RGC Ref. No.:
UGC/FDS14/B13/21
(please insert ref. above)

RESEARCH GRANTS COUNCIL
COMPETITIVE RESEARCH FUNDING SCHEMES FOR
THE LOCAL SELF-FINANCING DEGREE SECTOR

FACULTY DEVELOPMENT SCHEME (FDS)

Completion Report
(for completed projects only)

Submission Deadlines: *1. Auditor's report with unspent balance, if any: within **six** months of the approved project completion date.*
*2. Completion report: within **12** months of the approved project completion date.*

Part A: The Project and Investigator(s)

1. Project Title

How Do Companies Adapt to Extreme Weather? Evidence from Corporate Uses of Internal Cash Flow

2. Investigator(s) and Academic Department(s) / Unit(s) Involved

Research Team	Name / Post	Unit / Department / Institution
Principal Investigator	Dr. KWOK Wing Chun (Kaz) Associate Professor	Department of Economics and Finance, The Hang Seng University of Hong Kong
Co-Investigator	Prof. CHANG Xin (Simba) Professor of Finance & Associate Dean (Research)	Nanyang Business School, Nanyang Technological University
Co-Investigator	Dr. WONG George Associate Professor & Associate Head	School of Accounting and Finance, The Hong Kong Polytechnic University

3. Project Duration

	Original	Revised	Date of RGC / Institution Approval *(must be quoted)*
Project Start Date	2022.01.01		
Project Completion Date	2023.12.31	2024.06.30	2023.05.25 (HSUHK)

Duration *(in month)*	24	30	2023.05.25 (HSUHK)
Deadline for Submission of Completion Report	2024.12.31	2025.06.30	2023.05.25 (HSUHK)

4.3 Please attach photo(s) of acknowledgement of RGC-funded facilities / equipment.

Part B: The Final Report

5. Project Objectives

5.1 Objectives as per original application

1. This project aims to design an integrated empirical framework to offer a complete picture of how firms use internal funds to counteract the adverse effects of climate change.

2. Using the actual extreme weather events reported by the National Centers of Environmental Information and a difference-in-differences (DiD) approach, this project will study whether and how adverse climate change may influence cash flow allocation of the US firms.

3. Using Global Climate Risk Index (GCRI) published by Germanwatch to measure the severity of damage caused by adverse climate change on eighty different countries, this project will study whether and how adverse climate change may influence cash flow allocation of firms around the world.

4. This project will study whether and how firms with different characteristics, in different industries, or located in different geographic regions may respond to adverse climate change differently in making their cash flow allocation decisions.

5. This project aims to fill the gaps between the climate economy and finance literature by investigating how firms adapt to adverse climate change through an "internal finance channel".

6. This project also has educational impact. Recently, "green business" has attracted a lot of attention from business schools around the world. As such, sustainability component has been included in many business programmes. Figuring out how to deploy cash flow when facing adverse climate change can provide important insight for green finance educators.

5.2 Revised objectives

Date of approval from the RGC: No revision to project objectives.

Reasons for the change:

5.3 Realisation of the objectives

(Maximum 1 page; please state how and to what extent the project objectives have been achieved; give reasons for under-achievements and outline attempts to overcome problems, if any)

The project has six key objectives, all of which have been accomplished:

1. Integrated Empirical Framework
An integrated empirical framework was developed, providing a comprehensive overview of how firms use internal funds to address climate change impacts.

2. Cash Flow Allocation in US Firms
Using extreme weather event data from the National Centers of Environmental Information and a difference-in-differences (DiD) approach, we analyzed how climate change affects cash flow allocation in US firms. There is some evidence to indicate adjustments in financial strategies in response to extreme weather.

3 & 4. Global Cash Flow Analysis, Firm Characteristics, and Geographic Location
Employing the Global Climate Risk Index (GCRI) published by Germanwatch, we studied cash flow allocation in various countries. This analysis confirmed that climate change affects firms globally. Furthermore, our analysis reveals that country-specific regulatory risk, industry transition risk, firm-level asset tangibility, and local economic conditions shape the way firms respond to climate risk through the internal financing channel.

5. Bridging Literature Gaps
The project bridged gaps between climate economy and finance literature by exploring how firms adapt to climate change through an "internal finance channel," contributing valuable insights to academic discourse.

6. Educational Impact
The project also aimed to impact education in "green business", providing insights for educators in green finance. Understanding cash flow allocation in the context of climate challenges will enhance business curricula.

