



## COUPLED POLICY BRIEF

### Assessing relationship patterns in commodity supply chains and their sustainability implications

The production, consumption and trade of global agricultural commodities, such as soy, beef and palm oil, are responsible for significant global forest loss<sup>1</sup>, carbon emissions<sup>2</sup> and biodiversity loss<sup>3</sup>. Supply chain actors, such as food processors, slaughterhouses, traders or retailers, play a crucial role in shaping land use dynamics. Recently, they have been forming coalitions to pledge sustainability goals, including zero-deforestation commitments<sup>4</sup>. So far, little attention has been given to the persistence of supply chains relationships, including companies' sourcing patterns, and how they influence these sustainability goals. We show that although more persistent supply chains may lead to more adoption of commitments, they may also increase deforestation. Therefore, supply chain sustainability initiatives need to consider sourcing patterns in their design.

#### KEY MESSAGES

- Persistence in global commodity supply chains is the maintenance over time of supply chains' geographic network configurations, including trade relationships, sourcing and supplying patterns;
- In Brazil's soy supply chain, companies with more persistent sourcing behaviors are more likely to adopt zero-deforestation commitments;
- These more persistent Brazil's soy companies in sourcing behaviors also have higher deforestation risks;
- Relationship patterns and whether they are more persistent or volatile need to be considered in the design of public policies, territorial planning and supply chain sustainability interventions because this knowledge informs how companies move, source and influence land use and rural development trajectories.

## What is persistence in global commodity supply chains?

Persistence in global commodity supply chains is the maintenance over time of supply chains' geographic network configurations, i.e., the network of trade linkages and flows between specific places of production and consumption, and specific actors including producers, traders, retailers, and consumers<sup>5</sup>. This persistence in global commodity supply chains is mostly influenced, determined and predicted by factors and dynamic processes such as infrastructural conditions and lock-ins created by companies, land-tenure, credit policy, trust, companies' power and business models, geographic sourcing strategies, the existence of cooperatives, the use of technologies such as genetically-modified seeds, irrigation, and biophysical conditions such as climate and temperature and topography<sup>6</sup>.

### SOURCING PATTERNS, STICKINESS AND WHAT IT IMPLIES

**Sourcing patterns** refer to where and how frequently a company purchases products from one location or another.

#### Example of Brazil's soy supply chain: How a soybean trading company makes its purchases

A soybean trading company may choose to purchase all the soy it needs from ten municipalities in the South of Brazil, and for various reasons this company chooses to buy those soy volumes from these same ten municipalities every year. In contrast, another company may choose to buy from five municipalities in the South and another twenty municipalities in the North this year, but next year it decides to reconfigure its sourcing network completely, for various reasons, and buys soy from twelve municipalities in the North-East and from another five locations in the Center-West of the country. These persistent or volatile sourcing patterns imply different land use and rural development trajectories for these locations because these different sourcing patterns will drive different trust levels, investment decisions, the formation of clustering or agricultural agglomeration economies. Therefore, it is crucial to observe, elicit and quantify these sourcing patterns.

The measurement of **stickiness** focuses on the set of linkages and the changes in their configurations around each actor in the network. Our stickiness measurement captures and quantifies changes in the sourcing patterns so that we can shed light on this phenomenon and use the information on these sourcing patterns to formulate public policies and sustainability interventions.

## Assessing persistence in Brazil's soy supply chain

Using Brazil's soy supply chain with data provided by Trase<sup>7</sup>, we found municipalities of production and trade that have persistent supplying patterns with export traders (red municipalities, Figure 1) and volatile patterns (yellow municipalities, Figure 1)<sup>5</sup>. These supplying patterns lead to different land use and rural development trajectories. More persistent traders are more likely to adopt zero-deforestation commitments<sup>8</sup>. Nevertheless, they also promote more deforestation and native vegetation conversion for agricultural usages overall<sup>8</sup>. In addition, we found that these more persistent relationships moderated by agricultural cooperatives may result in more inclusive rural development patterns<sup>8</sup>, while more volatile trade patterns without cooperatives may result in excluding development or maldevelopment<sup>10</sup>.

