In response, banks also face a downturn in interest income and principal amount. Esposito et al. (2015) take the sample of Italian banks to investigate the outcome of increasing interest rate in 2008 GFC. Esposito notes that banks use financial derivatives relevant to interest rate risk to survive in crisis. They note that Italian banks use these instruments to restrain interest rate exposure. Moreover, Karpavičius and Yu (2017) find that industrial firms have either zero or a slightly negative relationship with the federal reserve fund rate. They suggest that the US firms do not adjust their capital structure based on interest rates. Further, they find that the US firms have other sources of financing apart from bank loans, such as corporate bonds and commercial papers. These financing options reduce US firms' dependency on bank loans.

2.3.4 Inflation rate and cash holdings

Firms' cash holdings also affected by the change in the inflation rate. Firms attempt to maintain a balance between the cost and benefit of idle cash reserve because increasing inflation, decreases the time value of cash and vice-versa (Wang et al., 2014). Hence, this cost and benefit of reserve cash also depend upon the change in the inflation rate. Wang further document that an increase in inflation rate leads to a decrease in the purchasing power of firm because of increasing price of raw material. Therefore, firms increase their cash level to maintain purchasing power over time. Increase or decrease in inflation rate has universal impact in the country's economy. When inflation increases, it also decreases the buying power of final consumer, hence firms' turnover decreases which lead to poor cash inflows. At the time of poor cash inflows, firms seek to adjust cash policies to pay the obligations. However, these findings are consistent with (Chen & Mahajan, 2010). The authors report the consistent cash holding strategy, but Chen further suggests that to cover the decreasing value of cash holdings, firms should invest in business operation to increase the cash inflow. This cash inflow helps firms to increase their economic value of cash.

Baum et al. (2004) report that macroeconomic variables such as inflation and GDP are the causes to change in a firm's cash value. They argue that macroeconomic variables disrupt financial managers' decisions. Hence, firms attempt to hold cash above their transaction needs in order to diminish the effects of inflation. However, if firms fail to maintain the good cash inflows in high inflation and interest rates, then firms' liquid assets decrease (Chen & Yo, 2012).

Curtis et al. (2017) document the impact of inflation on cash holdings of US firms. They claim that this investigation is the first to explicitly analyze inflation in terms of its effect on the evolution and dynamics of liquid assets. Using OLS, they find that a 1% increase in inflation leads to change in a 0.34 percentage point in firm's cash holdings. However, the inflation rate is not much fluctuated in the US. Hence, the US firms do not hedge their non-current assets fully to counter the increases in inflation. This means that increase(decrease) in inflation change the economic value of assets. Geyser and Lowies (2001) find that economic events and macroeconomic variables such as inflation, affect the stock market daily. They suggest that inflation is key factors that influence stock prices. Using samples from South Africa and Namibian stock exchanges they conclude that companies do not adequately protect their

firms against inflation. Increasing inflation helps financial institutions to increase their profit. Tan and Floros (2012) examine the determinants of bank profitability in China using a sample of 101 Chinese banks. They report that when inflation increases, banks increase their interest rate as well, hence interest income of banks increases in China. Moreover, de Almeida (2015) find that inflation did not fall as much as predicted by the standard New Keynesian model in the Eurozone. This model predicted that inflation would fall after the 2008 GFC and the euro debt crisis. Due to the increase in prices of raw material, the US firms prefer to purchase raw material because of diminishing value of cash.

Jazz et al. (2016) report that cash holdings and inflation are significant and positively related. Jazz further find that in periods of high inflation, it better for firms to hold cash to survive in a competitive market. Moreover, Song and Lee (2012) note that cash holdings are more explained by macroeconomic variables rather than firm factors. For instance, inflation and GDP have positive effect on firms' liquidity (Chen & Mahajan, 2010). Chen further argues that firms can adjust their cash needs according to the business operations, however, the corporate manager cannot neglect the macroeconomic factors. As after the 2008 GFC, Bacchetta et al. (2014) note a sharp drop in cash holdings of US firms. They report that liquidity and productivity shock trigger negative trends in cash ratios and employment levels. Palazzo (2012) reports that aggregate risks (systematic and unsystematic) affect optimal cash holding levels in the US.

Madsen (2003) argues that inflation curbs investment. The author reports that a low inflation rate is related to higher levels of investment. If firms, make lots of investments then cash holding levels drop. In contrast, if they reduce their investment levels, this leads to higher cash holdings. This finding is coherent with (Wang et al., 2014). They find that in periods of high inflation, firms hold more cash rather than invest in different projects. Hatzinikolaou et al. (2002) examine inflation uncertainty effects on firm capital structure. They use thirty Dow Jones industrial firms with twenty years of the dataset and find that inflation uncertainty has a strong negative effect on firms' debt to equity ratios.

Apart from firm leverage, inflation also affects a country's national growth (Khan & Ssnhadji, 2001). The authors find that an increase in inflation negatively affects the growth of developed countries by 3% and developing countries by 12%. Rousseau and Wachtel (2002) examine the relationship between the size of a country's financial sector and its economic growth. They argue that fluctuation in the inflation rate from its threshold level leads financial

growth to stop and financial growth behave inversely against the volatility of inflation. Similarly, Boyd et al. (2001) suggest that an increase in the inflation rate interferes with fund allocation in the banking sector. They document an inverse nexus between inflation and growth in both the banking sector and the equity market. Moreover, Ozkan and Ozkan (2004) suggest that in the presence of macroeconomic factors, firm's optimal cash holding policy is irrelevant. Based on this argument, Naumoski and Juhasz (2018) confirm that macroeconomic variables such as inflation rate is integral part of firm's cash holdings policies. They further find that corporate policies are integrated with inflation rate along with firms' characteristics.

2.3.5 Foreign exchange rates and cash holdings

In emerging economies, firm survival is affected by variations in foreign currencies. When exchange rates rise, manufacturing firms are less profitable and may not survive. This is particularly accurate of export firms in developing countries where the currency exchange rate is more volatile compared to developed countries. Non-FC firms with high production levels have a higher probability of survival due to their large amount of assets than FC firms with low levels of productivity (Toraganlı & Yazgan, 2016). Furthermore, firms associated with imports and exports, design their risk management policies in accordance with exchange rate volatility (Ito et al., 2016).

Bodnar and Marston (2002) suggest that effect of exchange rate on firms' profit depends on three variables: (i) the ratio of the firm's foreign currency revenue, (ii) expenditure in foreign currency, and (iii) profit rate. In terms of lower firm profits, they suggest that foreign exchange exposure is more significant. They note that firms with greater exports face greater levels of foreign exchange exposure. These firms use different hedging techniques to overcome exchange rate risks, such as (i) financial hedge and (ii) operational hedges. Firms which conduct their business transactions in the local currency experience less foreign exchange exposure. Dominguez (1998) examines this phenomenon utilizing sample of Japanese firms. The author finds that firms in Japan hedge their funds with movement in dollar with the help of the capital asset pricing model (CAPM). The author's results show that the yen to US dollar conversion is highly related to a firm's return.

However, when the exchange rate decreases, it has positive effect on foreign investment and exports but effects negatively if imports are high. Nucci and Pozzolo (2001) investigate that exchange rate variation and firms' investment strength. Nucci takes the sample of Italian non-

financial firms. They document that when exchange rate depreciated, firms prefer to invest more in businesses that involved in export activity. The strength of investment depends on import of raw material, share of export revenue in total revenue and movement in exchange rate.

Depreciation of currency also reduces levels of aggregate investment. Landon and Smith (2009) use a sample of 17 Organization for Economic Corporation and Development (OECD) countries and find that real currency depreciation reduces aggregate levels of investment in the long run. Kandilov and Leblebicioğlu (2011) examine the effect of foreign exchange rates on firms' investment decisions in Columbia. They estimate the dynamic equation model of investment using the system-GMM estimator. Their finding shows that the exchange rate negatively affects firm investment. These findings are consistent with Bahmani-Oskooee and Hajilee (2013). Bahmani investigates the effect of exchange rate volatility on internal investment of firms in short and long run. The authors take the sample of 39 countries and note that 27 countries have short term negative effect and 12 countries have long-run negative effect of exchange rate volatility on investment of firm.

In contrast, Allayannis and Weston (2001) find that foreign currency derivatives and firm value exhibit a positive relationship. They use a sample of US non-financial firms and suggest that hedge premium is statistically significant with firm value. Moreover, firms' value also effects because of the variation in the exchange rate. Most of the prior studies such as Chue and Cook (2008) and Dominguez and Tesar (2006) document negative effect of exchange rate on firm value. They note that a change in stock prices when exchange rate varies. Stock prices of multinationals firms also affected by exchange rate. Most of the time, multinational firms invest in other countries through US dollar against local currency. These firms usually invest in portfolio investment and acquire stocks of firms (Jorion, 1990). Jorion document that floating exchange rate is positively affected firm value because, if exchange rate increase, foreign investors purchase more stock against one dollar. Hence, exchange rate is major component of uncertainty for multinationals to invest. The basic reason for the exchange rate uncertainty is that it is more volatile than inflation rate and interest rate. Moreover, corporations involved in international trade also affected by exchange rate (Hayakawa & Kimura, 2009). Regardless of import and export, cash flow of these firms fluctuates because of exchange rate (Mathur & Loy, 1984). Mathur further finds that foreign exchange rate risk is key concern for both financial and non-financial institutions.

They find that on average, future rates are unbiased forecasts for trade and that the floating exchange rate does not provide a rational hedge due to the long-run financial period. Future exchange rates in international trade confirm a fixed exchange rate between importers and exporters. Both importers and exporters hedge their funds for payments based on future rates. In contrast, with a floating exchange rate, it is difficult for importers and exporters to create a hedge for international payment. Exchange rate exposure is also a major source of risk for firms globally (Allayannis et al., 2001). Allayannis recommend that firms reduce their exchange rate risk by using financial derivatives and operational hedges. The authors note that operational hedging is not a useful proxy for risk management. Griffin and Stulz (2001) examine the significance of exchange rate movement and industry competition for stock returns across the world. The authors find that international trade across the world is more affected by industry shock than exchange rate shocks. They further suggest that weekly changes in foreign exchange rates have no impact on firm stock returns and on firm performance. They use a sample of Japanese firms and find that these firms compete with each other to remain stable in the international market. El-Masry et al. (2007) examine the relationship between exchange rate exposure and firm value in relation to non-financial listed firms in the UK. The authors find a significant relationship between lagged exchange rate exposure and firm stock returns. They suggest that international investors adjust their investment risks based on exchange rate volatility; hence, stock prices depend upon lagged exchange rate exposure. Furthermore, Anand et al. (2018) document that with the prediction of increase in foreign exchange rate, firms hold less cash to curb the transaction losses.

2.3.6 Economic policy uncertainty and non-financial firms' cash holdings

The economic context in which firms operate alters constantly due to political and governmental decisions and bureaucracy (Gulen & Ion, 2016). It is essential to examine whether firms' corporate decisions are related to economic-uncertainty. Gulen and Ion (2016) describe the negative relationship between capital investment and economic uncertainty. Moreover, the authors suggest that in periods of high economic uncertainty, firms decrease their corporate investments and hold onto cash to avoid risk and vice-versa.

Most of the firm-specific variables, for instance, dispersion in the forecasted stock returns, total factor productivity, sale-purchase prices, and firm components affect firm performance (Gulen & Ion, 2016). Determining the percentage of economic uncertainty associated with

governmental and regulatory systems is a challenging task. However, Gulen and Ion (2016) note that some studies focus on specific types of macroeconomic policies such as fiscal policy, monetary, and social security while economic policy uncertainty has substantially ignored in macroeconomic factors.

Chakraborty et al. (2017) find that macroeconomic uncertainty affects firms' cash holdings. They use inflation (the Consumer Price Index) as one of the macroeconomic variables and use the ARCH (GARCH(1,1)) model to predict the macroeconomic uncertainty. They suggest that shareholders focus more on macroeconomic uncertainty rather than firm-specific uncertainty. They note that the value of cash changes over the period because of a change in inflation.

Baum et al. (2006) discuss the demand for liquidity and factors that stress firms. The authors find that instability in the macroeconomic environment affects managers' decisions regarding appropriates liquidity levels. They use four proxies: (i) real GDP, (ii) the indicator of industrial production, (iii) the rate of inflation and (iv) the return of S&P 500 stock market index for macroeconomic uncertainty. They discover that firms with different micro factors (sales growth, assets, and credit lines) respond differently to macroeconomic volatility. Xu et al. (2016) apply the grabbing hand hypothesis to cash holdings and find that political uncertainty has a significant and negatively related to firm liquidity in China. They suggest that smaller firms hold less cash when faced with higher political extraction risk.

Along with a country's political environment, national judicial efficiency is highly associated with firm cash holdings (Shah & Shah, 2016). The authors find that strengthening creditor rights increases corporate cash holdings. This finding is subject to the availability of efficient laws and enforcement through judicial systems.

After the 2008 GFC, firms decrease their capital investments and hold more cash as precautionary motive (Song & Lee, 2012). The authors suggest that firm characteristics do not explain any changes in firm cash holding decision but that these changes are due to firms' demands for cash. This finding indicates that financial crises systematically change firms' cash holding policies. As the review of these studies has shown, it is difficult to find an appropriate measure for economic uncertainty.

Baker et al. (2015), BBD[7] index, cover the research gap and measure the economic uncertainty in the finance literature. They use three distinctive factors to construct an index that can measure cumulative economic policy uncertainty. First, the authors use fundamental terms related to policy uncertainty derived from national newspapers. Second, they include factors related to future changes to tax codes through the dollar impact of tax provision. The third factor includes the CPI and, government spending which is a proxy for uncertainty about fiscal and monetary policy. In the global era, EPU and cash holdings are the main interest for researches and corporations. Hence, one may raise the problem of specious relation between EPU index and cash holdings (Phan et al., 2019). To alleviate the concern that firms' cash holdings are dependent on government expenditure[8] and these firms hold more cash when uncertainty increases in government, Phan et al. (2019) follow the measure of industry sensitivity to government spending by (Belo et al., 2013). After controlling the EPU with dummy of industry sensitivity, Phan finds that all corporations (depend on government expenditures or not) hold more cash when uncertainty increases.

Moreover, Duong et al. (2018) document the strategic motive of cash holdings of the US non-financial firms to counter the EPU. They suggest that the US firms hold more cash in response to higher uncertainty. This response (holding of cash) is more pronounced in case of financially constraint, and firms' sensitivity towards policy uncertainty. They further conclude that holding of cash in high EPU, increases the firm value and lessens the negative impact on capital expenditures of firm. Corporate investments like capital expenditure, corporate managers also take long-term decisions such as merger and acquisitions to increase the firm value, shareholder wealth, and firm performance. While using the real option channels, Bonaime et al. (2018), document that EPU is strongly associated with merge and acquisitions. Similarly, the value of cash holdings and investments decreases when EPU increases. Feng et al. (2019) note that Chinese firms that hold more cash during the high EPU, can sustain the firm value and avoid under investment. Moreover, state-owned firms hold less cash even when EPU increases, however, non-state-owned or financially constrained firms hold large amount of cash.

Alongside the non-financial firms, banks are the integral part of any economy. Financially strong and efficient banking system can lead the economy in effective way (Hermes et al.,

[7] Baker, Bloom and Davis are the economist who developed this index.

[8] Infrastructure, social sector reforms and public sector organization.

2018). Banks, as a fundamental part of economy are also affected by EPU. This effect leads to lower borrowing to household and corporation. Berger et al. (2018) suggest that increase in EPU, decreases the liquidity generation of banks. Banks are therefore more reluctant to increase their assets side of balance sheet in term of lending loans, because of decrease in purchasing power of households and corporation.

Moreover, firm performance also affected by policy uncertainty. When uncertainty increases in the economy, it directly affects the almost all performance indicators of firm and economy. The performance indicators include the decrease in bank financing, reduction in sales growth, unusual increase in operating cost and raw material prices and fear of loss of investment in managers sentiment. Iqbal et al. (2019) take four proxies of firm performance and document that EPU negatively related to all four proxies. Out of the four proxies, the coefficient of Tobin's q ratio is the highest which suggest that stock market react more promptly against the increasing uncertainty in economy.

2.3.6.1. Framework of uncertainty index

Gulen and Ion (2016) use Baker et al. (2016) economic uncertainty index in their study and find a significant negative relationship with corporate investment. They suggest that as economic uncertainty increases, firms' levels of investment decrease; in short, firms increase cash level as a precautionary measure and vice versa. The authors argue that since Baker et al. (2016) BBD index (herein after), is based on newspaper reports and not direct economic variables, it cannot produce reliable results. To eliminate the bias associated with the BBD index, they use the terms such as "stock price," "equity price" or "market return" to replace "uncertainty." They find a 0.73 correlation using the Chicago Board Options Exchange (CBOE)[9] Volatility Index (VIX). This index is a highly acknowledged measure of uncertainty related to the equity measure. Gulen and Ion (2016) note that newspapers articles may not be reliable sources of information about policy uncertainty and thus call into question the validity of the BBD index. The major information source of BBD index is newspapers but how much the reports and news of newspapers are credible? The problem is, some of the newspapers support the opposition and other support sitting government. Hence, there are two types of newspapers, (i) left-leaning and (ii) right-leaning and through this categorization, the information may not be credible. For instance, right-leaning newspapers highlight more about

[9] The CBOE Volatility index is a famous instrument uses to measure equity prices uncertainty.

economic uncertainty when republicans are in power and vice-versa[10]. Baker et al. (2016) investigate this problem and use the media slant index developed by (Gentzkow & Shapiro, 2010). To check the media slant, Baker et al. (2016) use ten most credible newspapers and divide into the two groups. Five for left-leaning and five from right-leaning. They then apply textual search individually on both sets of newspaper and explore both sets (Left and Right Leaning Newspaper) of policy uncertainty to track each other closely.

They found that both groups (right and left-leaning newspapers) contain the same information (in terms of context and content). Further, they find that both newspapers published the same news reports and not a single newspaper contained biased news. These findings suggest that variations in news based index are not the result of political perspective. On the basis of the above arguments, Gulen and Ion (2016) find that the BBD index does not hold any bias in the above discussion.

2.3.6.2. Market validity index

Commercial data providers such as Bloomberg, FRED, Haver, and Reuters offer the BBD index to meet researchers, banks, corporations, hedge funds, and policymakers' demand. The BBD index of policy uncertainty has very strong market validity (Baker et al., 2016), and is often used to make firm investment decisions (Gulen & Ion, 2016). Our study argues that cash holding (an indicator of investment activities) is influenced by policy uncertainty. Previous literature has failed to investigate the role of policy uncertainty on firms' cash holding practices outside the US market. This study aims to fill this research gap by examining the impact of policy uncertainty on firm cash holding practices.

[10] Left leaning newspapers support the opposition party and right leaning papers support the ruling party. The media slant index suggests that left and right leaning newspaper track each other and not a single newspaper is biased or favors a particular party.

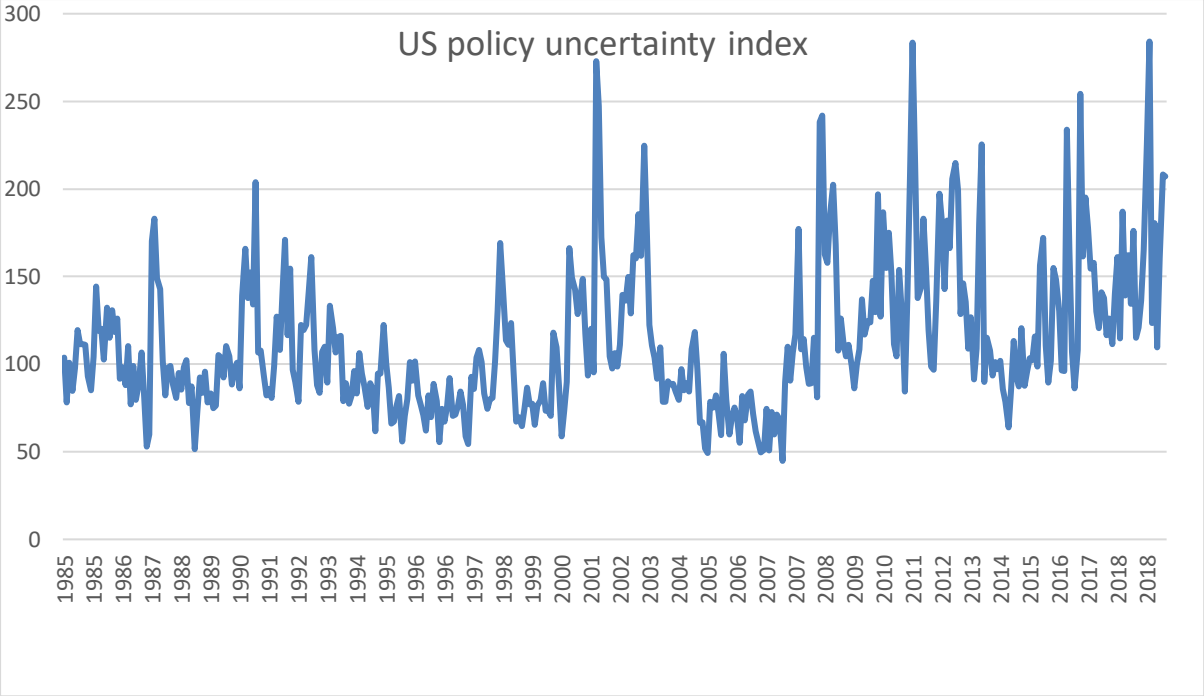


Figure 2.1 Economic policy uncertainty index

Source: (Baker et al., 2016)

Figure 1 shows volatility in the policy uncertainty index due to macroeconomic events in the US market. The index increases when something happens at a national or international level, such as major government decisions and macroeconomic uncertainty. The index decreases when there is no event in the market. When an uncertain event occurs, managers halt business investments to avoid risk. This strategy ultimately increases its cash reserves (Baker et al., 2016; Gulen & Ion, 2016).

Table 2.1 Selected studies on cash holdings

Authors	D.Variables	I.Variables	Methodology	Relationship	Country
Opler et al. (1999)	Cash holdings	WC, CCC, Firm Size, Debt to Asset, Capex	OLS	(+), (-),(-), (+), (+)	USA
Dittmar et al. (2003)	Cash holdings, Cash/Sales	Shareholders right, Common Law, WC, Size	OLS	(-),(-),(-),(-).	USA
Almeida et al. (2004)	Cash holdings	Cashflow, FC measures, Size, Capex, WC, Acquisition	OLS	(+), -/(+), (-), (+), (-)	USA
Baum et al. (2004)	Cash holdings	Inflation, Libor	System-GMM	(-), (+)	UK
Baum et al. (2006)	Cash holdings	Macroeconomic uncertainty	System-GMM	(-)	UK
El-Masry et al. (2007)	Exchange rate exposure	Size, Sales, Assets, Income	OLS	(-), (-), (-), (-)	UK
Dominguez and Tesar (2006)	Market return	Foreign sale, Industry coverage	OLS	(+), (+)	UK, Germany, France, Japan, Chili, Italy
Guney et al. (2007)	Cash holdings	Leverage, Leverage^2, Capex	OLS, FE	(-), (+), (+)	UK, USA, France, Germany, Japan
Curtis et al. (2017)	Cash holdings	Inflation	OLS	(-)	USA
Phan et al. (2019)	Cash holdings	Economic policy uncertainty	OLE, FE	(+)	USA
Iqbal et al. (2019)	ROA, ROE, NP, TQ ratio	Economic policy uncertainty	System-GMM	(-)	USA
Stone (2018)	Cash holding	Interest rate	Quantile regression	(+)	USA
Berger et al. (2018)	Bank's liquidity	Economic policy uncertainty	FE	(+)	USA
Wang et al. (2014)	Cash holdings	Inflation rate, operating cycle	OLS, FE	(-), (-)	China
Bonaime et al. (2018)	M&A	Economic policy uncertainty	OLE, FE	(-)	USA

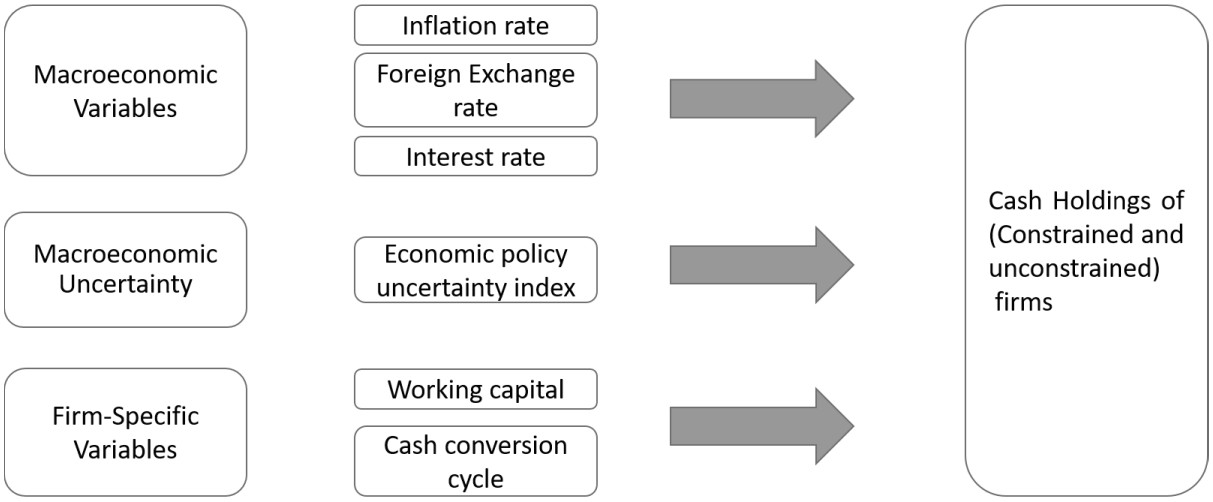
Note: D = dependent variable and I = independent variable

Source: Author's compilation

2.4 Conclusion

This chapter has discussed relevant literature on cash holdings and the factors that affect it. The chapter also discussed firm-specific factors (such as working capital and CCC), macroeconomic variables (such as interest rates, inflation rates, exchange rates and macroeconomic uncertainty (the economic policy uncertainty index). We also provide evidence from, and references in, previous literature which explains the framework, validity, and reliability of the BBD index. Most of these studies argue that the information generated by this index is unbiased and reliable.

Figure 2.2 Conceptual framework of the study



Note: FC and Non-FC refer to the financial health of non-financial firms.

Source: Author's compilation based on previous studies.

Figure 2 shows the conceptual framework of the study.

The literature suggests that when inflation increases that firms will hold less cash because its value declines. Thus, firms will invest in projects that will bring them high returns (Wang et al., 2014). Similarly, when interest rates increase, firms will increase their cash holdings because banks will also increase their interest rates on deposits and firms will have greater incentives to hold cash at the banks in lieu of investing in risky projects (Stone et al., 2015). As foreign exchange rates increase or decrease, firms experience volatility in their cash balances. Mathur and Loy (1984) suggest that firms who participate in international trade,

either through importing or exporting, experience fluctuations in their cash flows due to foreign exchange rate volatility. Toraganlı and Yazgan (2016) also document a positive significant relationship between volatility in foreign exchange rate firm behavior and survival. They suggest that firms with large sale volumes have a higher probability of survival than smaller firms when there is currency exchange volatility.

Firms often hold cash as a buffer to decrease their future risks, but large firms can reserve less cash because of easier access to financial markets (Denis & Sibilkov, 2010). They further note that FC firms tend to accumulate a large amount of cash because these firms have not easier access to bank loans and the financial markets. If the CCC of Non-FC firms increases, then these firms can access funds from other sources, such as bank loans and sales revenues. With these external sources of finance, Non-FC firms can meet their operation requirements without facing any liquidity shortages (Bigelli & Sánchez-Vidal, 2012). However, it is a different story for FC firms. If the cash conversion period increases, then FC firms may face liquidity challenges as they cannot access outside funding. The same is true of working capital. If firms, which have good financial health, invest more in working capital then they can avail opportunity costs due to other sources of financing. Nevertheless, this is reversed in FC firms (Huang et al., 2015).

Song and Lee (2012) describe that firm cash holdings are influenced by macroeconomic factors rather than firm-specific variables. The authors further note that after 2008 GFC firms changed their corporate cash holdings policies. They explain that it was difficult for some firms to raise external financing during the crisis period because it was too expensive. Thus, after this period, those firms which survived made a greater effort to lessen the dependency on external financing and to hold more liquid assets with cash inflows.

