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How Does Climate Policy Uncertainty Impact Corporate Cash Holdings? Evidence from UAE

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ABSTRACT

This study explores the impact of climate policy uncertainty (CPU) on corporate cash holdings in the United Arab Emirates (UAE). The UAE Sustainable Finance Working Group has set principles for effectively managing climate-related risks in the UAE market. Using a panel data analysis for a sample of 46 non-financial firms listed on UAE stock markets during the period from 2013Q1 to 2022Q4, we find that CPU reduces corporate cash holdings. This result confirms the prediction of agency theory and the transaction motive theory. Furthermore, we find that the cash held by corporations responds to high CPU events differently from low CPU events, supporting the asymmetric effect phenomenon. We also find that firm size plays a significant role in reducing the link between CPU and cash holdings. Cash held by large firms responds to CPU differently from cash held by small firms. An increase in CPU produces a greater cash crunch for small firms and very low cash saving for large firms, meaning that liquidity in small firms is greatly harmed by CPU compared to that in large firms. This study serves as a guide for policymakers, managers, stakeholders, and climate policy risk regulators. Public authorities should pursue climate policy risk plans to as to mitigate the negative effect of CPU. Managers should improve corporate governance to mitigate the negative impact of CPU on corporate cash holdings by effectively managing short-term liquidity and disclosing appropriate information to pursue controlling for climate policy risk.

Keywords: Climate Policy Uncertainty, Corporate Cash Holdings, Sustainable Finance, UAE
JEL Classifications: Q54; F32; G18

1. INTRODUCTION

The term "climate policy" describes the collective legislations and actions taken by governments to mitigate climate change, including global warming and other climate system changes (Chu et al., 2024). The ambiguity of climate conditions causes variations in climate policy, leading to climate policy uncertainty (CPU). Climate change, often referred to as "green swan" events, generates severe global chaos owing to physical, transitional, and regulatory risks (BIS, 2020), harming corporate sustainability, and creating uncertainty about the future (Jia and Li, 2020; Jia et al., 2024). Different from the physical risks of extreme climate change-related events, or the transitional risks that could disrupt certain industries (Javadi and Masum, 2021), regulatory risks are the focus of this study. Regulatory risks are associated with government policies and regulations aimed at reducing carbon emissions and addressing climate change (Fard et al., 2020).

There is consensus that better regulatory procedures and well-developed climate risk policies can mitigate potentially catastrophic climate change consequences. Stroebel and Wurgler (2021) argued that climate regulatory risks are often the primary climate risks that firms and investors should handle to pursue universal sustainability. Hence, firms should disclose information about business operations that contribute to enhancing climate risk, including greenhouse gas emissions (Berkman et al., 2024;

Vestrelli et al., 2024). If climate risk is unstable, climate policies are also uncertain; therefore, the characteristics of each business entity would be affected by climate policy risk. More pressure on a firm's costs from mitigating climate policy risk tends to alter cash holdings as firms incur heavy spending to protect the environment and engage in eco-friendly projects. Hence, it is important to explore the impact of CPU on corporate cash holdings.

CPU has the potential to influence firms' cash-holding status in different ways. Increased uncertainty in climate policy allows firms to adjust their cash holdings. The unexpected costs lead firms that do not adopt climate-change regulatory policy to encounter salient uncertainties about their future costs, thus motivating them to secure financial slack. CPU may enhance corporate cash holdings because firms are likely to hold more cash to deal with transition risks. Furthermore, CPU leads firms to alter their cash holdings to meet transaction costs or hedge against climate risk. Bates et al. (2009) argued that an increased CPU not only generates challenges in cash-holding decisions but also brings opportunities related to cash decisions. Firms with greater cash holdings that operate in a strong investor-protection business environment with robust governance quality and high corporate social responsibility performance might exploit the profitable opportunities associated with climate risks. These firms are likely to hold more cash (Chambers and Cifter, 2022).

However, increased CPU may exacerbate the agency problem by increasing information asymmetry between insiders and outsiders (Bates et al., 2009; Javadi and Masum, 2021). Asymmetric information heightens agency problems, because managers' opportunistic behaviors (e.g., reducing cash holdings) is detected less frequently. Managers may waste or overuse corporate resources in order to serve their personal interests. Firms operating in climate-risk-exposed business environments with more strictly regulated environmental policies may hold less cash than firms that do not have strict regulated environmental policies. Hence, shareholders may force managers to hold less cash to mitigate managerial opportunism at the shareholders' expense. Hence, because of the uncertainty in climate policies, instability in cash holdings may occur.

CPU may reduce firms' profits and sales growth, enabling them to hold less or more cash (Javadi et al., 2023; Liu et al., 2023). Climate risk increases firms' costs because it requires corporations to spend more money implementing costly climate risk-reduction strategies and environmentally friendly policies (Subramaniam et al., 2011). These strategies may lead firms to increase their cash positions either to meet transaction costs (to mitigate their financial obligations and hedge against different types of risk) or for precautionary purposes (to meet unexpected and coinciding financial obligations and to mitigate the danger of illiquidity and external funding) (Dittmar and Mahrt-Smith, 2007; Javadi et al., 2023; Weidemann, 2018). Therefore, examining how CPU affect corporate cash holdings is an appealing research topic.

Extant studies that consider the influence of CPU on corporate cash management are limited and lack clear evidence, focusing mostly on developed markets and geographic regions where data are regularly available in the corporate context. A few studies have investigated the effect of CPU on various firms' performance factors, such as corporate green innovation performance (Huo et al., 2024), firm performance (Persakis, 2024; Borozan and Pirgaip, 2024), dividend policy (Cavlak et al., 2021; Ali Taher and Al-Shboul, 2023), and bank risk (Dai and Zhang, 2023); some studies have analyzed ESG's impact on cash holdings (AlHares et al., 2023; Cavlak et al., 2021; Gu et al., 2024; Yu et al., 2022)., However, the existing literature pays limited attention to firms' cash holdings; those that do so provide inconsistent results and inconclusive evidence of the link between CPU and cash holdings. Importantly, research on CPU in developing countries is still understudied, especially in emerging and developing economies, such as the United Arab Emirates (UAE). To fill in the research gaps, this study examines how global CPU affects corporate cash holdings in the UAE. We address the following research question: does CPU affect corporate cash holdings in the UAE? The UAE is a unique developing country where heavy investments in climate risk reduction and new regulatory policies for climate risk have been implemented in recent years.

The UAE's central bank established principles for the effective management of climate-related financial risks through the UAE Sustainable Finance Working Group (SFWG)[1], established in 2019. The principles could encourage a proper economic transition and foster the implementation of sustainable finance in the UAE. The goals of the SFWG are aligned with those of the Paris Agreement, which was endorsed by the UAE government in 2016, domestic acts and initiatives, and UAE national plans, such as the Green Agenda 2015–2030, the National Climate Change Plan for 2017–2050, and the UAE Net Zero Strategic Initiative by 2050. The UAE's private sector is concerned with climate risk regulation. Economic entities within the UAE are required to make sustainability disclosures in their annual reports and comply with regulated products, consumer production, and risk management. This study intends to provide a roadmap for how corporate leaders can mitigate the negative effect of CPU on firm performance.

This study makes an important contribution to the literature. First, it provides new, comprehensive evidence to explore the link between CPU and corporate cash holdings. Furthermore, we display evidence of the level of cash holdings in periods of high and low CPU. We also examine whether firm size influences the link between CPU and cash holdings and provide evidence on whether the cash held by large and small firms is differently influenced by CPU. This analysis aims to support research on the variation in the level of cash held by corporations caused by CPU. In addition, examining this topic is of great importance to governments and policymakers, allowing them to determine the role played by CPU in environmental governance as well as their relevance and feasibility in implementing better climate policy programs to promote corporate cash holdings.

Understanding the impact of climate uncertainty on corporate cash holdings is important for corporate managers, climate

1 https://rulebook.centralbank.ae/sites/default/files/en_net_file_store/CBUAE_EN_5114_VER1.pdf

policymakers, regulators, shareholders, and academics. It allows financial decision-makers to diversify their business portfolios against CPU, thereby maximizing shareholders' wealth; and it allows policymakers to clearly determine investment signals in highly dynamic contexts by considering CPU as an important risk factor. Understanding this relationship is advantageous for shareholders in promoting mechanisms to monitor managerial actions. It allows firms to quantify optimal cash ratios appropriate for climate policy risk.

The remainder of this paper is organized as follows. Section 2 reviews the literature. Section 3 presents the theoretical framework and develops hypotheses. Section 4 describes the methodology and data. Section 5 presents the results and analysis. Section 6 concludes.

