Do Banks Fully Price Biodiversity Risk?

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March 2026

Abstract

We investigate whether banks fully incorporate biodiversity risk into loan pricing using a large sample of securitised loans to small and medium-sized enterprises (SMEs) in Europe. Combining loan-level data from European DataWarehouse with high-resolution biodiversity indicators from the Natural History Museum, we construct a borrower-level measure of biodiversity risk across time and space. Our empirical strategy jointly examines the relationship between biodiversity risk, credit risk, and loan pricing. First, we document that biodiversity loss is significantly associated with higher loan spreads, suggesting that banks do account for this risk in lending rates. Second, and most importantly, we find that biodiversity loss is positively associated with default probabilities even after controlling for loan spreads, indicating that biodiversity risk contains information not fully captured by banks' pricing decisions. These findings provide novel evidence of partial pricing: while biodiversity risk is reflected in loan spreads, it is not fully internalised, offering new insights into the efficiency of risk pricing in SME lending markets. Economically, a one-standard-deviation increase in biodiversity loss raises the probability of default by about 12 basis points, corresponding to a 14.8% increase relative to the sample average, implying a meaningful increase in firms' default risk.

Keywords: Biodiversity risk; Credit risk; Loan pricing; SMEs
JEL classifications: G21; G33; L25; Q57

1 Introduction

Biodiversity is a key component of natural capital that supports economic production and, increasingly, financial stability (Karolyi and Tobin-de la Puente, 2023; Giglio et al., 2026). It provides essential ecosystem services – such as pollination, water regulation, soil formation, and climate moderation – on which firms depend, often implicitly, to operate efficiently. Ecological research shows that ecosystems with higher biodiversity deliver these services more productively and with greater stability over time (Balvanera et al., 2006; Isbell et al., 2011; Gamfeldt et al., 2013). As biodiversity declines, the provision of these services weakens, thereby affecting economic output, increasing production costs, and amplifying the transmission of environmental shocks to firms' cash flows through real-to-financial channels, similar to those documented for climate and other environmental risks (Bolton and Kacperczyk, 2021, 2023).

This mechanism is particularly important given the rapid decline in global biodiversity. International assessments document widespread ecosystem degradation driven by land-use change, resource extraction, and pollution (MEA, 2005; IPBES, 2019). Estimates indicate that per capita natural capital stocks declined by around 40% over two decades (OECD, 2021), while global biodiversity has fallen by roughly 70% since 1970 (WWF, 2025). These trends suggest a gradual degradation of a production input that is only imperfectly substitutable. If ecological thresholds are crossed, the resulting economic adjustments could be abrupt and only partially reversible, making biodiversity loss relevant not only for environmental policy but also for financial stability.

A growing body of research in finance and banking has begun to examine whether biodiversity-related risks are already financially material for firms and financial intermediaries. For example, Giglio et al. (2026) use textual analysis of corporate 10-K reports to measure firms' exposure to biodiversity risk. Garel et al. (2026) develop a framework to assess corporate dependence on nature and study its implications for downside risk, while Garel et al. (2024) and Coqueret et al. (2025) find evidence that firms with a larger biodiversity footprint may command a biodiversity-related premium in equity markets. Similarly, Guidolin and Pedio (2026) show that commodities with greater biodiversity

impact, and thus higher exposure to transition risk, earn significant premia.

Other studies link biodiversity exposure to weaker firm outcomes. Cosma et al. (2025) and Bach et al. (2025) find that firms more exposed to biodiversity loss exhibit poorer operating performance, while Akbari et al. (2026) show that biodiversity-related regulatory oversight is associated with lower corporate profitability. Beyond corporate outcomes, Battiston et al. (2024) demonstrate that shocks to natural capital can propagate to bank portfolios and Liu et al. (2026) show that mitigating biodiversity risk through nature-based solutions can reduce the risk of housing price devaluation. Taken together, this emerging literature suggests that biodiversity loss can affect financial outcomes through both *physical* channels – via disruptions to ecosystem services – and *transition* channels, such as regulation, taxation, or reputational pressures.

On the credit side, Hoepner et al. (2023) and Becker et al. (2025) document that investors and creditors respond to firms' exposure to nature-related risks. In particular, stronger management of biodiversity risks is associated with lower credit risk, while greater exposure to biodiversity-related transition risks leads to higher borrowing costs. In addition, Nguyen et al. (2025) show that biodiversity-exposed U.S. small businesses face less favourable credit conditions, highlighting that such risks are also relevant for smaller and more financially constrained firms. Overall, this body of evidence suggests that financial institutions are increasingly incorporating biodiversity considerations into their lending decisions and are beginning to price biodiversity risk.

However, given the difficulties in measuring biodiversity risk and the lack of a widely accepted indicator (Visentin, 2026), it remains unclear whether creditors fully internalise such risk. While recent evidence suggests that financial institutions are beginning to price biodiversity risk (Becker et al., 2025), challenges in its accurate assessment hinder a comprehensive evaluation and, consequently, its full incorporation into lending decisions. As a result, pricing may not fully reflect borrowers' exposure to biodiversity risk. Although tools such as ENCORE[1] enable financial institutions to assess biodiversity-related risks, they rely on sector-level, time-invariant measures that do not capture firm-specific and

[1]See https://encorenature.org/en.

location-specific dynamics over time, thereby limiting accurate risk pricing. Moreover, recent proposals of credit scoring models incorporating biodiversity risk (Valente et al., 2026) further highlight the need for additional research to determine whether such risks are fully reflected in loan pricing.

We contribute to the emerging literature on biodiversity finance by providing the first evidence that banks do not fully price biodiversity risk. Specifically, we employ a large loan-level dataset on European small and medium-sized enterprises (SMEs) and match it with regional biodiversity information using the Biodiversity Intactness Index (BII) developed by the Natural History Museum (NHM). This approach allows us to link local environmental conditions to SME credit performance and to construct a location- and time-varying measure of biodiversity risk, which we first incorporate into a pricing model and then into a default model. Our pricing model indicates that biodiversity risk is priced by banks, in line with previous evidence (Becker et al., 2025; Nguyen et al., 2025). However, we extend this literature by showing that such risk is not fully reflected in loan pricing. The results of our default model show that biodiversity loss constitutes a significant risk factor, even after controlling for loan spreads, suggesting that banks do not fully incorporate this risk into lending decisions. By focusing on SMEs, and following Schopohl et al. (2025) and Nguyen et al. (2025), we shift attention from large corporations to a segment of the economy that is both more location-bound and financially fragile. SMEs nonetheless represent the backbone of the European economy, accounting for 99% of all businesses and employing over 80 million people (Council of the European Union, 2026). Our findings highlight the importance of developing credit scoring models that incorporate biodiversity risk factors, such as those proposed by Valente et al. (2026), in order to achieve a more comprehensive assessment of SME credit risk.

As a second contribution, this paper advances the literature by identifying biodiversity loss as a significant determinant of credit risk for firms. By combining loan-level information on securitised SME loans with high-resolution biodiversity data, we construct a biodiversity risk factor that captures environmental degradation in the regions where borrowers operate. Our empirical analysis shows that biodiversity loss is positively asso-

ciated with the probability of default, even after controlling for traditional financial and macroeconomic variables. Specifically, a one-standard-deviation increase in biodiversity loss raises the probability of default by approximately 12 basis points, corresponding to a 14.8% increase relative to the sample average. These findings demonstrate that ecological degradation can translate into tangible financial risk and, differently from Valente et al. (2026), who rely on a "black box" machine learning approach, our econometric framework allows us to provide a statistically significant and interpretable estimate of the economic impact of biodiversity loss on default risk.

A third contribution of this paper lies in documenting how the relationship between biodiversity loss and credit risk varies across different types of firms. Our results indicate that the impact of biodiversity loss on default probability is stronger for micro firms, which are typically more vulnerable to local environmental conditions and economic shocks. In contrast, financially constrained firms and firms operating in agriculture exhibit a lower probability of default in regions experiencing biodiversity loss. This pattern likely reflects the intensive use of natural resources by these firms, which can generate higher short-term revenues despite contributing to environmental degradation. In particular, agricultural firms often rely on practices such as the extensive use of fertilisers to sustain or increase output, which can mitigate the short-term financial impact of biodiversity loss even as they exacerbate environmental degradation.

The paper is structured as follows: section 2 reviews the literature on biodiversity finance and develops the hypotheses tested in the paper; section 3 describes the data and the empirical methodology; section 4 reports the results of our empirical investigation. Finally, Section 5 concludes and discusses the financial implications and policy recommendations.

2 Literature review and hypotheses development

The rise of biodiversity finance is often traced to the call by Karolyi and Tobin-de la Puente (2023) for finance scholars to examine how nature can be financed in a nature-

positive transition. Since then, a growing body of research has examined several key themes within biodiversity finance, including how financial institution portfolios both depend on and impact nature (e.g., Boldrini et al., 2023; Hadji-Lazaro et al., 2024), the influence of biodiversity on property prices (Cornaggia et al., 2026), and how investors assess and value biodiversity-related projects (Flammer et al., 2025).

Recent studies indicate that biodiversity risk is increasingly being priced in financial markets. Creditors charge higher interest rates to borrowers with greater exposure to biodiversity risk (Becker et al., 2025), and similar patterns are observed for U.S. small businesses (Nguyen et al., 2025). In equity markets, investors appear to require a biodiversity-related premium (Garel et al., 2024; Coqueret et al., 2025; Giglio et al., 2026), while biodiversity risk has also been linked to higher stock-price crash risk (Bassen et al., 2024) and wider bond spreads (Cherief et al., 2025). Although some studies report no significant pricing effects (Xin et al., 2025), the overall evidence for large firms points to increasing financial materiality.

