12 November 2020

Environmental credit risks for EU-27 sovereigns: Vulnerability and mitigation profiles determine exposure

The Netherlands, Slovenia, Italy and Belgium are among the rich and environmentally vulnerable EU countries which score best in how they address the relevant risks they face.

This study on the relative importance of environmental risks facing the EU-27 economies also shows that vulnerability to such risks is largely independent of a country's wealth, per capita incomes, geography and size. Some small, rich economies such as the Netherlands and Luxembourg are highly vulnerable to risks related to the cost of reducing dependence on fossil fuels and access to natural resources. In contrast, Denmark and Sweden look particularly resilient across all environmental risk dimensions.

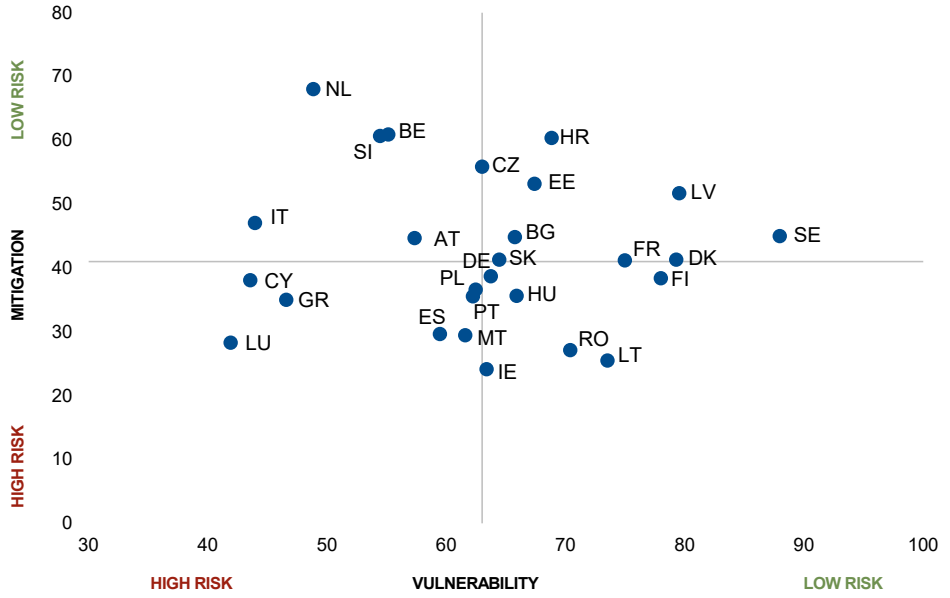
We identify three main environmental risk categories in our revised sovereign rating methodology - the cost of the transition to low-carbon economies, natural disasters, access to natural resources – while mitigating action might include investment, taxation, and policies on import dependency and final energy consumption.

In doing so, Scope is the first among the major credit rating agencies to include a separate and transparent analysis of credit-relevant environmental factors in its sovereign rating methodology. Environmental risks weigh already today on EU member states public finances, reflecting increasing cost for transition from coal industries towards renewables or construction of protective infrastructure against natural disasters.

In this study, we find that in general higher-income countries tend to spend more on the environment than lower-income countries, while the latter tend to invest more, partly determined by their access to external EU funds.

We also show that if, overall, some countries rank highly in taking action to address environmental risks, others score relatively poorly, such as Luxembourg – heavily dependent on fossil-fuel energy supplies – and Cyprus and Greece whose vulnerable economies face multiple environmental challenges (see **Figure 1**).

Figure 1: Environmental vulnerability and mitigating policy responses for EU-27



N.B. Scores are calculated based on a relative minimum-maximum algorithm across the EU-27 using six risk indicators and five mitigating factors, which result in a score ranging between 1 (high risk) and 100 (low risk).

Source: Scope Ratings GmbH

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Some of biggest EU economies have middle-rank profiles

Germany, the EU's biggest economy, has a middle-ranking risk and mitigation profile, compared with a modestly lower-risk France and higher-risk Spain, the EU's second- and fourth-largest economies respectively.

Our findings indicate where there is room for policy-making improvement. Governments in economies with energy-intensive industries could reduce their carbon footprint by replacing old coal plants with cleaner-burning generating capacity while countries dependent on energy imports could mitigate risks better through taxation and greater productivity.

The main results of the study:

1. Vulnerability to environmental risks appears independent of income levels, natural geographical features, population size and land size.
2. Countries with higher wealth and income levels per capita are on average more likely to mitigate environmental risks.
3. Vulnerability and mitigation are largely independent of each other, i.e. countries with higher vulnerability do not show systematically higher mitigation.