2. LITERATURE REVIEW

A large body of literature has examined the impact of CPU on corporate performance and other economic aspects. For example, studies have examined the impact of CPU on firm value (Ongsakul et al., 2023) and firm-level total factor productivity (Ren et al., 2022b). Amin et al. (2023) investigated the impact of CPU on corporate tax avoidance. Treepongkaruna et al. (2023) and He and Zhang (2022) examined the impact of CPU on the cross-section of stock returns and stock return predictability in the oil industry, respectively. Bouri et al. (2022) provided evidence of the effect of CPU on the price dynamics of green and brown energy stocks. Dai and Zhang (2023) investigated CPUs for bank risk-taking. Lang et al. (2023) examined the interaction between climate risk and bank liquidity in emerging markets transitioning to low-carbon energy. However, these studies reported inconclusive evidence of a link between CPU, firm-level performance, and other economic factors.

Considering the impact of climate change on a firm's characteristics, a recent stream of research has investigated the impact of CPU on firms' managerial and strategic decisions and on different aspects of corporate actions. For example, some studies (Bouri et al., 2022; Fuss et al., 2008; He and Zhang, 2022; Ren et al., 2022b) examined the impact of CPU on the stock returns of firms and industries in different sectors. Ren et al. (2024) and Ginglinger and Moreau (2023) investigated the effects of CPU on corporate debt. Dai and Zhang (2023) investigated the effect of CPU on the different risks faced by Chinese banks. Brownson et al. (2018) provided insights into the effect of policy uncertainty on real-life actions and the policymaking process. Monasterolo (2020) revealed that climate change reduces dependence on external sources of funding. Hunjra et al. (2022) found that uncertainty in financial policies has a greater effect on the management of climate change risks, suggesting that volatility in financial policies hinders financial progress in developing nations, thereby affecting the level of cash holdings (Lei et al., 2021).

In recent years, studies have shown a shift in the direction of such research topics. This new direction involves examining the direct impact of CPU on corporate cash holdings. However, the few studies that have discussed this impact have not provided conclusive evidence on such effects. Theoretically, climate change impacts corporate cash holdings in two ways, as suggested by the precautionary motive hypothesis and trade-off theory (TOT), whereby climate change enhances firms' cash holdings to protect themselves from potential policy changes (Zhang et al., 2023). The stakeholder theory suggests that firms should consider the needs of different groups of stakeholders in the decision-making process (Kivits and Sawang, 2021; Sajwani et al., 2024). This can be achieved by the reactions of firms to pressure from stakeholders, who increasingly require data disclosures regarding climate risk and policy uncertainty to determine the level of cash holdings. According to the legitimacy theory, owing to incomplete disclosures, firms can disclose information about their exposure to CPU through a symbolic legitimacy function that enables them to appear responsive to stakeholder pressure by holding an appropriate level of cash without providing real information that helps managerial accountability.

Another theoretical framework in corporate finance, among many frameworks, relates to the TOT and pecking order theory in explaining the link between CPU and cash holdings. According to the TOT, firms try to consider the positive aspects of cash (e.g., financial flexibility) and the negative aspects of cash, where they face the costs of not investing in other assets due to higher CPU (Vukovic et al., 2022). In situations in which regulatory actions on risk take place, and thus limited investment opportunities could appear due to an increase in climate contamination costs, firms may decide to hold more cash through cash precaution motives (Cambrea et al., 2022). The TOT posits that firms might hold more cash to invest in the future in green projects (Vukovic et al., 2022).

Zhang and Gao (2024) argued that CPU has a negative relationship with corporate cash holdings, particularly in the hotel industry, indicating that managers reduce cash holdings because of increased agency costs and information asymmetry. However, shareholders may request managers to distribute excess cash to prevent managerial opportunism. As Huang et al. (2018) noted, climate risk affects firms' financial decisions and, in particular, their cash management, suggesting that firms with high-risk exposure hold more cash to manage the fluctuations in earnings and cash flows generated by climate conditions. Oguntuase (2020) found that firms exposed to higher levels of climate risk held more cash reserves as a precaution and boosted their liquidity and financial position. Zhang et al. (2023) found a positive relationship between cash holdings and climate change, arguing that firms operating in geographical regions with high climate contamination hold more cash to protect their businesses against climate change threats.

One piece of supporting evidence for cash precautionary motives stems from agency costs. Some firms may hold more cash because of agency costs resulting from climate-policy risk. In addition, owing to vague and frequently changing rules and policies, it is difficult to estimate the future costs related to environmental compliance for firms that suffer higher agency costs (Li, 2019; Su et al., 2020). Firms may hold more cash reserves as an internal governing structure to prevent disputes between managers and shareholders. Yu et al. (2022) argued that because of climate risks in the general business environment, firms raise cash holdings to manage the operational risks arising from climate change. Javadi et al. (2023), for 41 countries, argued that firms' climate change exposure enhances their level of cash holdings, supporting the precautionary motive theory whereby firms hold more cash as a safeguard against the adverse impact of climate change.

Gounopoulos and Zhang (2024) found that firms increase their cash reserves in response to rising climate-related risks, indicating that increased environmental enforcement and physical risks are the main reasons for holding more cash. Their findings underscore the precautionary motives behind cash holdings. Zhang et al. (2024) found that county-level climate change social norms enhance cash holdings, arguing that cash holdings are an influential mechanism through which climate change social norms influence future environmental corporate social responsibility performance. Lee et al. (2023a), using a sample of 87 countries, illustrate that cash holdings are positively related to climate risk, indicating that this positive association is more pronounced for firms with higher financial constraints and located in nations with higher levels of green development. In such cases, firms increase their corporate cash holdings as a precautionary measure against external shocks.

Furthermore, Fernandes and Papadimitriou (2024) for unlisted and listed for in 12 Euro area countries, argued that drought risk as a climate risk measure exerts a greater impact on the cash holdings of unlisted firms compared to their listed counterparts, supporting the precautionary motive hypothesis. Zhang et al. (2023) showed that climate risk enhances corporate cash holdings, specifying that this positive association becomes stronger for small firms and those located in central and eastern China, confirming the cash holdings' precautionary motive. Huang et al. (2018) found that firms located in countries characterized by more severe weather are likely to hold more cash to build financial slack and, thereby, organizational resilience to climatic threats, supporting the transaction cash hypothesis.

3. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Climate risk not only causes uncertainty for economic entities but also calls for better adoption of suitable climate risk prevention strategies (Zhang et al., 2023). The link between CPU and corporate cash holdings is explained by the link between climate risk and cash holdings through several theories, such as the precautionary motivation theory (PMT) and transaction motive theory (TMT) in association with the TOT. These theories have been widely adopted to explain climate risk policies (i.e., Opler et al., 1999; Zhang et al., 2023). Firms hold cash as a precautionary measure against future uncertainty in climate risk policy. According to Javadi et al. (2023), climate change can reduce firms' profit margins because they might hold more cash than necessary to meet contingent outlays. In the context of PMT, firms may hold cash to hedge against possible future shocks or to help fund future investments related to climate change. Thus, according to PMT's prediction, CPU tend to enhance cash holdings.

According to Vukovic et al. (2022), firms weigh the costs and benefits of holding cash based on the TMT. Firms may face higher operational or transaction costs owing to policy reforms, leading them to hold more cash. However, holding excess cash incurs opportunity costs, potentially reducing firm value. The TOT suggests a more nuanced relationship between CPU and cash holdings, depending on the relative strength of these competing forces. According to these theories, CPU affects cash holdings through different pathways. This can occur when uncertainty in climate policy has potential to elevate expenses associated with uncertainties, limiting a firm's free cash flow. Businesses keep extra cash on hand to handle expenses associated with such policy risks. One obvious reason for this is that higher CPU can directly raise operational and transaction costs as firms adapt to changing regulations, thereby enabling them to hold more cash.

The second reason relates to competition: firms that hold more cash may be in a better position to respond more quickly to policy changes and better able to withstand the competitive pressures and costs from such policy changes, which can change competitiveness among firms. Thus, firm competitiveness is a potentially important moderating variable in the relationship between CPU and cash holdings. A firm's exposure to climate risk or the stringency of existing environmental regulations (Zhang et al., 2023) may also be mediating factors.

The PMT postulates that CPU may enhance corporate cash holdings, because firms are likely to hold more cash to deal with transition risks brought about by CPU. Furthermore, given the prediction of the TMT, whereby firms hold more cash to meet transaction costs or hedge against climate risk, higher CPU might not only generate challenges in cash-holding decisions (Bates et al., 2009) but also bring opportunities regarding cash decisions. Cash-rich firms might not miss the profitable opportunities associated with climate risk. More opportunistic firms, especially those operating in strong investor-protection business environments with robust governance quality and high corporate social responsibility performance, are likely to hold more cash (Chambers and Cifter, 2022).

However, in the presence of agency problems between insiders and outsiders, managers may reduce cash holdings, because an increase in CPU may increase information asymmetry between firm insiders and outsiders (Bates et al., 2009; Javadi and Masum, 2021). An asymmetric information environment may heighten agency problems, as managers' opportunistic behaviors are detected less frequently. Managers may waste corporate resources in order to serve their personal interests. Hence, shareholders may force managers to hold less cash to mitigate managerial opportunism at the shareholders' expense.

