

The market effect of acute biodiversity risk: the case of Brazilian corporate bonds

- Human activities erode biodiversity but biodiversity losses also impact human activities.
- Amundi's event study¹ is among the first of its kind, examining the linkages between biodiversity events and micro-level security prices (e.g., Brazilian corporate debt).
- Using Natural Language Processing (NLP) and the GDEL event database², biodiversity is considered a risk that affects companies' operations, reputations, finances and physical assets.
- The results highlight that companies in sectors most affected by biodiversity face a widening of their corporate bond spreads following acute biodiversity events.

BIODIVERSITY, HUMAN ACTIVITY AND CORPORATES

Biodiversity is part of the Earth's natural capital and considered the cornerstone of a well-functioning planet. The many benefits to humans provided by natural capital are often integral to the provision of clean drinking water, waste decomposition and food productivity as well as being critical for human health and mental well-being (see Box 1)³. These benefits are known as ecosystem services.

Box 1: Ecosystem services essential for human activities and well-being

1. Increases the **stock of natural capital** by contributing to crop pollination, soil fertility, air and water purification, flood control and climate regulation
2. Sustains **economic value creation** by supplying fuel, water, food and wood
3. Contributes to **social value creation** (e.g., recreational activities, spiritual well-being)

Biodiversity is vital for human activities and companies ((for example, paper companies rely on forests for wood production). However, human activities can erode biodiversity but biodiversity losses can, in turn, affect human activities. The latter is referred to as the **double materiality principle of biodiversity** (see Figure 1).

There are strong interlinkages between biodiversity, food security, climate change and socio-economic systems. This ensures notable second-order effects. For example, a specie's extinction may threaten a full food web and trigger a food security issue, while climate change can accelerate biodiversity losses.

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Figure 1: The Double Materiality Principle

Human activities impact biodiversity:

- Acid rain from air pollution harms fauna and flora⁴.
- Industrialisation and urbanisation increase ground level ozone & CO2 levels. This damages fauna, flora and plants' photosynthesis capabilities⁵.
- Climate change reduces soil production and carbon storage capabilities⁶.
- Unsustainable agricultural practices and land use conversion can erode soil quality⁷.
- Species are endangered by over-exploitation (e.g. hunting), or habitat degradation⁸, while the introduction of invasive species can be triggered by human travel.

Biodiversity losses impact human activities & health:

- Deforestation and urbanisation can reduce wildlife habitat that can result in greater wildlife-human contact. This can help to spread diseases from animals to humans⁹.
- Agricultural practices can favour certain vectors of transmission (e.g. flies) which can activate new influenza viruses¹⁰.
- Human actions can lower ecosystems services, accelerating climate change¹¹ (e.g., the marine ecosystem includes carbon sinks that can be damaged)¹².
- Biodiversity losses and population growth can reduce food security. Crop yields depend on soil quality¹³.

THE RELATIONSHIP BETWEEN CORPORATES AND BIODIVERSITY

The impact of biodiversity losses on human activities can be multifaceted and difficult to measure. In particular, companies often struggle to appraise their individual risks arising from biodiversity losses. Although they generally recognise reputational risk as an issue¹⁴, regulatory, operational, technological, market (consumers changing suppliers) and financial risks (limited access to finance) also exist. In order to gain an understanding of the links between biodiversity losses and companies, we decided to investigate the impact of biodiversity events on businesses' operational capabilities¹⁵.

Box 2: Biodiversity losses affect companies' operations that depend on forest products

Using a Carbon Disclosure Project (CDP) dataset (questionnaire), we examined the impact of biodiversity losses on businesses' operational capabilities in relation to their dependence on forest products. We defined operational risks as increases in operating costs, disruptions in production capacities and supply chain disruptions.

On examining companies' answers to the questionnaire, we saw that reputational and market risks dominated, while operational and regulatory risks represented a sizable share of the impacts. Tangible cases of operational risk included events such as forest fires or droughts that decreased crop yields or fruit production, but also a lack of pollination or insect infestation. Our analysis also showed that flora diseases could trigger higher operating costs, while damage caused by insect infestation may disrupt workforce management.

