Managerial Overconfidence and Corporate Cash Holdings: Evidence from Primary and Secondary Data

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ABSTRACT

The corporate finance literature argues that overconfident managers tend to hold less cash, and this leads to a significant deviation from optimal cash levels. We analyse the impact of executive overconfidence on the corporate cash holdings of listed Vietnamese firms. To quantify managerial overconfidence, a novel core measure used in our analyses is voice pitch, which is obtained from interviews with top-line managers. Other measures of managerial overconfidence are also used to support the results and confirm the validity of the voice pitch measure. Our empirical evidence, with economically significant results, reveals that higher levels of overconfidence amongst managers are associated with lower cash holdings. Surprisingly, the findings show that overconfident managers tend to be associated with a low level of deviation from optimal cash holding levels. In addition, our findings also provide evidence that managerial overconfidence can increase cash levels and deviations from target cash holdings for overinvesting firms.

Keywords*: Managerial overconfidence, optimism, cash holdings, overinvestment, Vietnam, voice pitch, psychometric tests.

*JEL Classification: G30, G32**, G41*

1. INTRODUCTION

Managerial overconfidence can potentially cause undesirable corporate outcomes due to subjective and aggressive decision-making process. According to Ackert and Deaves (2009), overconfident people might misjudge their abilities and knowledge and overestimate the precision of their predictions. Similarly, Heaton (2002) shows managerial overconfidence may increase firm risk, reduce the net worth of projects, increase the cost of external financing and investment sensitivity to free cash flows. Moreover, overconfident managers tend to prefer internal financing to external alternatives, which implies holding less cash and exposing their firms to excessive liquidity risks (Huang-Meier et al., 2016). Therefore, there is a suggestion that managerial overconfidence can have a significant negative impact on the cash holdings of firms. By using various measures of managerial overconfidence, this study provides reliable empirical results about the relationship between managerial overconfidence and cash holdings. The overconfidence measures include a unique approach of using voice pitch analysis as well as some other popular measures from previous studies such as psychometric tests, bias in earnings forecasts, the visibility of CEOs' photos in annual reports, and managers' gender. We also employ a comprehensive measure based on the combination of all the proxies used.

According to Keynes (1936), there are three main reasons for holding cash related to transaction costs, and speculative and precautionary motives. When firms are facing payments or need to raise funds, cash reserves might help to decrease the transaction costs from liquidating assets or obtaining external funds. Moreover, holding cash also helps to avoid risks from unexpected contingencies. These motivations were also mentioned by Miller and Orr (1966) and Myers and Majluf (1984). Miller and Orr (1966) indicated that the cash holdings help firms reduce brokerage costs. Myers and Majluf (1984) assert that due to the problem of asymmetric information firms should hold more cash because the cost of raising external funds is higher than that of using available cash in the firm. In reality, the decision concerning cash holdings is influenced by the level of market imperfections, whereby there exist asymmetric information problems, agency conflicts and financial constraints. Asymmetric information and agency conflicts increase the cost and difficulties of raising funds. Therefore, holding cash helps firms to become more independent and mitigate the cost of external financing and the risk of financial distress (Jensen, 1986). Regarding the precautionary motive (documented e.g., by Marwick et al., 2020), the volatility of free cash flows or financial constraints can be a reason to hold cash because it helps to reduce firm risks (Opler et al., 1999, Mikkelson and Partch, 2003). However, holding cash has both positive and negative effects: high cash reserves create more growth

opportunities but lower profitability and cause higher volatility in free cash flows (Kim et al., 1998, Opler et al., 1999).

Our study investigates cash holding decisions to determine the impact of managerial overconfidence on the amount of cash holdings and the deviation between the actual and optimal cash holding levels. The findings of this research are derived from an empirical study of Vietnamese listed companies. While cash holdings studies are neither new nor unique, many important factors have not yet been examined in sufficient detail. One important factor to have been recently studied is the influence of managerial attributes on corporate decisions. Most of the findings from previous studies have concluded that managerial traits have significant effects on corporate decisions, noting the conflicting expectations discussed in the extant literature. Similarly, Deshmuk et al. (2021) discuss the inconsistent findings and conjectures in the literature and imply the need for further research that relates CEOs' beliefs to these inconsistencies. Malmendier and Tate (2005a) propose a positive link between managerial overconfidence and cash holdings as managers avoid raising cash because they perceive equity as underpriced and hence they instead accumulate cash to increase internal reserves for the financing of future investment. On the other hand, overconfident executives tend to overinvest and therefore they might expend more cash than they save, which leads to a negative association between overconfidence and cash holdings (see e.g., Ben-David et al., 2013). Recently, Chen et al. (2020) found a positive relationship between CEO overconfidence and cash holdings as per the motives of trade-off theory and agency problems. The positive relationship is also revealed by Tran et al. (2020): they mentioned that optimistic managers might hold more cash for the purpose of investment in the near future. For our viewpoint, we conjecture that overconfident managers may often spend too much on investments, hence they end up having less cash. To extend this strand of the literature, our paper focuses on the effect of managerial overconfidence on corporate cash holding levels, considering also the cases of investment inefficiencies that can potentially impact how managers make decisions about liquidity management.

Managerial overconfidence is a concept that needs to be assessed carefully. A number of ways have been used to measure this attribute in previous studies, including upwardly-biased forecasts (Lin et al., 2005, Huang et al., 2011), options holding (Lambert et al., 1991; Meulbroek, 2001 and Malmendier and Tate, 2005a, b; and Chen et al., 2020), the relative salary of executives (Malmendier and Tate, 2015), media coverage (Brown and Sarma, 2007), and textual analysis based on the linguistic tone of the annual report (Tran et al., 2020). This study introduces a novel method namely using voice pitch to measure overconfidence. Voice pitch is analysed through recordings collected through direct interviews with 123 top-line managers of Vietnam's non-financial listed firms, which account for 11.94% of the total of 648 non-financial listed firms in

Vietnam. We adjust the voice pitch measure to be the inverse of the voice pitch to rationalize our analyses with more appropriate interpretation of the regression results. The reason for this adjustment is that lower levels of overconfidence suggests higher voice pitch levels; hence an increase in the adjusted measure implies an increase in managerial overconfidence. As well as voice pitch, this study also uses other methods to measure overconfidence to increase the robustness of our results and prevent bias. We also use psychometric tests, which were conducted through 123 interviews, and data from 648 listed firms in Vietnam which includes the size of the CEOs' photos shown in the firms' 2016 annual reports, the average bias in the earnings forecast in the years 2015 and 2016, and finally the gender of managers. Our study focuses mainly on two research questions: a) *what are the impacts of managerial overconfidence on cash holding levels?* b) *do overconfident managers have higher deviations from the target cash holding level?*

Our main findings (robust to the endogeneity concerns and robust across various overconfidence measures) are that the relationship between managerial overconfidence and corporate cash holdings is negative and that higher managerial overconfidence leads to a reduction in the deviation between actual and target cash holdings. Our results contrast with Chen et al. (2020) who report a positive link between overconfidence and cash holdings for the US firms and Tran et al. (2020) in the context of Vietnam. In addition, when we consider overinvestment and overconfidence simultaneously, our results suggest that overconfident managers can be associated with higher cash holdings and larger deviations from optimal cash levels in situations whereby overinvestment is an issue for the firms.

The contributions of this study are as follows. First, the paper contributes to the literature investigating the effect of managerial overconfidence on cash holdings in a detailed study using a variety of empirical measures. Second, our paper examines the impact of managerial overconfidence on the *deviation* between the actual and optimal levels of cash holdings which has only been studied to a limited extent in prior papers. Third, our use of voice pitch to measure managerial overconfidence is novel although, for robustness, we use six different proxies of managerial overconfidence. Fourth, the use of various research participants (including top-line managers, CEOs, and the whole board of managers) to avoid bias in the empirical analyses is another important contribution of this study. Finally, using both primary and secondary hand-collected data, we provide various results considering the relationship between cash holdings and overconfident managers and then we compare our results to previous findings using data from Vietnam or other economies. Our use of unique data also enables us to independently validate the use of voice pitch as a useful measure of executive overconfidence.

This paper is organized as follows. Section 2 provides a review of the literature, presenting an overview of previous studies and developing our hypotheses. Section 3 describes

the methods and data used. Section 4 provides the descriptive statistics and empirical results. Section 5 provides a discussion of the empirical findings. Section 6 concludes.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Determinants of cash holdings – empirical work

It was not until the late 1990s that empirical studies began investigating the determinants of cash holdings. Kim et al. (1998) and Schnure (1998) were among the first researchers to determine the factors affecting the cash holding level in corporate management. In their research, optimal models for a firm's level of liquid assets are investigated and this created a foundation for later research. Explanatory variables used in the models are firm size, growth opportunities, cash flow and its variations, the return spread between physical assets and risk-free assets, the cash conversion cycle and its variations, the debt ratio, bankruptcy estimation, economies of scale, agency problems, the ability to issue stocks and acquisition disbursement. Subsequently, many other studies have developed, and constructed models focused on cash holdings and using similar factors affecting cash holdings. Furthermore, some new variables have also been introduced. Those factors are growth opportunities or higher volatility in cash flow, firm size, dividend, managerial ownership, agency problems (Opler et al., 1999; Ferreira and Vilela, 2004; Faulkender, 2002; Ghaly et al., 2015; Kling et al., 2014; and, Garcia-Teruel and Martinez-Solano, 2008), financial distress, information asymmetry, taxes and agency cost (Faulkender, 2002; Locorotondo et al., 2014), profitability, firm age, employee wellbeing (Omet and Maghyereh, 2003), the tenure of CEOs, inside debt and firm leverage (Liu et al., 2014), technology spillover (Qiu and Wan, 2015), ownership structure of companies and the degree of stockholder protection (Guney et al., 2003). Moreover, other aspects were also investigated such as in Subramaniam et al. (2011) which found diversified firms also seem to have lower cash holding; Harford et al. (2014) state that refinancing risk is a key determinant of cash holdings with firms raising cash to minimize refinancing risk; Kusnadi and Wei (2011) showed that legal protection has a first-order impact on the cash policy of international companies; Kuan et al. (2011) showed a difference in cash holdings between family-controlled firms and non-family-controlled firms, privately held firms and publicly traded firms (Hall et al., 2014); Kusnadi et al. (2015) found that non-state-controlled companies normally hold more cash than others. Recently, some researchers such as Jebran et al. (2019) show that there is a positive relationship between principal-principal conflicts and cash holdings, meaning that controlling shareholders tend to pursue private interests and hence hold more cash. Further, the influence of former CEO directors is also examined by Li and Lan (2022): they find that firms with former CEOs who still have significant effects on the

operation of the firms tend to hold less cash.

2.2. Hypothesis development

Prior research shows that overconfident managers can make aggressive and risky decisions, which may lead to unexpected and perhaps poor outcomes in corporate management. Those unexpected outcomes can be to overestimate projects' profitability (Langer, 1975; and Malmendier and Tate, 2005a), higher return volatility (Hirshleifer et al., 2012), a decrease in the net present value of projects undertaken and increases in the cost of external financing and the sensitivity of the free cash flow of projects (Heaton, 2002), and to increase the liquidity risks of firms (Huang-Meier et al., 2016). Decisions made by overconfident managers can include investing more in risky and innovative industries (Hirshleifer et al., 2012), preferring internal finance to debt or equity (Huang-Meier et al., 2016; Deshmukh et al., 2013), a tendency to use more short-term debt (Graham et al., 2013; Huang et al., 2016), using a tight dividend policy (Deshmukh et al., 2013), and making more acquisitions than their counterparts (Graham et al., 2013). All of these considerations tend to increase corporate risk taking and reduce financial performance.

Except Chen et al. (2020), to our best knowledge, there is no other paper that directly investigates the impact of managerial overconfidence on cash holdings, although several studies have mentioned this relationship in indirect approaches, such as Malmendier and Tate (2008) and Malmendier et al. (2011). According to Malmendier and Tate (2008), overconfident managers have a higher propensity to use cash and debt for acquisition purposes. Malmendier et al. (2011) stress that overconfident managers prefer using cash financing. As discussed in Chen et al. (2020), the relationship between overconfidence and cash holdings can be negative or positive.

In brief, from a review of the definitions of managerial overconfidence and the effects of managerial overconfidence on corporate management, especially on cash holdings, we contend that overconfidence in managers is likely to have a significant impact on cash holdings. Specifically, overconfident managers tend to take more aggressive investment decisions and might aim to use more internal capital for investments and hence tend to hold less cash. In other words, we argue that overconfident top executives tend to overspend for investment, which implies that the amount of cash held is often at low levels due to overinvestment inefficiencies.

