Emmanuella Obeng

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NBER PhD Student Workshop on Climate Finance

Dear Professors Flammer and Giglio,

I am a rising fifth-year Finance PhD candidate at the University of Colorado Boulder (expected completion May 2026) working under the supervision of Professor Asaf Bernstein (NBER), who will serve as reference. My research interest lies in the area of climate change and finance and currently, I am examining how climate disaster shocks drive sovereign default probability and evaluating how concessional adaptation finance can serve as a lifeline. I would be honored to receive feedback on my work-in-progress and to engage with fellow early career scholars at your workshop.

Thank you for your consideration.

Sincerely,

Emmanuella.

Emmanuella Obeng

University of Colorado, Boulder
eobeng@colorado.edu

Education

- **University of Colorado, Boulder** — Boulder, Colorado
  Ph.D. Finance — *August 2021 – May 2026*
- **Oklahoma State University (OSU)** — Stillwater, Oklahoma
  MS Quantitative Financial Economics — *August 2019 – May 2021*
- **Kwame Nkrumah University of Science and Technology (KNUST)** — Kumasi, Ghana
  BSc. Business Administration (Banking and Finance) — *Sept 2013 – July 2017*

Publications and Working Papers

- **IMF Working Paper (forthcoming, 2025).** "Climate Shocks, Debt Defaults, and Investment in Climate Adaptation – Squaring an Impossible Trilemma." (with C. de Soyres and J. Tan)
- "Climate Disasters, State-to-State Migration, and Insurance Markets in the United States." Working draft.
- "How Does Climate Vulnerability Affect Public Investments in Renewables?" Working draft.
- **Refereed Publication.** "Board Gender Diversity and the Capital Structure of Microfinance Institutions: A Global Analysis." *Quarterly Review of Economics and Finance* 71 (2019): 258–269. (with M. Adusei)

Professional Association

- Financial Management Association, (FMA), American Finance Association, (AFA) - member since 2023

Work Experience

- **International Monetary Fund, IMF** — Washington, DC
  Fund Intern Program, Macroeconomics — *June - August 2025*
  - Constructed a database linking climate shocks and historical public debt for 182 countries using the IMF-EMDAT disaster records with the BoC/BoE and the Asonuma and Trebesch, 2016 sovereign debt default database.
  - Applied rare-events logit and event studies to demonstrate that climate shocks increase sovereign default probability and quantified how concessional and semi-concessional adaptation finance can serve as a lifeline.

- **Capital for Climate, C4C** — Remote
  Climate Finance Researcher and Writer, Intern — *June - August 2024*
  - Researched and authored detailed profiles of climate focused companies, funds and financial vehicles for Capital for Climate's investment database
  - Contributed to reports aiding stakeholders in making strategic investment decisions

- **Environmental Defense Fund, Office of the Chief Economist** — Remote
  Doctoral Economics Intern, Climate Finance — *June - August 2023*
  - Identified original research questions to address climate financing challenges in mitigation in emerging and developing markets
  - Investigated the potential role of carbon markets and other financial sources in leveraging the finance needed in the renewable energy sector in developing countries

- **Leeds School of Business, University of Colorado** — Boulder, Colorado
  Graduate Research Assistant — *August 2021 - Dec 2023*
  - Collected data, updated and maintained database for faculty as well as prepared reports and paperwork related to findings
  - Assisted Faculty in performing research related duties such as compiling, reviewing and summarizing articles

Teaching Experience

- **Leeds School of Business, University of Colorado** — Boulder, Colorado
  Instructor of Record, Investments and Portfolio Analysis — *Summer 2024, 2025*
  - Designed and delivered lectures for an accelerated Maymester course
  - Created and graded assignments to assess student understanding
  - Facilitated class discussions to enhance learning of complex investment topics

- **Leeds School of Business, University of Colorado** — Boulder, Colorado
  Teaching Assistant, Investments and Portfolio Analysis — *Jan - May 2024*
  - Create and deliver engaging weekly tutorial sessions for students, improving their understanding of complex concepts taught in class