This chapter discusses the detailed literature review of cash holdings with theoretical and empirical support. The next chapter discusses the sample size, time span of the study sample, variables definition and econometric methodology.

Chapter 3

Research data and methodology

3.1 Introduction

This chapter provides an overview of the data sampling, empirical estimation, problems with OLS and fixed effect estimation and their possible solutions. Section 3.1 discusses the sample selection and data sources. Sections 3.2 and 3.3 outlines the study's dependent, independent and control variables. Section 3.4 discusses in detail the static and dynamic model specifications. While section 3.5 reviews the SGMM diagnostic test, section 3.6 investigates the problem of decline in cash holdings during the 2008 GFC.

3.2 Sample selection and data sources

This study uses annual data from 2003 to 2015 (13 years). This study estimates (i) the effect of firm-specific, and (ii) macroeconomic variables and economic uncertainty on non-financial firms' cash holdings. The data was obtained from Bloomberg (for firm-specific), The World Bank (for macroeconomic factors) and the economic policy uncertainty index (EPU) (for macroeconomic uncertainty). We use non-financial firms, listed in top indexes (such as the S&P 500 index for the US, the CSI 300 index for China, the Nikkei 225 for Japan and the NIFTY 500 for India) of the selected countries (the US, China, Japan, and India). All of these firms are in our population framework. In this study, I exclude the financial firms. Phan et al. (2019) suggest that cash holdings in financial firms have different meaning. Following Welch (2004), I winsorized data from bottom (top) at 5 (95) percentile to remove the extreme bottom (top) values. I use 5 (95) percentile because the data is not normalise at 1 (99) percentile. Abnormal values show biased results[11]. This study considers the 2008 GFC because corporations changed their cash holdings policies after this crisis. The study includes pre-GFC, during the GFC and post-GFC periods to ascertain the impact of firm-specific, macroeconomic-specific and macroeconomic uncertainty (EPU) on non-financial firms' cash holdings. Song and Lee (2012) suggest note firms' cash holdings are better explained by macroeconomic factors than

[11] The data is winsorized at 5 (95) percentile and not trimmed to take the effect of all observation in the dataset.

firm-specific factors. They further, describe that after the GFC, firms changed their corporate policies and now hold more liquid assets to overcome the financial turmoil.

This study selects both developed and developing economies to investigate the cash holdings practice in different economies; hence we can generalize the findings in terms of both developed and developing countries. We consider the list of countries for our study sample using Baker et al's (2016) Economic Policy Uncertainty (EPU) index[12]. The MSCI index[13] is used to categorize developed and developing economies along with the EPU index. There are 19 countries that have an EPU index: 13 are developed and 6 are developing countries. Table 3.1 shows information about the countries selected for this study.

Table 3.1 Market capitalization of countries

Countries with Economic Policy Uncertainty Index (EPUI)			
Developed economies	**Market capitalization in USD (millions)**	**Developing economies**	**Market capitalization in USD (millions)**
USA	27,473,000	China	7,603,000
Europe	12,278,000	India	2,105,000
Japan	5,779,000	Korea	1,482,000
UK	3,546,000	Brazil	902,272
France	2,418,000	Russia	564,899
Germany	2,247,000	Chile	269,154
Canada	2,231,000		
Australia	1,325,000		
Spain	822,514		
Sweden	813,002		
Italy	687,096		
Netherland	610,768		
Singapore	553,531		
Ireland	125,425		

Source: Bloomberg, Countries segregated based on MSCI index

[12] http://www.policyuncertainty.com/

[13] https://www.msci.com/documents/10199/2c8ba380-f990-4efe-8532-500307e046ee

This study chooses the top two countries from each category based on total market capitalization and uses each selected country for all the study objectives. We choose our sample countries equally; that is, top two from developed and two from developing markets. We find missing data in the rest of the developing countries such as Korea, Brazil, Russia and Chile hence we have to choose the top two countries from developing and two from developed markets[14]. Next, we differentiate between FC and Non-FC firms for each country and each objective to determine the differences in the behaviour of both types of firms (FC and unconstrained). To differentiate between constrained and Non-FC firms, we use total firm assets to determine the firm size (Almeida et al., 2004; Duchin, 2010).

3.3 Dependent variable

3.3.1 Cash ratio

Cash ratio represents the total amount of cash and marketable securities to total assets. The ratio suggests the level of liquid assets retains by a firm against its total assets. These liquid assets help firms to run business operation and to finance further capital investments. The firms with higher sales and assets hold large amount of cash. These firms normally have enormous cash inflows, however, firms with lower sale and assets hold smaller cash. In this study, we measure the percentage of cash against its total assets held by a firm following previous studies such as (Huang et al., 2015; Mun & Jang, 2015; Wang et al., 2014).

3.4 Independent variables

3.4.1 Working capital

Firms generate its account receivable and payables for two reasons. The first reason is to run the business operations efficiently, for instance, a firm's accounts payable increases when firm unable to make payment at the time of transaction due to shortage of cash. Second, when firm makes a credit sale to increase market share and receive the sales amount later then there is an increase in account receivables. The difference between these two accounting components is called working capital. Managers subtract current liabilities from current assets to obtain the amount of working capital. The positive answer of the calculation

[14] Researchers find missing values of firm specific variable such as cash conversion cycle, total debt, profitability, cash flow from operation and market to book ratio in many years.

indicates that firm has more current assets than current liabilities and vice-versa. The increase in working capital suggests that firm is unable to recover its debtors' amount and firm can face a cash shortfall which indicates a negative relationship of working capital and cash holdings (Harford et al., 2012; Opler et al., 1999). However, in more cash-rich firms, working capital is positive sign to increase cash holdings (Wang et al., 2014).

3.4.2 Cash conversion cycle

This measure provides an indication of a firm's financial performance; that is, how many days a firm takes to complete its cash cycle (from purchasing raw materials to receiving cash from sales). Previous studies such as Bigelli et al. (2014), Drobetz and Grüninger (2007) and, Nobanee et al. (2011) consider the CCC as an effective component if the receivables turnover and inventory turnover meet the optimal level set by the firm. Drobetz and Grüninger (2007) and, Nobanee et al. (2011) document an inverse relationship between the CCC and cash holdings.

3.4.3 Inflation rate

The general price level of good and services increases in the economy over the period. This increase in price level is called inflation. Most of the economist use consumer price index (CPI) to measure the inflation rate. When inflation increase in the economy, purchasing power regarding commodities decreases against one dollar than the preceding period. As price increase, one dollar drops its buying value of commodities. Hence, increase in inflation rate shows a decline in purchasing power in the economy.

This study uses the inflation rate to analyze the effect of increasing (decreasing) inflation on cash holdings of firms. Prior studies document that with an increase in the inflation rate, firm has to spend more to maintain its purchasing power, hence level of cash decreases (Baum et al., 2004; Opler et al., 1999; Wang et al., 2014).

3.4.4 Interest rate

This measure represents the percentage of principal amount charges (the lender charges the borrower) for a specific time period. The interest rate, normally charged on an annual basis, is known as the annual percentage or annual interest rate. Stone et al. (2015) use the annual interest rate and document that interest rate and cash holdings are significant and positively

related. However, Drobetz and Grüninger (2007) and, Zeng (2015) note that interest rate and cash holdings are negatively related. Zeng (2015) documents a downward trend in cash ratios during the 1980s and 1990s. The author finds the relationship between macroeconomic variables (such as GDP & interest rate) and the cash ratio of Norwegian firms. Drobetz and Grüninger (2007) note that firms with higher levels of leverage tend to hold less cash because higher cash holdings increase opportunity costs along with interest expenses.

3.4.5 Foreign exchange rate

This indicates the value of one country's currency to another country's currency. Hence, the exchange rate has two components: the domestic currency and foreign currency. Dominguez (1998) and, Landon and Smith (2009) use the exchange rate of Japanese Yen and Euro respectively. The authors suggest that an increase in the exchange rate of a country increases the probability of foreign investment. In contrast, Landon and Smith (2009) document that it is difficult for local investors to make an investment when exchange rate increase. Furthermore, Ito et al. (2016) and, Toraganlı and Yazgan (2016) find that importing and exporting firms design their liquidity risk management policies according to the exchange rate volatility.

3.4.6 Economic policy uncertainty

This measure shows the overall level of economic uncertainty in the country. It includes national interest, such as political instability, terrorism, election or any media report which reflects uncertainty in a country's economy. In this thesis, Baker et al.'s (2006) economic policy uncertainty (EPU) index is used as a proxy for macroeconomic uncertainty. Gulen and Ion (2016) use this index to analyse the impact of economic uncertainty on firm investment and find a negative relationship.

3.5 Other explanatory variables

3.5.1 Market to book ratio

This measure represents the evaluation of a company's stock (whether it is undervalued or overvalued by comparing its book value). Denis and Sibilkov (2009) and, Dittmar et al. (2003) both document that financial distress positively affects the firm's cash holdings. They find that firms with a higher market to book ratios tend to hold more cash in seasons of financial distress.

3.5.2 Leverage

The firms have two sources of financing to complete a capital structure. The first and most common source is equity financing. The second source to get financing is bank and other non-banking financial institutions. The purpose of the financing is to provide an uplift in business growth in short span of business cycle. But how much a business is financed from banks against its total assets. The calculation of this measure is called leverage. Leverage is debt amount that a firm acquires from financial institutions to buy more assets. Guney et al. (2007) and, Ozkan and Ozkan (2004) investigate the relationship between leverage and cash holdings and find a positive relation. Their findings suggest that firms cover cash shortages through debt. Hence, firm leverage increases.

3.5.3 Profit/(loss) for the year

This measure shows a firm's financial gains or losses. This figure is determined by deducting costs from sales in one operating year. Al-Najjar (2013) and, Opler et al. (1999) find that the cash to asset ratio varies across industrial sectors and tends to be higher in profitable firms. They find a positive relationship between profitability and cash holdings.

3.5.4 Firm size

This measure shows the size (or total assets) of a firm and whether it is considered FC or Non-FC. Harford et al. (2012) and, Opler et al. (1999) take the natural log of firm assets to determine whether a firm is FC or Non-FC. They find that firm size has a negative relationship with cash holdings.

3.5.5 Sales growth (yearly)

This variable represents the growth in a firm's sales over the financial year. It is the percentage change in sales from year to year. D'Mello et al. (2008), Dittmar and Mahrt-Smith (2007b) and, Pinkowitz and Williamson (2002) all find that sales growth has a positive impact on firm cash holdings.

3.5.6 Cash flow from operations

Firms obtain cash from various sources. However, what is most important is how much a firm generates from its operation. Previous studies (see for example), Gulen and Ion (2016) divide cash flow from operations to total assets to determine one-year performance. Harford (1999) and, Wang et al. (2014) use this variable and find a positive relationship with cash holdings.

3.5.7 Capital expenditure

This ratio represents a firm's expenses in acquiring non-current assets (land, building, plants, and machinery) in each financial period. The capital expenditure ratio is measured by dividing capital expenses from the total net cash assets. Opler et al. (1999), D'Mello et al. (2008) and, Harford et al. (2012) use this variable and find a positive relationship between capital expenditure and cash holdings.

3.5.8 Rule of law

The "rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence."[15] Dudley and Zhang (2016), Pinkowitz et al. (2006) and, Ramirez and Tadesse (2009) all use this variable and find a negative relationship with firm cash holdings. They suggest that firms tend to hold higher levels of cash where the rule of law is not very effective and vice-versa.

3.5.9 Regulatory quality

"Regulatory quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector

[15] http://info.worldbank.org/governance/wgi

development[16]." Dudley and Zhang (2016) use this measure for the first time in cash holdings literature and find a negative relationship. They note that firms working in highly regulated environments hold less cash and vice-versa.

3.5.10 Gross domestic product (GDP)

Country's economic health is normally measured by the GDP in one year. GDP is the sum of all business activities in a region. Increase in GDP from the preceding year, indicate that the economy is growing, and level of employment is increasing. This state of economy has positive indication for local and international investors to finance profitable projects. Increase in GDP create more business opportunity, and in response corporation significantly hold cash (Baum, 2006; Baum et al., 2008; Zeng, 2015).

3.5.11 Money supply

Firms cash holding levels differ as a result of contractions[17] in monetary policy (Wang et al., 2014). During monetary policy contractions, firms hold more cash to avoid having to borrow money from external financing sources (Jigao & Zhengfei, 2009). This enables firms to meet future demands for positive NPV projects.

3.6 Empirical models

This study has three main aims: The first aim is to investigate the impact of firm-specific variables (CCC and working capital) on cash holdings. The second aim is to examine the effect of macroeconomic variables (the interest rate, inflation, the foreign exchange rate, and economic uncertainty) on cash holdings. The third aim is to analyse the combined impact of firm-specific and macroeconomic variables on cash holdings.

Chen and Mahajan (2010) investigate the effect of macroeconomic variables on corporate liquidity. They use GDP and the inflation rate to examine the impact on cash holdings. They also use firm-specific variables that include the market to book ratio, leverage, and dividends. Using the fixed effect estimation technique, they find that that macroeconomic variables have an indirect impact on cash holdings because macroeconomic variables affect firm-specific

[16] http://info.worldbank.org/governance/wgi

[17] Contraction of money supply is carried out by a country's central bank. The central bank may sell bonds to the public so that the amount of money available in the market decreases.

variables. The general specifications of their model are the firm specifications and macroeconomic variables given as follows:

$$y_{ijt} = c_i + \sum_{f=1}^{F} \vartheta_f \prod_{ijt}^{f} + \sum_{m=1}^{M} \mu_m \prod_{ikt}^{m} + X_{ijt} + \lambda_t + \varepsilon_{it} \quad (3.1)$$

Where:

$\varepsilon_{it} = \mu_i + v_{it}$

(y_{ijt}) represents the dependent variable for firms' cash 'i' of country 'j' at time 't', with '$i = 1 \ldots N$ and $t = 1 \ldots T$'. N is the number of cross-sectional observations. The length of the sample period is represented by T. (c_i) denotes the constant term. $(\prod_{jt}^{F}, \prod_{kt}^{m})$ denote firm-specific and macroeconomic variables. Xijt: denotes control variables for cash holdings. (ε_{it}) refers to the disturbance error. (μ_i) refers to unobserved heterogeneity (fixed effect) for firm *i* and λ_t is the time-specific effect for firm *i*. (v_{it}) refers to the idiosyncratic error. Equation (3.1) is a two-way error component regression, where (μ_i) is ~IIN $(0,\sigma_{\mu_i}^2)$ and independent of (v_{it}) which is ~IIN (0, $\sigma_{v_{it}}^2$).

Following is the equation (3.1.2) which is the specification of equation (3.1):

$$\begin{aligned} Cash_{i,t} = \alpha_i &+ \beta_1 NWC_{i,t} + \beta_2 CCC_{i,t} + \beta_3 Epu_t + \beta_4 Intr_t + \beta_5 Infl_t + \beta_6 Fxr_t \\ &+ \beta_7 Gdp_t + \beta_8 Moneysupply_t + \beta_9 Mtb_{i,t} + \beta_{10} Size_{i,t} + \beta_{11} Lev_{i,t} \\ &+ \beta_{12} Capex_{i,t} + \beta_{13} Cfo_{i,t} + \beta_{14} Rule_t + \beta_{15} Reg_t + \beta_{16} Prof_{i,t} \\ &+ \beta_{17} Salesgrowth_{i,t} + \lambda_t + \varepsilon_{it} \ldots\ldots (3.1.2) \end{aligned}$$

Where *i* represents a firm with yearly time effect on t. μ_i and λ_t are the (unobserved) individual and time-specific effects. Cash is the dependent variable and $\acute{\varepsilon}$ denotes the error term. *Cash* is cash holdings of a firm in year t, *Nwc* is networking capital, *CCC* is the cash conversion cycle, *Epu* represents economic policy uncertainty, *Intr* represents interest rate, *Infl* is inflation in the fiscal year, *Fxr* is average foreign exchange rate in a fiscal year. The control variables will be used to predict the accuracy of the results. *Gdp* represents gross domestic product, *Moneysupply* is the money supply of a given country, *Mtb* is market to book ratio, *Size* refers to firm size (total assets), *Lev* is firm leverage, *Capex* is capital expenditure, *Cfo* is cash flow from operations, *Rule* is rule of law in a country, *Reg* is regulatory

quality of a country, *Prof* as firm profitability and *Salesgrowth* is sales growth of a firm in a given year.

3.6.1 Static and dynamic model specifications

In this section, we review the general framework of panel data. We discuss common econometric issues in panel data estimation. The estimations include static OLS, Fixed Effect, dynamic panel data analysis and advanced estimation approaches i.e. System-GMM.

3.6.2 Multiple regression

We start our analysis with static regression estimations (OLS & Fixed Effect) to measure the relationship between independent variables (see Table 3.2) on firm cash holdings.

Table 3.2 Variables and measurements

Variables	Symbol	Measurement
Dependent variable		
Cash holdings	$CH_{i,t}$	Cash and cash equivalents/total assets.
Independent variable		
Firm-specific variables		
Working capital	$WC_{i,t}$	Current assets-current liabilities over total assets
Cash conversion cycle	$CCC_{i,t}$	CCC = DIO + DSO – DPO
Macroeconomic variables		
Economic policy uncertainty	EPU_t	EPU as a proxy for overall policy uncertainty
Interest rate	Int_t	Annual average interest rate in a single year t.
Inflation rate	$Infl_t$	Changes in the Consumer Price Index (CPI) for year t, of each country.
Foreign exchange rate	FXR_t	Annual avg. of the foreign exchange rate of year t with respect to US$.
Firm controls		
Market to book ratio	$MTB_{i,t}$	Market price/book value in year t.
Size (firm size)	$SIZE_{i,t}$	Ln of total assets in year t.
Firm leverage	$LEV_{i,t}$	Debt over total assets of a company in year t.
Capital expenditure	$CAPEX_{i,t}$	Capital expenditure/total assets
Cash flow from operations	$CFO_{i,t}$	Cash flow from operations
Firm profitability	$PROF_{i,t}$	Ln of profit (loss)
Revenue growth	$GROWTH_{i,t}$	Δ of sales
Macro controls		
Gross domestic product	GDP_t	Total value of goods & services in a country in year t.
Money supply	MS_t	Total value of monetary assets within a country in year t.
Rule of law	$RULE_t$	Rule of law in a country within year t.
Regulatory quality	REG_t	Regulatory quality in a country within year t.
Year		Year dummies
Industry control		Industrial dummies

Previous studies such as Chakraborty et al. (2017), Im et al. (2017), Wang et al. (2014) and, Wu et al. (2016) begin their analysis with OLS followed by fixed effect estimation. Researchers such as Baltagi (2008) and, Gujarati (2004) suggest that the OLS technique is the best linear unbiased estimator (BLUE) for panel data. However, they note that scholars must first confirm assumptions before they run empirical estimation on panel data.

3.6.3 Classic linear regression model

Before applying OLS estimation, it is first necessary to execute some basic diagnostic tests on the data set. These tests are like several Classic Linear Regression Model (CLRM) assumptions discussed below:

3.6.4 Unit root test

One should confirm the presence of stationarity in panel data (Maddala & Wu, 1999). It means that there is no time dependence of the mean and variance of variables. However, variables have to be independent and should not be dependent on their previous years' values (Gujarati, 2004). The application of CLRM to a non-stationarity dataset can produce spurious results (Gujarati, 2004). However, in the field of economics and finance, time related or seasonal shocks in one time period may strongly influence the subsequent period(s). To check for stationarity in our dataset, we apply the Augmented Dicky-Fuller test. The test can be written as:

$$P = -2 \sum_{i=1}^{n} \ln Pi \rightarrow x^2 (2n) \qquad (3.2)$$

Equation (3.2) is designed for relatively smaller N. Choi (2001) presents a modified version of the Fisher-Type test to deal with large N. The test is written as follows:

$$P_m = \frac{1}{2\sqrt{n}} - \sum_{i=1}^{n} (-2Ln\ Pi - 2) \rightarrow N(0,1) \qquad (3.3)$$

The current study applies both the Fisher-Type and Modified Fisher-Type tests to check for stationarity in the unbalance data.

3.6.5 Multicollinearity

According to Baltagi (2008) and Gujarati (2004), another basic assumption of CLRM is that there should be no multicollinearity among the independent variables. For this purpose, we apply the Pearson Pairwise Correlation test and check the degree correlation among regressors. If the regressor correlation is above 0.80, this indicates the presence of multicollinearity (Gujarati, 2004). Baltagi (2008) argues that the existence of collinearity violates the basic assumption of the CLRM.

3.6.6 Problems of Static OLS

Most cash holdings studies for instance Nobanee et al. (2011), Saddour (2006) and, Wang et al. (2014) use OLS estimation, but there are several underlying assumptions of OLS that must be met in order to ensure the robustness of the results (Baltagi, 2008; Gujarati, 2004). According to Gujarati (2004), the OLS model is likely to produce highly significant results and a higher R^2. Wang et al. (2014) determine the impact of inflation on cash holdings using fixed effect (FE) estimation. Wang et al., suggest that OLS produces inefficient and biased results. Saddour (2006) examines the cash holdings behaviour of French firms. Saddour uses OLS and then applies the FE model to overcome the biases of the OLS results.

One major problem is that OLS does not distinguish between cross-sections; that is, firms in our case. In other words, OLS cannot determine whether the response of cash holdings to firm-specific factors, macroeconomic factors, and economic uncertainty is similar or different over time and among cross-sections. If the response over time is different the CLRM suffers from a heterogeneity problem.

The heterogeneity problem can, however, be eliminated using the FE model because it allows individuals to have their own intercepts. In other words, one can control for firm-specific fixed effects in FE regression, which is not possible in OLS. The next section reports and discusses the FE estimation of our basic regression models.

3.6.7 Fixed-Effect Estimation (FE)

Baltagi (2008) argues that fixed-effects estimation controls for individual effects hence overcomes the problem of OLS estimation where individual effects are dumped into the error term. In this section, we apply the FE estimation to measure the impact of firm-specific,

macroeconomic specific variables and economic uncertainty on cash holdings of developed and developing markets.

3.6.8 Advanced diagnostic tests

One important assumption of CLRM is that the error term is constant over time as well as across cross-sections; violation of this assumption causes heteroscedasticity (Gujarati, 2004). Similarly, the error term should not be correlated with its past value; violation of this assumption means that there is a serial correlation in the data and OLS or fixed-effects estimation will no longer be the *Best Linear Unbiased Estimation* (BLUE). In the next section, we discuss these two assumptions.

3.6.9 The Breusch-Pagan/Cook-Weisberg Test for Heteroscedasticity

An important CLRM assumption is that the error term must be constant with the passage of time as well as cross-sections. If this assumption is violated, it causes heteroscedasticity in the model (Gujarati, 2004). In other words, the error term μ_i must be equal to a constant number, which is variance (σ^2). To address this issue, we apply the Breuch-Pagan/Cook-Weisberg test for heteroscedasiticity. It can be numerically written as:

$$E\,(\mu_i^2) = \sigma^2 \; where \; i = 1, 2, \ldots . n \qquad (3.4)$$

We use the Breusch-Pagan test since it overcomes the limitation of correctly identifying the *X* variable which is not possible with the Goldfeld-Quandt test. The Breusch-Pagan test can be illustrated using a simple numerical equation as outlined below:
We assume our basic model where cash holdings *(Cash)* depends on *X* variables:

$$(Cash)i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_{ki} + u_i \qquad (3.5)$$

error term (σ^2) is:

$$\sigma^2 = f(\alpha_1 + \alpha_2 Z_2 + \ldots . + a_k Z_{ki}) \qquad (3.6)$$

Equation (3.6) assumes that σ^2 is a linear function of *Z* variables or $a_2 = a_3 = 0$ or $\sigma_i^2 = a_1$ which is constant. We test the null hypothesis of the Breusch-Pagan test that, $a_2 = a_3 = 0$, which is homoscedasticity.

3.6.10 Autocorrelation Test

The CLRM assumes that there is no autocorrelation in the disturbance term. In other words, the error term related to one particular observation is not influenced by the error term of the other observation (Baltagi, 2008; Gujarati, 2004). This relationship can be written symbolically as:

$$cov(u_i, u_j | x_i, x_j) = E(u_i\, u_j) = 0 \quad \text{where } i \neq j \qquad (3.7)$$

However, Baltagi (2008) and Gujarati (2004), argue that this assumption might be very restrictive in cross-sectional data, especially in economics and finance where shocks in the current period might influence the next period. What happens to CLRM if the disturbance terms are correlated? Baltagi (2008) argues that linear panel estimations are affected by autocorrelation; they are considered inefficient because of the downward biased standard error. Autocorrelation in panel data can be detected using several tests, including the Baltagi-Wu test, Durbin-Watson test, and the Breusch-Godfrey test. According to Drukker (2003), these tests employ many assumptions such as individual effect types, the need for non-stochastic regression and an inability to work in the presence of heteroscedasticity. Drukker (2003) further argues that Wooldridge's (2010) autocorrelation test does not have such limitations. It can deal with unbalanced panel data, even if there are gaps in the observations. Thus we use the Wooldridge (2010) test. It is can be written as:

$$y_{it} - y_{it-1} = (X_{it} - X_{it-1})\beta_1 + \varepsilon_{it} - \varepsilon_{it-1} \qquad (3.8)$$

or

$$\Delta y_{it} = (\Delta X_{it})\beta_1 + \Delta\varepsilon_{it} \qquad (3.9)$$

Where y_{it} is firm cash holdings (cash/assets), X_{it} is a vector of independent variables such as working capital, the cash conversion cycle, the interest rate, the inflation rate, the exchange rate, and economic uncertainty and ε_{it} is the error term. This test uses the residuals from the simple regression in the first difference Δ and tests the null hypothesis that there is no

autocorrelation. We estimate this test using the user-written command “xtserial” in STATA (version 12), which implement the Woolridge test for serial correlation in unbalanced data.

3.6.11 Reliability of static models (OLS & FE) and possible solutions

There is heteroscedasticity and autocorrelation in data if the diagnostic tests reject the null hypothesis. Hence, the question is, how reliable are the OLS estimations in comparison to FE? What are the possible solutions to these problems? Baltagi (2008) argues that the OLS estimates are consistent but inefficient in the presence of heteroscedasticity and autocorrelation, as the standard errors are downward biased, and CLRM assumes that disturbance terms are constant and independent across cross-sections and time. Similarly, FE estimation also assumes that the disturbance term V_{it} is identically distributed and independent of V_{it} for all i and t. Thus, our estimates (OLS & FE) for this study are inefficient.

3.7 The problem of endogeneity

3.7.1 Reverse causality

In this study, we must also consider the problem of endogeneity in the data set. This means that if the firm factors and macroeconomic determinants affect cash holdings then cash holdings can also affect firm and macroeconomic determinants. The existence of endogeneity causes simultaneity or reverse causality in the dataset. If simultaneity is found in the dataset then OLS and FE are no longer the best estimators to use as they will generate biased results (Wintoki et al., 2012). To solve the problem of simultaneity (endogeneity), Gujarati (2004) recommend using dynamic panel data (DPD) analysis.

3.7.2 Dynamic Panel Data Estimation

Gujarati (2004) states that one method to investigate whether the empirical model is dynamic, or static is to test whether the lagged dependent variable is also a regressor. If the test is significant, then it implies that the model is dynamic and should be estimated using the dynamic panel data model.

Based on this, our basic linear model can be written as a dynamic model, with a lagged dependent variable:

$$Cash_{it} = Cash_{i,t-1} + \sum_{f=1}^{F} \vartheta_f \prod_{it}^{f} + \sum_{m=1}^{M} \mu_m \prod_{ikt}^{m} + X_{it} + \lambda_t + \varepsilon_{it} \quad (3.10)$$

Where:

$$\varepsilon_{it} = \mu_i + v_{it}$$

$Cash$ is a firm's cash holdings and $Cash_{i,t-1}$ is lagged firm cash holdings. ($\prod_{jt}^{F}, \prod_{kt}^{m}$) denote firm-specific and macroeconomic variables. $X_{i,t}$: denotes control variables of cash holdings. (ε_{it}) refers to the disturbance error. (μ_i) refers to the unobserved heterogeneity (the fixed effect) for firm *i* and λ_t is the time-specific effect for firm *i*. (v_{it}) refers to the idiosyncratic error.

Ozkan and Ozkan (2004) use dynamic panel data estimation to explore the nexus of corporate governance and cash holdings. They document that corporate governance endogenously related to cash holdings. Larger firms have ample revenue so that these firms can develop their corporate governance structures to run their business affairs. If a firm maintains a good and effective governance structure, then it can perform efficiently and can grow.