Vietnam has a relatively weak corporate governance mechanism with many shortcomings. The current law in Vietnam stipulates a number of terms and conditions that make it difficult for shareholders - especially minority shareholders- to participate in critical corporate decisions such as nominating people to the Board of Directors and accessing information about operations of the company. Shareholders often encounter many obstacles in accessing necessary information

to sue managers who abuse their positions and powers to cause financial damage to the company or shareholders. The corresponding implication is that managerial traits might have significant effects on corporate decisions, including the management of liquid assets.

The preference for holding less cash, as a sub-optimal decision given the corporate characteristics and macroeconomic situation, can also lead to a higher deviation between the actual and the optimal cash holdings level. The heightened deviation can be attributable to irrational decision making by overconfident executives, which cannot directly be alleviated via the current corporate governance mechanisms in the country. Therefore, we set up the two main hypotheses for our study as follows.

H1: Corporate cash holdings are negatively associated with managerial overconfidence.

H2: Overconfident managers are associated with higher deviations from the target cash holdings.

3. METHODS

3.1. Research design

3.1.1. Sample selection and data sources

Most previous studies have used secondary data to conduct research and investigate the relationship between cash holdings and other variables. In this study, primary data were collected through direct interviews with 123 top managers of Vietnam's listed companies to measure managerial overconfidence and other attributes. The interviews used both closed-ended questions and open-ended questions. The close-ended questions were used to evaluate the overconfidence of managers through psychometric questions, while the open-ended questions were used to ask about relevant issues in order to collect the voice pitch of the managers. Secondary data were taken from Reuters Datastream, and hand collected from the annual reports of 648 companies to create proxies for other overconfidence measurements and other control variables to use in the research models.

3.1.2. Data collection

Three research samples are used in this study. One is collected from interviews, and the second and the third samples are extended to cover all 648 Vietnam non-finance listed firms. For the smaller sub-sample, 123 non-finance listed firms on the Vietnam stock exchange were targeted, which were collected randomly from the whole population of 648 firms. The time period for the secondary data spans the years between 2005 and 2016. The most important data in this sub-sample is the interviews with 123 top-line managers of Vietnamese non-financial listed firms. To obtain the primary data, emails and phone calls were sent, asking for participants in the

research, with 424 listed companies being contacted. There were 123 positive responses with 5 companies declining to allow the recording of the interviews, giving an 18.98% sample (cross-sectionally) of the population of non-finance listed companies. In respect of the respondents, there are 19 Chief Executive Officers (CEOs), of which 4 are both CEO and chairmen, 73 Chief Administrative Officers (CAOs), of which three are both CAOs and vice executive directors, eight Chief Financial Officers (CFOs) and 23 vice executive directors. The companies with CAOs do not have chief financial officers, hence, CAOs can be seen as playing a role similar to CFOs. The interviews were conducted over two periods; one was from February to May 2017 when 79 interviews were conducted and the other was from October 2017 to February 2018 when the remaining 44 interviews were conducted. Most of the interviews were conducted at the working place of the managers, although some were conducted at the annual conference for listed companies on the Hanoi Stock Exchange organized at the beginning of October 2017 and a small number were held in other places such as homes and cafés. All interviewees had worked at their firms since at least the beginning of 2016.

3.2. Measurements of managerial overconfidence

3.2.1. Definition of overconfidence

There are many definitions of overconfidence in previous studies. Ackert and Deaves (2009), for example, state that overconfidence refers to people who misjudge their abilities and knowledge and also overestimate the precision of their predictions. Additionally, Svenson (1981) and Alicke (1985) describe overconfident people as those who normally overstate their acumen relative to the average. From these statements of overconfidence, it is seen that decisions that are made by overconfident people might bring unexpected and undesirable outcomes (Camerer and Lovallo, 1999).

Generally, managerial overconfidence can be defined as managers who are always too confident about themselves and tend to misjudge their abilities, knowledge, and predictions. They also tend to overestimate the benefits of all events and outcomes, and always believe that they are better than average. Taking everything into consideration, we can state that managerial overconfidence can be associated with poor firm performance due to overconfident managers' identified characteristics. The following section examines the impact of overconfident managers on some aspects of corporate management in more detail.

3.2.2. Overconfidence measurement from previous studies

To examine the effect of overconfidence on corporate management, it is necessary to understand how to measure overconfidence. This section briefly discusses previous empirical studies to identify the best way to measure this factor.

Lin et al. (2005) focused on forecasts and believed that an optimistic manager might have more upward-biased forecasts than downward-biased forecasts during the manager's term. Similarly, the bias in forecast and actual earnings is used in Huang et al. (2011) and Huang and Kisgen (2013) to measure overconfidence. Accordingly, it is stated that an overconfident manager might tend to make over optimistic forecasts during the period of their management term.

Graham et al. (2013) constructed a number of psychometric questions to identify people who were risk-averse, optimistic, or had a time preference for gains and losses by giving them a choice of a sure loss or a gamble. The same method of using a psychometric approach can also be found in Scheier et al. (1994). In this research, a set of questions were constructed and put to the participants to identify their confidence level. According to Schrand and Zechman (2012), overconfidence can also be measured by the visibility of the CEO's photograph in the firm's annual reports. Accordingly, a higher confidence level is associated with a greater size of the CEO's photographs appearing in annual reports. From a different viewpoint, overconfidence is measured by the gender of managers (Huang and Kisgen, 2013). In these studies, male managers are usually found to be more overconfident than female managers. However, Hardies et al. (2012) find no difference between male and female in terms of their overconfidence level. Even though there is a conflict about the effectiveness of the use of gender to measure overconfidence, the majority of gender and overconfidence studies believe that females tend to be less overconfident than males (see e.g., Dowling and Aribi, 2013). Thus, it can also be seen as an alternative measurement for overconfidence. A very recent paper by Zuo et al. (2022) uses the definition of 'payment to the manager over total payment of all managers within the same firm' as an alternative method to quantify overconfidence.

Consequently, in this paper, six methods are used to measures the overconfidence of managers. These methods are an analysis of voice pitch, a psychometric test for managers, an examination of the visibility of CEOs' photographs in annual reports, a measurement of the bias in earnings forecasts and the gender of managers and finally a comprehensive index constructed from the five prior proxies. For the voice pitch analysis, this research is unique because a large number of direct interviews were carried out, and the study used the Praats software to evaluate the voices of managers in recordings of direct interviews to determine which managers were overconfident. The reasons for using voice pitch to measure overconfidence stem from several previous studies relating to the effect of different voice pitch leading to different outcomes. In particular, the analysis of the effect of vocal pitch or tone of voice on relevant aspects of corporate behaviour has been examined carefully by a number of scholars, such as Mayew et al. (2013) who use a similar method of voice pitch analysis with the same software and show that an interquartile decrease in the voice pitch of male CEOs is associated with larger and more profitable firms.

Hobson et al. (2012) showed that vocal dissonance has a positive impact on financial misreporting; Davis et al. (2012) found that the tone in conference calls has a significant relationship with managerial style; and Elkins et al. (2012) stated that the human voice can be used as a carrier of alerting and emotional messages. Furthermore, a change of tone by managers might also give an indication of the strength of a company's information environment (Feldman et al., 2010). Feldman et al. (2010) additionally indicated that the management's change of tone could help predict the drift return. In another study by Mayew and Venkatachalam (2012), the power of voice was analysed to predict the future earnings of a firm. In other areas, such as psychology research, Gamer et al. (2006) used vocal measures to detect guilty and innocent participants. From these studies, it can be stated that voice pitch is a very appropriate measure for overconfidence in this study.

The psychometric test used is based mainly on Graham et al. (2013) who constructed a list of questions to be asked during the interviews to measure both relevant terms and overconfidence. The structure of the interviews is presented in the methodology section. To assess the visibility of photographs shown in annual reports, all 2016 annual reports for both the small sample size and larger sample size were checked manually. For the next proxy of overconfidence, the bias in the earnings forecast was also collected manually in all the firm's annual reports. The last proxy of manager's gender was collected through companies' profiles.

Furthermore, a comprehensive index is also constructed from the data of voice pitch, psychometric test, the visibility of CEOs' photos in annual reports, bias in earnings forecast, and managers' gender. The use of five different approaches as well as the comprehensive index should prevent bias in the research. If all approaches reveal the same empirical results, the reliability and robustness of the research become evident. All the proxies are explained in detail in the following section.

3.2.3. Our measurements for managerial overconfidence and other managerial traits

The most important proxy, and the one that is unique to this study, is the use of voice pitch to measure the overconfidence of CEOs. According to Mayew et al. (2013), the analysis of voice pitch of executives has an economic meaning and voice pitch represents the confidence level of managers with deeper voice pitch implying higher confidence. According to Dabbs and Mallinger (1999), high testosterone levels predict a low voice pitch in men. High testosterone levels are also thought to be related to risk-taking behaviour (Stenstrom et al., 2011) and especially to taking more risks in financial decision-making (Apicella et al., 2008). Furthermore, testosterone levels also indicate masculinity. For instance, Penton-Voak and Chen (2004)

suggested that high testosterone levels are highly associated with facial masculinity. Additionally, facial masculinity has been demonstrated to positively affect the firm risk as measured by higher stock price volatility, higher leverage and more acquisitions (Kamiya et al., 2019). We can therefore state the testosterone levels or voice pitch can help us to reflect the risk levels of firms. Hence, there is evidence that there is likely to be a relationship between voice pitch and risk-taking behaviours. Further, higher risk-taking has been shown to be influenced by a higher level of overconfidence (Menkhoff et al., 2006). Thus, voice pitch is used as an appropriate proxy to measure overconfident managers in this study. As the higher the voice pitch, the lower the testosterone level, there are assumed to be lower levels of confidence in people with a high voice pitch. In this research, voice pitch ranges from 0 to 300 F_0 in Hz (F_0 in Hz – the measurement of voice pitch), therefore, to simplify, 100 is divided by voice pitch to make the measure more appropriate. We term the resulting variable "adjusted voice pitch" and use it as one of the main explanatory variables to measure overconfidence. Specifically, the higher the adjusted voice pitch (i.e., 100/Voice Pitch), the greater the overconfidence. The interviews were conducted to collect voice pitch with a number of general questions related to cash holdings decision-making, debt maturity, merger and acquisitions.

The second proxy was based on a psychometric test that was developed based on the studies by Graham et al. (2013) and Scheier et al. (1994). The psychometric data was collected through a number of questions in interviews with top managers. There were four questions that aimed to ascertain the behaviour of the managers in some events in daily life and the corporate context. From these questions, risk-averse, myopic and overconfident managers were identified. Each answer was marked, and the more points the respondents had, the more overconfident they were. Specifically, as explained by Menkhoff et al. (2006), overconfident managers tend to take higher risks, hence, two questions asked about risk aversion as shown below:

Question 1a:
Assuming that total value of **all** your assets is 1 million dollars, you are offered two investment projects that require 1 million dollars for the initial investment. Which project would you prefer?
- Project 1: 100% chance of creating NPV equalling 1.3 million dollars in 3 years
- Project 2: 70% chance of creating NPV of 10 million dollars in 3 years, but with 30% chance of getting a total loss.

If the respondent picked project 2, the survey continued to ask question 1.b. If not, it went to question 2.

Question 1.b:
Assuming that the total value of **all** your assets is 1 million dollars, you are offered two investment projects that require 1 million dollars for the initial investment. Which project would you prefer?
- Project 1: 100% chance of creating NPV equalling 1.3 million dollars in 3 years

- Project 2: 50% chance of creating NPV of 20 million dollars in 3 years, but with 50% chance of getting a total loss.

If the respondents chose project 1 for the first question, they received 1 point. If they chose project 2, they received 2 points. If they moved to question 1.b and they chose project 1, they received no points and if they choose project 2, they received an extra 2 points due to a much higher risk.

Question 2 was constructed following the measurement of optimism concept of Graham et al. (2013). In this study, the concept of optimism is considered in a similar way to the concept of overconfidence. Therefore, the same questions were asked of the respondents, as follows:

Question 2:
1. In uncertain times, I usually expect the best.
2. If something can go wrong for me, it will.
3. I'm always optimistic about my future.
4. I hardly ever expect things to go my way.
5. I rarely count on good things happening to me.
6. Overall, I expect more good things to happen to me than bad.