5.4 Summary of objectives addressed to date

Objectives *(as per 5.1/5.2 above)*	**Addressed** *(please tick)*	**Percentage Achieved** *(please estimate)*
1. This project aims to design an integrated empirical framework to offer a complete picture of how firms use internal funds to counteract the adverse effects of climate change.	√	100%
2. Using the actual extreme weather events reported by the National Centers of Environmental Information and a difference-in-differences (DiD) approach, this project will study whether and how adverse climate change may influence cash flow allocation of the US firms.	√	100%
3. Using Global Climate Risk Index (GCRI) published by Germanwatch to measure the severity of damage caused by adverse climate change on eighty different countries, this project will study whether and how adverse climate change may influence cash flow allocation of firms around the world.	√	100%
4. This project will study whether and how firms with different characteristics, in different industries, or located in different geographic regions may respond to adverse climate change differently in making their cash flow allocation decisions.	√	100%
5. *This project aims to fill the gaps between the climate economy and finance literature by investigating how firms*	√	100%

adapt to adverse climate change through an "internal finance channel".		
6. *This project also has educational impact. Recently, "green business" has attracted a lot of attention from business schools around the world. As such, sustainability component has been included in many business programmes. Figuring out how to deploy cash flow when facing adverse climate change can provide important insight for green finance educators.*	√	100%

6. Research Outcome

6.1 Major findings and research outcome

(Maximum 1 page; please make reference to Part C where necessary)

Using a large panel of global public firms from 2006 to 2019, we investigate how firms in countries with elevated climate risk allocate their cash flow across different uses. We employ the Global Climate Risk Index (CRI) published by Germanwatch as our primary proxy of climate risk. To examine the independent effects of cash flow and climate risk on various uses of cash flow, we first regress each use of cash flow on climate risk, cash flow, and control variables within the integrated regression framework. Consistent with previous studies, the cash flow coefficients add to unity and firms simultaneously allocate their cash flow to investment, reduction of external financing, and holding cash as precautionary reserves. This results in positive investment- and cash-cash flow sensitivities and negative external financing-cash flow sensitivity. Furthermore, consistent with prior studies, firms in countries with elevated climate risk tend to bolster their financial flexibility by holding larger cash reserves and distributing fewer dividends. Additionally, these firms exhibit lower levels of financial leverage given the challenges they face in obtaining debt, leading them to resort to costly equity issuance.

Additionally, we investigate how firms adjust their cash flow allocation across various uses in response to climate risk. We augment our system of regression equations by including the interaction term between cash flow and climate risk. Our results indicate that, when faced with a one-dollar increase in cash flow, firms operating in countries with heightened climate risk tend to allocate, on average, an additional 18 cents toward reducing external financing. Simultaneously, they allocate 6 cents fewer to dividends, 8 cents fewer to cash reserves, and 3 cents fewer to investment. Our findings reveal that because firms face challenges in obtaining debt, they often resort to issuing more costly equity when confronted with heightened climate risk. Consequently, when faced with a one-dollar increase in cash flow, firms prioritize reducing equity financing, which simultaneously leads to a decrease in cash flow allocated to dividends, cash holdings, and investment.

We also investigate how country-level regulatory risk, industry-level transition risk, and firm-level tangibility influence cash flow allocation in response to climate risk. Our results indicate that the effects of climate risk on cash flow allocation are more pronounced for firms with higher regulatory risk, higher transition risk, and lower tangibility. Specifically, when these firms experience a one-dollar increase in cash flow, they respond to an increase in climate risk by allocating more cash flow toward reducing equity financing. Simultaneously, they increase more debt issuance and allocate less to dividends, cash reserves, and investment.

Finally, we examine how firms located in countries with varying levels of economic development allocate their cash flow in response to climate risk. Our results reveal that firms in developing countries face challenges in obtaining external financing, particularly for debt, in the presence of elevated climate risk. As a result, they rely more on their internal cash flow to finance investment and build cash reserves, resulting in a reduction in cash flow allocated to dividend payments. In contrast, firms in developed countries are less affected by elevated climate risk in terms of external financing. Thus, they depend less on internal cash flow for investment and cash reserves. Moreover, when faced with an additional cash flow, they can reduce costly equity financing and capitalize on the increase in cash flow to raise additional debt. Collectively, our results illustrate how regulatory risk, transition risk, tangibility, and local economic conditions shape the way firms respond to climate risk through the internal financing channel.

6.2 Potential for further development of the research and the proposed course of action *(Maximum half a page)*

The findings from our cross-country analysis provide a foundation for further research into how firms allocate internal cash flow in response to climate risk. Future studies could explore the impact of specific regulatory environments and industry characteristics on cash flow allocation decisions. Additionally, investigating the long-term effects of these allocation strategies on firm performance could yield valuable insights.

