Climate Change and Investment Efficiency in Egyptian Firms: The Moderating Effect of Cash Holding

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Abstract

The main objective of this study is to investigate the impact of Climate Change on Investment Efficiency in light of the presence of the Cash holding as a moderator variable affecting this relationship.

The Study methodology relies on the content analysis approach by examining and analyzing the financial reports published for a sample consisting of (37) firms listed at the Egyptian Stock Exchange (EGX) with a total of 259 observations from 2015 to 2021 The research hypotheses were tested using the panel corrected standard errors (PCSE) method and the feasible generalized least squares (FGLS) method.

The results of the study concluded that climate change has a negative effect on the investment efficiency in the Egyptian listed firms. Also, Egyptian firms with a high level of CH have a tendency to invest at a higher rate. In addition to, cash holdings in Egyptian listed firms support the Negative relationship between climate change and investment efficiency.

Based on this results, Egyptians Firms should cash holding as a cushion against climate change risks, support liquidity, overcome financial distress risk, lower the cost of capital, increase future investment opportunities and reduce uncertainty. Additionally, policymakers, Regulators at the EGX and Financial Regulatory Authority need to realize the importance of climate change and increase the support for firms that adopt environmentally conscious business practices such as the conservation of natural resources, the production of alternative energy sources and the implementation of clean air and water projects in Egyptian listed firms in accordance with Egypt's Vision 2030.

Keywords - Climate Change, Investment Efficiency, Cash Holding.

1. Introduction

The environment is the main source of natural economic resources on which economic activity is based. However, technological developments and economic and industrial progress in all fields have changed the businesses' dynamics, increased harmful emissions and depleted natural resources, which resulted in the phenomenon of climate change. **The Intergovernmental Panel on Climate Change (IPCC)** refers to climate change as a change in the mean and/or the variability of its properties, and

that persists for an extended period, typically decades or longer. According to the **United Nations Framework Convention**, a change in the climate is due directly or indirectly to human activities, which lead to a noticeable change in the composition of the atmosphere in addition to the natural variability of the climate over time periods. Thus, global environment rising prominence of climate change and greenhouse gases (GHGs) emission issues. One of the significant challenges to minimize greenhouse gas (GHG) emissions and adaptation to climate change and sustainability (Zhang *et al*., 2019).

Therefore, climate change and the rise in global temperature are one of the primary threats and environmental and natural issues facing emerging countries more than developed countries, because they are affected more than developed countries and cause many environmental problems, including global greenhouse gas emissions. warming as a result of relying on fossil fuels such as coal, oil and gas as a major source of energy with about 78% of the energy used in the world, whose combustion results in emissions of huge amounts of gases, including carbon dioxide (CO2), which is primarily responsible for the phenomenon of global warming, which causes more pressure and its inability To address these problems (Blakeslee and Fishman, 2018), as well as deforestation and trees, which are an important component of the absorption of Greenhouse Gases (GHG). Climate change and global warming represent a major cause of the spread of epidemics, including the spread of the Covid-19 virus in 2019, which was confirmed by the World Health Organization (WHO) as the transmission of this virus from animals to humans (*Eabris, 2020*), Therefor Carbon emissions negatively affect people health, causes environmental degradation and sustainability.

According to Adams *et al*. (2018)**,** years 2015 and 2016 witnessed a decline in global greenhouse gas (GHG) emissions, especially carbon dioxide emissions, due to investments in renewable energy, especially solar energy and wind energy in the United States and the European Union. Adger *et al*. (2015) and Beine and Parsons (2017), indicated that greenhouse gas emissions increased in 2017 and 2018 to reach a new record of about 36.2 and 37.1 Giga tones, respectively, of carbon dioxide equivalent (Gt CO2 equivalent) as a standard measure for expressing greenhouse gas emissions (it is a mass of greenhouse gases equivalent to one ton of carbon dioxide), excluding greenhouse gases from land use due to the increase in global coal consumption by China and India. According to the world watch institute, about 90% of greenhouse gas emissions result from human activities, 10% as a result of natural activities. Among the most important sectors that cause greenhouse gas emissions are the energy sector (power stations), the manufacturing and construction industries sector (cement companies, iron and steel companies, aluminum smelters, lead), transportation and aviation, therefore efforts of firms operating in highly polluting

industries to reduce greenhouse gas emissions increase because of their negative effects on the environment (Han *et al*., 2023) , this prompted firms around the world to quantify emissions and report them to stakeholders to meet legislative Requirements, carbon trading, or as part of social responsibility and reduce emissions to gain a competitive advantage.

Egypt is highly vulnerable to climate change, according to **intergovernmental panel on climate (IPCC)**, stated that Egypt is one of three "highly dangerous" hotspots in the world, and future projections indicate that Egypt will suffer from the following as a result of climate change: sea level rise, Water scarcity, and the increase in the frequency and intensity of extreme weather events, such as heat waves, floods, heavy rains, and sand and dust storms (Kamal *et al*., 2021). Quantitative estimates of greenhouse gases in Egypt indicate about 197 million tons of carbon dioxide equivalent (2012-2014) According to the data of the **Central Agency for Public Mobilization and Statistics (CAMPAS)** on the amount of carbon dioxide emissions, the electricity and industry sectors are the main sources of these emissions resulting from the consumption of petroleum products by 40% and 16%, respectively. Although Egypt's emissions of greenhouse gases represent only 0.56% of the global total in 2019, it is the country most affected by the effects of climate change (Gawande *et al*., 2017)**.**

Egypt witnessed a rise in total carbon emissions by 140% during the period (1990-2016), with an annual average of 3.5%. The growth in total emissions in Egypt during that period was three times faster than the global average. However, an improvement in the carbon footprint of Egypt during the period (2016-2020), according to what came in the USAID report for the year 2015 (www.USAID.org). Furthermore, Egypt advanced 35 places in the Environmental Sustainability Index issued by the World Economic Forum, which measures the extent of protection of natural resources and the extent of vulnerability and preparedness for climate change, as it ranked 42 in 2021, compared to 77 in 2015. However, by 2026, global renewable electricity capacity is expected to rise by more from 60% of 2020 levels to more than 4,800 kilowatts, equivalent to the total Current global energy capacity of electricity generated from fossil fuel plants. It is also Renewable energy sources are likely to account for approximately 95% of the increase in capacity Global energy until 2026, solar PV alone provides more than half, as it is expected that the amount of renewable energy added during the period from 2021 to 2026 50% higher than from 2015 to 2020 (**www.iea.org**). Thus, Egypt aims to prepare the national strategy for climate change and move towards Green projects and the use of renewable energy 2050, and defining a low-carbon emissions strategy to achieve sustainable development in accordance with Vision 2030.