Question	1	2	3	4	5	6
I agree a lot						
I agree a little						
I neither agree nor disagree						
I disagree a little						
I disagree a lot						

For question 2, sections 1, 3, 5, 6 are marked as 2.5, 2, 1.5, 1 and 0.5 equivalent to "I agree a lot", "I agree a little", "I neither agree nor disagree", "I disagree a little", "I disagree a lot", respectively. In contrast, for sections 2 and 4, the marks are 0.5, 1, 1.5, 2 and 2.5 for "I agree a lot", "I agree a little", "I neither agree nor disagree", "I disagree a little", "I disagree a lot", respectively.

Question 3 was used to ask about managerial myopia. Overconfident CEOs tend to take a long-term view or follow long-term strategies (Ridge et al., 2014), therefore, if they are more overconfident, they might choose the answer with potential long-term benefits and not one with certain benefits in the short term. Question 3 was structured as follows:

Question 3.a:
If you had an inheritance of $100,000, would you prefer to have it now with $100,000 or receive it as $140,000 one year from now?
1. Get it now with $100,000
2. Have $140,000 after one year

If the respondent chooses 1, please move to question 3.b; if not, move to question 4.

Question 3.b:
What will you do with the $100,000 you receive today?
1. Keep it in a cash vault or deposit it in a bank account as savings

2. Invest the money today and expect higher interest

For question 3.a, if the respondents chose to receive the inheritance now, they received 1 point; if they chose to have it, later they received 2 points. For question 3.b, if they chose 1, they got no extra points due to showing caution; if they chose 2, they received an extra 1 point for more confidence.

Question 4 is also a question that tests the risk-taking of managers. It was designed to examine the aversion to sure losses with the case as follows:

Question 4:
As a financial analyst, if your best friend came to ask you for advice, what would you advise him about his situation?
Last year, his company invested $5 million in a project that was expected to generate cash flows of $10 million after one year. A year has passed and the project has yielded nothing.
Now your friend has the opportunity to invest an additional sum in this same project. There is a 20% chance that the project will generate a $10 million cash flow in a year's time and nothing thereafter. There is an 80% chance that the new investment will generate nothing at all. How should your friend do now?

1. Continue to invest extra $2 million US dollars to get the chance.
2. Stop the project

If the respondents chose 1, they received 2 points, if they chose 2, they received 1 point.

In the psychometric test, the total points were calculated and the higher the points, the more overconfident the managers were. The points calculated for the psychometric test were subsequently transformed to logarithmic form to have a better fit for the regression models.

Regarding the third proxy of overconfidence, all related firms' annual reports were checked and the level of overconfidence identified through the size of the CEOs' photographs appearing in annual reports. Following Schrand and Zechman (2012), the points for CEO overconfidence in this research are represented as 4, 3, 2, and 1. To be more specific: 4 if the CEO photograph takes up at least half a page, 3 if the photograph appears on less than half a page but more than a quarter of a page, 2 for quite a small photograph that is less than a quarter of a page, and 1 if no CEO photo shown in the annual report. Accordingly, the higher the points, the greater the confidence level is identified. For this proxy, only photographs of the CEOs of firms are collected and analysed, not the photos of other managers on the management board.

For the fourth overconfidence proxy, the bias in earnings forecasts is examined. Unlike previous studies that use just a one-year bias, we use the average bias in the earnings forecast of firms for two consecutive years, and then use a dummy variable: 1 if there is a negative bias, and 0 otherwise. The negative bias comes from the actual earnings being less than the forecast earnings. Overconfident managers are therefore identified if they have a negative bias in the difference

between these earnings. It should further be noted that Kaplan et al. (2020) show that overconfidence measures based on earnings forecasts are comparable to those based on option-moneyness approaches. The advantage of this proxy is that it can be used in larger samples as it is based on secondary data.

For the last overconfidence proxy, male and female CEOs are identified. Following Huang and Kisgen (2013), males are considered to be more confident than females. Thus, a dummy variable is used with 1 for overconfidence and 0 for non-overconfidence.

The comprehensive index that is composed of above five proxies is constructed as follows. The fourth and the fifth proxies were already coded as dummy variables with values of 1 or 0. The first, second and third proxies are translated to dummy variable form: 1 indicates overconfident managers and 0 indicates non-overconfident managers. Specifically, firstly, for the voice pitch measure and psychometric test, we find the median value for each type of data. And then, if the sample value is higher than median value, it is given the value of 1, and 0 otherwise. Secondly, for the visibility of CEO's photos in annual reports, we based our assessments on the range from 1 to 4 and setup CEOs with 4 points are overconfident with the value of 1 and CEOs with 1, 2, 3 points are non-overconfident managers with the value of 0. After that, the sum of all five proxies is calculated and represents the level of confidence of each manager. The higher the point score, the higher the level of overconfidence. Now, we have a new measurement of overconfidence based on five different proxies and we call it as the sixth proxy of overconfidence. From these six proxies, six different groups of models were used to test the effect of overconfident managers on cash holdings.

Besides the main variable of overconfidence, other traits of managers were also collected as control variables: age, education, tenure, duality and managerial ownership. Based on the studies of Malmendier et al. (2011), Graham et al. (2011) and Orens and Reheul (2013), gender, age, education, tenure and duality have a significant relationship with corporate decisions. Hence, this study also uses these variables to examine their relationship with cash holdings.

In fact, there might be a question about whether there is a relationship between age, education, tenure, duality or managerial ownership and the level of managerial overconfidence in general, and especially, for voice pitch in particular. To answer this question, we run simple OLS regression models with the dependent variable as each different proxy of managerial overconfidence and the explanatory variables being age, education, tenure, duality or managerial ownership. That means we run five different models with five different proxies, and we find the there are no significant relationships between managerial overconfidence and age, education, tenure, duality or managerial ownership. Therefore, we can conclude that age, education, tenure,

duality or managerial ownership do not affect the level of voice pitch, the result of the psychometric test and also other overconfidence measures.

3.3. Proxies for cash holdings and other controls for the determinants of cash holdings

3.3.1. Cash holdings

Faulkender (2002) used the cash-sales ratio to estimate cash holdings, while Guney et al. (2003) and Faleye (2004) used the ratio of cash and marketable securities to total assets as a proxy for cash holdings. Jiang and Lie (2016) represented cash holdings through cash and marketable securities. Pinkowitz and Williamson (2001) used the natural logarithm of cash over net assets or assets, which is the same approach as Subramaniam et al. (2011). Cash and marketable securities over net assets was used by Locorotondo et al. (2014), and Liu et al. (2014). Kling et al. (2014), Achary et al. (2012), Kusnadi et al. (2015), and Hall et al. (2014) used cash and cash equivalents relative to total assets and the ratio of cash and short-term investments to total assets (Ghaly et al., 2015). Based on the previous studies outlined above, cash holdings in this study is measured by the ratio of cash and equivalent, and short-term investment to the total assets.

For other independent variables, besides the main independent variable of overconfident managers and their traits, all the appropriate common control variables that were generally considered by previous studies to affect the cash holding decision are applied. The list of the variables is as follows.

3.3.2. Managerial traits

Duality: According to Jensen (1993), the manager and the chairperson tend to dominate the firm's operations, which affects firm performance. Duality can affect corporate decisions. Dual responsibility might make the manager tend to hold excess cash to protect their position (Dahya and Travlos, 2000). In this study, duality is denoted as 1 if the manager is also the chairperson and 0 if the manager does not hold the chairperson position.

Age: The age of managers was collected through interviews and annual reports. Age is stated to affect management decisions (Orens and Reheul, 2013).

Tenure: The tenure refers to the total number of years in a firm regardless of the number of years holding the position. Following Orens and Reheul (2013) and Ting et al. (2015), this study uses the number of consecutive years for which the managers have worked in the company until 2016. Similar to the variable of age, tenure is converted to log of tenure and represented by LogTenure.

Education: Manager's education is the measurement of the manager's qualification. There are 0 points for managers having education below university level, 1 for bachelor's degree, 2 for holding a master's degree, and 3 if the manager holds a doctoral degree. The point arrangement is based on the research of Ting et al. (2015) about examining the impact of manager's traits on

financial leverage but modified for this research.

Managerial ownership: There is a conflict of interest between managers and shareholders, which is known as the agency problem (Jensen, 1986; Jensen and Meckling, 1976). Accordingly, managers may have different motivations from shareholders in that they normally tend to keep a large amount of cash for safety and protection motives, hence leading to a lower profit for firms. Also, managers might use funds for inefficient investments (Ozkan and Ozkan, 2004). It is suggested that if the percentage of ownership by managers increases, the interests of managers and shareholders can align. Based on previous studies, this study investigates managerial ownership as a characteristic variable to examine its relationship with cash holdings. Managerial ownership is the percentage of shares held by the incumbent managers.

3.3.3. Control variables

Ownership concentration: Ownership concentration can impact negatively cash holdings due to higher ownership concentration causing difficulties in accumulating cash (Guney et al., 2007; Ferreira and Vilela, 2004). Ownership concentration is normally measured by the percentage of common shares owned by the largest three shareholders in firms (Guney et al., 2007). ***Board size:*** Board size has been used in a number of previous studies and has been found to play an important role in business operations. It is defined as the number of directors on the board of management (Kusnadi and Wei, 2011). According to Yermack (1996), a small board of managers is more effective in corporate management than a larger board of management, especially in the decision-making process. In addition, larger boards tend to hold more cash than smaller boards (Yermack, 1996). However, Kusnadi and Wei (2011) found that the relationship between board size and excess cash is negative. ***Firm value:*** This study employs two measures: Tobin's Q and market-to-book ratio for market value creation or as growth options proxies by the firm. A number of studies have used Tobin's Q to measure firm performance (Wernerfelt and Montgomery, 1988) and firm value (Mak and Kusnadi, 2005). There have been a number of studies regarding firm value as one of the major factors affecting the cash holding level. Firm value creation also can represent the growth opportunities of firms (Lang et al., 1991; and Han and Qiu, 2007). The more growth opportunities firms have, the higher the cash reserves they maintain in order to capture all opportunities. Tobin's Q is measured by market value of equity less book equity plus total assets scaled by total assets. Market to book ratio or value is market equity plus book equity divided by total assets (Pinkowitz et al., 2006). ***Z-score:*** According to Garcia-Teruel et al. (2008), financial distress has a significant impact on the holding of liquid assets. The impact is associated with the reduction in default risk when firms increase their cash holdings (Guney et al., 2003, Ferreira and Vilela, 2004, and Ozkan and Ozkan, 2004). However,

Kim et al. (1998) also found that a lower cash holding level is determined by a greater possibility of financial distress. Based on these findings, the study uses Altman's Z score as the proxy for financial distress and examines the relationship between these two aspects. ***Dividends:*** The findings from previous studies are inconclusive about the relationship between dividends and cash holdings. Some studies find that the distribution of dividends leads to lower cash levels (Opler et al., 1999). In contrast, Ozkan and Ozkan (2004) find that, due to the demand for higher cash holdings to pay dividends, firms that pay dividends normally hold more cash. This study, therefore, tests the effect of dividends on cash holdings. We use dividends paid divided by the profit after tax to represent dividend policy. ***Leverage:*** Leverage plays a very important role in firms and is seen as an alternative for capital in the firm as well as a good substitute for cash (Steijvers and Niskanen, 2013). That means an increase in leverage might lead to a decrease in cash holdings (Kim et al., 1998, Opler et al., 1999, Ozkan and Ozkan, 2004, Ferreira and Vilela, 2004, Najjar, 2012). However, a very high leverage level might make it difficult for a firm to access other borrowing sources such as bank loans. Hence, more cash may be held to minimize risk (Guney et al., 2007). A positive relationship between cash holdings and leverage is also indicated in Gamba and Triantis (2008). This study expects a negative effect from leverage on cash holdings. Leverage is measured by two proxies: total debt to total assets (Steijvers and Niskanen, 2013, Subramaniam et al., 2011) and total debt to total equity (García-Teruel and Martínez-Solano, 2008). However, as the regression results are qualitatively the same, we report the findings based on only one definition. ***Change in share price:*** There has been no evidence suggesting that there is a relationship between cash holdings and change in the share price. However, Bourne et al. (2003) stated that share price has a significant impact on firm performance; therefore, this study examines whether there is a link between cash holdings and change in the share price. Change in share price is measured by the percentage change in stock prices between the consecutive two years. ***Firm size:*** It is argued that smaller firms might find it difficult to access diversified borrowing sources and find obtaining capital is more costly than larger firms (Whited, 1992). Therefore, there may be a significant relationship between firm size and cash holdings. Following Guney et al. (2007) and García-Teruel and Martínez-Solano (2008), this research examines the effect of firm size, measured by the natural logarithm of gross sales, on cash holdings. ***Firm quality:*** Earnings per share can be a proxy for firm performance or firm quality (Mangel and Singh, 1993). This study aims to investigate the impact of firm quality on the level of cash holdings, and thus uses change in earnings per share as a proxy for firm quality. ***Intangible assets:*** Lin and Su (2008) show that intangible assets have a significant negative impact on cash holdings. Martínez-Sola et al. (2013) also found a significant relationship between intangible assets and cash holdings. Therefore, this study examines the

impact of intangible assets on cash holdings. Intangible assets measure is total intangible assets to total assets (Lin and Su, 2008). **Firm age:** Liu and Mauer (2011) found a significant relationship between firm age and cash holdings. We thus use firm age as a control variable to investigate the cash determinants.