Much less evidence is available for SMEs. These firms play an important role in credit transmission (Cathcart et al., 2020; Barro et al., 2025) and will soon be subject to mandatory environmental disclosure requirements (European Commission, 2022). Existing research on SMEs has mainly focused on sustainability reporting (Rodríguez-Gutiérrez et al., 2021) or ESG assessments (Barro et al., 2025). Studies in climate finance show that physical climate risks can affect SME profitability and increase default risk (Cathcart et al., 2022, 2023), suggesting that biodiversity loss could produce similar effects, particularly in sectors that rely heavily on natural capital. However, this area remains largely underexplored.

The model developed by Giglio et al. (2024) provides a theoretical framework illustrating how biodiversity decline can negatively affect firm production. Biodiversity supports a wide range of ecosystem services, and firms rely on these services – such as pollination, water purification, and soil fertility – to sustain their economic activities. As biodiversity declines, these services deteriorate, directly reducing productivity and eroding profits. This dependence is particularly strong for SMEs, which typically operate at a local scale,

are more geographically concentrated, and have more limited capacity to absorb shocks (Nguyen et al., 2025). Consequently, reduced productivity can translate into lower cash flows, which can heighten credit risk and increase probability of loan default.

As financial risks stemming from biodiversity loss and ecosystem fragility can undermine firms' creditworthiness, they also expose lending institutions to higher default risk and potential asset losses. In this sense, nature-related risks can propagate from borrowers to lenders. Consequently, it is becoming increasingly important for financial institutions to account for biodiversity loss and environmental factors in their lending decisions. This may involve reallocating portfolios toward more sustainable and biodiversity-friendly sectors, as well as adjusting interest rates or tightening lending standards to better reflect the risks associated with environmental degradation (Becker et al., 2025). Based on this, we hypothesise that banks incorporate biodiversity risk into loan pricing:

H1. Loans to firms located in areas with stronger localised biodiversity loss experience a higher spread.

Given the challenges in measuring biodiversity risk – including the choice of an appropriate indicator and the lack of widely accepted metrics (Visentin, 2026) – it is plausible that banks do not fully incorporate this risk when pricing loans. In other words, even after accounting for a firm's credit risk, as proxied by the loan spread, biodiversity loss may continue to be a significant determinant of default. If biodiversity loss remains statistically significant in regressions that control for spreads, this would provide evidence that banks are not fully pricing biodiversity risk. Based on this premise, our main hypothesis is as follows:

H2. Loans to firms located in areas with stronger localised biodiversity loss experience a higher probability of default even after controlling for loan spread.

Notice that hypothesis H2 further posits that biodiversity loss is a significant determinant of default risk. In other words, while our primary objective is to assess whether banks only partially price biodiversity risk, we also contribute to the literature by pro-

viding evidence that biodiversity loss constitutes a significant and material risk factor for firm default.

In areas characterised by larger biodiversity fluctuations, ecosystems tend to be more volatile and less predictable, which can amplify the economic consequences of biodiversity loss. This instability may disrupt production processes, increase operating costs, or reduce the reliability of natural inputs on which firms depend. As a result, firms located in regions with greater biodiversity variability may face higher uncertainty and financial pressure when biodiversity declines, increasing their likelihood of loan default. Consequently, we formulate the following hypothesis:

H3. The positive association between loan default and localised biodiversity loss is stronger for firms located in areas with larger biodiversity fluctuations.

Furthermore, we expect the relationship between loan default and localised biodiversity loss to be different under certain firm characteristics. Agricultural production is inherently dependent on land use and natural resources, making it closely linked to biodiversity dynamics. In this context, biodiversity loss may be associated with the expansion or intensification of agricultural activity aimed at increasing output. Practices such as land conversion, monoculture cultivation, and the intensive use of inputs – including chemical fertilisers and pesticides – can degrade local ecosystems and reduce biodiversity. At the same time, these practices often enhance yields and boost revenues in the short to medium term. The use of fertilisers, in particular, can significantly increase productivity, even though it may contribute to soil degradation and biodiversity decline over time. Higher output and revenues can improve firms' financial performance and strengthen their capacity to meet debt obligations. Thus, we hypothesise:

H4. The association between loan default and localised biodiversity loss is negative for firms in the agriculture sector.

In addition, since smaller firms tend to be more affected by financial crises (Chang, 2010; Sydnor et al., 2017) and climate shocks (Berg et al., 2025) than larger firms, it

is plausible that they are also disproportionately exposed to biodiversity loss risk. In particular, micro firms are likely to be more influenced by biodiversity conditions in limited geographic areas. Compared with small and medium-sized enterprises, micro firms are typically more location-bound and have even fewer resources to invest in adaptation or mitigation strategies. They also tend to have lower capital reserves and more limited access to credit, making them less resilient to disruptions associated with biodiversity loss. For this reason, we formulate the following hypothesis:

H5. The positive association between loan default and localised biodiversity loss is stronger for micro firms.

Finally, we examine financially constrained firms. Such firms have stronger incentives to maintain revenue under tight financing conditions. Facing higher risks of distress and limited access to credit, these firms may intensify the exploitation of local natural resources to sustain cash flow and meet their financial obligations, thereby reducing the likelihood of default in the short term despite contributing to biodiversity loss. For this reason, we hypothesise the following:

H6. The association between loan default and localised biodiversity loss is negative for financially constrained firms.

We explain how we test hypotheses H1-H6 in Section 3.2, where we outline the econometric methodology employed in this paper.

3 Data and methodology

3.1 Data

We combine different datasets from various sources to analyse the relationship between biodiversity loss and SME loans. SMEs are defined according to the European Commission as firms with fewer than 250 employees and either a turnover below €50 million or a balance sheet total below €43 million. We collect data on European SME securitised

loans from European Data Warehouse (EDW), a central European repository that collects and provides detailed data on securitisation transactions. The sample comprises 3,292,660 loans granted to firms operating outside the financial industry and the public sector[2]. In detail, we obtain quarterly data from 2011–Q4 to 2023–Q4 for six European countries, namely, Belgium, France, Italy, the Netherlands, Portugal, and Spain. The EDW dataset includes information on arrears, loan seniority, years to maturity, original loan amount, the deposit to loan ratio, loan interest rate, and leverage. The sample composition by sector and country are reported in Tables A1 and A2, respectively. Securitised loans to SMEs in the Agriculture, forestry and fishing sector account for 22.84% of the sample, followed by the Wholesale and retail trade (19.45%), Construction (10.68%), and Manufacturing (10.10%) sectors. In terms of country composition, France represents 31.28% of the sample, followed by Spain (25.99%) and Belgium (25.05%). Figure 1 shows the total number of loans by NUTS 3 region. There is no evidence of cluster effects whereby SMEs in adjacent regions receive a higher concentration of loans.

To assess biodiversity loss, we employ the Biodiversity Intactness Index (BII), developed by the Natural History Museum (NHM) at a 1 km^2 spatial resolution. The BII is a biodiversity indicator that integrates data on species composition and abundance to assess how much native biodiversity remains under human pressures. It is expressed as a percentage: a value of 0 represents the total loss of original biodiversity, while 100 indicates that biodiversity is intact and unchanged. We obtain annual BII data from 2000 to 2023 from the NHM. More information about how the NHM calculates the BII can be found in Schopohl et al. (2025). Since the borrower is anonymised, we cannot trace back to the full postcode or address of the SME. For this reason, similarly to Chen et al. (2026) and Valente et al. (2026), we compute an aggregated BII at the NUTS 3 level by taking the average of the cells falling under the NUTS 3 region where the borrower is located. Alternatively, since it is more likely that firms operate in areas with large human presence, where biodiversity is lower, we consider only the minimum of the BII at the NUTS 3 level. As biodiversity data are available annually, following Valente et al. (2026),

[2]In the literature on default determinants, it is common to exclude such sectors. See for instance Cathcart et al. (2020).

we assume that the BII remains constant across all four quarters of the corresponding year for each NUTS 3 region. Finally, we calculate biodiversity loss for loan i at time t, $BL_{i,t}$, as follows:

$$BL_{i,t} = 100 - BII_{i,t} \tag{1}$$

where $BII_{i,t}$ is either the average or the minimum of the cells falling under the NUTS 3 region where the borrower is located. Figures 2 and 3 report the average and the minimum BII by NUTS 3, respectively, in 2023. Notably, there is substantial heterogeneity across NUTS 3 regions. Areas hosting major industrial clusters (e.g., northern Italy) exhibit lower average BII levels. When examining the minimum BII at the NUTS 3 level, heterogeneity persists; however, most regions in the sample display very low minimum values (often close to 0) likely indicating that, in the areas where firms are located, native biodiversity has been almost entirely depleted. Nonetheless, some regions still exhibit minimum BII values well above 0 (i.e., lower maximum biodiversity loss), particularly in Portugal and southern France.

Finally, we collect and compute quarterly GDP log growth from the Eurostat website and domestic 3-month interest rate from Bloomberg. In addition, to calculate the loan spread we obtain the EURIBOR from the European Central Bank website. For fixed-rate loans, we compute the spread as the difference between the interest rate and the EURIBOR at origination. For floating-rate loans, we define the spread as the difference between the interest rate at the first reporting date and the EURIBOR at the same date. The list of variables is reported in Table A3. To exclude outliers, all the continuous variables are winsorised at the 1% and 99% levels.

In Table 1 we report the descriptive statistics for the variables used in our pricing model. To estimate the pricing model, we use a single observation per loan originated from 2000 to 2023. The mean of the spread, our dependent variable, is 2.8, with a standard deviation of 2.29. Regarding the biodiversity loss measures, the mean of biodiversity loss (average) is 71, indicating that, on average, loans are granted to SMEs operating in NUTS 3 regions that retain roughly 30% of their native biodiversity. This figure increases substantially when considering biodiversity loss (maximum), whose mean is

98.7, suggesting that, across the six countries in our sample, most of the NUTS 3 regions typically include at least one location where biodiversity has been almost entirely lost. Notably, the standard deviation of biodiversity loss (maximum) is considerably lower than that of biodiversity loss (average), suggesting that extremely high biodiversity loss is relatively widespread across regions.