In this regard, Egypt has realized the seriousness and importance of the phenomenon of climate change, and this is what prompted it to ratify the number of international protocols and agreements were formulated to reduce this phenomenon and its environmental, social and economic repercussions, most notably the United Nations Framework Convention UNFCCC in 1994, as well as the adoption of the Kyoto protocol 1997 is considered to be the largest government-mandated market-based mechanism to reduce GHG emissions, and finally ratifying the Paris Agreement 2016. Also, Egypt has issued the Egyptian Environment Law No. (4) of 1994, amended by Law No. (9) of 2009 and its executive regulations, which includes a number of articles with the aim of protecting the environment from greenhouse gas emissions that cause global warming and setting maximum limits for these emissions, Resolutions (107 & 108) issued by the Egyptian Financial Supervision Authority, as well as a set of environmental penalties and fines.

Moreover, Egypt hosted the World Climate Summit (Conference of the Parties to the upcoming United Nations Convention on Climate Change) in its twenty-seventh session, COP27, in Sharm El-Sheikh in November 2022. When these limits are exceeded, the government also launched the National Strategy for Climate Change in Egypt 2050 through a ceremony organized by the Ministry of Environment in May 2022, in light of Egypt's Vision 2030, which is facing the challenges of climate change. Thus, environmental corporate social responsibility (CSR) such as carbon emissions management has become an important aspect of societal expectations toward firms (Flammer, 2013). As well as meeting the needs of stakeholders through the Firms voluntary disclosure in their annual reports, environmental reports, or independent sustainability reports of environmental information in addition to information related to climate change, for example (climate change policy, the amount of greenhouse gas emissions, initiatives to reduce greenhouse gas emissions, initiatives Improving energy efficiency, and using clean energy sources such as biofuels.

Prior studies have focused on investment efficiency, metrics, and determinants in different countries (Chen *et al*.,2011; Wang *et al*., 2015; Houcine, 2017; Gan ,2019; Yu *et al*.,2022). Investment efficiency has been defined by Biddle *et al*. (2009), Chen *et al*. (2010), Wang *et al*. (2015) and Majeed *et al*. (2018) as “firms undertake projects with a positive net present value and avoid projects with negative NPV”. Biddle *et al*. (2009) indicated Investment efficiency is related to the optimal level of investment when the marginal benefit is equal to the marginal cost of investment and is determined by the increase in Firm net value. However, the optimal level of investment is often rare, and therefore failure to achieve this level results in inefficient investment decisions**.** Biddle *et al*. (2009) and Chen *et al*. (2011) indicated the inefficiency of

investment as an over- investment when the company undertakes projects with a negative net present value or purchases unnecessary assets for the company or expresses a low investment that is less than necessary, which means that there are positive investment opportunities and the company does not implement it. Investment efficiency is linked to Firm's Ability and success in allocating its available resources optimally (Chen *et al*.,2017).

Investment efficiency enhances firm profitability, competitiveness, and thus enhances the efficiency of the national economy. However, there are difficulties that impede the achievement of investment efficiency, the most important of which is the problem of climate change, which exposes companies to an uncertain environment, climate-related risks that can affect the company's financial statements, whether they are material risks resulting from climate-related disasters, for example, the exposure of facilities to damage due to Extreme weather or risks associated with the transition to a low-carbon economy (Dutta and Dutta, 2021). Where these risks lead to a higher actual investment made by the company than the expected investment, which indicates that there is Over-Investment. The actual investment may be lower than the expected investment, which indicates a Under - Investment, as the management avoids investing in projects with a net positive net present value, due to financial restrictions that limit the provision of adequate financing, or the management's preference for a quiet life away from bearing the risks of the investment process (Myers and Majluf, 1984; Herbert and Harto,2021).

In the Egyptian business environment, Egyptian business firms have recently tended, according to the vision of sustainable development for Egypt 2030, towards achieving competitive sustainability by expanding the scope of corporate goals to include economic goals in addition to environmental, social and governance goals (Dierkes and Siepelmeyer, 2019), in addition to, adopting modern technologies and strategies to increase profits and ensure their sustainability and increase Its competitiveness and then reduce the expectations gap between management and current and prospective investors and attract more investment opportunities. Firms that have higher carbon intensity experience numerous risks, which impedes the ability of firms to invest in profitable projects and negatively affects the firm value. However, none of the prior studies examined the effect of Climate Change on Investment efficiency, especially in emerging economies like Egypt. In this case, the research fills a gap in the literature by investigating the effect of Climate Change on Investment efficiency of firms listed at the Egyptian Stock Exchange (EGX).

Regarding the relationship between cash holdings and Climate change, there is a huge literature related to cash holdings and investors' perceptions of the intense use of cash in firms. Based on the previous studies, there are two contrasting incentives for managers to perform Cash Holding practices. This indicates that companies keep more cash holdings as a precaution when exposed to climatic changes. First, according to the theory based on natural resources, which links climate-related risks with the financial decision of the firm (Harts ,1995)**.** Second, managers resort to increasing the level of cash holding in order to provide sufficient financial liquidity to ensure the efficiency of its investment policy and financing investments opportunities in light of the high cost of obtaining external financing **(**Opler *et al*., 1991; Tawiah and O'Connor Keefe, 2022)**.** Some studies explored the link between Cash holding and investment efficiency of the firm, like Denis and Sibilkov (2010) and Chuan *et al*. (2019) who found a positive effect of Cash holding on investment opportunities and the firm's future financial risks. On the contrary, other studies have revealed the negative impact of Cash Holding on investment efficiency of the firm (Huang *et al*., 2015; Gulen and Ion ,2016; Nguyen and Phan ,2019; Moolchandani and Kar, 2021; Tran *et al*., 2021; Wen *et al*., 2021; Xu *et al*., 2021)**.**

In the Arabian and Egyptian contexts, few prior studies have been interested in investigating determinants of investment efficiency such as (Ali ,2017; Menshawy *et al*., 2021; Khalaf,2020). Ali (2017) concluded the quality of financial reports negatively affects investment efficiency. It was found that 36% of the sample (73 Egyptian companies) suffer from an increase in investment, and the rest of the sample (64%) suffer from a lack of investment. Menshawy *et al*. (2021) concluded: The independence of the board of directors, compensation, leadership, and job concerns of the CEO have a negative impact on the investment efficiency. Using a sample of listed Egyptian firms, On the other hand, Khalaf (2020) recently concluded that High quality of corporate financial reports positively affects investment efficiency.

According to the above discussions, emerging economies such as Egypt have a scarcity of studies that test the link between climate change, cash holding and investment efficiency. Consistent with natural resources theory, liquidity preference theory, the current study adds evidence to the literature on investment efficiency by investigating the effect of climate change on investment efficiency in emerging economies. According to Egypt's Vision 2030, the empirical findings in this study extend previous findings by providing strong additional evidence in emerging countries regarding the moderating effect of cash holdings on the link between climate change and investment efficiency. To the best of the researcher's knowledge, this is the first study that considers the role of cash holding, as a moderator variable, on the

association between climate change and investment efficiency in the Egyptian context. The findings would help investors to evaluate the firms 'taking action on a real threat and combat the dramatic consequences of global warming, climate change, and environmental pollution, while capitalizing on the transition toward a lower carbon economy.

