

# DebtStreamness: an ecological approach to credit flows in inter-firm networks

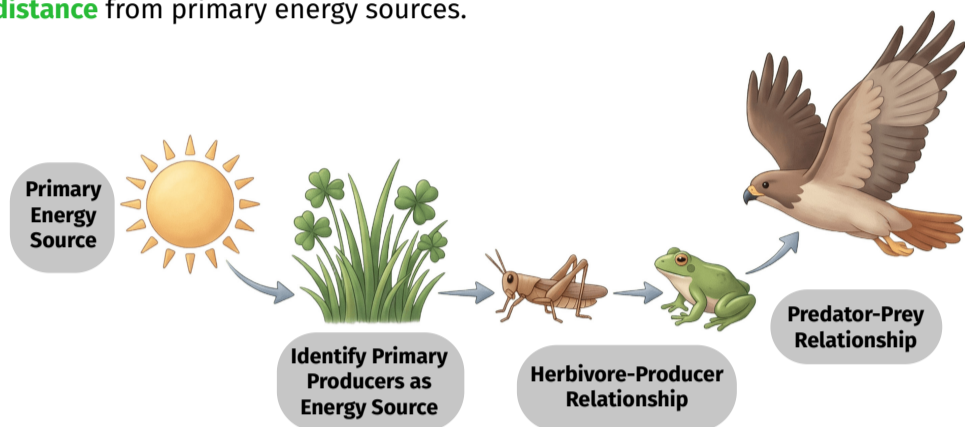
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## Ecological networks

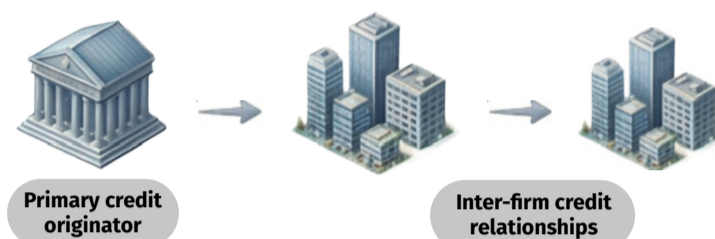
In **ecological food webs**, **species** are connected by predator-prey relationships. A species' position within this web is captured by its **trophic level**, indicating **their distance** from primary energy sources.



Food chains are related to the **stability of ecosystems**, showing **resilience** when strong and weak link coexist.

## Financial networks

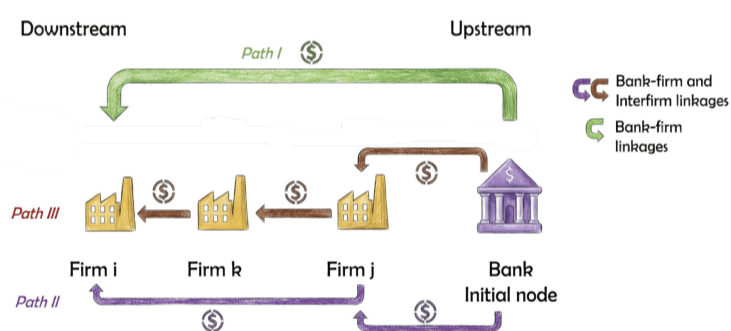
In **economic networks**, **firms** are connected by **credit relationships**, where **banks act** as the "primary energy source". The structure of **financial interactions** and the **positions of firms** within the network is linked to the **system's stability**.



This research studies **how credit flows** between firms and **how these connections affect financial stability**.

## What is DebtStreamness?

We introduce a new measure, inspired by **ecological networks**, called **DebtStreamness**, which captures **how far a firm is from banks** along credit chains.



The **DebtStreamness** of a firm is the **average over all paths** that originate in the banking sector and reach the firm, with each path **weighted by the amount of credit flowing through it**.

