macrocosm

# IT'S TIME TO CLOSE THE SUPPLY CHAIN PROTECTION GAP

More can be done to price the risk that costs the global economy $184 billion a year.

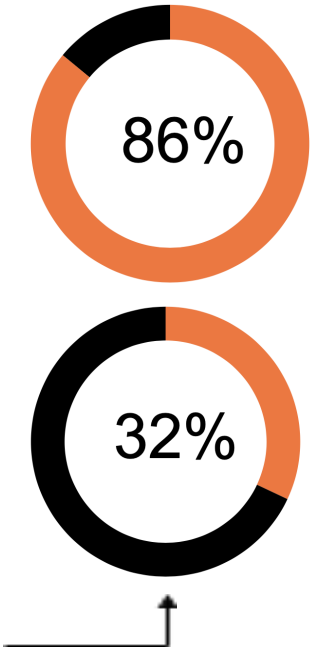
## EXECUTIVE SUMMARY

Supply chain disruption costs the global economy well over $100 billion each year; one recent estimate puts the number at $184 billion[1]. Yet insurance companies continue to struggle to price this risk. The result is twofold: the majority of businesses remain partially or entirely uninsured against supply chain shocks[2], while insurers themselves carry accumulated exposure that goes unmeasured across their portfolios. We propose a new approach.

[1] JS Held
[2] BCI Supply Chain Resilience Report 2024

# THE GROWING COST OF SUPPLY CHAIN DISRUPTION

Supply chain disruptions are expensive, widespread, and largely uninsured. Although exact numbers are hard to come by, a recent JS Held report cites a global economic cost of $184 billion per year.[3] But this figure obscures how concentrated the damage can be: large supply chain events can create severe losses in a matter of days. For example, the eruption of the Icelandic volcano Eyjafjallajökull created $5.0 billion in lost GDP in only six days in 2010[4]after grounding flights, and the blockage of the Suez Canal by the Ever Given racked up €2–2.5 billion over the 6.5-day blockage.[5] Furthermore, these types of disruptions are becoming more common. In 2024, 78% of companies reported experiencing supply chain disruption (up from 66% the prior year), with 11% reporting more than 10 disruptions in a calendar year.[6]




Consequences of supply chain disruption can range from customer complaints and increased production costs to delayed cash flows, reputational damage, and lost revenue. Yet, despite the fact that **86% of companies experienced supply chain losses in 2025, only 32% of those companies were fully insured.**[7]

Given that the cost of supply chain risk is borne by companies, it's not surprising that business interruption has ranked among business leaders' top concerns for the past six years[8]. What's more surprising is that the insurance industry — despite many years acknowledging this opportunity — has still not found adequate ways to serve this growing market.

Furthermore, for insurers writing contingent business interruption (CBI) coverage, disruptions like the Ever Given blockage or the Eyjafjallajökull eruption can generate correlated losses across dozens of seemingly unrelated policies. Because that dependency sits several tiers deep in each policyholder's supply chain, Insurers underwriting these policies independently have no way of seeing that correlation until the claims arrive together.

*"Any company would love to insure its products against supply chain disruption, not just for policy and trade, but for anything else that we've seen."*
*- Strategy Executive at a US Battery Manufacturer*

[3] JS Held
[4] Allianz. 2012. Managing disruptions Supply chain risk: an insurer's perspective.
[5] Greco Services
[6] BCI Supply Chain Resilience Report 2024
[7] Gallagher Re
[8] Allianz Risk Barometer, 2026.

# SUPPLY CHAIN RISK IS DIFFICULT TO QUANTIFY

The insurance industry has established mature, validated methods for quantifying risk across a number of perils and asset classes. Supply chain risk, however, faces four structural barriers that leave insurance companies with no standard way to price, underwrite, or manage supply chain risk.

**1** **Supply chain data is incomplete and difficult to obtain**

Insurers pricing property risk can typically identify the asset, its location, construction, and value with a fair degree of precision. When it comes to supply chain risk, however, information is incredibly sparse: many companies do not know who supplies their business beyond their direct (Tier 1) suppliers, let alone details of what is bought and sold within the network, production capacity, inventory buffers, and alternative sourcing options. These asset-level details are needed to assess risk, and are rarely disclosed or centrally available. Moreover, the supply chain is constantly changing as suppliers respond to market forces, meaning supply chain data requires constant maintenance.