This study highlights the importance of climate change for firms in emerging markets, the transition towards a green low-carbon economy and the environmental, economic and social challenges it poses, which can impose significant damage to corporate profits, significant negative effects on long-run economic growth. Consistent with policies that attempt to moderate such effects, Firms may hold cash to support liquidity, overcome financial distress risk, reduce uncertainty and increase future investment opportunities. The results would also help the policymakers, regulators at the EGX and Financial Regulatory Authority and stakeholders to realize the importance of climate change, anti-climate change measures such as fiscal incentives coupled to sustainability like financial products to encourage the mobilization of private capital into climate finance and increase the support for firms that adopt environmentally conscious business practices such as the conservation of natural resources, the production of alternative energy sources and the implementation of clean air and water projects in Egyptian listed firms in accordance with Egypt's Vision 2030.

Research motivated to conduct this study in the context of Egypt because Egypt is a developing economy that has recently suffered from economic instability, political instability, market inefficiency, and poor shareholder protection. In this line, Blakeslee and Fishman (2018) indicated that Climate change and global warming are among the most important threats developing countries compared to developed countries. Such instability could affect the managerial decisions of firms operating in Egypt. More specifically, Climate change, political and economic instability can trigger managers to hold cash as a cushion against climate change risks and cash shortages. Attempting to contribute to enhancing the research in this field in Egypt, the study offers the following questions: First, what is the effect of Climate change on the investment efficiency of firms listed at EGX? Second, how do Cash holdings affect the relationship between Climate change and investment efficiency?

The remainder of the current study is designed as follows: Section 2 presents the literature review and develops hypotheses, Section 3 explains the research methodology, Section 4 discusses the data analysis and reports the findings and Section 5 presents the conclusions.

2. Literature Review and Hypotheses Development

2.1 The Impact of Climate Change on Investment Efficiency

Some previous studies documented a negative effect of climate change on economic growth and prosperity (Giglio *et al*., 2018; Caby *et al*., 2022; Zhang,2022). As economic progress that depends on fossil fuels exacerbates the climate change crisis and thus impedes economic growth. Moreover, Giglio *et al*. (2018) point out, climate change constitutes "a rare event with potentially devastating consequences for the economy." Here, the need to switch to alternative energy and reduce carbon emissions emerges. (Gelzinis and Steele, 2019) indicated that If temperatures rise to 4°C above pre-industrial levels over the next 80 years, global economic losses could reach US$23 trillion annually. Addoum *et al*. (2020) Show that extreme temperatures can negatively affect corporate profits, reducing revenue and operating income. The evidence provided by Lagarde (2020) revealed that Total economic losses have increased from about US$60 billion in 1980 to US$150 billion in 2019, peaking at US$350 billion in 2018.Zhang (2022) Found that overall stock markets negatively respond to increased climate risks.

Firms of higher carbon intensity are likely to face more severe financing constraints than their clean peers to obtain external financing as inability to borrow because of heightened carbon risks, or an inability to issue equity a risk premium for shareholders to compensate for the carbon risk the firm bears (Wang *et al*.,2018; Krueger *et al*.,2020; Trinks *et al*., 2020). Which leads to impedes the ability of firms to invest in profitable projects and negatively affects the firm value. Moreover, Investors exclude high-emitting sectors or firms (Nguyen, 2018; Krueger *et al*., 2020; Trinks *et al*., 2020). Therefore, financially constrained companies often lack the necessary funds to finance investment opportunities with a positive net present value. Thus, the financial constraints can be seen as a deviation of the actual investment level of the facility from the optimal investment level.

The country takes many policies to reduce carbon emissions and Greenhouse Gases emissions and contributes to stabilizing climate change. However, these policies create substantial risks for firms as uncertain future cost of emitting carbon (carbon risk) (Eccles *et al*., 2011; Trinks *et al*., 2020). The additional compliance of complying with laws and regulations environmental reducing emissions affect the productivity

and competitive advantage of firms (Nguyen, 2018). as well as increasing the environmental firms' total cost and reducing profitability and future net cash inflows then the stock returns of the companies will decline (Shen *et al*.,2023). However, additional compliance with environmental laws and regulations provides opportunities according to the Porter Hypothesis, it was formulated in the mid-1990s and has been completely ignored in recent work on climate change. According to the hypothesis of Porter (Porter and Linde, 1995), strict environmental regulations can improve co-efficiency, encourage innovation and competitive Opportunities. Also, Lewandowski (2017) Found higher short-term profitability in low-carbon firms that help improve business competitiveness. Offering loans to environmentally friendly Firms, thus reducing risk taking and more innovative projects (Gangi *et al*., 2019). Moreover, Kumarasiri and Gunasekarage (2017) reveals that, while perceiving climate change risk as a threat (both financial and reputational), company managers believed that climate change risk presented them with opportunities to develop new renewable energy sources, introduce low carbon products, and support their customers in managing their emissions.

Consistent with natural resource-based view (NRBV) theory, where sustainable environmental practices focus on waste reduction and emission from existing operations, it results in a decrease in regulatory costs, minimized liabilities, and consequently improves financial performance (Sarkis and Cordeiro, 2001). Therefore, firms with climate-friendly practices a reduce GHG emissions are favorably evaluated by financial markets (Delmas *et al*., 2013). Caby *et al*. (2022) refers to the overall quality of climate change management and disclosure positively impacts profitability. Boakye *et al*. (2020) observe a significant and nonlinear (concave) relationship between sustainable environmental practices as energy efficiency practices, greenhouse gases, material, and resource efficiency and firms' financial performance among small and medium-sized enterprises (SMEs) in the UK. furthermore, if a firm's managers care about these pressures or obtain other private benefits from E&S investments, they will They will overinvest (Cheng *et al*., 2013; Masulis and Reza, 2015; Cronqvist and Yu, 2017).

High performing CSR Firms invest more efficiently, as they are less likely to invest in projects with a negative net present value (overinvestment) and less likely to abandon projects with a positive net present value (underinvestment) (Samet and Jarboui,2017; Cook *et al*.,2018).

Some studies documented a positive impact of Climate Change on a firm's reputation and investor satisfaction (Clarkson *et al*., 2008; Choi and Noh,2016; Siddique *et al*., 2021). Clarkson *et al*., (2008) found that investors are even more likely to react positively to a firm voluntarily disclosing emissions data in cases in which this information was previously not available to the public. Choi and Noh (2016) argued that firms that disclose voluntary disclosure of information on carbon emissions have a more positive effect on the capital market and credit ratings than firms that do not make these disclosures. However, they emphasize that despite the positive role of voluntary disclosure, carbon emissions negatively affect credit ratings if they are too high. Moreover, Siddique *et al*. (2021) examined how carbon disclosure affects financial performance with a sample of 500 global firms from 2011 to 2015. results show that carbon disclosure negatively (positively) affects financial performance in the short-term (long-term), consistent with the signaling theory. in addition to help regulators to monitor carbon disclosure and assist investors with investment decisions.