[Insert Table 1]

In Table 2 we present the descriptive statistics for the variables used in our default model. The mean of our dependent variable, the default dummy, is 0.019, with a standard deviation of 0.137. The descriptive statistics of the other variables are similar to those of the pricing model.

[Insert Table 2]

Table A4 reports the default rate by NACE sector. The table shows substantial variation in default rates across sectors. Default risk appears highest in Accommodation and food services (7.09%), Construction (6.81%), and Mining and quarrying (6.80%), suggesting these sectors are more vulnerable, likely due to higher cyclicality and cost pressures. In contrast, Agriculture (2.40%), Administrative services (2.77%), and Household activities (2.76%) exhibit relatively low default rates. Table A5 illustrates the default rate by country. The table reveals strong cross-country differences in default rates. Spain (7.99%) and Italy (5.58%) exhibit the highest default rates, indicating relatively higher credit risk, while Portugal (5.16%) also shows elevated levels. In contrast, Belgium (2.75%), France (0.77%), and especially the Netherlands (0.05%) display much lower default rates. Spain and Italy also account for the largest number of companies and defaults, making them key drivers of overall default risk in the sample. The Netherlands stands out with an extremely low default rate, though this may be influenced by its much smaller sample size.

3.2 Methodology

Our initial hypothesis (H1) is that banks price biodiversity risk. Existing evidence suggests that creditors are beginning to incorporate biodiversity-related risks in the syndicated loan market (Becker et al., 2025); however, it remains unclear whether such risk pricing extends to credit for smaller firms. First, to investigate whether biodiversity risk is priced in the SME loan market, we estimate the following linear regression model:

$$Spread_{i,t} = \beta_0 + \beta_1 BL_{i,t} + \beta_2 \boldsymbol{X}_{i,t} + \theta_j + \mu_c + \zeta_b + \gamma_t + \epsilon_{i,t} \tag{2}$$

where $Spread_{i,t}$ denotes the loan spread for loan i in origination year t for fixed-rate loans, and at the first reporting year t for floating-rate loans, $BL_{i,t}$ is biodiversity loss for loan i in year t, as defined in equation (1), $\boldsymbol{X}_{i,t}$ is the vector of control variables including the original loan amount, loan duration, seniority, leverage, GDP growth, and the 3-month government bond rate, and θ_j, μ_c, ζ_b, and γ_t are sector, country, bank, and year fixed effects. To account for the presence of autocorrelation, we use robust standard errors double-clustered at the firm and year levels. Hypothesis H1 is empirically supported if β_1 in equation (2) is positive and significant.

Secondly, to test the relationship between biodiversity loss and SME loan defaults, as our dependent variable is an indicator variable, we employ a panel logit model (Shumway, 2001; Campbell et al., 2008; Cathcart et al., 2020). Following the literature on credit risk (Cathcart et al., 2020, 2023), our baseline model also includes several loan-level, firm-level, and macroeconomic controls, as well as sectoral, country, and year-quarter fixed effects. Our model relating default to biodiversity loss is as follows:

$$\begin{aligned} P_t(Default_{i,t} = 1) &= \Phi(\beta_0 + \beta_1 BL_{i,t} + \beta_2 \boldsymbol{X}_{i,t} + \theta_j + \mu_c + \gamma_t) \\ &= \frac{1}{1 + \exp[-(\beta_0 + \beta_1 BL_{i,t} + \beta_2 \boldsymbol{X}_{i,t} + \theta_j + \mu_c + \gamma_t)]} \end{aligned} \tag{3}$$

where $Default_{i,t}$ is equal to 1 if loan i is either in interest or principal arrears for more than 90 days at time t, and 0 otherwise, $BL_{i,t}$ is biodiversity loss for loan i at time t, $\boldsymbol{X}_{i,t}$ is the vector of control variables including seniority, years to maturity, deposit to

loan, loan spread, leverage, GDP growth, and the 3-month government bond rate, and θ_j, μ_c, and γ_t are sector, country, and year-quarter fixed effects. Robust standard errors are double clustered at the loan and year-quarter levels. If empirical evidence validates hypothesis H2, β_1 in model (3) should be positive and significant.

We test whether the positive association between loan default and localised biodiversity loss is stronger for firms located in areas experiencing larger biodiversity fluctuations (H3). To this end, we focus on the subset of NUTS 3 regions where biodiversity decline between 2000 and 2023 has been more pronounced. We adopt three alternative strategies. First, we consider the subsample of observations located in NUTS 3 regions where the change in *average* BII is below the median change in average BII (-0.31). Second, we focus on regions where the change in *maximum* BII is below the median change in maximum BII (-0.56). Third, we examine regions where the change in *minimum* BII is below the median change in minimum BII (-0.26). Each strategy corresponds to a different empirical specification. Support for H3 requires that the coefficient on biodiversity loss be positive, statistically significant, and larger than that estimated in the baseline specification.

We perform a series of heterogeneity tests. First, we test whether for loan to firms in the agriculture sector the relationship between default and biodiversity loss is negative (H4). To do so, we define the dummy variable $Agriculture_i$ that takes the value of 1 if loan i is granted to a firm operating in the agriculture sector. Then, we add to equation (3) the interaction term $BL_{i,t} \times Agriculture_i$ and estimate the logit model. Hypothesis H4 is empirically validated if the coefficient on the interaction term $BL_{i,t} \times Agriculture_i$ is negative and significant.

Next, we investigate the impact that biodiversity loss has on default of micro enterprises and test hypothesis H5. The strategy is similar to that used to test hypothesis H3: we define a dummy variable $Micro_i$ that takes the value of 1 if total assets of the borrower of loan i are less than or equal to €2,000,000. This threshold captures the smallest firms in our sample and corresponds to the micro-enterprise category. The interaction term $BL_{i,t} \times Micro_i$ is then added to equation (3) and subsequently the logit model is

estimated. Support for H5 requires a positive and significant interaction coefficient.

Finally, we test whether for loan to financially constrained firms the relationship between default and biodiversity loss is negative (H6). To do this, we need an index identifying financially constrained firms. Given the paucity of financial data available, we resort to the SA index (Hadlock and Pierce, 2010). Such an index is applicable to both public and private firms and requires only the size and the age of the company to be computed. The SA index is calculated as:

$$SA\,Index_{k,t} = -0.737 \times Size_{k,t} + 0.043 \times Size_{k,t}^2 - 0.040 \times Age_{k,t} \tag{4}$$

where $Size_{k,t}$ is the log of total assets of firm k at time t and $Age_{k,t}$ is expressed in years. Higher values indicate more constraints. Firms in the top 20% are coded as constrained ($SA\,dummy = 1$) and those in the bottom 80% quantile as unconstrained ($SA\,dummy = 0$). We then add the interaction term $BL_{i,t} \times SA\,dummy_{k,t}$ to model (3) and subsequently we estimate it. Hypothesis H6 is empirically validated if the coefficient on the interaction term $BL_{i,t} \times SA\,dummy_{k,t}$ is negative and significant.

4 Results

4.1 Pricing regression analysis

Table 3 reports the results from our pricing equation (2) using biodiversity loss averaged at the NUTS 3 level. In Column 1, the coefficient is positive and statistically significant at the 10% level; however, it changes sign and becomes insignificant once leverage is included in the model, with a corresponding reduction in sample size (Column 2). In Column 3, we further include bank-by-year fixed effects and find a positive coefficient that remains significant at the 10% level. Nonetheless, when leverage is added in Column 4, the coefficient again becomes statistically insignificant[3].

[3]Note also that the variables GDP growth and government bond are dropped from the regression for collinearity reasons (see Table 3).

[Insert Table 3]

In Table 4 we report the results from our pricing model using the maximum biodiversity loss at the NUTS 3 level. By focusing on maximum biodiversity loss, our measure captures the areas within each NUTS 3 region where biodiversity depletion is most severe and, arguably, where firms are more likely to operate. This time, the coefficient is positive and highly significant at the 1% level across all specifications. In Column 1, the coefficient on biodiversity loss is 0.007; therefore, a one-standard-deviation increase in biodiversity loss (maximum), equal to 2.29, would raise the spread by approximately 0.016, corresponding to a 0.6% increase relative to the sample mean spread of 2.80. When leverage is added to the model, the coefficient increases markedly to 0.0511, implying an increase in the spread of approximately 0.117. This corresponds to a 4.2% rise in relative terms with respect to the sample mean spread. When bank-by-year fixed effects are introduced in the model (Column 4), the magnitude of the estimated coefficient does not change significantly. Overall, these results suggest that creditors charge higher interest rates to firms located in regions where biodiversity has been more completely depleted. These results align with literature on biodiversity pricing (Becker et al., 2025; Nguyen et al., 2025) and support hypothesis H1.

[Insert Table 4]

4.2 Event study: the impact of the Kunming Declaration on loan pricing

To further corroborate our findings that financial institutions price biodiversity risk, we conduct an event study examining loan spreads for firms located in NUTS 3 regions with high versus low biodiversity loss around the date of the Kunming Declaration (2021). The Kunming Declaration is the biodiversity counterpart to the Paris Agreement in climate finance and led to the adoption of the Kunming-Montreal Global Biodiversity

Framework[4], which brings together 190 governments in a commitment to protect and restore 30% of the Earth's land and water by 2030 and to progressively phase out subsidies that harm nature. Consequently, given the evidence of risk pricing, lenders should have responded to the Kunming Declaration by increasing loan spreads for firms located in regions more exposed to biodiversity risk. The event study therefore enables us to examine how banks revised their valuation of SMEs with greater exposure to biodiversity risk around the time of the declaration.

Our empirical specification is as follows:

$$Spread_{i,t} = \beta_0 + \beta_1 Large\,BL_i \times Post_t + \theta_j + \mu_c + \zeta_b + \gamma_t + \epsilon_{i,t} \tag{5}$$

where $Large\,BL_i$ is a dummy variable equal to 1 if biodiversity loss aggregated at the NUTS 3 level (either the average or the maximum value) where the borrower of loan i is located is larger than the median of biodiversity loss (either the average or the maximum value), and 0 otherwise, and $Post_t$ is a dummy variable equal to 1 for the years 2021 and onwards.