The above study illustrates the material impact of biodiversity losses on businesses' operations. There were other risks mentioned by companies in the questionnaire relating to biodiversity. These included: regulatory risk which was viewed as being the cost associated with a new material's certification; reputational risk which was linked to the cost of the additional reporting needed to address sustainability concerns; and technological risks which related a lack of access to crop varieties developed by other countries, or poor innovative responses to changing raw materials.

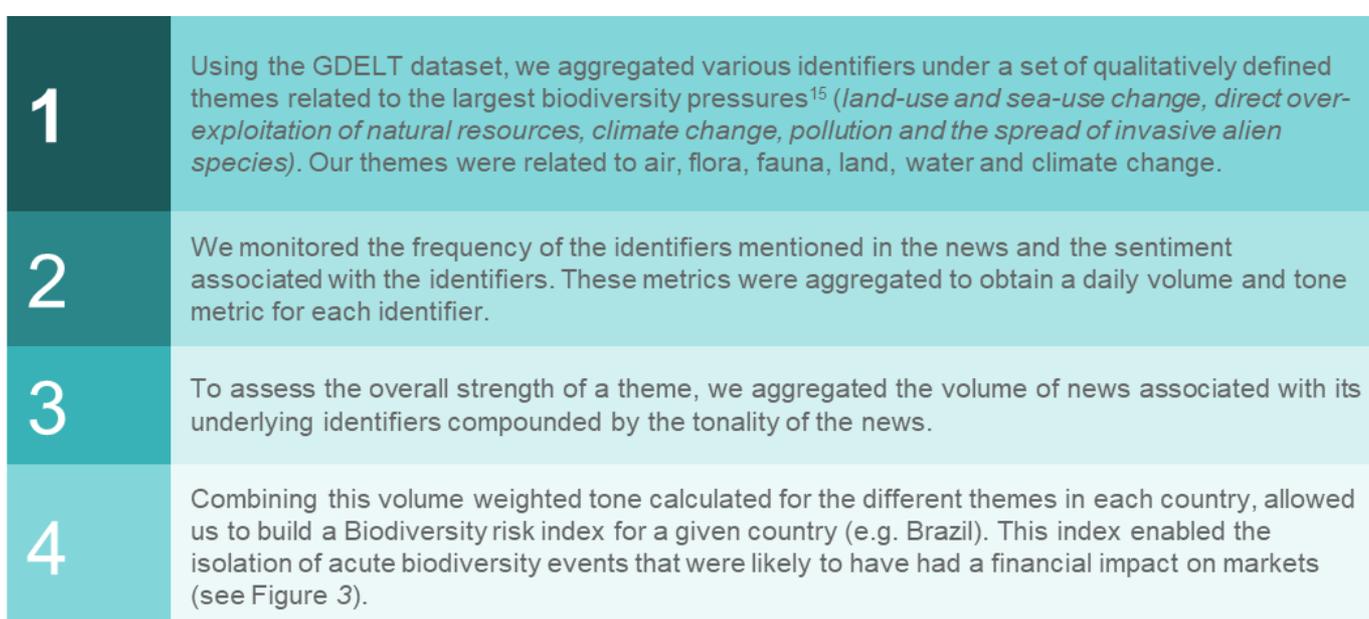


MEASURING ACUTE BIODIVERSITY RISK

Although there has been a notable volume of studies on biodiversity, to our knowledge, the financial industry has not provided research focused on the linkages between acute biodiversity events and the pricing of securities. Sector analysis has been popular for identifying which activities are the most dependent on biodiversity. However, in our view, appraising the impact of biodiversity loss on a company’s finances solely based on its sector activities might conceal company-specific features. Thus, the objective of our event study was to shed light on the impact of acute biodiversity events on the pricing of individual corporate bonds. In particular, we aimed to measure the risk of these events on Brazilian companies’ debt. The decision to focus on Brazilian companies was due to the Amazon rainforest being a home to the most diverse flora and fauna on the planet, making Brazil a “megadiverse” country.

