The 17th CBR-HSE-NES Economic Seminar

Climate Risk and Bank Liquidity Creation in MENA Region: A Dual Threshold–Quantile Approach

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Motivation

Why Climate Risk and Bank Liquidity Creation?

- Climate change is a systemic risk to financial stability
- Financial stability depends on banks' complete function, not just lending

- MENA: A critical testing ground where banks are the main financial intermediaries. Understanding their response to climate shocks is key for financial stability.

- Results can inform climate-resilient banking regulation

Motivation

Why Climate Risk ~~and Bank Liquidity Creation~~?

A Perfect Storm of Vulnerabilities:

- Extreme Water Stress: 16 of the world's 25 most water-stressed countries are in MENA (Carnegie, 2024).
- Severe Economic Impacts: Climate disasters have already caused permanent GDP losses up to 1.1% (IMF, 2023). Projected losses from water shortage alone could reach 14% of GDP by 2050 (World Bank, 2017)

Rising Physical Threats:

- Coastal financial hubs like Alexandria are threatened by sea-level rise, with projections of up to 0.6 meters by 2100 (World Bank, 2024).

Motivation

Why ~~Climate Risk and~~ Bank Liquidity Creation?

The Narrow Focus:

- Vast majority of climate-finance research looks only at BANK LENDING.
- Consensus: Climate risk hurts banks, so they reduce loan supply.

The Critical Blind Spot:

- Banks' most crucial function is LIQUIDITY CREATION (LC)—a much broader concept than just loans.
- LC includes transforming deposits into loans AND providing off-balance-sheet liquidity insurance (credit lines, guarantees)—the "financial safety net" for firms in crisis.

We simply don't know how climate risk affects this essential lifeline.

Why Climate Risk and Bank Liquidity Creation?

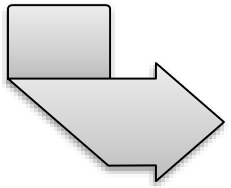
- Does climate risk paralyze banks? (The lending view)
- Or does it force them to become liquidity lifelines? (The LC view)

Our Mission: To move beyond the narrow "credit channel" and investigate the complete picture of banking resilience in the face of climate shocks.

Research question & Hypotheses

Central Research Question:
What is the impact of climate risk on bank liquidity creation in the MENA region, and is this relationship nonlinear and heterogeneous?

Theoretical Foundations:
Precautionary Savings: Climate fear → households/firms save more → bank deposits rise.
Flight to Quality: Climate crisis → investors seek safety → funds flow to stable banks.



Hypotheses:
H1: Climate risk has a nonlinear (threshold) effect on bank LC.
H2: The relationship is heterogeneous across the distribution of LC (affects high, mid, and low LC banks differently).

Research Design

Data Collection

- Bank-level: BankFocus, bank websites.
- Climate Risk: Germanwatch Climate Risk Index (CRI).
- Macroeconomics: World Bank.

Sample

- 126 Banks over 17 years period (2006-2022)

Country	Number of Banks	CRI	Country	Number of Banks	CRI
ALGERIA	7	46.16	SYRIA	2	40.85
TUNISIA	11	52.98	PALESTINE	1	46.74
LIBYA	4	46.87	OMAN	5	52.59
MAURITANIA	5	37.88	LEBANON	10	44.87
MOROCCO	4	49.89	KUWAIT	5	51.92
TURKEY	17	53.46	JORDAN	8	50.49
UAE	12	56.97	IRAQ	2	41.41
QATAR	4	56.88	EGYPT	15	45.93
KSA	8	51.58	BAHRAIN	5	51.86
YEMEN	1	37.58	TOTAL	126	

The table illustrates the countries, the number of banks and the average climate risk index (CRI) for each country in our sample. The CRI values reported in this table are the raw, pre-transformation values, provided for descriptive context. For all regression analyses, a transformed variable (CRI_transformed = CRI × -1) is used, where a higher value indicates higher climate risk.

Methodology

Key Variable Definitions

- **Dependent Variable: Bank Liquidity Creation (LC)**
  - · Berger & Bouwman (2009) "cat fat" measure.
  - · Transforms illiquid assets & liquid liabilities into a single metric.
  - · Includes both On & Off-Balance Sheet items (e.g., loans, deposits, credit lines, guarantees).