As firms are affected differently by uncertainty in climate policies, which generates instability in cash holdings, we argue that firms operating in more climate-risk-exposed business environments or in more strictly regulated environmental policies may hold less cash. We propose as follows.

H_1: CPU reduces corporate cash holdings.

According to signaling theory, corporate cash holdings may be affected by extreme changes in CPU. As a higher CPU signals negative news to market participants and policymakers, one would expect firms to hold less cash. This is because greater variability in climate policies creates an opaque business environment that leads to unfair treatment and competition for corporations in general and for those engaging in climate risk reduction programs. Higher CPU could increase a firm's overall costs, including transaction and agency costs, reducing the amount of cash held by corporations. However, in periods of higher CPU, firms may defer their operations, business activities, and business expansion and, therefore, increase retained earnings, enabling firms to hold more cash.

If lower CPU signals positive news due to firms' lower risk exposure, firms may hold less cash because they are not required to hedge against CPU or may even increase their cash holdings for precautionary purposes. Thus, in periods of lower climate-policy risk, managers face lower pressure, and they may hold less cash. However, well-developed climate change policies enable firms to engage more in projects with different levels and types of risk, thereby leading them to hold more cash to meet their transaction cost motives. We propose as follows.

H_2: High CPU affects corporate cash holdings differently to low CPU.

Another concern in this context is the impact of firm size on the link between CPU and corporate cash holdings, which remains understudied. Firms of different sizes may be affected differently by the link between COU and cash holdings. This is because firms of different sizes may have different growth opportunities, may be subject to different levels of CPU, and may have different capabilities in mitigating the effect of CPU. Finally, firms of different sizes may hold different amounts of cash.

Large firms may hold greater amounts of cash to reduce different types of risks, including CPU. Although the amount of cash held by large firms might change owing to external risk factors, it may increase when CPU declines, supporting the TMT. However, it may decrease when CPU increases, supporting the precautionary motive theory. Unlike small firms, large corporations may be more concerned about diversifying their theoretical portfolio investments, as they can access finances more easily and at lower costs and may have higher growth opportunities. These characteristics enable firms to generate more profit and productivity (Liu et al., 2023) and have a highly authentic production process. Furthermore, these firms are likely to be well diversified and have highly regulated board members compared to small firms. Better corporate governance that applies to the board of directors in large firms may enable such firms to hold more cash during periods of extreme CPU. The CPU effect may be lower for large corporations because such firms have more talented managers than other firms, which are highly sensitive to climate change (Ayed et al., 2024).

However, large firms might hold less cash than small firms when CPU is high. Given that large corporations might be characterized by higher information asymmetry with certain adverse selection problems, opaqueness in the information environment allows managers to hold less cash owing to opportunistic managerial behavior, which might be less detected in this environment. Large firms might be heavily involved in hedging contacts, operations, and economic activities, allowing them to hold more cash to meet risks, particularly those associated with CPU. CPU may positively affect firm-level outcomes, such as share price volatility, in periods of economic downturns. When uncertainty is driven by failure in the climate-policy process rather than success, large firms may hold more cash to mitigate the failure of the CPU process. Ayed et al. (2024) concluded that larger firms may hold more cash during higher CPU events, because such firms have more talented managers who are able to pay more cash dividends to shareholders. However, Ren et al. (2022b) concluded that CPU reduces free cash flow and negatively impacts RandD investment. Because large firms may experience a higher probability of bankruptcy owing to CPU, they may face cash shortages (Guizani and Ajmi, 2023). Owing to the latest worldwide pandemic and financial crisis, one could argue that firms have been forced to accumulate considerable cash reserves to protect against economic and climate policy instability. We propose H3 and H4 as follows.

H_3: Firm size mitigates the detrimental effect of CPU and corporate cash holdings

H_4: Cash held by large firms responds to CPU differently from cash held by small firms.

4. METHODOLOGY AND DATA

4.1. Methodology

4.1.1. The main model

A multivariate panel data analysis is implemented in this study. The model for the hypothesis that CPU impacts corporate cash holdings is specified by Equation (1).

$$CHO_{it} = \beta_0 + \beta_1 CPU_{it} + \sum_{l=1}^{L} \beta_l FS_{ijt}^{l} + \sum_{k=1}^{K} \beta_k CS_{jt}^{k} + \varepsilon_{it} \qquad (1)$$

where i and t are the firm and quarter, respectively. CHO_{it} refers to the proxies for corporate cash holdings. We use four proxies for cash holdings: (1) The ratio of cash to total assets, (2) cash and cash equivalents/current assets, and (3) cash and cash equivalents/total capital. CPU_1 is the CPU proxy developed by Gavriilidis (2021).[2] We also use an alternative proxy for climate-policy risk, CPU_2_{it}, measured by the volatility of the return of the climate-change MSCI index. This proxy is developed on a quarterly basis, taking the 6-month daily returns of the MSCI climate change global index as a window. *VAT* refers to the value-added tax, where a dummy variable is constructed, taking a value of 1 for every quarter between 2018Q1 and 2022Q4 and 0 otherwise.

The first group of control variables contains the firm-specific variable FS_{it}^{l}. Firm size (SIZE) is negatively associated with cash holdings (e.g., Magerakis et al., 2020; Alam et al., 2022) or positively associated with cash holdings (Magerakis et al., 2020; Ozkan and Ozkan, 2004). Leverage ratio (LEV) is quantified by the total debt-to-equity ratio; holding more debt in the capital

2 The climate change uncertainty index is available at https://www.policyuncertainty.com/climate_uncertainty.html

structure allows firms to hold more cash (Alomran and Alsubaiei, 2022; Al-Shboul et al., 2022), whereas engaging in corporate debt may adversely impact cash holdings (Ferreira and Vilela, 2004). Return on equity (ROE) refers to net income divided by total shareholder equity. Firms tend to hold more cash when ROE is high, whereas firms with a lower ROE may hold less cash (Alnori, 2020; Jiang et al., 2024). The application of IRFS may reduce firms' cash holdings (Ozkan et al., 2021) or may increase them (Wang and Yu, 2021; Kim and Ryu, 2018).

The second group of control variables contains the global risk variable, CS_{it}^{k} The geopolitical risk factor (GPR)[3], developed by Caldara and Iacoviello (2022), may decrease a firm's cash holdings (Kotcharin and Maneenop, 2020) or may increase them (Opler et al., 1999; Wang et al., 2021)). In terms of sovereign debt (SOV), developed by Baker et al. (2016), corporations may hold less cash because they have to pay off existing debt (Singh and Sirimaneetham, 2021) or may hold more cash as insurance against financial losses and for precautionary purposes. Trade policy uncertainty (TRAD)[4], is an index developed by Baker et al. (2016). The effect of trade policy risk and can cash holdings are examined by Graham et al. (2024) and Pan and Lei, 2023), among others.

4.1.2. High and low climate policy uncertainty

To examine how cash holdings asymmetrical respond to high and low CPU, we propose the following equations (2 and 3). According to the signaling theory, corporate cash holdings may differently respond to extreme changes in CPU. If higher CPU signals bad news, firms may reduce their cash holdings. An increase in the variability of climate policies may create an opaque business environment that leads to unfair treatment and competition especially for corporations engaging in climate risk reduction programs. Higher CPU may increase a firm's overall costs, including transaction and agency costs, and thereby reducing the amount of cash holdings. However, in periods of higher CPU, firms may defer their business operations, activities, and expansion and, therefore, increase retained earnings, enabling firms to hold more cash.

If lower CPU signals positive news as firms are being exposed to lower risk, firms may hold less cash because they are not required to hedge against CPU or may even increase their cash holdings for precautionary purposes. Thus, in periods of lower climate-policy risk, managers may face lower pressure, and then they may hold less cash. However, well-developed climate change policies enable firms to engage more in projects with different levels and types of risk, thereby leading them to hold more cash to meet their transaction cost motives. We propose as follows.

$$CHO_{it} = \beta_0 + \beta_1 CPU_{it}^{H} + \beta_2 CPU_{it}^{H} \times CPU_{it} + \sum_{l=1}^{L}\beta_l FS_{it}^{l} + \sum_{k=1}^{K}\beta_k CS_{it}^{k} + \varepsilon_{it} \quad (2)$$

3 The geopolitical risk index is available at: https://www.policyuncertainty.com/gpr.html

4 The trade policy uncertainty and sovereign debt indexes are available at: https://www.policyuncertainty.com/trade_uncertainty.html

$$CHO_{it} = \beta_0 + \beta_1 CPU_{it}^{L} + \beta_2 CPU_{it}^{L} \times CPU_{it} + \sum_{l=1}^{L}\beta_l FS_{it}^{l} + \sum_{k=1}^{K}\beta_k CS_{it}^{k} + \varepsilon_{it} \quad (3)$$

Where CPU_{it}^{H} and CPU_{it}^{L} are dummy variables representing high and low CPU, respectively. The high CPU dummy takes a value of 1 if the value of the CPU index in each quarter is higher than the mean value of CPU in the whole sample, and 0 otherwise. The high CPU dummy takes a value of 1 if the value of the CPU index in each quarter is lower than the mean value of CPU in the whole sample, and 0 otherwise.