Awards and Fellowships

- **Hart Fellowship, Leeds School of Business** Boulder, Colorado
  (Summer 2024)

- **University of Colorado, Boulder – Graduate School Fellowship** Boulder, Colorado
  (Fall 2022)

- **The Royal Bank – College of Humanities and Social Sciences Awards, KNUST** Kumasi, Ghana
  Best Student — Runner–up (Banking and Finance)

Technical and Programming Experience

- Programming Languages: Intermediate experience with R, STATA, Python, MATLAB in graduate school projects
- Application of Python (Pandas and Numpy libraries) in finance modeling and derivative analytics
- Valuation and financial modeling with Excel
- Experience with applied regression modeling, causal inference and applied microeconometrics

Conferences/Workshops attended

- Colorado Finance Summit 2022, Vail, Colorado
- Northwestern-Duke Causal Inference Workshop 2022, Chicago, Illinois
- Four Corners Center for Research on Index Investments Conference 2022, Boulder, Colorado

Language capabilities

- Fluent in English, proficient in French, with a reading capability of both English and French.

CLIMATE SHOCKS, DEBT DEFAULTS AND INVESTMENT IN CLIMATE ADAPTATION – SQUARING AN IMPOSSIBLE TRILEMMA

de Soyres, C[1], Tan, J[2], and Obeng, E[3].

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1. INTRODUCTION

Climate disasters are increasing in both frequency and severity, yet our understanding of how these physical shocks translate into sovereign debt distress remains incomplete. Prior works have documented impacts of disaster and the climate risk premium it imposes on sovereign entities but stop short of linking event-level shocks to actual default episodes. In the context of elevated public debt ratios, countries that are already susceptible to climate damage remain more vulnerable and are at risk of not being able to sustain their debt levels. The investment needs of these countries for adaptation and mitigation are set to rise. We believe concessional and semi-concessional sources of financing may serve as a lifeline for countries facing this impossible trilemma. We move the debate from using structural vulnerability measures to actual event level disaster shocks with a more global dataset.

2. DATA

We construct a panel with data ranging from 1995 to 2020 across 182 countries. We measure climate shocks by building an intensity index following Felbermayr & Groschl (2014) and another with the IMF-EMDAT disaster database and include some indicators from the ND-GAIN set. We have two proxies for defaults and define defaults as either debt restructurings and negotiations that are implemented prior to a unilateral payment default and events of missed payments or a large arrears build up compared to the previous year. Data for debt defaults was gleaned from a combination of Asonuma and Trebesch (AT), 2016 (~192 default spells) and the BoC-BoE sovereign default database. For each country i and time t, we set the Asonuma-Trebesch default indicator D_{it}^{AT} to 1 with default episode k starting at $s_{i,k}$ and ending at $e_{i,k}$.

$$D_{i,t}^{AT} = 1\{\exists k \text{ s.t. } t \in [s_{i,k}, e_{i,k}]\}, \quad t \in \mathcal{T} \qquad (1)$$

Macro controls like gross domestic product, debt to GDP, inflation, financial development, terms of trade and real effective exchange rates are drawn from the World Bank's World Development Indicators and the IMF World Economic Outlook following Cevik & Jalles (2022), Manasse & Roubini (2005) and Reinhart et. al., (2003). Climate finance data was collected from AidData and the OECD.