3.7.3 Unobserved heterogeneity

The second source of endogeneity is unobserved heterogeneity: that is, there are some other firm-specific and macroeconomic specific factors, such as capital structure and R&D. which might affect firm cash holdings. The fixed part of this unobserved heterogeneity can be solved by applying FE estimation to the linear model (Wintoki et al., 2012). But, as (Baltagi, 2008) argues, the FE estimator will only produce unbiased results if the current value of the independent variables (firm-specific, macroeconomic-specific and economic uncertainty) are independent of past values of the dependent variable (cash holdings).

3.8 Dynamic panel data estimation: System GMM

Endogeneity (due to simultaneity and unobserved heterogeneity) restricts the use of static OLS and FE estimation because these estimators produce biased and inefficient results (Wintoki et al., 2012). Thus, we apply the dynamic panel data (DPD) estimation model so that we can incorporate the dynamic nature of the relationship between firm cash holdings and firm-specific factors, macroeconomic factors and economic uncertainty factors, which produce unbiased results.

$$Cash_{it} = \alpha_i + \beta_1 NWC_{i,t} + \beta_2 CCC_{i,t} + \beta_3 Epu_t + \beta_4 Intr_t + \beta_5 Infl_t + \beta_6 Fxr_t + \beta_7 Gdp_t + \beta_8 Moneysupply_t + \beta_9 Mtb_{i,t} + \beta_{10} Size_{i,t} + \beta_{11} Lev_{i,t} + \beta_{12} Capex_{i,t} + \beta_{13} Cfo_{i,t} + \beta_{14} Rule_t + \beta_{15} Reg_t + \beta_{16} Prof_{i,t} + \beta_{17} Salesgrowth_{i,t} + \beta_{18} Cash_{t-1} + \lambda_t + \varepsilon_{it} \ldots. (3.12)$$

Where:

$$\varepsilon_{it} = \mu_i + v_{it}$$

Baltagi (2008) describe that at least there are two basic characteristics of dynamic panel data i.e., (i) autocorrelation and (ii) endogeneity problem (mainly because of the simultaneity). The presence of autocorrelation means that lag dependent variable is also a function of the error term. For instance, in this case, the cash regressor ($Cash_{i,t-1}$) in equation (3.12) and it is the function of ε_{it}, likewise $Cash_{it}$. Estimation of OLS is inconsistent and biased if model is dynamic, even there is no serial correlation.

Secondly, these models have endogeneity (mainly because of the simultaneity) problem. Similarly, the FE estimator can eliminate firm-specific fixed effects in our model, but $Cash_{it-1}$ will still be correlated with ε_{it}, which makes it inappropriate to use the FE estimator in the dynamic models of panel data (Baltagi, 2008). Particularly, Wooldridge (2010) document that the FE estimator in equation (3.12) possibly generate the following bias.

$$1/T \sum_{t-1}^{T} E(Z_{it}, \varepsilon_{it}) = -1/T \sum_{t-1}^{T} E(Z^{-}_{it}, \varepsilon_{it}) = -E(Z^{-}_{i}, \varepsilon_i) \ldots. (3.13)$$

Where Z is $Z - Z^{-}$ and Z is the current year value of the independent variables, firm-specific, macroeconomic-specific factors and economic uncertainty. Equation (3.13) implies that if the current value of the regressor is positively (or negatively) correlated with the past value of cash holdings then the FE of current values of the cash holdings on current values of the independent variables will be negatively (or positively) biased.

3.8.1 Justification for the Blundell and Bond (1998) estimator

As discussed, there is the problem of endogeneity when using dynamic panel data analysis. We discuss some possible solutions to deal with these issues. There are several techniques suggested in econometric literature. Based on Arellano and Bond (1991) work, Blundell and

Bond (1998) propose a system of equation, particularly for the data of shorter time period. This model uses different level of equations to enhance the efficiency and robustness of empirical results. In the case of weak instruments at the first difference equation, SGMM is the robust and efficient estimator. The use of the level equation also increases one other assumption of SGMM about the exogeneity of the instrument. Another important aspect of GMM or SGMM is that these estimators use lagged values of the dependent or independent variables as instruments. This means that all necessary information used for instrument construction comes from the firms' history (Arellano & Bond, 1991; Blundell & Bond, 1998). This characteristic is particularly important when one cannot find strict exogenous instruments from outside the dataset. In other words, SGMM allows us to use instruments from within the existing data.

3.8.2 Reliability of dynamic panel data estimation: System GMM

System GMM can solve most econometric problems embedded in our dataset, range from heteroscedasticity to endogeneity, which can be resolved through the application of SGMM. But, how reliable are the SGMM estimations? Roodman (2006) and Baum (2006) argue that one should perform diagnostic tests on SGMM to check for the reliability of the estimator. In the next section, we discuss the validity tests of SGMM estimations based on the literature.

3.8.3 First-order (AR1) and second-order (AR2) autocorrelation tests

Arellano and Bond (1991) argue that the SGMM estimator requires first-order autocorrelation but not second-order autocorrelation in the error term. They recommended checking for AR (1) and AR (2) diagnostic tests. The hypothesis under both tests is that there is no autocorrelation in the first and second order for AR (1) and AR (2), respectively. Therefore, one should strictly not reject the null hypothesis in AR (2). The *p*-values of AR (1) must be significant at the 5% level, which means that there is the first-order autocorrelation that is required in the SGMM estimator.

3.8.4 The Hansen J. test for over-identification of instruments

The validity of instruments used in SGMM is very important since SGMM can easily over-identify instruments, which violates the assumption of SGMM. Baum (2006) argues that the Hansen J. Test is robust in the case of SGMM, to test for over-identification restrictions. The

null hypothesis under this test that over-identifying restrictions are true, and instruments are exogenous. Insignificant p-values in the Hansen J. test means we cannot reject the null hypothesis and the instruments used in our SGMM estimation are valid and/or correctly identified (Roodman, 2006).

3.8.5 The difference-in-Hansen test of exogeneity

SGMM bears an additional assumption of exogeneity of lagged differences as instruments, hence it is important to test this assumption. Baum (2006) and Roodman (2006) suggest that this assumption can be tested using the difference-in-Hansen test. The null hypothesis of this test is that the subset of instruments (lagged differences) are exogenous.

3.8.6 Assumption of steady-state

One can also check for the validity of the instrument in SGMM using the "steady state" assumption (Roodman, 2006). Under this assumption, one should test the systematic relationship between deviations from long-term values and fixed effects. This means that the coefficients of the lagged dependent variables should be less than the absolute value of one.

3.8.7 Instrument count method

Roodman (2006) suggests that one should always report the number of instruments included in SGMM estimations. According to Roodman (2006), another way to check the validity of the SGMM results is to count the number of instruments. The rule of thumb is that the number of instruments should always be less than the number of observations. Thus, the diagnostic tests verify the validity of the SGMM estimation and suggest that our results are efficient and unbiased. This chapter discusses the dynamics of panel data estimation. It also discusses the problem in panel data estimation, econometric model and solution of those problems. Next chapter discusses the results of regression models.

Chapter 4

Empirical results

4.1 Introduction

This chapter discusses the dynamic nature of the relationship between firm-specific and macroeconomic factors and non-financial firms' cash holdings in both developed and developing markets. While section 4.2 discusses the descriptive statistics, section 4.3 outlines the Pearson Pairwise correlation of the model variables. Section 4.4 identifies cash holding determinants and provides justifications for using the two-step system-GMM technique. Section 4.5 discusses the system-GMM results for both developed and developing countries. Section 4.6 summarizes the key findings of the chapter.

4.2 Descriptive statistics

Comparison of cash holding determines in the US, Japanese, Chinese and Indian firm is one of the research objectives in this study. Table 4.1 reports the descriptive statistics of empirical models' dependent and independent variables all countries in this study. The result reports that the mean value of cash holdings (the cash to asset ratio) does not differentiate from 9.23 to 9.75 for the US and Japan, respectively. This result indicates that firms in both countries consistently hold their cash. The mean values of the cash ratio in the sampled developed countries (the US & Japan) are almost consistent. The highest cash holding level is in the US firms (28.51). The results for Japan are similar (24.90). The minimum values of cash holding are 0.53 and 1.85 in the US and Japanese markets, respectively. The mean value of cash holding for the US and Japanese firms are similar to previous studies, (Chen et al., 2015). The mean value of working capital is 0.0789 and 0.0442 for the US and Japanese firms, respectively. The maximum value of working capital for the US and Japanese firms is 0.400 and 0.295, respectively. The result shows the mean value of cash holding and working capital value for the US firms is higher than the Japanese firms, which implies that the US firms have more current assets than the Japanese firms. The negative values of working capital suggest that firms hold lower current assets than current liabilities, -0.143 and -0.181 for the US and Japan, respectively.

In the case of developing countries, China and India, the mean value of cash holding is 18.65 for Chinese firms and 5.54 for Indian firms, which is the lowest mean value of cash holdings in our overall sample. The mean value of cash holding for both countries firms is consistent with previous studies (Chen et al., 2015; Dudley & Zhang, 2016). The overall mean value of cash holding in our dataset is 10.5. The mean values of working capital for Chinese and Indian firms are -0.0088 and 0.0433 respectively, which show that Indian firms have more short-term obligations than short-term assets. In contrast, Chinese firms have more short-term assets than short-term obligations which suggest that they hold more liquid assets in term of cash. The overall mean value of working capital is 0.057 which is consistent with results reported by Chen et al. (2015) for most firms in the US, Japan, China and India and other developed and developing countries. In the case of the US, Japan, China and India, the mean value of working capital is 0.06155 and 0.0433, respectively, which suggest that firms in the US and Japan have more short-term assets than firms in China and India (Chen et al., 2015).

The mean value of the cash conversion cycle (CCC) of the US firms is 64.03 days and 80.91 days for Japanese firms. The overall mean value of the CCC is 79.24 days which suggests that firms in our data set complete their business cycle in 79 days. The maximum values in developed countries are 196.89 and 191 days for the US and Japanese firms, respectively, which indicate that firms in both markets complete their business cash cycle in approximately the same period. Table 4.1 also shows that developed countries have shorter CCCs than developing countries which imply that firms in developed countries receive their cash inflow more swiftly than developing countries. The minimum values of the CCC in Chinese and Indian firms are -22.77 and -959, respectively. These CCC minimum values are higher than in developed countries, which suggest that some firms in developing countries received cash in advance.

The mean values of Economic Policy Uncertainty (EPU) are 4.711 for the US firms and 4.600 for the Japanese firms. In the case of Chinese and Indian firms, the average EPU mean is 4.739. The maximum EPU value for Chinese firms is 5.498, and the minimum value is 3.901 for Indian firms, which indicates that there is more uncertainty in the Chinese economy. The mean value of the interest rate in the overall dataset is 2.88%. The mean value of the interest rate for developed countries firms (the US and Japan) is 1.177%. Chinese and Indian firms mean interest rate is 5.286%. In the US, the mean interest rate is 2.027%, the maximum interest rate is 6.020%, and the minimum value is 0.500%. In Japan, the mean value of the interest

rate is 0.327%, the maximum value of the interest rate is 0.721%, and the minimum value is 0.100%. The mean interest rate for Chinese firms is 3.184%, the maximum value is 3.940%, and the minimum value is 2.790%.

The mean inflation rates in the US and Japan are 2.050% and 0.224%, respectively. However, the mean value of these two countries is 1.137% which varies from the overall mean of the dataset which is 2.856%. The mean value of the inflation rate of the sampled developing countries, China and India, are 2.738% and 7.804%, respectively. The overall mean inflation rate is 5.271% which is higher than the mean inflation rate for developed countries (1.137%). The maximum value of the inflation rate in our dataset is 0.115 and 17.780 for US and Japan, respectively.

The foreign exchange rate has an overall mean value of 0.467. In the case of developed countries (the US and Japan), the mean value is 0.042, which is close to the overall mean value. The minimum value of the foreign exchange rate for the US is -0.220 and -14.730 for Japan. The mean value of the foreign exchange rate for the US is -0.012 and 0.096 for Japan. However, the mean value of China and India is -0.099 and 2.577 respectively.

The results of descriptive analysis indicate that firm specific and macroeconomic variables have diverse results, except for the values of cash holdings in the US and Japan. Further, the results suggest that the maximum value of cash holdings in the Chinese dataset implies that firms in China are cash rich. The reason behind the high level of cash holdings is that the Chinese firms are involve in mass production of goods and high level of exports. The massive production, high exports, high numbers of turnover globally, efficient CCC, and state-owned enterprises (SOE) structure are the main factors of high cash levels in Chinese firms. On the other hand, Indian firms hold lesser cash among the sample firms which shows that these firms invest more in business operation to maintain sales growth and production expenditures.

The macroeconomic variables such as interest rate, inflation rate, and foreign exchange rate reflect the economic condition of a country (Bilson et al., 2001). Higher inflation shows that the value of money is decreasing and higher interest rate indicates that the borrowing power of industry is getting low (Faulkender, 2005). Hence, both factors play an important role in cash policies of non-financial firms. It is worth monitoring that the values of all the macroeconomic factors are higher in the China and India which is indicate that these economies are at developing stage and firms manage cash accordingly.

Table 4.1 Cross-country descriptive statistics (dependent and independent variables[18])

		CH	WC	CC	EPU	INT	INFL	FXR	GDP	MS	MTB	SIZE	LEV	CAPEX	CFO	RULE	REG	PROF	GROWTH	Obs.
US	Mean	0.092	0.079	64.038	4.711	2.027	2.050	-0.012	29.539	32.069	4.063	9.194	23.679	-0.054	0.136	1.590	1.448	5.79	9.360	3716
	Median	0.070	0.052	55.980	4.702	0.770	2.069	0.001	29.655	32.075	3.150	9.150	22.685	-0.040	0.128	1.600	1.461	5.54	7.535	
	Std.Dev.	0.079	0.141	60.381	0.297	1.922	1.232	0.092	0.841	1.604	2.870	1.205	14.539	0.040	0.070	0.052	0.134	56.38	14.228	
	Min	0.005	-0.143	-38.230	4.267	0.500	-0.356	-0.220	27.912	30.178	1.080	7.064	0.000	-0.160	-0.023	1.436	1.256	-2406.30	-16.380	
	Max	0.285	0.400	196.890	5.149	6.020	3.839	0.115	30.528	34.767	12.180	11.440	52.430	-0.010	0.280	1.640	1.641	1163.60	43.700	
Japan	Mean	0.098	0.044	80.910	4.600	0.327	0.224	0.096	29.347	31.790	1.662	13.833	26.324	-0.048	0.080	1.355	1.141	-25.69	3.660	2356
	Median	0.081	0.042	76.308	4.594	0.300	-0.009	0.120	29.262	31.173	1.386	13.784	26.078	-0.044	0.073	1.326	1.132	13.00	3.456	
	Std.Dev.	0.064	0.132	50.445	0.243	0.169	0.981	10.168	0.860	1.919	0.914	0.996	15.974	0.025	0.045	0.108	0.066	187.99	10.024	
	Min	0.019	-0.181	1.815	4.190	0.100	-1.353	-14.370	27.274	29.799	0.614	12.231	0.625	-0.104	-0.089	1.196	1.019	-1082.10	-16.485	
	Max	0.249	0.296	191.000	4.925	0.721	2.762	17.780	30.320	34.606	4.053	15.842	55.988	-0.012	0.183	1.602	1.261	1808.30	24.280	
China	Mean	0.187	-0.009	107.630	4.833	3.184	2.738	-0.099	29.347	31.790	3.961	9.138	22.963	-0.082	0.086	-0.484	-0.241	-25.69	24.043	2061
	Median	0.156	-0.022	71.980	4.817	3.250	2.625	-0.117	29.141	30.680	3.020	9.271	22.340	-0.064	0.070	-0.465	-0.023	9.51	18.410	
	Std.Dev.	0.129	0.197	109.610	0.378	0.274	1.674	0.244	0.930	1.919	2.825	1.615	16.676	0.061	0.096	0.723	0.052	187.99	29.220	
	Min	0.028	-0.368	-22.770	4.173	2.790	-0.703	-0.658	27.274	29.799	1.030	6.681	0.000	-0.223	-0.609	-0.639	-0.333	-1082.20	-17.340	
	Max	0.496	0.375	390.200	5.498	3.940	5.864	0.357	30.320	34.606	11.580	12.302	57.440	-0.008	0.309	-0.407	-0.150	1808.30	102.620	
India	Mean	0.055	0.096	36.441	4.645	7.388	7.804	2.577	29.347	31.790	4.596	10.666	25.705	-0.079	0.099	-0.013	-0.393	6.11	17.202	1914
	Median	0.032	0.089	62.750	4.683	7.130	8.352	3.064	29.655	31.968	3.000	10.536	26.280	-0.065	0.087	-0.047	-0.391	5.33	15.330	
	Std.Dev.	0.061	0.162	306.320	0.404	1.311	2.593	2.753	0.870	1.919	4.355	1.405	18.611	0.058	0.096	0.076	0.062	168.95	17.898	
	Min	0.004	-0.205	-959.160	3.901	6.000	3.767	-3.973	27.911	29.799	0.550	8.453	0.000	-0.223	-0.047	-0.091	-0.473	-3775.70	-13.450	
	Max	0.231	0.413	614.470	5.222	9.000	11.992	6.747	30.528	34.606	16.440	13.564	59.330	-0.010	0.311	0.177	-0.280	4909.70	60.540	
Overall	Mean	0.105	0.057	79.240	4.698	2.887	2.859	0.467	29.444	31.843	3.536	10.583	24.515	-0.063	0.107	0.804	0.679	2.58	12.142	10047
	Median	0.077	0.044	65.550	4.691	2.400	2.069	0.011	29.448	31.549	2.546	10.170	23.900	-0.048	0.096	1.319	1.129	7.36	8.780	
	Std.Dev.	0.092	0.156	79.859	0.337	2.721	3.029	5.205	0.875	1.746	2.893	2.219	16.175	0.047	0.079	0.880	0.819	143.64	17.758	
	Min	0.007	-0.022	-50.440	3.902	0.100	-1.353	-14.370	27.120	29.743	0.740	7.240	0.000	-0.184	-0.023	-0.639	-0.473	-3775.70	-15.916	
	Max	0.336	0.378	278.210	5.499	9.000	11.992	17.780	30.528	34.767	11.710	14.637	55.540	-0.010	0.280	1.640	1.641	4919.20	56.750	

Note: This table reports the descriptive statistics of the key variables of the sample (US, Japan, China and Indian listed firms) and spans the period of 2003-2015. Definitions and measurements of the key variables are provided in Table 3.2. Minimum and maximum values are restricted to 5 and 95 percentiles, respectively.
Source: Author's calculations

[18] See Chapter 3 for variable definitions and measurements.

4.3 Pearson Pairwise Correlation

Baltagi (2008) and, Gujarati (2004) argue that scholars must ensure that there is no multicollinearity among the independent variables or regressors before they apply any statistical estimation techniques. This current study applies Pearson Pairwise Correlation to test whether the independent and dependent variables are correlated with each other and assess the degree of correlation among the regressors. If the correlation among variables is too strong, above 0.80, this implies the presence of multicollinearity (Gujarati, 2004), the existence of which violates the assumption of CLRM (Baltagi, 2008). The correlation results are presented in Tables 4.2 to 4.6 for developed and developing countries, respectively.

Table 4.2 shows that the independent variables are correlated with the dependent variables. The correlations results vary from country to country. Table 4.2 shows that all of the variables are correlated with each other. Working capital and the CCC are positively correlated with cash holdings and significant at the 5% level. Regarding the macroeconomic variables, only EPU is positively correlated with cash holdings. However, other macroeconomic indicators in our study, interest rate, inflation rate, and foreign exchange rate are negatively correlated at the 5% significance level.

The rule of thumb is that the correlation should not exceed 0.80 (Gujarati, 2004). Tables 4.2 to 4.6 show that the correlation among the variables does not exceed 0.80 in any specification, which means there is no multicollinearity problem in our dataset.

Table 4.2 Pearson Correlation Matrix for dependent and independent variables (US firms)

Variables	*CH*	*WC*	*CCC*	*EPU*	*INT*	*INFL*	*FXR*	*GDP*	*MS*	*MTB*	*SIZE*	*LEV*	*CAPEX*	*CFO*	*RULE*	*REG*	*PROF*	*GROWT*
CH	1.00																	
WC	0.19*	1.00																
CCC	0.09*	0.52*	1.00															
EPU	0.10*	0.00	0.03	1.00														
INT	-0.09*	0.03	-0.02	-0.46*	1.00													
INFL	-0.05*	0.03	-0.01	-0.32*	0.60*	1.00												
FXR	-0.06*	0.01	-0.01	-0.20*	0.45*	0.51*	1.00											
GDP	0.00	0.03*	0.05*	-0.03	0.01	0.01	0.01	1.00										
MS	-0.05*	-0.02	-0.08*	0.03	-0.02	-0.01	-0.02	-0.45*	1.00									
MTB	0.26*	-0.00	0.04*	-0.06*	-0.01	-0.01	-0.03	-0.01	-0.04*	1.00								
SIZE	-0.29*	-0.38*	-0.23*	0.07*	-0.13*	-0.12*	-0.07*	0.02	-0.01	-0.23*	1.00							
LEV	-0.34*	-0.35*	-0.04*	0.01	-0.08*	-0.10*	-0.07*	-0.01	0.06*	0.07*	0.19*	1.00						
CAPEX	0.05*	0.16*	0.34*	0.05*	-0.03*	0.01	-0.01	-0.00	0.01	-0.03	0.05*	0.07*	1.00					
CFO	0.44*	0.10*	-0.04*	0.04*	-0.03	-0.01	-0.01	0.00	-0.06*	0.42*	-0.20*	-0.39*	-0.30*	1.00				
RULE	0.02	-0.02	0.01	0.33*	-0.51*	-0.37*	-0.01	-0.01	0.01	-0.02	0.08*	0.03	-0.01	0.02	1.00			
REG	-0.10*	0.03	-0.02	-0.41*	0.73*	0.53*	0.37*	-0.03	-0.01	-0.13*	-0.18*	-0.11*	-0.05*	-0.03	-0.24*	1.00		
PROF	0.01	0.00	-0.02	-0.00	0.03	0.03	0.01	-0.01	-0.02	-0.01	-0.02	-0.02	-0.01	0.02	-0.02	0.02	1.00	
GROWTH	0.10*	0.15*	0.00	-0.11*	0.18*	0.16*	0.08*	-0.01	-0.03*	0.13*	-0.22*	-0.17*	-0.12*	0.15*	-0.08*	0.25*	0.04*	1.00

* shows significance at the .05 level

Table 4.3 Pearson Correlation Matrix for dependent and independent variables (Japanese firms)

Variables	CH	WC	CCC	EPU	INT	$INFL$	FXR	GDP	MS	MTB	$SIZE$	LEV	$CAPEX$	CFO	$RULE$	REG	$PROF$	$GROWTH$
CH	1.00																	
WC	0.21*	1.00																
CCC	0.03	0.60*	1.00															
EPU	0.01	0.06*	0.02	1.00														
INT	-0.02	0.02	-0.04	-0.32*	1.00													
$INFL$	0.03	0.02	0.03	-0.29*	0.23*	1.00												
FXR	0.03	0.01	0.02	-0.05*	-0.27*	0.36*	1.00											
GDP	0.13*	-0.05*	-0.07*	0.01	-0.01	-0.01	-0.01	1.00										
MS	-0.12*	-0.03	-0.07*	-0.00	-0.01	-0.00	-0.00	-0.30*	1.00									
MTB	0.23*	-0.09*	-0.05*	-0.41*	0.11*	0.12*	0.04	0.05*	-0.07*	1.00								
$SIZE$	-0.22*	-0.15*	-0.23*	0.02	0.03	0.03	-0.00	-0.02	0.14*	-0.14*	1.00							
LEV	-0.49*	-0.53*	-0.13*	0.03	-0.09*	-0.02	0.03	-0.07*	0.13*	-0.05*	0.18*	1.00						
$CAPEX$	0.00	0.10*	0.22*	0.02	-0.08*	0.05*	0.06*	-0.01	0.07*	0.04	-0.08*	-0.01	1.00					
CFO	0.41*	0.11*	-0.06*	-0.00	0.00	-0.04	-0.05*	0.06*	-0.14*	0.27*	-0.07*	-0.39*	-0.30*	1.00				
$RULE$	0.05*	0.11*	0.05*	-0.01	0.20*	0.37*	0.24*	-0.01	-0.01	-0.08*	0.10*	-0.08*	0.05*	-0.01	1.00			
REG	-0.00	-0.01	-0.03	-0.74*	0.31*	0.02	0.15*	-0.00	-0.01	0.29*	0.01	-0.06*	-0.04*	-0.02	0.15*	1.00		
$PROF$	0.10*	0.02	-0.12*	-0.19*	0.18*	0.03	-0.05*	0.01	0.01	0.36*	0.06*	-0.17*	-0.02	0.40*	0.08*	0.21*	1.00	
$GROWTH$	0.06*	0.03	-0.06*	-0.30*	0.19*	0.14*	0.09*	-0.00	-0.01	0.26*	0.01	-0.11*	0.00	0.15*	0.14*	0.32*	0.46*	1.00

Note: * shows significance at the .05 level

Table 4.4 Pearson Correlation Matrix for dependent and independent variables (Chinese firms)

Variables	CH	WC	CCC	EPU	INT	$INFL$	FXR	GDP	MS	MTB	$SIZE$	LEV	$CAPEX$	CFO	$RULE$	REG	$PROF$	$GROWT$
CH	1.00																	
WC	0.22*	1.00																
CCC	0.11*	0.52*	1.00															
EPU	0.02	0.09*	0.03	1.00														
INT	-0.02	-0.02	-0.02	-0.46*	1.00													
$INFL$	0.07*	-0.02	-0.03	-0.41*	0.53*	1.00												
FXR	-0.03	0.08*	0.05*	0.46*	-0.71*	-0.62*	1.00											
GDP	0.01	-0.04*	-0.07*	0.00	-0.01	-0.00	0.01	1.00										
MS	-0.11*	-0.06*	0.07*	-0.03	0.01	0.01	-0.01	-0.31*	1.00									
MTB	0.28*	0.23*	0.18*	-0.06*	0.15*	0.29*	-0.11*	-0.06*	-0.06*	1.00								
$SIZE$	-0.34*	-0.37*	-0.24*	0.24*	-0.09*	-0.10*	0.26*	0.07*	0.04	-0.36*	1.00							
LEV	-0.50*	-0.49*	-0.12*	-0.03	0.00	-0.04	0.00	0.05*	0.07*	-0.29*	0.34*	1.00						
$CAPEX$	-0.10*	0.17*	0.22*	0.03	-0.02	-0.03	0.12*	-0.01	0.00	-0.06*	0.04	-0.05*	1.00					
CFO	0.40*	-0.05*	-0.15*	-0.04	-0.05*	0.03	-0.01	-0.01	-0.06*	0.28*	-0.09*	-0.44*	-0.24*	1.00				
$RULE$	0.06*	0.07*	0.02	0.42*	-0.53*	-0.24*	0.53*	0.01	-0.02	0.14*	0.23*	-0.05*	0.07*	0.00	1.00			
REG	0.02	-0.07*	-0.05*	-0.15*	0.26*	0.05*	-0.68*	0.01	-0.01	0.06*	-0.11*	-0.01	-0.08*	0.03	-0.18*	1.00		
$PROF$	-0.01	0.00	0.02	0.01	-0.03	-0.03	0.02	-0.01	0.01	-0.04	0.00	0.04	0.02	-0.06*	0.03	0.01	1.00	
$GROWTH$	0.10*	0.01	-0.06*	-0.10*	0.07*	0.11*	-0.12*	-0.02	0.01	0.20*	-0.11*	-0.07*	-0.13*	0.10*	-0.02	0.02	-0.06*	1.00

Note: * shows significance at the .05 level

Table 4.5 Pearson Correlation Matrix for dependent and independent variables (Indian firms)