Distinguishing between financial and environmental materiality

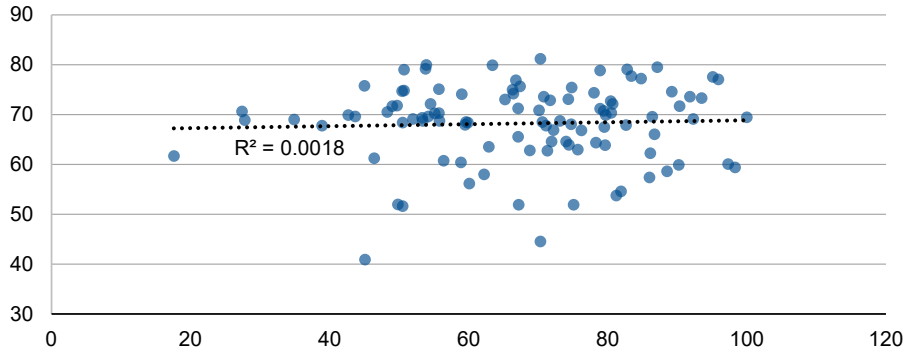
Distinction between financial, environmental materiality is key

ESG rating providers often disagree on the analytical methods and definitions regarding sustainability, resulting in a large dispersion of ESG rating levels. The upcoming EU taxonomy on sustainable finance will provide more guidance on environmental standards for the real economy and the financial sector. The EU's initiative will presumably lower the uncertainty regarding the 'E' in ESG. Most importantly, the EU distinguishes between i) financial materiality, a sovereign's exposure to environmental risks; and ii) environmental materiality, a sovereign's impact on the environment. This concept is defined as double materiality[1].

Sovereign environmental credit, impact risks uncorrelated

For this exercise, we selected factors that best approximate each materiality definition (see Annex II for a complete list of variables). Using a sample of 102 developed countries and frontier markets, we found the two materiality types to be mostly uncorrelated. The broad conclusion is that risk-oriented investors (financial materiality) and impact-oriented investors (environmental materiality) require separate ESG assessments. In this research, we focus on financial materiality.

Figure 2: Environmental impact versus environmental exposure worldwide



N.B. Scores are based on averages of popular environment-related variables across 102 countries (blue dots in the scatterplot). The underlying variables for exposure and impact risks (selected United Nations Sustainability Development Goals) are displayed in Annex II of this study.

Source: Scope Ratings GmbH

[1] See European Commission: "Guidelines on reporting climate-related information", https://ec.europa.eu/finance/docs/policy/190618-climate-related-information-reporting-guidelines_en.pdf.

Risk vulnerability versus risk mitigation

Differentiating between vulnerability and mitigation

Our sovereign rating methodology now explicitly accounts for environmental credit risks, both quantitatively and qualitatively. Our quantitative score includes three environmental risk pillars: transition risks, natural disaster risks, and resource availability risks. The quantitative outcomes are also informed by a qualitative analysis, which examines policies to mitigate defined environmental risks, such as investment, taxation, import dependency and final energy consumption. **Annex I** outlines the variables used for qualitative analyses, sorted by the three risk pillars.

This distinction between the risk pillars and mitigating measures allows us to:

i) distinguish between fundamental risks and (mostly) policy-determined mitigating factors;

ii) assess dynamics across the three risk pillars as a function of the exposure and the according policy action; and

iii) identify areas for effective government policies in the future.

Vulnerability of sovereigns to environmental risks

Identifying key environmental risks for sovereigns

The assessment of financial materiality first requires a rationale on how environmental risks are linked with a sovereign's willingness and ability to repay financial obligations.

We have identified the three environmental vulnerabilities (risk pillars) most likely to impede a sovereign's ability to repay financial obligations. We also determined the two key risk indicators for each of the three risk pillars.

1) **Transition risks:** We define these as the cost of transforming economies towards renewables use and the timely abolition of fossil fuels in production and consumption. These costs are likely to burden public budgets through transfer obligations or compensation to affected industries. The two risk indicators used to approximate these risks are i) CO_2 emissions per USD 1,000 of GDP; and ii) greenhouse gas (GHG) emissions per capita.

2) **Natural disaster risks:** Depending on their location, governments face different exposures regarding weather events, seismic activity, sea levels or droughts. These require pre-emptive investment or repair costs paid by public and private sources. The two risk indicators here are: i) the World Risk Index; and ii) estimated soil erosion by water as provided by Eurostat.

3) **Resource availability risks:** Reliance on natural resources depends on own availabilities as well as production and consumption needs. Scarce resources lead to a reliance on imports, which comes with significant price risks. The two risk indicators here are i) a country's biocapacity balance; and ii) its dependency on energy imports.