Chen and Chu (2022) argued that although infrastructure deteriorates due to climate change however the adverse effects can be mitigated by expanding investments in infrastructure projects and low-carbon sectors. However, there is a positive relationship between carbon efficiency and market value because Carbon efficient firms exhibit superior resource efficiency (Lewandowski, 2018), investors attach a positive evaluation for these firms then positive on market value and increase future cash flows. Good environmental practices make the firm attractive to important stakeholders like quality employees and management as this could lead to positive operational efficiency and cost reduction (Hart and Ahuja, 1995; Ramanathan, 2016). the issue of global warming has become increasingly salient, firms' disclosure of carbon emissions is a critical component of stakeholders' decision-making (Luo and Tang, 2014). Stakeholders, therefore, encourage firms to disclose information about their carbon emissions (Luo *et al*., 2013). In recent times, stakeholders, such as shareholders, consumers and regulatory authorities, have started exerting pressure on corporations to decrease their GHG emissions (Siddique *et al*.,2021).

Based on the above discussions, emerging countries such as Egypt, lack studies that examine the association between Climate Change and Investment efficiency. Then, the first hypothesis will be stated as follows:

H1. Climate Change has a negative impact on Investment efficiency in Egyptian firms.

2.2 The Impact of Cash Holding on the Relationship between Climate Change and Investment Efficiency

Many studies have shown different relationships between Cash holdings and other variables such as the cost of external financing, market value, financial constraints and financial risks (Bates *et al*., 2009; Denis and Sibilkov,2010; Harford *et al*., 2014; Asimakopoulos *et al*., 2019; Chuan *et al*., 2019; Cruz *et al*., 2019; Dimitropoulos *et al*., 2020; Moolchandani and Kar,2021). Yet, CHs constitute an essential element of the total assets of firms (Opler et al., 1999; Bates et al., 2009). Mouline (2021) documented that large American digital companies such as Google, Amazon, Facebook, and Apple Microsoft (GAFAM) increased their liquidity levels and cash Holdings.

Some studies find that climate change exposes firms to an uncertain environment. U-Din et *al. (2022*) Found higher stock market volatility due to catastrophes of the Canadian weather. *Huang et al. (2018*), find that the likelihood of loss from major storms, flooding, heat waves, and other natural disasters is associated with lower and more volatile earnings and cash flows. Also, *Kling et al. (2021*) Found that climate vulnerability could affect firms' cost of capital and access to finance. Also, *Balvers et al. (2017*) demonstrated the negative impact of temperature shocks on the average cost of equity capital on a sample of U.S. firms for the time span 1953 to 2015. On the other hand, *Addoum et al. (2020*) Found no statistically significant effect of temperature exposure on annual and quarterly firm-level sales, productivity and profitability in the case of U.S. firms over the period 1990-2015, excepting the energy sector. Also, *Tzouvanas et al. (2019*) provided empirical evidence for a nonlinear effect of temperature on systemic risk.

In light of the economic recession, economic fluctuations, and conditions of uncertainty surrounding the work environment, firm management may resort to increasing the level of cash holding in order to provide sufficient financial liquidity to ensure the efficiency of its investment policy and financing investments opportunities in light of the high cost of obtaining external financing compared to the cost of internal financing, which leads to Exacerbate corporate financial constraints (Pástor and Veronesi, 2013; Gilchrist *et al*., 2014;Brogaard and Detzel, 2015). In addition to mitigating potential future cash deficit shocks as a result of expected economic conditions, and as an attempt to hedge against the risks of operating cash flow deficit as a result of its unexpected fluctuations.

Some previous studies indicated that uncertainty and financial constraints cause a firm to hold more cash to ensure sufficient funds for business operations and to absorb future risks. Huang *et al*. (2018) found that firms in countries that are more exposed to physical risk retain more cash and reduce dividends. Also, Tawiah and O'Connor Keefe (2022) indicated how Firms could keep more money during the COVID-19 pandemic as a precautionary strategy. Thus, financial constraints are the main factor in Firms retaining more liquidity as a precaution against upcoming unexpected economic shocks (Opler *et al*., 1991), especially companies with a higher carbon intensity than their clean peers (Wang *et al*.,2018; Krueger *et al*., 2020).

Thus, companies keep more cash holdings as a precaution when exposed to climatic changes according to the theory based on natural resources, which links climate-related risks with the financial decision of the firm (Harts,1995). Hasan *et al*. (2022) indicated that climate risks motivate firms to hold more cash as a precautionary motivation against uncertainty and use short-term debt due to the deterioration of cash flow. Javadi *et al*. (2021) and Magerakis and Habib (2022) Showed that firms hold cash as a hedge against local climate risk. Furthermore, Brahmana and Kontesa (2023) indicated that climatic deviations resulting from climate change, such as rising sea temperatures for the fishing industry, lead to increased business risks and increased uncertainty, which leads to retaining more cash, and climate change may lead to a decrease in corporate investment due to Its financial conservatism affects the economic growth of the country. Consequently, Firms become more financially conservative when faced with environmental uncertainty, inducing firms to hold more cash, which Businesses are negatively affected by climate change.

The emerging literature in finance provides both theoretical and empirical evidence that institutional investors should consider climate risks in their investment decisions (Krueger et al., 2020). Where investors believe that climate change is a risk, due to the great uncertainty regarding climate change and its consequences (Barnett *et al*., 2020). Therefore, carbon disclosure has been gaining increasing importance in recent years to help firms communicate their climate change activities to their stakeholders and creditors through environment disclosures, to make better investment decisions (Hahn *et al*.,2015; Uyar ,2020). These disclosures help regulators agencies, institutional investors, and the public to better monitor and regulate a firm's carbon emissions, affecting the firm's financial performance (Shen *et al*., 2019). Even though carbon emissions data for firms is often considered a negative aspect, many firms nevertheless seek to disclose this information voluntarily. Voluntarily disclosing information about carbon emissions the uncertainty of future cash flow is reduced, resulting in a lower cost of capital, competitive economic advantage and increasing firm value according to signaling theory Thus, the investment efficiency improves

(Beyer *et al*., 2010 ;Armstrong *et al*., 2012).Some studies have shown Golmohammadi *et al*. (2017) and Benlemlih and Bitar (2018) that failure to meet the expectations of stakeholders leads to Market fears on the Firm and the loss of profitable investment opportunities for it, which leads to a decrease in the efficiency of its investments, so companies respond to the requirements of stakeholders by improving their financial and social performance as a result of increasing the efficiency of their investments. Given the dual objective of integrated reporting, namely improved information for outside providers of financial capital and better internal decision making, it is possible that high quality integrated reports can improve investment efficiency by reducing information asymmetry and improving shareholders' monitoring ability (Biddle *et al*., 2009).