Variables	CH	WC	CCC	EPU	INT	$INFL$	FXR	GDP	MS	MTB	$SIZE$	LEV	$CAPEX$	CFO	$RULE$	REG	$PROF$	$GROWTH$
CH	1.00																	
WC	-0.08*	1.00																
CCC	0.01	0.24*	1.00															
EPU	0.08*	-0.12*	-0.01	1.00														
INT	0.03	-0.16*	-0.01	0.64*	1.00													
$INFL$	0.06*	0.00	-0.01	0.61*	-0.03	1.00												
FXR	0.01	-0.11*	-0.01	0.59*	0.66*	0.12*	1.00											
GDP	0.06*	0.04	0.03	-0.03	-0.03	0.01	-0.04	1.00										
MS	-0.06*	0.09*	0.02	-0.01	-0.00	-0.02	-0.01	-0.46*	1.00									
MTB	0.20*	-0.01	0.01	-0.23*	-0.13*	-0.12*	-0.14*	0.06*	0.02	1.00								
$SIZE$	0.02	-0.25*	-0.12*	0.07*	0.14*	-0.03	0.09*	-0.03	-0.02	-0.21*	1.00							
LEV	-0.35*	-0.37*	-0.02	-0.02	-0.04	0.02	-0.03	-0.07*	0.00	-0.28*	0.20*	1.00						
$CAPEX$	0.04	0.18*	0.10*	-0.06*	0.06*	-0.18*	0.01	-0.00	0.05*	-0.04	0.01	-0.20*	1.00					
CFO	0.38*	0.07*	-0.09*	-0.07*	-0.09*	-0.02	-0.07*	0.07*	-0.05*	0.41*	-0.13*	-0.55*	-0.13*	1.00				
$RULE$	-0.11*	0.17*	0.01	-0.65*	-0.76*	-0.06*	-0.60*	0.02	0.01	0.13*	-0.16*	0.05*	-0.08*	0.08*	1.00			
REG	-0.04	0.13*	-0.01	-0.55*	-0.68*	0.13*	-0.38*	0.04	-0.01	0.12*	-0.12*	0.04	-0.10*	0.07*	0.64*	1.00		
$PROF$	-0.00	-0.02	-0.07*	0.05*	0.02	0.03	0.04	-0.02	0.03	-0.03	0.00	-0.03	-0.05*	0.00	-0.01	-0.04	1.00	
$GROWTH$	-0.03	0.02	-0.03	0.01	-0.09*	0.16*	-0.01	0.00	0.02	0.15*	-0.04	0.06*	-0.22*	0.04	0.16*	0.15*	-0.01	1.00

Note: * shows significance at the .05 level

4.4 Determinants of cash holdings

According to Gujarati (2004), one of the methods researchers can use to investigate if an empirical model is dynamic or static is to test whether the lagged dependent variable is also a regressor. If the test is significant, this implies that the model is dynamic and should be estimated using dynamic panel data models. According to Baltagi (2008) and Gujarati (2004), the application of static OLS and FE will lead to biased results because of simultaneity (a major cause of endogeneity)[19]. Taking this into account, our basic linear model can be written as a dynamic model with a lag dependent variable:

$$Cash_{it} = \alpha_i + \beta_1 NWC_{i,t} + \beta_2 CCC_{i,t} + \beta_3 Epu_t + \beta_4 Intr_t + \beta_5 Infl_t + \beta_6 Fxr_t + \beta_7 Gdp_t + \beta_8 Moneysupply_t + \beta_9 Mtb_{i,t} + \beta_{10} Size_{i,t} + \beta_{11} Lev_{i,t} + \beta_{12} Capex_{i,t} + \beta_{13} Cfo_{i,t} + \beta_{14} Rule_t + \beta_{15} Reg_t + \beta_{16} Prof_{i,t} + \beta_{17} Salesgrowth_{i,t} + \beta_{18} Cash_{t-1} + \lambda_t + \varepsilon_{it} \quad (4.1)$$

$$Cash_{it} = \alpha_i + \beta_1 NWC_{i,t} + \beta_2 CCC_{i,t} + \beta_3 Mtb_{i,t} + \beta_4 Size_{i,t} + \beta_5 Lev_{i,t} + \beta_6 Capex_{i,t} + \beta_7 Cfo_{i,t} + \beta_8 Prof_{i,t} + \beta_9 Salesgrowth_{i,t} + \beta_{10} Cash_{t-1} + \lambda_t + \varepsilon_{it} \quad (4.2)$$

$$Cash_{it} = \alpha_i + \beta_1 Epu_{i,t} + \beta_2 Intr_{i,t} + \beta_3 Infl_{i,t} + \beta_4 Fxr_{i,t} + \beta_5 Gdp_{i,t} + \beta_6 Moneysupply_{i,t} + \beta_7 Rule_{i,t} + \beta_8 Reg_{i,t} + \beta_9 Cash_{t-1} + \lambda_t + \varepsilon_{it} \quad (4.3)$$

Where:

$$\varepsilon_{it} = \mu_i + v_{it}$$

To address the OLS and FE estimation problems, we use a two-step system GMM instead of the one-step because, as Roodman (2006) argues the two-step method yields a robust covariance matrix even when autocorrelation and heteroscedasticity exists. Another reason is that the two-step method contains the Sargan test (the robust Hansen J-Test), which is not available in the one-step SGMM method.

[19] See chapter 3 for further details.

4.4.1 Firm cash holdings during the global financial crisis 2008

The global financial crisis (GFC) of 2008 was one of the worst financial crises in history and led many firms to rethink their strategic investments (Lin & Edvinsson, 2010). Song and Lee (2012) note that the 2008 GFC increased demands for liquid assets. Asian firms responded to the crisis by reducing their investment activities (which ultimately increased their cash levels). In the post GFC period, the authors find that firms changed their cash holdings policies and tended to increase cash holdings by decreasing capital expenditure. They suggest that macroeconomic factors rather than firm-specific factors better explain cash levels.

The 2008 GFC had a significant impact on firms' financial performances.

During the crisis, fixed assets have been sold by firms to meet the obligations and to survive in the market (Campello et al., 2010). The authors document that FC firms increased credit line through bank loans and banks tightened up their lending criteria for firms. Campello et al. (2010) and Kahle and Stulz (2013) note that constrained US firms reduced their number of employees and capital spending. These firms minimized their cash outflows through employee redundancies and stopped capital investment to increase their cash levels. Ivashina and Scharfstein (2010) document that during the financial crisis the demand for new loans fell by 79%, relative to the starting period of crisis by 47%. Additional lending for investment, such as working capital and capital expenditure, also decreased, by 14% in the last quarter of 2008.

Moreover, firms were unable to pay-off the obligations, hence they extended the credit lines (Garcia-Appendini & Montoriol-Garriga, 2013). Lian et al. (2011) document that firm's hold more cash from cash inflows in the crisis period.

To analyze firm behavior of cash holdings during GFC, before and after 2008 GFC, we use a dummy variable with a value of 1 otherwise 0 for before, during after the crisis year 2007 to 2009 in equation (4.1). We introduce interaction terms (for pre, during and post-crisis) of the 2007-2009 GFC with working capital, the CCC, EPU, interest rate, inflation rate, and foreign exchange rate. We estimated these using the following regression model:

$$Cash_{it} = \alpha_i + \beta_1 C * NWC_{i,t} + \beta_2 C * CCC_{i,t} + \beta_3 C * Epu_t + \beta_4 C * Intr_t + \beta_5 C * Infl_t + \beta_6 C * Fxr_t + \beta_7 Control + \beta_8 Cash_{t-1} + \lambda_t + \varepsilon_{it} \quad (4.4)$$

In equation (4.4), each key variable is interacted with crisis dummy with value of 1 otherwise 0 for 2008 GFC. Similarly, the dummy variable approach is employed for pre-crisis period and post-crisis period in equations (4.5) and 4.6). The empirical models for pre and post crisis are:

$$Cash_{it} = \alpha_i + \beta_1 bC * NWC_{i,t} + \beta_2 bC * CCC_{i,t} + \beta_3 bC * Epu_t + \beta_4 bC * Intr_t + \beta_5 bC * Infl_t + \beta_6 bC * Fxr_t + \beta_7 Control + \beta_8 Cash_{t-1} + \lambda_t + \varepsilon_{it} \quad (4.5)$$

Where bC is before crisis dummy for the period 2003-2006. Moreover, equation (4.6) shows the dummy of post crisis, where pC is post crisis dummy for the period 2010-2015.

$$Cash_{it} = \alpha_i + \beta_1 pC * NWC_{i,t} + \beta_2 pC * CCC_{i,t} + \beta_3 pC * Epu_t + \beta_4 pC * Intr_t + \beta_5 pC * Infl_t + \beta_6 pC * Fxr_t + \beta_7 Control + \beta_8 Cash_{t-1} + \lambda_t + \varepsilon_{it} \quad (4.6)$$

4.5 Cash holdings in the overall sample period (2003-2015)

This section discusses the two-step SGMM results of four countries. The analysis includes two developed countries i.e. the US and Japan: and two developing countries i.e. China and India. Models (1), (2) and (3) of the overall sample period in Tables 4.7, 4.8, 4.9 and 4.10 report the effect of independent variables on cash holdings in US, Japan, China, and Indian firms, respectively. First, we discuss the results for overall firms (combined FC and Non-FC firms).

4.5.1 Effect of working capital and CCC on cash holdings[20]

The empirical results of the US and Japanese and Chinese and Indian markets (overall sample period 2003-2015) show that working capital is significantly positive, while CCC is significant and negatively related to cash holdings in all markets at the 5% level. The CCC relationship is insignificant only for the US firms (see Table 4.7). The findings of firm-specific factors are consistent with previous studies such as (Anjum & Malik, 2013; Nobanee et al., 2011; Wasiuzzaman, 2015).

Working capital is defined as the difference between current assets and current liabilities (Gill, 2012). Current assets and current liabilities are connected because current assets are used to

[20] I explained the effect of working capital and CCC on cash holdings for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. For example, for the US Table 4.7, for Japan Table 4.8, for China Table 4.9, and for India Table 4.10.

pay off liabilities. Firms also use current liabilities to generate or acquire current assets. However, firms must maintain a certain level of cash (Jamil, 2016). To ensure smooth operations, firms need a particular amount of cash, but it is difficult for business managers to invest all of their cash in operations, hence they are always trying to balance cash holdings and business investment (Jamil, 2016). Thus, firms hold cash and cash equivalents to meet financial obligations and to reinvest in business operations (working capital), hence, working capital is significant and positively related to cash holdings. These findings suggest that in most markets, firms increase their cash holdings in working capital to increase their cash inflows. Our findings are consistent with the trade-off of cash holdings in which firms must maintain symmetry between holding cash and investing cash in operations. Opler et al. (1999) suggest that the trade-off of cash holdings can help firms to invest cash in operations when other sources of finance are too expensive or not available.

In addition, greater investment of cash holdings in working capital leads to an increase in the collection period for accounts receivables. Hence, an increase in the CCC or delay in accounts receivables reduces firms' cash levels. The CCC depends on two factors which greatly affect cash levels: time and speed. The CCC and cash holdings have a significant negative relationship at the 5% level because an increase in the CCC means it takes more time for a company to convert resources (for example, raw materials) such as inputs into cash inflows (sales /Revenues). Likewise, a shorter cash collection period is beneficial for firms as it allows them to collect account receivables from debtors and utilize the collected amount to pay off their creditors (Wang et al., 2014). Firms with longer CCCs hold more cash to run their operations (Bigelli & Sánchez-Vidal, 2012), hence firms have to rely on another source of financing. The authors argue that smaller (financially constrained) firms tend to hold cash from their cash flows to meet their liquidity demands. This finding which negates Myers' (1984) financial hierarchy theory. Financial hierarchy theory only explains larger (Non-FC) firms which have higher cash to asset ratios and easy access to financial markets such as banks and equity markets to meet their demands for cash. FC firms have lower cash to asset ratios and are unable to access the financial market. Higher cash ratios and easy access to the financial markets leads to increased shareholder wealth. According to Jensen (1986), higher cash to asset ratio increases the problem of agency costs related to free cash flow, as shareholders require excess cash in the form of dividends, share-repurchase or want cash

invested in positive NPV projects. However, it must remember that firms are not homogenous in terms of financial health and therefore we cannot apply theories such as financial hierarchy theory, trade-off theory, and agency theory of free cash flow in a wholesale way; that is, we cannot apply them in a general way based on firm size. In Chapter 5, we divide our firms into two classes to examine differences in cash holding behaviour: (i) FC and (ii) Non-FC firms.

4.5.2 Effect of EPU on cash holdings during 2003-2015[21]

Table 4.8 shows that EPU has significant and positive relationship with cash holdings in the Japanese firms at the 1% level and in Table 4.9 EPU negatively associated with cash holdings in the Indian firms at the 10% level. The US firms in Table 4.7 and Chinese firms in Table 4.9 show an insignificant relationship between EPU and cash holdings in the overall sample period (2003-2015). These findings suggest that firms in Japan (see Table 4.8) hold their cash when EPU increases because firms decrease their investments to avoid losses; hence, cash levels increase in the Japanese market. These findings are consistent with Demir and Ersan (2017) and Phan et al. (2019) who document that EPU and cash holdings are positively related. Our findings endorse Keynes' (1936) precautionary theory of cash holdings which argues that firms hold cash as a buffer to meet their liquidity demands.

In contrast, in the Indian firms (see Table 4.10), cash level decrease when EPU increases. The variation in results, between the Japanese and Indian economies, echoes Choong et al. (2010) findings. The author suggests that the economic structures of developed and developing economies are diverse. Our findings suggest that firms' cash structures are dynamic:[22] Firms use both debt and equity financing to meet their liquidity demands. This structure is more fragile (dynamic) in emerging economies (Kumar et al., 2017). When uncertainty increases, economic activities decrease; high investment of firm cash in working capital and increased CCC leads to decreased cash holdings in emerging markets.

[21] I explained the effect of EPU for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. For example, for the US Table 4.7, for Japan Table 4.8, for China Table 4.9, and for India Table 4.10.

[22] Firms change their cash structure (their mix of debt and equity) according to overall market conditions.

4.5.3 Effect of Interest rate on cash holdings during 2003-2015[23]

Furthermore, in the overall sample period, models (1), (2) and (3) in Tables 4.7,4.8,4.9 and 4.10 show that the interest rate is significant and negatively related to cash holdings in the US (see Table 4.7) and Japanese (see Table 4.8) markets at the 1% level. In contrast, it is significant and positively related to cash holdings at the 10% level in the Chinese (see Table 4.9) and Indian (see Table 4.10) market. Our results in the US and Japanese markets are consistent with previous studies (García-Teruel & Martínez-Solano, 2008; Harford et al., 2014; Lins et al., 2010). These authors document a significant and negative relationship between the interest rate and firms' cash holdings. This implies that firms use lines of credit instead of non-operating cash for future NPV projects in developed economies when the interest rate is low and avoid credit lines when the interest rate is high. Hence the interest rate is significant and negatively related to cash holdings in the US and Japanese markets. In the case of Chinese and Indian markets, firms are more sensitive to interest rate changes[24] and interest rate volatility (Kumar et al., 2017). Furthermore, a firm's decision to invest depends on the interest rate and debt levels (Bo & Sterken, 2002). The significant positive coefficients of interest rate in the Chinese and Indian markets indicates that firms decrease their investments in operating activities and invest their cash into short-term investments[25] to earn a higher interest rate instead of investing in risky business operations (Stone, 2018).

4.5.4 Effect of inflation rate on cash holdings during 2003-2015[26]

Moreover, the coefficients of inflation rate are significant and negatively related to cash holdings in the US firms (see Table 4.7) at the 1% level. In contrast, they are positively significant in the Indian firms (see Table 4.10) at the 10% level. In the case of Japanese (see Table 4.8) and Chinese firms (see Table 4.9), there is an insignificant relationship between the inflation rate and cash holdings. Like our results, the relationship between the inflation rate and cash holdings in the US and Japanese firms are negative and significant in previous studies

[23] I explained the effect of interest rate for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. For example, for the US Table 4.7, for Japan Table 4.8, for China Table 4.9, and for India Table 4.10.

[24] Due to limited financial resources, firms depend on bank loans.

[25] According to International Accounting Standards (IAS) 7 which states the cash flow statements, firms' cash in the bank is the part of cash and cash equivalents of firms.

[26] I explained the effect of inflation rate for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. Such as for the US table 4.7, for Japan table 4.8, for China table 4.9, and for India table 4.10 (follow above changes).

(Baum et al., 2004; Chen & Mahajan, 2010; Curtis et al., 2017; Wang et al., 2014). These findings suggest that firms in the US and Japanese markets spend more money when inflation increases. In the case of Indian firms (see Table 4.10), the coefficient of the inflation rate is significant and positively related to cash holdings, a finding which is consistent with Tan and Floros (2012) results. These findings suggest that when inflation increases in developing markets, firms hold more cash to maintain their purchasing power. Our findings are consistent with Wang et al. (2014) who suggest that firms' cash holdings policy must weigh the costs and benefits of holding cash. At a macro level, firms are inclined to adjust and optimize their cash-holding strategies in response to changes in purchasing power due to inflation. Taylor (2000) and Silver and Ioannidis (2001) suggest that declines in purchasing power are often associated with a decline in the inflation rate. The effect of the inflation rate on cash holdings varies in developed and developing markets. These different results show that the macroeconomic variables are heterogeneous and context-dependent (Ghironi & Melits, 2005).

4.5.5 Effect of foreign exchange rate on cash holdings[27]

The coefficient of foreign exchange rate is positive and significantly related to cash holdings in the US (see Table 4.7) and Chinese firms (see Table 4.9) at the 1% and 5% levels, respectively. In contrast, the Japanese firms (see Table 4.8) show a significant and negative relationship at the 10% level. There is no significant relationship with cash holdings for the Indian firms (see Table 4.10). These findings suggest that firms in the US and Japan accumulate cash when the foreign exchange rate increases. Bodnar and Marston (2002) suggest that the effect of the foreign exchange rate depends on three variables, (i) the percentage of a firm's revenue in foreign currency, (ii) expenditure in foreign currency, and (iii) the profit rate. They suggest that foreign exchange rate exposure is more significant in the case of lower profit firms. Our findings suggest that firms dynamically adjust their cash holdings in response to exchange rate changes.

[27] I explained the effect of foreign exchange rate for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. Such as for the US table 4.7, for Japan table 4.8, for China table 4.9, and for India table 4.10 (follow above changes).

4.6 Cash holdings and the global financial crisis (2007-2009)

The global financial crisis of 2007 to 2009 was one of the worst financial disasters in history and led many firms to rethink their investment strategies (Lin & Edvinsson, 2010). Song and Lee (2012) note that the global financial crisis increased firms' liquid demands. In particular, Asian firms increased their cash levels by reducing their investment activities after the financial crisis. Firms across the globe enacted substantial changes after the 2007-2009 global financial crises. During the crisis, while some firms were forced to shut down, some survived and even thrived (Lian et al., 2011). A basic question that arises is what contributes to changes within a firm during a crisis. Many factors may contribute to such changes; however, the focal point of this study is to investigate the effect of firm-specific and macroeconomic variables in the global financial crisis on cash holdings. Holding cash is costly because of lower financial returns, as well as the high agency costs because holding too much cash might make management lax and encourages imprudent acquisition and expansion.

However, firms still prefer to reserve cash due to the following reasons. First, cash provides a buffer for uncertainty (Bates et al., 2009). This buffer is crucial during periods of financial crises when capital markets cannot function efficiently and bank financing dries up (Song & Lee, 2012). Second, cash provides warranties and covenants to debts and credit lines and helps firms to maintain their reputations in the capital markets (Campello et al., 2010). Third, companies with the largest cash holdings can seize investment opportunities and evade liquidity risks (Gulen & Ion, 2016).

This section discusses the firm behavior in terms of cash holdings in three periods: pre-crisis (2003-2006), post-crisis (2010-2015) and during the global financial crisis (2007-2009). We are interested in the effect of firm-specific and macroeconomic factors on cash holdings during in pre, post and during the global financial crisis in models (1), (2) and (3)[28]. Tables 4.7, 4.8, 4.9 and 4.10 report the SGMM estimations of the US, Japanese, Chinese and Indian firms, respectively.

[28] See table notes for further details.

4.6.1 Effect of WC and CCC on cash holdings, pre,post and during crisis period[29]

Our findings suggest that firm-specific variables (working capital and CCC) are consistently significant with the overall sample period in all firms. However, macroeconomic variables such as EPU, interest rate, inflation rate, and foreign exchange rate behave differently according to each period (pre, post and during crisis period) and market structure (developed and developing), a finding which is consistent with prior studies (Choong et al., 2010). The economic structures of developed and developing economies are diverse and macroeconomic variables are heterogeneous and context-dependent (Ghironi & Melits, 2005).

4.6.2 Effect of EPU on cash holdings, pre,post and during crisis period[30]

Our findings show that the EPU coefficient is insignificant for US firms (see Table 4.7) in the overall sample period (2003-2015), but during the financial crisis period (2007-2009) EPU is significant and positively related to cash holdings in the US (see Table 4.7) and Japanese firms (see Table 4.8) at the 5% level. It is significant and negatively related with cash holdings in the Chinese (see Table 4.9) and Indian firms (see Table 4.10) at the 10% level, except for the Chinese firms where EPU is negative and significantly related to cash holdings at a 10% level only during the pre-crisis period. EPU is insignificant during and the post-crisis period in China. The findings of the Chinese firms are consistent with the highest mean value of cash holdings in our study (18.00). The highest mean value of cash holdings in China suggests that Chinese firms have enough cash, thus our SGMM results for EPU are insignificant during and after the financial crisis period. These results are consistent with Gulen and Ion (2016) findings that firms hold more cash by reducing their capital expenditure more effectively after the global financial crisis to evade liquidity shortages. In developing markets, firms' capital structure is more inclined to debt financing. Hence, firms return their borrowed amount to avoid financial costs and the opportunity cost of idle cash (Kumar et al., 2017). Moreover, Baker et al. (2016) suggest that economic uncertainty contributed to a steep economic decline around the globe

[29] I explained the effect of working capital and CCC during the 2008 GFC for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. Such as for the US table 4.7, for Japan table 4.8, for China table 4.9, and for India table 4.10 (follow above changes).

[30] I explained the effect of EPU during the 2008 GFC for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. Such as for the US table 4.7, for Japan table 4.8, for China table 4.9, and for India table 4.10. (follow above changes).

in 2008–2009 and slowed of economic activities afterward. In short, EPU effects bank credit growth negatively in developing markets (Chi & Li, 2017).

4.6.3 Effect of interest rate on cash holdings, pre,post and during crisis period[31]

Except for the pre-crisis and during the crisis period of the world, our results show that the interest rate is significant and negatively related to cash holdings in the US (see Table 4.7) and Japanese firms (see Table 4.8) at the 1% level. In the Chinese (see Table 4.9) and Indian firms (see Table 4.10), the interest rate is significant and positively related to cash holdings at the 5% level in all sample periods (pre-crisis, post-crisis and during the crisis period). These findings are consistent with our overall sample period results.

4.6.4 Effect of interest rate on cash holdings, pre,post and during crisis period[32]

Furthermore, our results show that the inflation rate is negative and significantly related to cash holdings in the US firms (see Table 4.7) at the 1% level in all sub-sample periods (pre-crisis, post-crisis, and during financial crisis period). However, in case of Indian firms (see Table 4.10), inflation has significant and positive relationship with cash holdings at the 5% level. The Japanese (see Table 4.8) and Chinese firms (see Table 4.9) show no significant relationship, which is consistent with the overall sample period results.

4.6.5 Effect of foreign exchange rate on cash holdings, pre,post and during crisis period[33]

Further, the foreign exchange rate coefficient exhibits consistent results with the overall sample results, except for Japanese firms because they increased their hedge funds against the foreign exchange rate after the global financial crisis hence, the foreign exchange rate is insignificant with cash holdings after the global financial crisis (Song & Lee, 2012). In the case of the Indian firms (table 4.10), the foreign exchange rate is insignificant in the overall sample

[31] I explained the effect of interest rate during the 2008 GFC for all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. Such as for the US table 4.7, for Japan table 4.8, for China table 4.9, and for India table 4.10. (follow above changes).

[32] I explained the effect of inflation rate during the 2008 GFC of all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. Such as for the US table 4.7, for Japan table 4.8, for China table 4.9, and for India table 4.10.

[33] I explained the effect of foreign exchange rate during the 2008 GFC of all sample countries one-by-one under this heading. For each country, I have added the table numbers to make it clear. Such as for the US table 4.7, for Japan table 4.8, for China table 4.9, and for India table 4.10. Please make the changes as above

period. In the pre-crisis and post-crisis period, the foreign exchange rate is significant and positively related to cash holdings at the 10% level. This finding suggests that firms in the US (see Table 4.7), China (see Table 4.9) and India (see Table 4.10), except for the Japanese firms (seeTable 4.8), accumulate cash with the increase in the foreign exchange rate.

The results of the subsamples analysis in the US, Japanese, Chinese and Indian firms are consistent with our prediction. We predict the diverse results in all sample country's firms and in all subsamples. Findings endorse that firms' characteristics (working capital and CCC) have consistent results however, in case of macroeconomic factors diverse results reported which is context dependent. The findings further indicate that firms are more inclined with macroeconomic factors and firms' cash behaviour changed according to the change in macroeconomic environment such as pre-crisis, during crisis and post-crisis period.