Assessments based on relative risk definition

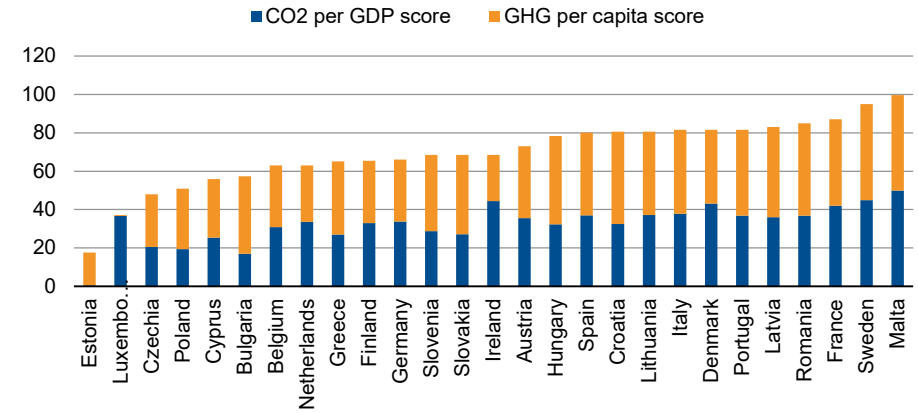
The six key indicators across the three risk pillars are shown in **Annex I**. These risk indicators were weighted equally to ensure transparency and comparability across the risk pillars. Our scoring of a country's vulnerability to environmental risks – the relative resilience score – uses a relative approach, with the lowest (highest) observed value in one risk pillar serving as a lower (upper) benchmark for the overall sample. Compared with other regions, EU-27 countries are relatively homogeneous in terms of their location, income levels and environmental policies, meaning any risk pillar is less likely to have outliers. A definition of the absolute thresholds would require more information on the absolute probabilities of risk materialisation, which is beyond the scope of this study. Hence, the quantitative scores should not be interpreted as a

country's absolute vulnerability to environmental risks but as its relative vulnerability among the EU-27.

Transition risks measured by CO_2 and GHG emissions

Regarding transition risks, **Figure 3** shows the countries' relative vulnerability, with higher scores signalling higher resilience. While most of the countries are similarly exposed to CO_2 and GHG emissions, the countries with the highest overall transition risks are more vulnerable to only one risk indicator (Luxembourg to GHG; Estonia to CO_2). This highlights the importance of using both indicators to measure this risk. Our findings also show that eastern European countries are more exposed to CO_2 emissions per GDP (Estonia, Czech Republic, Bulgaria), while western European countries are more vulnerable to GHG emissions per capita (Luxembourg, Ireland).

Figure 3: Relative resilience score, transition risks

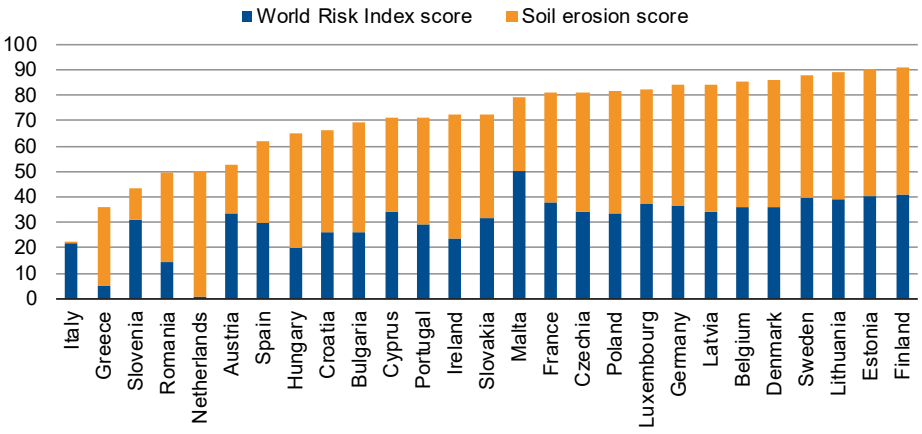


Sources: Eurostat, Scope Ratings GmbH

Natural disaster risks measured by World Risk Index and estimated soil erosion by water

Relative vulnerability to natural disaster risks is shown in **Figure 4**. Across the sample, variance in the two risk indicators (World Risk Index and the estimated soil erosion by water) was more evident for risk-prone countries such as Italy, Greece, Slovenia, Romania and the Netherlands, whose risks are linked to their respective natural geographical features (e.g. mountains, rainfall, and proximity to sea).

Figure 4: Relative resilience score, natural disaster risks



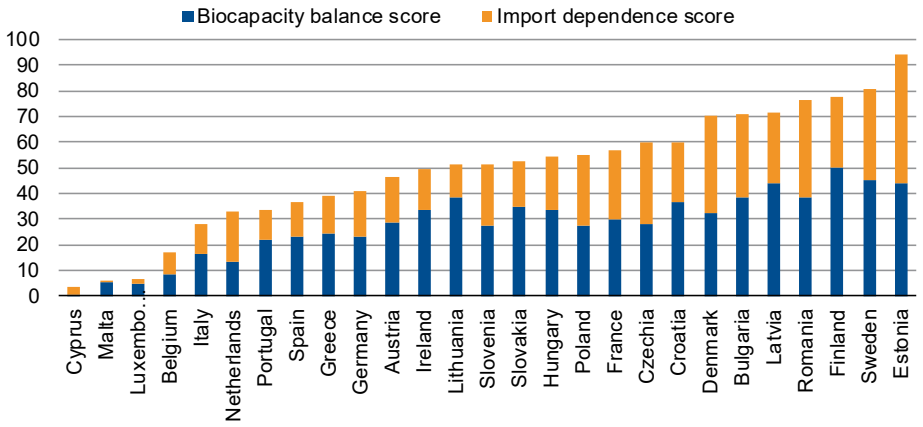
Sources: World Risk Index, Eurostat, Scope Ratings GmbH

Measuring resource availability risks

The vulnerability to resource availability risks is shown in **Figure 5**. The distribution of scores shows that small, densely populated countries are generally more vulnerable to resource scarcity (Cyprus, Malta, Luxembourg) than sparsely populated countries

(Estonia, Sweden, Finland). In addition, the availability of natural resources, such as oil shale in Estonia, contributes to relative resource resilience (though weighing negatively on transition risk).