- **Independent Variable: Climate Risk**
  - · Transformed Climate Risk Index (CRI).
  - · Higher value = Higher climate risk.

- **Control Variables:**
  - · Bank-level: Size, Deposits, Profitability (ROA), Non-Performing Loans.
  - · Country-level: GDP Growth, Inflation.
  - · Global Shocks: Dummy for Financial Crisis & COVID-19.

Methodology

A Dual-Method Approach

Capturing Complex Effects

We need more than a simple linear model! Effects are likely complex, vary across conditions, and require granular analysis.

1. Panel Threshold Model (Hansen, 1999)

Goal: To test H1. Find the critical "tipping point" where the effect of climate risk on LC changes.

Does the relationship change after a certain risk level?

$$LC_{it} = \alpha_0 + LC_{it-1} + CRI\_transformed_{it} \, I(CRI\_transformed_{it} < \delta_1)\beta_1 +$$

$$CRI\_transformed_{it} \, I(\delta_1 \leq CRI\_transformed_{it} < \delta_2)\beta_2 + \cdots + CRI\_transformed_{it} I(CRI\_transformed_{it} \geq \delta_n)\beta_{n+1} +$$

$$\alpha \sum Control_{it} + \mu_i + \gamma_t + \varepsilon_{it}$$

Methodology

A Double-Method Approach

2. Method-of-Moments Quantile Regression (MM-QR)

Goal: To test H2. See if the effect differs for banks with low, medium, or high levels of LC.
Do banks with different initial liquidity profiles react differently?

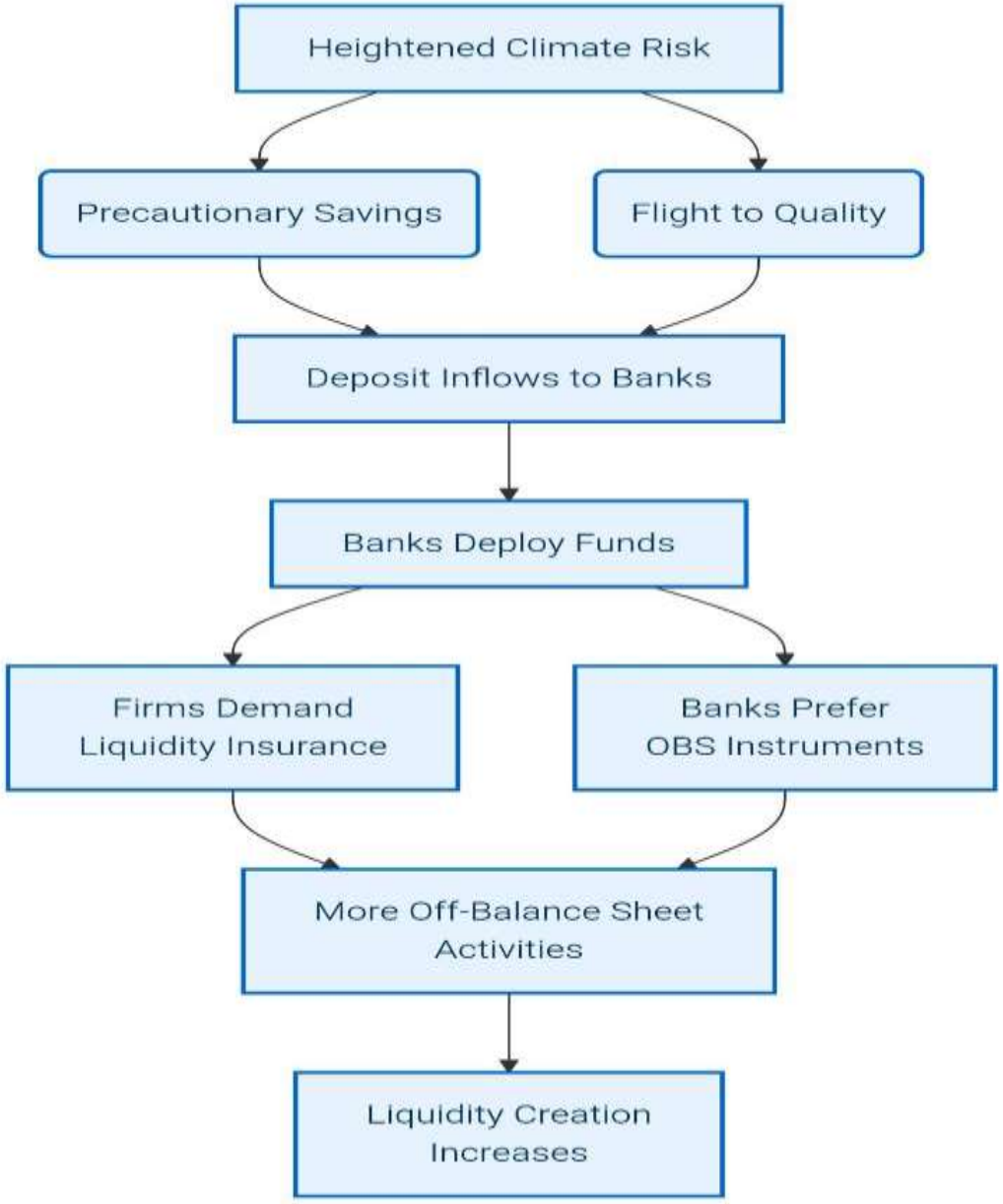
$$Q_{LC}(\theta \mid CRI\_transformed, Z) = \alpha_{0\,(\theta)} + \beta_{1\,(\theta)}\, CRI\_transformed_{it} + \delta_{j\,(\theta)} Z + \mu_{i\,(\theta)} + \gamma_{t\,(\theta)} + \varepsilon_{it\,(\theta)}$$