4.1.3. Firm size effect

We next investigate the mediating role of firm size on the relationship between CPU and corporate cash holdings. Firms of different sizes (natural logarithm of total assets) may play a pivotal role in the relationship between climate and policy uncertainty and cash holdings. Given that total assets, especially fixed assets, are typically more irrevocable than other types of assets, large firms may react more strongly to a rise in CPU than small firms to a decrease in CPU, thereby experiencing changes in their cash holdings due to an increase in CPU. To examine this, we first examine the interaction effect between firm size and CPU on cash, represented by the variable (SIZE×CPU) in Equation (4).

$$CHO_{it} = \beta_0 + \beta_1 CPU_{it} + \beta_2 SIZE \times CPU_{it} + \sum_{l=1}^{L}\beta_l FS_{it}^{l} + \sum_{k=1}^{K}\beta_k CS_{it}^{k} + \varepsilon_{it} \quad (4)$$

where SIZE is the size of the firm per quarter.

To extend our model, we examine whether cash held by large firms responds to CPU asymmetrically to that held by small firms. We divide the sample into two subsamples, representing small and large firms:

$$CHO_{it} = \beta_0 + \beta_1 CPU_{it} + \beta_2 SIZE^{H} \times CPU_{it} + \beta_2 SIZE^{L} \times CPU_{it} + \sum_{l=1}^{L}\beta_l FS_{it}^{l} + \sum_{k=1}^{K}\beta_k CS_{it}^{k} + \varepsilon_{it} \quad (5)$$

where $SIZE^{H}$ and $SIZE^{L}$ are dummy variables representing large and small firms, respectively. The large firm dummy takes the value of 1 if the total assets of the firm in each quarter are higher than the median of total assets in the sample firms, and 0 otherwise. The small dummy takes the value of one when the total assets of the firm in each quarter are lower than the median of the total assets of the sample firms. The error term, ε_{it} is assumed to be normally distributed ε_{it}~iid $N(0, \sigma^2)$. To address the potential endogeneity in all regressors in our model specifications, which could lead to inconsistent estimates due to simultaneity and reverse causality, we use the system (SYS) GMM panel dynamic estimation developed by Arellano and Bover (1995) and Blundell and Bond (1998). This estimation deals with endogenous regressors and unobserved individual-specific heterogeneity by employing moment conditions at the first differences and levels.

4.2. Data

Our sample contains listed firms in the UAE stock markets covering the period–2013Q1 and 2022Q4. After extracting the data, firms operating in the energy and financial sectors are excluded from the sample, as these firms always hold and receive a large amount of cash owing to their daily business activities, and primarily rely on cash payments and receipts. Furthermore, as our main topic is the effect of CPU, excluding energy-producing firms is the correct action. These firms are involved in more direct and indirect climate risk, which may enforce certain climate-change reduction policies. Quarters with incomplete or missing data are also excluded. The final sample comprises 58 firms for 40 quarters, with a total of 2,320 observations. The financial accounting data of such firms are extracted from the Refinitiv workplace database. Refer to Table 1 for variables description.

5. RESULTS AND ANALYSIS

5.1. Univariate Analysis

Table 2 presents the descriptive statistics for the variables used in this study. Focusing on cash-holding proxies, we see that given the difference in the scales of these ratios, their means and standard deviations are different. CHO1 has the highest mean and standard

Table 1: Variables description

Variables	Description	Source
Dependent variables		
Cash holding1 (CHO1)	Cash/total assets	Refinitiv/Datastream and authors' own calculations
Cash holding2 (CHO2)	Cash and cash equivalent/current assets	Refinitiv/Datastream and authors' own calculations
Cash holding3 (CHO3)	Cash and cash equivalent/total capital	Refinitiv/Datastream and authors' own calculations
Independent variables		
Climate policy uncertainty (CPU_1)	The global climate Policy Uncertainty Index	Gavriilidis (2021) at www.PolicyUncertainty.com
Climate change risk (CPU_2)	The continuously compounded quarterly return series of the climate change global MSCI index.	Refinitiv/Datastream and authors' own calculations https://www.msci.com/indexes/group/climate-change-indexes
Control variables		
Firm size (SIZE)	Natural logarithm of total assets	Refinitiv/Datastream and authors' own calculations
Leverage (LEV)	Total net debt divided by total assets	Refinitiv/Datastream and authors' own calculations
Return on equity (ROE)	Return on shareholders' equity, measured by dividing net income on total shareholders' equity	Refinitiv/Datastream and authors' own calculations
Value-added tax (VAT)	A dummy variable represents the use of the value-added-tax, which takes taking a value of 1 for every quarter for the period 2018Q1 to 2022Q4, and 0 otherwise.	Authors' own calculations
Accounting method (ACC)	The implementation of long-term accounting method, which is measured by a dummy variable taking a value of 1 if the firm is reporting their statements following "all subsidiaries are consolidated," and 0 otherwise.	Refinitiv/Datastream and authors' own calculations
IFRS	A dummy variable takes the value of 1 if the firm use International Financial Reporting Standard (IFRS), or 2 if the company use local standards, or 3 if the company follows any other systems (e.g., GAAP, among others), and 0 otherwise (e.g., "No consolidation, cost basis (parent company only" or "not applicable").	Refinitiv/Datastream and authors' own calculations
Sovereign debt (SOV)	Sovereign debt currency crisis index	Categorical data, Baker et al. (2016) at www.PolicyUncertainty.com
Geopolitical risk (GPR)	Geopolitical Risk Index	Caldara et al. (2021) at: https://www.policyuncertainty.com/gpr.html
Trade policy (TRD)	Trade Policy Uncertainty Index	Categorical data, Baker et al. (2016) at www.PolicyUncertainty.com
COVID-19 (COVID)	A dummy variable represents the Coronavirus disease outbreak, taking the value of 1 in the years 2020, 2021, and 2022, and 0 otherwise.	Authors' own calculations
Year-quarter	An indicator variable represents a year-quarter effect applied for each firm in every quarter.	Authors' own calculations
Industry	An indicator variable represents an industry effect applied for each firm in every quarter.	Authors' own calculations

Table 2: Summary descriptive statistics

No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Variables	**CHO1**	**CHO2**	**CHO3**	**CPU_1**	**CPU_2**	**SIZE**	**LEVERAGE**	**ROE**	**COVID**	**VAT**	**GPR**	**TRADE**	**SOVEREIRGN**
Mean	37.078	0.065	0.138	4.937	18.784	15.025	0.119	1.710	0.100	0.400	102.890	205.869	60.349
Semean	0.541	0.002	0.014	0.010	0.402	0.042	0.008	0.712	0.006	0.010	0.844	6.173	1.208
p50	33.980	0.039	0.051	4.994	10.386	14.681	0.088	5.980	0.000	0.000	97.705	85.775	38.592
SD	26.046	0.073	0.689	0.494	19.379	2.035	0.383	34.281	0.300	0.490	40.635	297.353	58.199
Skewness	0.542	2.283	20.774	−0.090	1.537	0.334	7.673	−12.942	2.667	0.408	4.008	2.259	1.721
Kurtosis	2.392	10.255	465.528	2.039	4.698	2.617	96.187	236.761	8.111	1.167	22.171	7.783	5.780
Count	2320	2320	2265	2320	2320	2320	2320	2320	2320	2320	2320	2320	2320
Min	0.000	0.000	0.035	4.062	0.444	10.587	−0.919	−655.220	0.000	0.000	64.070	7.673	5.962
Max	99.880	0.585	15.724	5.848	76.979	20.639	5.506	110.770	1.000	1.000	324.230	1374.280	249.398

The table provides the summary descriptive statistics of the variables used in the study.