Figure 5: Relative resilience score, resource availability risks

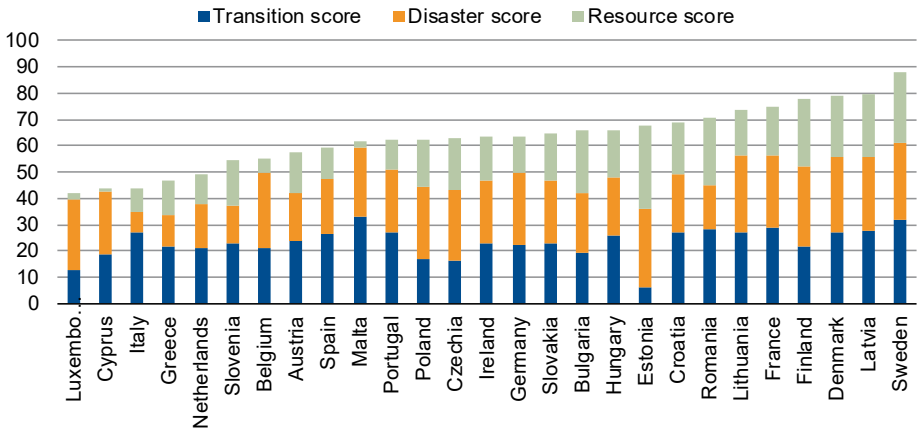


Sources: Global Footprint Network, Eurostat, Scope Ratings GmbH

Resilience scores uncorrelated with income, population, area

The vulnerability to total environmental risks is summarised in **Figure 6**. This provides four important insights. First, the degree of the aggregate exposure differs, with Luxembourg and Cyprus the most vulnerable, and Sweden the least. Second, the risk level varies significantly across the three risk pillars. Despite similar overall resilience, Italy is most vulnerable to natural disasters, and Luxembourg to resource availability. Third, the distribution of relative resilience appears largely uncorrelated with income levels, population size, or land area (Estonia versus Cyprus; France versus Italy). Finally, resource availability is the main risk driver for the most vulnerable sovereigns (Luxembourg, Cyprus) while the most resilient tend to be less exposed across all risk pillars (Sweden, Latvia, Denmark).

Figure 6: Relative resilience score, aggregate environmental risks



N.B. Resilience scores are calculated based on relative assessments of the EU-27 using a minimum-maximum approach with resulting scores ranging between 1 (low risk) and 100 (high risk). The scores are based on the six defined risk indicators and have equal weights (one-sixth each).

Source: Scope Ratings GmbH

Mitigation against environmental risks

Weight of mitigating factors rely on policy relevance

Mitigation efforts also inform a sovereign's relative resilience to environmental risks, which form the qualitative portion of our analysis. We examine direct policy actions (taxation, expenditure and investment) as well as mitigation through indirect channels (renewables use and resource productivity). **Table 1** shows that the mitigation measures can often be applied to more than one risk pillar. For instance, public expenditure on environmental protection can mitigate both transition and natural disaster risks. Economy-wide environmental investment can target multiple risks, resulting in each of the five variables having different levels of importance, as defined below. Transition risks can be addressed through different policy measures, while disaster and resource availability risks require more targeted actions.

Table 1: Mitigating factors and applicability to risk pillars

	Transition risk	Natural disaster risk	Resource availability risk
Environmental taxation	*x*		x
Environmental expenditure	*x*	x	
Environmental investment	*x*	x	
Use of renewable energy	*x*		
Resource productivity			x

Transition risks informed by direct and indirect policy actions

Investment and expenditure on environmental protection are increasing in the EU-27, both directly as well as indirectly via subsidies of private sector projects. Measures aim at lowering pollution, increasing the efficiency of waste and water management, protecting biodiversity, as well as fostering research and development, education and training. These help in the transition towards more ecologically sustainable methods of production and consumption, which pay off through steadier long-run growth. Political headwinds are also boosting environmental investment, for example, the European Green Deal proposal to provide grants and subsidise interest costs.