Recent studies indicated a negative impact of Cash Holding on investment efficiency. Huang *et al*. (2015) Found that Cash Holding leads to overinvestment, which represents a heavy burden on shareholders due to the high cost of agency. Gulen and Ion (2016) and Nguyen and Phan (2019) reported that firms are more likely to delay investments amid high economic policy uncertainty. Also, Moolchandani and Kar (2021) confirmed that excessive retention of cash assets negatively affects the market evaluation of the company due to the negative evaluation of investors in exaggerating the company's retention of cash assets, in addition to, *Xu et al. (2021)* the high cost of external financing in high-growth industries, which increases the value of holding cash assets. Furthermore, Su *et al*. (2020), Wen *et al.* (2021) and Tran *et al*. (2021) found that the economic policy uncertainty (EPU) may lead businesses to reduce the firms' risk-taking, cash spending, and investment, then affects firms' financial decisions. firms may choose to delay investment amid high uncertainty (Bernanke, 1983; Gulen and Ion, 2016*)*, which also leads to an increase in cash holdings.

In contrast to the previous literature, several studies indicated a positive impact of Cash Holding on investment efficiency. Chen *et al*. (2020*)* Excessive confidence among executive managers pushes them to exploit cash assets in risky investments along with retaining or over-holding cash assets, and managers with excessive confidence are abler to deal with these high-risk projects than other managers, which reflects positively on the market value of retention with Cash assets. Denis and Sibilkov (2010) Found that firms with higher cash holdings tend to invest at a higher rate. Accordingly, increased cash holdings can provide flexibility that allows firms to exploit future profitable investment opportunities when uncertainty recedes. Moreover, Chuan *et al*. (2019) emphasized the importance of retaining cash for business enterprises that suffer from future financial risks compared to those enterprises that have large cash flows. The study also concluded that high cash holding may be subject to higher risks.

Regarding the CH in Egyptian firms, Dittmar *et al*. (2003) indicated that Egyptian firms keep relatively significant cash resources. According to Otaify *et al*. (2022), Egyptian firms tend to hold liquid assets as a cash alternative in managing their working capital and use debt as a cash alternative in funding their operations. Furthermore, Egyptian firms prefer to hold more cash during periods of high political instability. The level of cash holding has increased in Egypt, according to the Central Agency for Public Mobilization and Statistics **(CAPMAS)** that cash balances increased by 41.9%, reaching LE 456.5 billion ($25.45 billion) in 2015/2016 compared to LE 322 billion ($17.95 billion) in 2014-2015 *(Shehata and Rashed, 2021).*

Based on the above discussions, prior studies argued the impact of CH on Climate Change and Investment efficiency in developed countries. According to Egypt's Vision 2030 and vision of sustainable development towards achieving competitive sustainability by expanding the scope of corporate goals to include economic goals in addition to environmental, social and governance goals in recent years, we expect that Cash Holding may affect the relationship between Climate Change and Investment efficiency in emerging countries like Egypt. We assume that the relationship between Climate Change and Investment efficiency depends on how Climate Change is affected by Cash Holding. Accordingly, we examine whether there is an interaction between Cash Holding and Climate Change in affecting the Investment efficiency. Cash Holding is important as it could moderate the effect of Climate Change and Investment efficiency. Then, the second hypothesis will be formulated as follows:

***H2*. Cash Holding has a moderating Impact on the Relationship between Climate Change and Investment Efficiency in Egyptian Firms.**

3. Research Methodology

3.1 Selection of the Sample

The study population consists of the Egyptian companies included in the EGX 100 index, as this index includes the best performing Firms according to the standards of environment, social responsibility and governance (ESG), because Firms registered in the EGX 100 index are evaluated annually to choose the best 30 Firms at most to have the appropriate arrangement in the Egyptian Index S&P/EGX ESG Sustainability According to several indicators, including the extent to which it fulfills its environmental responsibility, which includes gas emissions, and setting specific targets to reduce those emissions. Data was collected from the annual reports, Sustainability reports and carbon footprint report of a sample of Egyptian companies

for a period of five years from 2015 to 2021, with a total of 700 observations. This study began in 2015 and does not include the years prior to 2015 due to the events of the revolutions in Egypt. This study also excluded the banking and financial institutions sectors because the determination of CASH depends on the regulations prepared by the financial institutions in Egypt, they adhere to different regulations. The final sample consisted of 259 observations of 37 listed non-financial Egyptian companies, whose annual reports were obtained through Thomson Reuters. Table 1 shows the criteria for selecting the sample in this study.

Table 1

Sample selection

	Firms	Observations
Population	**100**	**700**
(-) Financial institutions and banks	**(18)**	**(126)**
(-) Missing data items	**(45)**	**(315)**
Final sample	**37**	**259**

3.2 variables Measurement

3.2.1 Climate Change (CC)

Carbon footprint (C.F) as a quantitative measure of carbon dioxide emissions (Adger *et al*., 2015; Beine and Parsons,2017; Adams *et al*., 2018; Blakeslee and Fishman, 2018). CF It is a quantitative measure of carbon dioxide emissions direct and indirect (CO2) and greenhouse gases emissions (GHS) resulting from the various activities of the facility, and it is expressed in carbon dioxide equivalent and related to the product life cycle, from the production of raw materials to the disposal of the final product. CF is measured by units of tons of carbon dioxide emissions per year (Ton / Year), taking into account the group of greenhouse gases. The carbon footprint consists of two main components *(WWF, 2018)*:

- ***Primary Carbon Footprint***: The amount of direct emissions resulting from burning fossil fuels used in energy production and means of transportation.
- ***Secondary Footprint***: It is the amount of non-emissions directly resulting from the life cycle of the products we use (extraction - manufacturing - transportation and distribution.

The study used the proxy of carbon dioxide equivalent (CO2e) to measure carbon dioxide emissions because it is considered the most polluting gas and the main cause of climate change and carbon dioxide increase. Emissions also reflect the growth of all industrial activities.

3.2.2. Cash Holding (CH)

CH is a moderating variable, which is measured in the literature using several proxies; Habib *et al*. (2017) used the ratio of cash and cash equivalents to total assets as a measure of CH. Al-Najjar (2015) used the number Ratio of difference between the ratio of cash and cash equivalents to the company's market value or sales value. Also, Opler *et al*. (1999) used the ratio of cash and marketable securities divided by total assets minus cash and marketable securities. However, Foley *et al*. (2007) used the logarithm of the cash to net assets ratio to measure the CH and reduce the outliers' problem. The study used the ratio of cash and cash equivalents to total current assets to measure CH and determine the stability of the results.

3.2.3. Investment efficiency (*Inv Eff $_{it}$)*

Investment efficiency means that the firm invests in projects with a positive net present value, and thus a decrease in the firm's investment efficiency occurs when there is a deviation from the expected optimal investment size, through the presence of over-investment or under-investment, each of them leads to a decrease in the firm investment efficiency (Biddle *et al*., 2009; Chen *et al*., 2011;Wang *et al*., 2014; Park *et al*., 2017; Majeed *et al*., 2018) .There are many models for measuring investment efficiency as (Rajan *et al*., 2000; Ahn and Denis, 2004 ;Biddle *et al*., 2009;Chen *et al*., 2011;Garcia Lara *et al*., 2016). The Measures of Biddle *et al.* (2009*)* and Chen *et al.* (2011) are the most widely used measures for measuring Firm investment efficiency because they include and study all types of investments, whether tangible or intangible. In this study, The Researcher used the scale of Chen *et al*. (2011) to measure Inn eff, according to which the expected Firm investment volume in the coming year is estimated in light of the Firm's growth opportunities, and how the relationship between them may differ with the increase and decrease in sales volume.