Table A6 reports the results of the event study. In Column 1 we use average biodiversity loss at the NUTS 3 level and find a positive and statistically significant coefficient at the 1% level. In Column 2 we add bank-by-year fixed effects and the results hold. When we use maximum biodiversity loss at the NUTS 3 level, the coefficient retains its sign and significance (Column 3 and 4). These results suggest that banks revised their assessment of biodiversity risk following the Kunming Declaration, charging higher interest rates to SMEs located in more environmentally degraded areas. This provides further support for our finding that banks price biodiversity risk.

4.3 Default regression analysis

Table 5, Column 1, reports the average marginal effects from our baseline logit model of default on biodiversity loss (averaged at the NUTS 3 level), including fixed effects but no

[4]See https://www.cbd.int/gbf.

additional controls. The coefficient on biodiversity loss is positive and statistically significant at the 1% level; however, its magnitude is close to zero (below one basis point), suggesting that the effect is not economically meaningful. In Column 2, we include additional control variables. The estimated coefficient changes sign and loses statistical significance, while remaining economically negligible (i.e., below one basis point). In Column 3, we further include leverage as a control variable, at the cost of a substantial reduction in sample size (note also that the government bond variable is dropped from the regression for collinearity reasons). The coefficient remains negative and is not statistically significant and its magnitude is again effectively zero, indicating no economically meaningful effect. Overall, the evidence suggests that average biodiversity loss at the NUTS 3 level does not have a meaningful impact on default risk.

[Insert Table 5]

In Table 6 we report the average marginal effects from our logit model of default using the maximum biodiversity loss at the NUTS 3 level. Notably, because we focus on maximum biodiversity loss, the measure captures the areas within each NUTS 3 region where biodiversity depletion is most severe, and, arguably the locations where firms are more likely to operate. Column 1 includes fixed effects but no additional control variables. The coefficient on biodiversity loss (max) is positive and statistically significant at the 1% level, with an estimated magnitude of 0.0004. Economically, this implies that a one-standard-deviation increase in biodiversity loss (max) – equal to 2.34 – raises the probability of default by approximately 9 basis points ($2.34 \times 0.0004 \approx 0.0009$). Relative to the sample mean default probability of 0.019, this corresponds to an increase of about 5% in relative terms (0.0009/0.019). While not extremely large, this effect is economically non-negligible.

[Insert Table 6]

When additional control variables are included in Column 2, the estimated effect

decreases to approximately 2 basis point, but remains statistically significant at the 5% level. Importantly, we control for the loan spread in this specification and the coefficient on biodiversity loss remains significant: this suggests that banks are not fully pricing biodiversity risk, supporting hypothesis H2. Finally, in Column 3, we further control for leverage – at the cost of a reduction in sample size – and the coefficient becomes highly significant (1%) and increases to 0.0012 (12 basis points). This implies that a one-standard-deviation increase in biodiversity loss would lead to a 14.8% increase in default probability in relative terms ($2.34 \times 0.001/0.019$). This represents a substantial economic effect and reinforces the conclusion that biodiversity loss is an economically meaningful predictor of default risk, on the one hand, and that banks only partially price biodiversity risk (H2).

4.4 The time-variation dimension of biodiversity loss

In this section, we explore the time variation in biodiversity loss across NUTS 3 regions. Specifically, we focus on those regions that have experienced the largest declines in biodiversity and examine how the coefficient on biodiversity loss responds. To this end, we estimate three regression models. The first is estimated on the subsample of observations located in NUTS 3 regions where the change in *average* BII between 2000 and 2023 is below the median change in average BII (-0.31). The second is estimated on the subsample of regions where the change in *maximum* BII over the same period is below the median change in maximum BII (-0.56). The third is estimated on the subsample of regions where the change in *minimum* BII between 2000 and 2023 is below the median change in minimum BII (-0.26).

Table 7 reports the average marginal effects of the default regressions estimated on the detailed subsamples. Column 1 presents the results for regions where the change in average BII between 2000 and 2023 is below the median change in average BII. The coefficient on biodiversity loss is positive and highly significant (1%) and, as expected, larger than in the baseline specification (0.0012), indicating that in regions where biodiversity loss exhibits stronger time variation, the impact on default risk is amplified. In

particular, the increase relative to the baseline amounts to approximately 2 basis points.

[Insert Table 7]

Column 2 reports the results for regions where the change in maximum BII is below the median change in maximum BII. The coefficient retains its positive sign and statistical significance, and increases to 0.0017, further reinforcing the baseline findings.

By contrast, Column 3 focuses on regions where the change in minimum BII is below the median change in minimum BII. In this case, the coefficient on biodiversity loss is approximately half the baseline magnitude (0.0005), suggesting that, in areas where biodiversity levels are already low, the marginal impact of additional biodiversity loss on default risk is more limited.

Overall, these results confirm that the time variation in BII plays an important role in explaining default risk: regions experiencing larger biodiversity fluctuations are also those where exposure to default risk is stronger. This evidence supports hypothesis H3.

4.5 Heterogeneity analysis: agriculture sector, micro firms, and financially constrained firms

To further inspect the mechanisms through which biodiversity loss affects default risk, we conduct a series of heterogeneity tests. First, we focus on the agriculture sector, which exhibits the highest dependence on, and impact upon, natural resources (see Schopohl et al., 2025). The sector may be adversely affected by biodiversity loss due to its strong reliance on ecosystem services. At the same time, agricultural activity itself can contribute significantly to biodiversity depletion through fertilisers and intensive land use aimed at increasing output, potentially leading to higher revenues and, in turn, lower default risk.

To shed light on these mechanisms, we estimate a default model that includes an interaction term between biodiversity loss and a dummy variable identifying loans to firms in the agriculture sector. Table 8, Column 1, reports the corresponding average marginal effects. The coefficient on the interaction term is -0.0025 and is statistically significant

at the 1% level, more than offsetting the positive coefficient on biodiversity loss (0.0013). The resulting net negative effect suggests that, in areas where biodiversity loss is more pronounced – potentially reflecting stronger agricultural pressure on ecosystems – agricultural firms experience better economic conditions and, consequently, a lower probability of default. One possible explanation is that biodiversity loss is associated with more intensive farming practices, including the increased use of fertilisers and other chemical inputs. These inputs can enhance short-term agricultural productivity and yields, thereby improving revenues and debt-servicing capacity. In this context, fertilisers may act as a mechanism through which environmental degradation translates into improved financial performance in the short run, offsetting the adverse effects of biodiversity loss on long-term ecosystem sustainability. This highlights a potential trade-off between short-term economic gains and long-term environmental risks and supports hypothesis H4.

[Insert Table 8]

Next, we examine the impact of biodiversity loss on micro firms. Micro firms are likely to be more affected by the biodiversity conditions of restricted geographic areas. Compared with small and medium-sized enterprises, they are typically more location-bound and have fewer resources to invest in adaptation or mitigation measures. In addition, they generally hold lower capital reserves and face more limited access to credit, making them less resilient to disruptions linked to biodiversity loss.

Table 8, Column 2, reports the average marginal effects from a default model that includes an interaction term between biodiversity loss and a dummy variable identifying firms with total assets less than or equal to €2,000,000. The coefficient on the interaction term is 0.0001 and statistically significant at the 1% level, indicating that micro firms face an additional 1 basis point increase in default probability relative to larger firms for a given level of biodiversity loss, validating hypothesis H5. Although economically modest, this result suggests that micro firms are disproportionately more exposed to the adverse effects of biodiversity loss, consistent with prior expectations.

Finally, we examine financially constrained firms. Because these firms face tighter financing conditions and a higher risk of distress, they may have stronger incentives to intensify the exploitation of natural resources in order to sustain revenues and avoid default. If this mechanism is at play, we would expect a negative coefficient on the interaction term between biodiversity loss and a dummy identifying financially constrained firms. To identify such firms, given the limited availability of financial data, we employ the SA index of financial constraints (Hadlock and Pierce, 2010), which is constructed using only total assets and firm age.

Table 8, Column 3, reports the average marginal effects from a default model including this interaction term. Consistent with our hypothesis, the coefficient on the interaction term is negative and statistically significant at the 1% level, with a magnitude of -0.0002. This implies that the marginal effect of biodiversity loss on default is attenuated for financially constrained firms. The combined effect for these firms amounts to approximately 9 basis points, compared with 12 basis points in the baseline specification. These findings validate hypothesis H6 and suggest that financially constrained firms may offset part of the adverse impact of biodiversity loss on default risk, potentially through more intensive resource exploitation that temporarily supports revenues.

4.6 Robustness checks

To corroborate our findings, we conduct a series of robustness checks. Specifically, we re-estimate the default models using alternative sets of fixed effects, namely country-by-year-quarter and sector-by-year-quarter fixed effects. These specifications account for shocks or trends affecting all firms within a sector or country in a given period, such as regulatory changes or local economic conditions. Table A7 reports the results. Across the six specifications, only one yields a coefficient on biodiversity loss that is not statistically significant at the 10% level, while the remaining specifications display statistically significant coefficients with magnitudes comparable to those previously reported. Overall, the results remain largely unchanged, indicating that our findings are robust to alternative ways of capturing time-varying sectoral and geographic effects.

In addition, since the loan history begins in 2011, we re-estimate the default model using only loans originated from 2011 onwards. This allows us to compute the spread at origination for floating-rate loans. Table A8 reports the average marginal effects for the default model estimated on this subsample. The results remain largely unchanged, with the coefficient on biodiversity loss retaining its sign, statistical significance, and a magnitude comparable to the baseline estimates.

We also re-estimate the pricing model on the same subsample of loans originated from 2011 onwards (Table A9). Consistent with the baseline results, the findings remain largely unchanged.

