

# 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

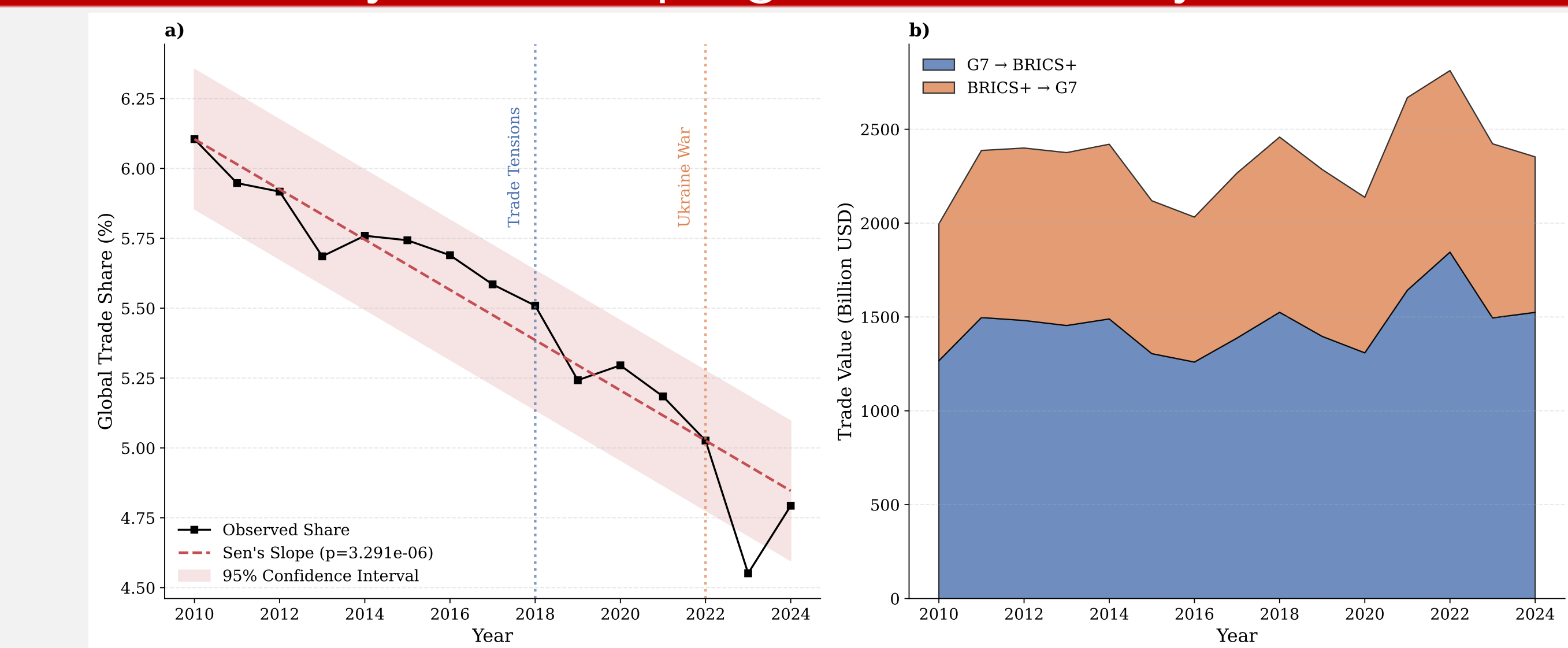
- **H1 Strategic Decoupling:** Declining G7–BRICS+ bilateral trade.
- **H2 Connector Stability:** Invariant structural hub positions.
- **H3 Bloc Fragmentation:** Multi-polar modularity ( $Q$ ).
- **H4 Geopolitical Alignment:** Clusters aligning with blocs.
- **H5 Systemic Fragility:** Vulnerability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