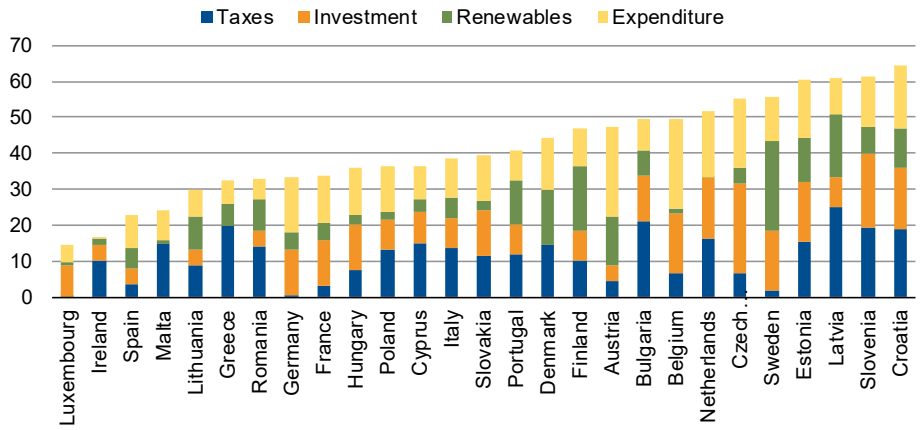
Figure 7 shows the sub-score for the factors mitigating transition risks across the EU-27, with higher scores showing higher mitigation. We found that countries with higher income levels per capita usually spend more on environmental measures, while lower-income countries tend towards higher investment (likely driven in part by EU funds). We also found that environmental taxation as a share of total government revenues (from taxes and social contributions) tends to be lower for high-income economies (Germany, France, Sweden), which could be partly explained by their higher income tax and VAT bases relative to lower-income peers.

The Czech Republic reported the highest share of investment to GDP at 0.7%, compared to the EU-27 average of 0.4%, according to the latest figures from 2017. The highest shares of expenditure to GDP were reported by Austria and Belgium, at around 3% (1.8% average). Across the EU-27, the share of environmental taxation among total tax revenues decreased during 2002-18, to 6% from 6.8%. As of 2018, Latvia had the highest share of environmental taxes, at 10.9%.

A high share of renewable energy in gross final energy consumption is another important mitigant against transition risks, showing progress towards a carbon-free economy. A high share can indicate strong innovativeness or transition costs already incurred. In 2018, Sweden had the highest share with 54%, against the EU-27 average of 18.9%.

For a more granular assessment of transition risk mitigation, our analysis is also informed by indicators such as the different transport modes for passengers and freight (share of passenger cars/trucks versus train use) or a population's exposure to particulate matter or transport pollutants.

Figure 7: Mitigation scores, transition risk

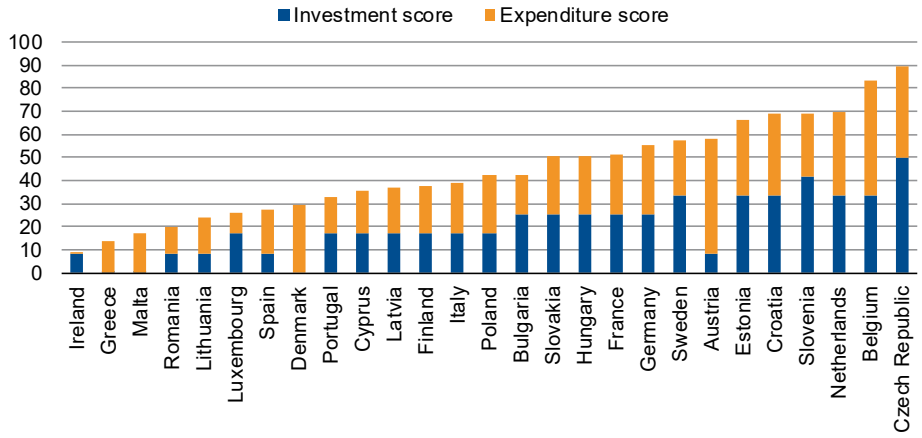


Sources: Eurostat, Scope Ratings GmbH

Current spending, investment impact natural disaster risks

Figure 8 summarises the impact of the mitigation of natural disaster risks. A country's ambition to mitigate these risks can be measured by economy-wide environmental investment or government expenditure as a share of GDP. Again, we found that richer economies focus on expenditure while less rich ones focus on investment.

Figure 8: Mitigation scores, natural disaster risk



Sources: Eurostat, World Risk Index, Scope Ratings GmbH

Resource availability risks mitigated by resource productivity and taxation

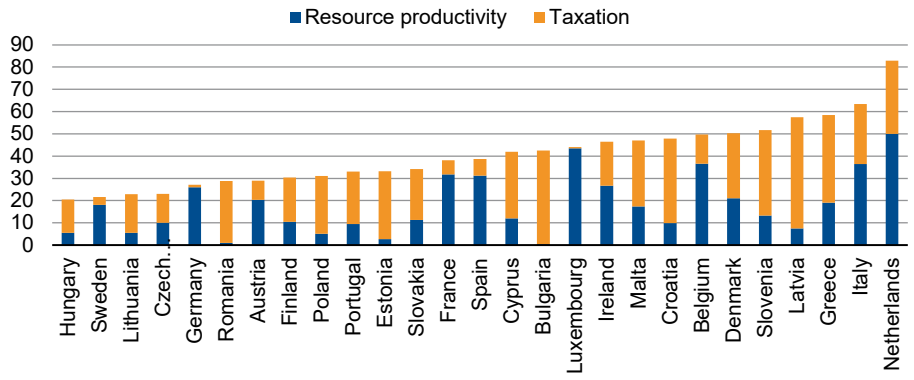
Figure 9 summarises the scores on resource risk mitigation. Here, we use resource productivity and environmental taxation as the two proxies for mitigation.