3. Quantile-on-Quantile Regression (QQR)

Goal: Granular Analysis. Uncover the nexus between the distribution of climate risk and the distribution of LC.
How do extreme climate risks affect banks that are already high-liquidity creators?
Provides the most complete picture of the dependence structure.

$$Q_{LC}(\theta \mid CRI\_transformed_{\partial}, Z) = \alpha_{0\,(\theta,\partial)} + \beta_{1\,(\theta,\partial)} CRI\_transformed_{it} + \delta_{j\,(\theta,\partial)} Z + \mu_{i\,(\theta,\partial)} + \gamma_{t\,(\theta,\partial)} + \varepsilon_{it\,(\theta,\partial)}$$

Methodology



Conceptual Framework: The Transmission Mechanism

Results

Results (The Threshold Effect)

Dependent variable: LC	Dynamic PT with endogenous regressors
LC_{t-1}	0.254 (0.000)***
Panel A : Estimation of threshold effect	
Threshold variable: CRI_transformed	The threshold value: **-46.38**
Panel B : Impact of climate risk on liquidity creation	
Independent variable: CRI_transformed **Below** **Above**	 0.034 (0.126) 0.047 (0.001)***
Control variables included	
Time fixed effects **Bank fixed effects** **SupW**	YES YES **7.82*** **

Note(s): *,** and *** indicate that the test results are significant at the 10% , 5% and 1% confidence levels respectively. The robust standard errors are reported. The annual average precipitation as the instrumental variable.

Only when climate risk becomes severe enough does it trigger the behavioral mechanisms (precautionary savings, flight to quality) that boost bank liquidity

Results

Results (The Heterogeneous Effect)

	0.25	0.50	0.75	0.90
CRI_transformed	0.004 (0.126)	0.021*** (0.001)	0.016*** (0.004)	0.006** (0.031)
Control variables included				
Pseudo R^2	0.211	0.201	0.304	0.296
Tests of the equality of slope estimates across various quantiles (F-tests)		18.34	16.47	17.68
P- value		(0.000)***	(0.157)	(0.106)
Bank fixed effects: YES **Time fixed-effects: YES**				
Note(s): *,** and *** indicate that the test results are significant at the 10% , 5% and 1% confidence levels respectively. The robust standard errors are reported.				

The positive effect is not uniform across all banks.
It is concentrated in the middle of the LC distribution (0.50 to 0.75 quantiles).