Table 4.6 Impact of firm-specific and macroeconomic variables on cash holdings of US (S&P 500) non-financial firms

	Dependent variable: Cash holding											
	Overall period			During the crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.620***	0.771***	0.871***	0.544***	0.743***	0.560***	0.754***	0.737***	0.840***	0.760***	0.773***	0.851***
	(0.067)	(0.049)	(0.069)	(0.035)	(0.053)	(0.039)	(0.051)	(0.046)	(0.053)	(0.049)	(0.045)	(0.102)
WC_t	0.056*	0.067**		0.066**	0.060**		0.055**	0.056**		0.050*	0.058**	
	(0.032)	(0.031)		(0.025)	(0.029)		(0.026)	(0.027)		(0.027)	(0.027)	
CCC_t	-0.000	-0.000		-0.000**	-0.000*		-0.000**	-0.000**		-0.000**	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	-0.000		-0.008	0.002		0.012*	-0.009		-0.004	-0.001		0.012**
	(0.004)		(0.006)	(0.006)		(0.007)	(0.007)		(0.007)	(0.007)		(0.006)
INT_t	-0.003***		-0.003**	-0.002		0.001	-0.005		-0.004	-0.003*		0.000
	(0.001)		(0.001)	(0.001)		(0.002)	(0.004)		(0.004)	(0.001)		(0.001)
$INFL_t$	-0.005***		-0.005***	-0.005***		-0.005***	-0.004***		-0.004**	-0.004***		-0.004***
	(0.001)		(0.001)	(0.001)		(0.001)	(0.002)		(0.002)	(0.001)		(0.001)
FXR_t	0.055***		0.053***	0.052***		0.027*	0.064***		0.049***	0.055***		0.035*
	(0.015)		(0.015)	(0.014)		(0.014)	(0.015)		(0.013)	(0.017)		(0.019)
GDP_t	-0.004		0.004	0.000		0.011	-0.010**		0.008	-0.009**		0.017
	(0.005)		(0.010)	(0.005)		(0.011)	(0.004)		(0.007)	(0.004)		(0.016)
MS_t	0.002		0.003	0.000		0.006	-0.001		0.004	-0.001		0.009
	(0.004)		(0.004)	(0.003)		(0.005)	(0.003)		(0.003)	(0.003)		(0.007)
MTB_t	0.002	-0.002**		0.001	-0.000		-0.001	-0.001		-0.000	-0.002*	
	(0.001)	(0.001)		(0.002)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)	
$SIZE_t$	-0.009**	-0.006**		-0.006	-0.005*		-0.006**	-0.008***		-0.005*	-0.005*	
	(0.004)	(0.002)		(0.004)	(0.003)		(0.003)	(0.002)		(0.003)	(0.003)	
LEV_t	-0.001**	-0.000		-0.001***	0.000		-0.001	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	0.147**	0.178**		0.203***	0.163**		0.191**	0.195***		0.197***	0.178**	
	(0.072)	(0.078)		(0.061)	(0.072)		(0.075)	(0.071)		(0.074)	(0.072)	
CFO_t	0.051	0.115*		0.014	0.079		-0.003	0.023		-0.006	0.061	
	(0.074)	(0.068)		(0.043)	(0.068)		(0.070)	(0.063)		(0.073)	(0.060)	

$RULE_t$	-0.009		-0.000	-0.008		-0.003	-0.001		-0.002	0.006		0.027
	(0.020)		(0.020)	(0.020)		(0.017)	(0.040)		(0.040)	(0.023)		(0.023)
REG_t	0.012		0.032***	0.001		-0.007	0.014		0.032**	-0.010		-0.011
	(0.015)		(0.012)	(0.014)		(0.014)	(0.016)		(0.012)	(0.020)		(0.017)
$PROF_t$	-0.000	-0.000		0.000	-0.000		0.000	-0.000		0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	0.000	-0.000*		-0.000	-0.000*		-0.000	-0.000		0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constant$	0.220	0.084***	-0.209	0.131	0.073***	-0.523	0.461**	0.131***	-0.373	0.423**	0.083***	-0.824
	(0.253)	(0.022)	(0.438)	(0.231)	(0.026)	(0.482)	(0.186)	(0.024)	(0.322)	(0.184)	(0.025)	(0.706)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,073	3,392	3,073	3,073	3,392	3,073	3,073	3,392	3,073	3,073	3,392	3,073
Number of firms	317	319	317	317	319	317	317	319	317	317	319	317
Number of instruments	245	244	61	270	276	83	312	318	94	312	319	38
AR2 p-value	0.564	0.356	0.266	0.807	0.281	0.409	0.553	0.482	0.252	0.535	0.427	0.233
Hansen-J	0.336	0.297	0.106	0.401	0.12	0.194	0.700	0.675	0.147	0.711	0.542	0.260
Difference in Hansen J	0.352	0.986	0.389	0.621	0.862	0.481	0.999	0.999	0.949	0.999	0.996	0.586
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 4.7 Impact of firm-specific and macroeconomic variables on cash holdings of Japanese (Nikkei 225) non-financial firms

	Dependent variable: Cash holding											
	Overall period			During the crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.777***	0.833***	0.808***	0.808***	0.838***	0.855***	0.781***	0.816***	0.845***	0.783***	0.804***	0.858***
	(0.046)	(0.054)	(0.027)	(0.049)	(0.053)	(0.045)	(0.047)	(0.050)	(0.047)	(0.046)	(0.054)	(0.044)
WC_t	0.042*	0.073**		0.050*	0.071**		0.048*	0.052**		0.052**	0.055**	
	(0.022)	(0.029)		(0.028)	(0.028)		(0.025)	(0.025)		(0.026)	(0.027)	
CCC_t	-0.000**	-0.000*		-0.000*	-0.000*		-0.000*	-0.000*		-0.000*	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	0.015***		0.012**	0.014**		0.015**	0.027**		0.026***	0.012**		0.018***
	(0.006)		(0.005)	(0.007)		(0.006)	(0.013)		(0.010)	(0.005)		(0.005)
INT_t	-0.020***		-0.020***	-0.020***		-0.016***	-0.019***		-0.017***	-0.016**		-0.013**
	(0.005)		(0.005)	(0.006)		(0.006)	(0.005)		(0.005)	(0.007)		(0.006)
$INFL_t$	-0.000		-0.001	-0.000		-0.001	0.001		0.000	-0.000		-0.000
	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)
FXR_t	-0.000*		-0.000*	-0.000		-0.000	-0.000*		-0.000***	-0.000		-0.000
	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)
GDP_t	-0.006*		-0.001	0.000		-0.002	0.001		-0.002	0.001		-0.002
	(0.004)		(0.002)	(0.001)		(0.003)	(0.001)		(0.002)	(0.001)		(0.003)
MS_t	-0.000		-0.004*	-0.000		-0.004	0.000		-0.004	0.000		-0.004
	(0.002)		(0.002)	(0.001)		(0.004)	(0.001)		(0.004)	(0.001)		(0.004)
MTB_t	0.005**	0.002		0.003**	0.002		0.004***	0.003		0.004***	0.003	
	(0.002)	(0.002)		(0.001)	(0.002)		(0.001)	(0.002)		(0.001)	(0.002)	
$SIZE_t$	-0.010**	-0.006		-0.008	-0.005		-0.007	-0.007*		-0.007	-0.007*	
	(0.005)	(0.004)		(0.005)	(0.004)		(0.005)	(0.004)		(0.005)	(0.004)	
LEV_t	-0.000*	0.000		-0.000	0.000		-0.000*	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	-0.078	-0.060		-0.119**	-0.049		-0.108*	-0.043		-0.097	-0.079	
	(0.057)	(0.057)		(0.058)	(0.062)		(0.061)	(0.059)		(0.059)	(0.059)	
CFO_t	-0.122**	0.012		-0.098***	0.011		-0.089**	-0.014		-0.084**	-0.013	
	(0.050)	(0.057)		(0.037)	(0.055)		(0.038)	(0.049)		(0.038)	(0.051)	
$RULE_t$	0.044***		0.031***	0.043***		0.038***	0.053***		0.050***	0.036***		0.040***
	(0.010)		(0.010)	(0.012)		(0.011)	(0.017)		(0.013)	(0.011)		(0.009)

REG_t	0.028		0.036	0.034		0.055*	0.023		0.068***	0.001		0.034
	(0.031)		(0.024)	(0.035)		(0.030)	(0.030)		(0.023)	(0.043)		(0.033)
$PROF_t$	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	-0.000***	-0.001***		-0.000***	-0.001***		-0.000***	-0.001***		-0.000***	-0.001***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constant$	0.216	0.094	0.045	-0.029	0.087	0.017	-0.116	0.119**	-0.073	0.004	0.121**	0.015
	(0.164)	(0.060)	(0.131)	(0.113)	(0.063)	(0.199)	(0.120)	(0.058)	(0.201)	(0.090)	(0.059)	(0.200)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,973	2,164	1,973	1,973	2,164	1,973	1,973	2,164	1,973	1,973	2,164	1,973
Number of firms	188	191	188	188	191	188	188	191	188	188	191	188
Number of instruments	158	156	160	161	156	70	182	175	70	182	175	70
AR3 p-value	0.509	0.265	0.445	0.367	0.271	0.467	0.366	0.290	0.495	0.352	0.266	0.440
Hansen-J	0.283	0.198	0.231	0.156	0.201	0.107	0.310	0.307	0.113	0.226	0.313	0.128
Difference in Hansen-J	0.612	0.534	0.813	0.558	0.342	0.943	0.793	0.961	0.913	0.642	0.943	0.915
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 4.8 Impact of firm-specific and macroeconomic variables on cash holdings of Chinese (CSI 300) non-financial firms

	Dependent variable: Cash holding											
	Overall period			During the crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.861***	0.922***	0.842***	0.861***	0.944***	0.691***	0.798***	0.969***	0.853***	0.770***	0.957***	0.818***
	(0.084)	(0.124)	(0.077)	(0.098)	(0.143)	(0.245)	(0.158)	(0.121)	(0.072)	(0.077)	(0.130)	(0.040)
WC_t	0.049***	0.061***		0.049***	0.067***		0.071***	0.055***		0.050***	0.060***	
	(0.018)	(0.016)		(0.018)	(0.019)		(0.022)	(0.019)		(0.017)	(0.021)	
CCC_t	-0.000*	-0.000**		-0.000*	-0.000*		-0.000**	-0.000**		-0.000*	-0.000**	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	0.000		-0.002	-0.000		-0.002	-0.018*		-0.002	0.003		0.001
	(0.005)		(0.005)	(0.005)		(0.008)	(0.010)		(0.008)	(0.006)		(0.007)
INT_t	0.031*		0.029*	0.031*		0.070*	0.020		0.034*	0.028*		0.030**
	(0.016)		(0.017)	(0.016)		(0.039)	(0.016)		(0.019)	(0.016)		(0.015)
$INFL_t$	0.001		0.001	0.001		0.010	0.007		0.001	0.001		0.003
	(0.002)		(0.002)	(0.002)		(0.007)	(0.006)		(0.002)	(0.002)		(0.002)
FXR_t	0.081**		0.072**	0.082**		0.138*	0.182*		0.076**	0.074**		0.073**
	(0.035)		(0.035)	(0.039)		(0.072)	(0.099)		(0.037)	(0.035)		(0.035)
GDP_t	0.001		0.000	0.001		-0.003	-0.014		-0.016	0.000		-0.000
	(0.002)		(0.002)	(0.002)		(0.003)	(0.014)		(0.013)	(0.002)		(0.002)
MS_t	-0.000		-0.001	-0.000		-0.004	-0.001		-0.001	-0.001		-0.002
	(0.001)		(0.001)	(0.001)		(0.002)	(0.002)		(0.001)	(0.001)		(0.001)
MTB_t	0.001	0.000		0.001	-0.000	-0.013	0.000	-0.001		0.002*	0.000	
	(0.001)	(0.001)		(0.001)	(0.002)	(0.012)	(0.001)	(0.002)		(0.001)	(0.001)	
$SIZE_t$	-0.001	-0.000		-0.001	0.000		-0.003	-0.002		-0.001	-0.000	
	(0.002)	(0.002)		(0.002)	(0.002)		(0.002)	(0.004)		(0.002)	(0.003)	
LEV_t	0.000	0.000		0.000	0.001		0.000	0.001*		-0.000	0.001	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	0.089**	0.074*		0.089**	0.089**		0.111**	0.074*		0.106***	0.077**	
	(0.040)	(0.038)		(0.040)	(0.043)		(0.044)	(0.038)		(0.034)	(0.038)	
CFO_t	-0.016	-0.004		-0.016	-0.006		0.020	-0.001		-0.003	-0.007	
	(0.030)	(0.030)		(0.031)	(0.031)		(0.039)	(0.031)		(0.029)	(0.031)	
$RULE_t$	-0.019		-0.010	-0.020		0.044	-0.176*		0.008	-0.005		0.035
	(0.029)		(0.027)	(0.030)		(0.086)	(0.096)		(0.040)	(0.023)		(0.024)

REG_t	0.199***		0.186**	0.199***		0.191*	0.627*		0.194**	0.167***		0.139**
	(0.074)		(0.077)	(0.074)		(0.106)	(0.322)		(0.079)	(0.061)		(0.070)
$PROF_t$	-0.000***	-0.000***		-0.000***	-0.000***		-0.000**	-0.000***		-0.000***	-0.000***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constant$	-0.031	0.006	-0.001	-0.029	-0.001	0.132	0.608	0.028	0.481	0.009	-0.001	0.050
	(0.110)	(0.039)	(0.124)	(0.110)	(0.043)	(0.238)	(0.449)	(0.057)	(0.408)	(0.094)	(0.040)	(0.104)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,648	1,852	1,648	1,648	1,852	1,648	1,246	1,852	1,648	1,648	1,852	1,648
Number of firms	202	204	202	202	204	202	195	204	202	202	204	202
Number of instruments	41	23	34	41	23	17	31	23	32	43	23	91
AR4 p-value	0.144	0.211	0.182	0.143	0.226	0.335	0.243	0.23	0.265	0.13	0.207	0.165
Hansen-J	0.275	0.386	0.150	0.230	0.329	0.312	0.884	0.36	0.231	0.898	0.381	0.215
Difference in Hansen J	0.275	0.627	0.778	0.209	0.459	0.351	0.998	0.73	0.224	0.842	0.681	0.733
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics. Standard02 errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 4.9 Impact of firm-specific and macroeconomic variables on cash holdings of Indian (NSI 500) non-financial firms

	Dependent variable: Cash holding											
	Overall period			During the crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.847***	0.836***	0.821***	0.788***	0.546***	0.867***	0.876***	0.565***	0.856***	0.907***	0.592***	0.905***
	(0.125)	(0.113)	(0.065)	(0.153)	(0.171)	(0.075)	(0.186)	(0.175)	(0.080)	(0.163)	(0.143)	(0.071)
WC_t	0.040**	0.045***		0.036*	0.018		0.044*	0.036*		0.047**	0.023	
	(0.019)	(0.016)		(0.019)	(0.021)		(0.026)	(0.018)		(0.023)	(0.021)	
CCC_t	-0.000**	-0.000**		-0.000*	-0.000**		-0.000**	-0.000***		-0.000**	-0.000**	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	-0.034*		-0.022	-0.026		-0.045*	-0.042*		-0.089**	-0.041*		-0.025*
	(0.020)		(0.014)	(0.021)		(0.027)	(0.022)		(0.035)	(0.021)		(0.015)
INT_t	0.005*		0.004*	0.005**		0.009**	0.006*		0.017***	0.004		0.004**
	(0.003)		(0.002)	(0.003)		(0.004)	(0.003)		(0.005)	(0.003)		(0.002)
$INFL_t$	0.003*		0.003*	0.002		0.003	0.003		0.007**	0.002		0.002
	(0.002)		(0.001)	(0.002)		(0.002)	(0.002)		(0.003)	(0.002)		(0.001)
FXR_t	0.000		0.001*	0.000		0.002	0.000		0.002	0.001		0.002*
	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)
GDP_t	0.001		0.010*	0.000		0.011	0.000		0.009	-0.000		0.008
	(0.002)		(0.005)	(0.002)		(0.007)	(0.002)		(0.007)	(0.002)		(0.006)
MS_t	-0.001		0.002	-0.001		0.003	-0.002*		0.002	-0.002**		0.002
	(0.001)		(0.004)	(0.001)		(0.004)	(0.001)		(0.004)	(0.001)		(0.004)
MTB_t	0.001	0.001*		0.001	0.002***		0.000	0.002**		0.001	0.002***	
	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)	
$SIZE_t$	-0.001	0.000		-0.000	0.001		-0.001	0.000		-0.000	0.000	
	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)	
LEV_t	-0.000	-0.000		-0.000	-0.000*		-0.000	-0.000		-0.000	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	0.032	0.035		0.043	0.088***		0.038	0.072**		0.029	0.076**	
	(0.029)	(0.030)		(0.030)	(0.031)		(0.035)	(0.030)		(0.030)	(0.031)	
CFO_t	-0.045	-0.034		-0.038	0.008		-0.051	0.012		-0.064**	0.004	
	(0.027)	(0.026)		(0.029)	(0.032)		(0.034)	(0.036)		(0.032)	(0.031)	
$RULE_t$	0.022		0.090**	0.011		0.042	0.050		0.246***	-0.114		0.014
	(0.050)		(0.036)	(0.048)		(0.070)	(0.092)		(0.074)	(0.074)		(0.052)

REG_t	-0.077*		-0.082**	-0.074*		-0.076	-0.081		-0.038	-0.122**		-0.088**
	(0.046)		(0.036)	(0.044)		(0.057)	(0.053)		(0.057)	(0.050)		(0.039)
$PROF_t$	0.000***	0.000***		0.000***	0.000***		0.000***	0.000***		0.000***	0.000***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	0.000	-0.000		0.000	-0.000		0.000	0.000		0.000	0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constant$	0.110	0.008	-0.322	0.095	0.031**	-0.311	0.165	0.034*	-0.077	0.186*	0.035**	-0.238
	(0.090)	(0.015)	(0.231)	(0.090)	(0.015)	(0.303)	(0.101)	(0.017)	(0.309)	(0.098)	(0.017)	(0.262)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,404	1,646	1,405	1,404	1,174	1,405	1,404	1,174	1,405	1,404	1,174	1,405
Number of firms	230	242	230	230	217	230	230	217	230	230	217	230
Number of instruments	37	28	188	37	39	111	30	39	111	30	39	119
AR2 p-value	0.843	0.743	0.706	0.792	0.394	0.557	0.868	0.553	0.202	0.784	0.424	0.737
Hansen-J	0.672	0.118	0.966	0.691	0.495	0.595	0.765	0.300	0.598	0.937	0.482	0.687
Difference in Hansen J	0.914	0.142	0.985	0.841	0.146	0.875	0.595	0.059	0.892	0.897	0.323	0.996
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

4.7 Chapter Summary

This chapter reports the descriptive statistics, Pearson pair-wise correlation, and two-step system GMM estimation models. The mean cash holdings score varies from 0.092 to 0.098 with an overall mean value of 0.105 for the two developed markets. Of the two developed markets, Japanese firms score the highest mean value and the US firms score the lowest, which implies that Japanese firms hold cash more than the US firms. The mean cash holdings scores are consistent with those reported by Chen et al. (2015) for the Japanese non-financial sector (0.13) and (0.099) for the US market. Regarding firms' working capital performances in the developed markets, the mean scores vary from 0.044 to 0.079, with an overall mean of 0.057. The US firms' working capital tops the score with Japanese firms at the bottom, which means that the US firms use working capital more efficiently than the Japanese firms. The EPU scores vary from 4.600 to 4.711, with an overall mean value of 4.698 among the two developed (the US and Japanese firms) markets. The interest rate scores among the two developed markets vary from 0.327 to 2.027, with an overall mean value of 2.887. The inflation rate scores vary from 0.224 to 2.050, with an overall mean value of 2.859 among the two developed markets. The foreign exchange rate scores for the two developed markets vary from 0.012 to 0.096, with an overall mean value of 0.467.

Among the developing markets, cash holding scores vary from 0.055 to 0.187, with an overall mean value of 0.105. The mean cash holdings scores are consistent with those reported by Chen et al. (2015) for the Chinese non-financial firms (0.139) and (0.052) for the Indian firms. Regarding working capital performance in developing markets, the mean scores vary from 0.009 to 0.096, with an overall mean value of 0.057. The Indian firms' working capital tops the score with the Chinese firms at the bottom, which means the Indian firms use working capital more efficiently than the Chinese firms. The EPU scores vary from 4.833 to 4.645, with an overall mean value of 4.698 for the two developing markets. The interest rate scores for the two developing markets vary from 7.388 to 3.184, with an overall mean value of 2.887. The inflation rate scores vary from 7.804 to 2.738, with an overall mean value of 2.859 for the two developing markets. The foreign exchange rate scores for the two developing markets vary from -0.099 to 2.577, with an overall mean value of 0.467.

We use the OLS estimation method since our data is unbalanced panel data. Before applying OLS estimation, we tested to determine if the OLS estimation meets the BLUE assumptions. We applied the Fisher-Type unit root test to check for the stationarity of our dataset and the *p-value of 0.000* rejects the null hypothesis, which indicates no unit root in our dataset. Next, we ran the Pearson pairwise correlation test. Correlation did not exceed 0.80 in any specification. This result indicates that there is no multicollinearity problem (Gujarati, 2004). Next, we applied the Breusch-Pagan test to check for heteroscedasticity and the Wooldridge test for autocorrelation in the dataset. Unreported results of these tests reject the null hypothesis, which indicates the presence of heteroscedasticity and autocorrelation. As Baltagi (2008) notes, the presence of heteroscedasticity and autocorrelation restrict us in terms of what techniques we can use: traditional OLS or fixed-effect methods.

Furthermore, the unreported empirical evidence in our study reveals that the relationship between firm-specific variables and cash holdings is dynamic. The dynamic OLS results show that there is a significant increase in adjusted R^2 from static to dynamic OLS, which reflects the dynamic nature of the relationship. The coefficients of the lagged dependent variables are statistically significant at the 5% level in all firms, which provides further evidence that lagged cash holdings act as a regressor and indicate the existence of endogeneity. In short, the results suggested that the relationship should be estimated using dynamic models. Our result shows that firm-specific and macroeconomic variables are related to past cash holdings, up to four years. The first lag is significant in all specifications; thus, we use the first lag of cash holdings as a regressor in the dynamic estimations and higher lags as instruments. We apply the two-step system GMM estimator to determine the dynamic relationship between firm-specific and macroeconomic variables with cash holdings. The results show that working capital is positive and significantly related to cash holdings at the 10% and the 1% level in all firms in both developed and developing markets, respectively. Except for the US firms, the CCC is significant and negatively related to cash holdings in all developed and developing markets at the 5% level. However, the macroeconomic variable results are heterogeneous, according to the economic structure of the country (developed or developing). The EPU is positive and significantly related to cash holdings at the 5% level in all firms from developed markets and negative and significantly related to cash holdings at the 10% level in all firms from developing markets, except for Chinese firms.

Likewise, the interest rate and the inflation rate are negative and significantly related to cash holdings at the 1% level in firms from developed markets and positive significantly related to cash holdings in all firms from developing markets. The foreign exchange rate is positive and significantly related to cash holdings at the 5% level in all firms, except for Japanese firms.

Diagnostic tests (AR1, AR2, and AR3 for first, second and third-order autocorrelation, the Hansen J. Test for over-identification of instruments, the difference in Hansen J. Test for exogeneity and the instrument count method), provide sufficient evidence that SGMM is an appropriate estimator for this study. We also analyzed the relationship between firm-specific, macroeconomic variables and cash holdings during the global financial crisis (2007-2009), pre-crisis period (2003-2006) and the post-crisis period (2010-2015). The results show similar heterogeneous behavior among the macroeconomic variables according to market structure (developed and developing) and period (pre-crisis, post-crisis and during the crisis). Most of the firms changed their cash holdings structure in the post-crisis period. For example, the Japanese firms created greater hedge funds against the volatility of foreign exchange rate, hence the foreign exchange rate is insignificant during the crisis and post-crisis period. The interest rate is significant and negatively related to cash holdings at the 10% level for US firms in the post-crisis period, otherwise, the interest rate is insignificant in the US firms in pre and during the crisis period.

Similarly, EPU is significant and positively related to cash holdings at the 10% level after the global financial crisis for the US firms. The Chinese firms show consistent results with the overall period results. Indian firms exhibit a significant and positive relationship between cash holdings, the inflation rate and the foreign exchange rate at the 5% level in the post-crisis period; however, there is an insignificant relationship during the global financial crisis period.

This chapter has shown that firms changed their cash holdings policies after the global financial crisis and firm-specific factors are not the only factors which affect cash holdings. In the next chapter, we extend our analysis to estimate the relationship of independent variables on non-financial, FC or Non-FC firms' cash holdings.

Chapter 5

Cash holdings of financially constrained and financially unconstrained firms

5.1 Introduction

This chapter investigates the dynamic nature of the relationship between firm-specific and macroeconomic factors and cash holding of FC and Non-FC firms in the US, Japanese, Chinese, and Indian firms. Section 5.2 discusses financial differences between FC and Non-FC firms in terms of cash holdings. Section 5.3 examines the cash holdings of FC firms. Section 5.4 considers the cash holdings of Non-FC firms. Section 5.5 discusses the robustness analysis of this study through a different cash holdings ratio i.e. Sales/Assets. Section 5.6 provides a summary of the chapter.

5.2 Cash holdings of FC and Non-FC firms

The main purpose of holding cash is that it permits firms to invest in positive NPV projects (Almeida et al., 2004). For this purpose, firms save cash from their cash flows (*the cash flow sensitivity of cash*).[34] Almeida and colleagues find that FC firms do systematic cash holdings related to cash flows whereas Non-FC firms' cash holdings are not systematically related to cash flows. Denis and Sibilkov (2010) suggest that cash holdings are more valuable for FC firms than for Non-FC firms. They find that high levels of cash of FC firms encourages them to undertake value-increasing projects that might otherwise be bypassed. They note that most FC firms hold too little cash because of persistently low cash flows. To investigate the cash holdings patterns of FC and Non-FC firms, we divided our dataset in two groups (i) FC and (ii) Non-FC firms. Almeida et al. (2004) use total firm assets (or firm size) size to determine whether a firm is FC or Non-FC. They take 30 percentiles top/(bottom) of firm size (total assets) to differentiate Non-FC and FC firms. This study uses similar estimation method to differentiate FC and Non-FC firms. In this chapter, we discuss the effect of firm-specific and

[34] This term refers to how much cash a firm retains from its cash flows. If a firm hold more cash against its cash flows, then it is considered more cash sensitive.

macroeconomic variables on two types of firms, based on firm size or total assets: that is, (i) FC and (ii) Non-FC firms.

5.3 Cash holdings of FC firms

This section investigates the cash holdings of FC firms. While section 5.3.1, examines the cash holdings of FC firms in the overall sample period (2003-2015), section 5.3.2 provides an overview of cash holdings of FC firms before and after the global financial crisis of 2007-09.

5.3.1 Cash holdings in the overall sample period

This section discusses the two-step SGMM results of FC firms in the US, Japan, China and India. Models (1), (2) and (3) of the overall sample period in Tables 5.1, 5.2, 5.3 and 5.4 reports the effect of the independent variables on cash holdings in the US, Japan, China and India respectively. First, we discuss the results of FC firms in the overall sample period (2003-2015).

The empirical results of the US (see Table 5.1), Japanese (see Table 5.2), Chinese (see Table 5.3) and Indian firms (see Table 5.4), show that working capital is significant and positive, while the CCC is significant and negatively related to cash holdings in the firms of all countries in the sample at the 5% level. These findings are consistent with the overall[35] sample firms which show similar results (see Chapter 4). Macroeconomic variables (EPU, interest rate, inflation rate and foreign exchange rate) have higher coefficients than overall firms and are consistent with overall sample firms (see Chapter 4), except for the interest rate in the Chinese firms (see Table 5.3). In both the Japanese (see Table 5.2) and Chinese firms (see Table 5.3), the foreign exchange rate shows an insignificant relationship with cash holdings. The insignificant relationship between the interest rate and cash holdings of Chinese FC firms (see Table 5.3) indicates that these firms prefer to use non-operating cash for NPV projects instead of using credit lines. To avoid the financial cost, García-Teruel and Martínez-Solano (2008), implies that firms prefer to use non-operating cash instead of using credit lines. The foreign exchange rate has a significant and positive relationship with cash holdings in the US and Indian firms. This positive effect is only found in post-crisis period (2010-2015). This result indicates that firm policymakers must consider foreign exchange rate volatility in order to avoid liquidity risk. In contrast, in Japan (see Table 5.2) and China (see Table 5.3), the foreign

[35] Both FC and Non-FC firms.

exchange rate has no significant relationship with cash holdings. This result indicates that firms in these markets create hedge funds to guard against foreign exchange rate volatility. This finding is consistent Song and Lee (2012) who indicate that firms create hedge funds to avoid foreign exchange risk.

5.3.2 Cash holdings of FC firms before and after the global financial crisis of 2007-2009

Firms around the globe changed their strategic investments policies after the global financial crisis of 2007-2009 (Lins et al., 2010). While some firms were forced to closed, others survived and even thrived during the financial crisis (Lian et al., 2011). This worst financial havoc increases the demand for liquid assets; firms decrease their investments so that they could increase the cash level to survive in such a crisis (Song & Lee, 2012). However, in the case of FC firms (see Tables 5.1 to 5.4), holding too much cash is costly because of lower financial returns on liquid assets, as well as the associated higher financial costs. In this section, we discuss FC firms' behavior in terms of cash holdings in pre (2003-2006), post (2010-2015) and during the global financial crisis period (2007-2009). We examine the effect of firm-specific and macroeconomic factors on cash holdings of FC firms (see Tables 5.1 to 5.4) in pre, post and during the global financial crisis in models (1), (2) and (3). Tables 5.1, 5.2, 5.3 and 5.4 report SGMM estimations for the US (see Table 5.1), Japan (see Table 5.2), China (see Table 5.3) and India (see Table 5.4). Our findings suggest that firm-specific variables have a significant relationship with cash holdings in the overall period (2003-2015). The insignificant relationship finds that only Indian firms (see Table 5.4) were not affected by the financial crisis period. In contrast, macroeconomic variables such as EPU, the interest rate, the inflation rate, and the foreign exchange rate behave differently according to different time periods (pre, post and during crisis period) and market structure (developed and developing). This finding is consistent with Choong et al. (2010) studies who argue that economic structures of developed and developing economies are diverse and that macroeconomic variables are heterogeneous and behave differently in each economy (Ghironi & Melits, 2005).

Our findings show that the EPU is significant and positively related to cash holdings in the US (see Table 5.1) and Japanese firms (see Table 5.2) at the 5% level. On the contrary, this relationship is significant and negative with cash holdings in Chinese (see Table 5.3) and Indian firms (see Table 5.4) at the 5% level in the overall sample period. These findings are consistent

with the overall sample period (2003-2015), except for Chinese firms where EPU is insignificant in the overall period (2003-2015). However, EPU is significant and negatively related to cash holdings at the 5% level during the global financial crisis period (2007-2009). This finding indicates that FC firms faced severe decreases in economic activities and cash inflows as a result of the financial crisis.