We expect countries that productively use raw materials and other physical inputs to be less prone to availability risks, even if they rely on resource imports. In 2019, the Netherlands reported the highest resource productivity, with production costing EUR 4.4 per kilogram of domestic material consumption, compared with the EUR 2.0 average for the EU-27. This is also reflected in the higher scores for strong manufacturing economies such as Germany, Netherlands or Belgium.

Environmental taxation, the second proxy, prompts households and companies to act more sustainably. While such taxes can also cause productive activities to disappear,

they provide another tool to reduce the use of and reliance on scarce and finite resources, thereby supporting governments in stabilising their biocapacity balance. In 2018, energy taxes accounted for 77% of total environmental taxation in the EU-27, well ahead of those levied on transport (20%) and pollution and resources (3%).

Figure 9: Mitigation scores, resource availability risks



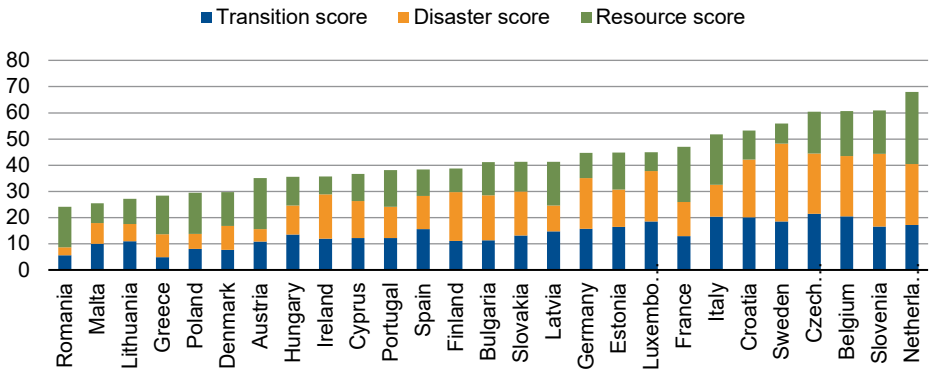
Source: Eurostat, Scope Ratings GmbH

Mitigation depends on economic well-being, vulnerability

Figure 10 summarises the mitigation scores for aggregate environmental credit risk. Two observations are worth highlighting. First, mitigation efforts across the three risk pillars are less volatile when compared with the outcome on vulnerabilities. This is partly because a mitigation measure can apply to more than one risk pillar. Second, high mitigation scores are positively related to high income and wealth levels, with the Netherlands, Belgium and Sweden among the top five. However, income and wealth indicators are less meaningful at the lower end of the distribution (see Malta, Denmark, Austria).

A comparison of resilience and mitigation scores shows that countries most vulnerable to environmental risks are more likely to invest in mitigation (Netherlands, Slovenia, Italy, Belgium), although some high-risk countries (Greece, Cyprus, Luxembourg) still fall within the medium-to-low end of the mitigation scores.

Figure 10: Mitigation risk versus environmental exposure



N.B. Mitigating risks are calculated based on relative assessments of the EU-27 using a minimum-maximum approach with resulting scores ranging between 1 (low risk) and 100 (high risk). The risk outcomes are based on the five defined mitigating factors, with a 25% relative weight for directly policy-linked measures (investment, expenditure, taxation) and lower weights for renewable energy consumption (8%) and resource productivity (17%). Each environmental risk pillar receives an equal weight of one-third.

Source: Scope Ratings GmbH

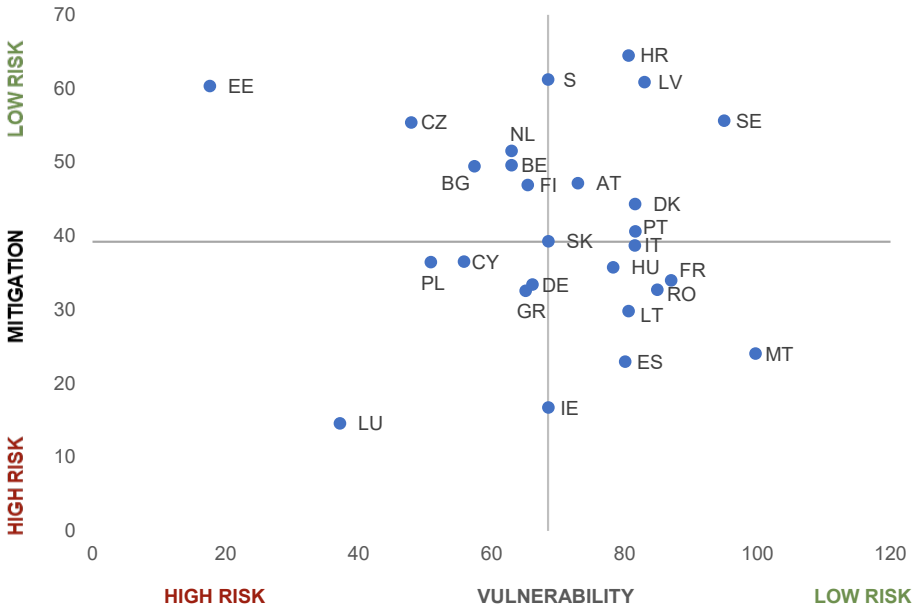
Effectiveness of policy to environmental vulnerability

To further qualify the above findings, we considered the effectiveness of mitigation measures to point out areas for potential policy action by EU-27 governments.