Results

Results (The Full Picture (QQR Results))

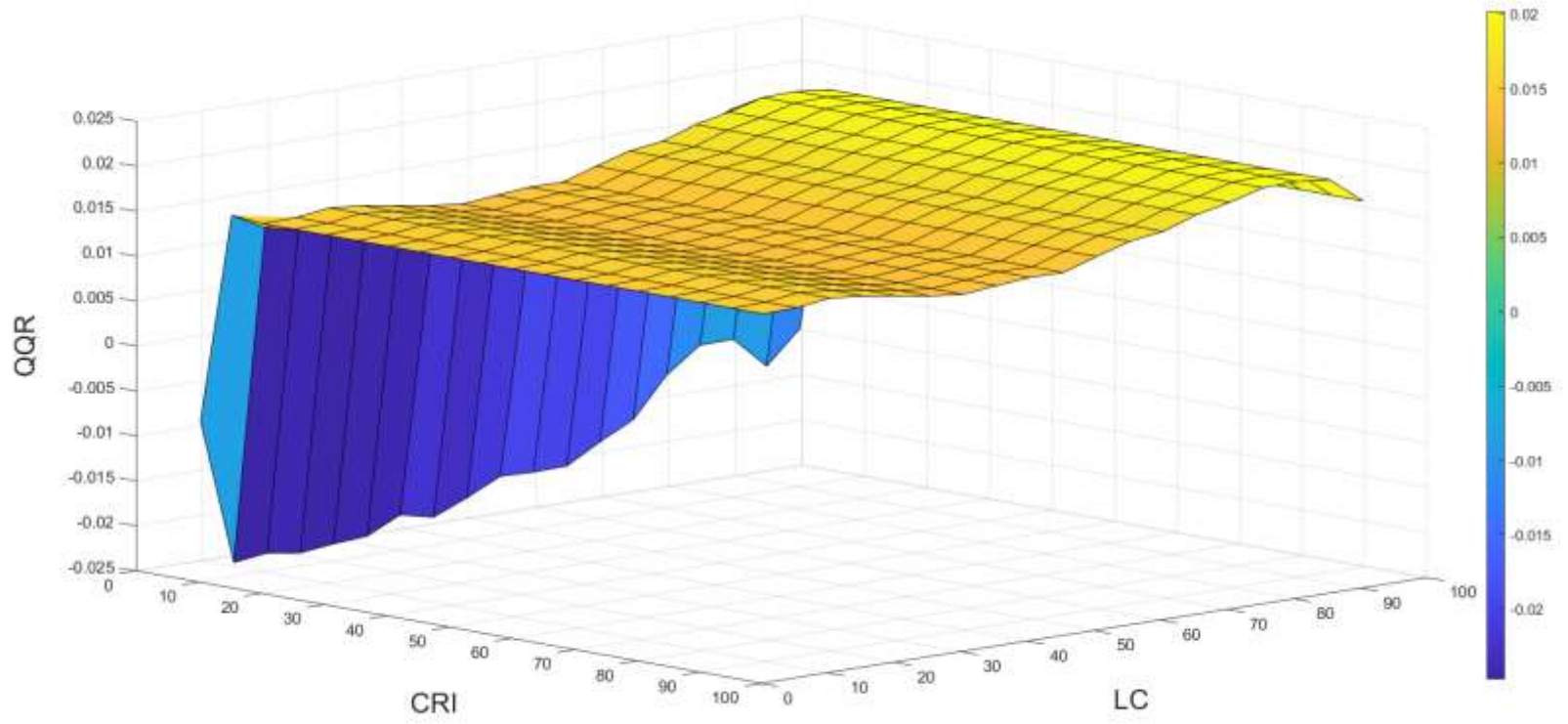


Figure 1: A 3D plot of the impact of climate risk on liquidity creation (Whole sample)