4. REGRESSION MODELS AND RESULTS

4.1. Cash holdings and overconfident managers

Our main regression model for cash holdings and managerial overconfidence is as follows:

$Cash_i = \beta_0 + \beta_1 Overconfidence_i + \beta_2 Duality_i + \beta_3 LogManager's\ Age_i + \beta_4 LogTenure_i + \beta_5 LogMaEdu_i + \beta_6 MaOwnership_i + \beta_7 OConcentration_i + \beta_8 LogBoardsize_i + \beta_9 Firmvalue_i + \beta_{10} Dividend_i + \beta_{11} ZScore_i + \beta_{12} Leverage_i + \beta_{13} Sharepricechange_i + \beta_{14} Firmsize_i + \beta_{15} Firmquality_i + \beta_{16} Intangible_i + \beta_{17} LogFirmage_i + \varepsilon_i$ (1)

Overconfident managers are associated with aggressive corporate decisions and they bring more risks to their firms. Therefore, we predict that overconfident managers will hold less cash and take more risks but expect to earn more profit as a result. For the duality variable, Dahya and Travlos (2000) suggested that, to protect their position, managers tend to hold more cash if they hold both the CEO and the chairperson positions. Thus, duality is predicted to bring a positive effect to cash holdings. In terms of manager's age, older managers would have more experience which will make them more cautious in their process of decision-making, and, therefore, tend to hold more cash. For tenure, we consider that if the manager has more years working in a firm, they better understand the firm, and tend to hold less cash. Similarly, the higher the education level of manager, the higher their level of confidence and the lower the level of cash holdings. Further, if a manager has a higher percentage of ownership, they tend to keep more cash to protect themselves.

A high percentage of ownership concentration may reduce cash holdings due to the difficulty in accumulating cash whereas a larger board leads to more diversified viewpoints and more cautious corporate decisions and the tendency to hold more cash. Moreover, higher firm value is associated with reserving more money to capture more investment opportunities, hence we anticipate a positive sign for the link between firm value and cash holdings. If a firm has a high probability of financial distress, they are likely to hold low cash: hence, the sign of the effect of z-score and cash holdings is predicted to be negative. If a firm pays more dividends, they must reserve more money, thus we expect a positive relationship between dividend and cash holdings. Leverage, as an alternative capital source, is predicted to have a negative impact on cash holdings. A reduction in the share price might reflect an unstable performance of the firm and hence reduce

17

affect cash holdings. It is considered that higher sales will tend to increase cash holdings. Moving on to firm quality, higher earnings per share reflects good firm performance with more successful investments. Cash might be used for investments and be held at a low level. Finally, it is expected that firm age is associated with higher cash reserves. All the expected signs and the associated definitions are shown in table 1.

Table 1. Definition of variables and their expected signs
Note: EIKON is from Refinitiv (*aka* Thomson Reuters); AR stands for annual reports.

Variable	Symbol	Definition	Sign	Data source
Cash holdings	Cash	Cash and short-term investment/Total assets		EIKON &AR
Overconfident manager 1	Overconfidence1	Measured by adjusted voice pitch	-	Interviews
Overconfident manager 2	Overconfidence2	Logarithm of the psychometric test points	-	Interviews
Overconfident manager 3	Overconfidence3	Scale of CEOs photos appeared in the annual reports	-	AR
Overconfident manager 4	Overconfidence4	Dummy for bias in earnings per share by managers: 1 if forecast EPS>actual EPS, otherwise 0	-	Authors
Overconfident manager 5	Overconfidence5	Dummy:1 if executive gender is male, 0 otherwise	-	AR
Comprehensive index	Overconfidence6	The comprehensive index combining Overconfidence1 to Overconfidence5	-	Authors
Duality	Duality	Dummy: 1 if the manager is also the chair, 0 otherwise	+	Interviews &AR
Managers' age	LogMaAge	The logarithm of the age of managers	+	Interviews &AR
Tenure	LogTenure	The logarithm of total number of close-knit years in firms regardless the number of years holding position.	-	Interviews &AR
Managers' education	LogMaEdu	It is 0 if the manager has no university degree; 1 for bachelor's degree; 2 for master's degree, 3 for PhD.	-	Interviews &AR
Managerial ownership	MaOwnership	The percentage of shares held by the managers	+	AR
Ownership concentration	OConcentration	The total percentage of top 3 owners of the firms	-	EIKON &AR
Board size	LogBoardsize	The logarithm of number of members in the board	+	EIKON &AR
Firm value	Firmvalue1	Tobin's Q is market value of equity less book equity plus total assets scaled by total assets	+	EIKON &AR
Firm value	Firmvalue2	Market to book value: market equity plus book equity divided by total assets	+	EIKON &AR
Dividend policy	Dividend	Dividends paid over profit after tax	+	EIKON &AR
Altman's Z-score	ZScore	Z-score = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E where: A = Working capital/ Total assets; B = Retained earnings/ Total assets; C = EBIT/ Total assets; D = Market value of equity/ Book value of total liabilities; E = Sales/ Total assets	-	EIKON &AR
Financial leverage	Leverage1/ Leverage2	Leverage1: total debt over total assets. Leverage2: total debt over total equity	-	EIKON &AR
Change in share price	Sharepricechange	The yearly change in share prices	-	EIKON
Firm size	Firmsize	The logarithm of growth in sales adjusted for inflation	+	EIKON &AR
Earnings per share change	Firmquality	Change in yearly earnings per share	-	EIKON &AR
Intangible assets	Intangible	Total intangible assets over total assets	-	EIKON &AR
Firm's age	LogFirmage	The logarithm of the firm's age	+	EIKON &AR
Cash deviation	Deviation	The difference between the absolute value of the actual and expected cash holdings	+	Authors
Overinvestment	Overinvestment	Dummy variable: 1 if the residual value of the investment model is in the top quartile of the distribution, 0 otherwise. See section 4.3.4 for the details	+	Authors

4.2. Descriptive statistics and correlation matrix

The descriptive statistics for all variables are provided in table 2. Panel A is for the variables in

the smaller sample size; panel B is due to using the variable Overconfidence 4 in the regression analyses in a larger sample.

Table 2 Descriptive statistics
Note: Panel A (B) presents the smaller (larger) sample descriptive statistics. All variables are winsorized at the 1% and 99% percentiles. See Table 1 for the definition of the variables.

Panel A: Descriptive statistics for the cross-sectional sample. N=123

Variable	Mean	SD	Min	Max
Cash	0.135	0.161	0	0.849
Overconfidence1	0.685	0.159	0.394	0.991
Overconfidence2	1.188	0.112	0.477	1.332
Overconfidence3	1.463	0.922	1	4
Overconfidence4	0.504	0.466	0	1
Overconfidence5	0.789	0.408	0	1
Overconfidence6	2.293	1.124	0	5
Duality	0.081	0.274	0	1
MaAge	41.705	6.156	30	61
MaEdu	1.407	0.545	0	3
Tenure	7.375	6.045	0.3	33
MaOwnership	0.032	0.08	0	0.678
OConcentration	0.523	0.212	0.041	0.994
Boardsize	4.691	1.777	2	10
Firmvalue1	1.1	0.797	0.28	6.449
Firmvalue2	0.813	0.8156	0.0103	6.269
Dividend	0.431	0.539	0.000	4.249
ZScore	4.197	7.544	-1.266	76.031
Leverage1	0.231	0.194	0.000	0.736
Leverage2	0.872	1.043	0.000	5.538
Sharepricechange	0.243	0.526	-0.8	2.135
Firmsize	8.601	0.805	6.52	10.76
Firmquality	-1.453	4.331	-17.457	5.934
Intangible	0.029	0.093	0.000	0.776
Firmage	23.301	14.126	4	59
Overinvestment	0.250	0.434	0	1
Deviation	0.082	0.110	0.000	0.705

Panel B: Descriptive statistics for the cross-sectional sample. N=648

Variables	Mean	SD	Min	Max
Cash	0.145	0.161	0	0.849
Overconfidence4	0.434	0.470	0	1
Duality	0.241	0.427	0	1
MaAge	48.431	8.533	25	73
MaEdu	1.277	0.530	0	3
Tenure	13.585	9.030	0.3	61
MaOwnership	0.069	0.096	0	0.678
OConcentration	0.529	0.219	0.050	0.995
Boardsize	4.505	1.741	2	18
Firmvalue1	1.072	0.534	0.182	6.449
Firmvalue2	0.812	0.533	0.0103	6.269
Dividend	0.519	0.809	0.000	5.670
ZScore	3.334	3.302	-0.319	76.031
Leverage1	0.225	0.188	0.000	0.658
Leverage2	0.769	1.071	0.000	6.668
Sharepricechange	0.215	0.573	-0.723	2.388
Firmsize	8.666	0.708	6.803	10.76
Firmquality	-1.338	9.238	-17.457	9.954
Intangible	0.020	0.040	0.000	0.776
Firmage	14.304	8.545	1	59
Overinvestment	0.252	0.434	0	1
Deviation	0.072	0.082	0.000	0.588

The statistics indicate that the mean cash holdings is 13.5% (14.5%) in the smaller (larger) sample. For the adjusted voice pitch measurement (Overconfidence1) the range is from 0.394 to 0.991 with a mean of 0.685. For the psychometric test (Overconfidence2), the range is from 0.477 to 1.332. For the photo size (Overconfidence3), the range is from 1 to 4. For the bias in earnings forecasts by executives (Overconfidence4), there is a roughly equal percentage of over- and underestimated earnings forecasts with mean 0.504 (0.434) in the smaller (larger) sample. The percentage of male managers (Overconfidence5) is 79%. The final composite overconfidence proxy (Overconfidence6) ranges from 0 to 5 and its mean is 2.293.

Duality implies that only 8% (24%) of respondents are holding the position of chairperson along with another position on the board of management in the smaller (larger) sample. The age of managers ranges from 25 to 73, the tenure is between 0.3 years and 61 years when both samples are considered. The mean for the manager's qualification (MaEdu) is 1.407 (1.277) in the smaller (larger) sample, ranging from 0 to 3. The percentage of share ownership of managers is not high, with an average of 3.2% (6.9%) in the smaller (larger) sample. The ownership concentration is between 4% - 99% with an average percentage of 52% in both samples. The number of managers in the management team ranges from 2 to 18 persons with about 5 persons in a team on average. The correlation coefficients are reported in table 3, noting the absence of the multicollinearity problem as VIFs are less than 2. It appears that there is a negative relationship between for all overconfidence proxies and cash holdings.

Our sub-sample analyses (untabulated) further reveal that female managers have higher voice pitch than male managers (i.e., the unadjusted overconfidence measure). In other words, female managers have lower values in the adjusted voice pitch measure than male managers.[1] Moreover, we find that the average cash holdings ratio of the firms managed by female executives is 16% but this ratio is only 12% for those managed by male CEOs that constitute 78.9% of our sample.

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[1] In order to examine the effect of overconfidence measured by the adjusted voice pitch on cash holdings decisions by also controlling for the gender of the executives, we used both Overconfidence 1 (voice pitch) and Overconfidence 5 (gender) in the same model. We did this by extending model 1 in Table 4. The coefficient estimates (z-values) (p-values) for Overconfidence 1 and Overconfidence 5 are -0.201 (-1.88) (0.06), and -0.004 (-0.10) (0.92), respectively. Therefore, Overconfidence 1 continues to have a significant and negative coefficient albeit its significance level is lowered to 6%. In this model, the gender related control variable is consistently negative but statistically insignificant. Overall, we can state that our voice pitch measure captures satisfactorily the extent of overconfidence after controlling for the gender of managers.