Estonia: effective action against high exposure to transition risk

Regarding transition risk, the upper left quadrant of **Figure 11** shows countries with a high intensity of mitigation efforts, given their higher transition risks relative to the remaining EU-27. For instance, Estonia, which scores the worst for CO_2 emissions, has one of highest rates of environmental taxation and renewable energy consumption (renewables use of 30% relative to 18.9% in the EU-27). In the lower left quadrant, Luxembourg's position marks the highest unused policy potential for mitigating high transition risk.

Figure 11: Resilience and mitigation scores, transition risk



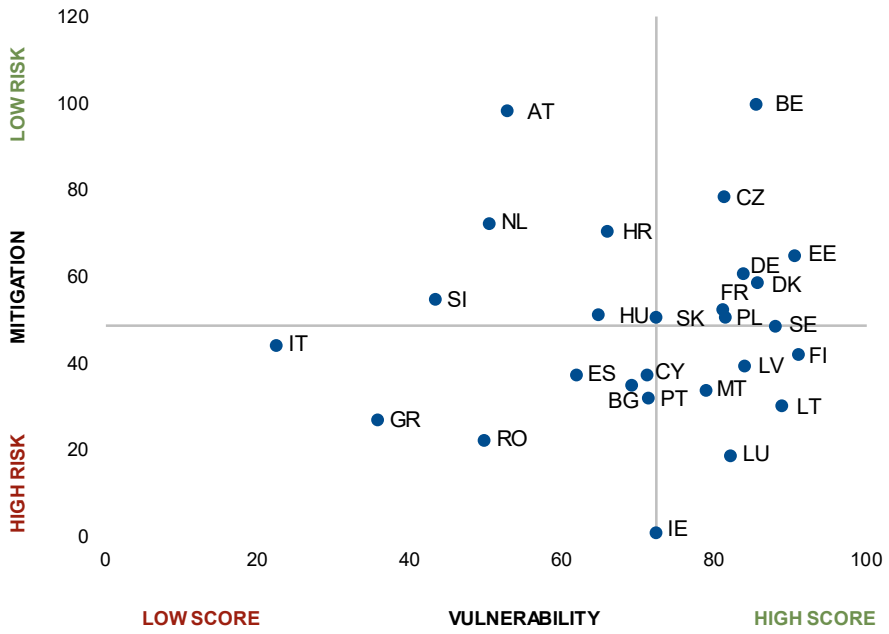
N.B. Scores are based on a relative comparison among the EU-27 countries. The blue vertical and horizontal axes report the median of the score distribution.

Source: Scope Ratings GmbH

Austria and Netherlands mitigate high natural disaster risks

Regarding natural disaster risk, the upper left quadrant also shows countries with high mitigation intensity, given their large exposure to these risks (**Figure 12**). Examples are Austria and the Netherlands, which score high for mitigation given their high natural disaster risks (soil erosion and rising sea levels, respectively). Mitigation is supported by high expenditure and investment. In the lower left quadrant, Greece and Romania still have a large scope for policy action give their high natural disaster risks.

Figure 12: Vulnerability and mitigation scores, natural disaster risk



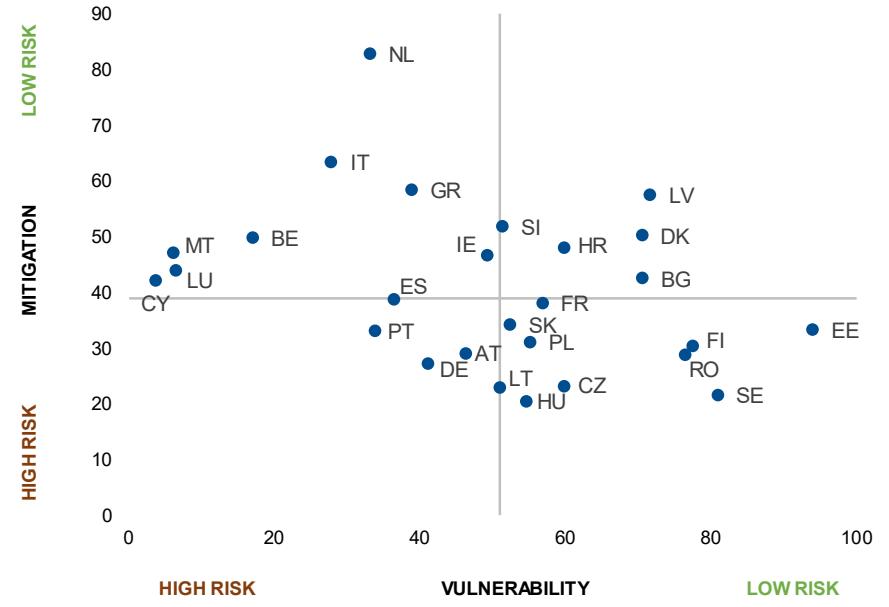
N.B. The scores are based on a relative comparison among the EU-27 countries. The blue vertical and horizontal axes report the median of the score distribution.

