

Fragmentation Dynamics in Global Trade

G7 vs. BRICS+: Decoupling, Re-routing, and Systemic Vulnerability (2010–2024)

1. Introduction: Rupture of the "Flat World"

The post-Cold War "flat world" paradigm of seamless global markets is fracturing. Recent systemic crises—the US-China trade war, COVID-19, and the Ukraine invasion—have replaced market efficiency with a "logic of security" and dirigiste industrial policy.

2. The Five Hypotheses

- **H1 Strategic Decoupling:** Declining G7–BRICS+ bilateral trade.
- **H2 Connector Stability:** Invariant structural hub positions.
- **H3 Bloc Fragmentation:** Multi-polar modularity (Q).
- **H4 Geopolitical Alignment:** Clusters aligning with blocs.
- **H5 Systemic Fragility:** Vulnerability via bottlenecks.

3. Data & Methodology

Analyzing WITS/UN Comtrade flows (2010–2024):

- **Network Modularity (Q) & Leiden Algorithm** for clustering.
- **Adjusted Rand Index (ARI)** for geopolitical alignment.
- **Resilience Loss Index (RLI)** via global efficiency E_t .

4. Visual Analysis: Decoupling vs. Connectivity

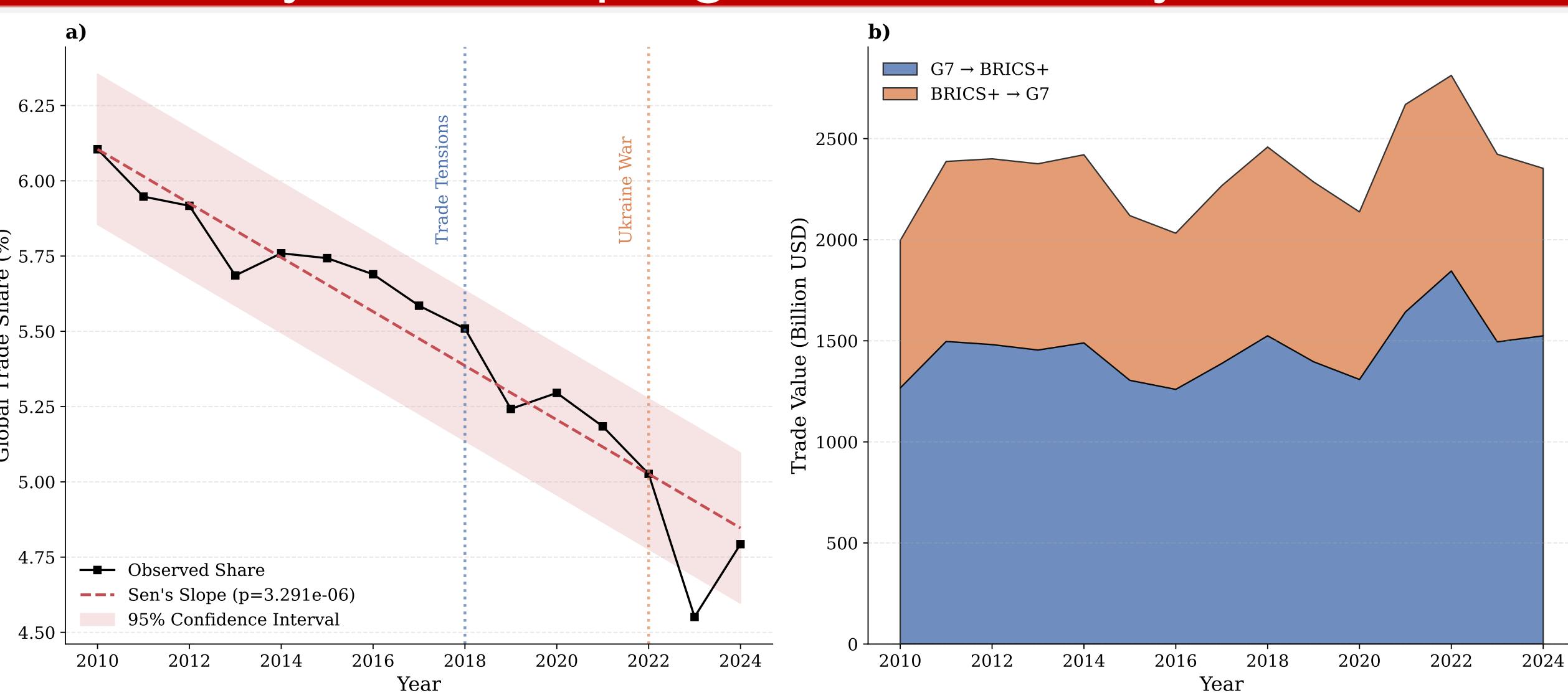


Figure: **Direct Decoupling:** G7–BRICS+ trade share contracted 21% since 2010. Annual proportional decline of $\sim 1.8\%$ ($\beta = -0.0177, p < 0.001$).