Table 3. Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Cash (1)	1.000																							
Overconfidence1 (2)	-0.093																							
Overconfidence2 (3)	-0.099	0.022																						
Overconfidence3 (4)	-0.097	-0.008	0.107																					
Overconfidence4 (5)	-0.287	-0.030	0.029	0.128																				
Overconfidence5 (6)	-0.078	0.667	0.057	-0.097	0.026																			
Overconfidence6 (7)	-0.215	0.608	0.291	0.253	0.494	0.599																		
Duality (8)	-0.035	0.079	0.044	-0.085	0.093	0.076	0.055																	
LogMaAge (9)	-0.050	-0.018	-0.098	-0.001	-0.102	-0.054	-0.132	0.086																
LogTenure (10)	0.165	0.035	-0.065	-0.038	-0.283	0.008	-0.114	0.195	0.402															
LogMaEdu (11)	0.146	0.140	0.050	0.168	-0.180	0.162	0.025	0.015	-0.082	-0.051														
MaOwnership (12)	0.214	0.037	0.027	-0.113	-0.023	0.054	-0.018	0.486	0.277	0.146	0.010													
OConcentration (13)	0.065	-0.133	0.108	-0.008	-0.131	-0.062	-0.107	-0.142	-0.161	0.136	0.216	-0.013												
LogBoardsize (14)	-0.134	-0.050	0.087	0.188	-0.049	0.048	0.031	-0.080	-0.079	-0.026	0.067	-0.083	0.173											
Firmvalue1 (15)	0.175	0.046	0.060	-0.026	-0.204	0.022	-0.024	-0.077	-0.078	0.088	0.029	-0.086	0.028	0.057										
Firmvalue2 (16)	0.200	0.049	0.036	-0.029	-0.191	0.002	-0.028	-0.082	-0.066	0.066	0.031	-0.081	-0.018	-0.018	0.975									
Dividend (17)	0.148	-0.153	0.081	-0.045	-0.118	-0.113	-0.082	-0.004	0.101	0.105	-0.011	0.015	-0.032	0.002	0.065	0.066								
ZScore (18)	0.160	0.049	0.045	-0.073	-0.106	0.080	-0.047	-0.028	-0.062	0.116	-0.012	0.107	-0.148	-0.244	0.350	0.385	-0.007							
Leverage1 (19)	-0.398	-0.093	-0.087	-0.056	0.129	-0.089	-0.022	0.104	-0.183	-0.129	-0.032	-0.171	-0.021	0.119	-0.139	-0.096	-0.110	-0.304						
Leverage2 (20)	-0.352	-0.126	-0.001	-0.098	0.176	-0.035	0.010	0.128	-0.164	-0.006	-0.023	-0.115	0.054	0.135	-0.115	-0.134	-0.155	-0.224	0.778					
Sharepricechange (21)	0.117	-0.080	-0.098	0.108	-0.259	-0.107	-0.097	-0.115	-0.002	0.058	0.056	-0.061	-0.074	-0.027	0.358	0.363	-0.041	0.285	-0.190	-0.195				
Firmsize (22)	-0.005	-0.210	0.090	0.401	-0.144	-0.199	-0.112	-0.135	-0.055	-0.023	0.176	-0.175	0.053	0.549	0.234	0.210	0.177	-0.124	0.228	0.126	0.137			
Firmquality (23)	-0.033	-0.094	-0.105	0.132	-0.031	-0.118	-0.002	0.089	0.227	-0.031	-0.092	0.003	-0.047	0.042	-0.005	-0.010	0.114	-0.399	-0.072	-0.151	0.044	0.075		
Intangible(24)	0.011	-0.029	-0.072	-0.049	-0.010	0.056	-0.011	0.198	-0.021	0.050	-0.146	0.171	-0.215	-0.149	0.059	0.096	-0.062	0.657	-0.153	-0.147	0.107	-0.066	-0.139	
LogFirmage (25)	0.033	0.062	-0.097	-0.231	0.100	0.040	0.058	-0.040	0.017	0.140	-0.018	0.035	0.079	-0.021	0.147	0.117	-0.059	0.040	0.121	0.185	-0.081	0.034	-0.022	0.001

This table reports the Pearson correlations based on the sample of 123 firm observations in 2016. All variables are winsorized at the 1% and 99% percentiles.

4.3. Empirical results

4.3.1. Overconfident managers and cash holdings

Table 4 reports the first set of cross-sectional GLS regression results. The only overconfidence variable available for the larger sample size is based on the bias in earnings forecasts, which is collected from the annual reports of 648 non-financial firms. Therefore, Overconfidence4, the managerial bias in earnings forecast is used as the overconfidence proxy in the extended sample size (model 7). Cash holdings are negatively related to managerial overconfidence for all overconfidence proxies for the smaller (N=123) and larger (N=648) samples.

Table 4. Cross-sectional regressions for managerial overconfidence and cash holdings
Note: The dependent variable is cash holdings levels. The asterisk * (**) (***) indicates significance level at the 10%, 5% and 1% level, respectively. The standard errors in the brackets are robust to heteroscedasticity. The sample firms are classified into three categories (service, manufacturing and merchandise) and industry fixed effects are used in all models. Wald test is for the joint significance of the model.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overconfidence1	-0.207***						
	(0.083)						
Overconfidence2		-0.274***					
		(0.112)					
Overconfidence3			-0.032**				
			(0.015)				
Overconfidence4				-0.075***			-0.038***
				(0.029)			(0.012)
Overconfidence5					-0.059*		
					(0.033)		
Overconfidence6						-0.038***	
						(0.011)	
Duality	-0.080	-0.060	-0.081	-0.054	-0.079	-0.068	0.007
	(0.058)	(0.057)	(0.057)	(0.057)	(0.057)	(0.055)	(0.014)
LogMaAge	-0.777***	-0.762***	-0.753***	-0.731***	-0.765***	-0.839***	0.062
	(0.238)	(0.233)	(0.235)	(0.233)	(0.236)	(0.230)	(0.070)
LogTenure	0.115***	0.084***	0.095***	0.067*	0.095***	0.090***	-0.005
	(0.036)	(0.036)	(0.036)	(0.037)	(0.036)	(0.035)	(0.003)
LogMaEdu	0.172**	0.106	0.134	0.077	0.155*	0.137*	0.071*
	(0.088)	(0.085)	(0.085)	(0.086)	(0.088)	(0.083)	(0.039)
MaOwnership	0.631***	0.608***	0.593***	0.565***	0.617***	0.595***	0.014
	(0.191)	(0.188)	(0.190)	(0.189)	(0.190)	(0.184)	(0.059)
OConcentration	-0.076	-0.039	-0.060	-0.066	-0.074	-0.094	0.085***
	(0.067)	(0.064)	(0.064)	(0.064)	(0.065)	(0.063)	(0.025)
LogBoardsize	-0.119	-0.180**	-0.200**	-0.185**	-0.146	-0.149*	0.004
	(0.089)	(0.087)	(0.088)	(0.087)	(0.091)	(0.086)	(0.037)
Firmvalue	0.029	0.029	0.023	0.024	0.033*	0.032*	0.026**
	(0.019)	(0.018)	(0.018)	(0.018)	(0.019)	(0.018)	(0.013)
Dividend	0.013	0.024	0.012	0.018	0.019	0.018	0.004
	(0.024)	(0.023)	(0.024)	(0.023)	(0.024)	(0.023)	(0.007)
ZScore	-0.001	-0.001	-0.002	-0.002	-0.002	-0.003	0.015***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Leverage	-0.055***	-0.340***	-0.339***	-0.315***	-0.326***	-0.333***	-0.158***
	(0.014)	(0.073)	(0.074)	(0.073)	(0.074)	(0.071)	(0.035)
Sharepricechange	-0.012	-0.017	-0.008	-0.019	-0.014	-0.016	-0.011
	(0.027)	(0.026)	(0.026)	(0.026)	(0.027)	(0.026)	(0.010)
Firmsize	0.006	0.037*	0.049**	0.028	0.020	0.021	0.007
	(0.021)	(0.020)	(0.023)	(0.020)	(0.021)	(0.020)	(0.010)
Firmquality	-0.002	-0.002	0.000	-0.002	-0.002	-0.002	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
Intangible	-0.162	-0.155	-0.104	-0.102	-0.061	-0.071	-0.147
	(0.195)	(0.193)	(0.192)	(0.191)	(0.193)	(0.187)	(0.132)
LogFirmage	0.038	0.015	0.001	0.047	0.029	0.044	0.028
	(0.047)	(0.046)	(0.047)	(0.046)	(0.046)	(0.045)	(0.026)
Constant	-0.007***	-0.007***	1.102***	1.194***	1.288***	1.444***	-0.063
	(0.036)	(0.035)	(0.416)	(0.412)	(0.423)	(0.411)	(0.134)
Firms	123	123	123	123	123	123	648
Wald	64.89***	72.02***	69.56***	72.86***	67.74***	81.10***	297.51***

The overall results show that higher managerial overconfidence in Vietnamese firms reduces cash holdings, which supports our hypothesis 1. Regarding the other variables, there is a negative relationship between the manager's age and cash holdings. Negative relationships are also found

for board size and leverage. Further, tenure, education level and stock ownership by managers are associated with higher cash holdings. The remaining variables do not seem to affect cash levels. Given that there are alternative definitions for leverage and firm value, we only report the results for Leverage1 and Firmvalue1 as the results are insensitive to alternative definitions.

As for the economic significance of the cross-sectional results for cash holdings levels in Table 4, we provide the following calculations (for model 1): one standard deviation increase in managerial overconfidence using the definition of *Overconfidence1* leads to a reduction in cash holdings levels by 0.0329 units [= 0.159*(-0.207)] or 3.29 percentage points. This is equivalent to a reduction of 24.38% [=0.0329/0.135] relative to the mean value of cash holdings. The other economic significance calculations as per the mean value of the dependent variables for the models 2 to 7 are 22.7%, 21.9%, 25.9%, 17.8%, 31.6% and 12.3%, respectively.

4.3.2. Do overconfident managers increase deviation from the target cash holdings?

We examine the second hypothesis concerning the relationship between the deviation from target cash holdings and overconfident managers. The dependent variable in the model below is *Deviation*, defined as the absolute value of the difference between actual and expected cash holdings. Each firm has a different target cash value that reflects the best-fit model for the cash holdings, which we obtain by following Opler et al. (1999).[2] We conjecture that greater overconfidence levels are linked to higher deviations from optimal cash. We construct the model as follows.

$$Deviation_i = \alpha_0 + \alpha_1 Overconfidence_i + \alpha_2 Duality_i + \alpha_3 LogManager's\ Age_i + \alpha_4 LogTenure_i + \alpha_5 LogMaEdu_i + \alpha_6 MaOwnership_i + \alpha_7 OConcentration_i + \alpha_8 LogBoardsize_i + \alpha_9 Firmvalue_i + \alpha_{10} Dividend_i + \alpha_{11} ZScore_i + \alpha_{12} Leverage_i + \alpha_{13} Sharepricechange_i + \alpha_{14} Firmsize_i + \alpha_{15} Firmquality_i + \alpha_{16} Intangible_i + \alpha_{17} LogFirmage_i + \varepsilon_i \tag{2}$$

The results in table 5 show that, except in models 2 and 5, there is a negative relationship between overconfident managers and cash deviation in all models. These results comfortably suggest that managerial overconfidence reduces the deviation between actual and target cash holdings and therefore do not support our hypothesis 2. This surprising finding may be due to relatively high

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[2] See Table A1 in the appendix for the regression results regarding cash holdings determinants. Additional to the fixed effects and GLS methods, to address the potential endogeneity concerns among the regressors, we also use the two-step system-generalised method of moments (GMM) estimation method (Blundell and Bond, 1998) for the dynamic panel-data estimations in this table. This method is effective in controlling for the potential endogeneity, simultaneity and firm-level heterogeneity and it addresses the dynamic nature of the cash holding behaviour of firms. The quality of the regression results regarding cash deviation does not change as per the system-GMM method.

levels of asymmetric information in Vietnam and the difficulty in accessing quickly external capital that leads overconfident managers to be more cautious in cash policies. Namely, overconfident executives may assume that the current cash level is lower than the optimal level (as they may potentially be aware of their current liquidity position due to excessive investment), rather than vice-versa, which makes their firm's cash balances closer to the desired levels. In other words, the managers themselves might perceive that they are holding less cash than the average or the optimal level; thus, they are likely to reduce the gap between actual level of cash holdings and the predicted optimal cash levels.

Furthermore, for the other cash deviation determinants, manager's age, board size, firm value, leverage, and intangible assets have negative effects on deviation. Meanwhile, a manager's tenure has a positive effect on deviation. In general, there is no evidence confirming significant impacts for the other factors.