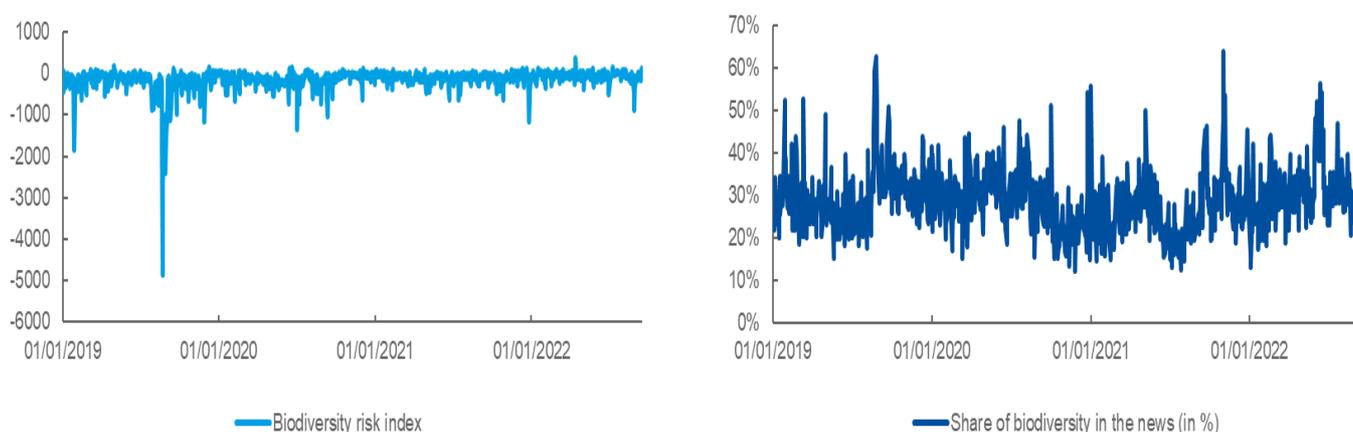
We used the Global Database of Events, Language and Tone (GDELT) dataset that records a large amount of global news for more than 23,000 identifiers. Importantly, this database provides the location of events and sentiment associated with the lexical field of biodiversity¹⁴. Our first aim was to determine a measure of biodiversity risk.

Figure 2: Constructing a Biodiversity risk index



In Figure 3 below, it can be seen that biodiversity is more frequently mentioned in the press when risks are high, which we quantified with negative spikes in the Brazilian Biodiversity risk index (e.g., August 2019). In other words, the downward spikes correspond to substantial negative biodiversity events (see Table 1 below).

Figure 3: The Biodiversity Risk Index in Brazil and biodiversity’s visibility in the news



Source: Amundi Institute. The data was based on the period January 2019 to November 2022.



BRAZILIAN CORPORATE BOND SPREADS AFTER BIODIVERSITY EVENTS

We conducted an event study to investigate the impact of acute events affecting biodiversity risk on corporate bonds. To select notable biodiversity events, we split the Brazilian Biodiversity risk index (see Figure 1) into sub-indices related to air, fauna, flora, land, water and climate change (see Table 1).

Based on those sub-indices we selected dates where sentiment and news volume were the most negative and the highest. In doing so, we went back, as far as possible, to the first date on which the event appeared in the news. The Brazilian corporate bonds were drawn from the Intercontinental Exchange Bank of America Merrill Lynch Investment Grade Index (denominated in USD).