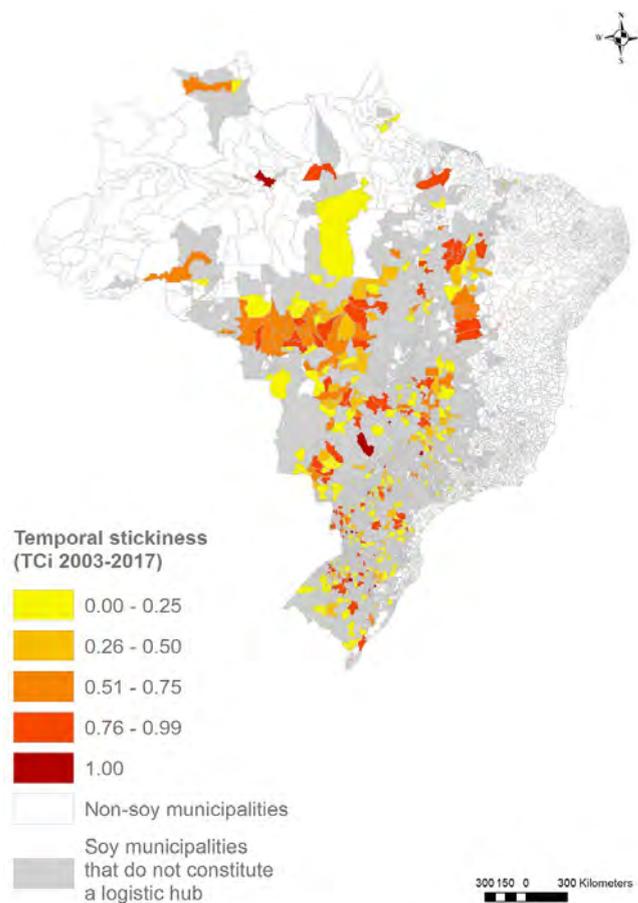


Figure 1. Spatial distribution of the persistence of soy producer municipalities in Brazil supplying to export traders. Municipalities in grey produce soy, but this soy is bought by traders through one of the logistics hub municipalities. Note that local soy transactions destined for local consumption in poultry or pork facilities are not captured by this dataset. The more yellowish municipalities, closer to 0, are those with more volatile supplying patterns. The more reddish municipalities, closer to 1, are those with more persistent supplying patterns. TCi refers to temporal average stickiness, which is the persistence measurement calculated consecutively for each pair of years between 2003 and 2017, i.e., 2003-2004, 2004-2005, 2005-2006, ..., 2016-2017, then averaged for the entire period.

## Implications of supply chain persistence for sustainability governance and policy

Supply chain networks may reconfigure under the influence of the factors and processes described here, including economic incentives, institutional enablers and constraints, social and power dimensions, biophysical and technological aspects, lock-in effects, trust, power and agency dynamics. By knowing more about this phenomenon, researchers and policymakers can better predict how volume flows of commodities may restructure and adjust in the face of interventions. Supply chain actors have business models and sourcing strategies that may be opaque. However, using this type of supply chain relationship analyses, we can elicit these patterns and behaviours by looking at historical patterns and project the supply chain re-configuration or consequences in the face of similar changes or interventions.

This knowledge, thus, may contribute to the design of public policies for territorial planning, for example, that generally do not consider companies' geographic sourcing patterns. In other words, territorial planning may consider why companies prefer to locate and source consistently from specific regions while others prefer to source volatily. Consequently, territorial planners and policy-makers can design different

sustainability interventions for each type of company. For example, creating tax incentives for farmers to build their own silos will benefit companies that have a volatile sourcing strategy and will jeopardise companies that already have their own silos and a persistent sourcing strategy. Do we want to do that, knowing that more persistence leads to more deforestation? With this persistence analysis, we can identify these companies and inform their profiles.

For zero-deforestation commitments both adopted by sectoral or multi-stakeholder coalitions, it is elementary for volatile companies to commit since they already have a non-stable sourcing pattern, meaning that they can move away from deforestation-risk areas. On the other hand, persistent companies tend to be more reluctant to adopt these commitments because, historically, it has been more difficult for them to move territorially. Therefore, supply chain relationships knowledge may contribute to design targeted interventions that consider the companies' geographic relationship patterns and propose tailored approaches to each of them acknowledging their geographic sourcing differences.

*Photo: Soy Production in Brazil, Primavera do Leste (credit Sentinel Hub, CC BY 2.0)*



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### Sources and interesting links

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COUPLED Policy Briefs feature highlights and policy implications from research conducted under the project Operationalising Telecouplings for Solving Sustainability Challenges for Land Use (COUPLED). COUPLED is a European research and training network that works on topics such as land use processes that link distant places (telecouplings) and how to govern these processes towards sustainability in an interconnected world. This project receives funding from the European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant agreement No 765408. Responsibility for the content rests entirely with the authors. Neither the COUPLED network nor the European Union's Horizon 2020 Research Executive Agency (REA) necessarily share the expressed views.

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10. Lopes, G.R., M.G. Bastos & T.N.P. dos Reis, Maldevelopment revisited: Inclusiveness and social impacts of soy expansion over Brazil's Cerrado in Matopiba. *World Dev.* 139, 105316 (2021).

### Selected publications from the COUPLED project

- Leijten, F., et al., The influence of company sourcing patterns on the adoption and effectiveness of zero-deforestation commitments in Brazil's soy supply chain. *Prep.*, 1–41 (2021).
- Reis, T.N.P. dos, et al., Understanding the Stickiness of Commodity Supply Chains Is Key to Improving Their Sustainability. *One Earth.* 3, 100–115 (2020).
- Reis, T.N.P. dos, et al., Understanding the potential environmental implications of companies sourcing patterns. *Glob. Environ. Chang.* - Prep. to be Submitt. (2021).
- Reis, T. N. P. dos, et al., The rural development implications of stickiness in Brazil's soy commodity supply chains. *Prep.*, 2021 (2021).
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