## 3. Data & Methodology

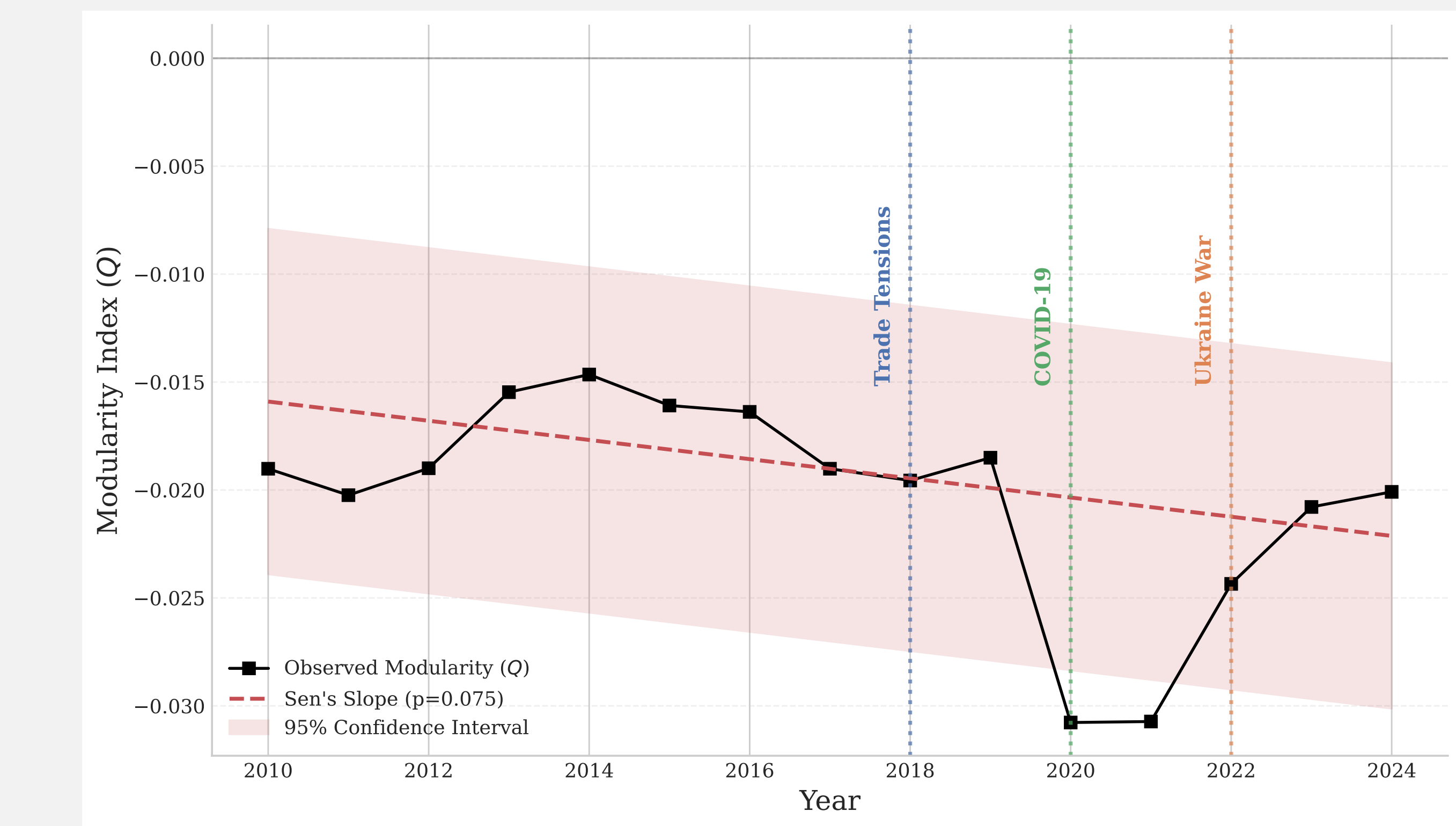
Analyzing WITS/UN Comtrade flows (2010–2024):

- **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"