Source: Scope Ratings GmbH

The Netherlands benefits from highest resource productivity

Regarding resource availability risk, the Netherlands also performs well **(Figure 13)**, for reducing reliance on energy imports and other resources, reporting the highest resource productivity across the EU-27, followed by Italy. Moreover, both the Netherlands and Italy collect a high share of environmental taxes (7-8% of total tax revenues), which could further lower resource dependence. Germany, Portugal and Austria, while above the EU-27 median for this risk, score below the median for mitigation.

Figure 13: Vulnerability and mitigation scores, resource availability risk



N.B. Scores are based on a relative comparison among the EU-27. The blue vertical and horizontal axes report the median of the score distribution.

Source: Scope Ratings GmbH

To conclude, the effectiveness of mitigating measures depends on a country's vulnerability to a given risk. While all countries face a degree of absolute risk to all three environmental risk pillars, efforts to reduce a high risk level usually yields greater marginal benefits than mitigating relatively low risks. For example, it is usually cheaper to replace carbon-intensive production by less carbon-intensive alternatives at very high levels of emissions – either due to the lower cost of replacing old coal plants or by lower replacement cost by those industries which are less energy-intensive in production.

Scope's sovereign methodology addresses qualitative mitigating factors to environmental risks

This research used five aggregate, broad measures to approximate the mitigation scores for the three risk pillars (see **Annex I**). We note that these only partly address the universe of mitigating procedures and their relative efficacy across countries.

At the same time, our analysis can indicate which areas have higher mitigation potential. Under our sovereign methodology, the qualitative framework informs the quantitative assessment of environmental risks when examining governments' efforts to mitigate vulnerabilities relative to similarly rated peers. The number and scope of variables used in this exercise could form a baseline for future qualitative analysis, which however, finally hinges on data availability and idiosyncratic country characteristics.

Annex I: Description of environmental risk pillars for sovereigns

Risk pillar	Risk indicator	Description	Source
Environmental vulnerabilities			
Transition risk	Fossil fuel CO_2 emissions	Tonnes per USD 1,000 of GDP (2019)	Emission Database for Global Atmospheric Research (EDGAR)
	Greenhouse gas emissions (GHG) per capita	Tonnes of CO_2 equivalent per capita	Eurostat, European Commission, national climate and energy plans
Natural disaster risk	World Risk Index	Composite index of disaster risks from extreme natural events (2020)	World Risk Index (WRI)
	Soil erosion by water	Percentage of area affected by severe erosion relative to all potentially erosive-prone land	Eurostat, European Commission, national climate and energy plans
Resource risk	Biocapacity balance	Log of most recent data on Ecological Footprint of Consumption relative to biocapacity within a country's borders (2016)	Global Footprint Network (GFN)
	Energy import dependence	Share of energy imports, diversification of imports and strategies to reduce the reliance on energy imports (2018)	Eurostat, European Commission, national climate and energy plans
Policy-dependent mitigating factors			
Transition risk / Natural disaster risk*	Environmental expenditure	Share of economy-wide expenditure on environmental protection as a percentage of nominal GDP (2017)	Eurostat, European Commission, national climate and energy plans
	Environment-related investment	Share of economy-wide investment to finance structural change towards a circular and zero-carbon economy as a percentage of nominal GDP (2017)	Eurostat, European Commission, national climate and energy plans
	Renewable energy use	Share of renewable energy in gross final energy consumption (2018)	Eurostat, European Commission, national climate and energy plans
Transition risk /Resource availability risk*	Resource productivity	GDP divided by domestic material consumption (DMC) (2019)	Eurostat, European Commission, national climate and energy plans
	Environment-related taxation	Share of environmental taxes (in total government revenues raised from taxes and social contributions) that support the achievement of the goals under the Paris Agreement	Eurostat, European Commission, national climate and energy plans

*Mitigating factors for natural disaster risk are environmental expenditure and investment, renewable energy use and taxation

Source: Scope Ratings GmbH

Annex II: Overview of variables used for impact risk versus exposure risk for sovereigns

Risk pillar	Risk indicator	Source
Impact risk	Sustainable Cities (Sustainable Development Goal 11)	United Nations Global SDG database
	Responsible Production and Consumption (SDG 12)	United Nations Global SDG database
	Climate Action (SDG 13)	United Nations Global SDG database
	Life below Water (SDG 14)	United Nations Global SDG database
	Life on Land (SDG 15)	United Nations Global SDG database
Exposure risk	Fossil fuel CO_2 emissions	Emission Database for Global Atmospheric Research (EDGAR)
	World Risk Index	World Risk Index (WRI)
	Biocapacity balance	Global Footprint Network (GFN)

Source: Scope Ratings GmbH

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