7. Layman's Summary

(Describe in layman's language the nature, significance and value of the research project, in no more than 200 words)

This research contributes significantly to understanding how firms respond to climate change and manage their financial resilience. It highlights that beyond operational strategies, companies can enhance their financial resilience by making informed cash flow allocation decisions. By examining how cash flow is allocated across various uses, this study reveals how firms can mitigate climate risks through effective internal financing.

The paper also enriches the accounting literature by utilizing the Statement of Cash Flows to analyze how firms respond to cash flow shocks. It offers a new methodological perspective, demonstrating that cash flow identity can provide insights into cash flow allocations.

Moreover, this research expands on existing studies of cash flow sensitivity, moving beyond isolated analyses of cash uses like investments or dividends. By tracking all cash flow uses simultaneously, it captures the interdependencies of corporate financial policies.

Finally, this study is pioneering in its cross-country approach, providing a comprehensive examination of cash flow allocation worldwide in response to climate risk. This enhances our understanding of global corporate behavior, offering valuable insights for both academics and practitioners in finance and sustainability.

Part C: Research Output

8. Peer-Reviewed Journal Publication(s) Arising Directly From This Research Project

(Please attach a copy of the publication and/or the letter of acceptance if not yet submitted in the previous progress report(s). All listed publications must acknowledge RGC's funding support by quoting the specific grant reference.)

The Latest Status of Publications				Author(s) *(denote the corresponding author with an asterisk*)*	Title and Journal / Book *(with the volume, pages and other necessary publishing details specified)*	Submitted to RGC *(indicate the year ending of the relevant progress report)*	Attached to this Report *(Yes or No)*	Acknowledged the Support of RGC *(Yes or No)*	Accessible from the Institutional Repository *(Yes or No)*
Year of Publication	**Year of Acceptance** *(For paper accepted but not yet published)*	**Under Review**	**Under Preparation** *(optional)*						
N/A	N/A	Revise and Resubmit (2nd Round)		1. Xin Chang 2. Wing Chun Kwok* 3. Tao Li 4. George Wong 5. Jiaquan Yao	How Do Misvalued Firms Deploy Internal Cash Flow?	No	No	Yes	No

9. Recognized International Conference(s) In Which Paper(s) Related To This Research Project Was / Were Delivered

(Please attach a copy of each conference abstract)

Month / Year / Place	Title	Conference Name	Submitted to RGC *(indicate the year ending of the relevant progress report)*	Attached to this Report *(Yes or No)*	Acknowledged the Support of RGC *(Yes or No)*	Accessible from the Institutional Repository *(Yes or No)*
Jul 2022, France	How Do Misvalued Firms Deploy Internal Cash Flow?	2022 FMA European Conference	September 2022	Yes (Annex I)	Yes	No
Dec 2024, Bali	Weathering the Climate Risk: A Cross-Country Analysis on Cash Flow Allocation	Asia Sustainability and ESG Summit 2024	No	Yes (Annex II)	Yes	No
Jul 2025, Malta	Weathering the Climate Risk: A Cross-Country Analysis on Cash Flow Allocation	World Finance Conference	No	Yes (Annex II)	Yes	No

10. Whether Research Experience And New Knowledge Has Been Transferred / Has Contributed To Teaching And Learning

(Please elaborate)

Insights gained from studying cash flow allocation in response to climate risks enhance students' understanding of financial strategies in real-world scenarios. Additionally, the research informs curriculum development, enabling educators to incorporate practical examples, fostering critical thinking and application of theoretical concepts. This transfer of knowledge not only enriches the academic environment but also equips students with essential skills for navigating challenges in sustainable business practices.

11. Student(s) Trained

(Please attach a copy of the title page of the thesis)

Name	Degree Registered for	Date of Registration	Date of Thesis Submission / Graduation
N/A			

12. Other Impact

(e.g. award of patents or prizes, collaboration with other research institutions, technology transfer, teaching enhancement, etc.)

N/A

13. Statistics on Research Outputs

	Peer-reviewed Journal Publications	Conference Papers	Scholarly Books, Monographs and Chapters	Patents Awarded	Other Research Outputs (please specify)	
No. of outputs arising directly from this research project		2			Type	No.
					Research paper under revision and resubmission (2nd round) at a well-recognized journal	1

14. Public Access Of Completion Report

(Please specify the information, if any, that cannot be provided for public access and give the reasons.)

Information that Cannot Be Provided for Public Access	Reasons
N/A	