Table 1: Acute biodiversity events in Brazil

DATE	TAG	THEME	NEWS (in %)	COMMENT
25/01/2019	BR1	Water	33	Brumadinho dam disaster
22/08/2019	BR2	Land	56	Amazon wildfires (highest since 2007)
28/11/2019	BR3	Air	23	Amazon fires may cause Andes glacier to melt faster
28/11/2019	BR4	Generic	28	Bolsonaro describes Amazon "disinformation"
28/11/2019	BR5	Fauna	16	Species at risk of extinction in the Amazon
19/11/2021	BR6	Land	32	Deforestation in Amazon accelerates (15-year high)

Source: Amundi Institute. The data relates the period from January 2019 to November 2022.

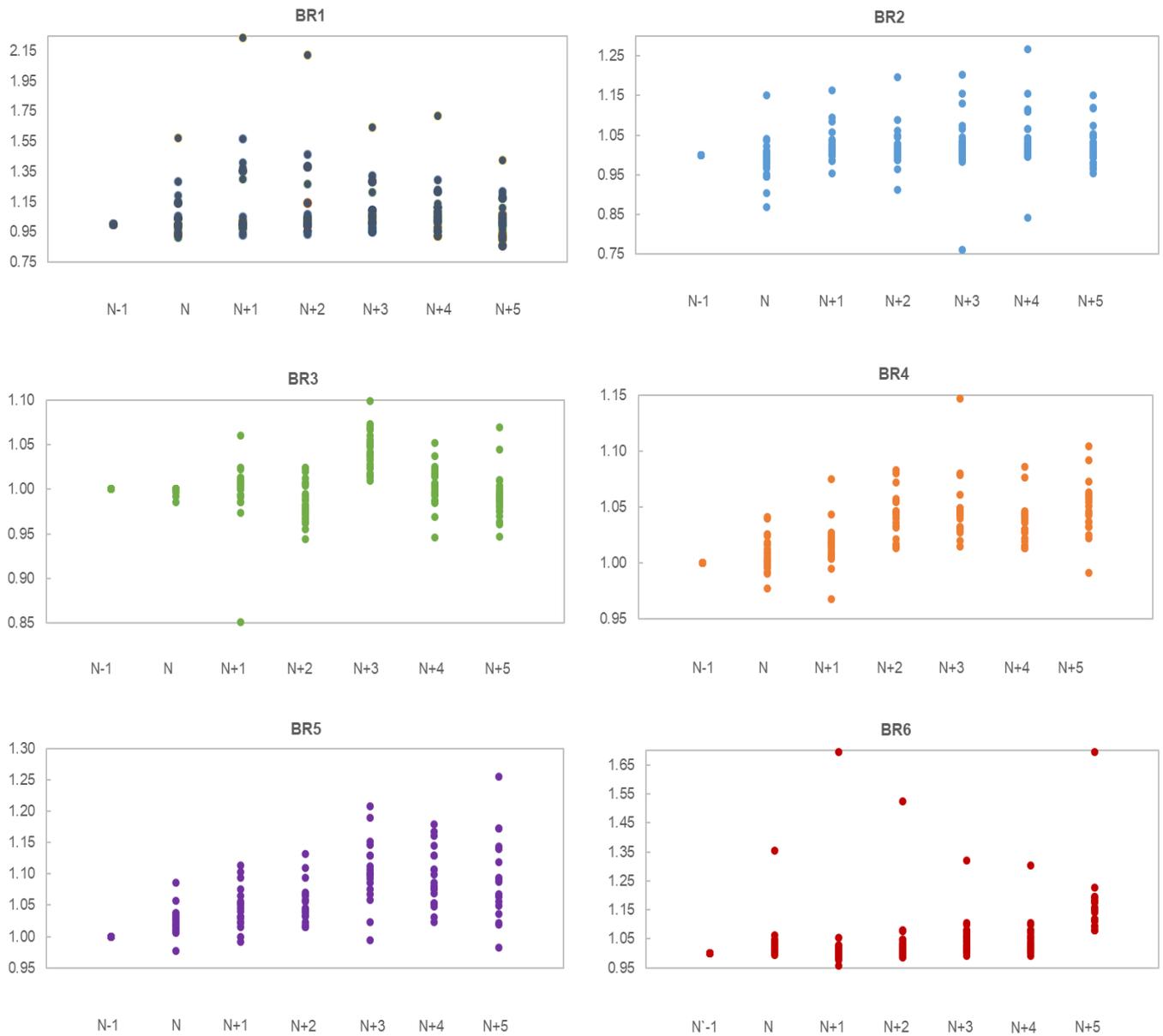
In Figure 4, we present the normalised bonds spread on the day before the event occurred and all 5 days after the event's starting date. We normalised the spreads to 1, one day before each event and observed how the bonds spreads moved.