Table 5. Cross-sectional regressions for the deviation from optimal cash and managerial overconfidence

Note: The dependent variable is the deviation from the target cash levels (*Deviation*). The asterisk * (**) (***) indicates significance level at the 10%, 5% and 1% level, respectively. The standard errors in the brackets are robust to heteroscedasticity. Industry fixed effects are used in all models. Wald test is for the joint significance of the models.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overconfidence1	-0.148***						
	(0.057)						
Overconfidence2		0.057					
		(0.080)					
Overconfidence3			-0.032***				
			(0.011)				
Overconfidence4				-0.048***			-0.016**
				(0.021)			(0.007)
Overconfidence5					-0.035		
					(0.023)		
Overconfidence6						-0.024***	
						(0.008)	
Duality	-0.047	-0.055	-0.051	-0.034	-0.050	-0.043	0.006
	(0.039)	(0.041)	(0.039)	(0.040)	(0.040)	(0.039)	(0.008)
LogMaAge	-0.538***	-0.506***	-0.518***	-0.501***	-0.522***	-0.570***	-0.081**
	(0.164)	(0.167)	(0.161)	(0.164)	(0.166)	(0.162)	(0.042)
LogTenure	0.086***	0.074***	0.075***	0.056***	0.073***	0.070***	-0.001
	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)	(0.025)	(0.002)
LogMaEdu	0.165***	0.131***	0.145***	0.102*	0.151***	0.141***	0.019
	(0.061)	(0.060)	(0.059)	(0.060)	(0.062)	(0.058)	(0.023)
MaOwnership	0.525***	0.516***	0.504***	0.490***	0.523***	0.509***	0.046
	(0.132)	(0.135)	(0.130)	(0.132)	(0.134)	(0.130)	(0.035)
OConcentration	-0.042	-0.025	-0.030	-0.031	-0.035	-0.049	0.022
	(0.046)	(0.046)	(0.044)	(0.045)	(0.046)	(0.045)	(0.015)
LogBoardsize	-0.055	-0.097	-0.111*	-0.096	-0.073	-0.074	-0.022
	(0.061)	(0.062)	(0.060)	(0.061)	(0.064)	(0.060)	(0.022)
Firmvalue	-0.009	-0.010	-0.015	-0.013	-0.007	-0.008	-0.003
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.008)
Dividend	0.003	0.010	0.001	0.008	0.009	0.008	-0.002
	(0.017)	(0.017)	(0.016)	(0.016)	(0.017)	(0.016)	(0.004)
ZScore	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Leverage	-0.034***	-0.174***	-0.201***	-0.178***	-0.184***	-0.189***	-0.023
	(0.009)	(0.053)	(0.051)	(0.051)	(0.052)	(0.050)	(0.021)
Sharepricechange	0.014	0.021	0.017	0.011	0.014	0.013	-0.011*
	(0.018)	(0.019)	(0.018)	(0.019)	(0.019)	(0.018)	(0.006)
Firmsize	-0.003	0.009	0.031	0.010	0.005	0.006	-0.003
	(0.014)	(0.015)	(0.015)	(0.014)	(0.015)	(0.014)	(0.006)
Firmquality	-0.003	-0.002	-0.002	-0.003	-0.003	-0.003	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)
Intangible	-0.146	-0.079	-0.116	-0.107	-0.082	-0.087	-0.124
	(0.134)	(0.138)	(0.132)	(0.134)	(0.136)	(0.132)	(0.079)
LogFirmage	0.026	0.017	-0.007	0.031	0.019	0.029	0.010
	(0.032)	(0.033)	(0.032)	(0.033)	(0.032)	(0.032)	(0.016)
Constant	1.062***	0.790***	0.789***	0.871***	0.925***	1.030***	0.238***
	(0.300)	(0.307)	(0.286)	(0.289)	(0.297)	(0.290)	(0.080)
Firms	123	123	123	123	123	123	648
Wald	70.32***	63.69***	76.58***	71.09***	66.31***	77.71***	118.54***

4.3.3. Endogeneity issues

There are potential endogeneity problems for studies using firm-level data as it is possible that a regressor is correlated with the error term of the regression model or there is reverse causality (see e.g., Amess et al., 2015; Barclay et al., 2003). For our cross-sectional models examining cash holdings decisions and the deviations from optimal cash levels, we consider two stages. The fitted values for the endogenous variables are obtained by regressing them on their lagged values as internal instruments and the other non-endogenous explanatory and control variables. Then, they are used in the main structural model to account for the endogeneity concerns.[3]

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[3] Our analyses confirm that Firm value, Dividend, Zscore, Leverage, Change in share price, Firm size, and Firm quality are the endogenous explanatory variables. Therefore, in the second stage of the estimations we used the fitted

Table 6. Cross-sectional models for managerial overconfidence and cash holdings: the consideration of endogenous regressors

Note: The dependent variable is cash holdings levels. The asterisk * (**) (***) indicates significance level at the 10%, 5% and 1% level, respectively. Model 7 is for the extended cross-sectional sample. Industry fixed effects are used in all models. The standard errors in the brackets are robust to heteroscedasticity. Wald test is for the joint significance of the model. See section 4.3.3 for the details of the estimations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overconfidence1	-0.167**						
	(0.087)						
Overconfidence2		-0.123					
		(0.125)					
Overconfidence3			-0.026				
			(0.016)				
Overconfidence4				-0.077***			-0.050***
				(0.030)			(0.012)
Overconfidence5					-0.058*		
					(0.033)		
Overconfidence6						-0.033***	
						(0.012)	
Duality	-0.133**	-0.145***	-0.145***	-0.112*	-0.143***	-0.129**	-0.002
	(0.063)	(0.062)	(0.061)	(0.062)	(0.061)	(0.060)	(0.014)
LogMaAge	-0.853***	-0.730***	-0.699***	-0.704***	-0.744***	-0.786***	0.103
	(0.257)	(0.249)	(0.247)	(0.243)	(0.247)	(0.243)	(0.073)
LogTenure	0.127***	0.117***	0.114***	0.086**	0.122***	0.116***	-0.005
	(0.039)	(0.038)	(0.038)	(0.039)	(0.038)	(0.037)	(0.004)
LogMaEdu	0.193**	0.141	0.166*	0.107	0.184**	0.166*	0.069*
	(0.098)	(0.094)	(0.094)	(0.093)	(0.096)	(0.092)	(0.041)
MaOwnership	0.475**	0.626***	0.570***	0.539***	0.579***	0.565***	0.030
	(0.234)	(0.233)	(0.229)	(0.226)	(0.228)	(0.224)	(0.062)
OConcentration	-0.121	-0.071	-0.077	-0.088	-0.104	-0.110	0.088***
	(0.076)	(0.074)	(0.072)	(0.071)	(0.073)	(0.071)	(0.027)
LogBoardsize	-0.115	-0.196**	-0.199**	-0.183**	-0.146	-0.153	-0.041
	(0.102)	(0.099)	(0.099)	(0.097)	(0.102)	(0.097)	(0.040)
Firmvalue	0.054*	0.040	0.038	0.040	0.046	0.044	0.062***
	(0.031)	(0.030)	(0.029)	(0.029)	(0.029)	(0.029)	(0.016)
Dividend	0.058	-0.043	-0.032	-0.038	-0.017	-0.034	-0.009
	(0.171)	(0.170)	(0.168)	(0.165)	(0.167)	(0.164)	(0.047)
ZScore	-0.002	-0.003	-0.003	-0.002	-0.004	-0.003	0.009***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Leverage	-0.540	-1.603***	-1.624***	-1.573***	-1.569***	-1.622***	-0.290***
	(0.399)	(0.495)	(0.492)	(0.481)	(0.489)	(0.480)	(0.041)
Sharepricechange	0.367	0.398	0.262	0.257	0.378	0.256	-0.300*
	(0.369)	(0.360)	(0.368)	(0.356)	(0.357)	(0.354)	(0.170)
Firmsize	-0.020	0.007	0.017	0.001	-0.009	-0.004	0.017
	(0.025)	(0.024)	(0.025)	(0.023)	(0.024)	(0.023)	(0.011)
Firmquality	-0.134	-0.157	-0.138	-0.151	-0.166	-0.123	-0.007
	(0.107)	(0.104)	(0.105)	(0.101)	(0.102)	(0.102)	(0.010)
Intangible	0.733*	0.324	0.506	0.423	0.509	0.425	-0.029
	(0.391)	(0.416)	(0.389)	(0.382)	(0.388)	(0.380)	(0.139)
LogFirmage	-0.015	-0.027	-0.043	0.008	-0.017	0.000	0.042
	(0.053)	(0.051)	(0.052)	(0.051)	(0.051)	(0.050)	(0.028)
Constant	1.981***	1.567***	1.395***	1.478***	1.552***	1.702***	-0.134
	(0.656)	(0.491)	(0.459)	(0.451)	(0.466)	(0.461)	(0.156)
Firms	123	123	123	123	123	123	648
Wald	46.77***	54.41***	56.66***	62.90***	57.44***	64.41***	205.82***

The corresponding regression results in table 6 confirm our main findings as the overconfidence measures yield significantly negative coefficients in five out of seven cases; again, cash holdings are negatively associated with managerial overconfidence. Similarly, in table 7, the negative and

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values of these variables obtained from the first stage in order to remove the parts correlated with the error term. This procedure is repeated for each endogenous regressor. Some previous studies use the lagged values of the explanatory variables to mitigate the endogeneity concerns (see e.g., Rajan and Zingales, 1995). We use the lagged values of the potentially endogenous variables as internal instruments in the first stage due to the absence of external instruments as per the extant literature. Our estimation approach is comparable to Huang et al. (2019).

significant relationship between managerial overconfidence and the deviation from the target cash confirms our results (five out of seven models) in the previous section that overconfident executives alleviate deviations from optimal cash balances.

Table 7. Cross-sectional models for managerial overconfidence and deviation from optimal cash: the consideration of endogenous regressors
Note: The dependent variable is the deviation from the target cash levels (*Deviation*). The asterisk * (**) (***) indicates significance level at the 10%, 5% and 1% level, respectively. Model 7 is for the extended cross-sectional sample. Industry fixed effects are used in all models. The standard errors in the brackets are robust to heteroscedasticity. Industry fixed effects are used in all models. Wald test is for the joint significance of the model. See section 4.3.3 for the details of the estimations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overconfidence1	-0.115**						
	(0.061)						
Overconfidence2		0.100					
		(0.086)					
Overconfidence3			-0.031***				
			(0.011)				
Overconfidence4				-0.048***			-0.019***
				(0.021)			(0.007)
Overconfidence5					-0.035		
					(0.023)		
Overconfidence6						-0.024***	
						(0.008)	
Duality	-0.105***	-0.122***	-0.113***	-0.095**	-0.114***	-0.103***	0.003
	(0.044)	(0.042)	(0.041)	(0.043)	(0.042)	(0.041)	(0.008)
LogMaAge	-0.572***	-0.489***	-0.474***	-0.489***	-0.513***	-0.546***	-0.070**
	(0.179)	(0.171)	(0.166)	(0.167)	(0.170)	(0.166)	(0.042)
LogTenure	0.093***	0.087***	0.082***	0.067***	0.089***	0.085***	-0.001
	(0.028)	(0.026)	(0.026)	(0.027)	(0.026)	(0.025)	(0.002)
LogMaEdu	0.214***	0.182***	0.202***	0.154***	0.201***	0.193***	0.011
	(0.069)	(0.065)	(0.063)	(0.064)	(0.066)	(0.063)	(0.024)
MaOwnership	0.552***	0.610***	0.617***	0.609***	0.634***	0.623***	0.054
	(0.163)	(0.160)	(0.154)	(0.156)	(0.157)	(0.153)	(0.036)
OConcentration	-0.071	-0.058	-0.040	-0.050	-0.060	-0.067	0.025
	(0.053)	(0.050)	(0.048)	(0.049)	(0.050)	(0.049)	(0.016)
LogBoardsize	-0.085	-0.130**	-0.142**	-0.128**	-0.106	-0.106	-0.043*
	(0.071)	(0.068)	(0.066)	(0.067)	(0.070)	(0.067)	(0.023)
Firmvalue	-0.015	-0.023	-0.029	-0.026	-0.022	-0.023	0.009
	(0.021)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.010)
Dividend	-0.090	-0.137	-0.171	-0.168	-0.154	-0.167	-0.027
	(0.119)	(0.117)	(0.113)	(0.114)	(0.115)	(0.112)	(0.027)
ZScore	-0.001	-0.002	-0.001	-0.001	-0.002	-0.001	0.004**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Leverage	-0.154	-1.145***	-1.260***	-1.191***	-1.189***	-1.228***	-0.110***
	(0.278)	(0.339)	(0.330)	(0.332)	(0.337)	(0.328)	(0.024)
Sharepricechange	0.271	0.290	0.133	0.205	0.280	0.190	-0.179*
	(0.257)	(0.247)	(0.247)	(0.245)	(0.246)	(0.242)	(0.099)
Firmsize	-0.011	-0.001	0.020	0.002	-0.004	-0.002	0.007
	(0.017)	(0.016)	(0.017)	(0.016)	(0.017)	(0.016)	(0.007)
Firmquality	-0.042	-0.084	-0.032	-0.059	-0.068	-0.036	-0.005
	(0.074)	(0.071)	(0.070)	(0.070)	(0.070)	(0.070)	(0.006)
Intangible	0.177	0.091	0.027	-0.048	0.004	-0.051	-0.091
	(0.272)	(0.285)	(0.261)	(0.263)	(0.267)	(0.260)	(0.081)
LogFirmage	-0.009	-0.011	-0.039	0.004	-0.011	0.001	0.018
	(0.037)	(0.035)	(0.035)	(0.035)	(0.035)	(0.034)	(0.016)
Constant	1.269***	0.995***	1.118***	1.175***	1.219***	1.344***	0.208**
	(0.457)	(0.336)	(0.308)	(0.311)	(0.320)	(0.315)	(0.090)
Firms	123	123	123	123	123	123	648
Wald	47.05***	60.42***	69.98***	66.64***	61.91***	71.45***	120.60***