3. EMPIRICAL STRATEGY

The baseline specification is a rare events logit [1] with some country and year fixed effects to assess the impact of disaster shocks on the probability of sovereign default. Sovereign defaults are rare events and are ~4\% of 4,628 country-years in our sample. Standard logit underestimates coefficients when events are very small. Firth's bias-reduced logit corrects small-sample bias in

[1] Firth (1993); Heinze and Schemper (2002)

maximum likelihood estimation and is useful not specifically for the rarity of events, but rather the possibility of a small number of cases on the rarer of the two outcomes. Felbermayr & Groschl, 2014 show that natural disasters lower GDP on impact. If that stands, fiscal strains will typically show in the following budget cycle than the disaster year itself. To capture that causal chain, avoid any bias and illustrate the time evolution of disaster effects, we enter disaster measures and macro controls with a lag. In effect, our work answers the questions: How do climate disaster shocks affect the probability of sovereign default and can concessional and semi-concessional adaptation finance mitigate this risk?. Robustness checks include standard logit, alternative lag structures and a diagnostic control that involves conditioning on IMF program episodes that may have coincided with debt restructuring events as well as estimates of the individual climate disaster intensity variables (drought, extreme temperature, flood, landslides and storms) on default probability.

$$Pr(default = 1) = f\left(disastershock_{i,t-1}, X_{i,t-1}\right) \qquad (2)$$

Second, we study the role of adaptation in moderating the macro impact of natural disasters and thus reducing the pass through from phyical damages to sovereign debt distress and defaults. To do so, we introduce an interaction term between adaptive capacity (proxied by an adjusted ND-GAIN adaptive capacity indicator) and natural disasters in a simple panel regression. Our third regressions looks at ODA adaptation finance and default probability. Finally, we introduce a structural sovereign default model with climate shocks and adaptation following Mallucci, 2022 (work in progress).

4. PRELIMINARY FINDINGS

4.1 Result 1.

Countries experiencing larger disaster losses in the previous year face higher odds of default in the current year. We show a percentage point increase in disaster-related losses (as a share of GDP) raises the probability of default by approximately 2–3%, robust across logit and rare-events logit models. Standard macro controls have expected signs.

Table 1: Logit and Rare-Events Logit Estimations of Default Probability

	(1) Logit ALL	*(2) Rare Logit ALL*	*(3) Rare Logit EME*	*(4) Rare Logit LIDC*
dam_l1 (% GDP)	0.025**	0.026**	0.021*	0.097
	(0.010)	(0.011)	(0.012)	(0.120)
gdp_growth_l1	–0.119*	–0.101***	–0.125***	–0.053
	(0.070)	(0.023)	(0.048)	(0.037)
ln_gdppc_l1	2.830	0.583***	0.014	1.413***
	(3.554)	(0.194)	(0.335)	(0.334)
infl_l1	0.079*	0.000	0.046***	–0.087***
	(0.047)	(0.011)	(0.017)	(0.030)
debt_gdp_l1	0.051***	0.006***	0.021***	0.002
	(0.010)	(0.002)	(0.004)	(0.002)
fin_dev_l1	0.052	–0.005	0.001	–0.068**
	(0.035)	(0.006)	(0.007)	(0.027)
ln_tot_l1	–3.646*	–1.848***	–0.665	–1.952***
	(2.108)	(0.434)	(0.772)	(0.606)
N	466	3,031	1,469	939
Country FE	Yes	No	No	No
Year FE	Yes	Yes	Yes	Yes
Income Group FE	No	Yes	No	No

*Standard errors in parentheses. Robust SEs clustered at the country level. *p < 0.10; **p < 0.05; ***p < 0.01*