Table 3: Correlation matrix

No.	(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Variables	**CHO1**	**CHO2**	**CHO3**	**CPU_1**	**CPU2**	**SIZE**	**LEVERAGE**	**ROE**	**COVID**	**VAT**	**GPR**	**TRADE**	**SOVEREIRGN**
CHO1	1												
CHO2	0.2690*	1											
CHO3	−0.0023	0.2411*	1										
CPU_1	0.0423*	0.0226	0.0084	1									
CPU_2	0.0321	0.0172	−0.0057	0.0457*	1								
SIZE	0.1814*	−0.0695*	0.0072	0.0323	0.0238	1							
LEVERAGE	−0.2358*	−0.0527	−0.0622*	0.0656*	0.0552*	0.1092*	1						
ROE	0.1327*	0.0732*	−0.2503*	−0.0289	−0.0368	0.0387	−0.0994*	1					
COVID	0.0562*	0.0335	−0.0047	0.0319*	0.0427*	0.0464*	0.0273	0.0418*	1				
VAT	0.0567*	0.0389	−0.0109	0.0705*	0.0680*	0.0478*	0.0918*	−0.0186	0.0402*	1			
GPR	0.0293	0.0178	0.0006	0.1119*	0.0532*	0.0283	−0.0035	0.0399	0.0633*	0.0702*	1		
TRADE	−0.0341	−0.0387	−0.0123	0.3004*	−0.0091	−0.0047	0.0242	−0.0448*	−0.1652*	0.1659*	−0.1011*	1	
SOVEREIRGN	0.0002	0.0001	0.0216	−0.1287*	0.2145*	−0.0047	−0.0072	−0.0191	0.2236*	−0.0281	0.0517*	−0.0785*	1

The (*) indicates significance at the 5% level deviation values compared to the other ratios because it is scaled on total assets. We also observed that CPU_1 had a lower mean and standard deviation than CPU_2.

Table 3 presents the correlation coefficients across the variables used in the correlation coefficient matrix. We find that the cash holdings measure is positively correlated with CPU proxies. We expect CPU to increase cash holdings by corporations. We also observe that firm size, leverage, and trade policy rate are expected to be negatively correlated with the amount of cash held by corporations. However, the other control variables show a positive correlation with cash holdings.

5.2. Multivariate Analysis

5.2.1. The main model estimation

Table 4 shows that the impact of CPU plays a role on determining corporate cash holdings in the UAE market. We use the twostep GMM system panel dynamic estimation (GMM sys) developed by Arellano and Bover (1995) and Blundell and Bond (1998) to obtain the results of the model estimation. These two methods are suitable to address the potential endogeneity in all regressors in our model specifications, which could lead to inconsistent estimates due to simultaneity and reverse causality. This estimation deals with endogenous regressors and unobserved individual-specific heterogeneity by employing moment conditions in first differences and levels. We find that CPU plays a role on determining corporate cash holdings in the UAE. CPU significantly reduces corporate cash holdings, confirming our hypothesis (H1). This means that an increase in the policy uncertainty in climate change dampens the cash held by corporations in the UAE. This negative effect of CPU on cash might result due to \the presence of agency costs, opaqueness in information environment and the managerial opportunistic behaviors. Following these reasonings, increase in CPU tends to exacerbate the agency problem by increasing the information asymmetry between insiders and outsiders, leading managers to waste funding resources to serve their own personal interests. Thus, owners tend to force managers to forgo excess cash to mitigate managerial opportunism which comes at the expense of shareholders. Our results are in line with the findings reported by Javadi and Masum (2021) and Gounopoulos and Zhang (2024). However, our results contradict the findings of Lee et al (2023b) who argued that the US listed firms held more cash for

Table 4: Climate policy Uncertainty and corporate cash holdings

Coefficients	GMM sys Blundell and Bond			GMM sys Arellano and Bover		
	(1)	(2)	(3)	(4)	(5)	(6)
	CHO1	CHO2	CHO3	CHO1	CHO2	CHO3
Cons	11.315	0.006	−1.259***	−14.104	0.025	−3.281***
	(0.99)	(0.21)	(−54.64)	(−1.13)	(1.11)	(−48.06)
L1.CHO1	0.934***			0.831***		
	(73.74)			(52.24)		
L1.CHO2		0.903***			0.860***	
		(101.39)			(70.29)	
L1.CHO3			0.145***			0.107***
			(110.95)			(57.31)
CPU_1	−0.001***	−0.000***	−0.000***	−0.002***	−0.000***	−0.000***
	(−3.78)	(−14.36)	(−28.49)	(−4.74)	(−14.39)	(−7.78)
SIZE	−0.571	−0.000	−0.100***	1.411*	−0.001	−0.234***
	(−0.77)	(−0.15)	(−59.26)	(1.72)	(−0.57)	(−57.06)
LEVERAGE	−0.148***	−0.001***	−0.204***	−0.106***	−0.001***	−0.211***
	(−5.58)	(−27.82)	(−760.26)	(−3.48)	(−28.90)	(−354.97)
ROE	0.015***	0.000***	−0.002***	0.004	0.000***	0.002***
	(3.02)	(12.16)	(−115.54)	(0.43)	(13.44)	(118.34)
COVID	−0.232	−0.005***	−0.074***	−0.605**	−0.005***	−0.101***
	(−0.83)	(−12.30)	(−25.19)	(−2.24)	(−13.61)	(−21.22)
VAT	0.564***	0.002***	0.086***	0.048	0.002***	0.067***
	(7.72)	(4.27)	(42.51)	(0.32)	(3.42)	(37.78)
GPR	−0.002**	−0.000***	−0.000***	−0.002**	−0.000***	−0.000***
	(−2.40)	(−9.01)	(−9.65)	(−2.36)	(−8.44)	(−21.90)
SOVEREIGN	0.002***	0.000***	−0.000***	0.002***	0.000***	0.000***
	(6.13)	(6.39)	(−26.62)	(4.41)	(6.62)	(14.82)
TRADE	−0.001***	−0.000***	−0.000***	−0.001***	−0.000***	−0.000***
	(−4.57)	(−6.20)	(−26.34)	(−3.83)	(−9.28)	(−13.15)
Year-quarter	Yes	Yes	Yes	Yes	Yes	YES
Industry	Yes	Yes	Yes	Yes	Yes	YES
N	2210	2210	2195	2151	2151	2136
AR (1)	−4.1328**	−2.4024**	−1.3188***	−4.1767**	−2.403**	−1.3683**
P-value	0.0145	0.0163	0.0000	0.0045	0.0316	0.0171
AR (2)	1.3109	1.6245	3.0516	1.3562	1.681	2.6716
P-value	0.1899	0.1043	0.2300	0.175	0.1928	0.2752
Sargan test	44.703	46.657	55.677	44.038	50.631	55.962
P-value (Sargan)	0.5466	0.5398	0.5876	0.6134	0.5981	0.5781
Wald test	319296.37***	368451.06***	8.32E+08***	4.92E+04***	243566.09***	3.53E+07***

The estimators are obtained from the GMM system dynamic panel estimation as proposed by Arellano-Bover (1995)/Blundell and Bond (1998). L1 refers to lag 1. The indicators (***, **, and *) represent the level of significance at (1%, 5% and 10%), respectively

Table 5: Robustness−Climate policy uncertainty and corporate cash holdings

Coefficients	GMM sys Blundell and Bond			GMM sys Arellano and Bover		
	(1)	(2)	(3)	(4)	(5)	(6)
	CHO1	CHO2	CHO3	CHO1	CHO2	CHO3
Cons	25.086	0.027	−1.226***	16.479	0.005	−3.425***
	(1.08)	(1.29)	(−51.42)	(0.73)	(0.19)	(−39.02)
L1.CHO1	0.935***			0.871***		
	(48.50)			(28.88)		
L1.CHO2		0.890***			0.856***	
		(98.58)			(127.81)	
L1.CHO3			0.145***			0.105***
			(122.97)			(66.44)
CPU_2	−0.004**	−0.000***	−0.000***	−0.003**	−0.000***	−0.000***
	(−2.56)	(−12.07)	(−29.21)	(−2.16)	(−8.64)	(−16.79)
SIZE	−1.502	−0.001	−0.097***	−0.781	−0.000	−0.242***
	(−0.95)	(−0.96)	(−56.85)	(−0.50)	(−0.16)	(−46.01)
LEVERAGE	−0.146***	−0.001***	−0.204***	−0.113***	−0.000***	−0.211***
	(−4.87)	(−19.96)	(−823.13)	(−3.10)	(−15.72)	(−426.60)
ROE	0.013	0.000***	0.002***	0.010	0.000***	0.002***
	(1.51)	(8.31)	(125.11)	(1.14)	(6.15)	(79.31)
COVID	−0.220	−0.007***	−0.063***	−0.517*	−0.007***	−0.101***
	(−0.60)	(−12.11)	(−21.76)	(−1.92)	(−10.12)	(−22.35)
VAT	0.604***	0.001**	0.079***	0.271	0.001	0.067***
	(2.93)	(2.51)	(31.73)	(0.91)	(1.32)	(52.36)
GPR	−0.001	−0.000	−0.000	−0.001	−0.000	−0.000***
	(−1.48)	(−0.05)	(−0.14)	(−1.08)	(−1.06)	(−27.67)
SOVEREIGN	0.002***	0.000***	−0.000***	0.002***	0.000***	0.000***
	(6.69)	(6.30)	(−21.65)	(5.46)	(7.26)	(16.29)
TRADE	−0.001***	−0.000***	−0.000***	−0.001***	−0.000***	−0.000***
	(−5.08)	(−8.71)	(−32.18)	(−5.41)	(−8.24)	(−17.19)
Year-quarter	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
N	2210	2210	2195	2151	2151	2136
AR (1)	−4.1319***	−2.3839**	−1.3335***	−4.1924***	−2.3818**	−3.8732***
P-value (Sargan)	0.0000	0.0171	0.0182	0.0000	0.0172	0.0000
AR (2)	1.8796	0.910	2.3076	1.8816	0.7755	1.0874
P-value	0.0602	0.3634	0.021	0.0599	0.438	0.3376
Sargan test	41.777	43.7502	53.445	42.646	48.657	46.987
P-value	0.478	0.6151	0.5643	0.5469	0.5589	0.5346
Wald test	93672.07***	229156.04***	1.02E+09***	3.95E+04***	41294.03***	5.27E+04***

The estimators are obtained from the GMM system dynamic panel estimation as proposed by Arellano-Bover (1995)/Blundell and Bond (1998). L1 refers to lag 1. The indicators (***, **, and *) represent the level of significance at (1%, 5% and 10%), respectively

precautionary purposes because these firms expected themselves to face greater climate policy uncertainty.