4.3.4. The relevance of overinvestment

Firms without effective control mechanisms such as well functioning corporate governance may have managers investing in non-profitable projects. Namely, poor management can lead to unnecessary investments by misusing internal cash reserves. Therefore, overinvestment should reduce cash holdings levels. In this section, we attempt to provide more direct tests regarding the presence of the moderating role of overinvestment on the association between overconfidence and cash holdings. Namely, what is the link between executives' overconfidence and cash holdings for overinvesting firms? The same investigation applies for the level of deviations from

optimal cash holdings. In a related study, Aktas et al. (2019) state that the effect of CEO overconfidence on corporate investment levels and the marginal value of holding cash is related to how much internal financing a firm has. Specifically, assuming the abundance of profitable independent projects, it is argued that overconfident CEOs spend more on investments relative to their rational peers as long as the firms have sufficient internal liquid reserves. If there are insufficient internal reserves, however, overconfident CEOs can then underinvest compared to the rational managers in order to avoid 'perceived' expensive external financing.

We follow Biddle et al. (2009) to construct a proxy for investment inefficiency: this procedure measures corporate investment in a specific year as the sum of capital expenditures, R&D expenditures, and acquisitions less sales of property, plant and equipment, all divided by lagged total assets. The first step estimation procedure examines a firm-specific real investment model as a function of growth options measured by sales growth (i.e., change in net sales).[4] The second step involves using the residuals obtained from the real investment regressions as a firm-specific proxy for deviations from expected investment levels. The authors treat the bottom quartile of the distribution of the residuals as underinvesting firms and the top quartile as overinvesting firms. Given this specification, we construct a dummy variable (*Overinvestment*) which is 1 for the top quartile observations, and 0, otherwise.

The corresponding regression models with the interacted terms are as follows:

$$Cash_i = \gamma_0 + \gamma_1 Overconfidence_i + \gamma_2 Overinvestment_i + \gamma_3\ Overconfidence_i * Overinvestment_i + \sum Controls + \varepsilon_i \tag{3}$$

$$Deviation_i = \delta_0 + \delta_1 Overconfidence_i + \delta_2 Overinvestment_i + \delta_3 Overconfidence_i * Overinvestment_i + \sum Controls + \varepsilon_i \tag{4}$$

In Eq. (3), for the overinvesting firms, the net effect of overconfidence on cash levels would be "$\gamma_1 + \gamma_3$" and for the non-overinvesting firms it would be "γ_1". In Eq. (4), for the overinvesting firms, the net effect of overconfidence on deviation is obtained by "$\delta_1 + \delta_3$" and for the non-overinvesting firms it is represented by "δ_1". As the previous sections reveal that our main results hold for the extended cross-sectional sample and after addressing the potential endogeneity concerns, in this section Eq. (3) and (4) are employed for the cross-sectional sample only.

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[4] For the Vietnamese firms, the R&D data are generally missing or incomplete. Therefore, our procedure does not consider the R&D data in order to avoid employing a small sample.

Table 8: Cross-sectional analyses for managerial overconfidence and cash holdings: moderating role of overinvestment

Note: The dependent variable is cash holdings levels. The asterisk * (**) (***) indicates significance level at the 10%, 5% and 1% level, respectively. Model 7 is for the extended cross-sectional sample. The standard errors in the brackets are robust to heteroscedasticity. Industry fixed effects are used in all models. Wald test is for the joint significance of the model. The estimations deal with the endogenous regressors as discussed in section 4.3.3.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overconfidence1	-0.286***						
	(0.096)						
Overconfidence2		-0.184					
		(0.158)					
Overconfidence3			-0.032*				
			(0.019)				
Overconfidence4				-0.072**			-0.055***
				(0.035)			(0.014)
Overconfidence5					-0.121***		
					(0.039)		
Overconfidence6						-0.050***	
						(0.013)	
Overinvestment	-0.376***	-0.314	-0.097	-0.033	-0.188***	-0.220***	-0.026
	(0.137)	(0.306)	(0.059)	(0.047)	(0.060)	(0.069)	(0.017)
Overconfidence*Overinvestment	0.491***	0.234	0.040	-0.015	0.197***	0.082***	0.014
	(0.193)	(0.260)	(0.032)	(0.069)	(0.070)	(0.028)	(0.029)
Duality	-0.128**	-0.136	-0.141**	-0.098	-0.112*	-0.137**	-0.003
	(0.061)	(0.063)	(0.063)	(0.065)	(0.061)	(0.060)	(0.014)
LogMaAge	-0.962***	-0.903**	-0.890***	-0.876***	-0.988***	-0.951***	0.097
	(0.255)	(0.264)	(0.262)	(0.260)	(0.254)	(0.249)	(0.075)
LogTenure	0.136***	0.124***	0.123***	0.095**	0.141***	0.123***	-0.006
	(0.039)	(0.040)	(0.040)	(0.041)	(0.039)	(0.038)	(0.004)
LogMaEdu	0.161*	0.147***	0.174*	0.109	0.170*	0.170*	0.063
	(0.096)	(0.097)	(0.097)	(0.096)	(0.096)	(0.092)	(0.041)
MaOwnership	0.427*	0.512**	0.449**	0.415*	0.414*	0.410*	0.034
	(0.227)	(0.238)	(0.234)	(0.232)	(0.226)	(0.222)	(0.064)
OConcentration	-0.101	-0.082	-0.086	-0.094	-0.096	-0.107	0.092***
	(0.074)	(0.076)	(0.074)	(0.073)	(0.073)	(0.071)	(0.027)
LogBoardsize	-0.159	-0.148	-0.144	-0.141	-0.134	-0.118	-0.037
	(0.100)	(0.103)	(0.102)	(0.101)	(0.102)	(0.098)	(0.040)
Firmvalue	0.060**	0.041	0.041	0.043	0.053*	0.048*	0.060***
	(0.030)	(0.031)	(0.030)	(0.030)	(0.029)	(0.029)	(0.017)
Dividend	0.035	0.002	0.030	0.022	0.042	0.005	0.010
	(0.166)	(0.175)	(0.171)	(0.171)	(0.165)	(0.163)	(0.048)
ZScore	-0.002	-0.001	-0.001	0.000	-0.001	-0.001	0.013***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Leverage	-0.567	-0.532	-0.587	-0.499	-0.500	-0.490	-0.034***
	(0.388)	(0.402)	(0.400)	(0.396)	(0.386)	(0.379)	(0.007)
Sharepricechange	0.618*	0.500	0.413	0.330	0.429	0.632*	-0.240
	(0.372)	(0.381)	(0.390)	(0.384)	(0.365)	(0.374)	(0.175)
Firmsize	-0.013	-0.001	0.001	-0.008	-0.013	-0.017	0.009
	(0.024)	(0.025)	(0.026)	(0.024)	(0.024)	(0.023)	(0.012)
Firmquality	-0.164	-0.140	-0.147	-0.114	-0.146	-0.180*	-0.004
	(0.108)	(0.112)	(0.114)	(0.108)	(0.105)	(0.109)	(0.011)
Intangible	0.789**	0.626	0.860**	0.740**	0.930***	0.863**	-0.043
	(0.379)	(0.419)	(0.393)	(0.386)	(0.380)	(0.373)	(0.142)
LogFirmage	-0.022	-0.045	-0.053	-0.012	-0.042	0.000	0.034
	(0.053)	(0.055)	(0.056)	(0.055)	(0.052)	(0.052)	(0.028)
Constant	2.169***	2.049***	1.883***	1.901***	2.106***	1.979***	-0.110
	(0.654)	(0.686)	(0.656)	(0.650)	(0.644)	(0.636)	(0.160)
Firms	123	123	123	123	123	123	648
Wald	57.77***	45.23***	47.79***	51.60***	59.31***	65.45***	176.25***

The regression results in Table 8 show that there is a negative relationship between cash holdings and overinvestment in all models (the link is significant in models 1, 5 and 6), which suggests that excessive spending for investments tends to be financed by internal resources in Vietnam. Overconfidence continues to have significant and negative coefficients in all models except model 2. In almost all models, the negative effect of overconfidence on cash holdings is mitigated for

the overinvesting firms and this effect is statistically significant for models 1, 5 and 6. Further, the net effect is positive in model 1 (0.115 = -0.376+0.491) and model 5 (0.009 =-0.188+0.197). These net effects can support the conjecture that as overconfident managers tend to undertake (inefficiently) more investments compared to their peers, they prefer to use internal reserves for investments in the near future. This preference motivates them to increase current cash holdings (i.e., transitory positive effect of overinvestment) so that they would be able to overinvest in the immediate future (eventual negative effect of overconfidence). These considerations imply further empirical studies that can be conducted in the future.

Table 9. Cross-sectional analyses for managerial overconfidence and deviation from optimal cash levels: moderating role of overinvestment

Note: The dependent variable is deviation from optimal cash (*Deviation*). The asterisk * (**) (***) indicates significance level at the 10%, 5% and 1% level, respectively. Model 7 is for the extended cross-sectional sample. The standard errors in the brackets are robust to heteroscedasticity. Wald test is for the joint significance of the model. Industry fixed effects are used in all models. The estimations deal with the endogenous regressors as discussed in section 4.3.3.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overconfidence1	-0.200***						
	(0.063)						
Overconfidence2		0.124					
		(0.097)					
Overconfidence3			-0.033***				
			(0.012)				
Overconfidence4				-0.043**			-0.021***
				(0.023)			(0.008)
Overconfidence5					-0.062***		
					(0.026)		
Overconfidence6						-0.029***	
						(0.009)	
Overinvestment	-0.180**	0.124	-0.037	-0.022	-0.099***	-0.081*	-0.012
	(0.087)	(0.216)	(0.037)	(0.028)	(0.042	(0.044)	(0.010)
Overconfidence*Overinvestment	0.237**	-0.121	0.010	0.000	0.102**	0.027	0.004
	(0.124)	(0.181)	(0.021)	(0.044)	(0.049	(0.018)	(0.016)
Duality	-0.044	-0.055	-0.053	-0.037	-0.049	-0.052	0.003
	(0.039)	(0.041)	(0.039)	(0.041)	(0.040)	(0.039)	(0.008)
LogMaAge	-0.584***	-0.528***	-0.545***	-0.523***	-0.587***	-0.584***	-0.074*
	(0.164)	(0.169)	(0.164)	(0.168)	(0.166	(0.164)	(0.043)
LogTenure	0.088***	0.085***	0.086***	0.067***	0.091***	0.079***	-0.001
	(0.025)	(0.026)	(0.025)	(0.026)	(0.025	(0.025)	(0.002)
LogMaEdu	0.155***	0.132***	0.151***	0.108*	0.144***	0.147***	0.009
	(0.060)	(0.060)	(0.059)	(0.061)	(0.061	(0.058)	(0.024)
MaOwnership	0.508***	0.511***	0.507***	0.497***	0.533***	0.513***	0.054
	(0.130)	(0.135)	(0.131)	(0.134)	(0.132	(0.130)	(0.037)
OConcentration	-0.028	-0.018	-0.019	-0.021	-0.016	-0.028	0.027*
	(0.046)	(0.046)	(0.044)	(0.045)	(0.045	(0.045)	(0.016)
LogBoardsize	-0.076	-0.083	-0.086	-0.078	-0.084	-0.057	-0.041*
	(0.061)	(0.062)	(0.061)	(0.062)	(0.064	(0.060)	(0.023)
Firmvalue	-0.010	-0.012	-0.016	-0.015	-0.012	-0.010	0.009
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013	(0.013)	(0.010)
Dividend	0.005	0.007	0.000	0.008	0.015	0.011	-0.022
	(0.016)	(0.017)	(0.017)	(0.017)	(0.017	(0.016)	(0.028)
ZScore	-0.001	-0.001	0.000	0.000	-0.001	-0.001	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002	(0.002)	(0.002)
Leverage	-0.033***	-0.032***	-0.033***	-0.028***	-0.028***	-0.027***	-0.011***
	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.004)
Sharepricechange	0.017	0.022	0.022	0.017	0.020	0.020	-0.152
	(0.018)	(0.020)	(0.019)	(0.019)	(0.019)	(0.018)	(0.101)
Firmsize	0.001	0.003	0.022	0.004	0.004	-0.003	0.003
	(0.014)	(0.014)	(0.015)	(0.014)	(0.015	(0.014)	(0.007)
Firmquality	-0.003	-0.003	-0.002	-0.003	-0.003	-0.003	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002	(0.002)	(0.006)
Intangible	-0.131	-0.067	-0.104	-0.102	-0.080	-0.073	-0.093
	(0.136)	(0.142)	(0.138)	(0.139)	(0.138	(0.135)	(0.082)
LogFirmage	0.026	0.018	-0.007	0.027	0.013	0.032	0.014
	(0.032)	(0.033)	(0.033)	(0.033)	(0.033	(0.032)	(0.016)
Constant	1.155***	0.769***	0.862***	0.923***	1.057***	1.091***	0.225***
	(0.299)	(0.317)	(0.292)	(0.295)	(0.299	(0.293)	(0.092)
Firms	123	123	123	123	123	123	648
Wald	77.22***	64.03**	96.37***	67.88***	77.83***	78.19***	68.08***