4.2 Result 2

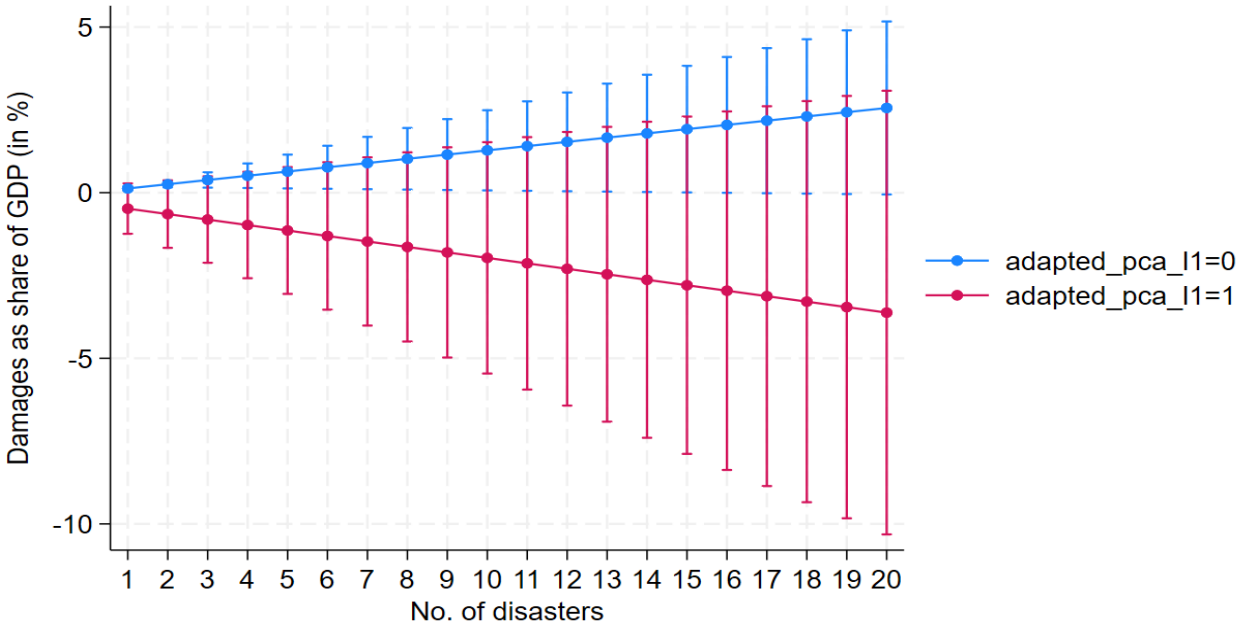
Adaptive capacity moderates' disaster damages monetary loss. One more disaster raises next-year damages by ~ 0.1 percentage points of GDP in less adapted countries. In more adapted countries, the marginal damage is smaller, with estimates larger in magnitude but maybe imprecisely estimated in LIDCs. Margins plots show a negative flat line for more adapted countries.

Table 2: Simple Panel Data Regression of Disaster Damages (% GDP) on Adaptive Capacity

	(1) All	*(2) EME*	*(3) LIDC*
total_disasters_l1	0.114***	0.113**	0.128*
	(0.038)	(0.045)	(0.072)
adaptive_capacity	–0.009	0.113	–0.316
	(0.116)	(0.152)	(0.312)
interaction*	–0.032	–0.008	–0.293
	(0.044)	(0.055)	(0.179)
Observations	3,031	1,469	939

Standard errors in parentheses. Controls included but not reported. Country and Year fixed effects included. *** p < 0.10; ** p < 0.05; *** p < 0.01*

Figure 1: Impact of Disaster Frequency on Disaster damages, by level of Adaptive Capacity.



5. CONCLUSION

To the best of our knowledge, this study provides the first global, event-level evidence that climate disaster shocks materially elevate sovereign default probability, and it demonstrates that both structural adaptive capacity and concessional adaptation finance can substantially mitigate this channel. Specifically, a one pp increase in disaster losses raises the odds of default by roughly 2–3

%, while higher adaptive capacity flattens the marginal damage curve. These results hold across alternative model specifications, lag structures, country-group samples, and default definitions. Together, they resolve the "impossible trilemma" facing vulnerable sovereigns: while climate shocks intensify debt distress, targeted investments in adaptation financed through concessional or semi-concessional instruments can both reduce the fiscal pass-through of disasters and lower debt defaults. Policy wise, this implies that scaling up concessional climate finance and strengthening domestic adaptation capacity are complementary for safeguarding debt sustainability in an era of escalating climate risk shaping both government financing strategies and international lenders' practices.

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