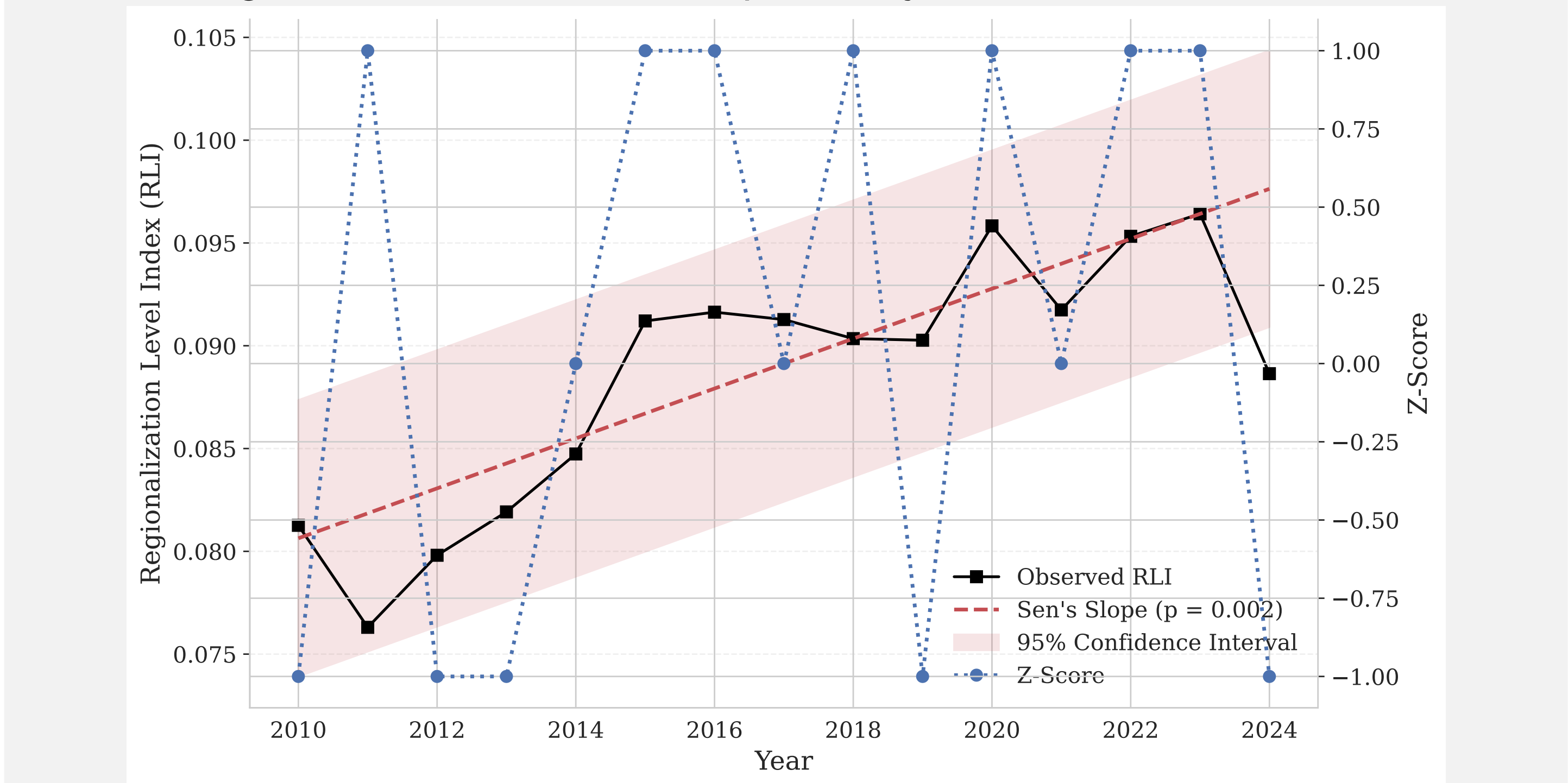
The global economy exhibits a state where the topological core remains unified even as bilateral ties fray.

- **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-binarization" 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".