For endogeneity, we also show the base model estimations using another CPU proxy (CPU_2), which is the volatility of the return series of the world MSCI climate-change index. Volatility is quantified using the GARCH(1,1) model for the daily return series of the index. Table 5 lists the estimation results. The table shows that volatility in the result series of the climate change index offers results similar to those reported when using the CPU. This shows that CPU significantly reduces corporate cash holdings. This means that greater policy uncertainty regarding climate change dampens the cash held by corporations. Hence, the attempt to address the endogeneity problem using an alternative proxy for CPU does not provide new results but confirms the findings of the original model estimations.

5.2.2. High and low climate policy uncertainty

We also examine whether high and low CPU asymmetrically impacts the level of cash held by corporations. Specifically, we explore the effect of asymmetric uncertainty on cash holdings using a size bias test for Hypothesis (H2). The results of this test support the nonlinear specification of the relationship between CPU and cash holdings. As specified previously, CPU^H and CPU^L in Equation (2) represent the direction effect of uncertainty exposure through the high and low uncertainty exposure effects, respectively. This test focuses on whether high and low uncertainty exposures have different effects on the level of cash held by corporations. The other bias test focuses on whether the magnitude of high and low uncertainties in climate policies (CPU^H×CPU_1 and CPU^L×CPU_1, respectively) has a statistically significant effect on the cash held by firms.

We found significant evidence of the existence of a bias test (Table 6). First, we find that higher CPU observations decrease firms' cash holdings, whereas lower CPU observations increase them. This means that high uncertainty impacts the level of cash differently from a low level of uncertainty, supporting that changes in the level of exposure asymmetrically affect cash holdings. Interestingly, we find that lower CPU exposure significantly

Table 6: High and low climate policy uncertainty and corporate cash holdings

Coefficients	GMM sys Blundell and Bond			GMM sys Arellano and Bover		
	(1)	(2)	(3)	(4)	(5)	(6)
	CHO1	CHO2	CHO3	CHO1	CHO2	CHO3
Cons	40.035**	−0.001	−1.293***	14.186	−0.019	−1.290***
	(2.08)	(−0.04)	(−49.98)	(1.17)	(−0.68)	(−49.30)
L1.CHO1	0.924***			0.942***		
	(39.53)			(33.93)		
L1.CHO2		0.899***			0.904***	
		(114.98)			(118.76)	
L1.CHO3			0.145***			0.147***
			(90.79)			(83.93)
CPU^H	−0.895***	−0.003***	−0.018***			
	(−2.65)	(−19.33)	(−29.74)			
CPU^H×CPU_1	0.001***	0.000***	0.000***			
	(2.94)	(7.98)	(28.61)			
CPU^L				0.724***	0.004***	0.017***
				(7.20)	(12.29)	(22.25)
CPU^L×CPU_1				−0.005***	−0.000***	−0.000***
				(−9.66)	(−10.52)	(−13.94)
SIZE	−2.457*	0.000	0.101***	−0.813	0.002	0.100***
	(−1.93)	(0.26)	(56.20)	(−1.04)	(0.81)	(53.79)
LEVERAGE	−0.128***	−0.001***	−0.204***	−0.160***	−0.001***	−0.204***
	(−3.58)	(−30.40)	(−561.80)	(−8.01)	(−23.02)	(−539.64)
ROE	0.015*	0.000***	−0.002***	0.015*	0.000***	−0.002***
	(1.86)	(7.91)	(−107.52)	(1.95)	(5.43)	(−145.33)
COVID	0.382	−0.007***	−0.081***	−0.380	−0.007***	−0.075***
	(1.03)	(−6.89)	(−34.39)	(−1.03)	(−6.12)	(−26.55)
VAT	0.734***	0.003***	0.084***	0.784***	0.003***	0.087***
	(4.59)	(4.92)	(49.07)	(5.99)	(6.22)	(45.01)
GPR	−0.002**	0.000	0.000***	−0.002	0.000	0.000***
	(−2.28)	(0.47)	(44.10)	(−1.55)	(0.14)	(23.94)
SOVEREIGN	0.003***	0.000***	−0.000***	0.004***	0.000***	−0.000***
	(4.90)	(12.72)	(−27.45)	(7.71)	(21.76)	(−20.72)
TRADE	−0.000**	−0.000***	−0.000***	−0.001***	−0.000***	−0.000***
	(−2.19)	(−5.26)	(−25.45)	(−3.24)	(−4.71)	(−20.10)
Year-quarter	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
N	2210	2210	2195	2210	2210	2138
AR (1)	−4.1664***	−2.4107**	−1.3622***	−4.134***	−2.4234**	−1.452**
P-value (Ar1)	0.000	0.0159	0.1731	0.000	0.0154	0.0146
AR (2)	0.84303	1.3824	0.93762	0.82943	1.258	−0.99624
P-value (Ar2)	0.3992	0.1669	0.3484	0.4069	0.2084	0.3191
Sargan	44.812	49.265	53.614	44.861	48.789	56.445
P-value (Sargan)	0.4389	0.4193	0.4129	0.5129	0.4378	0.3346
Wald test	180774.67***	127229.84***	1.74E+09***	5.25E+04***	1.04E+06***	3.50E+07***

The estimators are obtained from the GMM system dynamic panel estimation as proposed by Arellano-Bover (1995)/Blundell and Bond (1998). L1 refers to lag 1. The indicators (***, **, and *) represent the level of significance at (1%, 5% and 10%), respectively

enhances cash levels, while higher CPU exposure significantly reduces cash levels. This suggests that the amount of cash held by UAE corporations asymmetrically responds to high and low levels of CPU.

Considering the interaction variables, we observed no significant difference in the size effect between lower and higher CPU on cash holdings. Within the lower uncertainty events, the increasing relationship between CPU and cash is significantly weakened, but by a very small effect, while the decreasing relationship between CPU and cash within the higher uncertainty events is significantly reduced, but with a very small effect. This indicates that there is no noticeable difference in the size effect between CPU and cash for lower and higher CPU events. To conclude, although firms tend to increase or decrease their cash in response to high and low CPU events, such high and low CPU events do not lead firms to make significant adjustments to their level of cash holdings.

The results reported in Table 6 align with the signaling theory where corporate cash holdings are affected by extreme changes in CPU-new news conveyed by the market. Howevrr, our results contradict the findings of Bates et al. (2009) who stated that higher CPU might not only generate challenges in cash-holding decisions. In light of agency problems between insiders and outsiders, firms may reduce cash holdings because an increase in CPU may increase information asymmetry between firm insiders and outsiders (Bates et al., 2009; Javadi and Masum, 2021). The increase in asymmetric information may intensify agency problems, as managers' opportunistic behaviors are detected less frequently. In this case, managers may waste corporate resources

Table 7: Nonparametric estimation for high and low climate policy uncertainty and corporate cash holdings