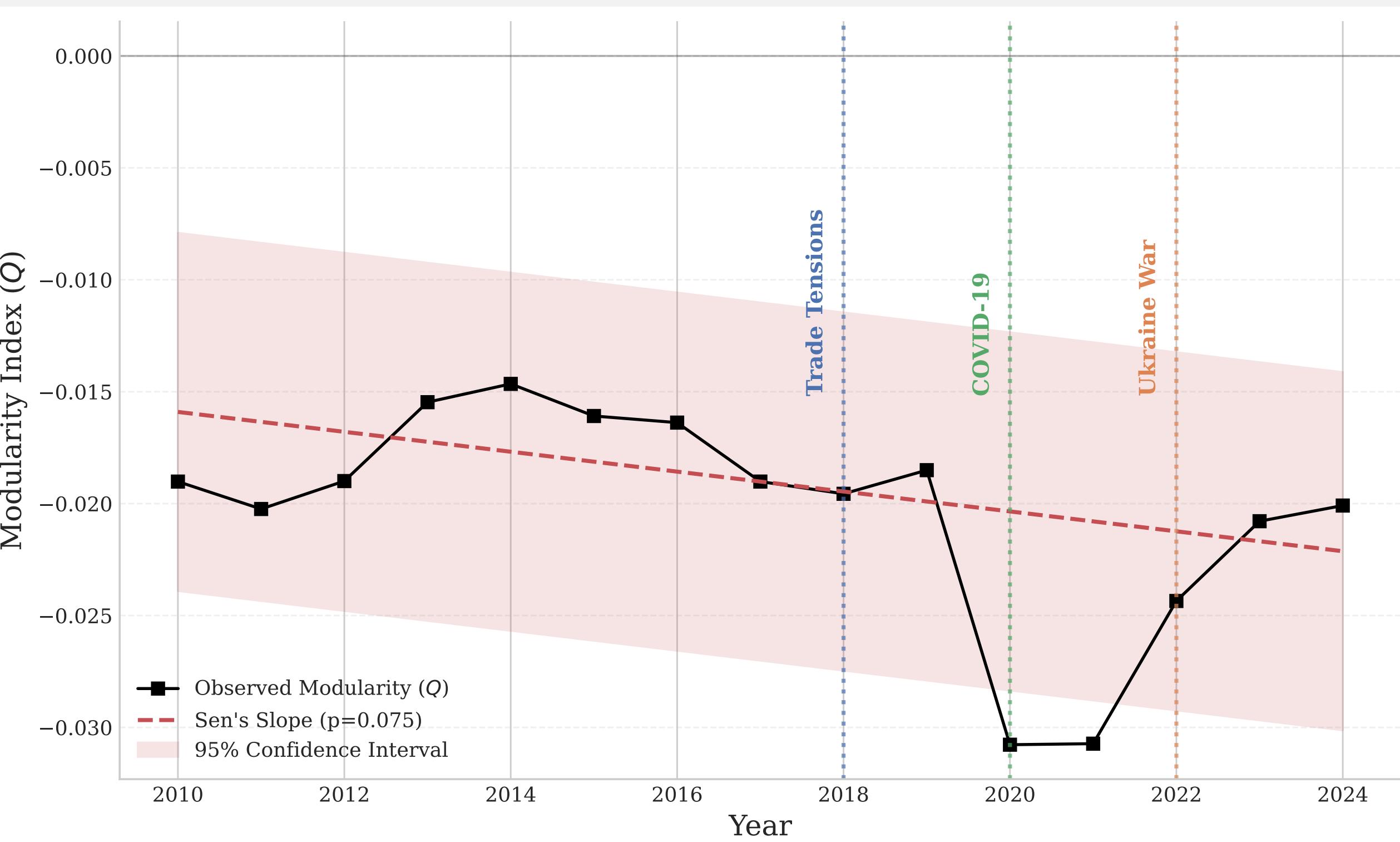


Figure: **Inertial Integration:** Q remains negative ($-0.015 > Q > -0.031$), proving G7 and BRICS+ are topologically inseparable despite decoupling.

The Stability Triad

USA ($S_i = 0.92$), China ($S_i = 0.78$), and France ($S_i = 0.77$) maintain invariant structural hub positions. Logistical path dependency protects these nodes from political turmoil.