Furthermore, the effect of the interest rate on cash holdings of FC firms is largely consistent with the overall sample results (2003-2015). The empirical results show that except for the US (table 5.1) and Japanese firms (see Table 5.2), the interest rate has an insignificant relationship with cash holdings in the post-crisis period (2010-2015). However, in Chinese firms (see Table 5.3), the interest rate has insignificant relationship with cash holdings during the crisis period. These findings suggest that after the global financial crisis (2007-2009), firms decreased their dependency on credit lines and changed their cash holdings policies (Song & Lee, 2012). The effect of the inflation rate on cash holdings in this section is consistent with the overall sample (2003-2015). Results indicate that in the global financial crisis (2007-2009), the inflation rate in developing (China and India) markets is significant and positively related to cash holdings at the 5% level. Our findings indicate that the Chinese (see Table 5.2) and Indian (see Table 5.3) FC firms have to spend more cash because of increased inflation rates (Wang et al., 2014), so that, these firms can maintain their purchasing power and consequently, their cash levels increase[36]. Our findings are consistent with Choong et al. (2010) and Ghironi and Melits (2005) who argue that the economic structures of developed and developing economies are diverse and macroeconomic variables are heterogeneous and behave differently in each economy . Further, the effect of the foreign exchange rate on FC firms' cash holdings in this section are consistent with the overall sample results (2003-2015), with the exception of the post-crisis period in the US (see Table 5.1), the pre-crisis period in India (see Table 5.4) and the global financial crisis period in China (see Table 5.3) where the foreign exchange rate has no relationship with cash holdings. These findings indicate that FC firms create hedge funds against foreign exchange rate volatility (Song & Lee, 2012).

Our findings in this section are consistent with the results of overall sample (combined FC and Non-FC firms). The results indicate that the coefficients of firm-specific and macroeconomic variables are higher in FC firms than the overall firm group. This shows that FC firms are more

[36] When inflation increases, general price levels increase (for example, the CPI). To maintain their purchasing power, firms hold greater amounts of cash.

sensitive to fluctuations due to variations in the independent variables. This implies that FC firms are more cash sensitive and these firms persistently attempt to hold cash from their cash flows (Almeida et al., 2004). These findings suggest that in most markets (developed and developing), FC firms persistently hold cash as a buffer to meet their liquidity demands. Our findings endorse Keynes' (1936) precautionary saving theory which argues that firms hold cash to protect themselves against internal (firm-specific) and external (macroeconomic) shocks. A central finding of this thesis is that the joint uncertainty of economy and firm cash flows is crucial when firms are financially constrained. This finding is consistent with Modigliani and Miller's (1958) insight that cash only affects firm value when markets are not frictionless. Our study also echo Almeida et al. (2004). They suggest that cash holdings and cash flows are correlated only in FC firms.

Table 5.1 Impact of firm-specific and macroeconomic variables on cash holdings of US (S&P 500) FC firms

	Dependent variable: cash holding											
	Overall period			During crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.667***	0.763***	0.704***	0.765***	0.782***	0.720***	0.598***	0.705***	0.663***	0.636***	0.758***	0.634***
	(0.061)	(0.048)	(0.110)	(0.077)	(0.050)	(0.106)	(0.097)	(0.054)	(0.103)	(0.101)	(0.064)	(0.198)
WC_t	0.063**	0.070**		0.110**	0.073***		0.111**	0.060**		0.110**	0.076**	
	(0.030)	(0.028)		(0.043)	(0.028)		(0.048)	(0.029)		(0.049)	(0.033)	
CCC_t	-0.000*	-0.000*		-0.000	-0.000*		-0.000*	-0.000*		-0.000	-0.000**	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	0.001		0.003	0.011*		0.011*	0.011		0.003	0.015**		0.015*
	(0.005)		(0.006)	(0.006)		(0.006)	(0.008)		(0.011)	(0.006)		(0.008)
INT_t	-0.004***		-0.001	0.001		0.002	0.004		0.000	0.000		-0.000
	(0.001)		(0.001)	(0.002)		(0.002)	(0.005)		(0.006)	(0.001)		(0.002)
$INFL_t$	-0.005***		-0.005***	-0.005***		-0.004***	-0.006***		-0.004**	-0.004***		-0.003***
	(0.001)		(0.001)	(0.001)		(0.001)	(0.002)		(0.002)	(0.001)		(0.001)
FXR_t	0.061***		0.044*	0.042**		0.008	0.041***		0.027	0.025		0.026
	(0.015)		(0.025)	(0.017)		(0.016)	(0.015)		(0.018)	(0.016)		(0.020)
GDP_t	-0.005		0.007	-0.004		0.008	-0.000		0.008	0.001		0.028
	(0.005)		(0.013)	(0.006)		(0.012)	(0.006)		(0.013)	(0.006)		(0.021)
MS_t	0.001		0.004	-0.005		0.005	-0.002		0.004	-0.001		0.014
	(0.003)		(0.006)	(0.004)		(0.005)	(0.004)		(0.006)	(0.004)		(0.009)
MTB_t	0.002*	-0.003**		0.003	-0.002		0.002	-0.002*		0.002	-0.001	
	(0.001)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)	
$SIZE_t$	-0.015**	-0.011**		0.000	-0.007		-0.001	-0.012**		0.002	-0.005	
	(0.006)	(0.005)		(0.006)	(0.004)		(0.005)	(0.005)		(0.005)	(0.005)	
LEV_t	-0.001*	0.000		-0.000	-0.000		-0.001*	-0.000		-0.001	-0.001*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	0.124*	0.223***		0.044	0.217***		0.183*	0.205**		0.170	0.056	
	(0.069)	(0.078)		(0.096)	(0.083)		(0.100)	(0.084)		(0.107)	(0.061)	
CFO_t	-0.006	0.141**		0.006	0.084		0.066	0.072		0.060	0.075	
	(0.063)	(0.062)		(0.078)	(0.068)		(0.090)	(0.071)		(0.090)	(0.063)	
$RULE_t$	-0.011		0.051	-0.002		0.102**	0.030		0.025	0.065		0.044
	(0.021)		(0.050)	(0.020)		(0.045)	(0.042)		(0.061)	(0.042)		(0.032)
REG_t	0.028*		-0.017	-0.003		-0.042**	0.009		-0.014	-0.028		-0.031
	(0.017)		(0.023)	(0.018)		(0.019)	(0.018)		(0.024)	(0.020)		(0.029)
$PROF_t$	-0.000	-0.000		-0.000	-0.000		-0.000	-0.000		-0.000	-0.000*	

	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	-0.000	-0.000*		0.000	-0.000		-0.000	-0.000		0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constrained$	-0.024	-0.013	0.065**	0.006	-0.010	0.060**	0.010	-0.001	0.068**	0.009	-0.002	0.058
	(0.016)	(0.014)	(0.027)	(0.013)	(0.012)	(0.027)	(0.011)	(0.014)	(0.027)	(0.011)	(0.012)	(0.052)
$Constant$	0.293	0.130**	-0.391	0.240	0.097**	-0.544	0.040	0.157***	-0.371	-0.091	0.080	-1.337
	(0.233)	(0.053)	(0.583)	(0.300)	(0.045)	(0.542)	(0.274)	(0.052)	(0.593)	(0.277)	(0.054)	(0.923)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,073	3,392	2,756	3,073	3,392	2,756	2,756	3,392	3,073	2,756	3,392	3,073
Number of firms	317	319	313	317	319	313	313	319	317	313	319	317
Number of instruments	244	244	61	135	244	65	128	244	61	128	221	30
AR2 p-value	0.511	0.306	0.288	0.526	0.307	0.268	0.398	0.409	0.544	0.357	0.42	0.505
Hansen-J	0.29	0.149	0.433	0.536	0.208	0.533	0.385	0.308	0.316	0.412	0.146	0.211
Difference in Hansen J	0.414	0.91	0.151	0.287	0.969	0.371	0.339	0.989	0.11	0.314	0.708	0.117
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006) during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 5.2 Impact of firm-specific and macroeconomic variables on cash holdings of Japanese (Nikkei 225) FC firms

	Dependent variable: Cash holding											
	Overall period			During-crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.785***	0.821***	0.891***	0.785***	0.825***	0.893***	0.786***	0.813***	0.886***	0.785***	0.801***	0.897***
	(0.046)	(0.048)	(0.028)	(0.044)	(0.048)	(0.027)	(0.046)	(0.050)	(0.028)	(0.044)	(0.054)	(0.027)
WC_t	0.053**	0.062**		0.051**	0.061**		0.051**	0.050*		0.053**	0.055*	
	(0.023)	(0.030)		(0.025)	(0.030)		(0.024)	(0.029)		(0.025)	(0.031)	
CCC_t	-0.000*	-0.000**		-0.000*	-0.000*		-0.000*	-0.000*		-0.000*	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	0.010**		0.016***	0.012*		0.013**	0.027**		0.025**	0.011**		0.018***
	(0.005)		(0.005)	(0.007)		(0.006)	(0.013)		(0.012)	(0.005)		(0.005)
INT_t	-0.018***		-0.018***	-0.020***		-0.016**	-0.018***		-0.018***	-0.017**		-0.012*
	(0.006)		(0.006)	(0.006)		(0.006)	(0.006)		(0.006)	(0.007)		(0.007)
$INFL_t$	-0.000		-0.000	-0.000		-0.001	0.001		0.000	-0.000		-0.000
	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)
FXR_t	-0.000		-0.000**	-0.000		-0.000	-0.000*		-0.000**	-0.000		-0.000
	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)
GDP_t	0.001		-0.002	0.001		-0.002	0.001		-0.002	0.001		-0.002
	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)
MS_t	-0.000		-0.004**	-0.000		-0.004*	-0.000		-0.004**	-0.000		-0.004*
	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)
MTB_t	0.003**	0.002		0.003**	0.001		0.003**	0.002		0.003**	0.002	
	(0.001)	(0.002)		(0.001)	(0.002)		(0.001)	(0.002)		(0.001)	(0.002)	
$SIZE_t$	-0.015**	-0.022***		-0.015**	-0.021***		-0.014**	-0.023***		-0.015**	-0.023***	
	(0.007)	(0.007)		(0.007)	(0.007)		(0.007)	(0.007)		(0.007)	(0.007)	
LEV_t	-0.000	-0.000		-0.000	-0.000		-0.000	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	-0.099*	-0.020		-0.103*	-0.012		-0.107*	-0.016		-0.098*	-0.050	
	(0.059)	(0.062)		(0.058)	(0.067)		(0.058)	(0.063)		(0.059)	(0.064)	
CFO_t	-0.090**	-0.015		-0.093***	-0.016		-0.092**	-0.024		-0.091**	-0.021	
	(0.035)	(0.050)		(0.035)	(0.049)		(0.036)	(0.049)		(0.035)	(0.051)	
$RULE_t$	0.035***		0.037***	0.039***		0.033***	0.053***		0.049***	0.037***		0.037***
	(0.010)		(0.010)	(0.012)		(0.012)	(0.017)		(0.017)	(0.010)		(0.010)
REG_t	0.019		0.054**	0.029		0.040	0.025		0.057**	0.011		0.016
	(0.028)		(0.025)	(0.036)		(0.032)	(0.028)		(0.026)	(0.041)		(0.035)

$PROF_t$	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	-0.000***	-0.001***		-0.000***	-0.001***		-0.000***	-0.001***		-0.000***	-0.001***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constrained$	-0.019	-0.034***	0.007	-0.018	-0.035***	0.007	-0.017	-0.034***	0.007	-0.019	-0.034***	0.007
	(0.011)	(0.012)	(0.009)	(0.012)	(0.012)	(0.009)	(0.012)	(0.012)	(0.009)	(0.012)	(0.012)	(0.008)
$Constant$	0.129	0.336***	0.018	0.106	0.333***	0.054	-0.000	0.350***	-0.030	0.137	0.352***	0.046
	(0.126)	(0.100)	(0.114)	(0.132)	(0.100)	(0.131)	(0.156)	(0.104)	(0.140)	(0.124)	(0.105)	(0.125)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,973	2,164	1,973	1,973	2,164	1,973	1,973	2,164	1,973	1,973	2,164	1,973
Number of firms	188	191	188	188	191	188	188	191	188	188	191	188
Number of instruments	182	175	139	182	175	139	182	175	139	182	175	139
AR3 p-value	0.362	0.293	0.471	0.368	0.299	0.453	0.369	0.309	0.482	0.359	0.286	0.437
Hansen-J	0.257	0.280	0.345	0.310	0.280	0.344	0.275	0.251	0.266	0.274	0.270	0.368
Difference in Hansen J	0.734	0.935	0.828	0.826	0.908	0.762	0.758	0.939	0.856	0.725	0.923	0.662
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 5.3 Impact of firm specific and macroeconomic variables on cash holdings of Chinese (CSI 300) FC firms

	Dependent variable: Cash holding											
	Overall crisis			During crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.999***	0.832***	0.884***	0.767***	0.821***	0.895***	0.775***	0.879***	0.752***	0.763***	0.887***	0.789***
	(0.092)	(0.125)	(0.078)	(0.086)	(0.122)	(0.054)	(0.085)	(0.143)	(0.045)	(0.063)	(0.135)	(0.056)
WC_t	0.083***	0.099***		0.033	0.093***		0.040	0.108***		-0.021	0.102***	
	(0.020)	(0.021)		(0.054)	(0.021)		(0.050)	(0.024)		(0.044)	(0.021)	
CCC_t	-0.000***	-0.000***		0.000	-0.000***		0.000	-0.000***		0.000	-0.000***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	-0.009*		-0.010*	-0.019**		-0.011**	-0.018**		-0.011*	-0.002		-0.003
	(0.005)		(0.005)	(0.008)		(0.005)	(0.009)		(0.006)	(0.007)		(0.006)
INT_t	-0.003		0.001	-0.007		0.010	-0.019		-0.002	0.024*		0.025**
	(0.012)		(0.012)	(0.019)		(0.013)	(0.017)		(0.010)	(0.014)		(0.010)
$INFL_t$	-0.001		-0.001	-0.002		-0.001	-0.005*		-0.000	0.001		0.002
	(0.002)		(0.003)	(0.003)		(0.003)	(0.002)		(0.002)	(0.002)		(0.002)
FXR_t	0.013		0.015	-0.005		0.014	-0.045		0.013	0.057		0.055*
	(0.028)		(0.043)	(0.052)		(0.044)	(0.043)		(0.026)	(0.037)		(0.030)
GDP_t	0.001		-0.000	0.009		-0.001	0.006		0.000	0.002		-0.001
	(0.002)		(0.003)	(0.008)		(0.002)	(0.008)		(0.002)	(0.007)		(0.002)
MS_t	0.000		-0.001	0.002		-0.000	0.001		-0.002*	0.001		-0.003**
	(0.001)		(0.001)	(0.004)		(0.001)	(0.004)		(0.001)	(0.003)		(0.001)
MTB_t	0.000	-0.000		-0.000	-0.000		0.002	-0.000		0.000	-0.000	
	(0.001)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)	
$SIZE_t$	-0.018***	-0.040***		0.009	-0.036***		0.008	-0.044***		0.002	-0.038***	
	(0.006)	(0.012)		(0.006)	(0.012)		(0.007)	(0.012)		(0.005)	(0.012)	
LEV_t	0.001*	0.000		-0.001	0.000		-0.001	0.000		-0.001	0.000	
	(0.000)	(0.000)		(0.001)	(0.000)		(0.001)	(0.000)		(0.001)	(0.000)	
$CAPEX_t$	0.103**	0.076*		0.138	0.077*		0.103	0.076*		0.164	0.085*	
	(0.041)	(0.044)		(0.124)	(0.042)		(0.123)	(0.043)		(0.127)	(0.044)	
CFO_t	-0.036	0.014		-0.091	0.020		-0.086	0.000		0.042	0.007	
	(0.031)	(0.030)		(0.092)	(0.029)		(0.101)	(0.036)		(0.092)	(0.031)	
$RULE_t$	-0.034		-0.039	-0.047		-0.011	-0.015		0.007	0.003		0.036
	(0.026)		(0.030)	(0.042)		(0.031)	(0.041)		(0.030)	(0.034)		(0.023)

REG_t	0.080		0.146	0.019		0.065	-0.020		0.068	0.151**		0.135*
	(0.071)		(0.127)	(0.100)		(0.117)	(0.089)		(0.066)	(0.073)		(0.069)
$PROF_t$	-0.000**	-0.000		-0.000	-0.000		-0.000	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	-0.000	-0.000		0.000	-0.000		-0.000	-0.000		0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constrained$	-0.096***	-0.181***	-0.053***	-0.011	-0.162***	-0.027**	-0.015	-0.205***	-0.009	-0.012	-0.179***	-0.020*
	(0.031)	(0.056)	(0.020)	(0.022)	(0.059)	(0.013)	(0.024)	(0.061)	(0.014)	(0.017)	(0.057)	(0.011)
$Constant$	0.228**	0.465***	0.120	-0.220	0.423***	0.098	-0.074	0.499***	0.183*	-0.073	0.442***	0.147
	(0.106)	(0.122)	(0.108)	(0.295)	(0.131)	(0.103)	(0.291)	(0.124)	(0.095)	(0.228)	(0.125)	(0.100)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,648	1,852	1,446	1,648	1,852	1,446	1,648	1,852	1,648	1,648	1,852	1,648
Number of firms	202	204	200	202	204	200	202	204	202	202	204	202
Number of instruments	48	34	38	48	34	38	88	34	67	133	34	65
AR4 p-value	0.256	0.758	0.219	0.131	0.161	0.165	0.099	0.695	0.164	0.126	0.221	0.132
Hansen-J	0.646	0.691	0.438	0.129	0.093	0.193	0.619	0.580	0.439	0.835	0.127	0.235
Difference in Hansen J	0.967	0.673	0.604	0.184	0.565	0.407	0.608	0.684	0.131	0.969	0.783	0.584
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 5.4 Impact of firm specific and macroeconomic variables on cash holdings of Indian (NSI 500) FC firms

	Dependent variable: Cash holding											
	Overall period			During crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.979***	0.660***	0.847***	0.758***	0.569***	0.978***	0.628***	0.709***	0.985***	0.873***	0.783***	0.992***
	(0.125)	(0.178)	(0.114)	(0.219)	(0.161)	(0.096)	(0.197)	(0.256)	(0.091)	(0.136)	(0.195)	(0.098)
WC_t	0.053**	0.034*		-0.005	0.006		0.009	0.042*		0.044**	0.037*	
	(0.021)	(0.020)		(0.040)	(0.017)		(0.019)	(0.023)		(0.019)	(0.021)	
CCC_t	-0.000**	-0.000***		-0.000	-0.000		-0.000	-0.000**		-0.000**	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	-0.050**		-0.024*	-0.062**		-0.036**	0.007		-0.036**	-0.010		-0.047***
	(0.022)		(0.014)	(0.029)		(0.016)	(0.011)		(0.016)	(0.013)		(0.016)
INT_t	0.005		0.004*	0.012**		0.007***	0.004**		0.008***	0.005***		0.006**
	(0.003)		(0.002)	(0.005)		(0.003)	(0.001)		(0.003)	(0.002)		(0.003)
$INFL_t$	0.004*		0.003*	0.005**		0.002	-0.001		0.003*	0.001		0.003**
	(0.002)		(0.001)	(0.003)		(0.002)	(0.001)		(0.002)	(0.001)		(0.001)
FXR_t	0.001		0.001	0.001		0.001	0.000		0.001	0.001		0.002*
	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)
GDP_t	0.000		-0.003	0.003		-0.001	0.001		-0.002	0.001		0.000
	(0.002)		(0.011)	(0.003)		(0.008)	(0.002)		(0.008)	(0.002)		(0.005)
MS_t	-0.002		-0.004	-0.001		-0.002	-0.001		-0.003	-0.001		0.002
	(0.001)		(0.006)	(0.002)		(0.006)	(0.001)		(0.007)	(0.001)		(0.004)
MTB_t	0.000	0.002**		0.002	0.002***		0.002***	0.001		0.001**	0.001*	
	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)	
$SIZE_t$	0.003	0.000		0.006	0.006		-0.003	-0.005		-0.006	0.001	
	(0.016)	(0.009)		(0.009)	(0.009)		(0.006)	(0.012)		(0.011)	(0.013)	
LEV_t	-0.000	-0.000		-0.000	-0.000**		-0.000	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	0.024	0.066**		0.035	0.105***		0.068**	0.063*		0.030	0.072**	
	(0.034)	(0.033)		(0.051)	(0.035)		(0.029)	(0.033)		(0.030)	(0.033)	
CFO_t	-0.069**	-0.003		-0.024	0.007		0.008	-0.020		-0.046	-0.040	
	(0.034)	(0.035)		(0.042)	(0.029)		(0.033)	(0.047)		(0.033)	(0.039)	
$RULE_t$	-0.020		0.098**	0.212***		0.075	0.145***		0.155**	0.005		-0.006
	(0.054)		(0.039)	(0.071)		(0.051)	(0.041)		(0.061)	(0.048)		(0.072)

REG_t	-0.105*		-0.072**	-0.053		-0.101**	0.020		-0.073	-0.038		-0.134***
	(0.054)		(0.037)	(0.044)		(0.042)	(0.028)		(0.045)	(0.037)		(0.041)
$PROF_t$	0.000***	0.000***		0.000	0.000***		0.000***	0.000**		0.000***	0.000***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	0.000	0.000		-0.000	-0.000		-0.000	0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constrained$	0.015	0.003	-0.020	0.044	0.027	0.008	-0.012	-0.025	0.006	-0.028	0.004	0.009
	(0.074)	(0.045)	(0.013)	(0.049)	(0.041)	(0.017)	(0.030)	(0.061)	(0.018)	(0.053)	(0.062)	(0.013)
$Constant$	0.143	0.028	0.268	0.045	-0.038	0.140	0.033	0.093	0.209	0.083	0.026	0.054
	(0.167)	(0.117)	(0.498)	(0.142)	(0.108)	(0.439)	(0.097)	(0.160)	(0.456)	(0.152)	(0.161)	(0.245)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,404	1,174	1,405	596	1,174	958	1,404	1,174	958	1,404	1,174	958
Number of firms	230	217	230	151	217	190	230	217	190	230	217	190
Number of instruments	35	39	87	31	53	41	63	26	41	45	26	53
AR2 p-value	0.827	0.484	0.763	0.479	0.271	0.375	0.828	0.551	0.394	0.873	0.38	0.361
Hansen-J	0.335	0.331	0.242	0.838	0.622	0.772	0.284	0.436	0.727	0.255	0.698	0.877
Difference in Hansen J	0.544	0.159	0.441	0.812	0.185	0.326	0.645	0.144	0.400	0.476	0.539	0.452
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

5.4 Cash holdings of Non-FC firms

This section discusses cash holdings of Non-FC firms. In section 5.4.1, we discuss the cash holdings of Non-FC firms in the overall sample period (2003-2015). Section 5.4.2 discusses the cash holdings of Non-FC firms before and after the global financial crisis of 2007-09.

5.4.1 Cash holdings in the overall sample period (2003-2015)

This section elaborates the two-step SGMM results of Non-FC firms of the US (see Table 5.5), Japan (see Table 5.6), China (see Table 5.7) and India (see Table 5.8). Models (1), (2) and (3) of the overall sample period in Tables 5.5, 5.6, 5.7 and 5.8 report the effect of independent variables on cash holdings in the US, Japan, China and India respectively. First, we discuss the results of Non-FC firms in the overall sample period (2003-2015). The empirical results for the US (see Table 5.5) Japan (see Table 5.6), China (see Table 5.7) and India (see Table 5.8) in this section, show that working capital is significant and positive while the CCC is significant and negatively related to cash holdings in both developed and developing markets at the 5% level. This finding is consistent with overall sample firms.

Furthermore, macroeconomic variables (EPU, the interest rate, the inflation rate and the foreign exchange rate) have similar results with the overall sample firms. First, we discuss EPU, which is significant and positively related to cash holdings in the Japanese firms (see Table 5.6) at the 5% level and significant negatively related to cash holdings in the Indian firms (see Table 5.8) at the 5% level. There is an insignificant relationship between EPU and cash holdings in the overall sample period (2003 – 2015) for Non-FC firms in the US (see Table 5.5) and Chinese (see Table 5.7) firms. These findings suggest that firms in Japan hold their cash when the EPU increases because firms decrease their investment to avoid losses, hence, cash level increases in firms. In contrast, for firms in India (see Table 5.8), cash level decreases when EPU increases. Our findings regarding EPU is consistent with Choong et al. (2010) who suggest that the economic structures of developed and developing economies are diverse and that macroeconomic variables are context dependent. Further, we find that in the case of Chinese FC firms (see Table 5.4), EPU is significant and negatively related to cash holdings at the 10% level. In contrast, in the case of Non-FC firms, EPU is insignificant. This result indicates that Non-FC firms have enough cash so EPU has no effect on these firms' cash

holdings. These findings are consistent with Almeida et al. (2004) who suggest that FC firms' cash holdings are systematically related to their cash flows while Non-FC firms' cash holdings are not determined by their cash flows. Furthermore, the interest rate, inflation rate and foreign exchange rate have inconsistent results with FC firms' results in the overall sample period (2003-2015). This finding implies that all macroeconomic variables of each country have consistent effects on cash holdings according to their economic structure (developed and developing). However, insignificant results indicate that macroeconomic variables have no effect on the cash holdings of Non-FC firms. Hence, our findings suggest that the coefficients of most variables are lower than those of FC firms. This finding implies that Non-FC firms are less cash sensitive then FC firms.

5.4.2 Cash holdings of Non-FC firms and the global financial crisis (2007-2009)

In this section, we discuss the Non-FC firms' behaviour of cash holdings in pre-crisis (2003-2006), during-crisis (2007-2009) and post financial crisis periods (2010-2015). We examine the effects of firm-specific and macroeconomic factors on cash holdings of Non-FC firms in pre, post and during global financial crisis in models (1), (2) and (3). Tables 5.5, 5.6, 5.7 and 5.8 report the SGMM estimations of the US (see Table 5.5), Japanese (table 5.6), Chinese (see Table 5.7) and Indian firms (see Table 5.8). Our findings suggest that firm-specific variables are once again significant with the overall period (2003-2015) in our results (See overall period section in tables 5.5, 5.6, 5.7 and 5.8). In the case of FC firms (see tables 5.1-5.4), Indian firms (see Table 5.4) shows an insignificant relationship with working capital and the CCC with cash holdings during the global financial crisis period which suggest that Indian FC firms decreased their operating activities. In the case of Non-FC firms in India (see Table 5.8), working capital is significant and positively related to cash holdings at the 5% level and the CCC is significant and negatively related to cash holdings at the 5% level during global financial crisis period. This result indicates that Indian Non-FC firms (see Table 5.8) were able to continue their operating activities even during a severe economic recession. These findings are consistent with Almeida et al. (2004) which suggest that cash holdings of Non-FC firms are not systematically related to firm cash flows. Except for the Japanese (see Table 5.6) and Indian firms (see Table 5.8), EPU is insignificant in the US (see Table 5.5) and Chinese firms (see Table 5.7) during the global financial crisis period. An insignificant relationship between EPU and

cash holdings of Non-FC firms during the crisis period indicate that these firms have enough cash to enable them to continue their business operations.

The effect of the interest rate on the cash holdings of Non-FC firms has consistent results with FC firms (tables 5.1 to 5.4), except for the post-crisis period (2010-2015) in Japan which is significant and negatively related to cash holdings at the 5% level. This finding indicates that Non-FC Japanese firms (see Table 5.6) avoid bank borrowing to decrease the financial and opportunity costs of idle cash. Our findings are consistent with Song and Lee (2012) who argue that firms changed their cash holdings policies after the global financial crisis. We extend our analysis to other variables: that is, inflation and the foreign exchange rate. Results show that the inflation rate has consistent results with FC firms (tables 5.1 to 5.4), except for the pre-crisis period for China (see Table 5.7) and in the global financial crisis period for India (see Table 5.8). These results indicate an insignificant relationship with cash holdings. Our findings suggest that Non-FC firms of China (see Table 5.7) and India (see Table 5.8) have enough cash inflows to maintain their purchasing power so that the inflation rate has no effect on cash holdings. Similarly, the effect of the foreign exchange rate on cash holdings of Non-FC firms is consistent with the FC firm results, except for the Chinese firms (see Table 5.7) which indicates a significant and positive relation with cash holdings at the 5% level. This result implies that during the financial crisis period, these firms held onto more cash to meet their demands for liquid assets against foreign exchange rate volatility.

Keynes (1936) precautionary motive theory can be applied to all firms, but Kim et al. (1998) and, Miller and Orr (1966) develop the trade-off model to determine the optimal level of cash holdings by balancing the cost of running out of cash and the cost of holding non-interest bearing cash. The trade-off model of optimal cash holdings is typically opposed to Myers' (1984) financing hierarchy theory which promotes higher cash holding levels to provide a financial backstop. In fact, FC firms or those firms with a lower access to external financing, should save more cash from their cash flows (Almeida et al., 2004), should use cash to lower debt through higher levels of hedging (Acharya et al., 2007) and have a higher dollar value in terms of cash held. However, financial hierarchy theory (the pecking order theory) supports Non-FC firms that have easier access to financial markets. These firms can get financing easier due to higher levels of fixed assets.