5 Conclusions

This paper documents that banks do not fully price biodiversity risk. Using geospatial biodiversity data at 1 km^2 resolution together with securitised loan information from the European Data Warehouse, we find evidence that banks price biodiversity risk. This result is consistent with recent evidence for European and UK banks in the syndicated loan market (Becker et al., 2025). Specifically, a one-standard-deviation increase in biodiversity loss raises loan spreads by approximately 0.117, corresponding to a 4.2% increase relative to the sample mean spread. Consistent with this finding, loan spreads increased following a major biodiversity policy event, the Kunming Declaration.

We show that a one-standard-deviation increase in biodiversity loss raises the probability of default by 12 basis points, corresponding to approximately 14.8% of the sample average default probability, even after controlling for loan spread, indicating that biodiversity risk contains information not fully captured by banks' pricing decisions. This effect is economically meaningful, indicating that biodiversity conditions can have material consequences for the creditworthiness of small businesses. Biodiversity loss can translate into financial risk by reducing the availability of local ecosystem services that support economic production, thereby lowering revenues and cash flows. This evidence points out that biodiversity loss constitutes an additional credit risk factor for European

SMEs.

We find that this effect is stronger for firms located in NUTS 3 regions where biodiversity has declined more. In particular, these firms face a probability of default up to 5 basis points higher than the baseline. The effect is also stronger for micro firms, which experience an additional increase of about 1 basis point in default probability. Compared with small and medium-sized enterprises, micro firms are more location-bound, have fewer resources to invest in biodiversity adaptation or mitigation measures, hold smaller capital buffers, and face more limited access to credit, making them less resilient to disruptions associated with biodiversity loss. By contrast, firms in the agriculture sector and financially constrained firms exhibit a lower probability of default when biodiversity declines. These firms may increase output by exploiting land, natural resources, and chemical inputs – such as fertilisers – more intensively, thereby boosting revenues and cash flows despite the resulting environmental degradation.

These results have clear implications for policy, supervision, banks, and corporate practice. First, the findings suggest that banks do not fully price biodiversity risk, indicating a potential underestimation of nature-related risks in lending decisions. Moreover, they show that biodiversity loss should be incorporated into financial risk assessment frameworks, as it can materially affect firms' creditworthiness. For policymakers and financial supervisors, this highlights the importance of integrating biodiversity considerations into prudential regulation, supervisory stress testing, and nature risk monitoring. From the perspective of banks, the results indicate that accounting for local ecological conditions can improve credit risk modelling and loan pricing, particularly for smaller and geographically concentrated firms. Finally, for firms, especially micro and location-dependent businesses, the findings underscore the economic importance of preserving local ecosystem services and investing in practices that reduce exposure to biodiversity-related disruptions. Overall, recognising local biodiversity loss as a source of financial risk can support more informed lending decisions and strengthen the resilience of both firms and the financial system.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT for proofreading and to improve the flow of the text. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the manuscript.

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Tables and figures

Tables

Table 1: Descriptive statistics of loan, biodiversity and macroeconomic variables used in the analysis (pricing dataset)

Variable	Observations	Mean	Std. Dev.	Min	Max
Spread	3,283,869	2.800	2.290	-2.660	11.000
Biodiversity loss (average)	3,234,993	71.000	12.000	40.300	90.800
Biodiversity loss (max)	3,234,993	98.700	2.140	89.300	100.000
Seniority					
Senior secured	3,138,984	0.263	0.440	0	1
Senior unsecured	3,138,984	0.642	0.479	0	1
Junior	3,138,984	0.007	0.081	0	1
Junior unsecured	3,138,984	0.002	0.045	0	1
Other	3,138,984	0.086	0.281	0	1
Ln(original loan amount)	3,284,524	10.600	1.420	7.600	15.200
Loan duration	3,284,038	6.140	4.520	1.000	25.000
Leverage	585,005	0.983	0.612	0	3.280
GDP growth	3,277,621	0.665	2.420	-5.400	6.300
Government bond	2,996,318	0.017	1.080	-0.918	3.690

Note: This table reports the descriptive statistics for the regression variables used in this study. Spread is the difference between the loan interest rate and the 3-month EURIBOR. Biodiversity loss (average) is defined as 100 minus the average Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Ln(original loan amount) is the natural log of the original loan amount. Loan duration is in years. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. GDP growth is the log growth rate of GDP relative to the previous year. Government bond is the country-level 3-month government bond yield. Observations are at the annual frequency, covering the period from 2000 to 2023. All continuous variables are winsorised at the 1% and 99% levels.

Table 2: Descriptive statistics of loan, biodiversity and macroeconomic variables used in the analysis (default dataset)

Variable	Observations	Mean	Std. Dev.	Min	Max
Default	34,658,431	0.019	0.137	0	1
Biodiversity loss (average)	34,157,852	71.900	11.900	40.900	94.500
Biodiversity loss (max)	34,157,852	98.500	2.340	88.900	100
Seniority					
Senior secured	34,142,081	0.292	0.454	0	1
Senior unsecured	34,142,081	0.639	0.480	0	1
Junior	34,142,081	0.009	0.095	0	1
Junior unsecured	34,142,081	0.002	0.046	0	1
Other	34,142,081	0.058	0.234	0	1
Years to maturity	33,600,348	3.960	3.880	0	19
Deposit to loan	23,123,149	0.289	1.440	0	11.600
Spread	34,434,003	2.530	2.080	-2.680	9.880
Leverage	4,532,285	0.933	0.618	0	3.280
GDP growth	34,658,431	0.433	5.948	-12.544	13.226
Government bond	34,658,431	-0.318	0.585	-0.904	3.390

Note: This table reports the descriptive statistics for the regression variables used in this study. Default is a dummy equal to 1 if the loan is in either interest or principal arrears for more than 90 days, and 0 otherwise. Biodiversity loss (average) is defined as 100 minus the average Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Years to maturity measures the remaining number of years to maturity. Deposit to loan is the ratio of the borrower's deposit amount within the entity to the current loan balance. Spread is the difference between the loan interest rate and the 3-month EURIBOR. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. GDP growth is the log growth rate of GDP relative to the previous quarter. Government bond is the country-level 3-month government bond yield. Observations are at the quarterly frequency, covering the period from 2011–Q4 to 2023–Q4. All continuous variables are winsorised at the 1% and 99% levels.

Table 3: Loan pricing regression model results (average biodiversity loss)

	Spread			
Variable	(1)	(2)	(3)	(4)
Biodiversity loss (average)	0.0009*	-0.0013	0.0008*	-0.0013
	(0.0005)	(0.0011)	(0.0005)	(0.0011)
Ln(original loan amount)	-0.3268***	-0.4500***	-0.3462***	-0.4522***
	(0.0324)	(0.0858)	(0.0282)	(0.0895)
Loan duration	0.0388***	0.0453*	0.0510***	0.0496**
	(0.0128)	(0.0232)	(0.0104)	(0.0222)
Seniority				
Senior unsecured	0.4366***	0.7789***	0.4251***	0.8162***
	(0.0835)	(0.1538)	(0.0463)	(0.1436)
Junior	-1.101***	-0.8370***	-1.044***	-0.7043***
	(0.1494)	(0.2546)	(0.1575)	(0.2312)
Junior unsecured	1.837***		1.475***	
	(0.2302)		(0.2678)	
Other	1.046***	1.245***	0.6637***	1.247***
	(0.2291)	(0.1482)	(0.1307)	(0.1564)
GDP growth	-0.0225	-0.9185***	-0.2234*	
	(0.0314)	(0.2875)	(0.1210)	
Government bond	0.3394*	-1.645***	0.0671	
	(0.1961)	(0.1475)	(0.4215)	
Leverage		0.2340***		0.2357***
		(0.0500)		(0.0546)
Observations	2,904,321	373,462	2,904,254	373,461
Adj. R^2	0.501	0.435	0.560	0.440
Country FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	No	No
Year FE	Yes	Yes	No	No
Bank × Year FE	No	No	Yes	Yes

Note: This table reports the results from the panel linear regression in equation (2), estimated by OLS. The dependent variable is the loan spread. Biodiversity loss (average) is defined as 100 minus the average Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Ln(original loan amount) is the natural log of the original loan amount. Loan duration is in years. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. GDP growth is the log growth rate of GDP relative to the previous year. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the annual frequency, covering the period from 2000 to 2023. Standard errors are double-clustered at the firm and year levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Loan pricing regression model results (max biodiversity loss)

	Spread			
Variable	(1)	(2)	(3)	(4)
Biodiversity loss (max)	0.0070***	0.0511***	0.0086***	0.0505***
	(0.0019)	(0.0110)	(0.0016)	(0.0106)
Ln(original loan amount)	-0.3271***	-0.4499***	-0.3466***	-0.4521***
	(0.0325)	(0.0860)	(0.0283)	(0.0897)
Loan duration	0.0389***	0.0457*	0.0512***	0.0501**
	(0.0128)	(0.0232)	(0.0104)	(0.0222)
Seniority				
Senior unsecured	0.4370***	0.7855***	0.4256***	0.8226***
	(0.0835)	(0.1525)	(0.0464)	(0.1424)
Junior	-1.102***	-0.8447***	-1.045***	-0.7126***
	(0.1493)	(0.2553)	(0.1577)	(0.2318)
Junior unsecured	1.836***		1.475***	
	(0.2305)		(0.2678)	
Other	1.046***	1.253***	0.6643***	1.255***
	(0.2291)	(0.1476)	(0.1308)	(0.1555)
GDP growth	-2.245	-0.9193***	-0.2203*	
	(3.145)	(0.2893)	(0.1195)	
Government bond	0.3395*	-1.647***	0.0576	
	(0.1961)	(0.1483)	(0.4151)	
Leverage		0.2358***		0.2375***
		(0.0503)		(0.0550)
Observations	2,904,321	373,462	2,904,254	373,461
Adj. R^2	0.501	0.436	0.561	0.441
Country FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	No	No
Year FE	Yes	Yes	No	No
Bank × Year FE	No	No	Yes	Yes