The investment efficiency is measured by the basis of the absolute value of the deviation from the expected investment, which reflects the in-efficiency of investment (as an inverse measure) of investment efficiency, Following the methodology of Biddle *et al*. (2009) to predict investment as a function of expected growth opportunities in revenues as follows:

$$Invest_{it} = \beta_0 + \beta_1 \, Revenue\ Growth_{It-1} + \varepsilon it \quad .....(1)$$

Where: $Invest_{it:}$ is the firm's total investments in the year, which is calculated by the increase in tangible and intangible assets divided by the total assets of the previous year. Revenue Growth $_{It-1}$ is the firm's growth in revenue per year. $\varepsilon_{it:}$ is the amount of error. β: is a coefficient of the regression model.

According to the model, the residuals from Equation (1) are used to rank firms on the probability of over-investment or under-investment as a proxy for in-efficient investment (INV EFF). Thereafter, if investments exceed the growth in sales, the residual values of the model is positive and reflects the increase in investment over the ideal limit and indicates the presence of over-investment. If it is negative, this means that the investment is less than optimal and indicates the presence of under-investment, and therefore the absolute value of these residuals is calculated, which reflects the in-efficiency of investment.

3.2.4. Control variables.

Regarding control variables, several prior studies focused on firm size, leverage and cash flow operations **(**Biddle *et al.,* 2009; Chen *et al.,* 2011; Wang *et al.,*2014; Park *et al.,*2017; Benlemlih and Bitar, 2018; lee,2020). The findings of Biddle *et al.* (2009) and Chen *et al.* (2011) indicated that firm size has a positive effect on the investment efficiency. According to, Lee (2020) and Benlemlih and Bitar (2018) confirmed that firm leverage and cash flow operations have a negative effect on the investment efficiency.

Based on the above discussions, **Table 2** summarizes the independent, Moderator and dependent variables, their proxy measures, and the different sources of data.

Table 2

Variables Measurements, Proxies and Sources

Data Source	Proxies Measures	Abbreviation	Name	Variables
Financial Statements	**carbon dioxide equivalent *(CO2 e)*** by units of tons of carbon dioxide emissions per year (Ton / Year)	**The applied study relies on two Proxies to measure climate change:** ***-Carbon footprint (C.F $_{it}$)***	**Climate Change**	Independent Variable
Financial Statements	Cash and cash equivalents/total current Assets	**CashCR%**	**Cash Holding**	Moderating Variable
Financial Statements	$Invest$ it = β0 + β1 Revenue Growth $_{It-1}$+Ɛit	***Inv Eff $_{it}$***	**Investment Efficiency**	Dependent Variable
Financial Statements	The natural logarithm of total assets in the current year. Debt/Assets in current year. Net of Cash Flow operations / total assets in current year.	***SIZE $_{it}$*** ***LEV $_{it}$*** ***CFO $_{it}$***	**Firm size** **Leverage** **Cash Flow operations**	Controls Variables

3.3. The Research Model

To examine the impact of CC on Inv Eff, and to explore a moderating effect of CH on this relationship, the following two basic models are formulated as follows:

$$Inv\ Eff_{it} = \beta0 + \beta1\ CC_{it} + \beta2\ CH_{it} + \beta3\ Size_{it} + \beta4\ Lev_{it} + \beta5\ CFO_{it} + \varepsilon_{it} \quad \text{.....(2)}$$

$$Inv\ Eff_{it} = \beta0 + \beta1\ CC_{it} + \beta2\ CH_{it} + \beta3\ CH_{it} \times CC_{it} + \beta4\ Size_{it} + \beta5\ Lev_{it} + \beta6\ CFO_{it} + \varepsilon_{it} \quad \text{.....(3)}$$

Where: *Inn* Eff $_{it}$ is Investment Efficiency measured by regression model to *(Biddle et al. 2009).* ***CCit*** is **Climate Change** is measured by ***Carbon footprint (C.F $_{it}$).*** CH is the CH measured by the ratio of cash and cash equivalents to total current assets. $Size_{it}$ firm size, Lev_{it} is the leverage, CFO_{it} is the Cash flow operations and $CH_{it} \times CC_{it}$ is an interactive term between CH and CC.

3.4 The Research Technique

The panel data methodology is used to test the hypotheses. data has several advantages, including Differences over time, differences between companies or sectors when estimated by equations including and a large number of data points, more degrees of freedom, low collinearity between explanatory variables and greater control for individual heterogeneity (Baltagi *et al*., 2005; Gujarati, 2009)**.** Thus controls the problem of Heterogeneity by using the Durbin–Wu–Hausman (DWH).

In the case of relying on a data method that combines both time series and cross section data, the regression coefficients are estimated using the following three models: pooled regression model (PRM), fixed effects model (FEM), and random effects model (REM). It has been proven for a long time that when using time series data with cross sections, the use of PRM leads to misleading inference (*Chang and Lee,1977; O 'Connell,2007*), So the study used time series models for cross sectional data using the method of ordinary least squares (OLS) for the first time to examine the effect of CH modification on the relationship Between CC and Inn Eff, with control variables including firm size, leverage and cash flow Operations. For a robust analysis, study used the Hausman test to compare the fixed-effects model to the random-effects model, Where the fixed effects model assumes that the difference between the units of the cross-sectional sector can be known through the difference between the values of the fixed term only ***βo***, while the random effects model assumes that the difference between the units of the sector are expressed within the error term, which makes the limit The random error in these models differs from that in the fixed-effect models, in addition to assuming a single fixed limit for all sectors ***βo***, and one of the conditions for estimating random-effect models is that the number of sectors n is greater than the number of features that are estimated in the model.

4.1 Descriptive Analysis

Table 3 presents the descriptive analysis for the dependent, independent, and control variables used in this study. The range of the Carbon footprint (C.F it) is between -35.047 and 42.710, with a mean of 4.072. The average absolute value of the deviation from the expected investment (investment inefficiency) was (0.012), which indicates a decrease in investment inefficiency and then an increase in investment efficiency in Firms sample (0.024), with a standard deviation of (0.007). The mean of CH (CashCR%) is 17%, with a range between 0.006 and 0.84. This reveals that cash and cash equivalents represent 17% of total current assets. The mean firm size is 9. 321.Also, Leverage has a maximum of 0.850 with a mean of 0.517, indicating that total debt represents 0.850 of total assets. This confirms that Egyptian firms depend on equity for financing more than debt. The mean cash flow operations is 0.063.

Table 3.