Coefficients	(1)	(2)	(3)
	CHO1	CHO2	CHO3
Cons	7.543	0.026	−1.250***
	(0.56)	(0.78)	(−39.72)
L1.CHO1	0.940***		
	(31.38)		
L1.CHO2		0.888***	
		(91.36)	
L1.CHO3			0.148***
			(76.76)
CPU^{H}	−1.488***	−0.006***	−0.016***
	(−3.30)	(−13.04)	(−23.23)
CPU^{H}×CPU_1	0.003***	0.000***	0.000***
	(3.37)	(8.91)	(12.59)
CPU^{L}×CPU_1	−0.001***	−0.000***	−0.000***
	(−3.76)	(−6.07)	(15.19)
SIZE	−0.338	−0.001	0.097***
	(−0.40)	(−0.49)	(43.14)
LEVERAGE	−0.111***	−0.001***	−0.203***
	(−2.80)	(−22.65)	(−514.51)
ROE	0.011	0.000***	−0.002***
	(1.02)	(7.56)	(−132.97)
COVID	−0.262	−0.007***	−0.065***
	(−1.14)	(−4.62)	(−17.53)
VAT	0.822*	0.003***	0.086***
	(1.80)	(5.09)	(31.27)
GPR	−0.001	−0.000	0.000***
	(−1.14)	(−0.07)	(22.18)
SOVEREIGN	0.003***	0.000***	−0.000***
	(6.55)	(11.63)	(−15.23)
TRADE	−0.000***	−0.000***	−0.000***
	(−4.98)	(−4.15)	(−26.03)
Year-quarter	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	2210	2210	2138
AR (1)	−4.1416***	−2.3661**	−1.3069**
P-value (Ar1)	0.0000	0.0180	0.0191
AR (2)	1.6692	1.3124	1.3584
P-value (Ar2)	0.0951	0.1894	0.1743
Sargan	41.6207	48.6893	54.1693
P-value (Sargan)	0.564	0.576	0.559
Wald test	154101.39***	109601.62***	10600. 00***

The estimators are obtained from the use of the GMM system dynamic panel estimation as proposed by Blundell and Bond (1998). L1 refers to lag 1. The indicators (***, **, and *) represent the level of significance at (1%, 5% and 10%), respectively

in order to serve their personal interests. Hence, shareholders may force managers to hold less cash to mitigate managerial opportunism at the shareholders' expense.

For robustness, we re-examine the detrimental effect of CPU on the level of cash using a nonparametric estimation, as shown in Table 7. These results are similar to those reported in Table 6, where high uncertainty exposure impacts the level of cash differently than low uncertainty exposure, supporting the result that changes in the level of exposure asymmetrically affect cash holdings. However, we observed that there is no noticeable difference in the size effect between CPU and cash within the lower and higher CPU events. This means that firms do not show significant adjustments in their cash holding levels during high and low CPU events. This robustness estimation shows results similar to those reported in Table 6.

5.2.3. Firm size effect

To examine the moderating role of firm size on the relationship between CPU and cash holdings, we generate an interaction variable between firm size and CPU (SIZE×CPU) to test hypotheses (H3 and H4). Table 8 presents the results of the analysis. The table indicates that firm size plays a significant role in moderating the impact of CPU on cash holdings. Firm size tends to weaken the detrimental effect of CPU on the cash held by firms. This implies that differences in firm size tend to weaken the decrease in cash held by corporations because of an increase in CPU. Large firms might hold more cash in periods of low CPU events because of their greater growth opportunities, ability to reduce the negative effects of CPU, and higher cash flow generation mechanisms. Large firms might also increase their cash holdings to meet their heavy engagement in RandD and operating activities, despite the expected rise in CPU events. However, small firms may hold less cash because of their low cash-generating capability, limited growth opportunities, and fewer controls on the increase in CPU events. Our results confirm the findings reported by Ayed et al. (2024) who concluded that larger firms hold more cash in periods of greater CPU because such firms are mostly managed by highly talented directors who pay more cash dividends to shareholders. However, our results contradict the study of Ren et al. (2022a, b) who concluded that large firms might be exposed to higher probability of bankruptcy due to a rise in CPU which may face cash shortages (Guizani and Ajmi, 2023).

The other issue examined in this subsection is whether the difference in firm size (large versus small) plays a vital role in the impact of CPU on cash holdings. As mentioned, we generate two dummies representing large and small firms (SIZE^{L} and SIZE^{H}). For large firms, the dummy takes the value of 1 when the total assets of the firm per quarter are higher than the median of the total assets of the full sample firms, and 0 otherwise. The dummy of small firms takes a value of 1 when the total assets of the firm per quarter are lower than the median of the total assets of the full sample firms, and 0 otherwise. These dummies are then multiplied by the CPU proxy to generate the interaction variables (SIZE^{L}×CPU and SIZE^{H}×CPU), which measure the effect of the difference in firm size on the relationship between CPU and cash held by firms.

Table 9 presents the results of the analysis. The results show that large and small firms support the overall sample because they can alter the detrimental effect of CPU on cash holdings. Surprisingly, there appears to be a magnitude effect in the link between CPU and cash held by large and small firms. These results suggest that the detrimental effect of CPU on cash holdings is amplified for small firms and weakened for large firms. This indicates that the level of cash held by large and small firms is influenced differently by changes in CPU, where large firms tend to save some of their lost cash due to CPU, whereas small firms face a greater waste of their cash due to CPU. This indicates that large firms might be more resilient than small firms to CPU, as the former can pursue their risk climate risk-mitigation policies compared to small firms. Given that large firms tend to have higher growth opportunities, greater access to external and internal funding with lower borrowing costs, more authenticity to climate-mitigation policies,

Table 8: Effect of firm size on the link between climate policy uncertainty and corporate cash holdings

Coefficients	GMM sys Blundell and Bond			GMM sys Arellano and Bover		
	(1)	(2)	(3)	(4)	(5)	(6)
	CHO1	CHO2	CHO3	CHO1	CHO2	CHO3
Cons	−1.604*	0.008***	0.134***	1.275	0.012***	0.108***
	(−1.72)	(9.57)	(23.89)	(1.37)	(11.21)	(22.24)
L1.CHO1	0.963***			0.880***		
	(42.35)			(46.80)		
L1.CHO2		0.897***			0.856***	
		(295.50)			(77.91)	
L1.CHO3			0.150***			0.111***
			(193.49)			(235.10)
CPU_1	−0.002***	−0.000***	−0.000***	−0.002***	−0.000***	−0.000***
	(−6.40)	(−11.55)	(−34.19)	(−6.53)	(−12.76)	(−19.42)
SIZE×CPU_1	0.045***	0.000***	0.001***	0.046***	0.000	0.002***
	(10.18)	(4.72)	(18.14)	(9.70)	(0.77)	(28.84)
LEVERAGE	−0.087**	−0.001***	−0.203***	−0.097***	−0.001***	−0.210***
	(−2.31)	(−22.01)	(−1073.54)	(−3.24)	(−18.24)	(−916.03)
ROE	0.002	0.000***	−0.002***	0.002	0.000***	−0.002***
	(0.35)	(8.07)	(−102.08)	(0.18)	(12.70)	(−71.53)
COVID	−0.612***	−0.004***	−0.054***	−1.023***	−0.005***	−0.056***
	(−5.88)	(−12.79)	(−14.74)	(−4.29)	(−12.25)	(−17.89)
VAT	0.075	0.002***	0.071***	−0.168	0.001**	0.049***
	(1.11)	(4.01)	(25.72)	(−1.07)	(2.15)	(29.31)
GPR	0.000	−0.000***	0.000***	0.001	−0.000***	0.000***
	(0.48)	(−11.99)	(5.86)	(0.62)	(−7.26)	(12.28)
SOVEREIGN	0.003***	0.000***	−0.000***	0.003***	0.000***	−0.000***
	(5.11)	(7.81)	(−16.04)	(6.95)	(10.15)	(−6.79)
TRADE	−0.001***	−0.000***	−0.000***	−0.001***	−0.000***	−0.000***
	(−4.08)	(−6.06)	(−23.33)	(−4.42)	(−7.72)	(−19.61)
Year-quarter	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
N	2210	2210	2195	2151	2151	2136
AR (1)	−4.171***	−2.3973**	−1.3129**	−4.111**	−2.3966**	−2.3804**
P-value (Ar1)	0.000	0.0165	0.0189	0.000	0.0165	0.0168
AR (2)	0.8970	1.4374	−1.2814	0.9731	1.4506	−1.4018
P-value (Ar2)	0.3697	0.1506	0.2	0.3305	0.1469	0.161
Sargan	46.139	49.023	55.792	45.134	51.964	56.685
P-value (Sargan)	0.4128	0.4803	0.4462	0.4567	0.5176	0.5298
Wald test	256757.61***	385682.79***	1.29E+09***	1.28E+05***	172064.24***	1.93E+07***

The models are estimated using the GMM system dynamic panel estimation as proposed by Arellano-Bover (1995)/Blundell and Bond (1998). L1 refers to lag 1. The indicators (***, **, and *) represent the level of significance at (1%, 5% and 10%), respectively

Table 9: Effect of high and low firm size on the link between climate policy uncertainty and corporate cash holdings

Coefficients	GMM sys Blundell and Bond			GMM sys Arellano and Bover		
	(1)	(2)	(3)	(4)	(5)	(6)
	CHO1	CHO2	CHO3	CHO1	CHO2	CHO3
Cons	0.827	0.009***	0.321***	1.427	0.012***	0.374***
	(1.02)	(13.48)	(73.29)	(0.47)	(7.16)	(81.37)
L1.CHO1	0.939***			0.921***		
	(57.08)			(17.16)		
L1.CHO2		0.922***			0.871***	
		(141.58)			(42.93)	
L1.CHO3			0.142***			0.103***
			(123.10)			(128.01)
CPU_1	−0.002***	−0.000***	−0.000***	−0.002***	−0.000***	−0.000***
	(−6.68)	(−15.97)	(−17.73)	(−3.25)	(−12.44)	(−39.50)
$SIZE^H$ × CPU_1	0.005***	0.000***	0.000***	0.001	0.000***	0.001***
	(5.18)	(2.67)	(87.67)	(0.77)	(7.20)	(60.04)
$SIZE^L$ × CPU_1	−0.507***	−0.001***	−0.044***	−0.473	−0.001***	−0.062***
	(−2.80)	(−6.59)	(−41.06)	(−1.42)	(−5.58)	(−29.06)
LEVERAGE	−0.126***	−0.001***	−0.205***	−0.142***	−0.001***	−0.212***
	(−5.12)	(−29.99)	(−698.89)	(−5.89)	(−31.28)	(−908.63)
ROE	0.011*	0.000***	0.002***	0.013	0.000***	−0.001***
	(1.81)	(7.21)	(81.70)	(1.35)	(10.64)	(−63.09)

(Contd...)