Note: This table reports the results from the panel linear regression in equation (2), estimated by OLS. The dependent variable is the loan spread. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Ln(original loan amount) is the natural log of the original loan amount. Loan duration is in years. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. GDP growth is the log growth rate of GDP relative to the previous year. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the annual frequency, covering the period from 2000 to 2023. Standard errors are double-clustered at the firm and year levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Average marginal effects of default regression models (average biodiversity loss)

	Default		
Variable	(1)	(2)	(3)
Biodiversity loss (average)	0.0000***	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
Seniority			
Senior unsecured		-0.0083***	-0.0079***
		(0.0007)	(0.0019)
Junior		-0.0027**	0.0005
		(0.0012)	(0.0019)
Junior unsecured		0.0110**	
		(0.0051)	
Other		-0.0212***	-0.0191
		(0.0037)	(0.0143)
Years to maturity		-0.0004***	-0.0004
		(0.0001)	(0.0003)
Deposit to loan		-0.0073***	-0.0074***
		(0.0007)	(0.0009)
Spread		0.0004***	0.0013***
		(0.0001)	(0.0003)
GDP growth		0.0000	-0.0392***
		(0.0003)	(0.0010)
Government bond		-0.0049	
		(0.0061)	
Leverage			0.0041***
			(0.0013)
Observations	34,157,852	22,267,981	3,051,089
Adj. Pseudo R^2	0.130	0.161	0.115
Country FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes

Note: This table reports the average marginal effects from the panel logit regression in equation (3), estimated by maximum likelihood. The dependent variable is default, a dummy equal to 1 if the loan is in either interest or principal arrears for more than 90 days, and 0 otherwise. Biodiversity loss (average) is defined as 100 minus the average Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Years to maturity measures the remaining number of years to maturity. Deposit to loan is the ratio of the borrower's deposit amount within the entity to the current loan balance. Spread is the difference between the loan interest rate and the 3-month EURIBOR. GDP growth is the log growth rate of GDP relative to the previous quarter. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the quarterly frequency, covering the period from 2011–Q4 to 2023–Q4. Standard errors are double-clustered at the loan and year-quarter levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Average marginal effects of default regression models (max biodiversity loss)

	Default		
Variable	(1)	(2)	(3)
Biodiversity loss (max)	0.0004***	0.0002**	0.0012***
	(0.0001)	(0.0001)	(0.0002)
Seniority			
Senior unsecured		-0.0083***	-0.0078***
		(0.0007)	(0.0019)
Junior		-0.0027**	0.0004
		(0.0012)	(0.0019)
Junior unsecured		0.0111**	
		(0.0051)	
Other		-0.0211***	-0.0189
		(0.0037)	(0.0143)
Years to maturity		-0.0004***	-0.0004
		(0.0001)	(0.0003)
Deposit to loan		-0.0073***	-0.0074***
		(0.0007)	(0.0009)
Spread		0.0004***	0.0013***
		(0.0001)	(0.0003)
GDP growth		0.0000	-0.0391***
		(0.0003)	(0.0010)
Government bond		-0.0049	
		(0.0061)	
Leverage			0.0041***
			(0.0013)
Observations	34,157,852	22,267,981	3,051,089
Adj. Pseudo R^2	0.130	0.161	0.116
Country FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes

Note: This table reports the average marginal effects from the panel logit regression in equation (3), estimated by maximum likelihood. The dependent variable is default, a dummy equal to 1 if the loan is in either interest or principal arrears for more than 90 days, and 0 otherwise. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Years to maturity measures the remaining number of years to maturity. Deposit to loan is the ratio of the borrower's deposit amount within the entity to the current loan balance. Spread is the difference between the loan interest rate and the 3-month EURIBOR. GDP growth is the log growth rate of GDP relative to the previous quarter. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the quarterly frequency, covering the period from 2011–Q4 to 2023–Q4. Standard errors are double-clustered at the loan and year-quarter levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7: Average marginal effects of default regression models for the subsample with highest change in biodiversity loss ($\Delta BL_{2000-2023}$)

	Default		
Variable	(1)	(2)	(3)
Biodiversity loss (max)	0.0014***	0.0017***	0.0005**
	(0.0003)	(0.0005)	(0.0002)
Seniority			
Senior unsecured	-0.0076***	-0.0067***	-0.0099***
	(0.0022)	(0.0023)	(0.0017)
Junior	0.0002	-0.0003	0.0010
	(0.0021)	(0.0022)	(0.0022)
Other	-0.0192	-0.0168	-0.0202
	(0.0153)	(0.0164)	(0.0132)
Years to maturity	-0.0003	-0.0002	-0.0005**
	(0.0003)	(0.0003)	(0.0002)
Deposit to loan	-0.0080***	-0.0078***	-0.0069***
	(0.0012)	(0.0011)	(0.0013)
Spread	0.0012***	0.0011***	0.0015***
	(0.0004)	(0.0004)	(0.0003)
GDP growth	-0.0419***	-0.0427***	-0.0398***
	(0.0009)	(0.0012)	(0.0006)
Leverage	0.0042***	0.0041***	0.0034***
	(0.0013)	(0.0014)	(0.0012)
Observations	2,393,475	1,882,705	1,637,460
Adj. Pseudo R^2	0.112	0.117	0.126
Country FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes

Note: This table reports the average marginal effects from the panel logit regression in equation (3), estimated by maximum likelihood. Model (1) is estimated on the subsample of observations located in NUTS 3 regions where the change in average BII between 2000 and 2023 is below the median of the changes in the average BII (-0.31). Model (2) is estimated on the subsample of observations located in NUTS 3 regions where the change in maximum BII between 2000 and 2023 is below the median of the changes in the maximum BII (-0.56). Model (3) is estimated on the subsample of observations located in NUTS 3 regions where the change in minimum BII between 2000 and 2023 is below the median of the changes in the minimum BII (-0.26). The dependent variable is default, a dummy equal to 1 if the loan is in either interest or principal arrears for more than 90 days, and 0 otherwise. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Years to maturity measures the remaining number of years to maturity. Deposit to loan is the ratio of the borrower's deposit amount within the entity to the current loan balance. Spread is the difference between the loan interest rate and the 3-month EURIBOR. GDP growth is the log growth rate of GDP relative to the previous quarter. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the quarterly frequency, covering the period from 2011–Q4 to 2023–Q4. Standard errors are double-clustered at the loan and year-quarter levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8: Average marginal effects for the heterogeneity test regressions: agriculture sector, micro firms, financially constrained firms

	Default		
Variable	(1)	(2)	(3)
Biodiversity loss (max)	0.0013***	0.0011***	0.0011***
	(0.0002)	(0.0002)	(0.0002)
Biodiversity loss (max) × Agriculture	-0.0025***		
	(0.0008)		
Biodiversity loss (max) × Micro		0.0001***	
		(0.0000)	
Biodiversity loss (max) × SA dummy			-0.0002***
			(0.0001)
Seniority			
Senior unsecured	-0.0077***	-0.0074***	-0.0074***
	(0.0019)	(0.0020)	(0.0020)
Junior	0.0004	-0.0001	0.0004
	(0.0019)	(0.0019)	(0.0019)
Other	-0.0189	-0.0121	-0.0135
	(0.0143)	(0.0148)	(0.0140)
Years to maturity	-0.0004	-0.0004	-0.0004
	(0.0003)	(0.0002)	(0.0003)
Deposit to loan	-0.0074***	-0.0075***	-0.0072***
	(0.0009)	(0.0009)	(0.0009)
Spread	0.0013***	0.0009***	0.0013***
	(0.0003)	(0.0003)	(0.0003)
GDP growth	-0.0391***	-0.0496***	
	(0.0010)	(0.0037)	
Leverage	0.0041***	0.0037***	0.0044***
	(0.0013)	(0.0013)	(0.0010)
Observations	3,051,089	3,051,089	3,035,705
Adj. Pseudo R^2	0.116	0.122	0.111
Country FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Year-quarter FE	Yes	Yes	Yes

Note: This table reports the average marginal effects from the panel logit regression in equation (3), estimated by maximum likelihood. The dependent variable is default, a dummy equal to 1 if the loan is in either interest or principal arrears for more than 90 days, and 0 otherwise. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Years to maturity measures the remaining number of years to maturity. Deposit to loan is the ratio of the borrower's deposit amount within the entity to the current loan balance. Spread is the difference between the loan interest rate and the 3-month EURIBOR. GDP growth is the log growth rate of GDP relative to the previous quarter. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Agriculture is a dummy variable identifying loans to SMEs in the agriculture sector. Micro is a dummy variable identifying loans to firms with total assets less than or equal to €2,000,000. SA dummy identifies loans to financially constrained firms based on the SA index of financial constraint (Hadlock and Pierce, 2010). Observations are at the quarterly frequency, covering the period from 2011–Q4 to 2023–Q4. Standard errors are double-clustered at the loan and year-quarter levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Figures