Descriptive statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Carbon footprint (C.F $_{it}$)	259	-35.047	42.710	4.072	8.546
CashCR%	259	0.006	0.84	0.17	0.15
Inv Eff $_{it}$	259	0.000	0.024	0.012	0.007
SIZE $_{it}$	259	5.030	9.780	9.321	0.852
LEV $_{it}$	259	0.024	0.850	0.517	0.210
CFO $_{it}$	259	-0.530	0.630	0.063	0.127

4.2 Correlation Matrix

The correlation matrix between the dependent variable (Inv Eff) and all other variables in the basic model is shown in Table 4. The findings show that There is a positive significant relationship between the absolute value of deviation from the expected investment (investment inefficiency) as a reversible measure of investment efficiency (the dependent variable) and the carbon footprint as an independent measure of climate change at a significant level less than (0.0001) and with a correlation coefficient of (0.527), which indicates that the greater the carbon dioxide emissions Whenever this leads to an increase in investment inefficiency, which means that there is an inverse relationship between the carbon footprint and investment efficiency, that is, the greater the carbon dioxide emissions, the lower the investment efficiency, and vice versa.

While, there is a negative significant relationship was found between the absolute value of deviation from expected investment (investment inefficiency) as an inverse measure of investment efficiency (dependent variable) and renewable energy as an independent measure of climate change at a significant level less than (0.0001) and with a correlation coefficient of (-0.429), which indicates that the greater the production Renewable energy whenever this leads to a reduction in investment inefficiency, which means that there is a positive relationship between renewable energy and investment efficiency, that is, the greater the use of renewable energy, the higher the investment efficiency, and vice versa.

There is a negative significant relationship was found between the absolute value of deviation from expected investment (investment inefficiency) as an inverse measure of investment efficiency (dependent variable) and cash Holding as a Moderator variable at a significant level less than (0.0001) and with a correlation coefficient of (-0.429), which means that there is a positive relationship between cash

Holding and investment efficiency. also found a positive correlation between the size, leverage and in-efficiency of investment, while a negative correlation between operating cash flows and inefficiency of investment.

Table 4.

Correlation Matrix

	Carbon footprint (C.F $_{it}$)	***CashCR%***	***Inv Eff $_{it}$***	***SIZE $_{it}$***	***LEV $_{it}$***	***CFO $_{it}$***
Carbon footprint (C.F $_{it}$)	**1**					
CashCR%	**-0.25*** **	**1**				
Inv Eff $_{it}$	**0.527*** **	**-0.18** **	**1**			
SIZE $_{it}$	**0.062**	**0.17**	**0.108***	**1**		
LEV $_{it}$	**-0.352**	**-0.10**	**0.094**	**0.052**	**1**	
CFO $_{it}$	**0.012**	**0.12** **	**-0.265*** **	**-0.040**	**-0.531*** **	**1**
Note(s): *, **, and * represent significance at the 1%, 5% and 10% levels, respectively**						

4.3Regression analysis and testing hypotheses

4.31. The Impact of Climate Change on Investment Efficiency.

Table 5 shows the regression model designed to test the association between ***CC*** and ***Inv Eff*** by the PCSE method. The results indicate that climate change has a positive effect on the absolute value of the deviation from the expected investment (investment inefficiency) as an inverse measure of investment efficiency, which means that there is a negative relationship between climate change and investment efficiency. Also, the results show a negative relationship between current CH and the absolute value of deviation from expected investment (investment inefficiency) as an inverse measure of investment efficiency, and has a positive relationship between CH and investment efficiency. With regard to the control variables, the results indicate that investment efficiency is positively affected by the size of the company and operating cash flows, and negatively by financial leverage. The R-square of the model is 38%.

4.3.2 The Impact of Cash Holding on the Relationship between Climate Change and Investment Efficiency.

Table 6 presents the regression model that is designed to explore the moderating impact of Cash Holding on the association between ***CC*** and ***Inv Eff*** by the PCSE method. The findings indicate that ***CH*** has a negative effect on the association between ***CC*** and absolute value of deviation from expected investment (investment inefficiency) as an inverse measure of investment efficiency, and has a positive effect of Cash Holding on the association between CC and investment efficiency. Regarding the control variables, the results show that investment efficiency is positively affected by the size of the company and operating cash flows, and negatively by financial leverage. The R-square of the model is 38%.

Table 5
The Impact of Climate Change on Investment Efficiency

	Inv Eff $_{it}$
c	***1.68***
Carbon footprint (C.F $_{it}$***)***	***0.243***
CashCR%	***-3.85******
SIZE $_{it}$	-5.96***
LEV $_{it}$	3.45***
CFO $_{it}$	-0.214**
R2	***0.38***
Note(s): ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively	

Table 6
The impact of Cash Holding on the Relationship between Climate Change and Investment Efficiency.

	Inv Eff $_{it}$
c	***1.63***
Carbon footprint (C.F $_{it}$***)***	***0.217***
CashCR%	***-3.61******
$CH_{it} \times CC_{it}$	***-3.84****
SIZE $_{it}$	-6.82***
LEV $_{it}$	2.97***
CFO $_{it}$	-0.211**
R2	***0.38***
Note(s): ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively	

4.4 Discussion of the Results

This study was designed to examine the effect of Climate change on investment efficiency and to investigate the impact of Cash Holding on the relationship between CC and ***Inv Eff***.The results also show that cash holdings has a positive effect on investment efficiency. This indicates that Egyptian firms with a high level of CH have a tendency to invest at a higher rate. This result is in line with natural resources theory, liquidity preference theory, which suggests that firms keep more cash holdings as a precaution during periods of high political instability and exposure to climate change. This result is also in alignment with previous studies which found that firms increased cash holdings can provide flexibility that allows firms to exploit future profitable investment opportunities especially with a higher carbon intensity than their clean peers *(*Denis and Sibilkov ,2010; Wang *et al*., 2018; Chuan *et al*., 2019; Krueger *et al*., 2020*)*. Additionally, the results indicate that CH supports the positive effect of CH (CashCR%) on the investment efficiency. According to natural resources theory and liquidity theory, firms hold more cash holdings as a precautionary motivation against uncertainty and use short-term debt due to the deterioration of cash flow as a hedge against local climate risk, thereby increasing investment efficiency. Regarding the control variables, the results show that large firms with high cash flow operations have adequate liquidity and Implementation of investment projects have positive effects on investment efficiency, while firms with high leverage have negative effects on investment efficiency.

4.5 Robustness Analysis

The study used the Hausman test to compare between the fixed effects model and the random-effects model, the hypothesis Null under this test is the preference of the random effects model, while the alternative hypothesis is Fixed effects model takes precedence, and the null hypothesis is accepted if the probability calculated according to a test Hausman is greater than 5%, while the alternative hypothesis is accepted if the probability calculated according to a test Hausmann less than 5.The P-value of the Hausman test is significant ($p < 0.05$). Then, the study used the fixed-effects model. To ascertain the results estimated by the fixed effects model, this study used the diagnostics tests (Wooldridge test for autocorrelation and modified Wald test for group-wise heteroscedasticity) in panel data, , the hypothesis Null under this test is the preference of the random effects model, while the alternative hypothesis is Fixed effects model takes precedence, and the null hypothesis is accepted if the probability calculated according to a test Wooldridge is greater than 5%, while the alternative hypothesis is accepted if the probability calculated according to a test Wooldridge less than 5.