Table 9: ***(Continued)***

Coefficients	GMM sys Blundell and Bond			GMM sys Arellano and Bover		
	(1)	(2)	(3)	(4)	(5)	(6)
	CHO1	CHO2	CHO3	CHO1	CHO2	CHO3
COVID	−0.422	−0.003***	−0.058***	−1.028***	−0.005***	−0.069***
	(−1.35)	(−5.91)	(−10.72)	(−3.51)	(−10.52)	(−11.96)
VAT	0.169*	0.002***	0.108***	0.424	0.002***	0.117***
	(1.87)	(9.16)	(50.75)	(1.34)	(3.92)	(37.76)
GPR	−0.001*	−0.000***	−0.000***	−0.002	−0.000	−0.000***
	(−1.66)	(−4.68)	(−19.16)	(−1.36)	(−0.83)	(−40.17)
SOVEREIGN	−0.003***	−0.000***	−0.000***	0.002***	0.000***	−0.000***
	(−9.13)	(−5.74)	(−49.66)	(3.34)	(5.65)	(−36.78)
TRADE	−0.000*	−0.000***	−0.000***	−0.001***	−0.000***	−0.000***
	(−1.91)	(−11.58)	(−16.68)	(−3.36)	(−5.78)	(−23.26)
Year-quarter	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
N	2210	2210	2195	2151	2151	2136
AR (1)	−4.1664***	−2.4107**	−1.3622**	−4.134***	−2.4234**	−1.452**
P-value (Ar1)	0.0000	0.0159	0.0173	0.000	0.0154	0.0141
AR (2)	0.84303	1.3824	0.93762	0.82943	1.258	−0.99624
P-value (Ar2)	0.3992	0.1669	0.3484	0.4069	0.2084	0.3191
Sargan	44.812	49.264	53.614	44.860	48.789	56.445
P-value (Sargan)	0.4598	0.5023	0.4768	0.5142	0.4876	0.5032
Wald test	180774.67***	127229.84***	1.74E + 09***	5.25E + 04***	1.04E + 06***	3.50E + 07***

The models are estimated using the GMM system dynamic panel estimation as proposed by Arellano-Bover (1995)/Blundell and Bond (1998). L1 refers to lag 1. The indicators (***, **, and *) represent the level of significance at (1%, 5% and 10%), respectively

and better shareholding monitoring mechanisms, these firms might be able to hold more cash than small firms in periods of greater CPU. The potential political connections with governments and political parties, where institutional, governmental, and managerial shareholders are mostly present in large firms, could enhance the cash positions in periods of high CPU because such political, governmental, and public engagements might offer large firms the advantage of mitigating different types of risk, including CPU.

6. CONCLUSION AND POLICY IMPLICATIONS

This study provides evidence of the adverse effect of CPU on cash holdings for listed corporations in the UAE market. This finding suggests that firms reduce their cash holdings to meet transaction costs, especially CPU costs. This finding supports the climate risk theory of Bolten et al. (2011), and firms in the UAE market support the cash-holding transaction motive.

Our results also show that high and low CPU have different effects on firms' cash holdings, suggesting that corporate cash holdings respond differently to changes in climate-policy risk. Specifically, during periods of high CPU use, firms tend to decrease their cash holdings, whereas during periods of low CPU use, firms tend to increase their cash holdings. However, the size or magnitude of the effect of the change in CPU on cash differs in both periods. In periods of high CPU, firms tend to have a greater reduction in cash, whereas in periods of low CPU, they tend to have a smaller increase in cash. This can be interpreted by the fact that in extreme periods, CPU may face uncertain situations that prevent them from appropriately determining the level of cash that should be held due to negative consequences, as well as urgent financial situations.

We report that firm size alters the effect of CPU on cash holdings, suggesting that firm size weakens this adverse effect. For large firms, cash holdings tend to have a lower negative CPU effect, whereas small firms tend to have a higher negative CPU effect. This suggests that large firms can retain more cash or eliminate the negative effects of CPU better than small firms can. This can happen because large firms tend to have greater access to external and internal funding, higher profitability, and market share than small firms, thereby avoiding CPU and retaining more cash. Furthermore, firms may be less affected by changes in climate policy because of their highly regulated contracts and commitments to climate risk.

The findings of this study have important policy implications. They offer insights into the use of better climate policies for the development of firms, not only for the UAE market, but also for worldwide markets, as parties are concerned about the impact of climate change risks on cash holdings, such as risk managers, shareholders, the government, and climate policy developers. Our results can help governments focus on improving climate policies to eliminate the risks associated with these policies, thereby promoting sustainable development. Adopting a forward-looking climate policy can offer different sources of information to ensure that an enhanced climate policy can improve firm-level cash holdings in the long run. Our results can help firms that fail to maintain the appropriate amount of cash holdings that fit with climate-policy stability to place appropriate supportive measures against climate-policy risks, which ultimately reduce the effectiveness of these policies on cash holdings. In the case of CPU, insufficient long-term investments and reduced free cash flow, profitability, and productivity are important factors for private firms to take care of. Policymakers are advised to find ways to reduce the risks generated by increasing policy uncertainty. They can follow a modelling approach to examine a range of sources of risk and incorporate different assumptions about the nature of climate change policy risks. This can help identify effective approaches for providing robust policy-relevant insights into the nature of cash-holding incentives created by climate change policies.

Our results are beneficial to shareholders and managers. To avoid the negative impact of CPU on cash holdings, they must reduce agency costs, asymmetric information, and adverse selection problems and activate shareholders' monitoring mechanisms. By focusing on improving cash-holding policies and productivity and reducing costs and financing constraints, they can efficiently mitigate the risks associated with CPU and enhance the development of their firms and, ultimately, the real economy. Policymakers in the UAE may formulate targeted support policies according to the characteristics of their firms. In addition to the UAE market, our findings reveal societal and global impacts relevant to other markets. Other governments can improve their policies to deal with CPU, stabilize financial markets, and promote economic development by developing special economic policies tailored to the effect of CPU on corporations' cash holdings. To avoid deficient monitoring of mechanisms, policymakers and regulators may collaborate to enhance the structure of risk regulation mechanisms. Firms can improve their ability to identify CPU procedures and reduce asset allocation risks, particularly in cash portfolios. As the global economy gradually expands, managers are required to strengthen their firms' internal risk management and supervision in an enforceable manner and incorporate CPU indicators into their existing risk management indicators, which mainly arise from the risks associated with financial decisions.

Research limitations are noticed in this paper. First, the paper focuses on only the UAE corporations while firms other countries in the Gulf cooperative Council (GCC) might be included to make the study more comprehensive, given the effect of the global CPU proxy. Second, Relying on one specific CPU index may result in some shortcomings allowing for using alternative CPU proxies especially those of country-specific measures. Another limitation is the adoption of limited control variables in the model. In this case, other variables might be used to make the results more meaningful. These additional variables might represent firm characteristics, especially those directly influencing the degree of cash holdings such as trade credit, short term investment and inventories

Further research should be conducted to improve the results of this research. One possible research direction is to examine the mediating effect of value-added tax (VAT) on the impact of CPU on cash holdings since VAT was introduced at the beginning of 2018. This study provides new evidence to improve the results of our research idea in this paper. Furthermore, the role of tax avoidance in the link between CPU and cash holdings for corporations in different countries can be examined. Studying corporate tax avoidance in other markets could lead to further exploration of the effect of variations in CPU on cash. Future research could also consider the effect of institutional, economic, or country-specific regulations, such as tax reforms, labor laws, and governmental policy changes. Determining the effect of the CPU index may result in some shortcomings, calling for the use of alternative CPU proxies (country-specific measures) rather than the global index used in our study.

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