Table 5.5 Impact of firm specific and macroeconomic variables on cash holdings of US (S&P 500) Non-FC firms

	Dependent variable: Cash holdings											
	Overall period			During crisis			Pre-crisis period			Post-crisis period		
Variables	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
CH_{t-1}	0.628***	0.765***	0.799***	0.638***	0.782***	0.835***	0.592***	0.706***	0.763***		0.762***	0.736***
	(0.068)	(0.048)	(0.102)	(0.087)	(0.050)	(0.081)	(0.095)	(0.053)	(0.104)	(0.100)	(0.063)	(0.104)
WC_t	0.058*	0.074**		0.107**	0.084***		0.109**	0.065**		0.108**	0.073**	
	(0.031)	(0.030)		(0.045)	(0.030)		(0.048)	(0.030)		(0.048)	(0.033)	
CCC_t	-0.000	-0.000*		-0.000	-0.000*		-0.000*	-0.000*		-0.000	-0.000**	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	-0.001		-0.003	0.010		0.009	0.011		-0.001	0.014**		0.014
	(0.004)		(0.005)	(0.007)		(0.006)	(0.008)		(0.012)	(0.006)		(0.008)
INT_t	-0.003***		-0.002*	0.000		0.003	0.003		-0.000	0.000		-0.000
	(0.001)		(0.001)	(0.002)		(0.002)	(0.005)		(0.007)	(0.001)		(0.001)
$INFL_t$	-0.005***		-0.006***	-0.005***		-0.004***	-0.006***		-0.005**	-0.004***		-0.004***
	(0.001)		(0.001)	(0.001)		(0.001)	(0.002)		(0.002)	(0.001)		(0.001)
FXR_t	0.056***		0.064***	0.038**		0.017	0.039**		0.038**	0.026		0.021
	(0.016)		(0.023)	(0.016)		(0.016)	(0.016)		(0.017)	(0.017)		(0.017)
GDP_t	-0.004		-0.003	-0.002		-0.001	-0.001		-0.004	0.000		-0.009
	(0.005)		(0.012)	(0.007)		(0.011)	(0.006)		(0.013)	(0.006)		(0.019)
MS_t	0.002		-0.002	-0.004		-0.000	-0.003		-0.002	-0.001		-0.005
	(0.004)		(0.005)	(0.005)		(0.005)	(0.004)		(0.006)	(0.004)		(0.009)
MTB_t	0.002	-0.003**		0.002	-0.002		0.002	-0.002*		0.002	-0.001	
	(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)	
$SIZE_t$	-0.008	-0.003		-0.010	0.001		-0.012*	-0.009**		-0.006	-0.006	
	(0.006)	(0.004)		(0.007)	(0.004)		(0.007)	(0.004)		(0.008)	(0.007)	
LEV_t	-0.001**	-0.000		-0.001**	-0.000		-0.001*	-0.000		-0.001	-0.001*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	0.150**	0.189**		0.159	0.214**		0.181*	0.205**		0.177*	0.051	
	(0.072)	(0.081)		(0.097)	(0.083)		(0.099)	(0.082)		(0.107)	(0.060)	
CFO_t	0.042	0.112*		0.070	0.076		0.086	0.071		0.076	0.076	
	(0.074)	(0.067)		(0.092)	(0.068)		(0.089)	(0.070)		(0.091)	(0.065)	
$RULE_t$	-0.009		0.023	-0.001		0.094**	0.024		0.002	0.057		0.062**
	(0.019)		(0.048)	(0.021)		(0.044)	(0.043)		(0.062)	(0.044)		(0.025)
REG_t	0.013		0.017	-0.015		-0.020	0.001		0.020	-0.029		-0.032*
	(0.015)		(0.016)	(0.018)		(0.017)	(0.019)		(0.018)	(0.019)		(0.019)

$PROF_t$	-0.000	-0.000		-0.000	-0.000		-0.000	-0.000		-0.000	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	0.000	-0.000*		0.000	-0.000		0.000	-0.000		0.000	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Unconstrained$	-0.001	-0.012	-0.060*	0.027	-0.020	-0.043*	0.025	-0.007	-0.061*	0.017	0.005	-0.114***
	(0.012)	(0.012)	(0.032)	(0.017)	(0.013)	(0.025)	(0.019)	(0.013)	(0.035)	(0.019)	(0.016)	(0.042)
$Constant$	0.211	0.062**	0.161	0.292	0.029	-0.099	0.177	0.138***	0.191	0.025	0.083	0.383
	(0.265)	(0.029)	(0.538)	(0.347)	(0.033)	(0.491)	(0.288)	(0.035)	(0.568)	(0.301)	(0.057)	(0.852)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,073	3,392	2,756	3,073	3,392	2,756	2,756	3,392	3,073	2,756	3,392	3,073
Number of firms	317	319	313	317	319	313	313	319	317	313	319	317
Number of instruments	245	244	61	135	244	65	128	244	61	128	221	48
AR2 p-value	0.573	0.354	0.114	0.726	0.32	0.127	0.405	0.407	0.257	0.357	0.426	0.235
Hansen-J	0.399	0.315	0.346	0.479	0.288	0.392	0.488	0.336	0.209	0.471	0.132	0.461
Difference in Hansen J	0.482	0.977	0.413	0.211	0.964	0.489	0.434	0.983	0.406	0.366	0.668	0.722
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 5.6 Impact of firm specific and macroeconomic variables on cash holdings of Japanese (Nikkei 225) Non-FC firms

	Dependent variable: Cash holding											
	Overall period			During-crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.789***	0.827***	0.893***	0.789***	0.827***	0.899***	0.787***	0.818***	0.892***	0.791***	0.804***	0.901***
	(0.048)	(0.051)	(0.026)	(0.048)	(0.051)	(0.025)	(0.048)	(0.054)	(0.026)	(0.048)	(0.057)	(0.025)
WC_t	0.054**	0.063**		0.053**	0.063**		0.051*	0.053**		0.055**	0.055**	
	(0.024)	(0.026)		(0.026)	(0.026)		(0.026)	(0.025)		(0.025)	(0.027)	
CCC_t	-0.000*	-0.000*		-0.000*	-0.000*		-0.000*	-0.000*		-0.000*	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	0.011**		0.014***	0.011*		0.011*	0.026**		0.023*	0.012**		0.017***
	(0.005)		(0.005)	(0.007)		(0.006)	(0.013)		(0.012)	(0.005)		(0.005)
INT_t	-0.020***		-0.018***	-0.020***		-0.015**	-0.019***		-0.018***	-0.017**		-0.012*
	(0.005)		(0.006)	(0.006)		(0.006)	(0.005)		(0.006)	(0.007)		(0.007)
$INFL_t$	-0.001		-0.001	-0.000		-0.001	0.001		0.000	-0.000		-0.000
	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)
FXR_t	-0.000		-0.000**	-0.000		-0.000	-0.000*		-0.000**	-0.000		0.000
	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)
GDP_t	0.001		-0.002	0.001		-0.002	0.001		-0.002	0.001		-0.002
	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)
MS_t	-0.000		-0.004**	0.000		-0.004*	0.000		-0.004**	-0.000		-0.003*
	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)
MTB_t	0.004***	0.002		0.004***	0.002		0.004***	0.003*		0.004***	0.003	
	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.002)		(0.001)	(0.002)	
$SIZE_t$	-0.009	-0.012**		-0.009	-0.012*		-0.009	-0.013**		-0.009	-0.013**	
	(0.006)	(0.006)		(0.006)	(0.006)		(0.006)	(0.006)		(0.006)	(0.006)	
LEV_t	-0.000	-0.000		-0.000	-0.000		-0.000*	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	-0.097*	-0.047		-0.098*	-0.045		-0.105*	-0.042		-0.091*	-0.080	
	(0.056)	(0.062)		(0.057)	(0.067)		(0.059)	(0.063)		(0.054)	(0.065)	
CFO_t	-0.090**	-0.016		-0.091**	-0.016		-0.093**	-0.021		-0.088**	-0.023	
	(0.038)	(0.051)		(0.038)	(0.051)		(0.038)	(0.048)		(0.038)	(0.048)	
$RULE_t$	0.036***		0.035***	0.037***		0.030**	0.051***		0.046**	0.036***		0.035***
	(0.010)		(0.011)	(0.013)		(0.013)	(0.017)		(0.018)	(0.010)		(0.011)
REG_t	0.021		0.045*	0.022		0.030	0.024		0.048*	0.001		0.007
	(0.028)		(0.025)	(0.037)		(0.032)	(0.028)		(0.026)	(0.041)		(0.035)

$PROF_t$	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	-0.000***	-0.001***		-0.000***	-0.001***		-0.000***	-0.001***		-0.000***	-0.001***	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Constrained$	0.008	0.015*	-0.004	0.008	0.015*	-0.005	0.008	0.015*	-0.005	0.008	0.016*	-0.005
	(0.010)	(0.009)	(0.007)	(0.011)	(0.009)	(0.007)	(0.011)	(0.009)	(0.007)	(0.010)	(0.009)	(0.007)
$Constant$	0.026	0.182**	0.050	0.023	0.181**	0.065	-0.070	0.195**	-0.008	0.040	0.204**	0.056
	(0.115)	(0.083)	(0.108)	(0.127)	(0.085)	(0.112)	(0.150)	(0.085)	(0.135)	(0.116)	(0.087)	(0.106)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,973	2,164	1,973	1,973	2,164	1,973	1,973	2,164	1,973	1,973	2,164	1,973
Number of firms	188	191	188	188	191	188	188	191	188	188	191	188
Number of instruments	182	175	139	182	175	139	182	175	139	182	175	139
AR3 p-value	0.352	0.265	0.476	0.353	0.266	0.459	0.358	0.275	0.482	0.345	0.252	0.440
Hansen-J	0.235	0.336	0.302	0.221	0.315	0.331	0.249	0.302	0.301	0.211	0.338	0.361
Difference in Hansen J	0.696	0.941	0.956	0.697	0.937	0.933	0.711	0.944	0.985	0.625	0.948	0.878
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics.
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 5.7 Impact of firm specific and macroeconomic variables on cash holdings of Chinese (CSI 300) Non-FC firms

	Dependent variable: Cash holding											
	Overall crisis			During crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.797***	0.797***	0.778***	0.771***	0.734***	0.808***	0.772***	0.737***	0.765***	0.761***	0.809***	0.780***
	(0.080)	(0.104)	(0.072)	(0.064)	(0.118)	(0.045)	(0.049)	(0.117)	(0.056)	(0.064)	(0.105)	(0.055)
WC_t	0.056***	0.064***		-0.024	0.059***		0.058*	0.060***		-0.009	0.064***	
	(0.020)	(0.017)		(0.049)	(0.018)		(0.032)	(0.018)		(0.049)	(0.017)	
CCC_t	-0.000*	-0.000**		0.000	-0.000		0.000	-0.000*		0.000	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	-0.004		-0.008	-0.006		-0.003	-0.005		-0.015**	-0.001		-0.003
	(0.005)		(0.006)	(0.006)		(0.006)	(0.007)		(0.007)	(0.007)		(0.006)
INT_t	0.004		0.001	0.020		0.020	0.008		0.000	0.024*		0.023**
	(0.011)		(0.012)	(0.013)		(0.012)	(0.015)		(0.012)	(0.014)		(0.011)
$INFL_t$	-0.001		-0.002	0.001		-0.001	-0.002		-0.001	0.001		0.002
	(0.002)		(0.003)	(0.002)		(0.003)	(0.002)		(0.002)	(0.002)		(0.002)
FXR_t	0.027		-0.007	0.065*		0.021	0.017		0.012	0.062		0.052
	(0.028)		(0.041)	(0.038)		(0.044)	(0.032)		(0.029)	(0.038)		(0.032)
GDP_t	-0.000		-0.001	0.004		-0.002	0.002		-0.002	0.004		-0.002
	(0.002)		(0.003)	(0.007)		(0.002)	(0.007)		(0.002)	(0.007)		(0.002)
MS_t	-0.001		-0.001	0.001		-0.001	0.001		-0.002*	0.002		-0.003*
	(0.001)		(0.001)	(0.004)		(0.001)	(0.003)		(0.001)	(0.004)		(0.001)
MTB_t	0.001	0.001		0.000	0.001		0.003*	0.000		0.001	0.001	
	(0.001)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)	
$SIZE_t$	0.004	0.017		-0.007	0.004		-0.003	0.017		-0.004	0.009	
	(0.009)	(0.013)		(0.008)	(0.014)		(0.008)	(0.013)		(0.009)	(0.016)	
LEV_t	0.000	0.000		-0.001	0.000		0.001	0.000		-0.001	0.000	
	(0.000)	(0.000)		(0.001)	(0.000)		(0.001)	(0.000)		(0.001)	(0.000)	
$CAPEX_t$	0.101**	0.060		0.229*	0.062		0.065	0.059		0.223*	0.064	
	(0.043)	(0.043)		(0.125)	(0.042)		(0.089)	(0.043)		(0.127)	(0.043)	
CFO_t	-0.007	0.000		0.069	0.017		0.084	0.018		0.064	-0.005	
	(0.032)	(0.029)		(0.097)	(0.031)		(0.090)	(0.033)		(0.099)	(0.028)	
$RULE_t$	-0.008		0.008	-0.029		0.014	0.006		-0.000	-0.003		0.039*
	(0.026)		(0.028)	(0.039)		(0.028)	(0.040)		(0.036)	(0.034)		(0.023)

REG_t	0.114*		0.021	0.166**		0.009	0.121		0.059	0.168**		0.129*
	(0.066)		(0.118)	(0.077)		(0.121)	(0.074)		(0.071)	(0.077)		(0.072)
$PROF_t$	-0.000**	-0.000		-0.000	-0.000**		-0.000*	-0.000		-0.000	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	0.000	0.000		0.000	0.000		-0.000	0.000		0.000	0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Unconstrained$	-0.026	-0.084	0.004	0.030	-0.028	-0.006	0.025	-0.088	0.005	0.030	-0.043	0.015
	(0.038)	(0.056)	(0.021)	(0.026)	(0.058)	(0.012)	(0.027)	(0.056)	(0.013)	(0.028)	(0.069)	(0.013)
$Constant$	0.062	-0.107	0.129	-0.047	0.011	0.076	-0.018	-0.087	0.252**	-0.113	-0.042	0.148
	(0.127)	(0.121)	(0.113)	(0.240)	(0.129)	(0.099)	(0.225)	(0.123)	(0.101)	(0.247)	(0.137)	(0.105)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,648	1,852	1,446	1,648	1,852	1,446	1,648	1,852	1,648	1,648	1,852	1,648
Number of firms	202	204	200	202	204	200	202	204	202	202	204	202
Number of instruments	48	34	38	133	34	65	173	34	0.186	133	34	75
AR4 p-value	0.131	0.161	0.165	0.126	0.221	0.132	0.127	0.180	0.186	0.127	0.182	0.180
Hansen-J	0.129	0.093	0.193	0.835	0.127	0.235	0.384	0.088	0.207	0.839	0.097	0.300
Difference in Hansen J	0.184	0.565	0.407	0.969	0.783	0.584	0.852	0.603	0.022	0.958	0.677	0.275
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

Table 5.8 Impact of firm specific and macroeconomic variables on cash holdings of Indian (NSI 500) Non-FC firms

	Dependent variable: Cash holding											
	Overall period			During crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.896***	0.597***	0.883***	0.761***	0.716***	0.973***	0.508**	0.762***	0.982***	0.943***	0.806***	0.980***
	(0.096)	(0.122)	(0.083)	(0.177)	(0.211)	(0.111)	(0.258)	(0.230)	(0.104)	(0.108)	(0.179)	(0.084)
WC_t	0.042**	0.032**		0.043*	0.034		0.006	0.046**		0.051***	0.039*	
	(0.017)	(0.015)		(0.023)	(0.024)		(0.028)	(0.022)		(0.019)	(0.021)	
CCC_t	-0.000*	-0.000***		-0.000	-0.000*		-0.000	-0.000**		-0.000**	-0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	-0.047**		-0.023*	-0.005		-0.036**	0.020*		-0.037**	-0.012		-0.046***
	(0.021)		(0.014)	(0.011)		(0.017)	(0.010)		(0.017)	(0.012)		(0.016)
INT_t	0.004		0.004**	0.005***		0.007**	0.002		0.008**	0.005***		0.006**
	(0.003)		(0.002)	(0.002)		(0.003)	(0.002)		(0.003)	(0.002)		(0.002)
$INFL_t$	0.004*		0.003*	-0.000		0.002	-0.001		0.003*	0.001		0.003**
	(0.002)		(0.001)	(0.001)		(0.002)	(0.001)		(0.002)	(0.001)		(0.001)
FXR_t	0.001		0.001	0.000		0.001	-0.001		0.001	0.001		0.002*
	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)
GDP_t	0.000		-0.003	-0.001		0.000	-0.000		-0.001	0.000		0.001
	(0.002)		(0.008)	(0.002)		(0.012)	(0.002)		(0.012)	(0.002)		(0.006)
MS_t	-0.002*		-0.003	-0.002		-0.001	-0.002*		-0.001	-0.002		0.002
	(0.001)		(0.005)	(0.001)		(0.010)	(0.001)		(0.010)	(0.001)		(0.004)
MTB_t	0.000	0.002***		0.002***	0.001**		0.002***	0.001		0.001**	0.001*	
	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)	
$SIZE_t$	0.000	-0.004		0.000	-0.003		-0.007	-0.000		0.009	-0.002	
	(0.013)	(0.007)		(0.012)	(0.013)		(0.005)	(0.014)		(0.009)	(0.014)	
LEV_t	-0.000	-0.000		-0.000	-0.000		-0.000	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$CAPEX_t$	0.030	0.078**		0.045	0.080**		0.112***	0.062*		0.022	0.070**	
	(0.031)	(0.031)		(0.029)	(0.033)		(0.035)	(0.033)		(0.033)	(0.033)	
CFO_t	-0.053*	0.019		-0.041	-0.034		0.026	-0.033		-0.063**	-0.045	
	(0.030)	(0.029)		(0.030)	(0.034)		(0.041)	(0.039)		(0.029)	(0.036)	
$RULE_t$	-0.018		0.096**	0.035		0.081	0.175***		0.161**	0.002		0.000
	(0.059)		(0.046)	(0.038)		(0.051)	(0.037)		(0.074)	(0.049)		(0.072)

REG_t	-0.101**		-0.075**	-0.030		-0.098**	0.028		-0.071	-0.046		-0.133***
	(0.050)		(0.036)	(0.032)		(0.044)	(0.029)		(0.046)	(0.035)		(0.046)
$PROF_t$	0.000***	0.000***		0.000**	0.000		0.000	0.000**		0.000***	0.000*	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	0.000	0.000		0.000	-0.000		0.000	0.000		0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$Unconstrained$	-0.002	0.018	0.009	0.002	0.012	0.000	0.034*	0.002	0.000	-0.033	0.009	-0.003
	(0.057)	(0.027)	(0.007)	(0.050)	(0.056)	(0.010)	(0.019)	(0.056)	(0.011)	(0.035)	(0.059)	(0.008)
$Constant$	0.185	0.074	0.216	0.061	0.054	0.063	0.098	0.030	0.117	-0.031	0.053	0.023
	(0.124)	(0.062)	(0.355)	(0.104)	(0.128)	(0.667)	(0.098)	(0.127)	(0.685)	(0.103)	(0.134)	(0.280)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,404	1,174	1,405	1,404	1,174	958	1,404	1,174	958	1,404	1,174	958
Number of firms	230	217	230	230	217	190	230	217	190	230	217	190
Number of instruments	31	44	91	38	26	41	47	26	41	45	26	53
AR2 p-value	0.847	0.567	0.734	0.803	0.435	0.389	0.966	0.487	0.408	0.658	0.423	0.363
Hansen-J	0.689	0.433	0.453	0.725	0.622	0.683	0.150	0.431	0.614	0.297	0.644	0.868
Difference in Hansen J	0.674	0.117	0.661	0.939	0.328	0.237	0.025	0.139	0.368	0.982	0.483	0.481
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

5.5 Robustness analysis

To test the robustness of our results, we use the alternate measure. Hence, analysis is extended to another performance measure; that is, cash holdings (cash/sales) for the robustness check following (Dittmar et al., 2003). In Table 5.9, we use (cash/sales) as measure for cash behaviour. It produces similar results to cash holdings (cash/assets). We assess all markets together to check whether the results are consistent. Table 5.9 indicates that the relationship between firm-specific variables and cash holdings (cash/sales) is positive and significant at the 1%, 5% and 10% levels in all different time periods (the overall sample period, pre, post and during crisis periods), except for the CCC which shows an insignificant relationship with cash holdings (cash/sales). Our SGMM estimates are consistent with (Dittmar et al., 2003). They report a significant and positive relationship between working capital and cash holdings (cash/sales).

We also extend our analysis to macroeconomic variables (EPU, the interest rate, the inflation rate and the foreign exchange rate) to check for robustness. Table 5.9 shows the effect of all macroeconomic variables on cash holdings (cash/sales). Except for the foreign exchange rate, EPU, the interest rate and the inflation rate all have a significant and negative relationship with cash holdings at the 1%, 5% and 10% levels in different time periods (the overall sample period, pre, post and during crisis periods) (see Table 5.9). Only the foreign exchange rate shows a significant and positive relationship with cash holdings (cash/sales) at the 1%, 5% and 10% levels. The significant results of independent variables on cash holdings (cash/sales) indicate the accuracy and robustness of our results.

Table 5.9 Impact of firm-specific and macroeconomic variables on cash holdings of all markets (robustness analysis)

Dependent variable: Cash holding (cash/sales)												
	Overall period			During crisis			Pre-crisis			Post-crisis		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
CH_{t-1}	0.685***	0.806***	0.693***	0.701***	0.794***	0.708***	0.686***	0.691***	0.705***	0.641***	0.768***	0.708***
	(0.104)	(0.125)	(0.183)	(0.107)	(0.129)	(0.208)	(0.105)	(0.150)	(0.094)	-0.081	(0.133)	(0.098)
WC_t	0.216*	0.321**		0.206*	0.316**		0.215*	0.405***		0.229**	0.331**	
	(0.114)	(0.132)		(0.117)	(0.132)		(0.122)	(0.141)		(0.107)	(0.138)	
CCC_t	-0.000	-0.000		-0.000	-0.000		-0.000	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
EPU_t	0.004		-0.027*	0.006		-0.027*	0.002		-0.023*	0.004		-0.027***
	(0.009)		(0.014)	(0.009)		(0.014)	(0.009)		(0.013)	(0.011)		(0.010)
INT_t	-0.004*		-0.011*	-0.002		-0.010*	-0.003		-0.009**	-0.005*		-0.009**
	(0.002)		(0.006)	(0.003)		(0.006)	(0.003)		(0.004)	(0.003)		(0.004)
$INFL_t$	-0.006***		-0.007***	-0.006***		-0.007***	-0.006***		-0.008***	-0.006***		-0.008***
	(0.001)		(0.003)	(0.001)		(0.003)	(0.001)		(0.001)	(0.001)		(0.001)
FXR_t	0.000**		0.000**	0.000**		0.001	0.000**		0.000	0.000**		0.000
	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)
GDP_t	-0.004*		0.000	-0.004*		0.000	-0.004*		-0.000	-0.003		0.000
	(0.002)		(0.003)	(0.002)		(0.003)	(0.002)		(0.003)	(0.002)		(0.003)
MS_t	-0.004*		0.001	-0.005**		0.001	-0.005*		-0.000	-0.003		0.000
	(0.002)		(0.002)	(0.002)		(0.003)	(0.003)		(0.002)	(0.002)		(0.002)
MTB_t	0.006*	0.009***		0.005	0.008***		0.005	0.011***		0.004	0.009**	
	(0.003)	(0.003)		(0.003)	(0.003)		(0.004)	(0.004)		(0.004)	(0.003)	
$SIZE_t$	-0.006*	-0.002		-0.005	-0.001		-0.007*	-0.007		-0.006**	-0.003	
	(0.004)	(0.004)		(0.003)	(0.005)		(0.004)	(0.006)		(0.003)	(0.005)	
LEV_t	0.000	0.002		0.001	0.002		0.001	0.002		-0.000	0.002	
	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)	
$CAPEX_t$	-0.620**	-0.084		-0.394	-0.020		-0.562**	-0.050		-0.541**	-0.087	
	(0.242)	(0.323)		(0.317)	(0.346)		(0.262)	(0.366)		(0.249)	(0.345)	
CFO_t	-0.113	-0.130		-0.072	-0.127		-0.083	-0.132		-0.122	-0.124	
	(0.082)	(0.177)		(0.092)	(0.171)		(0.101)	(0.180)		(0.090)	(0.171)	
$RULE_t$	0.004		-0.018	0.011		-0.016	0.004		0.064*	-0.001		0.056
	(0.024)		(0.050)	(0.025)		(0.051)	(0.024)		(0.036)	(0.020)		(0.034)

REG_t	-0.022		-0.068	-0.024		-0.070	-0.018		-0.145***	-0.024		-0.141***
	(0.018)		(0.062)	(0.017)		(0.062)	(0.019)		(0.034)	(0.015)		(0.032)
$PROF_t$	-0.000	0.000		-0.000	0.000		-0.000	-0.000		-0.000	-0.000	
	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
$GROWTH_t$	-0.000	-0.001		-0.000	-0.000		-0.000	-0.000		-0.000	-0.001	
	(0.000)	(0.000)		(0.000)	(0.001)		(0.000)	(0.000)		(0.000)	(0.001)	
$Constant$	0.323**	-0.006	0.247**	0.322**	-0.006	0.235*	0.360**	0.062	0.269***	0.318**	0.013	0.260**
	(0.141)	(0.080)	(0.116)	(0.136)	(0.080)	(0.131)	(0.151)	(0.093)	(0.104)	(0.153)	(0.083)	(0.113)
Industry and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,098	9,054	8,099	8,098	9,054	8,099	8,098	9,054	8,099	8,098	9,054	8,099
Number of firms	937	956	937	937	956	937	937	956	937	937	956	937
Numbers of instruments	133	121	27	133	121	27	133	121	62	181	121	62
AR2 p-value	0.779	0.708	0.699	0.734	0.709	0.679	0.766	0.87	0.651	0.863	0.738	0.657
Hansen-J	0.285	0.793	0.759	0.808	0.880	0.339	0.268	0.864	0.564	0.123	0.904	0.556
Difference in Hansen J	0.748	0.802	0.351	0.006	0.649	0.519	0.648	0.896	0.179	0.222	0.596	0.154
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: This table reports the system-GMM results for all firms in the sample for the overall period from 2003-2015 and the three subsamples periods: pre-GFC (2003-2006), during-GFC (2007-2009) and post-GFC (2010-2015). The definition and measurement of the key variables are defined in Table 3.2. We use dummy variables interaction terms to classify the sample into pre-GFC, during-GFC and post-GFC period. $PRE{-}CRISIS$ is a dummy variable for the 'pre-GFC period' which takes the value of 1 for all observations between 2003-2006 and 0 otherwise. $CRISIS$ is a dummy variable for 'during-GFC period' which takes the value of 1 for all observations between 2007-2009 and 0 otherwise. $POST{-}CRISIS$ is a dummy variable for 'post-GFC period' which takes the value of 1 for all observations between 2010-2015 and 0 otherwise. The table also reports the diagnostic tests results such as autoregression of second-order, Hansen-J test for over-identification of instruments, Difference-in Hansen-J test. In column (1) cash holding regressed on both the firm-specific and macroeconomic variables while in columns (2) and (3) cash holding individually regressed on firm-specific and macroeconomic variables, respectively, for overall, pre-GFC, during-GFC and post-GFC periods. Heteroskedastic-consistent standard errors are used to predict t-statistics. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10

5.6 Chapter summary

In this chapter, we have reported the effect of firm- specific and macroeconomic variables on the cash holdings of two types of firms based on firm size or total assets; that is, (i) FC and (ii) Non-FC firms. The main motive for holding cash is that it permits firms to invest in positive NPV projects (Almeida et al., 2004). For this purpose, firms used to save cash from their cash flows (*the cash flow sensitivity of cash*). Almeida et al. find that cash flow of FC firms is related to cash holdings whereas there is no relationship between cash holding and cash flows in Non-FC firms. We divided our dataset in two classes (i) FC and (ii) Non-FC firms to differentiate the effect of cash holdings on FC and Non-FC firms. Almeida et al. (2004) use a firm's total assets as a measure of size to divide the firms into these two groups. They take 30 percentiles top(bottom) of firm size (total assets) to differentiate Non-FC and (FC) firms. This study follows a similar estimation method to differentiate FC firms from Non-FC ones.