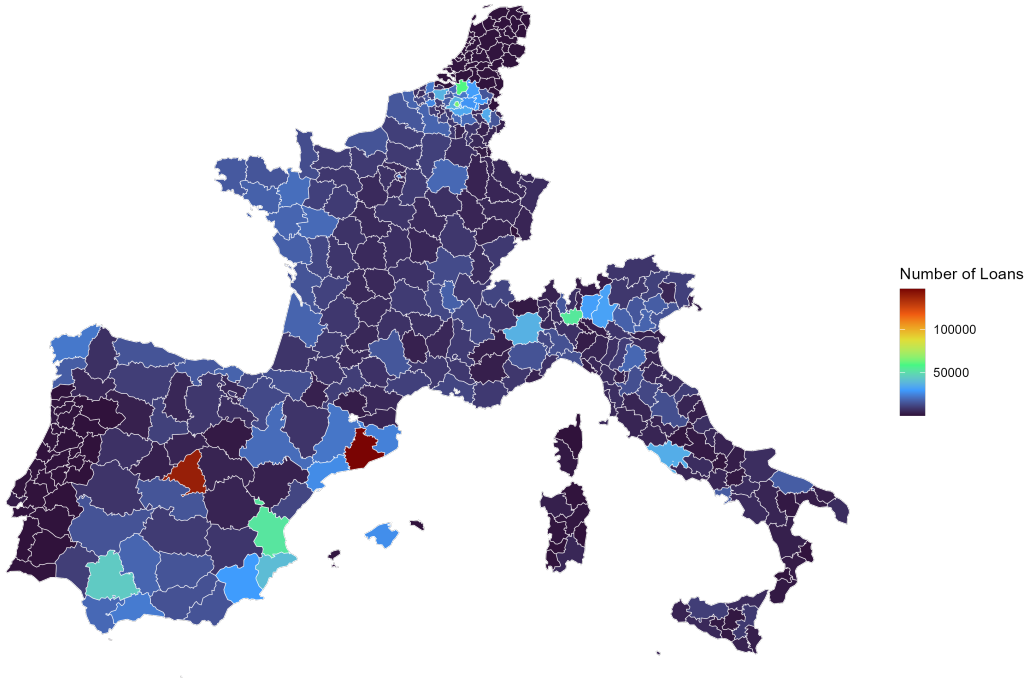


Figure 1: Total number of loans by NUTS 3

Note: This figure shows the total number of loans by NUTS 3 for Belgium, France, Italy, the Netherlands, Portugal, and Spain over the period 2011-Q4 to 2023-Q4.

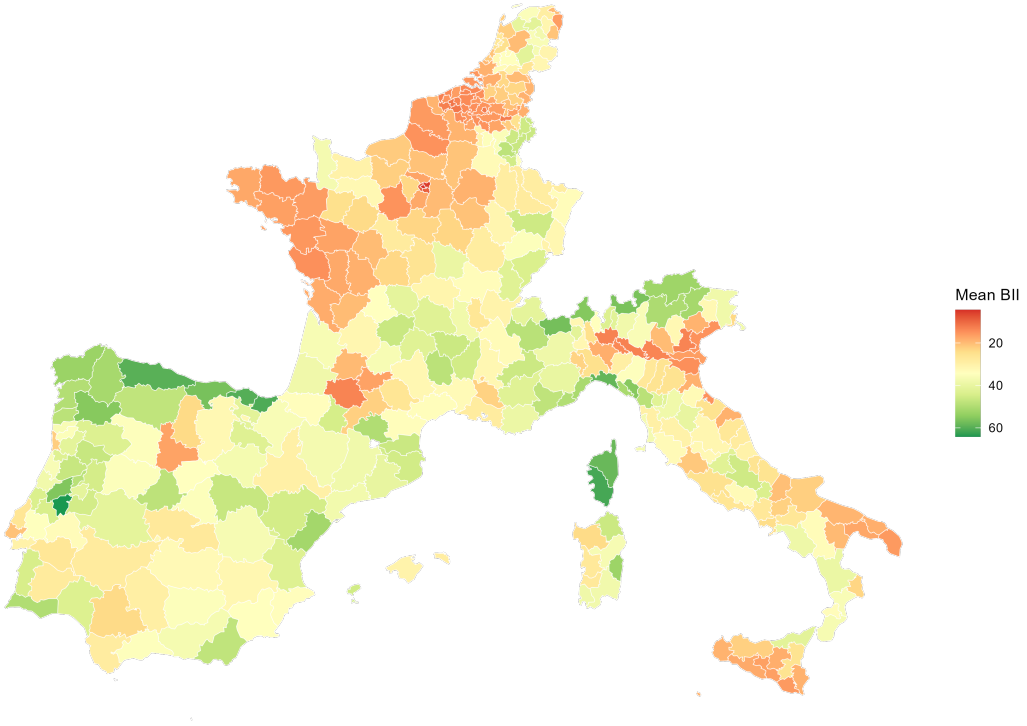


Figure 2: Average BII by NUTS 3 (2023)

Note: This figure shows the average Biodiversity Intactness Index (BII), developed by the Natural History Museum, aggregated at the NUTS 3 level for Belgium, France, Italy, the Netherlands, Portugal, and Spain in 2023. Data are at 1 km^2 resolution. A higher value of the Index denotes lower biodiversity loss.

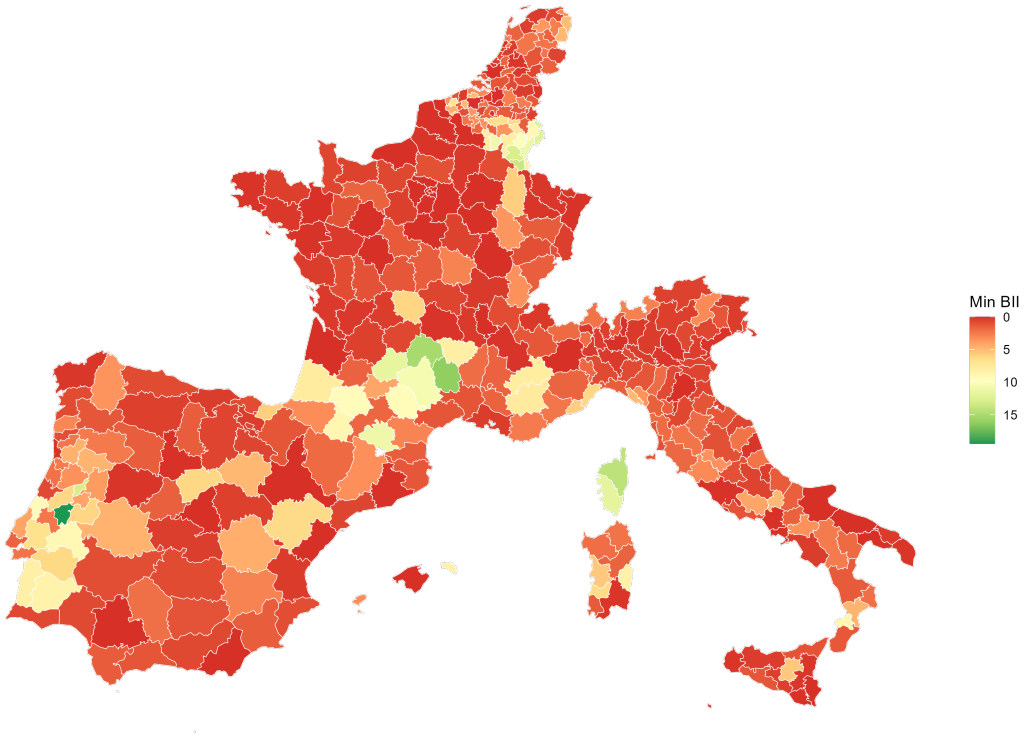


Figure 3: Minimum BII by NUTS 3 (2023)

Note: This figure shows the minimum Biodiversity Intactness Index (BII), developed by the Natural History Museum, aggregated at the NUTS 3 level for Belgium, France, Italy, the Netherlands, Portugal, and Spain in 2023. Data are at 1 km^2 resolution. A higher value of the Index denotes lower biodiversity loss.

A Appendix

Table A1: Loan sample composition by NACE sector

Sector	Loan-year-quarter observations	Percent
A - Agriculture, forestry and fishing	7,915,890	22.84
B - Mining and quarrying	47,511	0.14
C - Manufacturing	3,500,353	10.10
D - Electricity, gas, steam and air conditioning supply	95,812	0.28
E - Water supply, sewerage, waste management and remediation activities	115,915	0.33
F - Construction	3,701,124	10.68
G - Wholesale and retail trade, repair of motor vehicles and motorcycles	6,740,948	19.45
H - Transportation and storage	1,520,002	4.39
I - Accommodation and food services	2,321,725	6.70
J - Information and communication	632,038	1.82
L - Real estate activities	2,150,789	6.21
M - Professional, scientific and technical activities	2,635,015	7.60
N - Administrative and support service activities	1,604,919	4.63
R - Arts, entertainment and recreation	389,277	1.12
S - Other service activities	1,259,673	3.63
T - Activities of households as employers	27,440	0.08
Total	34,658,431	100.00

Note: This table reports the composition of our sample by NACE sector. Column 2 reports the number of loan-year-quarter observations by NACE sector, and Column 3 the percentage.

Table A2: Loan sample composition by country

Country	Loan-year-quarter observations	Percent
Belgium	8,681,556	25.05
France	10,839,816	31.28
Italy	5,899,677	17.02
Netherlands	122,147	0.35
Portugal	106,721	0.31
Spain	9,008,514	25.99
Total	34,658,431	100.00

Table A3: Description of regression variables

Variable	Type	Description	Source
Default	Dependent	Dummy variable equal to one if the loan is either in interest or principal arrears for more than 90 days, and zero otherwise	EDW
Biodiversity loss (average)	Interest	100 minus the average Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level	NHM
Biodiversity loss (max)	Interest	100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level	NHM
Seniority	Control	Categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other	EDW
Years to maturity	Control	Remaining number of years to maturity	EDW
Deposit to loan	Control	Ratio of the borrower's deposit amount within the entity to the current loan balance	EDW
Spread	Control	Difference between the loan interest rate at the first reporting date and the 3-month EURIBOR	EDW
Leverage	Control	Ratio of the sum of short-term financial debt, long-term debt, and commercial liabilities to total assets	EDW
Ln(original loan amount)	Control	Natural log of the original loan amount	EDW
Loan duration	Control	Loan duration in years	EDW
GDP growth	Control	Log growth rate of GDP relative to the previous quarter	Eurostat
Government bond	Control	Country-level 3-month government bond yield	Bloomberg

Note: This table defines the variables employed in our regression analyses and their source.