**2** **Supply chains are subject to a broad range of perils**

Traditional catastrophe pricing is built around a clear causal chain: a hazard strikes a known asset, physical damage occurs, and loss follows from the extent of that damage. Supply chain disruption breaks this pattern. Physical damage to an asset can disrupt a supply chain, but a number of other perils — geopolitical shocks, cyberattacks, insolvency, labor strikes — can create supply chain losses without any physical damage at all. And even when physical damage does occur, the damaged asset is often several tiers removed from the insured, well outside what a traditional property policy would cover. As a result, the peril set insurers must underwrite for CBI is both broader than traditional property perils and, in many cases, categorically different since loss doesn't map cleanly onto a damaged, insured asset the way property claims do.

**3** **Many supply chain perils lack an established loss history**

Property catastrophe pricing draws on decades of consistent, standardized loss data (e.g., hurricane tracks, earthquake magnitudes, flood elevations) that let actuaries build reliable frequency and severity curves. Many supply chain perils lack this established loss history. As an example, geopolitical shocks and cyber attacks are comparatively recent, poorly standardized, and rarely recorded in a form that ties a specific event to a specific downstream loss amount. Even where a peril is well understood qualitatively, there may be little actuarial basis for pricing its frequency or severity. Without loss curves and base rates to anchor pricing, much of CBI underwriting relies only on expert judgment.

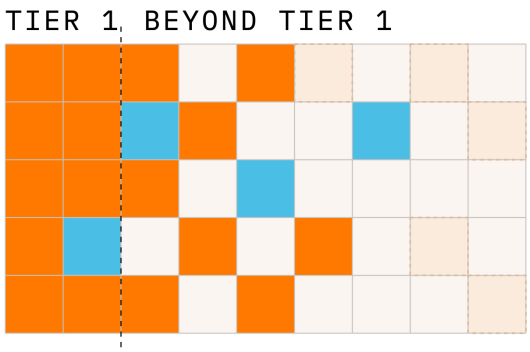
**4** **Loss propagates through network relationships, not physical proximity**

Property catastrophe models are built on the assumption that risk can be assessed asset by asset, with correlation arising mainly from shared geography (for instance, properties in the same flood zone or earthquake fault line). Supply chain risk doesn't behave this way. A single supplier disruption can cascade through a network via substitution effects, inventory

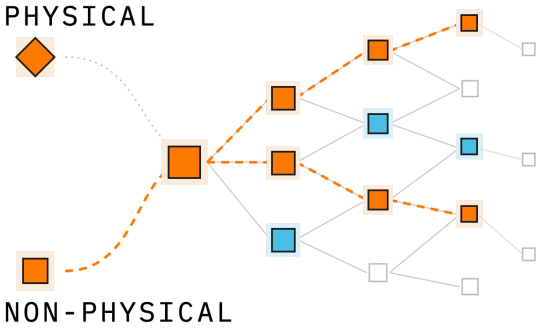
drawdowns, and second-order shortages, producing losses at companies with no direct relationship to the initial event and often no geographic proximity to it at all. The severity of the loss depends less on what happened at the point of disruption than on the topology surrounding it. The structure of the network — how many downstream firms depend on that node, whether alternate suppliers exist, how quickly capacity can be rerouted — controls how a loss will propagate.

## A NEW APPROACH TO SUPPLY CHAIN RISK

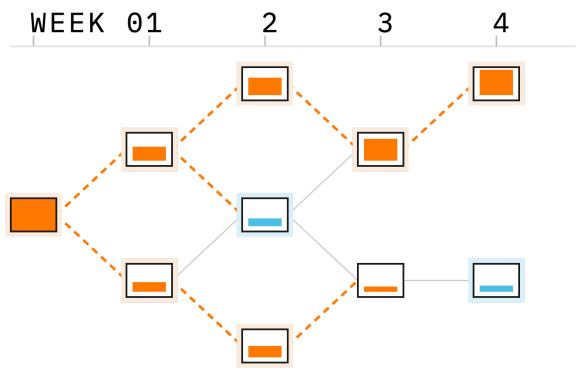
As insurers look to expand CBI coverage, and to measure accumulated portfolio risk, they need quantitative methods capable of measuring supply chain risk in a reproducible and defensible manner. One way to do this is to adopt a fundamentally different modeling approach: rather than pricing supply chain risk as a set of independent, damage-triggered exposures, we can model the economy as a network of interacting firms. Supply chain risk then emerges in the simulation as a dynamic cascade, mirroring what we see in reality. Returning to the four problems introduced earlier, this approach addresses each directly:



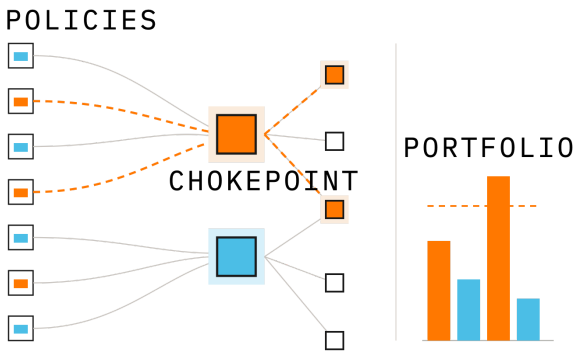

**Work with incomplete data.** Supply chain data, augmented with synthetic populations that mirror real economies, translates network uncertainty into a range of outcomes. That gives a working picture of exposure even where visibility beyond Tier 1 is limited, and it sharpens as more data arrives.




**Represent loss without requiring physical damage.** A policy change, a blocked shipping route, or a cyber-driven shutdown enters as a shock to a firm's production capacity and propagates through the network exactly as a physical disruption would. That expands the range of perils the model can price.




**Model novel events.** Shocks propagate week by week from first principles: who loses access to inputs, who has substitutes, how fast capacity reroutes, where disruption dissipates or compounds. The result is a loss estimate reflecting a firm's actual position in the network, even in unprecedented situations.




**Measure accumulation across a portfolio.** Because every exposure sits in the same underlying network, the approach that prices one policy runs across an entire book, surfacing shared chokepoints and correlated exposures invisible when policies are priced independently. Risk teams can monitor accumulation directly.

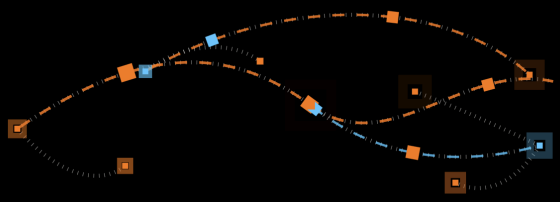
## CONCLUSION

Together, these capabilities enable a quantitative approach to measuring supply chain risk, made viable by advances in artificial intelligence. This allows for coverage that extends beyond physical damage triggers, pricing grounded in simulated and validated loss data rather than rules of thumb, and portfolio-level visibility into accumulation risk that is otherwise invisible. For the insurance industry, this represents not just a modeling improvement, but a substantial opportunity to manage portfolio risk and expand coverage into a largely underserved market.

Request a demo at macrocosm.group or contact us at info@macrocosm.group to learn more.

PRESENTING

# SUPPLY CHAIN RISK INTELLIGENCE



## Macrocosm's supply chain risk intelligence offering for insurance and reinsurance professionals aims to take the guess work out of pricing supply chain risk.

KEY CAPABILITIES

### MODEL A GLOBAL SHOCK

Feed in a shock — an earthquake, a pandemic, a tariff — and see how the impact travels along the supply chain week by week, from the point of disruption outward.

### QUANTIFY FINANCIAL IMPACT

Get output loss estimates at firm, sector, country, or regional granularity. This includes the second- and third-order effects that equilibrium models are structurally unable to see, calibrated against real disruption events and validated on observed data.

### DISCOVER HIDDEN EXPOSURE

Find vulnerable firms and sectors sitting in the cascade path. The firms hit hardest by a shock are often several links removed from it. We determine exposure from network position rather than proximity.

### MEASURE TIMING AND RECOVERY

Anticipate impacts before they strike. The model runs at weekly granularity to show when the cascade reaches each sector, when losses peak, and how long the recovery tail extends.

VALIDATION

**Why trust us?**

Macrocosm's models have been tested against actual historical disruptions — including the 2011 Tōhoku and 2016 Kumamoto earthquakes in Japan — at a scale of approximately 1.5 million individual firms. This validation work, conducted in partnership with Oxford-Aioi R&D Lab, grounds the model's outputs in observed outcomes. Learn more about our research and model validation at macrocosm.group.

## ABOUT MACROCOSM

Founded in 2023, Macrocosm is a public benefit corporation spun out of Oxford University that builds economic world models to predict, plan and position under uncertainty. Macrocosm's work is grounded in complexity economics and agent-based modeling research led by Chief Scientist and founder J. Doyne Farmer. The company works with insurers, reinsurers, and corporations to bring simulation-based risk assessment and decision analysis to problems that traditional models struggle to capture.