The results of diagnostic tests show autocorrelation problems (P > F 5 0.000) and heteroscedasticity problems (P > X2 5 0.000). To solve these problems in the fixed effects model, The Study used the feasible generalized least squares (FGLS) method. The FGLS method allows estimation in the presence of AR (1) autocorrelation with panel and cross-sectional correlation and heteroscedasticity across panels. The results in Table 7 confirm the positive effect of climate change on the absolute value of the deviation from the expected investment (investment inefficiency) as an inverse measure of investment efficiency, which means that there is a negative relationship between climate change and investment efficiency using the FGLS method. Moreover, the results support the negative effect of cash holdings (CashCr%) Ons the absolute value of deviation from expected investment (investment inefficiency) as an inverse measure of investment efficiency, then a positive effect of Cash Holding on investment efficiency. The results were the same regarding some control variables such as size, leverage and liquidity. Furthermore, the results show that investment efficiency is positively affected by the size of the company and operating cash flows, and negatively by financial leverage. Regarding the moderating effect of CH, the results in Table 8 confirm that the existence of CH (Cash Cr%) increases and supports the positive effect of CC (carbon footprint) on investment efficiency.

Table 7
The impact of Climate Change on Investment Efficiency using FGLS.

	Inv Eff $_{it}$
c	***1.61***
Carbon footprint (C.F $_{it)}$	***0.284***
CashCR%	***-3.61******
SIZE $_{it}$	-7.04***
LEV $_{it}$	4.67***
CFO $_{it}$	-0.329**
prob	***0.000***
Note(s): ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively	

Table 8
The impact of Cash Holding on the Relationship between Climate Change and Investment Efficiency using FGLS.

	Inv Eff it
c	***1.65***
Carbon footprint (C.F it)	***0.293***
CashCR%	***-3.61******
CHit × CCit	***-2.94****
SIZE it	***-7.12******
LEV it	***2.98******
CFO it	***-0.315****
Prob	***0.000***
Note(s): ***, **, and * represent significance at the 1%, 5% and 10% levels, respectively	

5. Conclusion

The purpose of this study is to investigate the effect of Climate change on investment efficiency of Egyptian firms, in addition to exploring the moderating effect of Cash holdings on the association between CC and investment efficiency. The panel data were used through a sample consisting of 37 Egyptian listed firms, with a total of 259 observations, from 2015 to 2021.The results indicate that Egyptian firms with high level of CH have a tend to invest at a higher rate Also, the findings reveal that a negative relationship between Climate change and Investment Efficiency. The current study provides several contributions. First, consistent with natural resources theory, liquidity preference theory, the current study adds evidence to the literature on Investment Efficiency by investigating the effect of Climate change on Investment Efficiency in emerging economies. Second, according to Egypt's vision 2030, the empirical findings in this study extend previous findings by providing strong additional evidence in emerging countries regarding the moderating effect of cash holdings on the link between Climate change and Investment Efficiency. Third, to the best of our knowledge, this study is the first to investigate the relationship between CH, CC and Inv Eff in Egypt.

Findings will help investors to evaluate climate change risks and the environmental, economic and social challenges it poses, can impose significant damage to corporate profits, significant negative effects on long-run economic growth, then recognize alternative investment opportunities and make appropriate decisions. This study highlights the importance of cash holding for firms in emerging economies. Firms may hold cash as a cushion against climate change risks, support liquidity, overcome financial distress risk, lower the cost of capital, increase future investment

opportunities and reduce uncertainty. Additionally, the results would also help the help the policymakers, regulators at the EGX and Financial Regulatory Authority to realize the importance of climate change, anti-climate change measures such as fiscal incentives coupled to sustainability like financial products to encourage the mobilization of private capital into climate finance and increase the support for firms that adopt environmentally conscious business practices such as the conservation of natural resources, the production of alternative energy sources and the implementation of clean air and water projects in Egyptian listed firms in accordance with Egypt's Vision 2030.Finally, the limitations need to be considered. First, the sample size was relatively small. Second, the analysis does not include other measures of Climate change due to a lack of data. Future research may focus on examining the effect of CC on Inn Eff in Egyptian Banks and small and medium-sized firms, as well as investigating the moderating effect of Audit Quality on the association between CC and Inv Eff.

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تأثير تغير المناخ على كفاءة الاستثمار في الشركات المصرية فى ظل التأثير المعدل للاحتفاظ بالنقدية

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المستخلص

يتمثل الهدف الرئيس لهذه الدراسة فى التحقق من تأثير تغير المناخ على كفاءة الاستثمار في ظل وجود الاحتفاظ بالنقدية كمتغير مؤثر على هذه العلاقة.وتعتمد منهجية الدراسة على أسلوب تحليل المحتوى وذلك بفحص وتحليل التقارير المالية المنشورة لعينة مكونة من (٣٧) شركة مدرجة في البورصة المصرية (EGX) بإجمالي ٢٥٩ ملاحظة من عام ٢٠١٥ إلى عام ٢٠٢١. وتم اختبار فرضيات البحث باستخدام طريقة الأخطاء المعيارية المصححة panel corrected standard errors (PCSE) وطريقة المربعات الصغرى المعممة الممكنة feasible generalized least squares (FGLS)

وخلصت نتائج الدراسة إلى أن تغير المناخ له تأثير سلبي على كفاءة الاستثمار في الشركات المصرية المدرجة. كما أن الشركات المصرية ذات المستوى المرتفع من الحيازة النقدية لديها ميل للاستثمار بمعدل أعلى. بالإضافة إلى ذلك، فإن الحيازات النقدية في الشركات المصرية المدرجة تدعم العلاقة السلبية بين تغير المناخ وكفاءة الاستثمار.

واستناداً إلى ذلك توصى الدراسة بضرورة اهتمام الشركات المصرية بالاحتفاظ بالنقدية كوسيلة للوقاية من مخاطر تغير المناخ، ودعم السيولة، والتغلب على مخاطر الضائقة المالية، وخفض تكلفة رأس المال، وزيادة فرص الاستثمار المستقبلية والحد من عدم اليقين. بالإضافة إلى ذلك، ضرورة إدراك صناع السياسات والجهات التنظيمية في البورصة المصرية وهيئة الرقابة المالية أهمية تغير المناخ وزيادة الدعم للشركات التي تتبنى ممارسات تجارية واعية بيئيًا مثل الحفاظ على الموارد الطبيعية، وإنتاج مصادر الطاقة البديلة وتنفيذ مشاريع الهواء النظيف والمياه في الشركات المصرية المدرجة وفقًا لرؤية مصر ٢٠٣٠.

الكلمات المفتاحية: تغير المناخ، كفاءة الاستثمار، الاحتفاظ بالنقدية.