First, we estimated the cash holdings of FC firms in both the developed and developing market. The results show that working capital is positive and significantly related to cash holdings at 1% and 5% in all developed and developing markets respectively. While the CCC is significant and negatively related to cash holdings at both the 10% and 5% level in all developed and developing markets. However, the results of the macroeconomic variables are heterogeneous and depend on the country's economic structure (developed or developing). Except for FC firms in the US, US FC firms, EPU is positive and significantly related to cash holdings at the 5% level in Japan and significant and negatively related to the cash holdings at the 10% level in all developing (China and India) markets. However, the interest rate is significant and negatively related to cash holdings at the 1% level in all developed (US and Japan) markets and significantly positive in the developing (India) markets at the 10% level, except for China. Except for Japan and China, the inflation rate is significant and negatively related to cash holdings at the 1% level in the US and significantly positively related to cash holdings at the 10% level in India. Furthermore, except for the US, the foreign exchange rate has no relationship with cash holdings. Our key findings indicate that variables' coefficients of FC firms in most markets are higher than overall firms. This implies that FC firms are more cash sensitive.

Further, we have examined the cash holdings of Non-FC firms in all markets. The variables' coefficients of Non-FC firms are lower than FC firms. This result shows that these firms have enough cash inflows, so these firms are less cash sensitive.

Chapter 6

Conclusion and policy implications

6.1 Introduction

The main objective of this study was to identify and compare the determinants of cash holding in the context of developed (the US and Japan) and developing (China and India) economies. To accomplish this, the study had three objectives. Objective one involved investigating the impact of working capital and the CCC on cash holdings. Objective two involved investigating the impact of the interest rate, the inflation rate, the foreign exchange rate and economic policy uncertainty (EPU) on cash holdings. Finally, objective three examining the impact of firm-specific (working capital and the CCC) and macroeconomic factors (the interest rate, the inflation rate, the foreign exchange rate, and EPU) on cash holdings. In addition, this study also tested firm- and country-specific determinants on two specific conditions: (i) FC/Non-FC and (ii) exogenous shocks (in this case, the 2008 global financial crisis).

Cash holdings have been among the most investigated strands of accounting and corporate finance over the last couple of decades. The importance of cash holdings has increased especially during and after the 2008 GFC. Cash reserves are particularly important during periods of crisis because when firms are financially stressed, they look for other means of funding for survival, such as selling off their fixed assets and borrowing money at higher interest rates to meet their liquidity demands. After the 2008 GFC, firms recognized that relying solely on external (debt and equity) sources of financing, meant that during times of crisis they may not be able to meet their liquidity demands. Following Myers (1984), pecking order theory firms prefer to use three sources of financing, in the following order; (i) internal funds, (ii) debt over equity financing because of lower information costs and (iii) equity financing.

Firms obtain external sources of financing to meet additional demands for cash. However, firms often face difficulties obtaining external sources of financing because of higher financing costs, the restrictive conditions of the financial markets and the financial health of firms (FC and unconstrained) (Denis & Sibilkov, 2009; Opler et al., 1999). This study investigates the effect of firm-specific (working capital and the CCC) and macroeconomic factors (the interest rate, the inflation rate, the foreign exchange rate, and EPU) on the cash holdings of firms in different economies: that is, developed and developing.

The remainder of this chapter is structured as follow: Section 6.1 discusses the key research findings. Section 6.2 presents the policy implications of the research results. While section 6.3 discusses the study's contribution, and section 6.4 presents the study's limitations and recommendations for future research.

6.2 Summary of the major findings

6.2.1 Preliminary Findings

The descriptive statistics show that mean cash holdings vary across different economies. Mean cash holdings are higher for developing markets (0.121) followed by developed markets (0.095). It is worth mentioning here that the mean value for developing markets is particularly high because of the extraordinary mean value of China (0.187). This preliminary analysis shows that economically developed markets hold less cash. The mean cash holdings in this study is consistent with those reported by (Chen et al., 2015).

The result also shows that the mean working capital is higher for developing markets (0.0435) followed by developed markets (0.0165). This means that developing markets hold more liquid assets than developed markets. The mean CCC for developed and developing markets is almost the same (72.50) and (72.00), respectively, which indicates that time of cash outflow (purchase of raw material) and cash inflow (sales) is similar. Developing markets exhibit a higher EPU mean (4.739) followed by developed markets (4.650). In addition, the mean value of cash holdings, CCC and EPU in developing markets are high because of the extraordinarily high value of descriptive statistics of Chinese firms.

The mean interest rate is higher for developing markets (5.286) followed by developed markets (1.177). The value of other macroeconomic variables such as the inflation rate and the exchange rate are higher for developing markets. The mean inflation rate is (5.271) for developing markets followed by developed markets (1.137). Further, developing markets exhibit a higher mean foreign exchange rate (1.239) followed by developed markets (0.042).

6.2.2 Empirical Findings

This section discusses the effect of firm-specific and macroeconomic variables on cash holdings. Before examining this relationship based on panel data, this study applied basic diagnostic tests to eliminate the spurious regression problem. We applied the panel data unit root test to check for stationarity in the dataset: the Fisher-Type *p* test. The results showed that there was no unit root problem in the dataset, which means that the mean and variance

do not depend on time, hence the application of classical linear regression model (CLRM) can produce meaningful results (Gujarati, 2004). Next, we applied Pearson correlation to test for correlation among the variables. The results in Chapter 4 show that there is a significant correlation among the variables, which prompts further empirical investigation. If the correlation among the variables is more than 0.80, then multicollinearity exists (Gujarati, 2004). The test results indicated that no correlations exceeded 0.80, which means there was no multicollinearity in the dataset.

Next, we applied advanced diagnostic tests: the Breusch-Pagan Test to check for heteroscedasticity and the Wooldridge (2010) test for autocorrelation. The unreported results provided evidence for the presence of both heteroscedasticity and autocorrelation. Both problems were resolved using OLS and fixed-effects estimators but at this point, we investigated another potential econometric problem: the presence of endogeneity due to simultaneity and unobserved heterogeneity.

Following Wintoki et al. (2012), we applied both dynamic OLS and Wooldridge (2010) strict exogeneity tests. The dynamic OLS results provide clear evidence that a firm's past cash holdings act as a regressor. This can be observed from the increase in adjusted R-squared from the static OLS to dynamic OLS and from the coefficients on the lagged dependent variable, which are significantly different from zero in all four study markets. The Wooldridge test results provided sufficient evidence that the null hypotheses could be rejected (at 10% or less) in all markets. This finding implies that the future value of the independent variables was correlated with current or past value of the dependent variable (cash holdings), which signals the presence of endogeneity. To cover the OLS and FE estimation problems, we applied the two-step system generalized method of moments (SGMM) to investigate the dynamic relationship between the independent variables and cash holdings in the presence of heteroscedasticity, autocorrelation and endogeneity.

Table 6.1 Summary of the results from SGMM estimation

Variables	Full sample				Financially constrained firms				Financially unconstrained firms			
	Full period	During-GFC	Pre-GFC	Post-GFC	Full period	During-GFC	Pre-GFC	Post-GFC	Full period	During-GFC	Pre-GFC	Post-GFC
Summary of the US results												
WC	(+)*	(+)**	(+)**	(+)**	(+)**	(+)***	(+)**	(+)**	(+)**	(+)**	(+)**	(+)**
CCC	NR	(-)***	(-)**	(-)**	(-)*	(-)*	(-)*	(-)**	(-)*	(-)*	(-)*	(-)**
EPU	NR	(-)*	NR	(-)**	NR	(+)*	NR	(+)**	NR	NR	NR	(+)**
INT	(-)***	NR	NR	(-)*	(-)***	NR	NR	NR	(-)***	NR	NR	NR
INF	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***	(-)***
FXR	(+)***	(+)***	(+)***	(+)***	(+)***	(+)**	(+)***	NR	(+)***	(+)**	(+)**	NR
Summary of Japan results												
WC	(+)**	(+)**	(+)**	(+)**	(+)**	(+)**	(+)**	(+)*	(+)**	(+)**	(+)**	(+)**
CCC	(-)**	(-)*	(-)*	(-)*	(-)**	(-)*	(-)*	(-)*	(-)*	(-)*	(-)*	(-)*
EPU	(+)***	(+)**	(+)***	(+)***	(+)***	(+)**	(+)**	(+)***	(+)***	(+)*	(+)*	(+)***
INT	(-)***	(-)***	(-)***	(-)**	(-)***	(-)***	(-)***	(-)**	(-)***	(-)***	(-)***	(-)**
INF	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
FXR	(-)*	NR	(-)***	NR	(-)**	NR	(-)**	NR	(-)**	NR	(-)**	NR
Summary of China results												
WC	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***
CCC	(-)**	(-)*	(-)**	(-)**	(-)***	(-)***	(-)***	(-)***	(-)*	NR	(-)*	(-)*
EPU	NR	NR	(-)*	NR	(-)*	(-)**	(-)**	NR	NR	NR	(-)**	NR
INT	(+)*	(+)*	(+)*	(+)**	NR	NR	NR	(+)**	NR	NR	NR	(+)**
INF	NR	NR	NR	NR	NR	NR	(-)*	NR	NR	NR	NR	NR
FXR	(+)**	(+)**	(+)**	(+)**	NR	NR	NR	(+)*	NR	(+)*	NR	NR
Summary of India results												
WC	(+)**	(+)*	(+)*	(+)**	(+)**	NR	(+)*	(+)**	(+)**	(+)*	(+)**	(+)***
CCC	(-)**	(-)**	(-)***	(-)**	(-)***	NR	(-)**	(-)**	(-)*	(-)*	(-)**	(-)**
EPU	(-)*	(-)***	(-)**	(-)*	(-)**	(-)**	(-)**	(-)***	(-)**	(-)**	(-)**	(-)***
INT	(+)*	(+)**	(+)***	(+)**	(+)*	(+)***	(+)***	(+)***	(+)**	(+)***	(+)**	(+)***
INF	(+)*	NR	(+)**	NR	(+)*	(+)**	(+)*	(+)**	(+)*	NR	(+)*	(+)**
FXR	(+)*	NR	NR	(+)*	NR	NR	NR	(+)*	NR	NR	NR	(+)*

Note: (+) and (-) represent positive and negative relationships; *, ** and *** indicate significance at 0.01, 0.05 and 0.10, respectively. NR shows no relationship.
Source: Author's calculations

6.2.2.1 Firm-specific & macroeconomic factors and cash holdings

We applied the two-step system GMM estimator to estimate the dynamic relationship between firm-specific and macroeconomic variables with cash holdings. The results showed that working capital is positive and significantly related to cash holdings at 10% and 1% levels in developed and developing markets, respectively. Our study found that the CCC is significant and negatively related to cash holdings in all developed and developing markets at the 5% level, except for US firms. However, the macroeconomic variable results were heterogeneous as can be expected with differences in each country's economic structures (developed or developing). The EPU was positive and significantly related to cash holdings at the 5% level in developed markets and negative and significantly related to cash holdings at the 10% level in developing markets, except for Chinese firms. Similarly, interest and inflation rates were negative and significantly related to cash holdings at the 1% level in firms in developed markets and positive significantly related to cash holdings in all firms in developing markets. The foreign exchange rate was positive and significantly related to cash holdings at the 5% level in all firms, except for Japanese firms. Our findings endorse the precautionary-motive theory and transaction-motive theory of (Keynes, 1936). First, and possibly most important, a firm can hold cash as a safety net against the risk of future cash shortfalls (for instance, the GFC 2007-09); this theory is known as the precautionary motive for cash holdings. Second, a firm can save on transaction costs by using cash to make payments and therefore avoid having to liquidate assets. This also confirms Miller and Orr (1966) claim that brokerage cost triggers firms to hold more liquid assets and to avoid external financing because it is more costly than internal financing (Myers & Majluf, 1984). Al-Najjar (2013) states that firms can obtain cash from the capital market by issuing equity securities. However, in recession periods, it can be more difficult for firms to obtain desirable external financing due to tightening financial situations. Al-Najjar further argues that firms reduce their dependency on bank borrowing because of the higher associated financial costs. Ferreira (2004) finds that firms increase their cash reserves to avoid the probability of financial distress due to unexpected losses. Our findings are consistent with (Opler et al., 1999) and (Song & Lee, 2012) findings.

Opler et al. (1999) report that FC firms and firms with risker activities hold more cash. Firms that have easier access to the capital market (Non-FC firms) hold less cash. However, Song and Lee (2012) suggest that the 2008 global financial crisis transformed corporate cash holdings policies for all firms and firms' demand for liquid assets are better explained by macroeconomic variables.

Nonetheless, our diagnostic tests for the two-step system GMM verify the reliability of the results and that SGMM estimator is the most appropriate estimator to investigate the dynamic relationship between the independent variables (firm-specific and macroeconomic variables) and cash holdings. We also investigated the relationship between independent variables and cash holdings during the 2008 global financial crisis. The interaction terms between the dummy variable for the 2008 global financial crisis and independent variables showed a significant relationship between the independent variables and cash holdings during financial turmoil, implying that the relationship was more pronounced during the period of financial crisis.

6.2.2.2 Cash holdings of FC and Non-FC firms

Cash holdings are more valuable for FC firms than for Non-FC firms (Denis & Sibilkov, 2009). A higher cash level encourages corporate managers to finance positive NPV projects that might otherwise be bypassed. Almeida et al. (2004) find that FC firms systematically withhold cash from their cash flows, whereas for financial Non-FC firms' cash is not systematically related to cash flows.

In this section, we report the results of cash holdings of FC firms of developed and developing markets. Our results showed that working capital is positive and significantly related to cash holdings at 1% and 5% for all developed and developing markets, respectively. The CCC is significant and negatively related to cash holdings at the 10% and 5% level in all developed and developing markets. However, the results of the macroeconomic variables are heterogeneous according to each country's economic structure (developed or developing). Except for the FC firms in US, EPU is positive and significantly related to cash holdings at the 5% level and significant and negatively related to cash holdings at the 10% level for all developing (China and India) markets. However, the interest rate is significant and negatively related to cash holdings at the 1% level in all developed (the US and Japan) markets and significantly positive for one developing (India) market at the 10% level (this does not apply to the Chinese market). Except for the Japanese and Chinese markets, the inflation rate is significant and negatively related to cash holdings at the 1% level in the US market and significant positively related to cash holdings at the 10% level in the Indian market. Furthermore, except for the US market, the foreign exchange rate has no relationship with cash holdings. Our key findings indicate that the coefficients of FC firms in most markets are higher than overall firms. This implies that FC firms are more cash sensitive.

6.3 Policy implications of the research

Corporate cash holdings have had enormous popularity over the last two decades. This is because different theories such as precautionary-motive theory and transaction-motive theory, emphasize the importance of liquid assets for a firm's competitive advantage. The topic has received even further attention since the 2008 global financial crisis (GFC). After the GFC, firms recognized that relying solely on external (debt and equity) sources of financing decreased their probability of being able meet their liquidity demands in a crisis. As noted above, firms prefer to use three sources of financing in the following order; (i) internal funds, (ii) debt over equity financing because of lower information cost and then (iii) equity financing (Myers, 1984). After utilizing all internal funds and to meet the further demand of cash, firms must obtain external source of financing. However, in some instances, it is difficult for firms to obtain external financing because of two basic reasons: (i) higher financing costs and tightened financial market conditions of financial markets, (ii) a firm's financial health (FC and unconstrained) (Denis & Sibilkov, 2009; Opler et al., 1999). The current study's findings provide several policy implications relevant for corporate managers, policymakers and researchers/scholars.

Changes in cash holdings levels due to changes in firm-specific and macroeconomic variables endorse both precautionary-motive theory and transaction-motive theory. This finding implies that adjustable[37] cash holdings help firms to avoid insolvency. However, the factors that affect cash holding levels varies across regions: that is, developed and developing markets. Our findings show that while the effect of macroeconomic variables on cash holdings vary across different regions (developed and developing markets), the effect of firm-specific variables (working capital and the CCC) on cash holdings is consistent.

The study found a significant positive relationship between working capital and cash holdings, which endorses trade-off theory. This result indicates that an increase in working capital leads to an increase in non-financial firms' cash holding levels in developed and developing markets. Corporate managers constantly evaluate short-term assets and liabilities and continue to seek a trade-off between existing cash holdings and working capital. Changes in trade-off levels can lead to insolvency if managers invest all their cash in working capital to enhance their business operations. In such cases, corporate managers can face a shortage of cash to fulfill other firm

[37] Adjustable means changes in cash holding levels to meet liquidity demands according to internal and external factors to remain competitive in the market and to avoid insolvency. For more detail, see results and discussion sections in Chapters 4 & 5.

obligations. These findings are particularly important for management who can increase investment in working capital to build a sustainable trade-off model between working capital and cash holdings using the transaction-motive theory. Jamil (2016) notes that while firms need a desirable level of cash to maintain smooth operations, it is difficult for business managers to invest all of their cash in operations. Thus, firms hold cash and cash equivalents to meet financial obligations and to reinvest in their business operations. However, the evaluation of working capital depends upon time (the CCC) and the level of cash required for short-term debt payments (Lyngstadaas & Berg, 2016).

This study found a significant, negative relationship between the CCC and cash holdings. This result indicates that managers should follow the precautionary-motive and transaction-motive theory of cash holdings. In short, these theories suggest that an increase in the CCC leads to a decrease in firm cash holdings. These findings are consistent with many prior studies (Berg, 2016; Nobanee et al., 2011; Wang et al., 2014). However, earlier studies tend to be limited to a single country, have a smaller sample size and/or rely on static estimation methods. (Berg, 2016; Nobanee et al., 2011; Wang et al., 2014) suggest that the CCC depends on two factors; time and speed have a significant impact on cash holding levels. Firms with a longer cash conversion cycle hold more cash to run their operations (Bigelli & Sánchez-Vidal, 2012). The authors argue that smaller firms tend to hold more cash because of longer CCCs, an argument which negates the financial hierarchy theory. Financial hierarchy theory only explains larger firms with higher cash to asset ratios and easy access to financial markets (banks and equity market). A higher cash ratio and easy access to the financial markets lead firms to increase their financial performance. These findings are useful for corporate managers who should maintain a desirable CCC to ensure efficient business operations. These findings are particularly important for management who have the ability to adjust cash holding levels to build a sustainable competitive advantage and to avail positive NPV projects. The findings on macroeconomic variables might be useful for potential investors and corporate managers to determine changes in future firm cash flows before making investment decisions. Today, investors are concerned about firms' operating and financial performances. The effect of macroeconomic variables on cash holdings determines the fate of firms. Thus, these findings can be used by rating agencies to evaluate firms' financial performances. Song and Lee (2012) suggest that firm cash holdings are better explained by macroeconomic factors rather than firm-specific factors. This study also analyzed the effect of macroeconomic variables (the interest rate, the inflation rate, and the foreign exchange rate) and economic

policy uncertainty (EPU) on cash holdings of non-financial firms in both developed and developing markets. The cross-region findings will be useful for different stakeholders, such as corporate managers, financial institutions, shareholders and regulatory authorities. From the stakeholders' point of view, high corporate cash holdings permit firms to fulfill their implicit claims in the future. However, from a management perspective, high corporate cash holdings permit a firm to finance positive NPV projects even during periods of poor cash inflows. During times of crisis, it is difficult for corporate managers to acquire financing from external sources and thus the probability of underinvestment is higher. The probability of underinvestment and poor cash inflows lead to default of the future implicit claims that encompass negative effect on the firm's survival. Financial institutions and regulatory authorities play important roles in the development of financial policy and constitute a vital link between corporate strategy and firm cash holding levels. In the next section, we discuss the policy implication of cash holdings in relation to changes in macroeconomic factors.

This study found a significant, positive relationship between EPU and cash holdings in developed markets and significant, negative relationship in developing markets. This result implies that firms in developed markets hold onto their cash when the EPU increases because firms decrease their investment levels to avoid losses. As a result, their cash level increases in developed markets. These results are consistent with Demir and Ersan (2017) and Phan et al. (2019) who both note significant and positive relationship between EPU and cash holdings.

Our findings endorse Keynes precautionary-motive theory of cash holdings which argues that firms hold cash as a buffer to meet their liquidity demands. In contrast, in developing countries, firm cash levels decreases when EPU increases. The variation in results between developed and developing economies echoes (Choong et al., 2010). They suggest that the economic structures of developed and developing markets are diverse and context dependent. Our findings suggest that firms' cash structures are dynamic[38], meaning that firms use debt and equity financing together to meet their liquidity demands. This structure is more fragile (dynamic) in emerging economies (Kumar et al., 2017). Economic activities decrease in an entire economy when uncertainty increases. This explains the high investment of cash in working capital. An increase in the CCC leads to decreased cash levels in firms in emerging markets.

[38] Firms change their cash structure (their mix of debt and equity) according to overall market conditions.

This study found significant, negative relationship between the interest rate and cash holdings in developed markets and a significant, positive relationship in developing markets. This implies that firms' managers use lines of credit instead of non-operating cash for future NPV projects in developed economies when the interest rate is low and avoid credit lines when the interest rate is high. Hence the interest rate is significant and negatively affected to cash holdings in developed markets. In the case of developing markets, the financial structure of the firms in these markets is more sensitive to interest rate changes and interest rate volatility (Kumar et al., 2017). Furthermore, a firm's decision to invest depends on the interest rate and debt level (Bo & Sterken, 2002). The significant positive coefficients of interest rate in developing markets indicate that firms decrease their investment in operating activities and invest their cash in short-term investments to enjoy higher interest rates instead of investing in risky business operations (Stone, 2018). These findings are particularly important for management whereby they can maintain the competitive advantage of cash holdings and interest rate under the precautionary-motive theory. Although financial institutions are leading source for non-financial firms to meet the demand for liquid assets, but still executives are very concerned with managing their firms' liquidity as a buffer during a crisis to avoid high financing cost. Restrictive market conditions and poor cash inflows prevent corporate managers from obtaining external financing. Lins et al. (2010) describe that corporate managers use different liquidity instruments to hedge their risks and the hedging decisions are based on precautionary motive.

Furthermore, this study found significant and, negative relationship between the inflation rate and, cash holdings in developed markets, however a significant, positive relationship in developing markets. This result endorses precautionary-motive theory. These cross-region findings will be useful for corporate managers in different economic contexts (developed and developing markets). For example, corporate managers can realize the importance of maintaining the purchasing power and for this purpose, managers seek to counter the increasing inflation to run the business operations. The managerial strategy to counter the increasing inflation can be different because of the variation in results in different markets. This is similar to the argument by Wang et al. (2014) that firms are urge to adjust and optimize their cash holding policies in response to changes in purchasing power due to inflation.

This study also documented a significant and, positive relationship between the foreign exchange rate and cash holdings in the US, China and India and a significant negative

relationship in the Japanese market. These results indicate that firms in all types of markets accumulate cash when the foreign exchange rate increases, with the exception of Japan. Bodnar and Marston (2002) suggest that the effect of the foreign exchange rate depends on three variables, (i) the percentage of the firm's revenue in foreign currency, (ii) expenditure in foreign currency, and (iii) profit rate. They suggest that foreign exchange rate exposure is more significant in the case of lower profit firms. Our findings suggest that firms dynamically adjust their cash holdings in response to exchange rate changes. Corporate managers can create financial and operational hedging to protect their business activities against external shocks and risks. Non-financial firms can be directly or indirectly affected by changes in foreign exchange rates through changes to international oil prices and prices increases/decreases for imported raw materials.

Our study's findings may be useful for policymakers and corporate managers who need to formulate effective cash holding strategies. The strategy of cash holdings, according to the behaviour of macroeconomic variables, can assist corporate managers to avoid the economic and financial shocks such as the 2008 GFC. As previously noted, Song and Lee (2012) suggest that cash holdings of firms are better explained by macroeconomic variables.

6.4 Research contributions

This current study contributes to cash holdings literature in several ways. First, the use of a large-scale data set or four different countries (two developed and two developing), differentiates this current study from previous studies that rely on small datasets which mean that it is difficult to generalize the results. Most of the cash holdings studies use US firms, with only a few studies investigating different countries.

Second, our study includes a different time period in the regression results: we cover pre, post and during the 2008 GFC period. Previous literature on cash holdings suggest that firms changed their cash holdings policies after the 2008 GFC and not surprisingly, this topic gets attention from the researchers after the crisis. The study period covers from 2003 to 2015, however, to analyse the effect of independent variables on cash holdings, this study divides the time period into three categories: pre-GFC period (2003-2006), during-GFC (2007-2009) and post-GFC (2009-2015). We find divergent results in different time period and in different economies such as developed and developing.

Third, we divided each country's firms into two categories: FC and unconstrained. The motive behind this division is that Non-FC firms have higher cash inflows, more liquid assets and easier

access to the financial market. In contrast, FC firms have limited cash inflows and do not have easy access to the financial market to obtain external funding. We used total firm assets to divide the firms into these two categories and found significant differences between these two groups.[39]

Fourth, this current study found a significant positive relationship between working capital and cash holdings, which implies that working capital contributes significantly towards cash holdings in all markets and FC and Non-FC firms. Furthermore, the current study found a negative relationship between CCC and cash holdings which implies that an increase in the CCC leads to decreases in cash holdings for FC and Non-FC firms. However, in the case of macroeconomic variables, we found that these factors are context dependent. This can be seen in the heterogeneous results. Heterogeneous results suggest that macroeconomic variables have diverse impacts on cash holdings because every country has a different economic structure. As Ghironi and Melits (2005) note the economic structures of developed and developing economies are diverse and macroeconomic variables are heterogeneous and context dependent. Managers should consider the external environment because our results show that firm-specific factors are not the only reason to change cash holdings levels. Macroeconomic variables impact on business operations. Firms thus need to increase or decrease their cash level of cash to remain competitive. Managers must consider the impact of macroeconomic variables in their design and implement new cash holdings policies.

6.5 Limitations and directions for future research

6.5.1 Limitations

This study also has some limitations. First, econometrics problems, such as serial correlation and endogeneity can be resolved by SGMM, however this estimator (SGMM) has some limitations. Wintoki et al. (2012) document that SGMM generate internal instruments and these instruments can be weak, particularly when the number of lags increased. Hence, ones should careful while interpreting the results after applying dynamic panel GMM to determine cash holdings. Furthermore, this methodology believes that all the variables have been included in the model that possibly influenced the cash holdings. Hence, unexpected change in cash holdings are expected future errors (Nadeem et al., 2018). This assumption is very restricted while using other proxies and omitted variables in empirical research (Wintoki et

[39] See Chapters 4 and 5 for results and discussion.

al., 2012). Second, this current study relies on data from publicly listed firms; in short, it excludes non-listed firms because of the unavailability of data. Findings drawn from listed firms can be difficult to generalize to non-listed firms that might have different characteristics such as different cash holding patterns. Moreover, while our study covers four markets across the globe, it is difficult to generalize our findings due country-specific factors such as macroeconomic variables.

6.5.2 Direction for Future Research

This study has identified areas where future research could be conducted. Firstly, future research could examine non-listed firms to see if there are differences in cash holding strategies between listed and non-listed firms. Further, a cross-industry analysis (financial and non-financial) of cash holdings may reveal significant outcomes such as industry-specific factors and macroeconomic factors which affect cash holdings. For example, industries such as non-financial firms (pharmaceutical, automobile, and high-tech) rely more on R&D. These firms need more cash to operate while the financial sector, such as banks can manage cash-shortfall through the central bank or interbank borrowing. These industry-specific factors will provide further insight into cash holding dynamics.

Furthermore, future research could focus on the moderating and/or mediating role of corporate governance and managerial efficiency on the relationship between firm-specific, macroeconomic factors, and cash holdings. In particular, future research could examine how improving managerial-efficiency can affect cash holdings. Future research could also investigate the role of state regulations in determining cash holding levels, and how this varies according to the industrial sector.

Finally, this study provides a new direction for future research by applying the dynamic panel GMM technique to measure the dynamic nature of the relationship between firm-specific, macroeconomic factors and cash holdings. Limitations associated with GMM discussed in the previous section provide an opportunity for future research. Scholars could use other instrumental variable regressions, such as 2SLS, provided strictly exogenous external instruments are available.

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