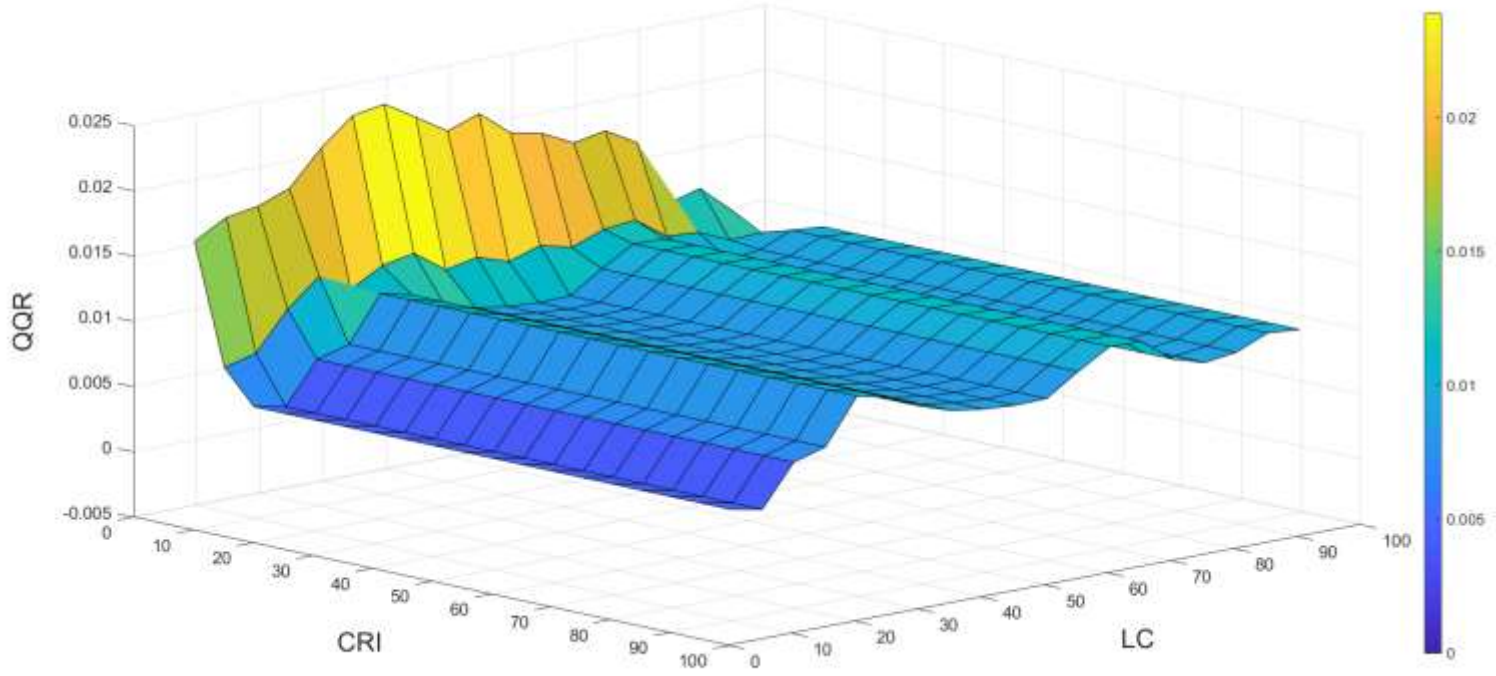
Low Climate Risk (0.05 - 0.10 quantiles): No significant effect on LC at any level of bank LC.

Medium-to-High Climate Risk (Quantiles > 0.15): Significant positive effects on LC across almost all bank LC quantiles.

Minor climate events are treated as background noise.
Once risk passes a critical point, it triggers a system-wide behavioral shift.

Results

Results (The Full Picture (QQR Results))



Saturation at the Extremes

In the very highest climate risk quantiles, the positive effect on LC diminishes.

Even aggressive banks become cautious during extreme disasters, moderating their liquidity expansion (consistent with "risk aversion" at the extremes).

Figure 2: A 3D plot of the impact of climate risk on liquidity creation (Above the threshold)

Conclusion

The climate risk-banking nexus is not monolithic. In MENA, high physical climate risk can expand bank liquidity creation through behavioral channels, contrary to the contraction seen in lending-focused studies.

Policy Implications:

- *For Regulators:* Climate stress tests must be non-linear and distribution-aware. Don't assume all banks react the same.
- *For Supervisors:* Pay close attention to off-balance-sheet exposures during climate stress; this is a key transmission channel.
- *For Policymakers*: A resilient banking system can be a shock absorber during climate crises, but policies must be tailored to different bank profiles

Contributions

To Climate Finance Literature: Shifts focus from credit to comprehensive liquidity creation, revealing a more complex and potentially stabilizing banking response.

To Regional Studies: Provides the first empirical evidence of this nexus in the under-researched, highly vulnerable MENA region.

To Methodology: Demonstrates the power of threshold and quantile methods to uncover nonlinearities and heterogeneities that linear models miss.

Q&A

Thank you !

Discussion & Questions

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