Table A4: Default rates by NACE sector

Sector	No. companies	No. defaulted	Default rate
A - Agriculture, forestry and fishing	203,890	4,889	0.0240
B - Mining and quarrying	3,161	215	0.0680
C - Manufacturing	250,531	14,173	0.0566
D - Electricity, gas, steam and air conditioning supply	7,419	328	0.0442
E - Water supply, sewerage, waste management and remediation activities	7,306	345	0.0472
F - Construction	213,080	14,519	0.0681
G - Wholesale and retail trade, repair of motor vehicles and motorcycles	473,483	26,003	0.0549
H - Transportation and storage	94,140	4,954	0.0526
I - Accommodation and food services	181,960	12,903	0.0709
J- Information and communication	45,334	2,400	0.0529
L- Real estate activities	133,467	5,698	0.0427
M - Professional, scientific and technical activities	161,443	5,901	0.0366
N - Administrative and support service activities	120,767	3,349	0.0277
R - Arts, entertainment and recreation	28,221	1,583	0.0561
S - Other service activities	120,439	6,141	0.0510
T - Activities of households as employers	3,945	109	0.0276

Note: This table reports the default rates by NACE sector. Column 2 reports the number number of companies by NACE sector, Column 3 the number of defaulted companies by NACE sector, and Column 4 the default rate.

Table A5: Default rates by country

Country	No. companies	No. defaulted	Default rate
Belgium	264,425	7,267	0.0275
France	330,203	2,556	0.0077
Italy	632,061	35,281	0.0558
Netherlands	5,941	3	0.0005
Portugal	10,286	531	0.0516
Spain	708,797	56,618	0.0799

Note: This table reports the default rates by country. Column 2 reports the number number of companies by country, Column 3 the number of defaulted companies by country, and Column 4 the default rate.

Table A6: DiD estimates of the effect of the Kunming Declaration (2021) on loan spread

	Spread			
Variable	(1)	(2)	(3)	(4)
Large BL (average) × Post	0.0649***	0.0374***		
	(0.0127)	(0.0134)		
Large BL (max) × Post			0.0207**	0.0483***
			(0.0095)	(0.0094)
Observations	3,234,992	3,234,893	3,234,992	3,234,893
Adj. R^2	0.442	0.520	0.442	0.520
Country FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Bank FE	Yes	No	Yes	No
Year FE	Yes	No	Yes	No
Bank × Year FE	No	Yes	No	Yes

Note: This table reports the results of the difference-in-differences (DiD) regression (5), estimated by OLS, examining whether loan spread increased following the 2021 Kunming Declaration. The dependent variable is the loan interest rate. Large BL (average) is a dummy variable equal to 1 if average biodiversity loss aggregated at the NUTS 3 level is larger than the median of average biodiversity loss, and 0 otherwise. Large BL (max) is a dummy variable equal to 1 if maximum biodiversity loss aggregated at the NUTS 3 level is larger than the median of maximum biodiversity loss, and 0 otherwise. Post is a dummy variable equal to 1 for the years 2021 and onwards. Observations are at the annual frequency, covering the period from 2000 to 2023. Standard errors are clustered at the firm level and are reported in parentheses. The dependent variable is winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A7: Average marginal effects for robustness test regressions: country by time and sector by time fixed effects

	Default					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity loss (max)	0.0005***	0.0002	0.0012***	0.0004***	0.0002**	0.0012***
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Seniority						
Senior unsecured		-0.0095***	-0.0078***		-0.0082***	-0.0077***
		(0.0008)	(0.0019)		(0.0007)	(0.0018)
Junior		-0.0027	0.0004		-0.0025**	0.0008
		(0.0021)	(0.0019)		(0.0012)	(0.0019)
Junior unsecured		-0.0032			0.0111**	
		(0.0020)			(0.0052)	
Other		-0.0295***	-0.0189		-0.0208***	-0.0158
		(0.0077)	(0.0143)		(0.0038)	(0.0140)
Years to maturity		-0.0004***	-0.0004		-0.0004***	-0.0004
		(0.0001)	(0.0002)		(0.0001)	(0.0003)
Deposit to loan		-0.0121***	-0.0074***		-0.0072***	-0.0073***
		(0.0012)	(0.0009)		(0.0007)	(0.0009)
Spread		0.0004**	0.0013***		0.0004***	0.0014***
		(0.0002)	(0.0003)		(0.0001)	(0.0003)
GDP growth					0.0000	-0.0378***
					(0.0003)	(0.0009)
Government bond					-0.0035	
					(0.0062)	
Leverage			0.0041***			0.0040***
			(0.0011)			(0.0013)
Observations	24,379,685	13,081,752	3,051,089	34,157,456	22,267,206	3,044,636
Adj. Pseudo R^2	0.082	0.108	0.116	0.133	0.166	0.127
Country FE	No	No	No	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	No	No	No
Country × Year-quarter FE	Yes	Yes	Yes	No	No	No
Sector × Year-quarter FE	No	No	No	Yes	Yes	Yes

Note: This table reports the average marginal effects from the panel logit regression in equation (3), estimated by maximum likelihood. The dependent variable is default, a dummy equal to 1 if the loan is in either interest or principal arrears for more than 90 days, and 0 otherwise. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Years to maturity measures the remaining number of years to maturity. Deposit to loan is the ratio of the borrower's deposit amount within the entity to the current loan balance. Spread is the difference between the loan interest rate and the 3-month EURIBOR. GDP growth is the log growth rate of GDP relative to the previous quarter. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the quarterly frequency, covering the period from 2011–Q4 to 2023–Q4. Standard errors are double-clustered at the loan and year-quarter levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A8: Robustness: average marginal effects of default regression models (max biodiversity loss) with the subset of loans originated from 2011 onwards

	Default	
Variable	(1)	(2)
Biodiversity loss (max)	0.0002***	0.0008***
	(0.0001)	(0.0002)
Seniority		
Senior unsecured	-0.0063***	-0.0114***
	(0.0009)	(0.0018)
Junior	-0.0015	0.0041*
	(0.0009)	(0.0025)
Junior unsecured	0.0095***	
	(0.0032)	
Other	-0.0207***	-0.0267*
	(0.0027)	(0.0161)
Years to maturity	-0.0011***	-0.0030***
	(0.0001)	(0.0004)
Deposit to loan	-0.0066***	-0.0094***
	(0.0008)	(0.0015)
Spread	0.0009***	0.0032***
	(0.0001)	(0.0002)
GDP growth	-0.0001	
	(0.0002)	
Government bond	-0.0229***	
	(0.0078)	
Leverage		0.0031***
		(0.0008)
Observations	18,404,857	2,308,049
Adj. Pseudo R^2	0.214	0.173
Country FE	Yes	Yes
Sector FE	Yes	Yes
Year-quarter FE	Yes	Yes

Note: This table reports the average marginal effects from the panel logit regression in equation (3), estimated by maximum likelihood. The dependent variable is default, a dummy equal to 1 if the loan is in either interest or principal arrears for more than 90 days, and 0 otherwise. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. Years to maturity measures the remaining number of years to maturity. Deposit to loan is the ratio of the borrower's deposit amount within the entity to the current loan balance. Spread is the difference between the loan interest rate and the 3-month EURIBOR. GDP growth is the log growth rate of GDP relative to the previous quarter. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the quarterly frequency, covering the period from 2011–Q4 to 2023–Q4. Standard errors are double-clustered at the loan and year-quarter levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A9: Robustness: loan pricing regression model results (max biodiversity loss) with the subset of loans originated from 2011 onwards

	Spread			
Variable	(1)	(2)	(3)	(4)
Biodiversity loss (max)	0.0098***	0.0531***	0.0107***	0.0525***
	(0.0015)	(0.0115)	(0.0014)	(0.0111)
Ln(original loan amount)	-0.3366***	-0.4560***	-0.3589***	-0.4585***
	(0.0370)	(0.0912)	(0.0311)	(0.0950)
Loan duration	0.0460***	0.0561*	0.0609***	0.0606**
	(0.0149)	(0.0266)	(0.0111)	(0.0254)
Seniority				
Senior unsecured	0.4161***	0.8475***	0.4749***	0.9032***
	(0.0851)	(0.1927)	(0.0493)	(0.1806)
Junior	-1.130***	-0.8741***	-1.196***	-0.7256***
	(0.1377)	(0.2024)	(0.1548)	(0.1973)
Junior unsecured	1.965***		1.840***	
	(0.2499)		(0.2848)	
Other	1.037***	1.302***	0.7213***	1.328***
	(0.2066)	(0.1515)	(0.1329)	(0.1509)
GDP growth	-0.0987	-0.9274**	-0.2203*	
	(0.0715)	(0.3029)	(0.1195)	
Government bond	-0.4774	-1.628***	0.0576	
	(0.3829)	(0.1678)	(0.4151)	
Leverage		0.3207***		0.3262***
		(0.0461)		(0.0518)
Observations	2,566,365	345,576	2,566,348	345,576
Adj. R^2	0.494	0.337	0.537	0.343
Country FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	No	No
Year FE	Yes	Yes	No	No
Bank × Year FE	No	No	Yes	Yes

Note: This table reports the results from the panel linear regression in equation (2), estimated by OLS. The dependent variable is the loan spread. Biodiversity loss (max) is defined as 100 minus the minimum Biodiversity Intactness Index computed at the 1 km^2 level and aggregated at the NUTS 3 level. Ln(original loan amount) is the natural log of the original loan amount. Loan duration is in years. Seniority is a categorical variable taking the values senior secured, senior unsecured, junior, junior unsecured, or other. GDP growth is the log growth rate of GDP relative to the previous year. Government bond is the country-level 3-month government bond yield. Leverage is the sum of short term financial debt, long term debt and commercial liabilities to total assets. Observations are at the annual frequency, covering the period from 2011 to 2023. Standard errors are double-clustered at the firm and year levels and are reported in parentheses. All continuous variables are winsorised at the 1% and 99% levels. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.