As for the cash deviations from the target levels, the results in Table 9 indicate that overinvestment and deviation from desired cash levels are negatively and significantly correlated in models 1, 5 and 6. This can happen when excess cash levels are reduced by overinvestment financed by internal reserves. The negative correlation between overconfidence and the magnitude of cash deviations tends to be reduced for the overinvesting firms and the corresponding net effect is even positive in models 1 and 5. Therefore, there is some evidence to suggest that overconfidence increases the deviations from target cash when the firms overinvest; and this conjecture is in line with our hypothesis 2.

5. DISCUSSION

In Vietnam, the thriving financial markets and corporate sector have significant potential information asymmetries and this situation does influence the cash reserves, investors' expectations and the trust of banks and suppliers. Therefore, an inappropriate cash holdings policy can harm all stakeholders' expectations, a firm's market value, and the overall competitiveness in the market.

Our findings are consistent with several previous studies stating that firms with overconfident managers tend to hold less cash. For example, Huang-Meier et al. (2016) state that optimistic managers normally hold less cash reserves for precautionary savings, inventories and receivables. Deshmukh et al. (2013) and Lin et al. (2005) indicate that overconfident managers prefer to use internal financing sources over other sources. Deshmukh et al. (2013) contend that external financing is costly and that overconfident managers prefer internal sources, which means they are inclined to hold less cash and use cash for investment purposes. Further, Deshmukh et al. (2021) show that optimistic CEOs do not prefer to hoard cash but instead prefer external financing to finance future projects as they expect a reduction in cost of borrowing. In contrast, non-optimistic managers have been shown to tend to hold larger amounts of cash for precautionary purposes. The six proxies used to represent overconfident managers showed similar findings in all regression models. This suggests that overconfident managers have a low propensity to hold cash, which supports the first hypothesis of the study. The negative and significant relationship between managerial overconfidence and cash holdings was confirmed over the various samples that we tested. However, our findings showed different results compared to the paper by Chen et al. (2020), and Tran et al. (2020). Interestingly, Tran et al. (2020)'s study was also conducted in the context of Vietnam with 663 non-financial firms from 2010 to 2016. The different findings might come from the different measurements of managerial overconfidence. We believe that with our six proxies including the novel proxy of voice pitch

and the overall & comprehensive proxy constructed from six proxies, and with two datasets including both cross-sectional and panel data, our findings can be considered as robust.

Corporate governance mechanisms in Vietnam are less than efficient with prevalent asymmetric information problems. These issues make the cost of external financing expensive. Our finding of holding less cash among overconfident managers can be a critical matter because it can create risks due to overinvestment in risky projects, increase the investment sensitivity to free cash flows, and increase the cost of external financing. Furthermore, the problem of increasing liquidity risk can also occur due to holding low cash, noting the transactions, precautionary and speculative motives of maintaining cash balances.

For the second hypothesis, the deviation between the actual cash holdings and the optimal value are also identified. The results of almost all models demonstrate that there is a significantly negative relationship between deviation and overconfident managers. It is interesting that overconfident managers do not seem to have much bias in their cash holdings level compared to the optimal level. The findings are supported by the responses of most of the interviewed managers. When asking about cash holdings, over 70% of respondents answer that they understand the importance of cash in business operations, hence make decisions about cash holdings quite carefully. Therefore, even though overconfident managers tend to hold less cash, econometrically, they do not tend to take the actual cash level far from the optimal level. These empirical results may reveal a unique environment in which the listed Vietnamese firms are operating.

Furthermore, it is also found that there is evidence suggesting a significant relationship between manager's age, tenure, manager's education, and manager's ownership with cash holdings. In terms of manager's ownership, our findings are similar to the findings of Liu et al. (2014) and Opler et al. (1999), who stated that management ownership has a positive impact on cash holdings. Additionally, Ozkan and Ozkan (2004) indicated that this relationship depends on the nature of the firm's controlling shareholders. Accordingly, they state that the relationship can become positive at higher levels of managerial ownership. For tenure, the results are consistent with the findings of Liu et al. (2014). Meanwhile, managerial age is identified as having both a positive and negative effect on cash holdings in both the small sample and larger extended sample. In addition, the findings indicate that there is no relationship between cash holdings and duality for both the small sample and the larger sample. This finding is similar to that of Ozkan and Ozkan (2004), who found no relationship between these two variables.

Regarding our hypothesis 2, the variables capturing managers' traits such as managers' age, tenure, education, and managerial ownership are found to have a significant impact on the

deviation. These results are the first to reveal the relationship between managers' traits and the deviation between the actual cash level and the optimal level of cash holdings.

All the control variables except for dividend, firm quality, change in share price, intangible, and firm age are shown to have a significant impact on cash holdings, which is a similar finding to the studies of Kim et al. (1998), Schnure (1998), Opler et al. (1999), Faulkender (2002), Omet and Maghyereh (2003) and Liu et al. (2014). The result related to the Z-score is similar to the study of Faulkender (2002), who stated that riskier firms tend to hold more cash. Opler et al. (1999) demonstrated that firms that pay dividends hold less cash, however, the findings in our study are different, but our findings are similar to the findings of Lins et al. (2010), that there is a positive relationship between dividends and cash holdings.

Overall, we can confirm that there is a negative link between managerial overconfidence and cash holdings. However, this does not mean that managerial overconfidence leads to a higher deviation between the actual and optimal cash holdings. Our study is the first paper to test the relationship between managerial overconfidence and the deviation between the desired and actual cash holdings. Our findings are intriguing in that managerial overconfidence leads to holding less cash but does not lead to a higher bias between the target and actual cash holdings. Future researchers might clarify this finding when doing similar studies in different countries. Additionally, all our managerial overconfidence proxies yield consistent results, illustrating that our new measurement of voice pitch and the comprehensive index are appropriate measures. We argue that this aspect of our study is an important contribution to the extant literature.

Based on our findings, we suggest that firms should regularly check their firm cash holding level and compare it to that of other firms, if their cash holding level is lower than average. They should also examine the board of directors carefully to avoid unexpected results in firm performance. This is because overconfident managers might tend to hold less cash, which might be due to inefficient real investment decision making process. Namely, investments by firms with overconfident managers tend to be in the form of overinvestment. In brief, we argue that our findings can be an indicator for managers, policymakers, and investors to understand and assess more precisely the future investment decisions of companies associated with overconfident executives who may suffer from cognitive biases.

6. CONCLUSION

By studying Vietnamese listed firms, our research indicates that managerial overconfidence has a significantly negative impact on cash holding levels. In this study, managerial overconfidence is measured by six different proxies to prevent bias and inconsistency in the regression results.

The proxies include analysing voice pitch, which is a novel measure not used in previous studies. Importantly, the sixth proxy is the combination of all five proxies, which again has not been attempted by the extant literature. Similar empirical results between the different models indicate that voice pitch is a strong and appropriate measurement of managerial overconfidence. The results from all models using various overconfidence proxies show that overconfident managers tend to hold less cash than their non-overconfident peers. Furthermore, we also find that overconfident managers tend to be associated with lower deviations between actual cash holding levels and optimal cash levels. It is interesting to reveal empirically that managerial overconfidence leads to holding less cash but does not lead to a high deviation in holding the actual cash level compared to the optimal level of cash holdings.

Our analyses further reveal that the negative effect of executives' overconfidence on cash levels for the full sample is reduced for the overinvesting firms only. We also report that the net effect is positive for some of the overconfidence proxies, which implies that overconfident managers are associated with higher cash holdings in cases of overinvestment inefficiency. Moreover, we show that the negative link between managerial overconfidence and deviations from optimal cash holdings is lower for the overinvesting firms. There is some evidence to suggest that overconfidence increases the cash deviations if the firms are suffering from overinvestment inefficiencies.

The tendency of holding insufficient cash can cause negative consequences such as increased liquidity risk, high transaction costs due to lack of internal source of capital, and low profitability and because some risky projects end up being unsuccessful. We believe that the findings (both statistically and economically significant) of our research can make a significant contribution to the practice of corporate management by providing insights for the corporate decision-makers and stakeholders in recruiting appropriate and suitable managers. Further research in the future may support or strengthen our findings by investigating the impact of managerial overconfidence on cash holdings and deviation from optimal cash holding levels for longer research periods and also in different countries. Additionally, extended studies can investigate the association between managerial overconfidence and other aspects of corporate finance given that we have shown the importance of managerial traits on corporate liquidity management.

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APPENDIX

Table A1. The determinants of cash holdings

Note: Panel data between 2005 and 2016 are used to run the regressions to investigate cash holdings determinants for Vietnamese firms. The dependent variable is cash holdings. *Lagged Cash* is one-period lagged cash holdings. Models 1 and 2 are respectively based on the GLS and the fixed effects method following the Hausman test. In model 3, we use the system-GMM specification. The asterisk * (**) (***) indicates significance level at the 10, 5 and 1% level, respectively. The standard errors in the brackets are robust to heteroscedasticity. Industry (in models 1 and 3) and time fixed effects (in all models) are used as appropriate. Wald test is for the joint significance of the model. AR (1) and AR(2) are the first and second order autocorrelation of residuals, respectively; which are asymptotically distributed as $N(0,1)$ under the null of no serial correlation. Hansen is the test of over identifying restrictions, asymptotically distributed as $\chi 2(df)$ under the null of instruments' validity given the overidentifying restrictions. All regressors other than the firm age are lagged at t-2 and earlier to use generate internal instruments.

	(1)	(2)	(3)
$Cash_{(t-1)}$			0.473***
			(0.067)
$Firmvalue_{(t-1)}$	0.016***	-0.002	0.017**
	(0.005)	(0.005)	(0.008)
$Dividend_{(t-1)}$	0.002	-0.002	-0.001
	(0.002)	(0.001)	(0.001)
$Zscore_{(t-1)}$	0.012***	0.005***	0.003
	(0.001)	(0.001)	(0.002)
$Leverage_{(t-1)}$	-0.236***	-0.097***	-0.081***
	(0.013)	(0.017)	(0.025)
$Sharepricechange_{(t-1)}$	0.002	0.002	-0.004
	(0.003)	(0.002)	(0.003)
$Firmsize_{(t-1)}$	0.022***	0.003	0.079
	(0.004)	(0.007)	(0.008)
$Firmquality_{(t-1)}$	0.001*	0.001***	0.004
	(0.001)	(0.001)	(0.001)
$Intangible_{(t-1)}$	-0.159***	-0.078	0.127
	(0.049)	(0.063)	(0.224)
$LogFirmage_{(t)}$	-0.002	0.046**	-0.009
	(0.007)	(0.022)	(0.032)
Constant	-0.059**	0.111*	0.054
	(0.03)	(0.065)	(0.076)
Observations	3426	3426	3426
Firms	551	551	551
Wald or F	1109.61***	32.93***	290.56***
AR(1) p-value			0.00
AR(2) p-value			0.69
Hansen p-value			0.13