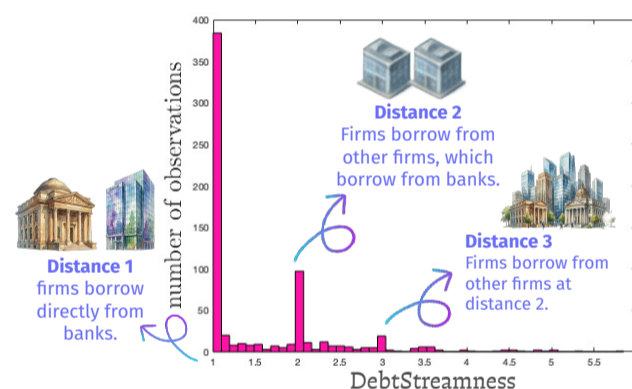
## Case study : Central Bank of Uruguay



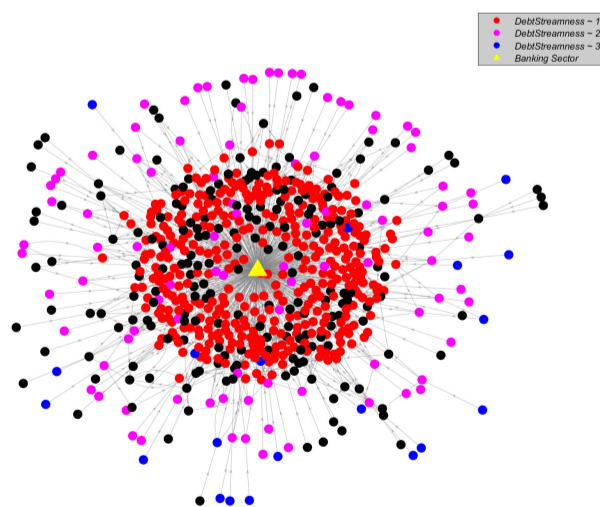
The Central Bank of Uruguay launched the **Economic Expectations Survey** in 2018, where they surveyed **Uruguayan firms with more than 50 employees, which represents 60% of their economy**.

Each firm reports its **top 3 debtors and creditors (commercial credit)** and **total amount borrowed from firms**.

We find a **tiered structure in the credit chains** (pink bars). This is analogous to **trophic levels in a food web**.



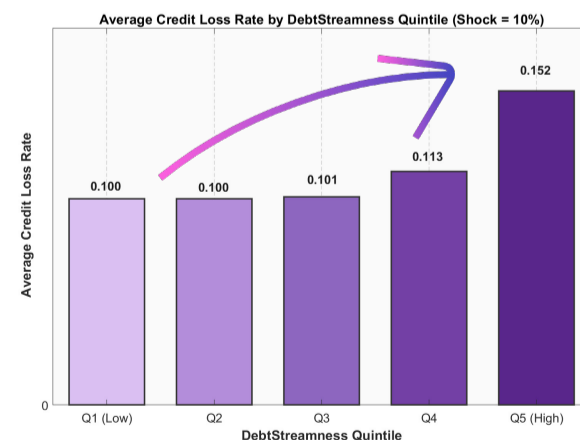
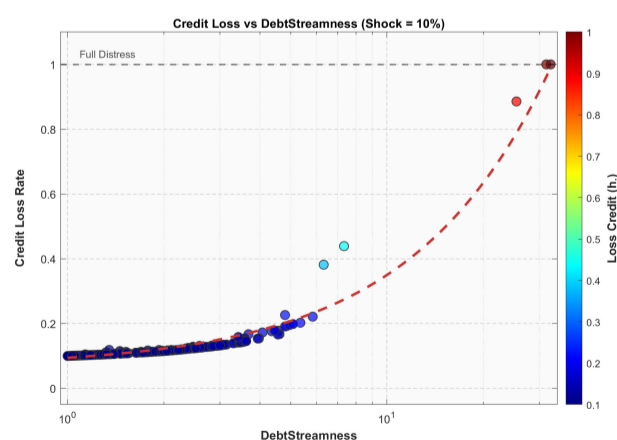
This **hierarchical structure in the credit chains** shows firms closer to the banking sector exhibiting lower DebtStreamness, while peripheral firms are associated with higher DebtStreamness due to longer credit chains.



Nodes represent firms, with colours indicating values of DebtStreamness: **red nodes have DebtStreamness-1**, **pink nodes have DebtStreamness-2** and **blue nodes have DebtStreamness-3**, the banking sector is in the middle (yellow triangle).

## Why does this matter...?

We analyze how **fragile** the system is when an **external shock** affects the financial system (**stress test analysis**). **Policymakers** can then **quantify** how this **shock propagates** through the firm network.



The **longer the credit chain** (DebtStreamness quintile = Q5), the **greater the credit losses**.

## CONCLUSION

- We introduce DebtStreamness to measure the **distance of firms from banks in the credit chains**, and we use it to **characterize the inter-firm credit network**.
- We find a **hierarchical structure of firm networks**.
- We show that DebtStreamness is useful to identify **financial vulnerabilities** within the inter-firm credit networks.