5. "Inertial Integration"

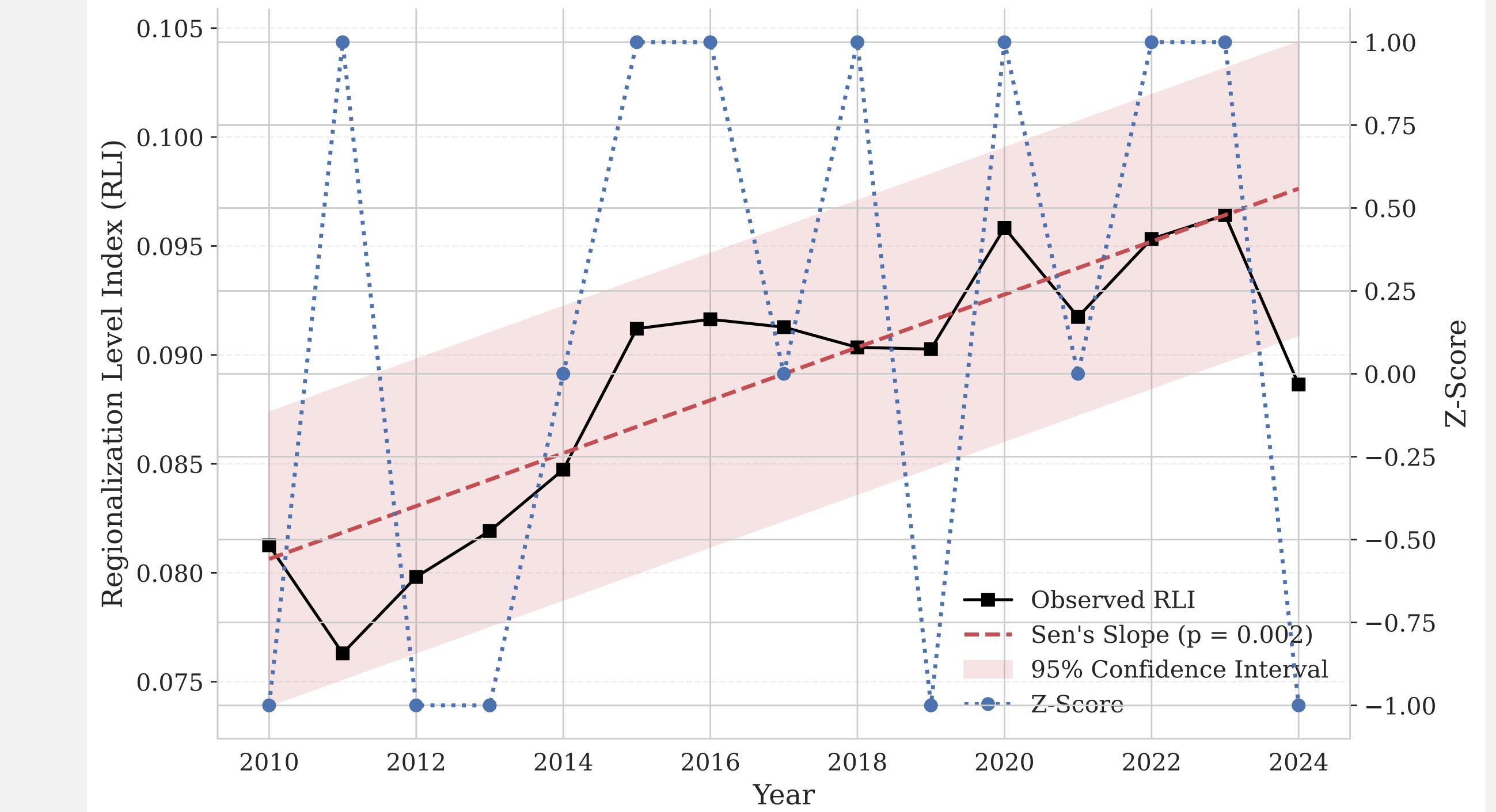
The global economy exhibits a state where the topological core remains unified even as bilateral ties fray.

- **Prohibitive Costs:** Reconfiguring deeply embedded manufacturing networks is too expensive.
- **Functional Necessity:** Cross-bloc dependence on rare earths, semiconductors, and APIs.

6. Realignment & Resilience Loss

The **Resilience Loss Index (RLI)** and **ARI** reveal:

- **2024 Realignment:** ARI spiked to 0.28 ($Z = 3.06, p < 0.01$), signaling "re-binarianization" along geopolitical lines.
- **Resilience Correction:** RLI dipped in 2024 (0.089) as states diversified sourcing to reduce bottleneck dependency.



7. Conclusions

- ① **"Inertial Integration":** Functional necessity of cross-bloc ties prevents modular fragmentation ($Q < 0$).
- ② **Structural Power:** Invariant hubs (G7/BRICS+) remain resilient to manufacturing redistribution.
- ③ **The 2024 Inflection:** Unprecedented geopolitical alignment (ARI) signals the collapse of the "flat world" and a shift toward a less efficient, but potentially more resilient, bipolarized order.

References

- [1] WITS World Bank Trade Data (2024).
- [2] Farrell & Newman (2019) "Weaponized Interdependence".
- [3] Friedman (2005) "The World is Flat".
- [4] Baldwin (2016) "The Great Convergence".