Our results indicated that in 83.3% of the cases after a negative biodiversity event, the average spread widened from the day prior to the event. Furthermore, we verified using a statistic test that the values of the average spreads in the following days after an acute event were significantly different from 1. In 20 dates out of 30, we noted the results were significant with a 1% confidence level.

To conclude, a widening of corporate bond spreads in reaction to acute biodiversity events highlights the issue of the potential future losses that may accelerate in the future as we reach biodiversity-tipping points. However, on a positive note, the widening of spreads following these events provides evidence of investors' growing awareness of biodiversity issues and the necessity to integrate them into credit risk and valuation analysis.



Figure 4: Normalised bond spreads (%) widened following acute biodiversity events



Source: Amundi Institute. The data is derived from the period from January 2019 to November 2022. The dots relate to the spreads of the individual corporate bonds after the spreads have been normalised to 1, one day before each event.



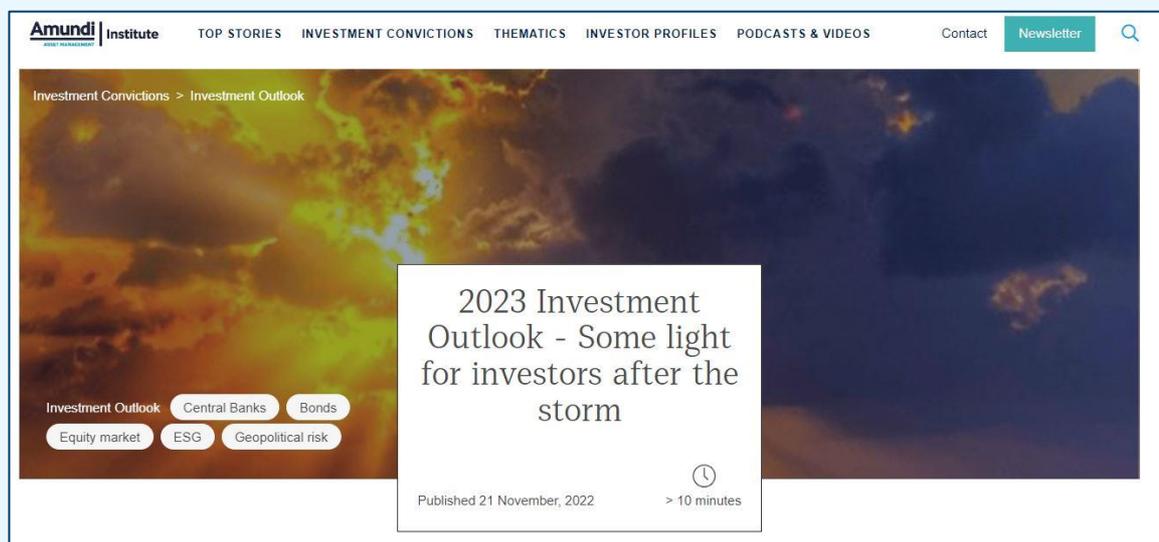
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- ¹⁵ Using a Carbon Disclosure Project (CDP) dataset (questionnaire), we employ the question "F1.6a C2 'Describe the forests-related detrimental impacts experienced by your organization, your response, and the total financial impact' Impact driver type" from CDP Forest Response dataset.



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