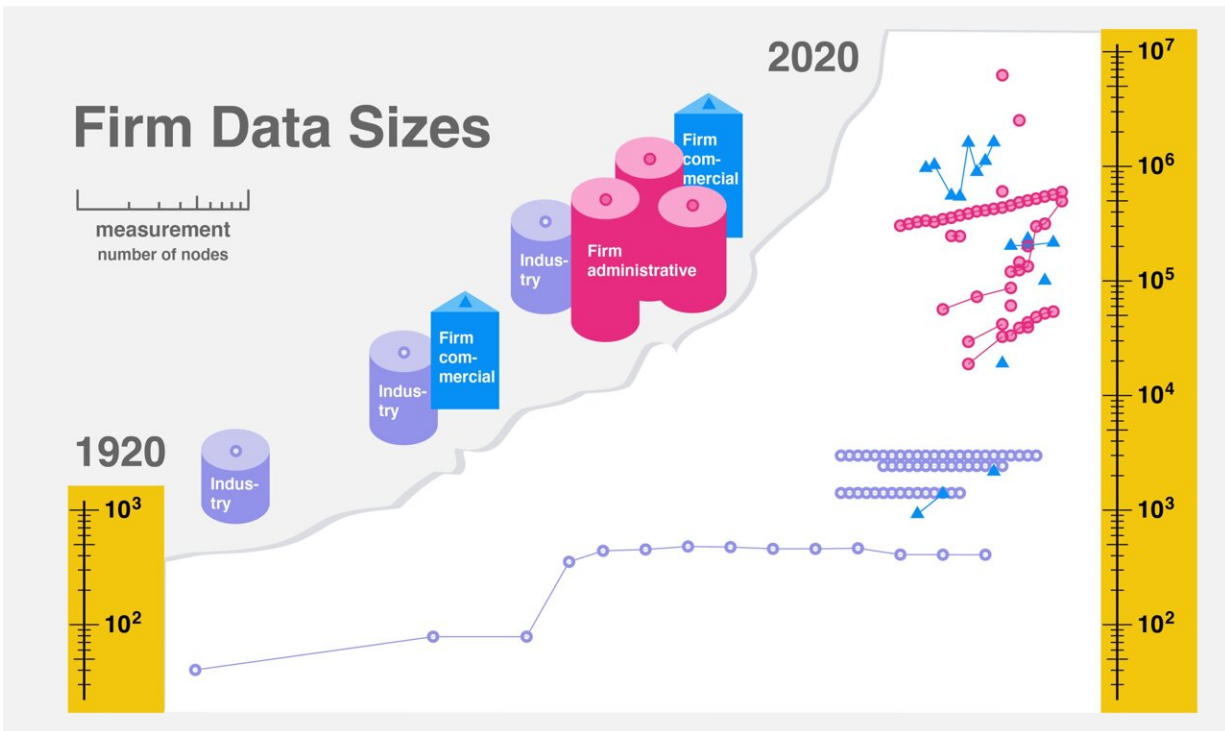


Researchers urge alliances to ensure supply chain security

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A data revolution has taken place in recent years, with the size of supply chain data exploding and the quality and richness of information improving significantly. In addition to aggregated industry-level data, there are now wide-ranging firm-level datasets. Credit: Complexity Science Hub

Understanding supply networks could have a significant impact on improving supply security, promoting and objective monitoring of the

green transition, strengthening human rights compliance, and reducing tax evasion. International alliances are needed for such an understanding, as emphasized by a research team led by the Complexity Science Hub in a recent commentary in *Science*.

Even though many companies only know their immediate trading partners, they depend on countless other supply relations up and down the supply chain. A supply shortage anywhere in this supply network may affect suppliers, suppliers of suppliers, and so on, as well as customers and their customers' customers. "Such supply disruptions caused an estimated loss of 2% of global GDP in 2021—approximately \$1.9 trillion—and significantly contributed to the current high inflation," explains CSH researcher Anton Pichler.

"For a long time, it was unthinkable to analyze the [global economy](#) at the [company](#) level, let alone its complex network of supply interconnections," says Pichler. That is changing now.

For almost a century, only aggregated data could be analyzed, such as the average values of entire industry sectors, for example, the automotive industry. Therefore, predicting how individual company failures will affect the system was simply not possible. What happens to the economy when a specific company stops its production? What if an earthquake paralyzes an entire region?

13 billion supply connections

Thanks to a new generation of data on the company level and a set of new analysis methods, we are entering a new era. Despite the vast amount of data—there are approximately 300 million companies worldwide, each with an average of 40 domestic suppliers, resulting in up to 13 billion supply connections—researchers can now map the connections between individual companies.

Currently, value-added tax (VAT) data is the most promising option for reconstructing reliable large-scale supply networks. Several countries like Spain, Hungary and Belgium use a standardized VAT collection that practically records all domestic business-to-business (b2b) transactions. With these, one can map the entire national trade of a country.

In most countries like Germany, Austria and France, where VAT is not collected for individual b2b transactions but only accumulated over a specific period, such mapping is currently not possible. "The standardized b2b collection could reduce administrative overheads for companies and would contribute substantially to tax compliance," says CSH researcher Christian Diem, co-author of the study. Estimates suggest that VAT-related fraudulent activities in the European Union (EU) amount to €130 billion annually. A tax gap that could be massively reduced.

The researchers stress that it is not only [tax evasion](#) but also other major challenges of our time that depend on the detailed knowledge of supply networks—ideally on a global scale. "For individual companies, it's nearly impossible to ensure that all trading partners, their suppliers, and their suppliers' suppliers operate environmentally friendly and in compliance with human rights. If this were centrally documented in a gigantic network, it could be more easily ensured," emphasizes Pichler.

One-fifth of the global economy on a map

The next step is to link trade data from different countries. Currently, the EU records trade in goods between its member states at the company level. If they also included services and linked them with VAT data, this could lead to a comprehensive cross-border company-level [network](#). According to the authors, this would represent almost 20% of the global GDP.

The European Commission laid the legal foundation by proposing "VAT in the Digital Age." "Unfortunately, this is far from being realized," says Stefan Thurner, an author of the commentary and President of the Complexity Science Hub, "So far, we do not have a single situation where the supply chain networks of any two countries have been joined and merged. This would be an essential next step."

To create a truly international picture of supply interconnections, hundreds of datasets must be joined, analytical tools developed, and an institutional framework must be created together with secure infrastructure for storing and processing enormous amounts of sensitive data.

"To advance this endeavor, a strong international alliance of various interest groups is required, including national governments, statistical offices, international organizations, [central banks](#), the private sector, and academia," explains Thurner. The first collaboration in science, involving authors in macroeconomics, [supply chain](#) research, and statistics, now aims to establish a foundation. The researchers hope to inspire others to join their efforts.

More information: Anton Pichler et al, Building an alliance to map global supply networks, *Science* (2023). [DOI: 10.1126/science.adi7521](https://doi.org/10.1126/science.adi7521). www.science.org/doi/10.1126/science.adi7521

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